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of Telecommunications Equipment
(including low-cost receivers for sound
broadcasting and television)

Vienna, 13 - 24 October 1969

DESIGN AND MANUFACTURING LOW-COST RECEIVERS OF RADIO BROADCASTS IN DEVELOPING COUNTRIES

Addendum 2:

Examples of Specifications and Design of Low-cost radio receivers [1]

by

Daiji Hara,
Managing Director, Toyo Radio Co., Ltd.,
Tokyo, Japan

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CORRIGENDUM

Page (iv)	Item 3.2 Read as "similar to type 'A' "
Page 1	Item 3 Read as "for input as under § 2"
	Item 5 Read as "At - 6 dB point; - 20 dB point;"
Page 10	Revised page 10 attached as Annex I
Page 13	Bottom View and Terminal Connections (4) Bise read as "Bias"
Page 19	Step 1-2-3 "Signal Source" "Territrod" read as "ferrite-rod" Step 1-2-3 "Set Radio Dial" "oper" read as "open"
Page 19	Step 4 "Step 1 through step 2 ....." Step 2 to read as step 3
	Step 5 "Tuning gang" to read "Tuning gang closed"

Page 22 — Item 3 (") for input 1 W/m
to read 1 W/m

Page 23 — Item 3
Add: "Must be such that the receiver does not require frequent retuning"

Page 24 — (3)
to read VOLUME CONTROL AND ON-OFF SWITCH

Page 28 — Fourth line from bottom
delete "Battery check"

Page 34 — Item 3 "Condition" The normal power supply voltage
read as: "At the normal power supply voltage"

Item 6 "Condition" the normal voltage
read as "At the normal voltage"

Page 35 — Item 8 Overall electrical fidelity
add: "within 6 dB limits"

Item 10 "Distortion"
add: "Output power 50 m W

Page 37 — fifth line from bottom "Gun cushion"
read as "Rubber cushion"

Page 47 — Note: I 100 kOhm
read as 100 kOhm

Page 48 — Revised page 48 attached as Annex II

Page 49 — Step "Receiver setting"
read as "Receiver dial setting"

ANNEX I

1.5.3 TUNING GANG CAPACITOR (1) (REVISED)

1. PERFORMANCE

(1) ANGULAR DISPLACEMENT VS CAPACITANCE OF EACH SECTION

ANGULAR DISPLACEMENT %	CAPACITANCE (PF)	
	SECTION # 1 (RF)	SECTION #2 (OSC)
100°	190.6	76.5
90	162.7	69.2
80	134.4	60.6
75	117.8	56.2
70	103.9	51.3
60	77.2	41.1
50	53.4	31.0
40	34.2	21.5
30	19.8	13.4
25.	14.4	9.9
20	9.9	7.2
10	3.1	2.2
0	0.0	0.0

(2) MINIMUM CAP. AT 0 A.D. : LESS THAN 9PF EACH SECTION INCLUDING MIN CAP OF TRIMMER

(3) TOLERANCE : ± (1PF + 1%) EACH SECTION

(4) MAX. CAP OF TRIMMER : MORE THAN 12PF EACH SECTION

(5) INSULATION RESISTANCE : 100MΩ MIN AT DC 250V

(6) Q : 300 MIN AT 10MHz, 50PF

(7) NOMINAL AIR GAP : # 1 SECTION : 0.15 MM

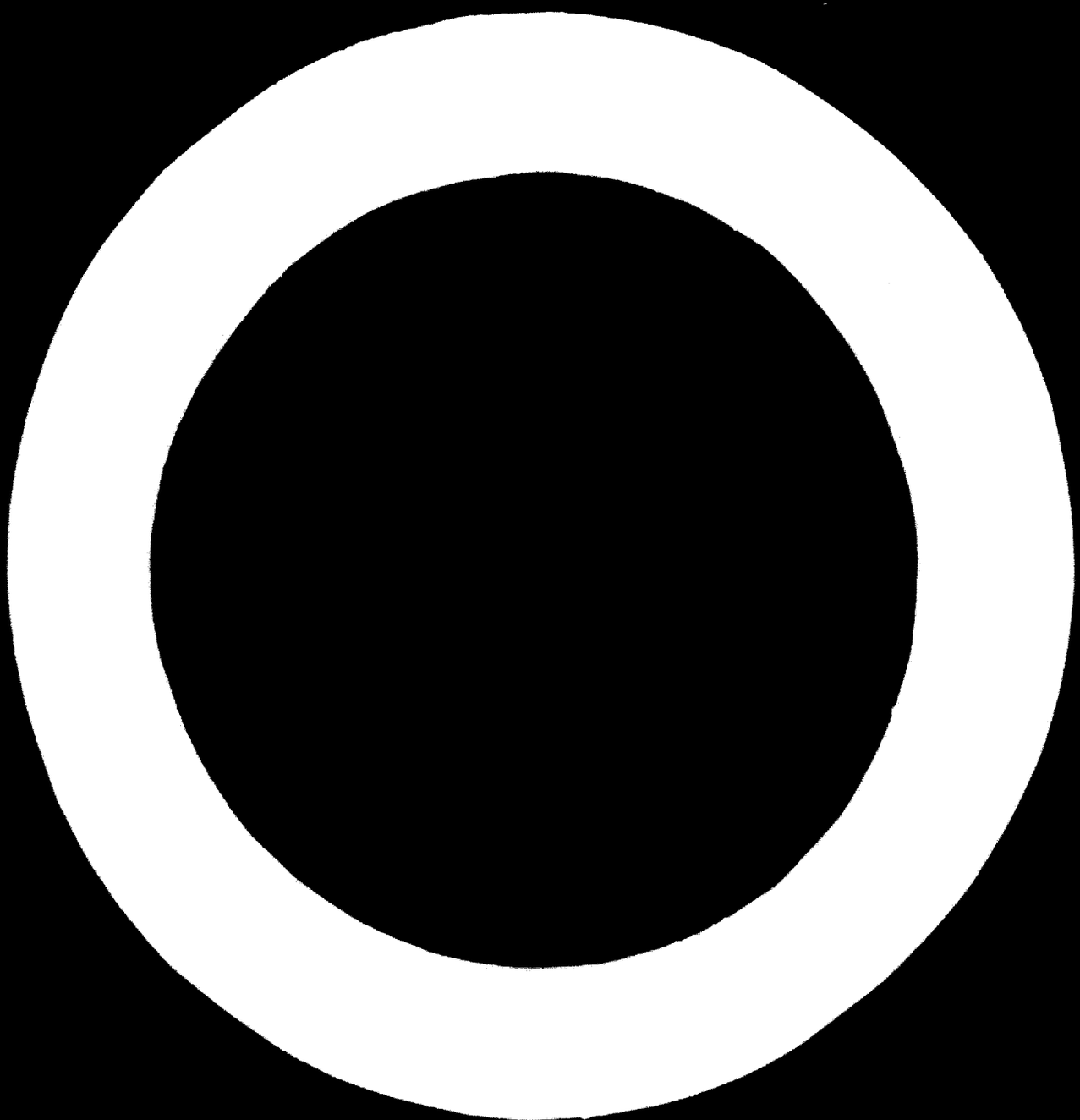
2 SECTION : 0.21 MM

(8) NO. OF PLATE (MOVABLE) : # 1 SECTION : 15

2 SECTION : 13

(9) MAX. ANG. DISP. : 180° ± 2°

(10) TORQUE REQUIRED : 100 - 300 g-cm



ANNEX II

3.6 ALGNMENT PROCEDURE

(REVISED)

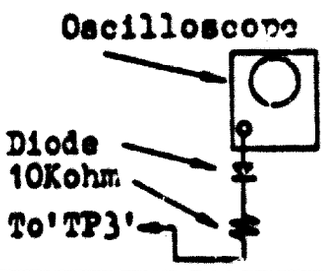
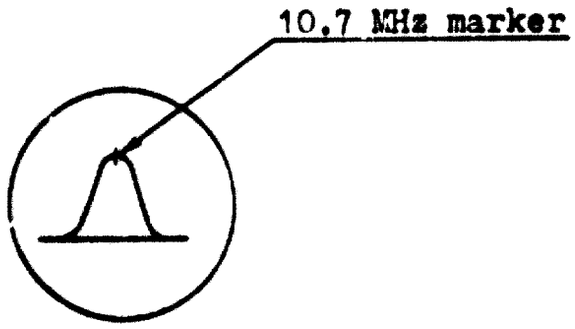
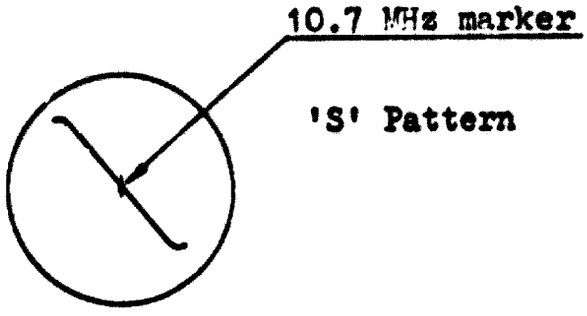
3,6,1 IF Section:

Test instrument Required;

(1) 10.7 MHz Sweep generator with marker generator
(2) Oscilloscope

General condition;

(1) Horizontal sweep of oscilloscope is synchronized with sweep generator
(2) Connect Sweep generator to test point TPZ through capacitor of 0.001uF
(3) Set tuning control of receiver under test at quiet point near 100 MHz

Step	Connect oscilloscope to	Adjust
1	To test point TP3 through diode and 10Kohm resistor in series as illustrated: 	Adjust IFT-C, IFT-B & IFT-A for max. and symmetrical pattern centered at 10.7 MHz marker as illustrated. 
2	To test point TP4	Adjust IFT-D for max. gain and then IFT-E for best linearity of 'S' pattern centering at 10.7MHz marker as illustrated. 

PREFACE

As discussed in chapter 3 of this paper, it may be somewhat difficult to present design details common to low cost radio receivers to be manufactured in various developing countries. Therefore, for reference, examples of performance specifications together with some of design drawing for Type A, B and C radio receivers are included in this Addendum 2; these types have been well received by many developing countries.

