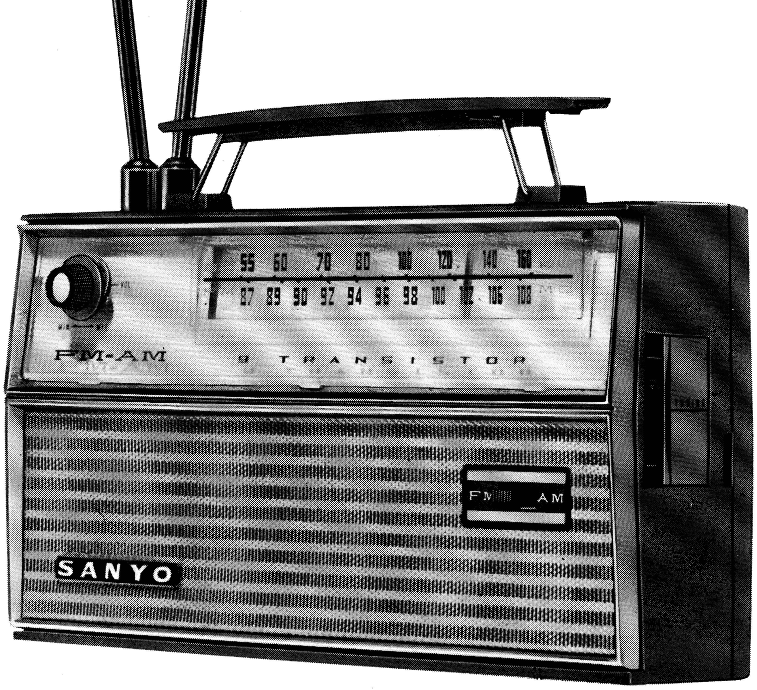
SANYO

MODEL
AFT-3

All-transistor Radio
Service Manual



SPECIFICATIONS

FREQUENCY RANGE

FM	87-108 Mc/s
AM	535-1605 Kc/s

INTERMEDIATE FREQUENCY

FM	10.7 Mc/s
AM	455 Kc/s

SENSITIVITY

FM	50 μV at 30 db quieting 75 ohms input
AM	Radiation sensitivity 50μV/m for 10 mW output

S/N RATIO

FM	55 db at 1 mV input

DISTORTION

FM	less than 4 % at 1 mV input

OUTPUT POWER

Undistorted	280 mW
Maximum	400 mW

POWER SOURCE

6 volts: 4 C size flashlight batteries
· Current drain FM no signal no output 18 mA
Maximum output 110 mA

TRANSISTORS

2SA240	FM	RF Amplifier
2SA240B2	FM	Converter
2SA93	FM	1st IF Amplifier
	AM	Converter
2SA93	FM	2nd IF Amplifier
	AM	1st IF Amplifier
2SA93	FM	3rd IF Amplifier
	AM	2nd IF Amplifier
2SB54	FM	Impedance Matching
2SB54	AF	Amplifier
2SB189 × 2		Power Amplifier

DIODES & THERMISTOR

1N60	AM	AVC
1N60	FM	Limiter
1N60 × 2	FM	Detector
1N60	AM	Detector & AVC
1N60	FM	AVC
D91A		Thermistor: Current Regulator

SPEAKER

3½″ Permanent dynamic speaker
Voice-coil impedance 7 ohms

ANTENNA

Ferrite core bar antenna for AM
Built-in telescoping V antenna for FM

DIMENSIONS

Width	9½″
Depth	2½″
Height	5″

WEIGHT

Approximately 3 pounds (with batteries)

SANYO ELECTRIC CO., LTD.

PART NO.	STOCK NO.	DESCRIPTION

FIXED RESISTORS

PART NO.	STOCK NO.	DESCRIPTION
R 1		2.2K ohm ±10% ½W Mold
R 2		5.6K ohm ±10% ½W Mold
R 3		560 ohm ±10% ½W Mold
R 4		100 ohm ±10% ½W Mold
R 5		1K ohm ± 5% ¼W Carbon film
R 6		2.2K ohm ± 3% ¼W Carbon film
R 7		6.2K ohm ± 3% ¼W Carbon film
R 8		100 ohm ±10% ½W Mold
R 9		4.7K ohm ±10% ½W Mold
R 10		27K ohm ±10% ½W Mold
R 11		1.5K ohm ±10% ½W Mold
R 12		3.3K ohm ±10% ½W Mold
R 13		22K ohm ±10% ½W Mold
R 14		5.6K ohm ±10% ½W Mold
R 15		3.3K ohm ±10% ½W Mold
R 16		330 ohm ±10% ½W Mold
R 17		220 ohm ±20% ½W Mold
R 18		5.6K ohm ±10% ½W Mold
R 19		5.6K ohm ±10% ½W Mold
R 20		5.6K ohm ±10% ½W Mold
R 21		220K ohm ±10% ½W Mold
R 22		220K ohm ±10% ½W Mold
R 23		10K ohm ±10% ½W Mold
R 24		5.6K ohm ±10% ½W Mold
R 25		18K ohm ±10% ½W Mold
R 26		1K ohm ±10% ½W Mold
R 27		4.7 ohm ±10% ½W Mold
R 28		1K ohm ±10% ½W Mold
R 29		100 ohm ±10% ½W Mold
R 30		68 ohm ±10% ½W Mold
R 31		1.3K ohm ± 5% ¼W Carbon film
R 32		2.2 ohm ±10% ½W Mold
R 33		100 ohm ±10% ½W Mold
R 34		5.6K ohm ±10% ½W Mold
R 35		56K ohm ±10% ½W Mold
R 36		10K ohm ±10% ½W Mold
R 37		27K ohm ±10% ½W Mold

