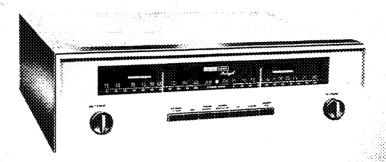
harman kardon



### The Madrigal I

MODEL ST360A

PROFESSIONAL STEREOPHONIC TUNER

### INSTRUCTION MANUAL

It is important you carefully read this manual prior to installing your high fidelity stereo system. You have invested in an extremely fine electronic instrument into which many advanced and excellent engineering features have been incorporated, and each is important for the proper operation of this tuner.

A few minutes taken now may save considerable time later. It is relatively simple to operate the ST360A and this booklet clearly covers every point of installation and operation.

Keep the booklet available at all times. It contains indispensible technical and service information.



#### **GENERAL DESCRIPTION**

The Madrigal II, Model ST360A is a professional tuner in every respect. A new type push button selector function switch assures positive, easy to select action with minimum effort. Specially balanced and counterweighted flywheel tuning for pinpoint station accuracy and rapid sweep of the entire AM and FM bands. Noise level and sensitivity that approaches theoretical maximum, limited only by distortion to less than ½%. The first tuner to provide space for a plug-in FM multiplex adapter on its chassis under the cage.

The Model ST360A may be used in any of the following ways:

- 1. Monophonic AM or FM tuner for regular broadcast reception.
- 2. Stereophonic AM-FM tuner for simulcast reception.
- 3. Stereophonic FM Multiplex tuner for stereo reception when used with the Model MA350 plug-in multiplex adapter.

### UNPACKING

Unpack the tuner carefully. Do not discard the packing material until you are certain you have all of the required accessories packed with the set. The carton should contain the following items:

- 1 Stereophonic tuner, Model ST360A
- 1 Instruction Booklet
- 1 Warranty Card

After unpacking The Madrigal II inspect it for signs of transit damage. The unit was subjected to many inspections and tests at the factory prior to final packing and it should therefore be in perfect condition. If damage is visible, notify your dealer at once. If the unit was shipped to you, notify the transportation company without delay.

### INSTALLATION PROCEDURE

#### Ventilation:

The ST360A tuner is well ventilated in itself. Great care has been given to the design and chassis layout to insure proper component placement. The power transformer is extra heavy duty to reduce heat build up. It is necessary, however, to allow sufficient space around the tuner to permit proper air flow. Install the tuner in a manner to allow for unristricted circulation. When mounting into a cabinet cut holes to the rear and above the tuner to allow the hot air to escape. Also allow at least 3" of space above the tubes. Do not place books or other objects on the cage or in the immediate vicinity of the tuner when installing on a bookshelf or table. This will reduce the air flow and may cause damage to the tubes and components.

One further word of caution. When installing the tuner in a cabinet do not place it directly over the amplifier. Allow as much room as possible between the two instruments. The heat generated by the amplifier may cause deterioration of tuner components and performance.

### Power Requirements:

Plug the AC cord into any outlet furnishing 117 volts, 50 or 60 cycle, AC current. The voltage may vary between 105 and 125 volts.

A switched AC convenience receptacle is located on the rear panel of the tuner. You may use it as a power source for your other high fidelity components. The total wattage is not to exceed 200 watts.

### Connecting The ST360A To An Amplifier:

There are two output receptacles on the right rear of the tuner chassis. They are used to connect the ST360A to your monophonic or stereophonic amplifier. All connection between the tuner and amplifier must be made with low-capacity shielded cable to prevent hum and noise pickup. Any length up to 20 feet may be used as the ST360A has a special anode follower output.

### Monophonic Connection:

Attach a shielded cable between the tuner or auxiliary input of your monophonic amplifier and either output receptacle on the rear panel of the ST360A tuner.

### Stereophonic Simulcast And FM Multiplex Connection:

Attach a shielded cable between each of the two outputs on the ST360A and the two tuner or auxiliary inputs of your stereophonic amplifier. The usual procedure is to connect the FM STEREO output to the left tuner or auxiliary input on your amplifier and the AM STEREO output to the right tuner or auxiliary amplifier input.

This permits AM-FM simulcast reception or FM-Multiplex reception if the Harman-Kardon Model MA350 plug-in multiplex adapter is used with the tuner.

### AM Antenna:

The AM swivel loopstick antenna on the rear of the ST360A chassis comprises all the antenna required for normal signal areas. In more remote locations an additional outdoor antenna may be required. This should consist of a single wire, as long as is reasonably practical. It must be kept away from large metal objects, power lines or electrical machinery to insure reception without extraneous noise. Attach external antenna to rear terminal strip marked "AM." The loopstick antenna may be swiveled as required for custom and bookshelf installation. If the metal cage is used, the loopstick should be moved down and away from the cage to prevent cancellation of the AM signals.

#### FM Antenna:

Due to the exceptionally high FM sensitivity of the ST360A, the 48" piece of wire supplied with the tuner will be sufficient antenna for all but the most difficult locations. One end of this wire should be stripped of insulation and attached to the rear screw terminal marked "FM" on the Antenna Terminal Strip located on the rear of the ST360A chassis. The other end of the wire should be extended horizontally along the cabinet or table. Horizontal placement of the antenna wire offers maximum polarization for optimum reception.

If an outdoor antenna is required to "reach" for distant stations use a special folded dipole or Yagi cut specifically for the FM band.

If your TV antenna is cut for the FM band as well as for TV reception, an antenna coupler or knife switch may be used to connect the antenna to both receivers.

When using an outdoor antenna, attach the 300 ohm lead-in wire (twisting it 4-5 times for each running foot) to the antenna terminals on the rear of the ST360A marked FM and G.

### Grounding:

It is not generally recommended to separately ground the ST360A tuner to your companion amplifier. This may cause a ground loop and induce hum.

#### **OPERATING INSTRUCTIONS**

### To Receive Monophonic AM Broadcasts:

Depress the AM push button to turn the tuner on and to select the AM broadcast band. Tune to the desired station with the AM TUNING control. To insure proper tuning a unique electronic eye tuning indicator has been incorporated into the AM circuit. Tune for minimum dark space between the green bars.

To receive noisy or distant AM stations depress the AM NOISE FILTER push button. A special electronic filter will eliminate the interference that generally accompanies long range AM reception.

### To Receive Monophonic FM Broadcasts:

Depress the FM push button to turn the tuner on and to select the FM broadcast band. Tune to the desired station with the FM TUNING control. To insure proper tuning tune for minimum dark space between the green bars on the electronic tuning eye. Now depress the FM-AFC push button to retune the station by a ratio of ten to one. AFC action will be discussed in a later paragraph.

### To Receive Stereophonic Simulcast AM-FM Broadcasts:

Depress the AM push button to turn the tuner on and to select the AM broadcast band. Tune to the desired AM station with the AM TUNING control.

Depress the FM push button and turn the FM TUNING control to the same station you just selected on the AM band. You will now have the same station on AM and FM. Now depress the STEREO AM-FM push button to operate the AM and FM bands simultaneously. The AM portion of the simulcast should appear in one speaker and the FM portion in the other to recreate the stereophonic broadcast. FM-AFC is automatically applied when the push button is in the STEREO AM-FM position.

The balance control on your amplifier should be set to the center position. The audio stereo balance can now be adjusted with the STEREO AM-FM BAL-ANCE control located on the lower left hand portion of the ST360A front panel. To adjust, turn the wheel-type knob either clockwise or counterclockwise. Turning clockwise increases the FM audio signal and counterclockwise increases the AM signal.

### To Receive Stereophonic Multiplex Broadcasts:

For this type reception the special Harman-Kardon MA350 multiplex adapter must be plugged into the receptacle provided for on the tuner chassis.

Reception of FM Multiplex broadcasts using the Crosby multiplex method of transmission is uncomplicated. Most of the work is done for you by the ST360A tuner. Depress the FM push button and tune to the desired multiplex station. Tune for minimum deflection of the electronic tuning indicator. Now depress the STEREO MULTIPLEX push button and adjust the DIMENSION control (located on the lower lip of the front panel) for maximum stereo effect. You will note when this control is turned to the extreme counterclockwise position, monophonic reception results. As the DIMENSION control is turned in a clockwise direction, the stereophonic effect will be introduced and will reach a maximum. After reaching this point, the stereo effect will diminish, and the tonal character of the program will change. The setting for stereo effect is fairly broad and may vary for different stations.

### TECHNICAL EXPLANATION OF THE CONTROLS

### **Push Button Selector Switch:**

This unique function selector switch has seven positions.

- 1. AM NOISE FILTER to eliminate extraneous noise for clear long distance reception.
  - 2. AM selects the AM band for monophonic reception.
- 3. STEREO AM-FM selects both the AM and FM band for simulcast stereophonic reception.
- 4. STEREO MULTIPLEX selects stereophonic FM when the Model MA350 multiplex adapter is plugged into the tuner.
  - 5. FM selects the FM band for monophonic reception.
- 6. FM-AFC selects the FM band for monophonic reception with the addition of a powerful Automatic Frequency Control circuit to help retune the station by a tuning ratio of 10:1.
- 7. POWER OFF when depressed turns the tuner off. To turn the tuner on merely depress any other push button.

### **Automatic Frequency Control:**

FM Broadcasting, by its very nature, eliminates almost all natural and manmade static. However, the characteristics of FM which makes this possible also

causes specific problems in tuning. The Madrigal II Model ST360A incorporates a special electronic circuit known as AFC (Automatic Frequency Control) that overcomes these problems and insures proper tuning even if the manual tuning is not accurately done. Therefore AFC always keeps the station in the center of the channel and eliminates distortion caused by inaccurate tuning.

It should be pointed out that AFC is not a means to eliminate tuner drift. A fine piece of electronic equipment as the ST360A will not drift on any FM push button position whether on FM or FM-AFC.

The following experiment will lead to an understanding of AFC, and the fuller enjoyment of the ST360A tuner.

Tune across the FM band with the push button selector switch in the FM-AFC position. Note how the stations "pop" into place. Now tune to any station, preferably one with a musical program. Defeat the AFC circuit by depressing the FM pushbutton, and tune slowly through the station from left to right. Notice there are three distinct points where the station sounds clear, interspersed with points of distorted sound. The middle clear-sounding point is the proper tuning position for the best tone quality with minimum noise and interference. Detune the station so that the sound is distorted. Now depress the FM-AFC push button and notice how the sounds clear up. The tuning has been readjusted by the operation of the AFC circuit, which automatically retunes the electronic circuits to the center of the station channel.