CONTENTS

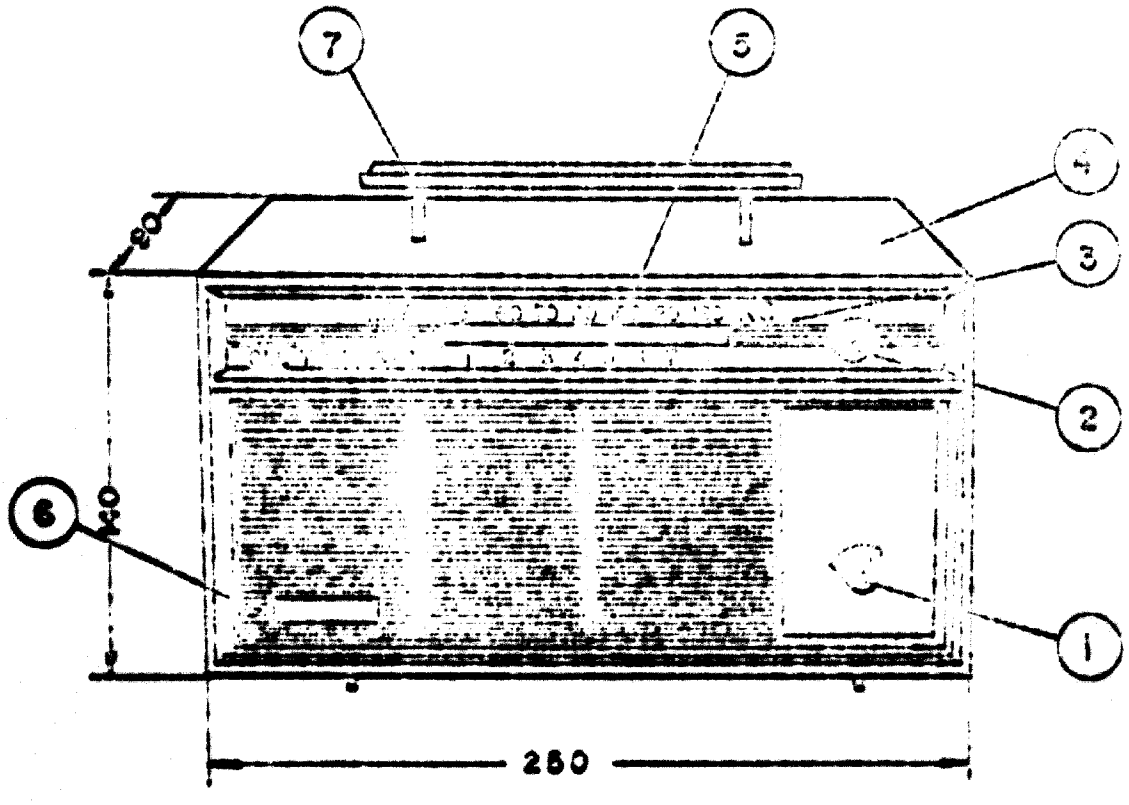
1.1 PERFORMANCE SPECIFICATIONS FOR TYPE "A" RADIO RECEIVERS

Item	Conditions	Nominal values	Acceptable limit
1. Frequency coverage	:	515 - 1650KHz	525 - 1605KHz
2. Sensitivity	: For 50mW output, 30% modulation at 400Hz with built-in antenna, at nominal power supply voltage	55μV/m	150μV/m
	- ditto - but at 70% power supply voltage of nominal voltage	550μV/m	1500μV/m
It shall be provided with facilities for using an external antenna.			
3. Signal-to-noise ratio	: For input as under S_2^S	30dB	24dB
4. Power output	: For distortion of 10% at nominal power supply voltage	400mW	300mW
	- ditto - but at 70% power supply voltage of nominal value	200mW	150mW
5. Overall selectivity	: At 0-6dB point;	±3KHz	±2.25KHz - ±4.5KHz
	-20dB point	±9KHz	±7KHz - ±13.5KHz
6. Intermediate frequency response ratio	: At 600KHz	35dB	30dB
Image frequency response ratio	--At 1400KHz	35dB	30dB
Spurious response ratio--		35dB	30dB
7. Overall electrical fidelity	: Within 12dB limits, reference 0dB level at 400Hz	80 - 3000Hz	200 - 3000Hz

8. Intermediate frequency	:	455KHz	450 - 460KHz
9. Distortion	: For input of 5mV/m at nominal power supply voltage	3%	7%
	- ditto - 50mV/m	5%	9%
10. Operative lowest power supply voltage	:	2.8V	3.5V

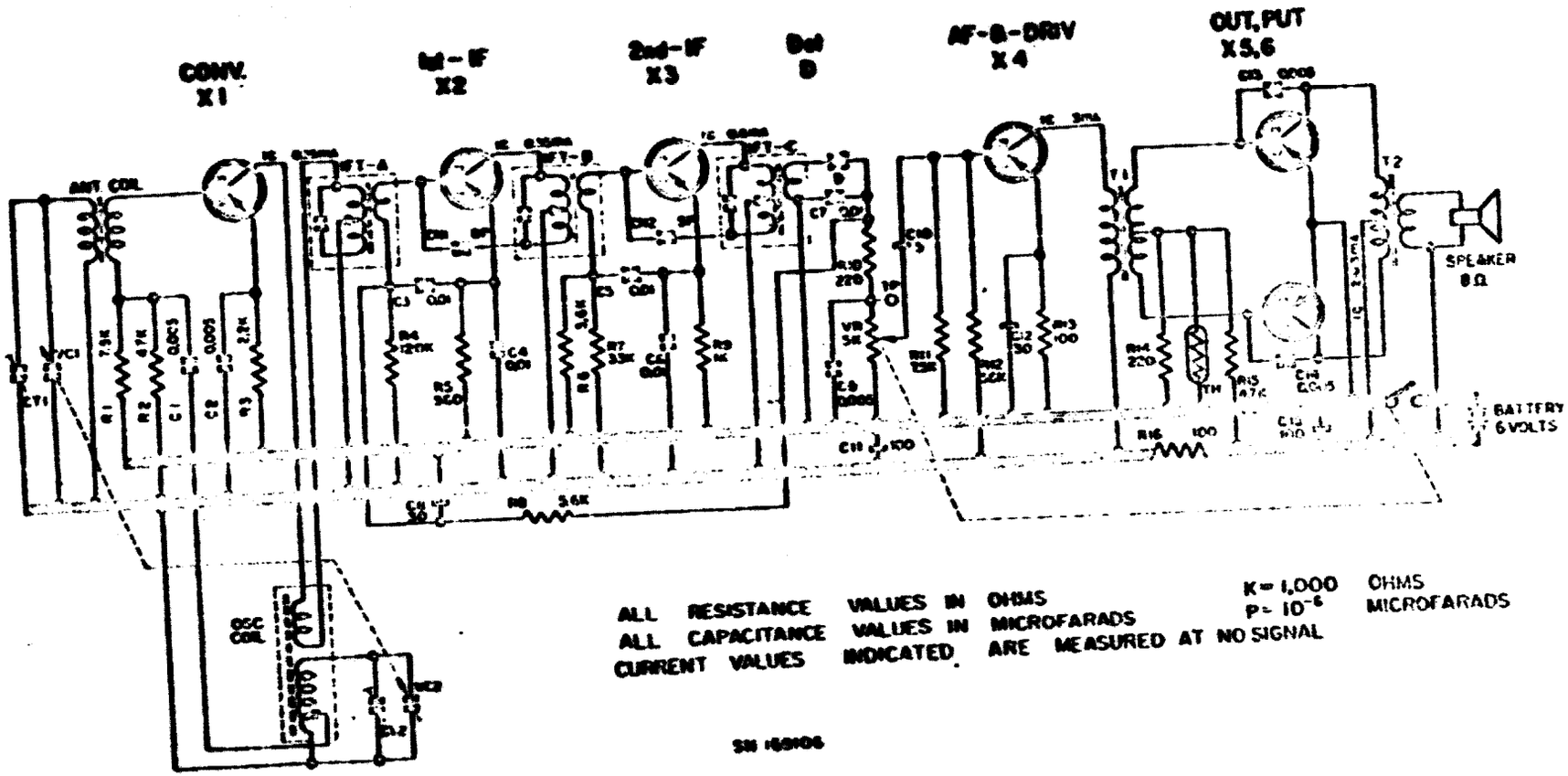
TYPE 'A'

1.2. EXTERNAL VIEW



① VOLUME CONTROL
② TUNING CONTROL
③ DIAL
④ CABINET
⑤ POINTER
⑥ NAME PLATE
⑦ CARRYING HANDLE

1.3 SCHEMATIC DIAGRAM TYPE "A"



ALL RESISTANCE VALUES IN OHMS K = 1,000 OHMS
ALL CAPACITANCE VALUES IN MICROFARADS P = 10^{-6} MICROFARADS
CURRENT VALUES INDICATED ARE MEASURED AT NO SIGNAL

SM-68106

1.4 LISTS OF COMPONENTS AND MATERIALS

ITEM NO.	SYMBOL NO.	DESCRIPTION
	X1	Transistor, 2SA201
	X2	- do - 2SA202
	X3	- do - 2SA202
	X4	- do - 2SB186
	X5, X6	- do - 2SB187
	D	Diode, IS188
	TH	Thermistor, 250Ω
	ANT	Antenna, transformer, includin ferrite rod
	OSC	Oscillator trans.
	IFT-A	1st IF transformer
	IFT-B	2nd IF trans.
	IFT-C	3rd IF trans.
	T1	Input trans.
	T2	Output trans.
	VC	Tuning gang control
	VR	Volume control
		Buffer, tuning control fitting
		Printed circuit board
		Chassis
		Speaker
		Tuning control shaft
		Spacer
		Antenna holder (2)
		Heat sink (2)
		Drum, tuning control use
		Spring, tuning control cord
		Cord, tuning control
		Battery (4)
		Wiring materials (see details)

R13, R16	Composite resistor,	100Ω, ±10%, 1/2W
R14	- do -	220Ω, ±10%, 1/2W
R5, R10	- do -	560Ω, ±10%, 1/2W
R9	- do -	1KΩ, ±10% 1/2W
R3	- do -	2.2KΩ, ±10%, 1/2
R15	- do -	4.7KΩ, ±10%, 1/2
R6, R8	- do -	5.0KΩ, ±10%, 1/2
R1, R11	- do -	7.5KΩ, ±10%, 1/2
R7	- do -	33KΩ, ±10%, 1/2W
R2	- do -	47KΩ, ±10%, 1/2W
R12	- do -	56KΩ, ±10%, 1/2W
R4	- do -	120KΩ, ±10%, 1/2

C10	Electrolytic capacitor,	3μF, 6WV
C8, C12	- do -	30μF, 6WV
C11, C15	- do -	100μF, 6WV

CN2	Ceramic capacitor,	5PF, ±0.5μF
CN1	- do -	8PF, ±0.5μF
C1, C2, C9, C13, C14	- do -	0.005μF, +100% -0%
C3, C4, C5, C6, C7	- do -	0.01μF, +100% -0%

Cabinet, unbreakable polystyrene
Back lid, cabinet, hardboard
Dial, acrylic resin
Control knob (2), polystyrene
Knurled screw (2), back lid securing
Panel, aluminum
Carrying handle, plastic, ABS
Badge, aluminum
Pointer

Battery retainer, vinyl chloride

Battery contact, positive terminal

- do - negative terminal

Battery holder

Pointer slide, pressboard

Gluing agent, Sony Bond or equivalent

Nejilock

Polystyrene bag

Carton box

Screw, 2.6ø x 6ℓ , C.R., P.H., drum fitting

- do - 2.6ø x 12ℓ, (2), C.R., P.H., antenna holder

- do - 3ø x 5ℓ , (3), C.R., P.H., tuning cont. fitting

- do - 3ø x 6ℓ , (2), C.R., P.H., tuning cont. shaft

- do - 3ø x 8ℓ, (6), C.R., P.H., battery contacts & battery holder

- do - 4ø x 10ℓ , (2), C.R., P.H., carrying handle

Self-tapping screw, 3ø x 8ℓ (4), chassis fitting

- do - 3ø x 6ℓ (4) speaker fitting

Nut, 3ø, HEX. (6), tuning cont. shaft (2), battery contacts (2), battery holder (2)

Washer, 3ø, (4), chassis use

- do - 4ø, (2), carrying handle use

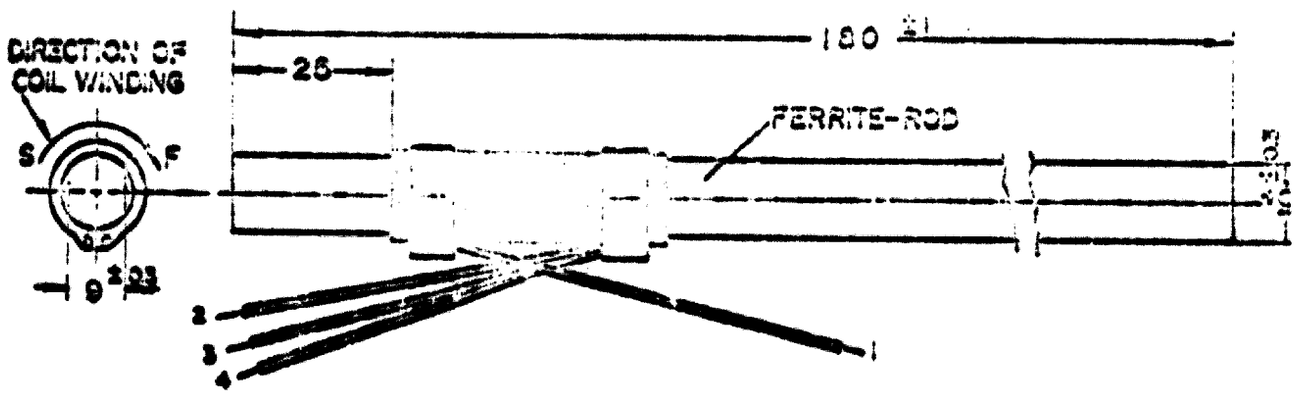
Washer, 8ø 8ø x 3.2ø x 0.5t (10), speaker (4), battery holder (6)

Spring washer, 3ø, (6), speaker fitting (4) tuning cont. shaft (2)

Details on Wiring Materials

Item	Coloring	Length	Pcs.	Use
Vinyl tubing 0.8I.D.	Transparent	6	2	TH
- do -	- do -	30	6	X5, X6
Vinyl-insulated Wire, O.D.:1.0. 0.12ϕ x 10	Red	50		OSC coil - VC ose
	Red	50		Battery (+) - VR switch
	Black	140		Sec. of T2 - SP
	White	140		Sec. of T2 - SP
Tinned Cu wire O.D.:0.6		10		VR (1) - R10, C9
		10		VR (2) - C10
		15		VR (3) - P.C. board ground
		10		VR.SW - P.C. board (-) power source