ELECTROLYTIC CAPACITORS

PART NO.	STOCK NO.	DESCRIPTION
C 20		30 μF 6 V
C 35		5 μF 6 V
C 36		30 μF 6 V
C 37		30 μF 6 V
C 38		200 μF 10 V
C 39		100 μF 6 V
C 40		200 μF 10 V

FIXED CAPACITORS

PART NO.	STOCK NO.	DESCRIPTION
C 1		25pF ±10% 250V Ceramic
C 2		10pF ±1pF 25V Ceramic
C 3		0.005μF +80-20% 25V Ceramic
C 4		0.005μF +80-20% 25V Ceramic
C 5		3pF ±0.5pF 500V Ceramic
C 6		500pF ±20% 50V Ceramic
C 7		20pF ±10% 250V Ceramic

FIXED CAPACITORS (Continued)

PART NO.	STOCK NO.	DESCRIPTION
C 8		0.001pF +80-20% 25V Ceramic
C 9		3pF ±0.5pF 500V Ceramic
C 10		50pF ±10% 500V Ceramic
C 11		0.005μF +80-20% 25V Ceramic
C 12		0.005μF +80-20% 25V Ceramic
C 13		15pF ±10% 25V Ceramic
C 14		0.005μF +30-20% 50V Mylar
C 15		0.005μF +30-20% 50V Mylar
C 17		10pF ±1pF 25V Ceramic
C 18		330pF ±10% 125V Styrol
C 19		0.01μF +30-20% 100V Mylar
C 22		6pF +0.5pF 25V Ceramic
C 23		0.01μF +80-20% 25V Ceramic
C 24		0.01μF +80-20% 25V Ceramic
C 25		25pF ±10% 250V Ceramic
C 26		8pF ±0.5pF 25V Ceramic
C 27		20pF ±10% 250V Ceramic
C 28		0.04μF +80-20% 25V Ceramic
C 29		0.04μF +30-20% 50V Mylar
C 30		0.02μF +30-20% 50V Mylar
C 31		200pF ±20% 500V Ceramic
C 32		200pF ±20% 500V Ceramic
C 33		0.001μF +30-20% 50V Mylar
C 34		0.01μF +80-20% 25V Ceramic
C 41		0 005μF +30-20% 50V Mylar
C 42		0.005μF +30-20% 50V Mylar
C 43		200pF ±20% 500V Ceramic
C 44		200pF ±20% 500V Ceramic

CABINET

PART NO.	STOCK NO.	DESCRIPTION
	R-31392 a	Cabinet
	R-31393	Back
	R-32192	Dial plate (polysryrol)
	R-28031	Frame metal
	R-26361	Front panel
	R-26364	FM/AM 9 TRANSISTOR panel
	R-35157	Handle
	R-23481	" SANYO " mark
	R-34051	Volume control knob
	R-33289	Drum
	R-33263	Tuning control knob

MISCELLANEOUS

PART NO.	STOCK NO.	DESCRIPTION
	R-26363	" Tuning " plate
	R-24031b	Screw to fix back cover
	R-15096a	Spring for drum
	R-23482	Pointer
	R-23367	Positive terminal
	R-S8279	Negative terminal
	R-S1136	Rod antenna
	R-S2040	Earphone jack
	R-S2025a	AM antenna jack
	R-S3100	FM antenna terminal board
	R-23348	Spade lug
	R-S8278	Back screen

Printed in Japan

ALIGNMENT PROCEDURES

In aligning this combined AM/FM receiver, the two alignment processes are substancially independent of each other but it should be mentioned that alignment of AM section should be proceded with that of FM because of avoiding unfavourable result which may be caused by interference between closely located parts.

Alignment of FM section

Many excellent instruments are used to speed up and increase the efficiency of the process of aligning FM set as well as to obtain the superior performance of our product.

Equipment required:

An oscilloscope

A sweep marker generator for FM IF alignment or a sweep type signal generator and a marker generator.

A tuning wand

A network (as in Fig. 2)

A FM signal generator covering 87 to 108 Mc/s

A vacuum tube voltmeter

The method of connecting the apparatus for visual alignment of FM receivers is illustrated in Fig. 1. It is common that, in order to assist with the alignment, a small "pip" can be produced on the displayed curve by injecting a marker signal from an accurately calibrated signal generator to the receiver together with a sweep generator signal.