In order to take advantage of the benefits of AFC, it is suggested that fine tuning be done with the push button selector in the FM position. When the push button selector is then depressed to the FM-AFC position the automatic frequency control circuit will improve your careful tuning by a tuning factor of 10:1. The procedure is especially recommended when a weak station is being tuned on a channel adjacent to a stronger one. This will prevent the AFC from reaching for the more powerful signal thereby skipping over the weaker one. Whenever a weak station is tuned, the AFC circuit should be defeated.

#### ADJUSTMENTS

In some installations, hum may be encountered due to a voltage difference between the amplifier, tuner and record player chassis. This may be eliminated by reversing one or all of the AC power cords. Simply reverse one at a time until improvement is experienced.

It is recommended to test the tubes of this tuner approximately every twelve months. When a tube is changed it may be necessary to have the tuner realigned to insure optimum performance.

#### Fuse:

The ST360A is fused in the AC primary to prevent the damage of tubes or components. The value of the fuse is 3A-3AG and should be replaced only with one of the same rating, Replacing with a fuse of higher rating will not protect the tuner, and may result in severe damage, which will not be covered by the factory warranty.

### MAINTENANCE AND REPAIRS

If your tuner should not perform properly during the first year after date of purchase, contact the factory for instructions. Do not have it repaired locally without first checking with Harman-Kardon. Authorized factory warranty stations are located in most major cities. For the address of the station nearest you, or for any other information concerning your tuner or other Harman-Kardon products, please write directly to the Customer Service Department, Harman-Kardon, Inc. 520 Main Street, Westbury, L. I., New York. Be sure to include the model number and serial number of the unit in question. A brief description of the other components in your high fidelity installation is often of help in answering your questions. We are always happy to be of service to you.

#### WARRANTY POLICY

We urge you to completely fill in your warranty card and mail it to the factory without delay to protect your rights under warranty. The warranty cards are carefully filed for reference and should you require information on the use of this high fidelity unit, or repair service, we will be able to immediately identify your set and reply quickly.

NOTE: It is necessary to receive factory authorization before returning a set for warranty repair either to the factory or to an authorized station. Repairs are to be returned on an Express Prepaid basis. A letter describing the exact difficulty must be included with the set upon return.

We warrant this instrument to be free from defects in material and workmanship under normal use and service, and in accordance with the conditions
berein below set forth, for a period of one year from date of delivery to the
original purchaser, and agree to replace or repair any part or parts, with the
exception of tubes which are covered by manufacturer's 90 day warranty, returned to us within said one year with transportation prepaid, and which our
examination shall disclose to our satisfaction to have been thus defective. This
warranty does not include free labor, nor is it applicable to any instrument which
shall have been repaired or altered in any way so as in our judgment to affect its
stability or reliability nor which has been subject to misuse, neglect, abuse,
negligence or accident, nor which has had the serial number altered, effaced or
removed. Neither shall this warranty apply to any instrument which has been
connected otherwise than in accordance with the instructions furnished by us.

This warranty is expressly in lieu of all other warranties, express or implied, and of all other obligations or liabilities on our part, and we neither assume nor authorize any representative or other person to assume for us any other liability in connection with the sale of this instrument.

### SPECIFICATIONS

Circuits:

Sensitivity:

Selectivity:

Drift:

Limiter:

Distortion:

Hum Level: Radiation: Output Level:

Circuits:

Sensitivity:

Selectivity:

Distortion:

Hum Level:

Frequency Range:

Frequency Response:

Image Rejection: IF Rejection:

Antenna Input:

Discriminator Peak to

Peak Separation:

Frequency Range:

Image Rejection: IF Rejection:

Antenna Input:

Frequency Response:

FM	
Armstrong circuit with zero time constant Gated Be Limiter, Foster-Seeley Discriminator, Automatic quency Control and Bar Type Tuning indicator. RF section consists of a Shaded Grid Low Noise, F Gain VHF Tetrode, High Gain Pentode Mixer followy three Wide Band IF stages, Limiter, Wide B (0.6 MC) Discriminator and Anode Follower Output.	Fre- The Iigh wed Sand
0.95 microvolts. (20 db quieting). 1.9 microvolts. (30 db quieting). 240 KC Bandwidth: 6 db down.	
0.6 megacycles. 88-108 M.C. $\pm$ 20 KC AFC off; $\pm$ 2½ KC AFC on. 40 db	,
70 db Gated beam, constant output.	
300 ohms Less than 0.1% IM at 30% modulation. Less than 0.25% IM at 100% modulation. ±½ db 20-20,000 c.p.s. including standard 75 ms second de-emphasis. 60 db below 100% modulation. Within FCC requirements. 1.5 volts for 100% modulation. 5 volts for 30% modulation.	icro-
AM	
Low noise, high gain RF pentode followed by a period converter, two broad band IF transformers, arate tuned AVC amplifier, infinite impedance duter and adjustable 10 KC whistle filter. The separation of the determination of the determinatio	sep- etec- arate ector oise-
16 KC Bandwidth: 6 db down. 530-1640 KC 55 db 55 db Built in Ferrite Loopstick with low impedance Territor external antenna.	ninal
Less than 0.8% harmonic. ± 3 db 20-8,000 cycles. 55db below 80% modulation.	

### REPLACEMENT PARTS FOR MODEL ST350

SEL RECTIFIER 65 MA

SEL RECTIFIER 75 MA

Description

LYTIC

Part No.

1362133

2923271

STCOM3270

**List Price** 

1.65

1.75

3.00

404041	Lillo	0.00
2923272	LYTIC	2.60
2923273	LYTIC	2.50
3223626	POWER TRANSFORMER	12.00
2923275	FUNCTION SWITCH	7.50
3223629	LOOPSTICK ANTENNA	2.25
3223624	DIAL GLASS	1.00
HC33901	FUSE HOLDER	.75
ZCOM3291	3 AG 3 AMP FUSE	.10
STCOM3279	AM OSC COIL	.75
GT2493012	RF TRANSF.	1.50
GT2503045	1st, 2nd, 3rd, 4th FM IF TRANSF.	1.50
GT2503052	DISC TRANSF.	2.00
GTCOM3346	IF TRANSF.	1.50
JV2923213	FM TUNING CAPACITOR	5.35
JV2923214	AM TUNING CAPACITOR	5.85
O TUNING CLOS		FM TUNING DRUM
•		