I.S.I. ANTENNA



INDUCTANCE OF L1 :	460μH ±15μH
	ADJUSTABLE WITHIN RANGE
	OF ± 10 %
QO OF L1 :	NOT LESS THAN 220
	AT 795 KHZ
L2 :	4 TURNS
COIL WINDING :	SOLENOID WINDING
WIRE USED :	0.07φ X 4, USSC
LEADS :	
1	130 L, WHITE
2	130 L, BLACK
3	180 L, RED
4	140 L, WHITE
FERRITE-ROD :	TDK'S Q2 OR EQUIVALENT

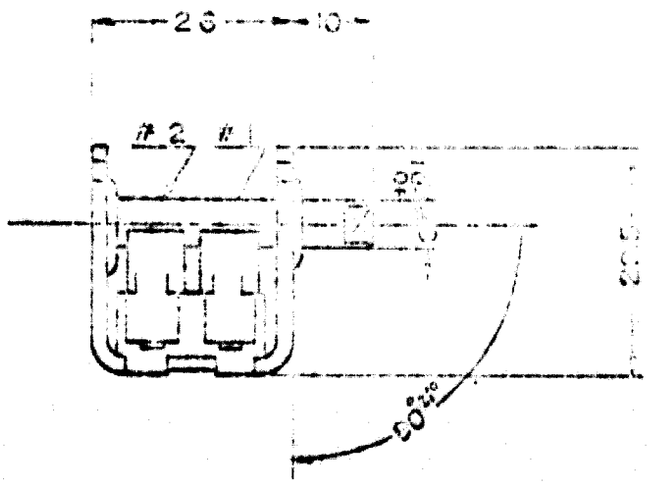
NOTE 1. CORE & COIL SHALL BE TREATED WITH WAX
2. ENDS OF LEADS SHALL BE SOLDERED UP TO 5 mm
3. VENDOR SHALL OBTAIN APPROVAL OF ENGINEERING SUBMITTING 2 PCS OF ACTUAL SAMPLES

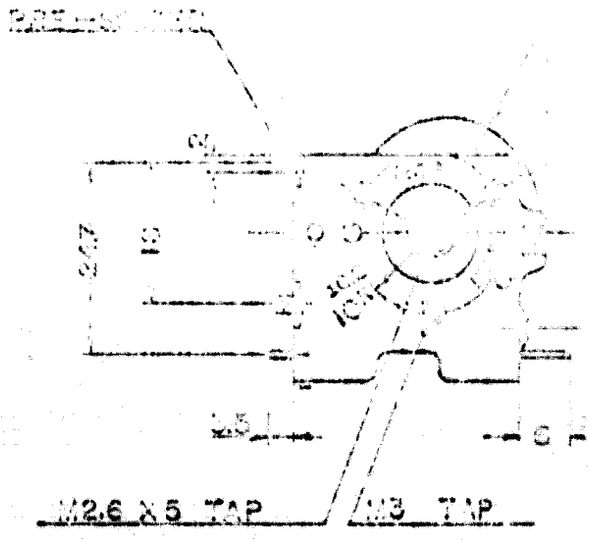
.5.3 TUNING GANG CAPACITOR (1)

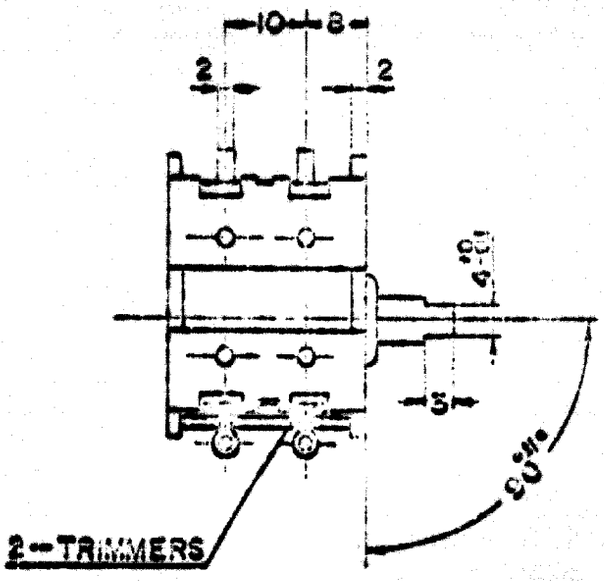
1. Performance

SEC	# 1	# 2
.OT(%)	(RF)	(OSC)
100	190.6 (PF)	76.5
90	162.7	69.2
80	134.4	60.6
75	117.8	56.2
70	103.9	51.3
60	77.2	41.1
50	53.4	31.0
40	34.2	21.5
30	19.8	13.4
25	14.4	9.9
20	9.9	7.2
10	3.1	2.2
0	0.0	0.0
C.MIN (PF)		
OLERANCES	±(IPF+1%)	±(IPF+1%)
RACKING	50.9%	100%
	ELECTRICAL INDEXING	
	12PF MIN	12PF MIN
RIMMER RANGE	ADD 2.0PF TO MINIMUM CAPACITY A TRIMMER	
NSULATION ESISTANCE(M)	100 MIN AT D.C 250V	
Q	300 MIN AT 10MHz, 50PF	
OMINAL AIR GAP	0.15	0.21
O OF PLATES	15	13
OTATION	CAPACITY TO INCREASE WITH COUNTER CLOCK WISE ROTATION	
	180°±2°	
ORQUE	100 - 300 g.cm	

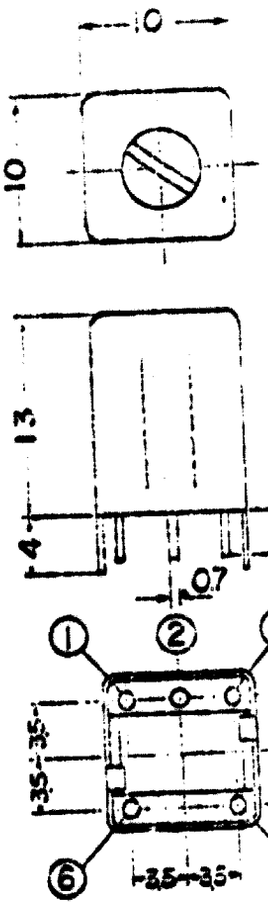
2. DIMENSIONS



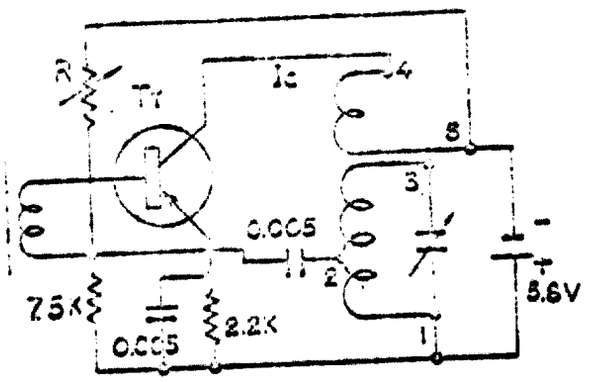




1.5.4 OSCILLATOR COIL



EXTERNAL VIEW



OSCILLATOR CIRCUIT

Tr : 2SA142
Ic : 350μA
f : 980 ~ 2105 KHz

SPECIFICATIONS

RATING

INDUCTANCE (L) : 280 μH. AT 795 KHz
ADJUSTABLE RANGE : L ± 8 % OR MORE
STRAY CAPACITANCE : LESS THAN 7.5 PF
Q : HIGHER THAN 90
OSCILLATION VOLTAGE : BETWEEN ① & ② 150 mV ± 30mV
COLOR CODING : RED
VOLTAGE WITHSTANDING : AC, 100V, 1 MINUTE
INSULATION : HIGHER THAN 100 MΩ AT 100V BETWEEN COILS & COILS TO CASING

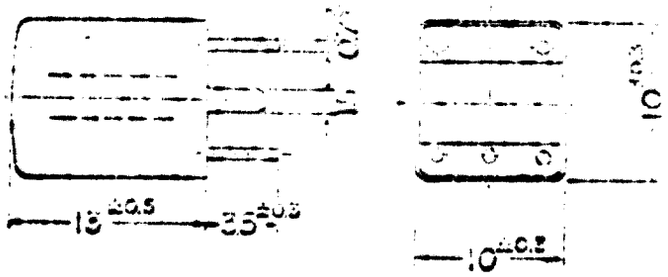
CHARACTERISTICS

TEMPERATURE : AFTER 1HR KEPT AT -20°C ~ +50°C, ABOVE RATING SHALL BE MAINTAINED

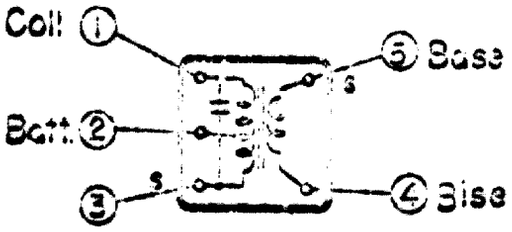
HUMIDITY : AFTER 1HR KEPT AT 45°C, 90% R.H. AND THEN 0.5HR KEPT AT NORMAL CONDITION ABOVE RATING SHALL BE MAINTAINED

1.5.5 I.F. TRANSFORMER

1. DIMENSIONS



2. BOTTOM VIEW & TERMINAL CONNECTIONS



3. NO. OF TURNS OF COILS & COLOR CODING

	① - ②	① - ⑤	④ - ⑤	C.C
IFT - A	80	174	9	YELLOW
IFT - B	70	174	9	WHITE
IFT - C	55	170	26	BLACK

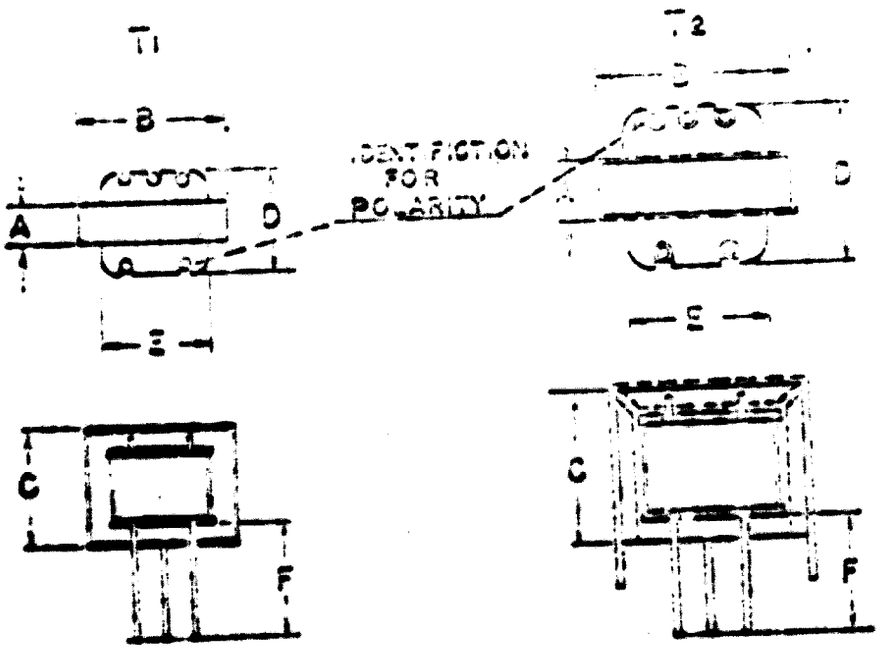
4. ELECTRICAL CHARACTERISTICS

ITEM	IFT - A	IFT - B	IFT - C
FREQ (K Hz)	455	455	455
INPUT IMP. ① - ③ (K Ω)	500	30	20
OUTPUT MATCH IMP. ④ - ⑤ (K Ω)	0.5	0.5	5
LOADED Q (QL)	35 ±15%	35 ±15%	35 ±15%
INSERTION LOSS (dB)	<5	<5	<5
NO LOAD Q (Qo)	100 ±15%	100 ±15%	100 ±15%
TUNING RANGE (K Hz)	455 ±20%	455 ±20%	455 ±20%
TUNING CAP. REQ'ED (PF)	188 ±20	188 ±20	188 ±20