In this illustrated case we use the sweep marker generator. It has a built-in marker generator which produces a signal of 10.7Mc/s fixed and 10.7Mc/s signal with the side marker signal of $\pm$200Kc/s separated from 10.7Mc/s.

The marker signal with its output variable is injected in the sweep generator to the signal which has passed through the receiver and is picked up from the receiver.

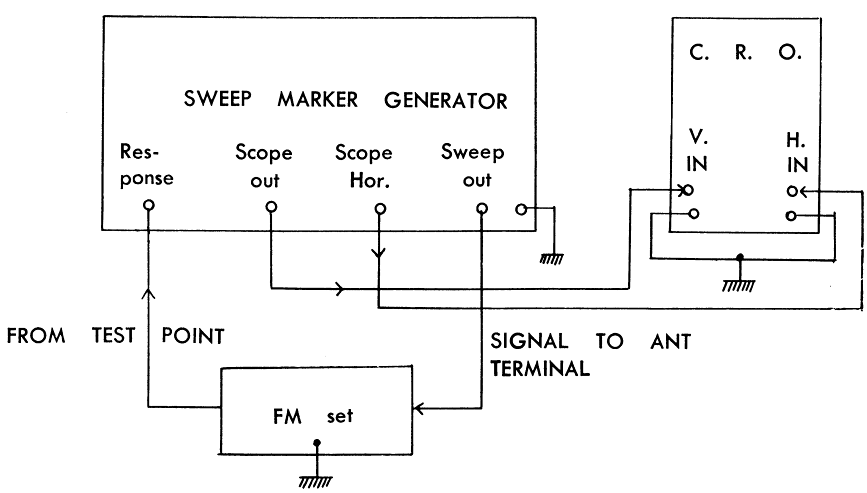


Fig. 1

FM IF alignment

1. Connect the "hot" lead from the sweep marker generator through $0.01\mu F$ to FM antenna terminal and the ground lead to the earth terminal. Before this connection the dial should be set at the position of both no interference signal and as-large-as-possible capacitance of the tuning gang.

2. Connect the "Response from Receiver" cable from the generator in series with a network illustrated in Fig. 2 between test point "A" and "E" (earth). (Refer to main parts location and Fig. 3)

3. Adjust the output of the sweep marker generator to a level just high enough to provide a sufficient scope pattern.

4. Adjust T1, T2, T4 and the primary of T6, viewing a scope pattern, to obtain a response curve indicated as Fig. 5.

5. This adjustment is accomplished as following. First tune T4 and primary of T5 for maximum gain, simultaneously keeping the trace precisely centered on the 10.7Mc/s. Next adjust T1 and T2 to make the on-10.7Mc/s-centered pattern symmetrically-shaped and to obtain maximum gain with simultaneous intent to locate the markers of plus and minus 200Kc/s symmetrically as to the 10.7Mc/s. This will complete the FM IF alignment.

6. In above procedures, the output of the sweep marker generator should be reduced to a level just high enough to provide a usable scope pattern in proportion to the gain increase of IF stages. It is necessary to avoid limiting effect for aiming at precise alignment.

FM discriminator alignment

1. Connect the sweep marker generator in the same way as IF alignment.

2. Connect the "Response from Receiver" cable directly to test point "B" (see Fig. 3), without the network of Fig. 2, and lower lead to earth.

3. Detune the secondary of detector transformer by turning its core at maximum anticlockwise position and then you will have the scope pattern which is similar to the pattern seen in IF alignment except the reverse polarity.

4. This pattern should be symmetrical as to 10.7Mc/s marker. If not symmetrical, readjust the primary of T5 a little bit for complete symmetry. When slight turn of the slug is not effective, realignment of IF stages should be necessary. Also check the symmetry of $\pm$200Kc/s markers.

5. If the symmetric curve obtained, tune the slug of the secondary for having the 10.7Mc/s marker located at the 0 level and obtaining "S"-shaped curve illustrated in Fig. 9.

6. Adjustment of detector stage is successfully completed if scope pattern as illustrated in Fig. 9, in which "S" curve and location of side markers of $\pm$200Kc/s are symmetrical viewed from the reference point of symmetry (10.7Mc/s), is obtained. In the case of unsymmetrical pattern, turn the slug of primary of T5 a little bit to make it symmetric. When slight turn of the slug is not effective, realignment of IF stages is required.

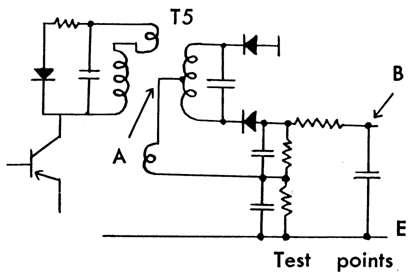


Fig. 3

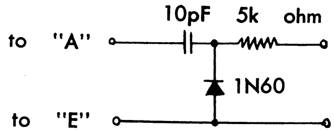


Fig. 2

Alignment for FM RF stages

Preparation for alignment

FM signal generator is used instead of a sweep marker generator and connected as in Fig. 4.