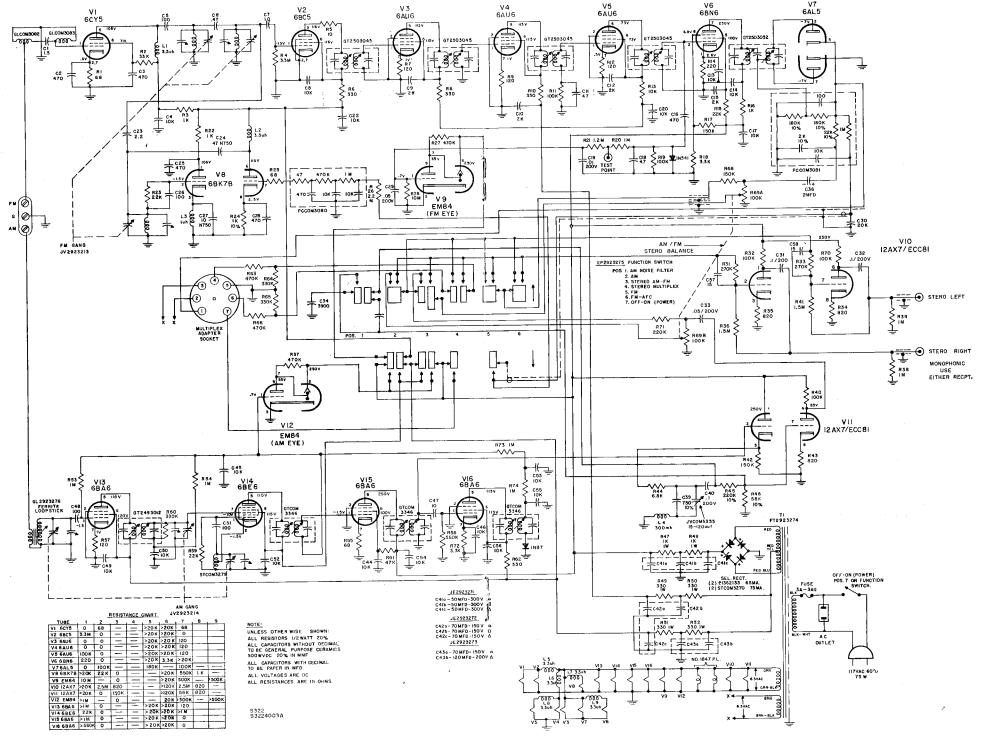
AM TUNING

FM TUNING DRUM

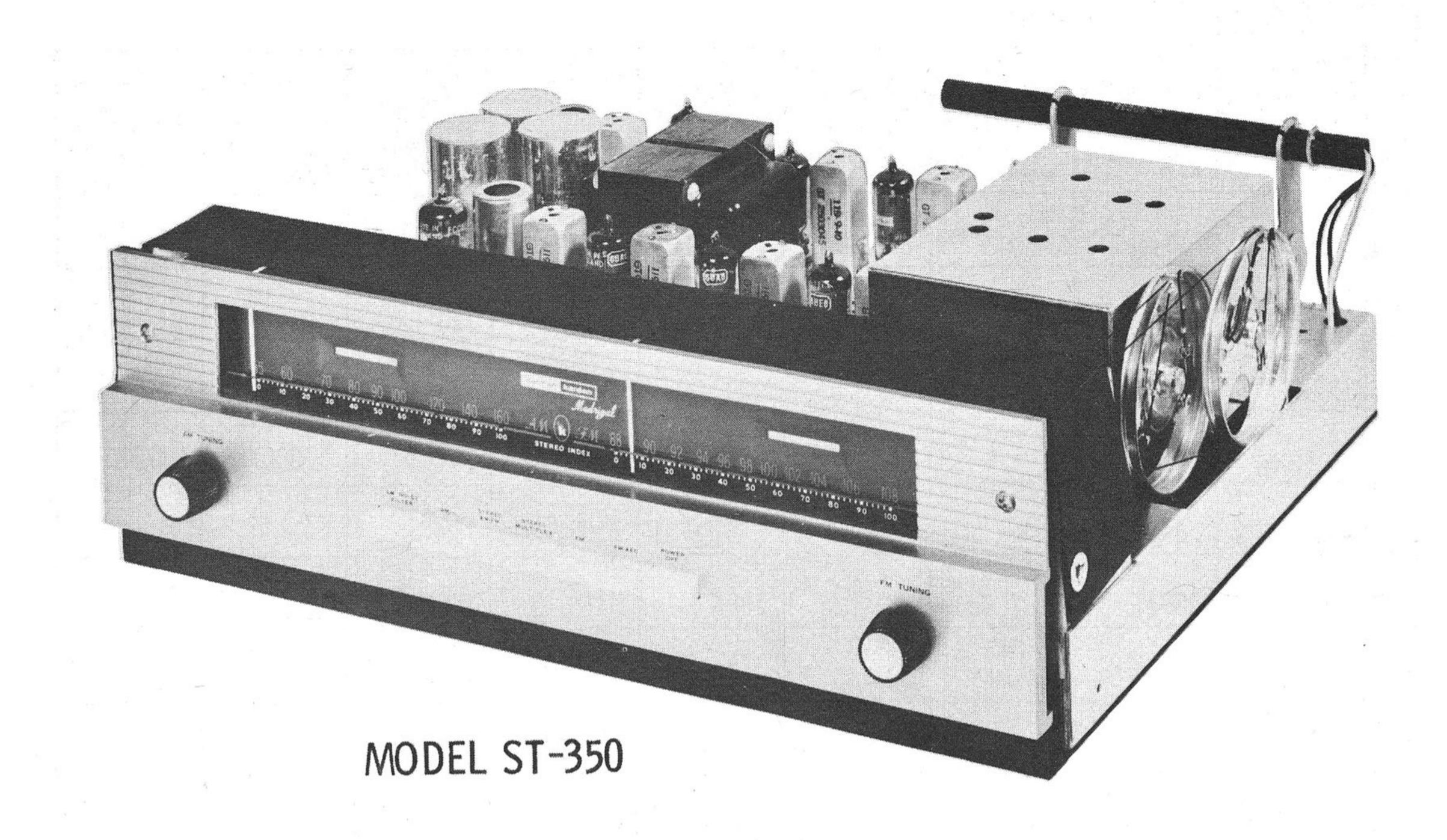
TUNING SHAFT

FM STRINGING DIAGRAM

TUNING CAPACITOR CLOSED



### HARMAN-KARDON MODELS ST-350, ST-360



TRADE NAME Harman-Kardon Models ST-350, ST-360 (The Madrigal)

MANUFACTURER

Harman-Kardon, Inc., 520 Main Street, Westbury, L. I., N. Y.

TYPE SET

AC Operated 16 Tube FM-AM Tuner

POWER SUPPLY

105-125 Volts AC, 60 Cycles

RATING

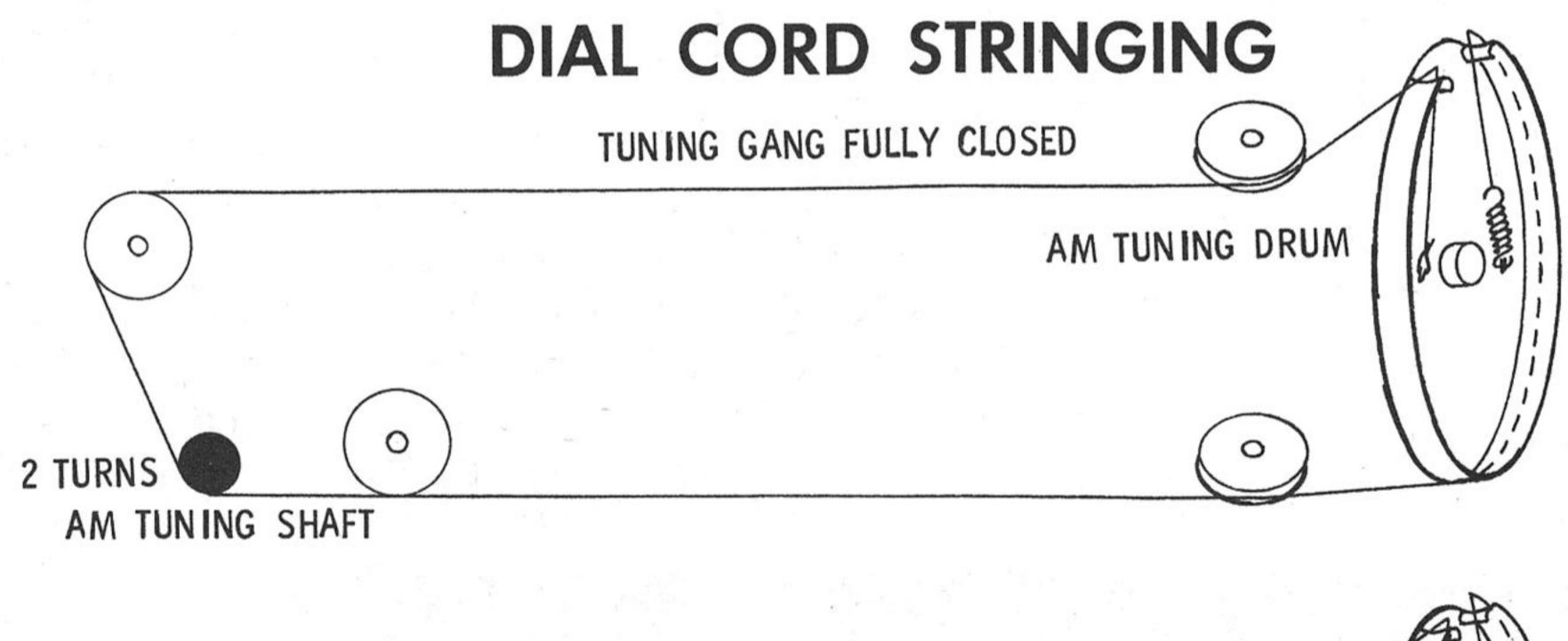
51 Watts, .5 Amp. @ 117 Volts AC

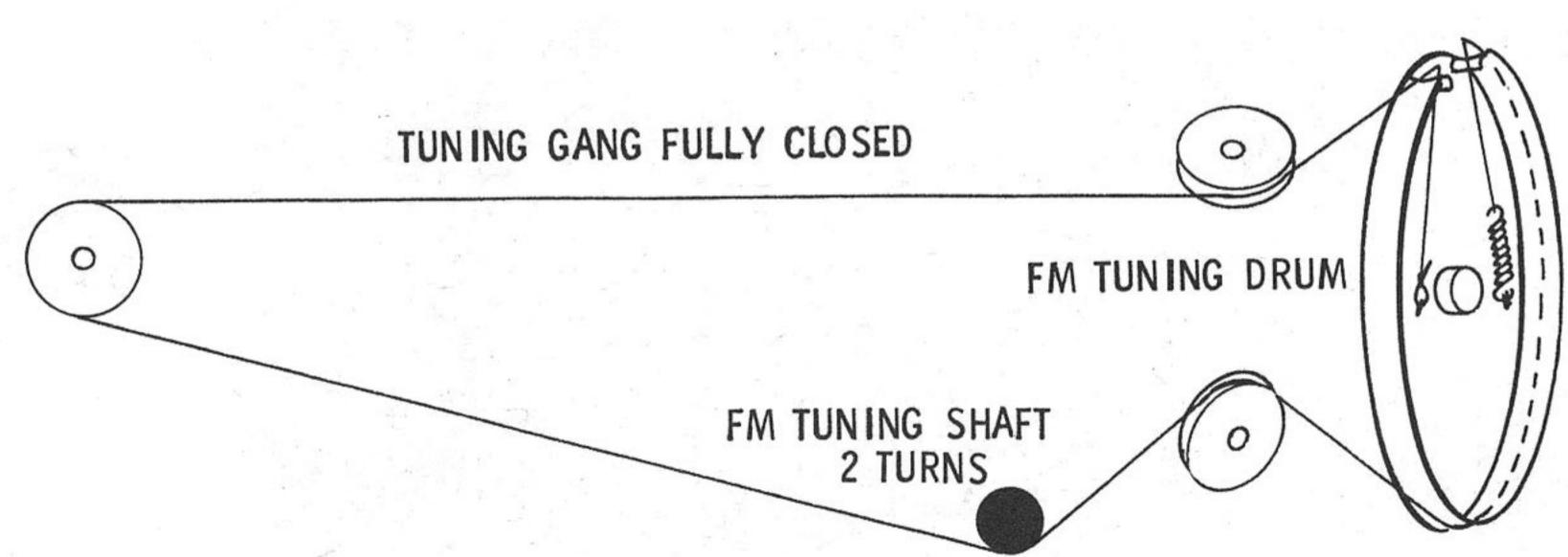
TUNING RANGE

BROADCAST 530 - 1640KC

FREQ. MOD.