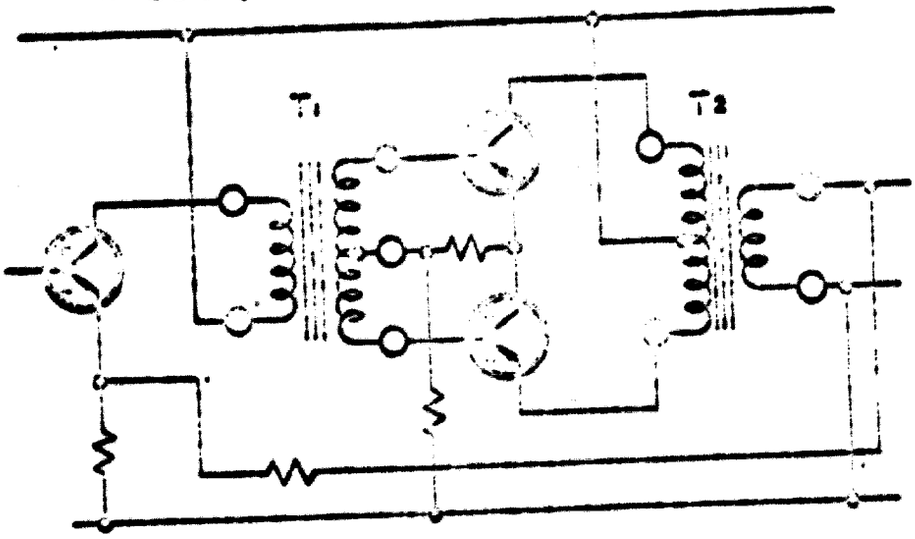
5. WITHSTANDING VOLTAGE : AC. 100V 1MIN
6. HUMIDITY RESIST : 45°C. RH90% OR HIGHER. 1HR
7. INSULATION BETWEEN COILS & COILS TO CASING, 100V. 100MΩ OR HIGHER

1.5.6 INPUT TRANSFORMER, T1

1.5.7 OUTPUT TRANSFORMER, T2



1. USE OF T1 AND T2 IN CLASS B POWER AMP CCTS.



2. DIMENSIONS

TRANSFORMER	A	B	C	D	E	F
INPUT T1	7	$20^{\pm 0.3}$	$16^{\pm 1}$	18	14.5	$15^{\pm 2}$
OUTPUT T2	8	$25.5^{\pm 0.5}$	$19^{\pm 1}$	22	18.5	$15^{\pm 2}$

3. ELECTRICAL CHARACTERISTICS

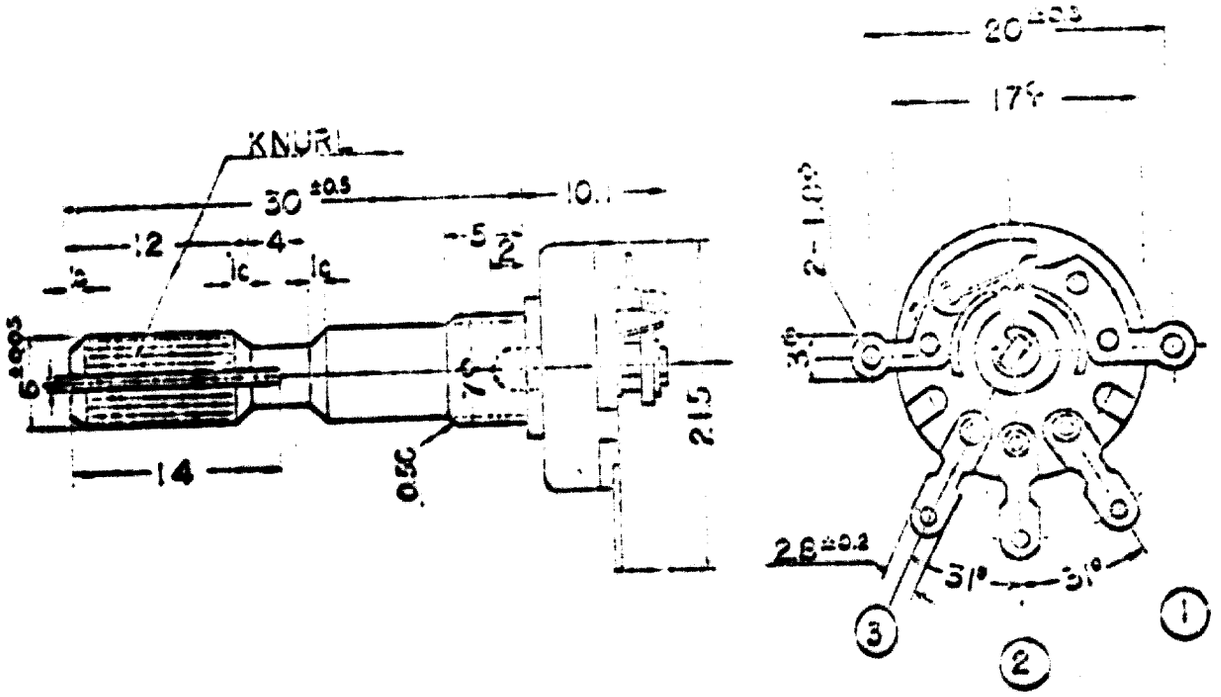
ITEMS	T_1	T_2
IMPEDANCE 1 RY : 2 RY IN Ω #	16000 : 4000 ±10%	120 : 8 ±10%
1 RY OPEN CCT IMPEDANCE IN Ω #	24000 ±20%	845 ±20%
D C RESISTANCE IN Ω 1 RY : 2 RY	480 : 250	8.5 : 0.85
INSULATION RESISTANCE BETWEEN COILS AND COILS AND CORE, AT 100V	NOT LESS THAN 100 MΩ	
VOLTAGE WITHSTAND BETWEEN COILS AND COIL AND CORE	DC, 100V, 1 MINUTE	
HUMIDITY RESIST	AFTER KEPT AT 40°C 95% R.H. FOR 24 HRS INSULATION OF NOT LESS THAN 10 MΩ FOR 100V	

4. MECHANICAL STRENGTH

TERMINALS SHALL WITHSTAND PULL ALONG THE TERMINAL OF 2 KG WITHOUT ANY DAMAGE.

NOTE # IMPEDANCES ARE MEASURED BY REPLACING METHOD WITH SIGNAL OF 1 KHZ, 1 V.

I.S.S VOLUME CONTROL



ELECTRICAL CHARACTERISTICS

NOMINAL TOTAL RESISTANCE :	5 KΩ ± 20%
RESISTANCE VS ANGULAR DISPLACEMENT :	TYPE "A"
NOMINAL POWER DISSP. :	0.05W
RESIDUAL RESISTANCE :	<5 Ω BETWEEN ① & ②
	<50 Ω BETWEEN ② & ③
NOISE DUE TO SLID. ADJ. :	<47 mV
INSULATION :	>50 MΩ , 500V
VOLTAGE WITHSTAND :	AC, 500V. 1MIN.
CONTACT RESISTANCE OF SWITCH :	<0.1 Ω

MECHANICAL

ANGULAR ADJ. RANGE :	230° ± 5°
SWITCH ACTING ANGLE :	35° ± 10°
STOPPER STRENGTH :	>5 kg-cm
ADJUSTING TORQUE :	30 ~ 100 g-cm
SWITCHING TORQUE :	150 ~ 500 g-cm
TYPE OF SWITCH :	SP. S.T.

NOTE 1. DETAIL OF KNURL SHALL BE SPECIFIED SEPARATELY.