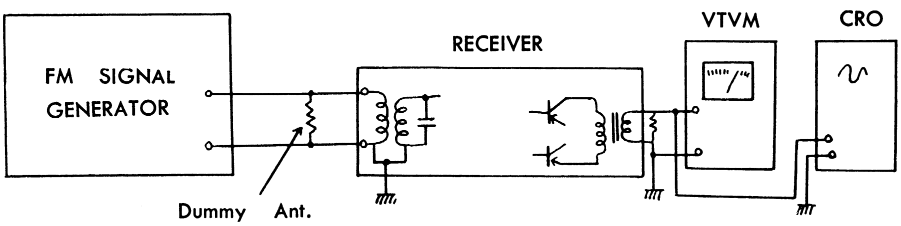


Fig. 4

Use FM signal modulated at 400cps with deviation of $\pm$22.5Kc/s, and the output cable from the generator should be terminated with dummy antenna, impedance of which depends on signal generator used. The signal developed across the dummy is applied to receiver.

Output power of receiver is consumed with dummy load equivalent to speaker.

A desirable voltage range of vacuum tube volt meter is 1.5V because alignment conducted at a level of 50mW output power.

FM RF alignment

1. Set the volume control at position of medium volume and set the tuner dial at 90Mc/s.

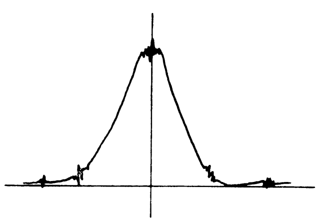
2. Set the generator frequency at 90Mc/s. Adjust oscillator coil for maximum deflection of meter. If it is difficult to obtain optimum gain, slight adjustment of oscillator trimmer (Ct 2) is paid.

3. Set the generator frequency and tuner dial at 106Mc/s, obtain maximum gain by adjustment of Osc. trimmer.

4. Again set tuner dial at 90Mc/s and vary the generator frequency around 90Mc/s to be tuned by the tuner. When the tuning generator frequency is not 90Mc/s adjust Osc. coil to obtain optimum gain at 90Mc/s of the generator frequency.

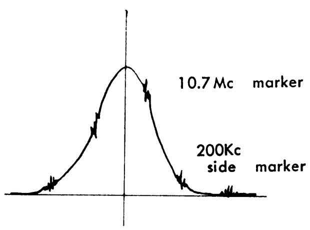
5. Set tuner dial at 106Mc/s and vary the generator frequency around 106Mc/s to be tuned by the tuner. When the tuning generator frequency is not 106Mc/s, adjust Ct2 to obtain optimum gain at 106Mc/s of generator frequency.

6. Repeat the entire process until no further adjustment is required at either point of the dial.



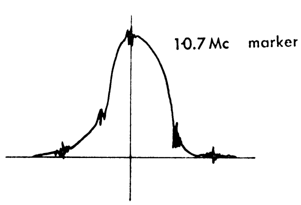
SCOPE PATTERN OF COMPLETE IF CHARACTERISTICS
Curve is symmetric. 10.7 Mc marker locates at center of curve. Symmetrical location of side markers.

Fig. 5



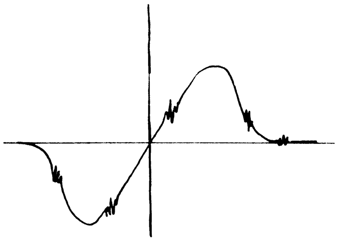
UNCOMPLETE IF CHARACTERISTIC PATTERN
Symmetric curve, but off-centered 10.7 Mc marker.

Fig. 6



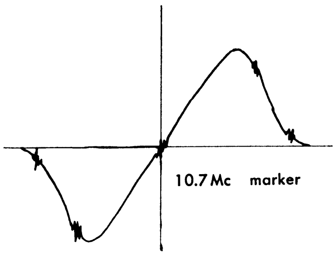
UNCOMPLETE IF CHARACTERISTIC SCOPE PATTERN
10.7 Mc marker on center of curve, but unsymmetric curve.

Fig. 7



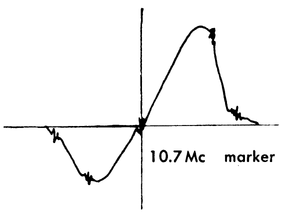
UNCOMPLETE DETECTOR CHARACTERISTIC SCOPE PATTERN
Symmetric curve, but bad location of markers.

Fig. 8



COMPLETE DETECTOR CHARACTERISTIC SCOPE PATTERN
" S " curve and location of markers is symmetric in reference to 10.7 Mc marker.

Fig. 9



UNCOMPLETE DETECTOR CHARACTERISTIC SCOPE PATTERN
" S " curve is unsymmetric viewed from reference point of 10.7 Mc marker.

Fig. 10

Tracking

1. Set the generator frequency at 106Mc/s and make the tuner tune in the 106Mc/s signal.

2. Adjust trimmer Ct1 for maximum gain. If the gain increases with approaching tuning wand to coil L3 for checking the tracking, readjust the trimmer for maximum meter reading.