88 - 108MC



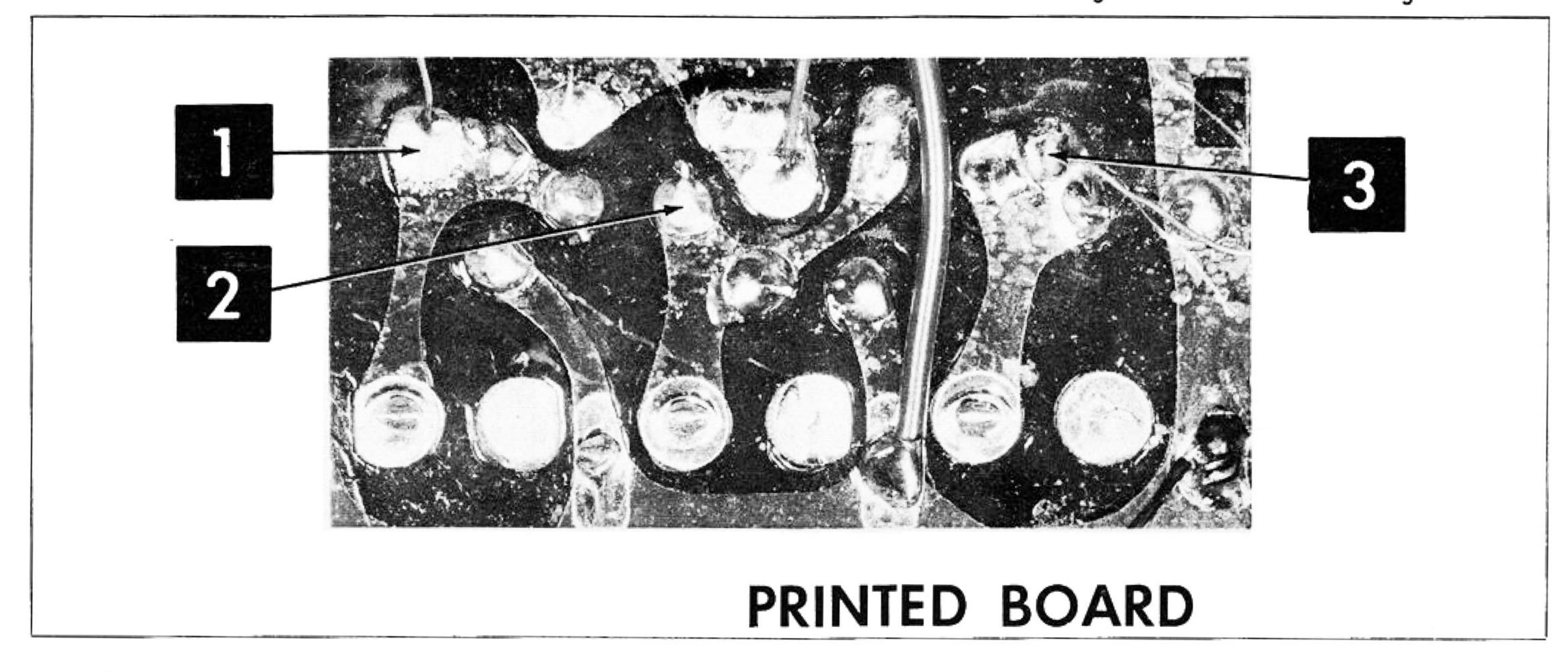


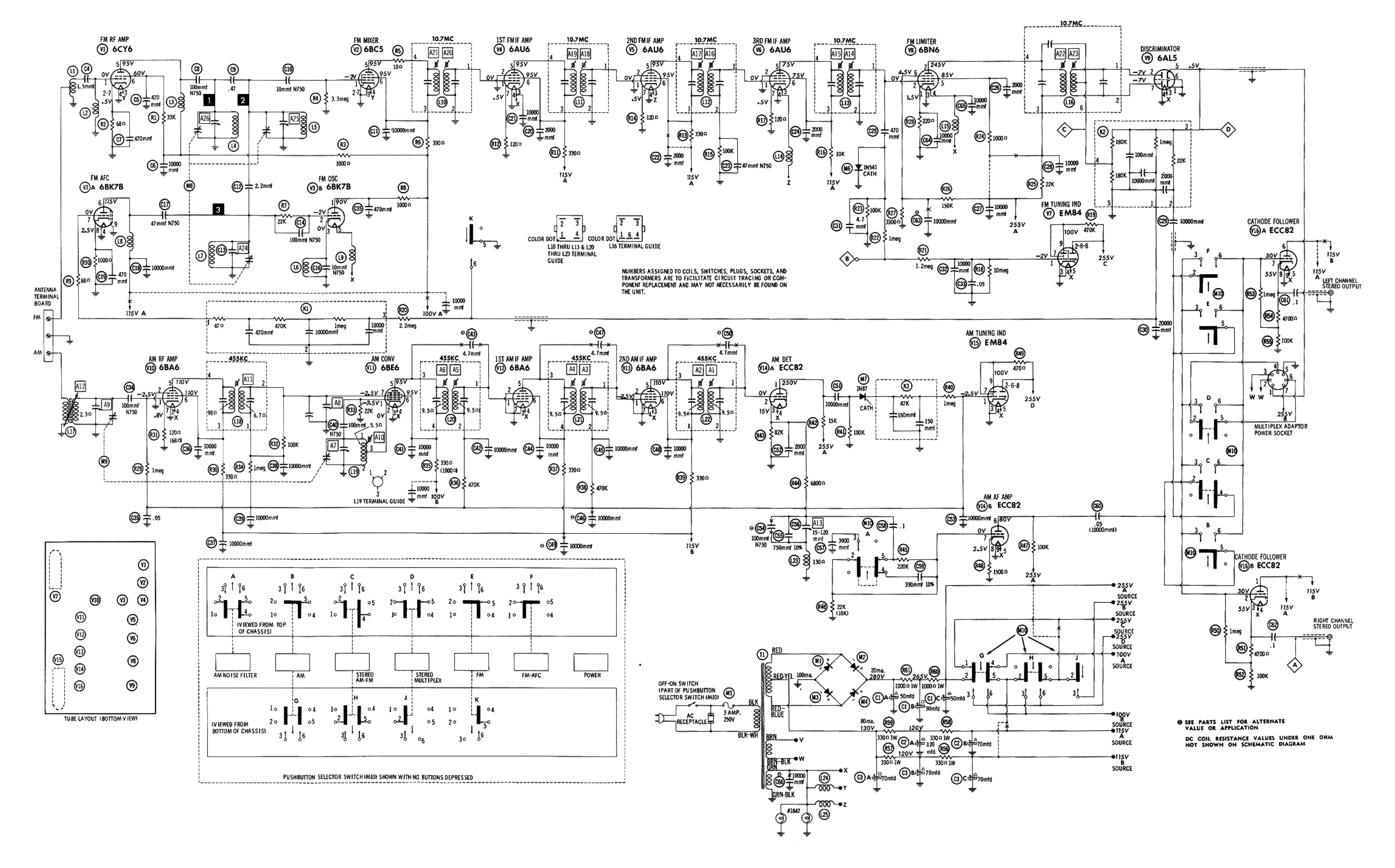
# RESISTANCE MEASUREMENTS

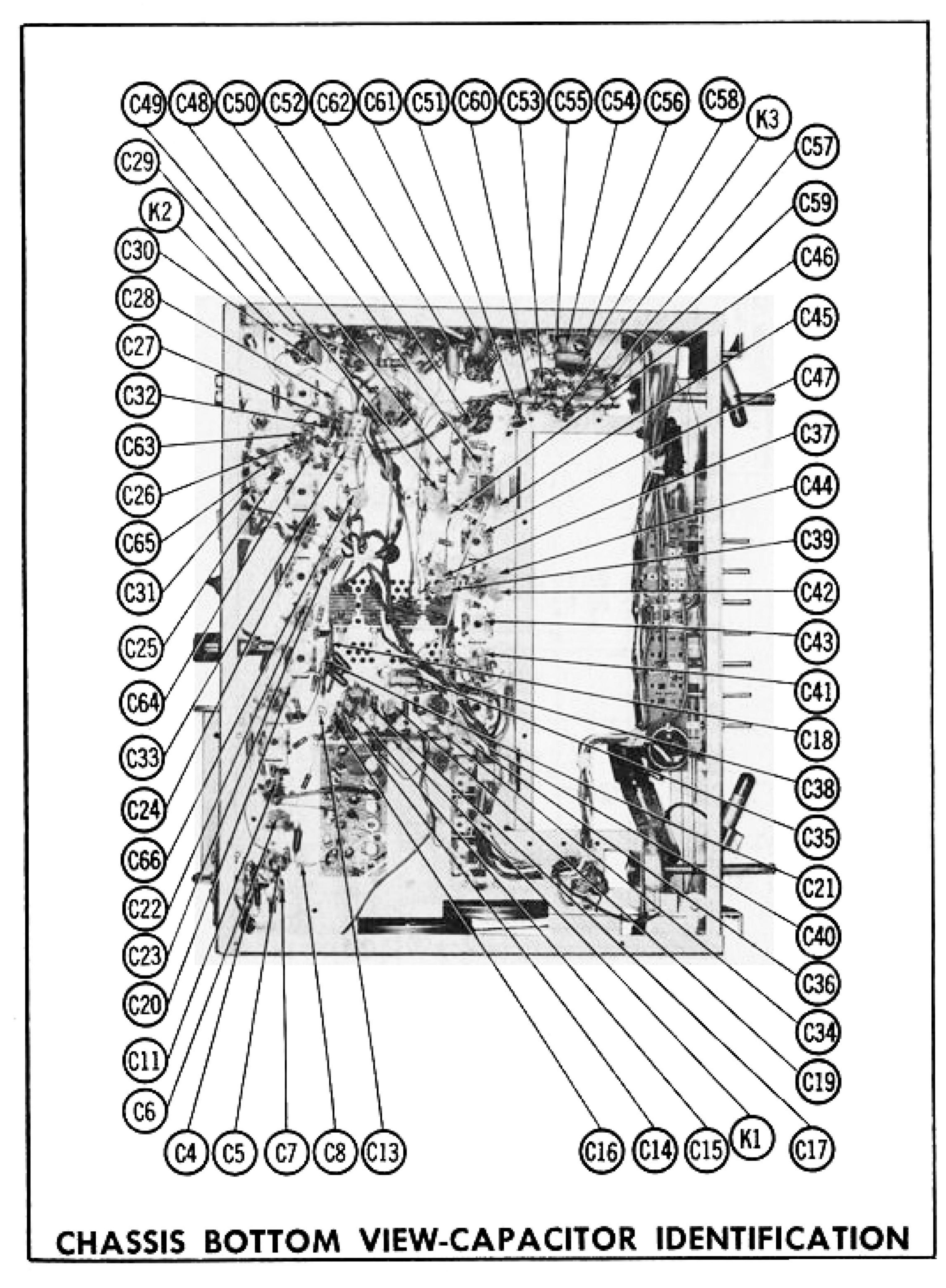
ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
۷l	6CY5	.1Ω	68 Ω	. 2Ω	0Ω	1700Ω.	▲ 35K	68Ω		
٧2	6BC5	3. 3meg	0Ω	0Ω	. 2Ω	▲ 1000Ω	▲ 1000 Ω	0Ω		
٧3	6BK7B	▲ 1700 Ω	22K	.1Ω	0Ω	. 2Ω	▲ 660 Ω	3. 6meg • 4. 7meg	1000 Ω	0Ω
٧4	6AU6	.6Ω	0Ω	. 2Ω	0Ω	▲ 1000Ω	▲ 1000Ω	120 Ω		
۷5	6AU6	.6Ω	0Ω	. 2Ω	0Ω	▲ 1000Ω	▲ 1000Ω	120 Ω		
٧6	6AU6	100K	0Ω	. 2Ω	0Ω	▲ 11K	▲ 11K	120 Ω		
٧7	EM84	1. 8 meg	† 2000 Ω	0Ω	0Ω	. 1Ω	† 2000 Ω	† 470K	† 2000 Ω	† 470K
٧8	6BN6	220 Ω	.6Ω	0Ω	. 2Ω	† 25K	3300 Ω	† 24K		
۷9	6AL5	0Ω	180 K	. 1Ω	0Ω	360K	0 Ω	180K		
V10	6BA6	• 2. 5meg	0Ω	0Ω	.1Ω	▲ 1000Ω	1000Ω	120 Ω		
V11	6BE6	22K	. 5Ω	0Ω	.1Ω	- 1000Ω	Δ 1000Ω	■ 2.5meg		
V12	6BA6	▲ 1.5meg	0Ω	0Ω	.1Ω	Δ 1000Ω	▲ 1000Ω	0Ω		
V13	6BA6	• 1.5meg	0Ω	.1Ω	0Ω	Δ 1000Ω	Δ 1000Ω	0Ω		
V14	ECC82	† 17K	9Ω	82K	.1Ω	.1Ω	† 100K	22K	1500 Ω	0Ω
V15	EM84	lmeg	† 2000 Ω	0Ω	0Ω	.1Ω	† 2000Ω	† 470 Ω	† 2000 Ω	† 470 Ω
V16	ECC82	660Ω	550K ◆ 1. 1 meg	105K	. 1Ω	.1Ω	▲ 660Ω	550K • 1. 1meg	105K	0Ω