2. DRAWINGS SHOW MIN. RESISTANCE CONDITION FOR ① ~ ②

1.5.0 SPEAKER (1)

1. DIMENSIONS

AS ILLUSTRATED

① FRAME : POLISHED STEEL SHEET, 0.8T ELECTRO STATIC COATING WITH Zn #2

② MAGNET, 14$^{\phi}$ x 15

③ YOKE, SOFT IRON, Zn #2

④ FRAME PACKING PAPER LAMINATE

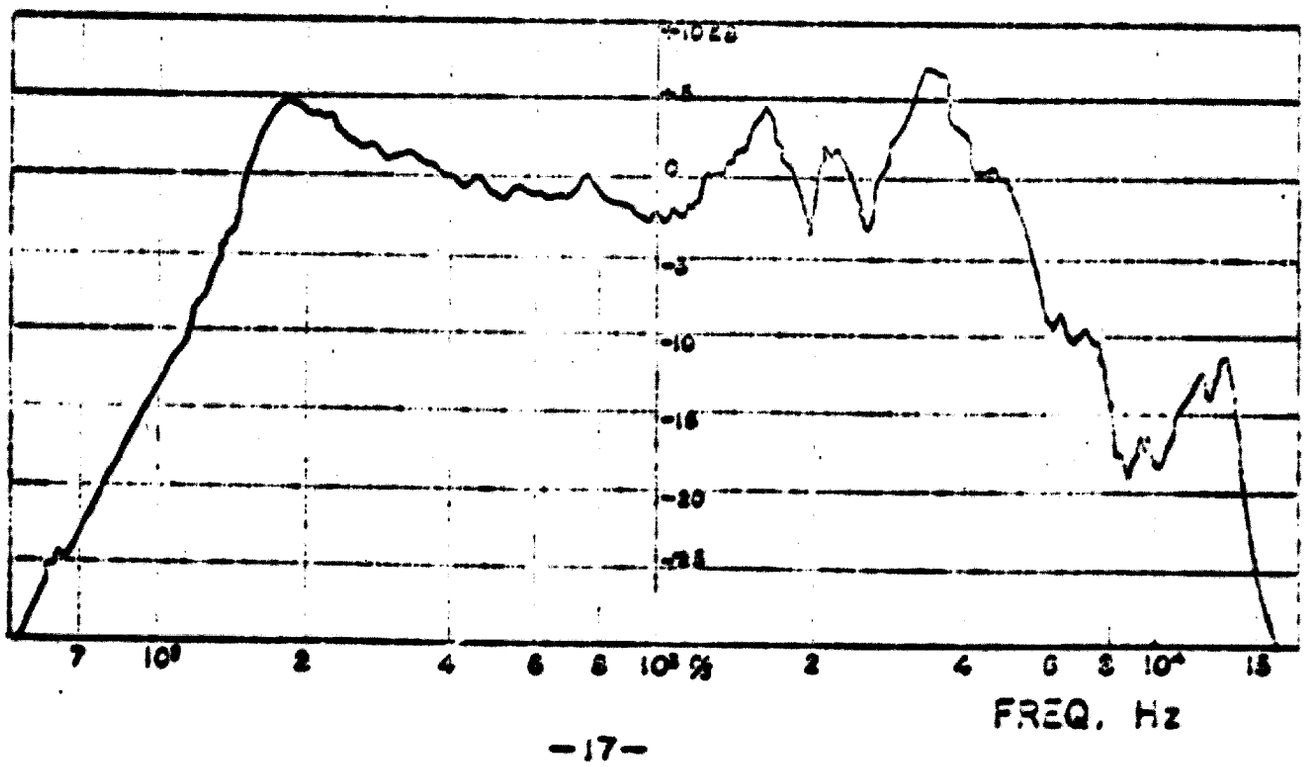
⑤ TERMINAL BOARD

Ⓐ Ⓒ TERMINALS

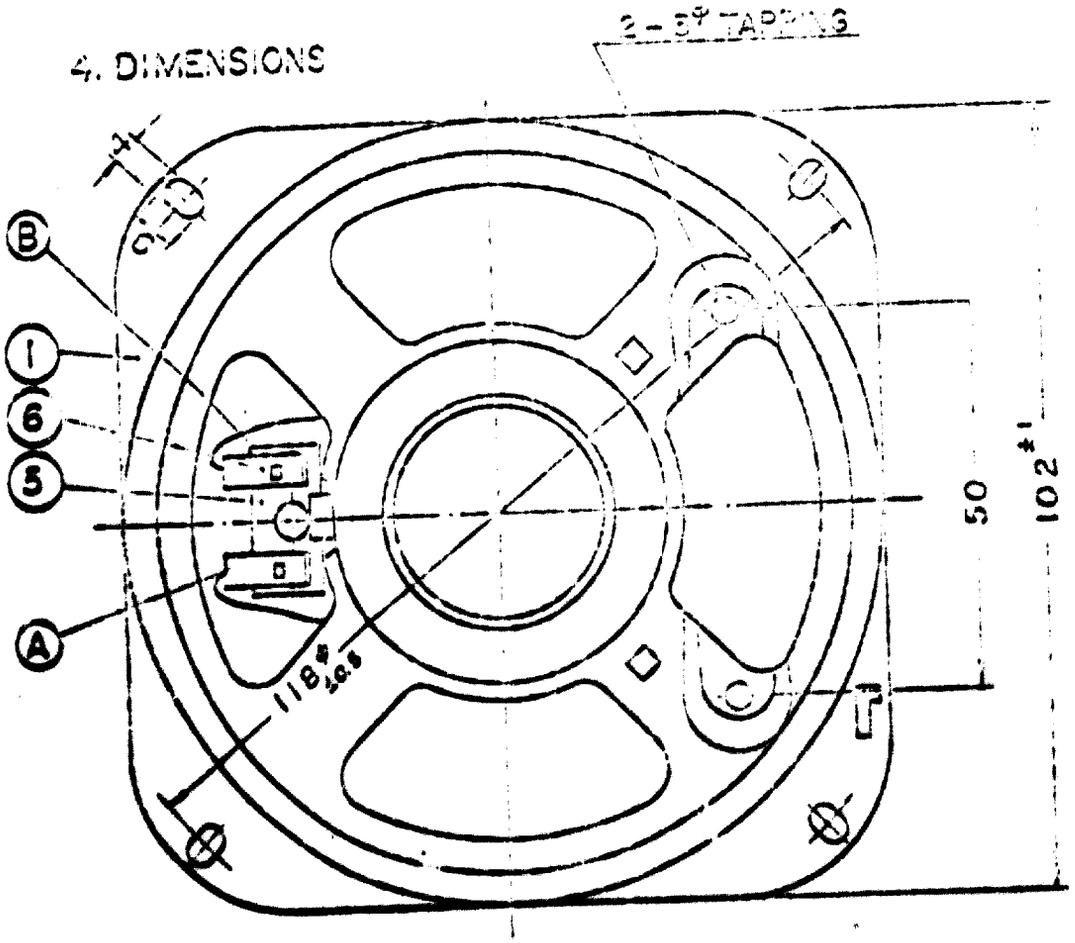
2. CHARACTERISTICS

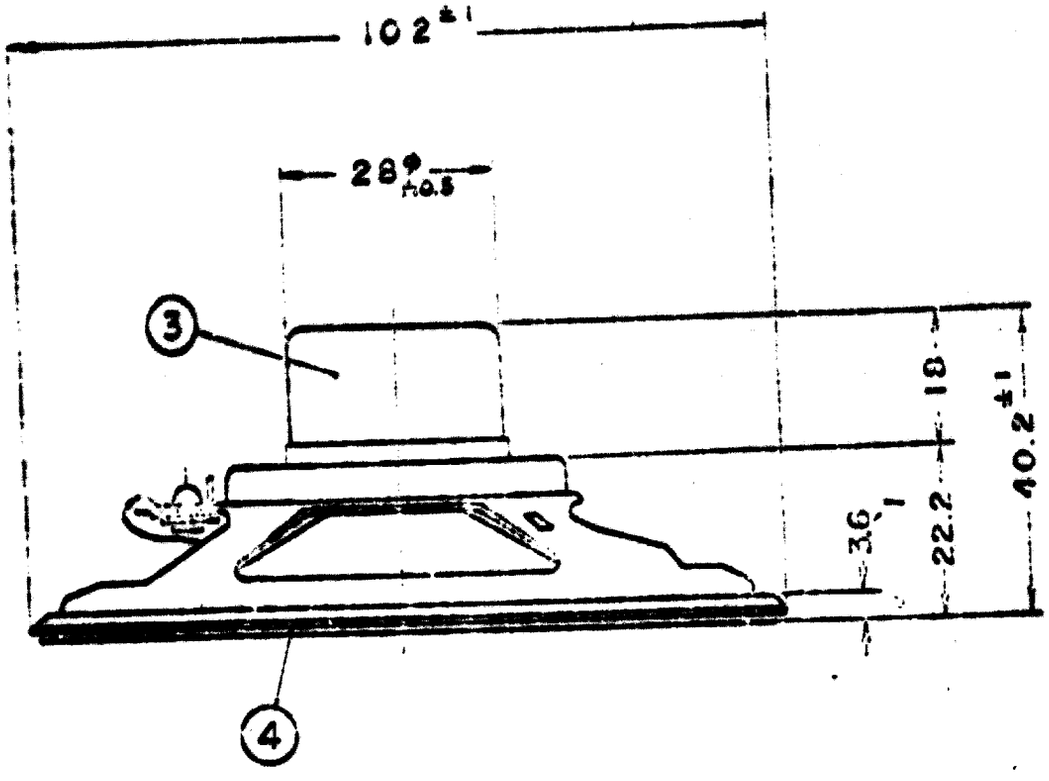
IMPEDANCE :	8 Ω ± 15 % AT 400 Hz
LOWER RESONANT FREQ. :	180 ± 40 Hz AT 1V INPUT
ACOUSTIC OUTPUT LEVEL :	WITHOUT BAFFLE BOARD NOT LESS THAN 92dB AT 300, 400, 500 AND 600 Hz
FREQUENCY RESPONSE :	20 dB WITHIN 70 TO 6000 Hz AT INPUT OF 1V, 50cm APART
NOMINAL INPUT :	1.5 W, 5.2 V PP AT MAX. INPUT
POLARITY	MOVING CONE MUST COME OUT BY APPLICATION OF POSITIVE BATTERY VOLTAGE TO TERMINAL Ⓐ AND NEGATIVE, TO Ⓒ

TYPICAL FREQ. VS OUTPUT



4. DIMENSIONS





1.6 ALIGNMENT PROCEDURE

Test Instrument Required

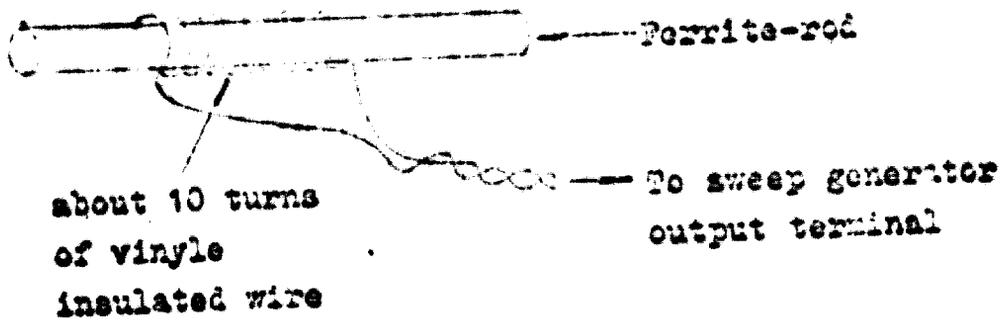
455KHz sweep generator, item No. 11
Oscilloscope, item No. 2
AM signal generator, item No.8
V.T.V.M. item No. 3

General Condition

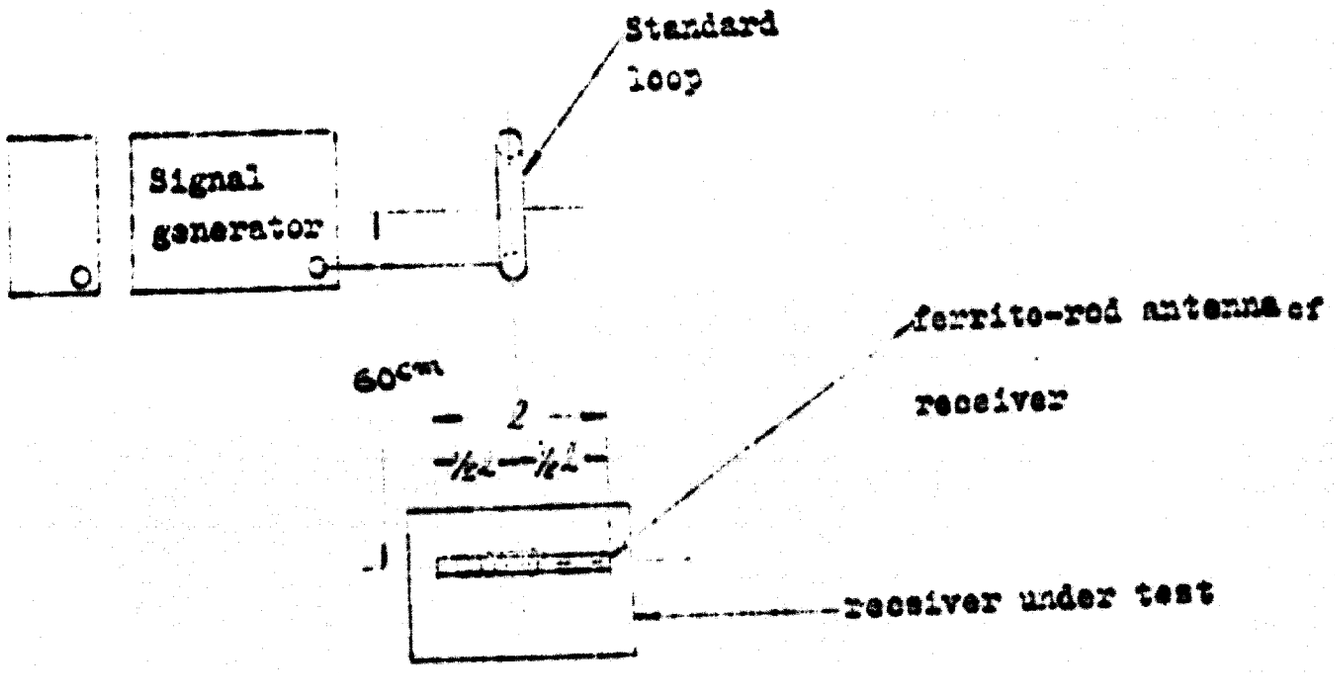
1. Signal input for alignment process should be kept low enough to avoid AGC action and clipping.
2. Set volume control of the receiver at maximum.

Step	Signal Source	Connect indicator to	Output of Sig. source	Set. Radio dial	Adjust	Adjust for
1	Sweep generator connected to a loop placed near ferritrod antenna of radio.(1)	Oscilloscope connected to TP or high side of volume control	Exactly 455 KHz with marker at 455KHz (400 Hz, 30 % modulated	Tuning gang control full oper	Top adj. of IFT-C	maxumum gain and symetry
2					do IFT-B	
3					do IFT-A	
4	Repeat step 1 through step 2 to obtain max, Sensitivity					
5	Signal generator connected to standard loop (2)	V.T.V.M connected across voice coil of Speaker	525KHz	Tuning gang full opened	Core of OSC COIL	maximum output
6			1650KHz		trimmer CT2	
7			600KHz	600KHz	Antenna coil (3)	
8			1400KHz	1400KHz	Antenna trimmer CT 1	
9	Repeat Step 5 through Step 8 to obtain max, sensitivity					

Note (1) The loop to be used in alignment step 1 through Step 3 is shown in the following illustration



(2) Arrangement of the standard loop in relation to receiver under test in alignment step 5 through 9 is shown in the following illustration



(3) In the case of alignment procedure of

step 7

a. When inductance of the antenna coil is too large;

Output of the receiver or indication of V.T.V.M increases by approaching

piece of aluminum or copper to the ferrite-rod antenna of the receiver;

b. When it is too small;

Output of the receiver increases by approaching piece of iron or ferrite

to the ferrite-rod antenna;

c. When it is just tuned in the signal, output at the receiver decreases

either by approaching piece of aluminum or iron.