3. Set the generator at 90Mc/s and make the tuner tune in the 90Mc/s signal. Adjust the slug of oscillator coil L3 for maximum gain. If the gain increases at the time of approaching tuning wand to L3, readjust the slug of L3.

4. Arrange in the manner as step 1 and approach the wand to L3. If the gain increases readjust the slug.

5. Arrange in the manner as step 3 and approach the wand to L3. If the gain increases readjust the trimmer.

6. Repeat steps 4 and 5 until no further adjustment is required at either end of the dial. During this entire procedures, make certain that the generator output is keeped to a level just high enough to produce usable meter deflection.

Overall checking of alignments

After adjustment of RF and IF stages finished, apply the signal of 94Mc/s to the antenna terminal of tuner and have the receiver tuned in the signal accurately. Observe the waveform of output signal across the dummy load with 30 db level of the signal modulated at 400 cps, 75 Kc deviation applied to the antenna. If the precise waveform of 400 cps sinewave appeared on the scope, adjustment will be proved to be successfully completed, and if heavily distorted waveform readjustment of IF and RF stages should be required. When the frequency of the signal generator is changed at same distance away from the center tuning frequency of the tuner on either side, waveform and degree of distortion of both cases should be similar to each other. If not, readjustment of IF stages and discriminator should be necessary.

AM sections alignment procedures

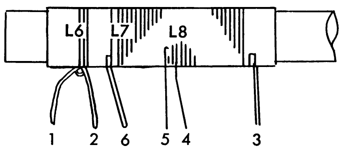
Apply volt-meter across the voice coil. Volume control should be at maximum position. Output of signal generator should be no higher than necessary to obtain output reading in order to avoid AVC function.

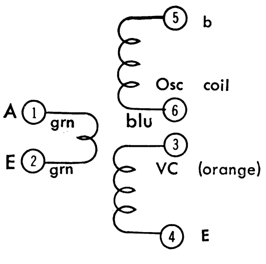
STEP	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	RADIO DIAL SETTING	ADJUST FOR MAXIMUM OUTPUT
IF ALIGNMENT				
1	High side through 0.1 mF capacitor to antenna stator lug on tuning gang. Low side to chassis.	455 Kc	540 Kc	IF transformer T7 T5 T3
BROADCAST RF ALIGNMENT				
2	Fashion loop of several turns of wire and radiate signal into loop antenna.	540 Kc	540 Kc	Osc. coil L 10
3		1600 Kc	1600 Kc	Osc. trimmer Ct 4
4		Repeat step 2 and 3.		
5		600 Kc	600 Kc	Ant. coil L 8
6		1400 Kc	1400 Kc	Ant. trimmer Ct 3
7		Repeat step 5 and 6.		

MAIN PARTS TERMINAL IDENTIFICATIONS

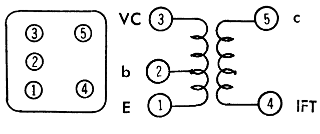
1. AM

Antenna coil L6 L7 L8

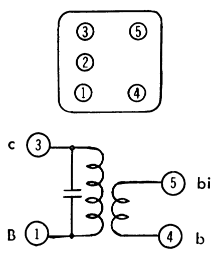




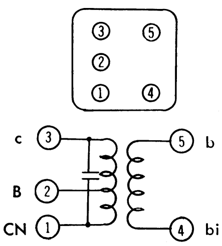
Osc coil L9 L10 (red)



IFT T3(yellow)

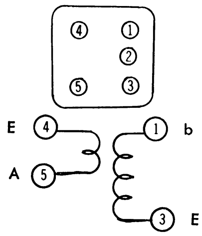


IFT T5(white) T7(black)