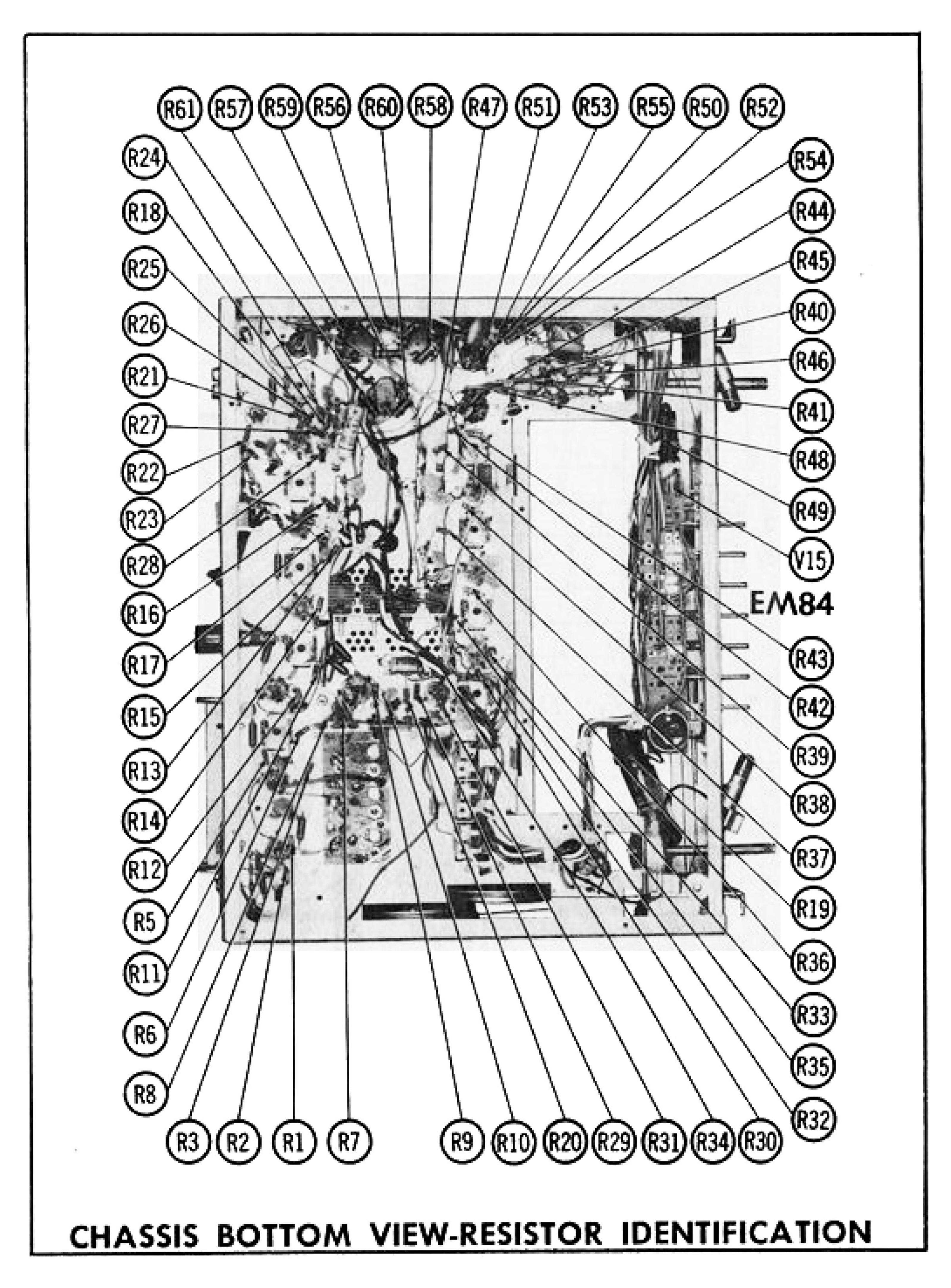
ALL MEASUREMENTS TAKEN IN "FM" POSITION UNLESS OTHERWISE DESIGNATED.

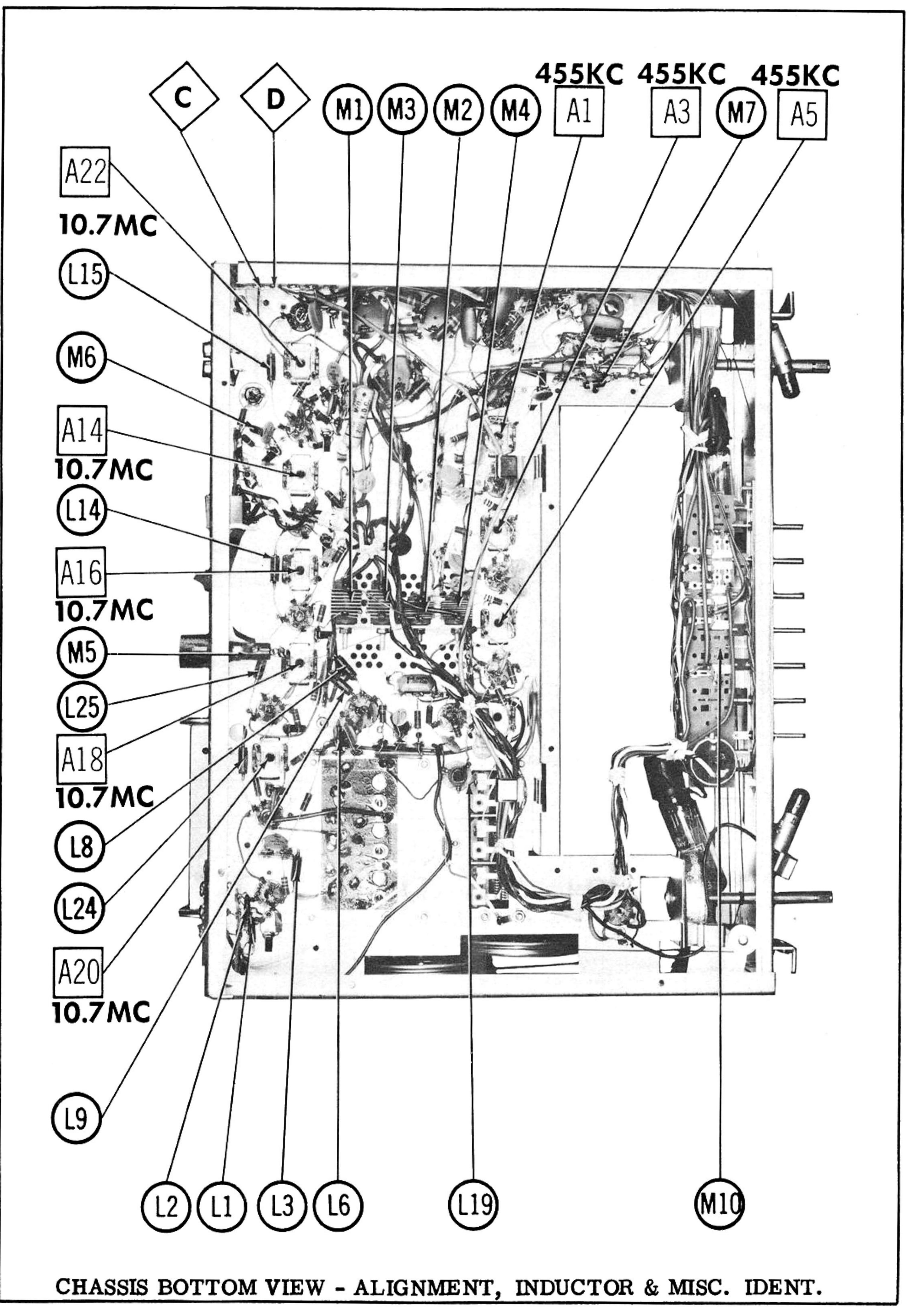
- † MEASURED FROM OUTPUT OF M2.
- MEASURED IN "AM" POSITION.
- MEASURED IN "FM-AFC" POSITION.
- ▲ MEASURED FROM JUNCTION OF R57 AND C2A.
- MEASURED IN "STEREO AM-FM" POSITION.
- DC voltage measurements taken with vacuum tube voltmeter;
   AC voltages measured at 1000 ohms per volt.
- 2. Socket connections are shown as bottom views.
- 3. Measured values are from socket pin to common negative.
- 4. Line voltage maintained at 117 volts for voltage readings.
- Nominal tolerance on component values makes possible a variation of ±15% in voltage and resistance readings.