d. To reduce antenna coil inductance, move antenna coil along the ferrite

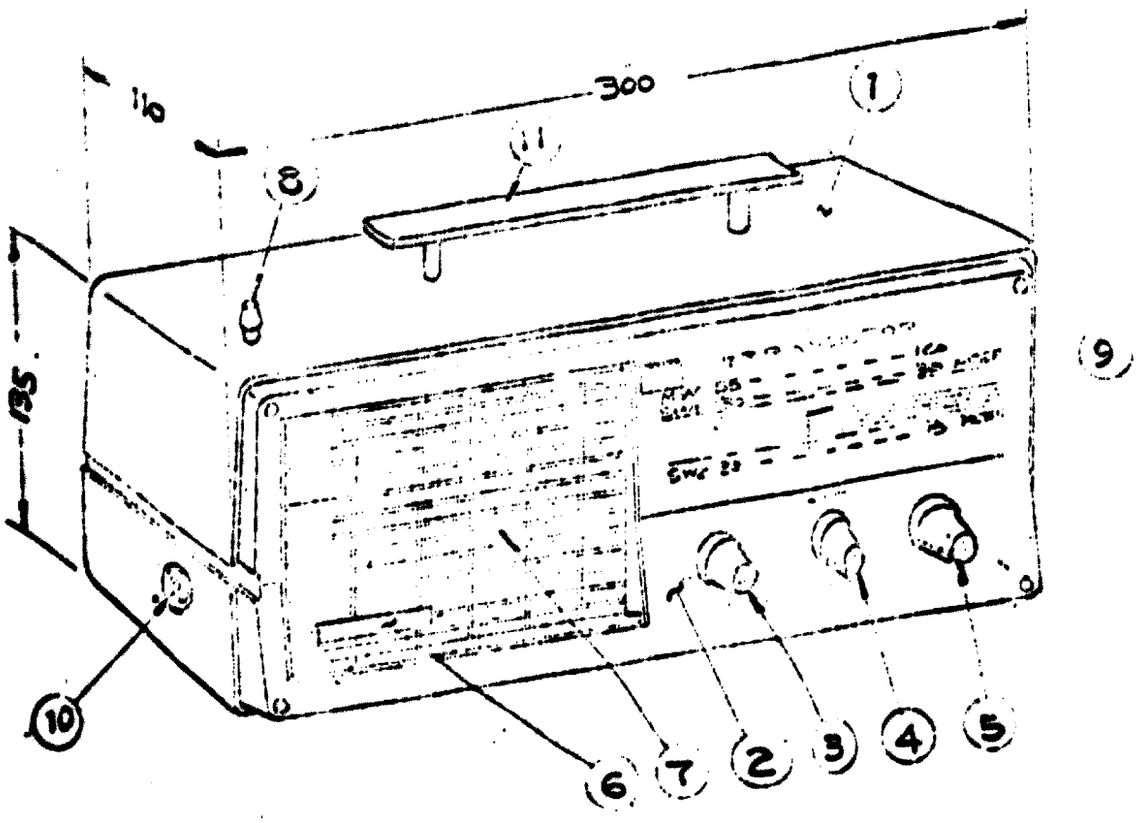
rod to its end, and vice versa.

2.1 Performance Specifications for Type "S" Radio Receivers

Item	Condition	Nominal values	Acceptable limit
1. Frequency coverage		(MW.) 515–1650KHz (SW1) 5.25–7.7MHz (SW2) 9–23 MHz	525–1605KHz 2.3–7.5MHz 9.2–22MHz
2. Sensitivity	For 50mW output 30% modulation at 400Hz with built in antenna at the nominal power supply voltage	(MW.) 600, 1000, 1400KHz 5.5uV/m (SW1) 3, 5, 7, MHz 7uV (SW2) 10, 16, 21 MHz 7uV	150uV/m 20uV 20uV
	-ditto- but at power supply voltage of 70% of the nominal voltage	(MW) 600, 1000, 1400KHz 550uV/m (SW1) 3, 5, 7, MHz 50uV (SW2) 10, 16, 21 MHz 50uV	1500uV/m 150uV 150uV
3. Signal to noise ratio	(MW) for input 1MV/m (SW1) for input 150uV (SW2) for input 150uV	26dB 32dB 32dB	20dB 26dB 26dB
4. Power Output	For distortion of 10% at the nominal power supply voltage	400mW	300mW
	-ditto- but at the power supply voltage of 70% nominal voltage	200mW	150mW
5. Overall selectivity	at -6dB point -20dB point -40dB point	± 3KHz ± 9 KHz ± 16KHz	± 2.25KHz– ± 4.5KHz ± 7KHz– ±12KHz ± 23KHz

6. Intermediate frequency response ratio	at 600KHz	32dB	25dB
Image frequency response ratio	at 1400KHz	35dB	30dB
	at 7MHz	16dB	12dB
	at 22MHz	10dB	5dB
Suprious response ratio		35dB	30dB
7. Overall electrical fidelity	within 12dB limits reference 0dB level at 400 Hz	80-4000 Hz	100-3000Hz
8. A.g.c. performance	at 1000 KHz change in output when the input is reduced by 30dB from 0.1V/m	6dB	10dB
9. Frequency stability			
10. Intermediate frequency		455KH	450-460KHz
11. Distortion	For input of 5mV/m at nominal power supply voltage	3%	7%
	-ditto- 50mV/m	5%	9%
12. Operative lowest power supply voltage		3.5V	4.0V

2.2 TYPE B EXTERNAL VIEW



(1) CABINET

(2) PANEL

(3) VOLUME CONTROL AND ON-OFF SWITCH

(4) BAND SWITCH

(5) TUNING CONTROL

(6) NAME PLATE

(7) GRILL

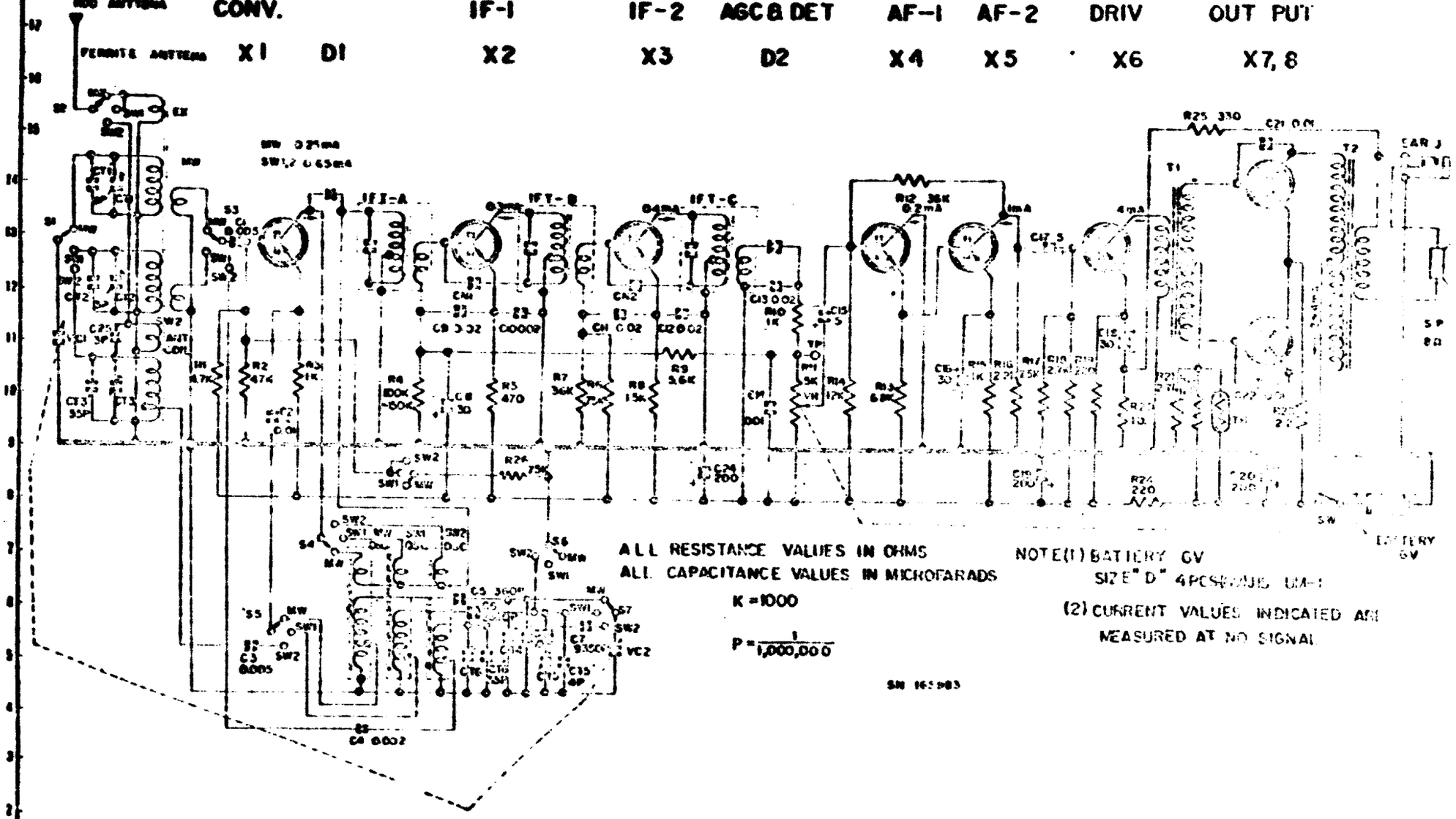
(8) TELESCOPIC ANTENNA

(9) DIAL

(10) EARPHONE JACK

(11) CARRYING HANDLE

FIG 2,3 SCHEMATIC DIAGRAM TYPE "B"



2.4 LIST OF COMPONENTS & MATERIALS (1)

Item No.	Symbol No.	Description
	X1	Transistor, 2SA222
	X2	-do- 2SA202
	X3	-do- 2SA202
	X4, X5, X6	-do- 2SB186
	X7, X8	-do- 2SB187
	D1, D2	Diode 1S-186
	TH	Thermistor TD5-A110
	L1, L2	Antenna transformer, including ferrite-rod, MW & SW1 use
	L3	-do- SW2 use
	L4	Oscillator coil, MW use
	L5	-do- SW1 use
	L6	-do- SW2 use
	IFT-A	1st IF transformer
	IFT-B	2nd IF transformer
	IFT-C	3rd IF transformer
	T2	Output transformer
	T1	Input transformer
	VC	Tuning gang capacitor
	TC1 through TC6	Trimmer capacitor
	SW	Band switch
	VR	Volume control
	J	Earphone jack
	EAR	Earphone, magnetic, 8Ω
	SP	Speaker
	BATT	Battery, Type UM-1 or equiv. (4req'd)
	PC	Printed cct board
		Chassis
		Pulley, 8φ
		Drum, tuning drive
		Shaft, tuning drive use
		Bracket, antenna use (2 req'd)
		Holder, antenna use (2 req'd)

	[illegible], [illegible] VC use ([illegible] req'd)
	Heat sink, common to X7 & X8
	Stanchion, (2 req'd)
	Spring, dial cord use
	Dial cord, 0.5m, 500L
	Wiring materials (details omitted)
C19, C20, C24	Electrolytic capacitor, 200uF, 6WV
C8, C16, C18	-do- 30uF, 6WV
C15, C17	-do- 5uF, 6WV
C14, C21, C22	Mylar capacitor, 0.01uF, ±20%
C9, C10, C11, C12, C13	-do- 0.02uF, ±20%
C5	Polystyrene capacitor, 360PF, ±5%
C6	-do- 2360PF, ±5%
C7	-do- 9350PF, ±5%
CN1, CN2, CT1	Ceramic capacitor, 8PF, ±0.5PF
CT2, C25	-do- 3PF, ±0.5PF
CT3, CT6	-do- 55PF, ±10%
CT4	-do- 10PF, ±0.5PF
CT5	-do- 4PF, ±0.5PF
C1, C3	Ceramic capacitor, 0.005uF, +80% -20%
C2	-do- 0.01uF -do-
C4	-do- 0.002uF, -do-
R23	Composite resistor, 2.2Ω, ±10%, 1/2W
R20	-do- 10Ω, -do- -do-
R22	-do- 120Ω, -do- -do-
R19, R24	-do- 220Ω, -do- -do-
R25	-do- 330Ω, -do- -do-
R5	-do- 470Ω, -do- -do-

R3, R10, R15	Composite resistor,	1KΩ,	±10%,	1/2W
R8	-do-	1.5KΩ	-do-	-do-
R16	-do-	2.2KΩ	-do-	-do-
R18, R21	-do-	2.7KΩ	-do-	-do-
R1	-do-	4.7KΩ	-do-	-do-
R9	-do-	5.6KΩ	-do-	-do-
R13	-do-	6.8KΩ	-do-	-do-
R6, R17	-do-	7.5KΩ	-do-	-do-
R14	-do-	12KΩ	-do-	-do-
R7, R12	-do-	36KΩ	-do-	-do-
R2	-do-	47KΩ	-do-	-do-
R26	-do-	75KΩ	-do-	-do-
R4	-do-	100KΩ, 120KΩ, or 150KΩ		