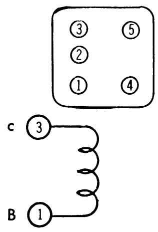


2. FM

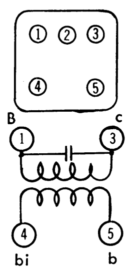
Antenna coil L1 L2



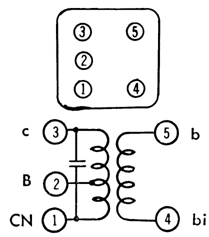
RF coil L3



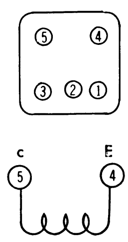
IFT TI



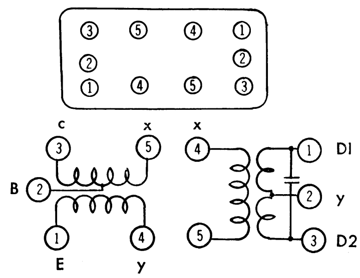
IFT T2 T4



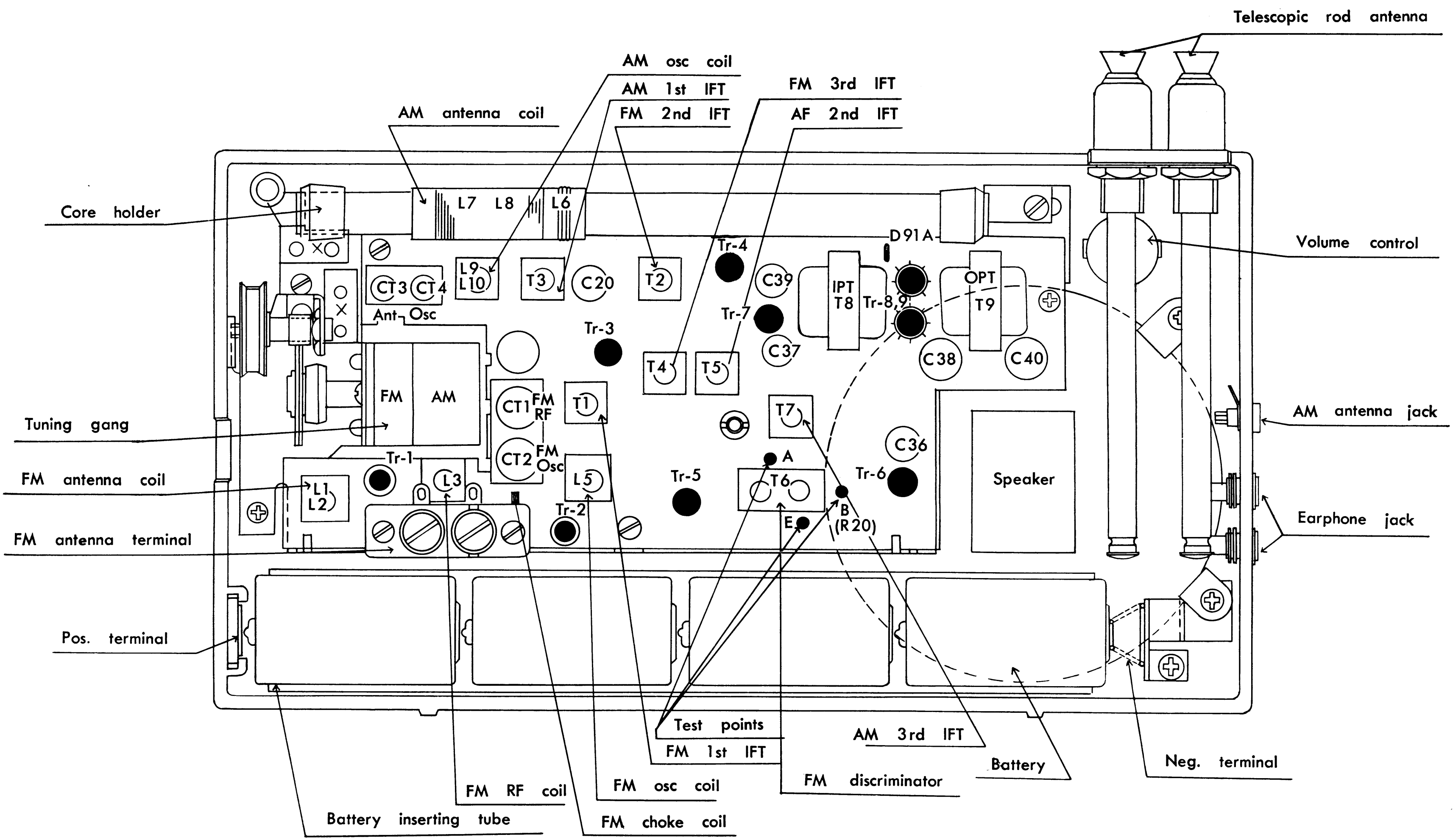
Osc coil L5



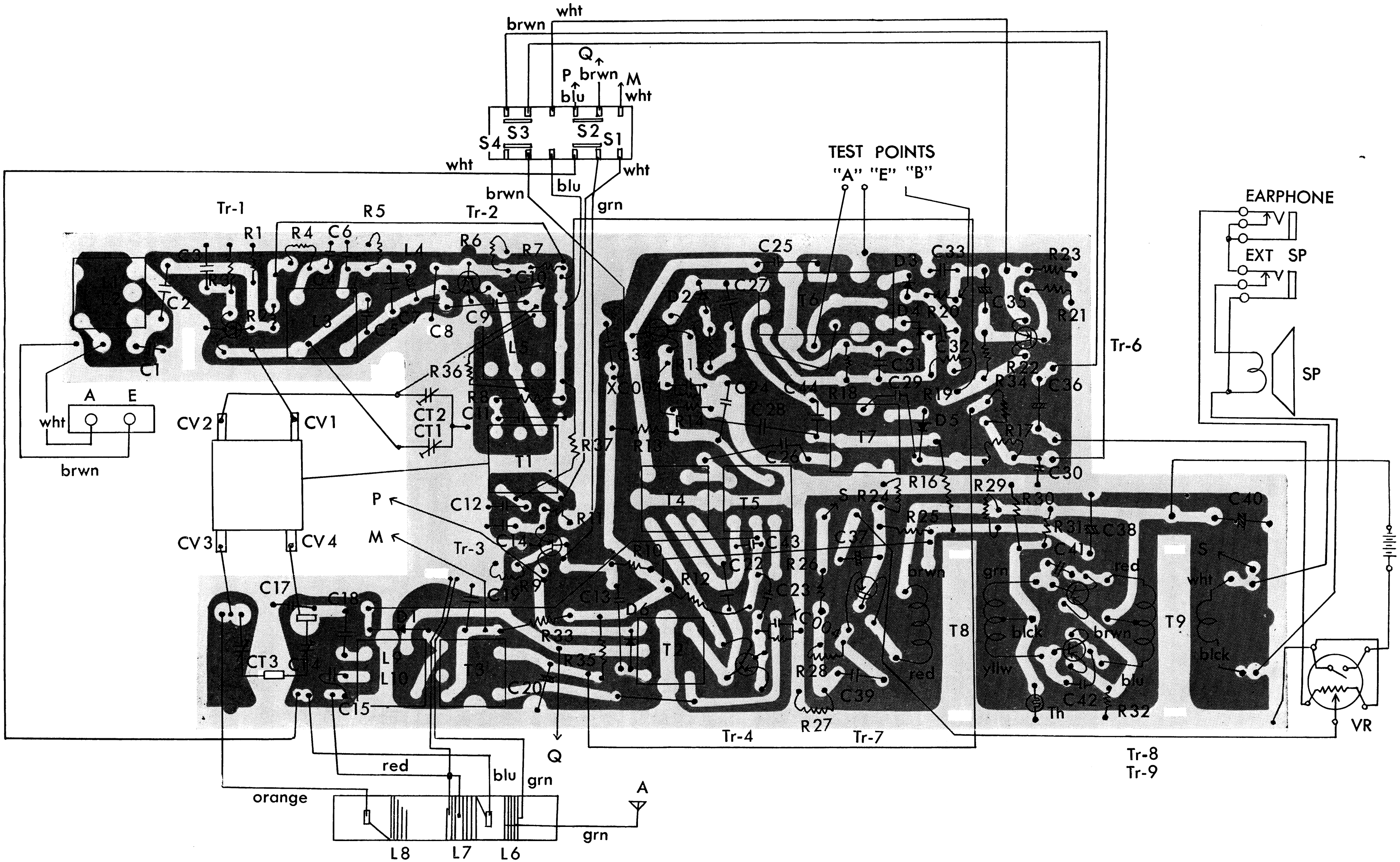
IFT T6



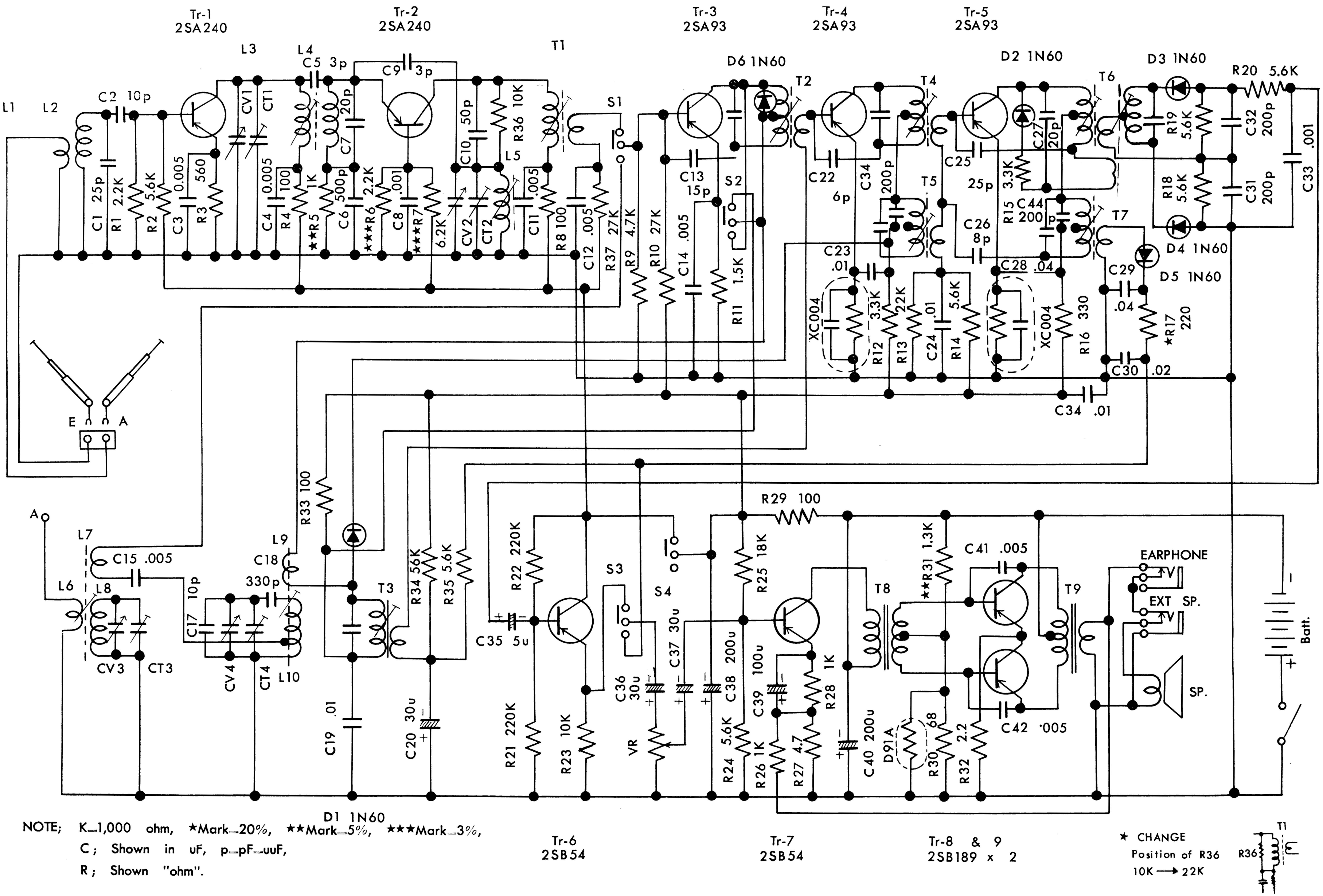
MAIN PARTS LAYOUT



INTER-PARTS WIRING ILLUSTRATION

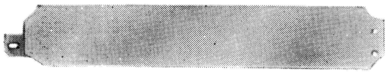


MODEL AFT-3 CIRCUIT DIAGRAM



NOTE; K—1,000 ohm, ★Mark—20%, ★★Mark—5%, ★★★Mark—3%,
C; Shown in uF, p—pF—uuF,
R; Shown "ohm".

(R-S8278)



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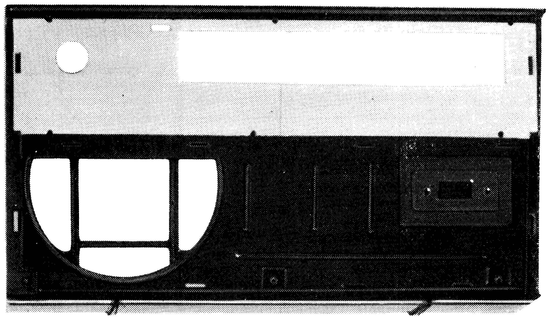