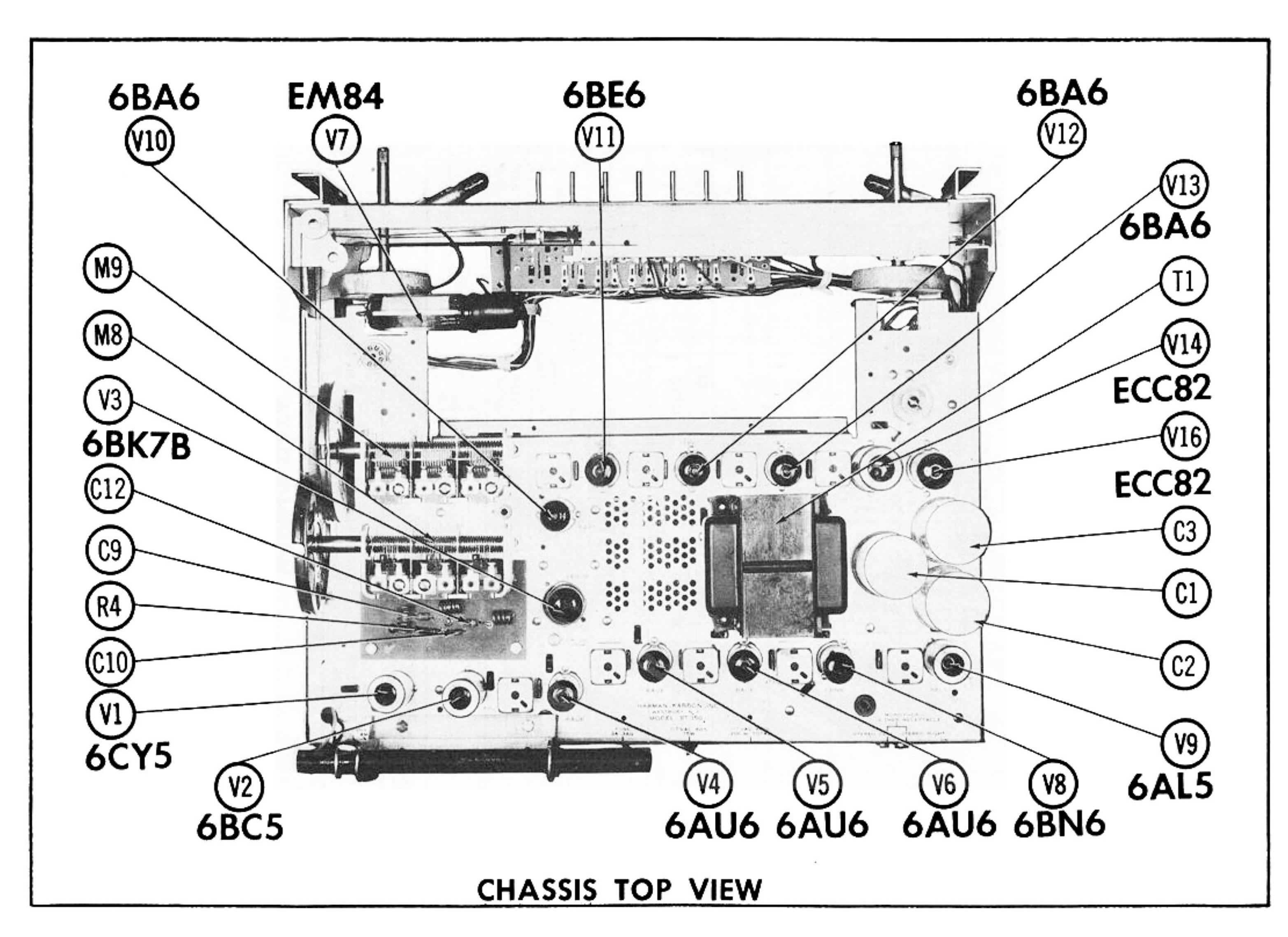


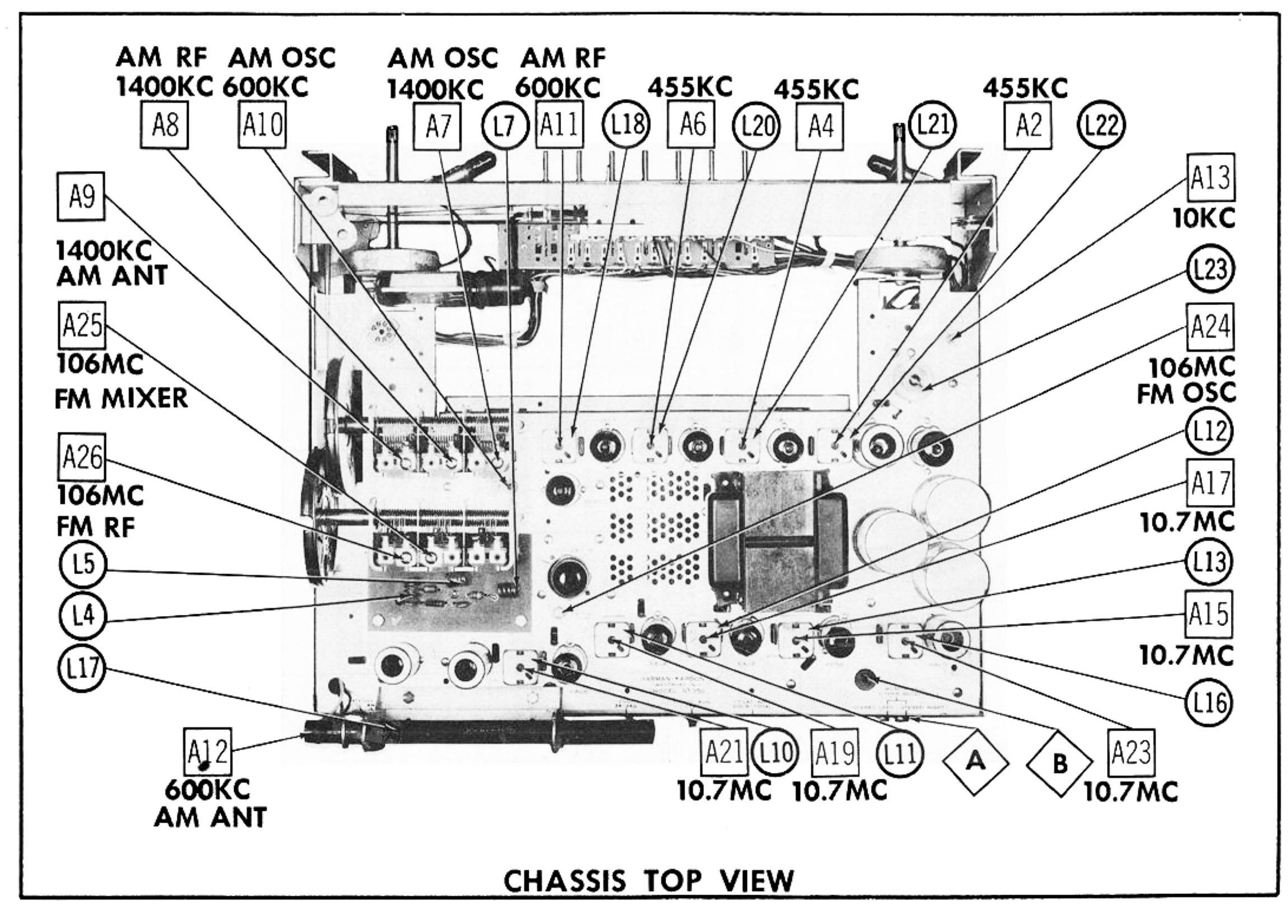












## ALIGNMENT INSTRUCTIONS

### PRE-ALIGNMENT INSTRUCTIONS

Use only enough generator output to provide a usable indication on VTVM.

Suggested Alignment Tools: Al thru A6, All, Al4 thru A23 ..... GENERAL CEMENT #5097, 8727

WALSCO #2515

A7, A8, A9, A24, A25, A26 ...... GENERAL CEMENT #5004, 5008, 5009 WALSCO #2520

A10 ....... GENERAL CEMENT #8282, 8606, 8606-L, 9295, 9440 WALSCO #2526, 2543, 2544, 2545

A13 ...... GENERAL CEMENT #8721, 8722

**WALSCO #2519** 

### AM ALIGNMENT - SELECTOR IN AM POSITION

	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	RADIO DIAL SETTING	CONNECT	ADJUST	REMARKS
1.	High side thru . 01mfd to AM RF stator lug of AM tuning gang. Low side to chassis.	455KC (400∿ 30% AM)	AM tuning gang fully open	AC probe to point A. Com-mon to chassis.	A1, A2, A3, A4, A5, A6	Adjust for maximum deflection.
2.	High side thru . Olmfd to AM antenna terminal. Low side to chassis.	1400KC	1400 KC	17	A7, A8, A9	1.5
3.	<b>)</b> • • • • • • • • • • • • • • • • • • •	600KC	600KC	*1	A10, A11, A12	Adjust for maximum deflection. Repeat step 2.
4.	Same as Step 1.	455KC (10KC 30% AM)	1600 KC	**	A13	Adjust for MINIMUM deflection.

### FM IF ALIGNMENT USING AM SIGNAL GENERATOR AND VTVM - SELECTOR IN FM POSITION

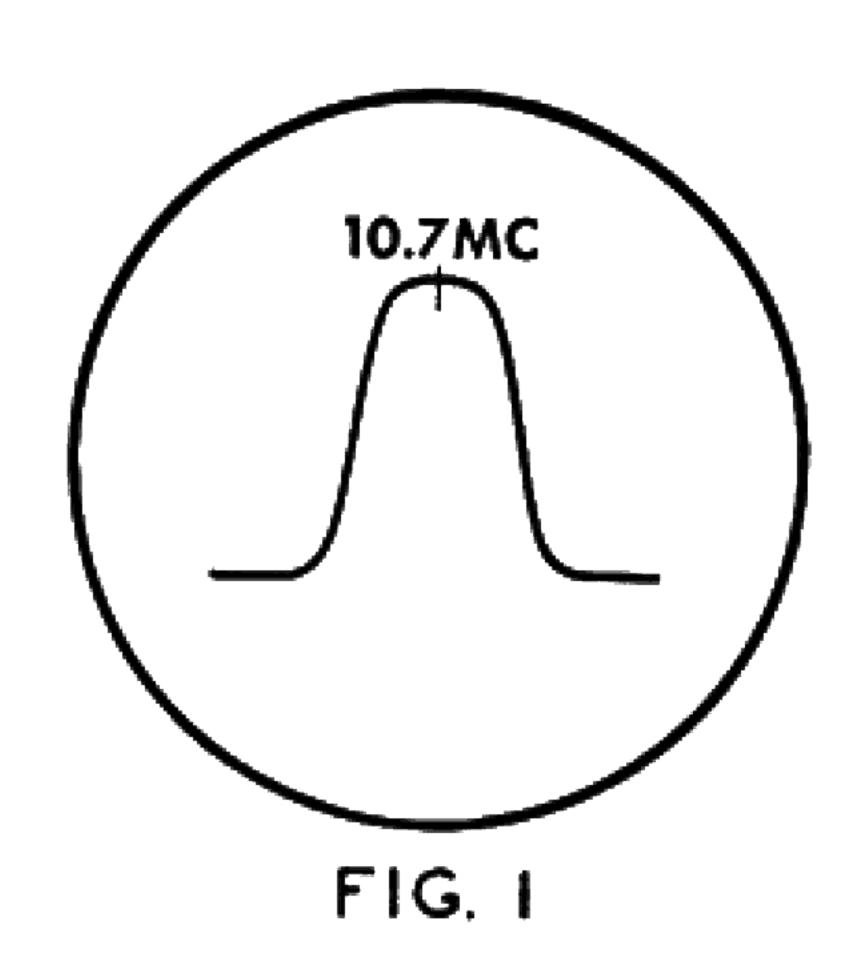
	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	RADIO DIAL SETTING	CONNECT	ADJUST	REMARKS
5.	High side thru.001mfd to FM RF stator lug of tuning gang. Low side to chassis.		FM point of non-interference	point B. Com- mon to chassis.	A14, A15, A16, A17, A18, A19, A20, A21	Adjust for maximum deflection.
6.	11	†¶	± 4	DC probe thru lmeg to point ©. Common to chassis.	A22	1.
7.		••	**	DC probe to point (D). Com-mon to chassis.	A23	Adjust for zero reading. A positive and negative reading will be obtained on either side of the correct setting.