Cabinet, Polystyrene
Panel, Polystyrene
Knob, Polystyrene, (3 req'd)
Name Plate
Ornament
Cabinet back lid, hardboard
Pointer
Pointer rail
Telescopic antenna
Spacer, T, ant, use ABS
Fabric speaker front
Carrying handle
Battery contact ⊕
-do- ⊖
Catch, battery use
Battery retainer
Battery check
Oval lug (2 req'd)
Machined screw, 2.6φx20L (2 req'd)
-do- 2.6φx25L (2 req'd)

Screw, C.R., P.H., 2.6φx6L, (2 req'd)

-do- 2.6φx8L, (6 req'd)
-do- 3φx4L, (14 req'd)
-do- 3φx8L (3 req'd)
-do- 3φx12L (2 req'd)

Tapping screw, 3φx6L (4 req'd)

Washer, 3.2φx10 x0.8T (5 req'd)
-do- 3φ (4 req'd)

Spring washer, 3φ (20 req'd)

Nut, HEX, 2.6φ (4 req'd)
Spacer, hardboard, chassis use
Solder, 10g
SP wax, 2g

Washer, 3φ (8 req'd)
-do- 2.6φ (1 req'd)

Spring washer, 3φ (8 req'd)
-do- 2.6φ (1 req'd)

Screw, C.R. P.H., 3φx8L (8 req'd)
-do- 3φx 30L (2 req'd)
-do- 2.6φx16L (1 req'd)

Nut, HEX, 3φ (6 req'd)
-do-
Adhesive tape, 10Wx15L (3 req'd)
Bond #1600
Polyethyrene film bag
Cotton paper
Carton

2.5.1 FERRITE-ROD ANTENNA FOR [illegible] (1)

Band	section	specification
MW	(1)-(2)	Inductance : 290 μH $^{+5\ \mu H}_{-10\ \mu H}$ at 796 KH Adjustable range of inductance : ± 10 % Stray capacitance : <5 PF Qo (no load) >100 at 796 KHz Conductor 0.07/7 USSC Litz wire
	(2)-(3)	Number of turns is arround 10 turns which shall be adjusted to result Q1 of (1)-(2) winding be a half of Qo chunting (2)-(3) with 3.2 KΩ at 796 KHz.
SW1	(6)-(7) (7)-(8)	Inductance : 4.9 μH ± 0.5 μH at 7.96 MHz Adjustable range of inductance ± 10 % Stray capacitance : <5 PF Qo : >140 at 7.96 MHz Winding 0.3φ tinned Cu space winding on press-board bobbin Number of turn : 1 1/4
LX	(4)-(5)	Number of turn : 5 conductor : 0.1/7, PVC

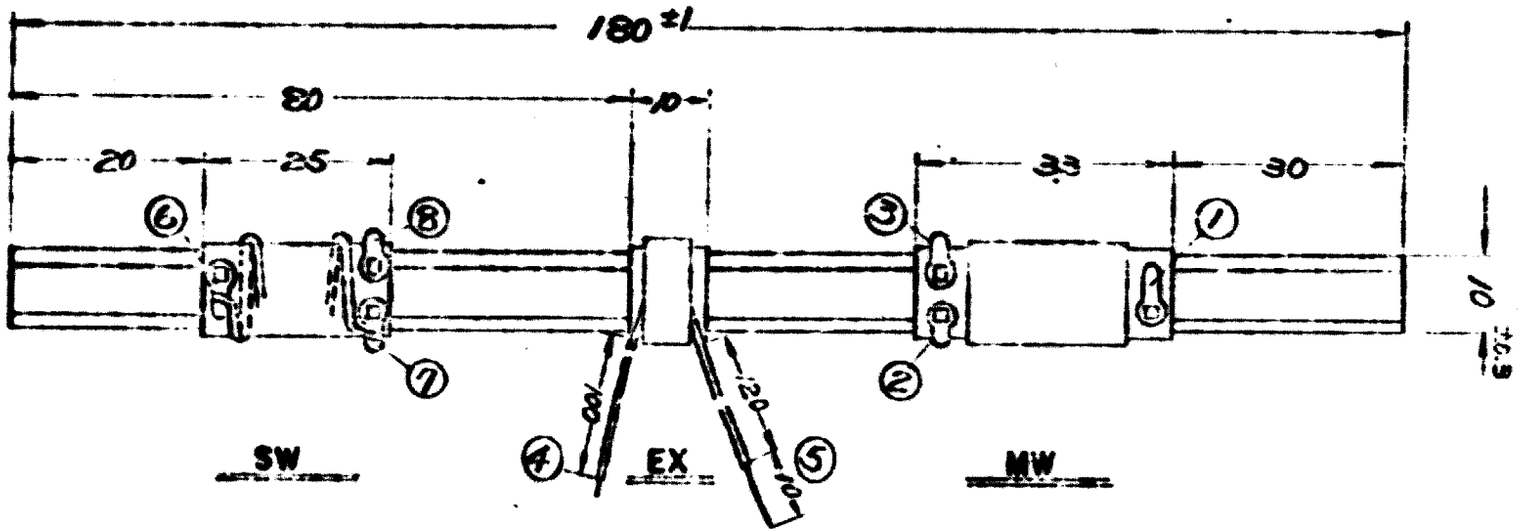
Note : (1) Ferrite-rod : NITTON FERRITECO, "S" L X " or Equivalent

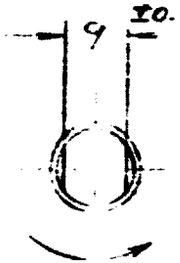
(2) Treatment : Ferrite-rod with wax. Coil with microcrystal wax

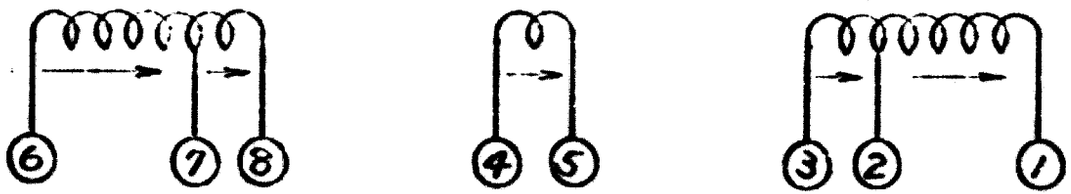
(3) Lead wire : soldered upto 3 mm removing insulation

(4) Coil setting : coils are movable along ferrite-rod and fixed at the positions with wedges.

2.5.1 MW & SW1 ANTENNA (2)

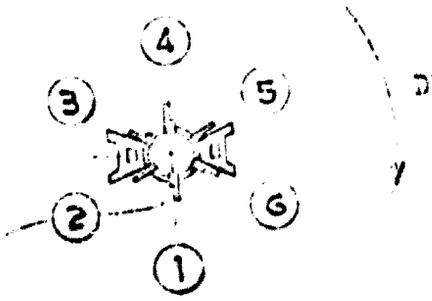




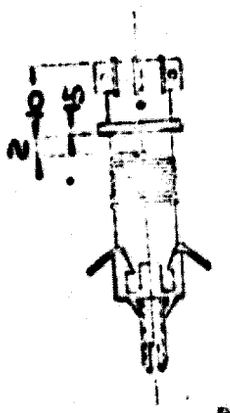


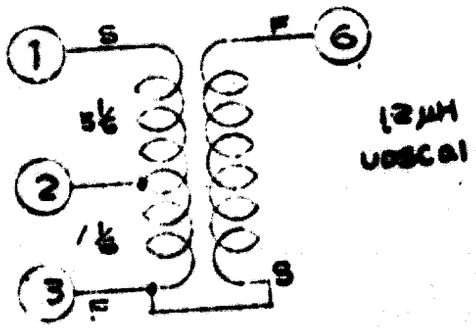
2.5.2 SW2 ANTENNA COIL

TERMINAL NO



CONNECTION





NO OF TURN : ①-② 5-1/6 TURNS } CONDUCTOR 0.1
②-③ 1-1/6 TURNS } POLYURETHANE INS'TD.
SPACE WINDING

INDUCTANCE : ①-③ 0.5 mH, ADJUSTABLE TO ± 10 %
③-⑥ 12 mH, COND, UDSC 0.1, HONEYCOMB WINDING.

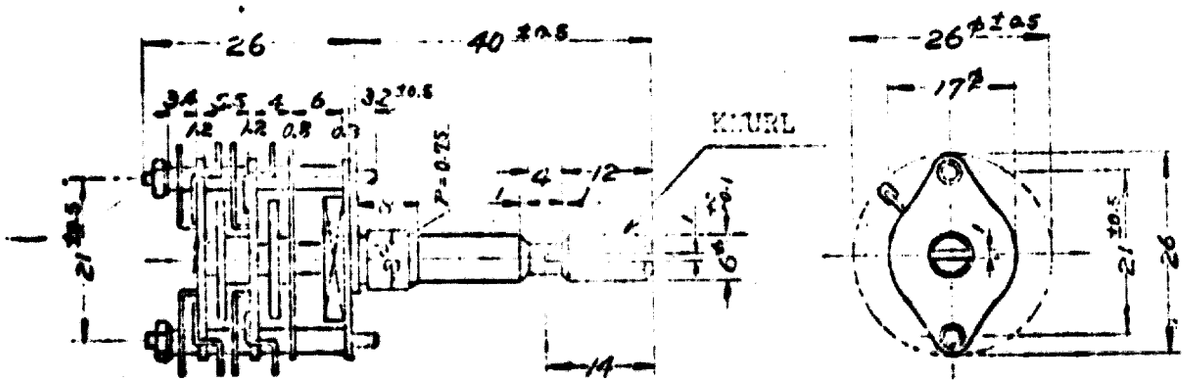
Q : ①-③ > 80

STRAY CAP. ③-⑥ 5 PF

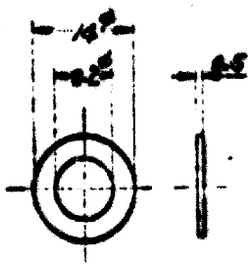
CORE : 6φ x 10 mmL, ATTACHED TO 3φ x 20L SCREW