(R-31392 a)



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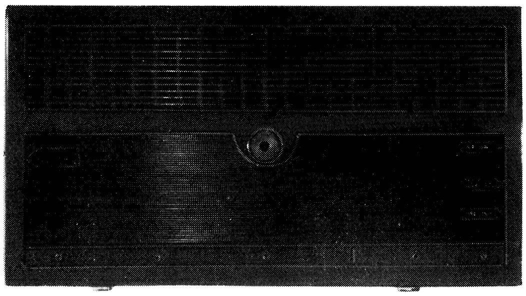

PART NO.	STOCK NO.	DESCRIPTION
TRANSISTORS		
Tr 1	2SA240	FM RF Amplifier
Tr 2	2SA240B2	FM Converter
Tr 3	2SA93	FM 1st IF Amplifier
		AM Converter
Tr 4	2SA93	FM 2nd IF Amplifier
		AM 1st IF Amplifier
Tr 5	2SA93	FM 3rd IF Amplifier
		AM 2nd IF Amplifier
Tr 6	2SB54	FM Impedance Matching
Tr 7	2SB54	AF Amplifier
Tr 8	2SB189	Power Amplifier
Tr 9	2SB189	Power Amplifier
DIODES & THERMISTOR		
D 1	1N-60	AM AVC
D 2	1N-60	FM Limiter
D 3	1N-60	FM Detector
D 4	1N-60	FM Detector
D 5	1N-60	AM Detector & AVC
D 6	1N-60	FM AVC
T H	D91A	Thermistor : Current Regulator
LOUD SPEAKER		
S P	R-S6150	3½″ Speaker
	(R-S6191 Recent change)	

PART NO.	STOCK NO.	DESCRIPTION
CONTROLS		
S1 ∼ 4	R-S4164	Slide switch
V C	R-C1061a	Variable Capacitor
Ct 1, 2	R-C0023	2-Block Trimmer
Ct 3, 4	R-C0013	2-Block Trimmer
V R	R-R11618	Volume control
COILS		
L 1, 2	R-W2078	FM Antenna coil
L 3	R-W4013	FM RF coil
L 4	R-W1014	FM Choke coil
L 5	R-W8048	FM Oscillator coil
L 6, 7, 8	R-S8419	AM Antenna coil
L 9, 10	R-W8025	AM Oscillator coil
TRANSFORMERS		
T 1	R-W5T076	FM IF Transformer 1st stage
T 2, 4	R-W5T075	FM IF Transformer 2nd & 3rd stage
T 3	R-W5T083	AM 1st IF Transformer
T 5	R-W5T084	AM 2nd IF Transformer
T 6	R-W5W004	FM IF Transformer det. stage
T 7	R-W5T073	AM 3rd IF Transformer
T 8	R-W6105	Input Transformer
T 9	R-W6106	Output Transformer
	(R-W6106① Recent change)	