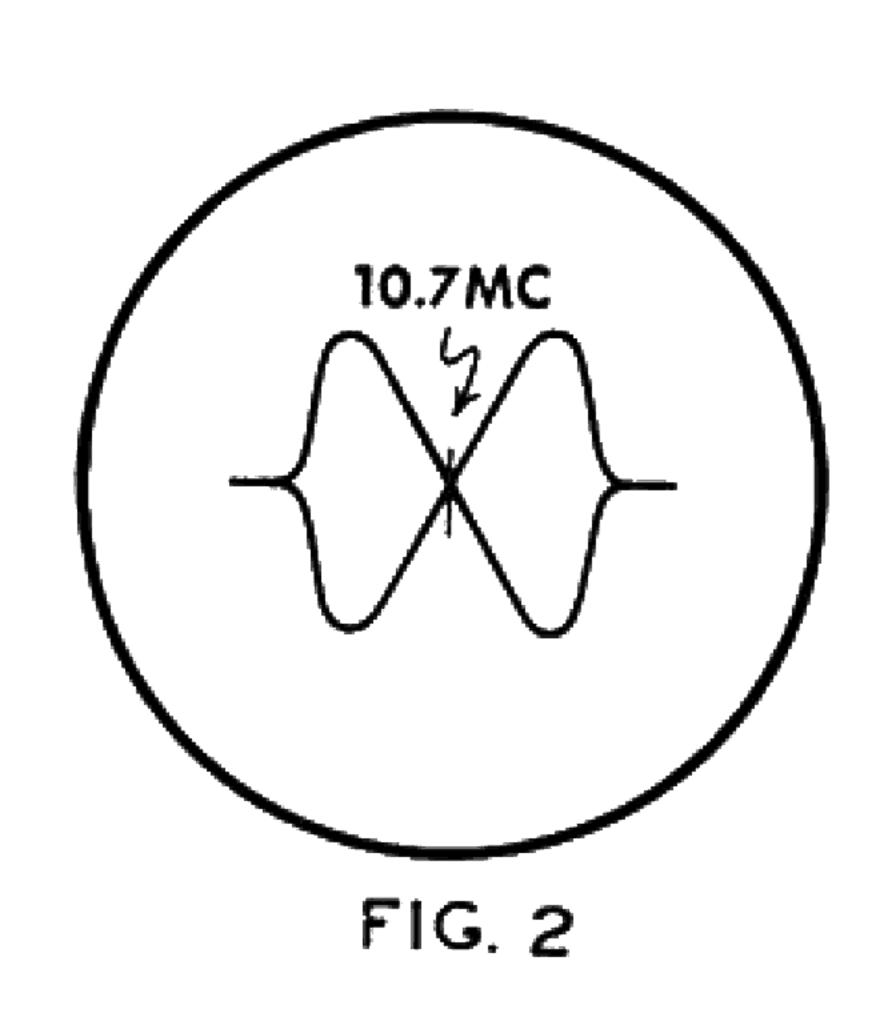
### FM IF ALIGNMENT USING FM SIGNAL GENERATOR AND OSCILLOSCOPE - SELECTOR IN FM POSITION

	Use frequency modulated s	ignal with 60°	modulation and	450KC sweep. Use	120∿ saw	tooth voltage in scope for horizontal deflection.
	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	RADIO DIAL SETTING	CONNECT	ADJUST	REMARKS
5.	High side thru. 001mfd to FM RF stator lug of FM tuning gang. Low side to chassis.		FM point of non-interference	point B. Com-	Al4, Al5, Al6, Al7, Al8, Al9, A20, A21	of response similar to Fig. 1.
6.	**	4 F	**	Vert. Amp. thru 27K to point (C). Low side to chassis.	A22	17
7.	- • • • • • • • • • • • • • • • • • • •	j. d		Vert. Amp. to point D. Low side to chassis.	A23	Adjust to place marker at the center of crossover lines similar to Fig. 2. SLIGHTLY retouch A22 for maximum amplitude and straightness of crossover lines.

### FM RF ALIGNMENT - SELECTOR IN FM POSITION

SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	RADIO DIAL SETTING	CONNECT	ADJUST	REMARKS
High side thru 270Ω to FM antenna terminal. Low side to chassis.	106MC (Unmod.)	FM 106MC	DC probe to point B. Com-mon to chassis.	A24, A25, A26	Adjust for maximum deflection.
† †	90MC	90MC	P.1	L7, L5,	† #





# PARTS LIST AND DESCRIPTIONS

## TUBES

	• C85 •	GENERAL ELECTRIC	+	RAYTHEON -	SYLVANIA +
ITEM. No.	ŲSE	TYPE	ITEM No.	USE	TYPE
V1 V3 V4 V5 V6 V7 V8	FM RF Amplifier FM Mixer FM AFC - FM Osc. ist FM IF Amplifier 2nd FM IF Amplifier 3rd FM IF Amplifier FM Tuning Indicator FM Limiter	6CY5 6BC5 6BK7B 6AU6 6AU6 6AU6 6BM84 6BM6	V9 V10 V11 V12 V13 V14 V15 V16	Discriminator AM RF Amplifier AM Converter lst AM IF Amplifier 2nd AM IF Amplifier AM Det AM AF Amp. AM Tuning Indicator Cathode Follower	6AL5 6BA6 6BA6 6BA6 ECC82 (12AU7) * EM84 ECC82 (12AU7) *

Alternate

## ELECTROLYTIC CAPACITORS

	RATING		REPLACEMENT DATA							
Me.	CAP.	VOLT.	Harman-Kardon PART No.	AEROVOX PART No.	CORNELL- DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SPRAGUE PART No.	NOTES	
CLA B C	50 50 50	300 300 300	JE 2923271A	AFH4-02-10	D022			TVLS-3580.7*		
C2A B	120 70	200 150	JE2923273A	AF#82-24-20	XB0194	FP335	TMT-15	TVL -24 64		
C3A B C	● 70 ▲ 70 <del></del> 70	150 150 150	JE2923272A	AFH3-21	XC0123		TMQ-34	TVL -3446		

\* Not normally in distributor's stock. Available thru distributor on order to manufacturer.

FIXED CAPACITORS
Capacity values given in the rating column are in mfd. for Paper
Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

			REPLACEMENT DATA					
Mo.	RATING	NG REMARKS	AEROVOX PART No.	CENTRALAB PART No.	CORNEUL- DUBILIER PART No.	ELMENCO PART No.	MALLORY PART No.	SPRAGUE PART No.
C4 C5 C6 C7 C8 C9 C10 C11 C12	1. 5 470 10000 470 100 N750 . 47 30 N750 10000 2. 2		NPO-\$I 1. 5 BPD-00047 BPD-01 BPD-00047 N750-DI 100 NPO-\$I 5 N750-DI 10 BPD-01 NPO-\$I 2. 2	TC 2-1R5 DD-471 DD-103 DD-471 DT N-100 TC Z-R5 DT N-10 DD-103 TC Z-2R2	CIOVISC BYAIOT47 BYAIOSI BYAIOSI CIOQIU BYAIOSI CIOVISC	CCD-471 CCD-471 CCD-471 CCTN-101 CCTN-100 CCD-103 CCTO-2R2	CNO-515 GP347 GP110 GP347 CN7-310 CN7-410 GP110 GP110 CNO-522	10TCC-V15 10TS-T47 5HK-S10 10TCU-Q10 5HK-S10 10TCC-V22
C13 C14 C15 C16 C17 C18 C19	100 N750 470 N750 47 N750 10000 470		N750-DI 100 BPD-00047 N750-DI 10 N750-DI 47 BPD-01 BPD-00047	DTN-100 DD-471 * DTN-10 DTN-47 DD-103 DD-471	CIOTIU BYAIOT47 CIOQIU CIOQ47U BYAIOSI BYAIOT47	CCTN-101 CCD-471 CCTN-100 CCTN-470 CCD-103 CCD-471	CN7-310 GP347 CN7-410 CN7-447 GP110 GP347	10TCU-T10 10TS-T47 10TCU-Q10 10TCU-Q47 5HK-S10 10TS-T47

## FIXED CAPACITORS (cont)

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						WENT DATA		
ITEM. No.	RATING	REMARKS	AEROYOX PART No.	CENTRALAB PART No.	CORNELL- DUBILIER PART No.	ELMENCO PART No.	MALLORY PART No.	SPRAGUE PART No.
C20	2000		BPD-002	DD-202	BYA10D2	CCD-202	GP220	5HK-D20
C21	10000		BPD-01	DD-103	BYAIOSI	CCD-103	GPHO	5HK-810
C22	2000		BPD-002	DD-202	BYA10D2	CCD-202	GP220	5HK-D20
C23	47 N750		N750-Dt 47	DTN-47	C10Q47U	CCTN-470	CN7-447	10TCU-Q47
C24	2000		BPD-002	DD-202	BYA10D2	CCD-202	GP220	5HK-D20
C25	4.70		BPD-00047	DD-471	BYA10T47	CCD-471	GP347	tors-747
C26	2000		BPD-002	DD-202	BYA10D2	CCD-202	GP220	5HK-D20
C27	10000		BP D-01	DD-103	BYAIOSI	CCD-103	GPH0	5HK-810
C28	10000		BPD-03	DD-103	BYAJOSI	CCD-103	GPHO	5HK-810
C29	10000		BPD-01	DD-103	BYAIOSI	CCD-103	GPHO	5HK-\$10
C30	20000		BPD-02	DD-203	BYB6S2	CCD-203	GPI20	5HK-S20
C31	4. 7		NPO-SI 4. 7	TCZ-4R7	C10V47C	CCTO-4R7	CNT-547	IOTCC-V47
C32	10000		BP D-01	DD-103	BYA1081	CCD-103	GPU0	5HK-810
C33	. 05 200V		P288N-05	DD-503	CUB285	4DP-3-503	GEM-415	2TM-S5
C34	100 N750	1	N750-DI 100	DTN-100	CIOTIU	CCTN-101	C NO -310	IOTCU-TIO
C35	. 05 400 V		P488N-05	DD-503	CUB485	4DP-3-503	GEM-415	4TM-85
C36	10000		BPD-01	DD-303	BYAIOSI	CCD-103	GPHO	5HK-810
C37	10000		BP D-01	DD-103	BYA1081	CCD-103	GPHO	5HK-S10
C38	10000		BPD-01	DD-103	BYAIOSI	CCD-103	GPNO	5HK-S10
C39	10000		BPD-01	DD-103	BYAIOSI	CCD-103	GPHO	5HK-810
C40	100 N750		N750-DI 100	DTN-100	CIOTIU	CCTN-101	CN7-310	IOTCU-TIO
C41	10000		BPD-01	DD-103	BYAJOSI	CCD-103	GPtto	5HK-\$10
C42	10000		BPD-01	DD-003	BYAIOSI	CCD-103	GPHO	5HK-810
C43	4. 7	Note 1	NPO-DI 4. 7	TC 2-4R7	CIOV47C	CCTO-4R7	CNO-547	10TCC-547
C44	10000	448482	BPD-01	DD-103	BYAIOSI	CCD-103	GPHO	5HK-810
C45	10000		BPD-01	DD-103	BYAIOSI	CCD-103	GPHO	5HK-S10
C46	10000	Note I	BPD-01	DD-103	BYA10SL	CCD-103	GPIIO	5HK-830
C47	4. 7	Note 1	MPO-SI 4. 7	TC Z -4R7	CIOV47C	CCTO-4R7	CNO-547	IOTCC-V47
C48	10000	4-marks R	BPD-01	DD-103	BYAIOSI	CCD-103	GPHO	5HK-810
C49	10000	Note 1	BPD-01	DD-103	BYA10SI	CCD-103	GPHO	5HK-810
C50	4. 7	Note 1	NPO-51 417	TCZ-4R7	C10V47C	CCTO-4R7	CNO-547	IOTCC-V47
C51	10000	21010 1	BPD-01	DD-103	BYA10SI	CCD-103	GPHO	5HK-830
C52	2000		BPD-002	DD-202	BYA10D2	CCD-202	GP220	5HK-D20
C53	10000		BPD-01	DD-103	BYA1051	CCD-103	GPUO	5HK-810
		Note t	N750-D1 100	DTN-100	CIOTIU	CCTN-101	CN7-310	10TCU-Tio
C54		2445440 8	DI-750	DD-753	IR5T75	CCD-781	GP375	10TS-T75
C55	750 10%	#JVCOM3335		DD-131	##4-2-F # 2-	302-M	- C. S. C. 1.0	1010-110
C56	15-120 2000	EN A COMPANY	SI 4000	DD-392	LIOD39	CCD-392	GP239	toTs-D39
C57	3900 1 40017		P488N-I	DF -104	CUB4P1	4Pt-3-104	GEM-401	4TM-P1
C58	.1 400V					CCD-331	GP333	10TS-T33
C59	330 10%	/400000 0. A	DI-330	DD-331	LIOT33		GEM-415	4TM-S5
C60	.05 400V	(100000 mmsf) *		DD-503	CUB485	4DP-3-503 4DP-3-t04	GEM-401	4TM-93
C61	. 1 400V		P488N-1	DF-004	CUB4PI	4DP -3-104	GEM-401	
C62	.1 400V	Main 1	P488N-1	DF -104	CUB4P1			4TM-P1 50/8-210
C63	10000	Note 1	BPD-01	DD-103	BYAIOSI	CCD-103	GP110	5HK-St0
C64	10000	N. T	BPD-01	DD-103	BYAIOSI	CCD-103	GPHO	5HK-810
C65	10000	Note t	BPD-01	DD-103	BYAIOSI	CCD-103	GPHO	5HK-810
C66	10000	Note 1	BPD-01	DD-103	BY A1051	CCD-103	GPILO	5HK-810

Note 1. Not used in some versions.

# Harman-Kardon Part Number.

Alternate Value.

# PARTS LIST AND DESCRIPTIONS (Continued)

## RESISTORS

## All wattages 1/2 watt, or less, unless otherwise listed.

	ITEM No.	RATING	REMARKS
	RI	33K	
	R2	6847	ł l
	R3	10000 ts	
	R4	3. 3meg	
	R5	10Ω:	
	R6	330€	
	R7	22K	
	RB	1000€	
	R9	68Ω	
	Rio	1000₽	
	Rit	3300	
	RI2	120Ω	
	R13	330Ω	
	RI4	$120\Omega$	
	RI5	100K	
	RIG	10 K	
	R17	120Ω	]
	R18	10meg	
	R19	470K	
	R20	2. 2meg	
	R21	1. 2 meg	
16.7		_	-

Mai No.	RATING	REMARKS
22	lmeg	
123	100K	
24	1000 \O	
125	22K	
26	150K	
(27	330017	
(28	22043	
(29	1meg	İ
t30	3300	
(3)	12052	(6847) *
(32	100K	
33	22K	
t34	lmeg	
225	3.300	(1000013) +
(36	470K	
137	33043	
138	4 70K	
139	3.30€	
₹40	leneg	
141	100K	
142	15K	

TEM No.	RATING	REMARKS
R43 R44	82K 6800Ω	
R45	220K	
R46	22K	(10 K) *
R47	100K	• •
R48	1500 €	
R49	470Ω	
R50	lmeg	
R51	4700Ω	
R52	100K	
R53	1meg	
R54	4700Ω	
R55	100K	
R56	330Ω IW	
R57	330Ω IW	
R58	330€ 1W	
R59	330Ω IW	
R60	1000 NW	
R61	1000Ω FW	

### Alternate Value.

# COILS (RF-IF)

			R	EPLACEMENT	DATA			
No.	USE	Harman-Kardon PART No.	Gramer PART No.	Meissner PART No.	Morit PART No.	Miller PART No.	Rom PART No.	NOTES
Li	FM Antenna Coll	GLCOM3082						2 ub
L2 L3	RF Choke RF Choke	GLCOM3083						
L4	FM RF Coll	i						3. 3uh
L5	FM Mixer Coll				l 1		'	
L6	Cathode Choke		19-1000	19-1000	BC -56t	4602		luh
L.7	FM Osc. Coil				200-200	7 444		II SALL
L8	RF Choke							3. 3uh
L9	Fit. Choke		l		l 1			3. 3uh
L10	ist FM IF Trans.	GT2503045	t6-3487	16-3487	FM-254	1463		
LII	2nd FM IF Trans.	GT2503045	16-3487	16-3487	FM-254	1463		
LI2	3rd FM (F Trans.	GT2503045	16-3487	16-3487	FM-254	1463		
LI3	4th FM IF Trans.	GT2503045	t6-3487	16-3487	FM-254	1463		
L14	Fil. Choke							3. 3uh
LIS	FU. Choke							3. 3սհ
LI6	Discriminator	GT2503052	17-3494	17-3494	FM-253	1464		
LI7	Loopstick	GL2923276			BC -418 †			
LLS	AM RF Trans.	GT2493012		1	l i			
LLS	AM Osc. Coll	STCOM3279				70 OSC		
L20	let AM IF Trans.	GTCOM3346	16-6758	16-6758	BC -352	12-C1	RF-L	
L21	2nd AM IF Trans.	GTCOM3346	16-6758	16-6758	BC -353	12-C2	RF-2	
L22 L23	3rd AM IF Trans.	GTCOM3346	16-6758	16-6758	BC -353	12-C2	RF-2	
L24	10KC Füter Fil. Choke							300MH
L25	Fil. Choke							3.3ah
بعد	t til in skrike							3. 3uh

<sup>†</sup> Use original mounting brackets.

# TRANSFORMER (POWER)

		•				REPLACI	EMENT DATA	•		
ITEM No.		RATING		Harman-Kardon	Halldorson	Morid	Rom	Stancor	Thordorson	Triad
	PRI.	SEC. 1	58C. 2	PART No.	PART No.	PART No.	PART No.	PART No.	PART No.	PART No.
T1	117V ③ .5A	220VCT 3 .100A	6. 3V 3 4.5A	FT2923274B						
	5EC. 3 6. 3 V	SEC. 4	5€C. 5							
ĺ	Not used								14	

## COMPONENT COMBINATIONS

ITEM. No.	USE	DESCRIPTION	Harman-Kardon PART No.	REPLACEMENT DATA
K1	FM AFC Filter	470mm!, 10000mmf, 10000mmf, 47Ω, 470K, Imeg	PCCOM3080	Sprague V-21
NC2	Discriminator Network	100mmt, 2000mmf, 10000mmt, 22K, 180K, 180K, 1meg	PCCOM308l	Sprague C-8
K3	AM Detector-Audio Filter	150mmf, 150mmf, 47K	P781599	Aerovox PA-98 Centralab PC-51 Cornell-Dubilter lllTM2 Sprague D-2

### RECTIFIERS

	RATING		REPLA	CEMENT DATA			
ITEM. No.	CURRENT (Measured)	Harman-Kardon PART No.	INTERNATIONAL PART No.	ITT PART No.	SARKES TARZIAN PART No.	SYLVANIA PART No.	NOTES
M12 M3 M4	. 050A . 050A . 010A . 010A	STCOM3270 • STCOM3270 • 1362133 • 1362133 •	RS065 * RS065 * R\$065 * R\$065 *	1234AH * 1234AH * 1234AH * 1234AH *	65A * 65A * 65 * 65 *	SR 200 + SR 200 + SR 200 + SR 200 +	* Scienium Type * Silicon Type

## **FUSES**

				REPLACEMENT DATA						
ITEM. No.	TYPE	RATING	Harman-Kardon PART No.					•	USS IT No.	
			FUSE	HOLDER	FUSE	HOLDER	FUSE	HOEDER		
M5	3AG	3A 250V	ZCOM329I	HC33901	312003 (3AG 3A 250V)	342001	AGC3	нкр		

## CRYSTAL DIODES

			REPLACEM	ENT DATA		
ITEM No.	ORIG. TYPE	Harman-Kardon PART No.	CBS PART No.	RAYTHEON PART No.	SYLVANIA PART No.	NOTES
M6 M7	1N541 1N87		1N636 1N636	1N295 1N295	1N295 1N295	FM Tuning Ind. Rect. (Pigtail) AM Tuning Ind. Rect. (Pigtail)

## MISCELLANEOUS

ITEM No.	PART NAME	Harman-Kardon PART No.	NOTES
M8	FM Tuning Cap. AM Tuning Cap. Switch	JV2923213	3 Gang
M9		JV2923214	3 Gang (Ant. 24-38kmmf, RF 20-390mmf, Osc. 15-90mmf)
M10		2923275	Function (Pushbutton Type)

# WIRING DATA

General-use Unshielded Hook-up Wire		•
Power Cord	Use BELDEN No.	
		$1725-K (7\frac{1}{2} \text{ Ft. Length})$