BOBBIN : TREATED WITH SILICONE FOR 3 HR AT 50°C

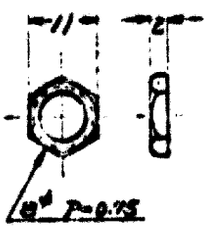
2.5.3 BAND SELECT SWITCH



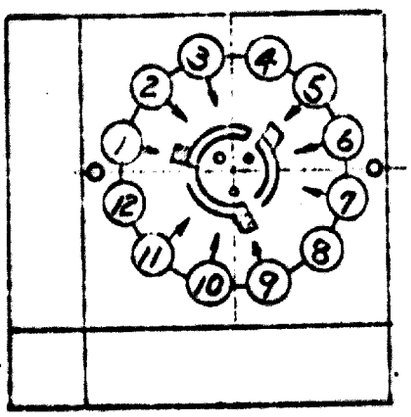
WASHER



NUT



CIRCUIT CONNECTION



NOTE 1. TOLERANCE OF ANG DISP. ± 0.3°

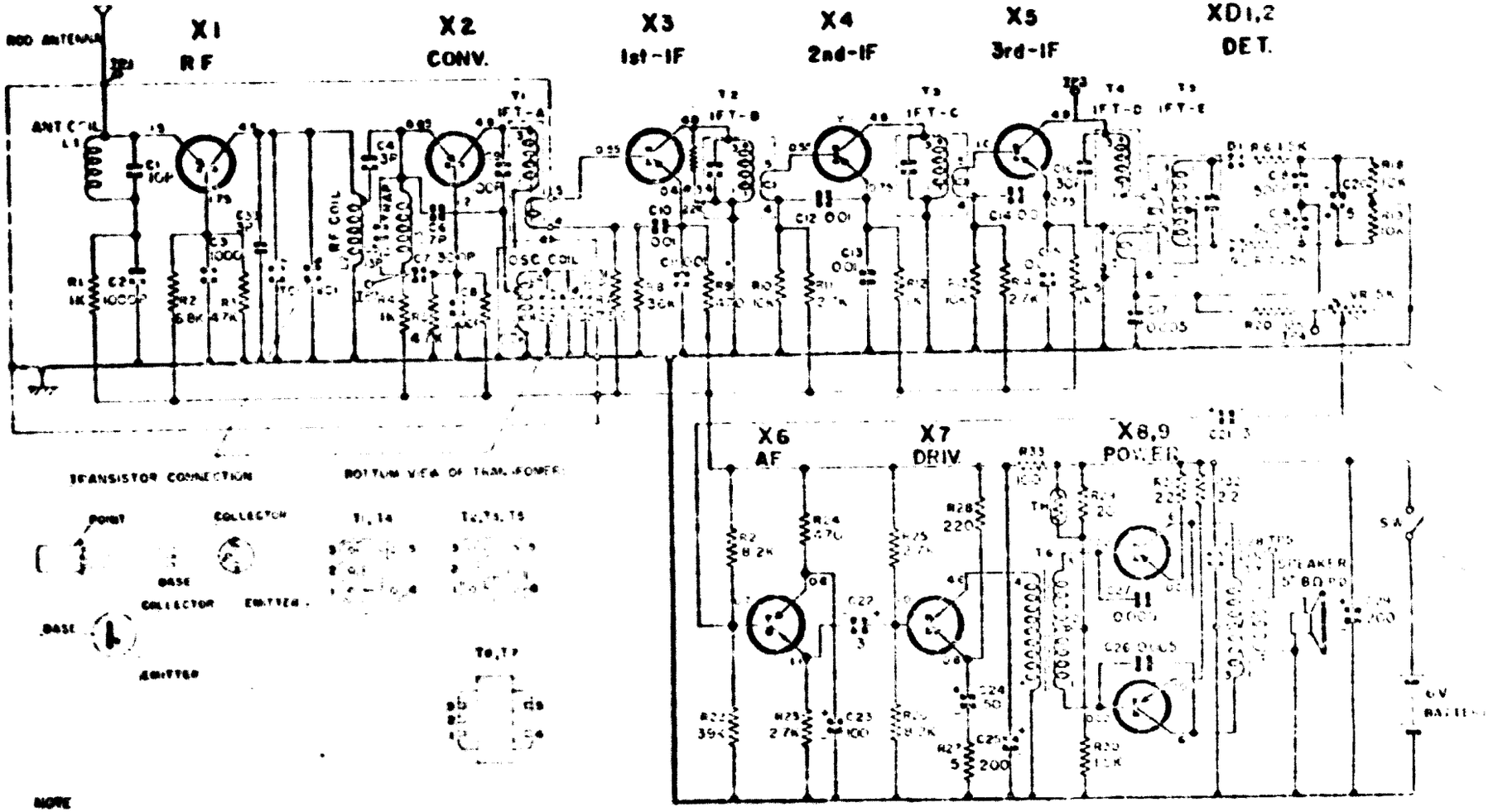
2. TORQUE : 0.7 kg-cm

3.1 Performance Specifications for Type [illegible] Radio receivers

Item	Condition	Nominal values	Acceptable limits
1. Frequency Coverage		86.5MHz–109MHz	87.5MHz–108MHz
2. Signal to noise ratio	For 50mW output 30% modulation at 400Hz 88, 100, 108MHz input 30uV	40dB	30dB
3. Sensitivity	For 500mW output 30% modulation at 400Hz The nominal power supply voltage	(10dB 3uV) 0.03PW	(20db 10uV) 0.4PW
	-ditto- but at power supply voltage of 70% of the nominal voltage	-105dB	-95dB
4. Inter mediate frequency		-85dB	-75dB
5. Amplitude-modulation suppression ratio		10.7 MHz	10.6–10.8MHz
6. Power output	for distortion of 10% at the nominal power supply voltage	25dB	20dB
	-ditto- but at power supply voltage of 70% the nominal voltage	450mW	300mW
7) Overall selectivity	at ± 300 KHz	200mW	150mW
		35dB	30dB

Electrical	80-6000Hz	100-5000Hz
8. Over all fidelity		
9. Radiation	The local oscillator radiation should be less than the limit specified by C.I.S.P.R. However, where natinal regulations exist, the radiation should be less than the limits specified therein	
10. Distortion	3%	5%
11. Frequency stability	Frequency drift due to change of ambient temperature,	± 50KHz
	The influence of the ambient temperature should be measured by making a rapid change of ambient temperature after frequency stability has been reached, and the subsequent changes the frequency record over a period of about one hour	

FIG 3,3 SCHEMATIC DIAGRAM TYPE "C"



NOTE

1. ALL RESISTANCE VALUES ARE IN OHMS UNLESS OTHERWISE SPECIFIED
   K = 1000 OHM
2. ALL CAPACITANCE VALUES ARE IN MICROFARADS OTHERWISE SPECIFIED. P = 10^{-6}
3. ALL VOLTAGES INDICATED ARE MEASURED WITH VTVM FROM BATTERY (+) TERMINAL
4. BATTERY DRAIN IS APPROX 20 MA WITH NO SIGNAL AT MINIMUM VOLUME CONTROL

3.4 LIST OF COMPONENTS AND MATERIALS

ITEM NO.	SYMBOL NO.	DESCRIPTION
	X1, X2	Mesa transistor, 2SA403
	X3, X4, X5	Grown transistor, 2SA216
	X6, X7	Alloy transistor, 2SB113
	X8, X9	-do- 2SB56C
	XD	Germanium diode, MD60
	TH	Thermistor, TD5-A110
	L1	Antenna coil
	L2	Tuning coil
	L3	IF trap
	L4	Oscillator coil
	T1	1st IF transformer
	T2	2nd IF transf.
	T3	3rd IF transf.
	T4	4th IF transf.
	T5	5th IF transf.
	T6	Input transf.
	T7	Output transf.
	VC1-2	Tuning gang capacitor
	VR	Volume control
		Chassis
		Tuning control shaft
		Tuning control drum
		Shield case 'A'
		-do- 'B'
		Gum cushion, (3 req'd), VC1-2 use
		P.C. board 'A'
		-do- 'B'
	SP	Speaker
		Dial cord.

	Spring, dial cord use
	Heat sink
	Telescopic whip antenna
	Shield, transistor use
R31, R32	Composite resistor, 2.2 Ω, ±10%, 2/1W
R27	-do- 5Ω, " "
R29	-do- 120Ω, " "
R28	-do- 220Ω, " "
R9, R24	-do- 470Ω, " "
R1, R4, R12, R15	-do- 1KΩ, " "
R16, R17, R30	-do- 1.5KΩ, " "
R6, R11, R14, R23, R25	-do- 2.7KΩ, " "
R3, R5	-do- 4.7KΩ, 5.6KΩ or 6.8KΩ, " "
R2	-do- 6.8KΩ, " " "
R7	-do- 7.5KΩ, " "
R21, R26	-do- 8.2KΩ, " "
R10, R13, R18, R19, R20	-do- 10KΩ, " "
R34	-do- 22KΩ, " "
R8	36KΩ, " "
R22	-do- 39KΩ, " "
R38	-do- 100KΩ, " "
TC-1, TC-2	Trimmer capacitor
C21, C22	Electrolytic capacitor, 3uF, 6WV
C20	-do- 5uF, 6WV
C24	-do- 50uF, 6WV
C23	-do- 100uF, 6WV
C25, C28, C29	-do- 200uF, 6WV
C17, C26, C27	Mylar capacitor, 0.005uF, ±20%
C18, C19	Polystyrene capacitor, 500PF, ± 5%

C4, C31, C32	Ceramic capacitor,	3PF, ±5%
C30	-do-	5PF, ±5%
C6	-do-	7PF, ±5%
C1		10PF, ±5%
C5		13PF, ±5%
C16		30PF, ±5%
C9		100PF, ±5%
C7		300PF, ±5%
C2, C3, C8		1000PF, ±10%
C10, C11, C12, C13 C14, C15		0.01uF, +80% −20%

Battery retainer
Battery, type UM-1 or eq'nt (4 req'd)

Wiring materials (See details)

Cabinet, Polystyrene
Back-lid, hard board
Dial, Polysyrene
Tuning control knob
Name plate
Pointer
Volume control knob
Battery contact (2 req'd)
Spring, battery use
Carrying handle
Bracket, carrying handle use(2 req'd)
Fabric, speaker front

Cartoon
Cotton paper
Polystyrene film bag

Screw, C.R., P.H., 2φx3L, Shield case use

-do- 2.6φx4L (3 req'd) P.C.board us

-do- 3φx5L (6 req'd) 2SC T7 & heat sink use, (5) battery (1)

-do- 3φx10L (3req'd) VC4-2 use

Tapping screw, 3φ x10L, (4req'd) speaker us

Washer, 2.6 φ (3req'd) PC. board use

-do- 3 φ (1req'd) speaker(4), chassis (4), VC1-2 (3)

Spring washer, 3φ (5req'd) T1,T2 & heat sink use

Nut 3φ, HEX. (9req'd), chassis use, (4) carrying handle (4), battery (1)

Screw, C.R., F.H., 3φx6L (4req'd) battery Contact use

Spring washer, 3φ (4req'd) carrying handle use

Special screw, 3φ x6L (2req'd) carrying handle use

Solder

Nejilock, screw fixing use

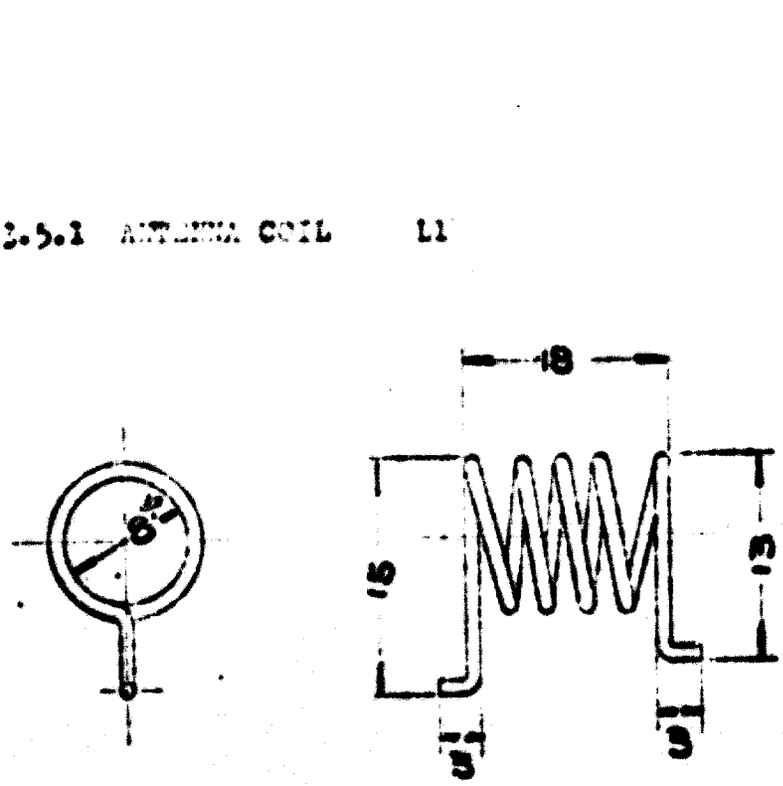
SP wax, coil fixing use

Vinyl acetate, Speaker front fabric and dial back pasting use

DETAILS OF WIRING MATERIALS

Item	Coloring	Length	Use
Vinyl-insulated wire 1.5 O.D 0.16/10	Red	120	SP-27
-do-	Black	110	SP-Ground on P.C. board
-do-	Black	140	Battery(-)-Ground on P.C. board
-do-	Red	80	VR, SW-P.C. board common positive
-do-	Red	175	VR, SW-Battery position terminal
-do-	Red	35	Tuner common positive -P.C. board com. positive
-do-	Green	35	IFT-A(4)-C.R. Bias
-do-	Yellow	40	IFT-A(5)-X3 base
-do-	White	80	Rod. ant.-Ant. coil
-do-	Red	40	R1,2,6(+)-P.C.board com. positive
-do-	Black	35	IC2-VC2
-do- 10.0., 0.12/10	Black	65	VR(1)-Com. ground on P.C. board
	Yellow	95	VR(2)-C2
	Red	75	VR(3)-R20
Vinyl tubing 41. D,	Transp	110	For braided conduxtor between IFT-B casing-chassis ground
-do- 1 1. D.,	Yellow	30	For 2SB156 base (2 req'd)
-do-	-do-	10	For TH use (2 req'd)
-do-	-do-	15	For D1 & D2 use (2 req'd)
	-do-	3	-do-
	Red	30	For 2SB collector (2 req'd)
	Green	30	For 2SB emitter (2 req'd)
Braided conductor,		30	Between common ground on P.C. board and tuner
-do-		20	Shield casing-chassis groun
-do-		120	IFT-B casing-chassis ground

3.5.1 ANTENNA COIL L1

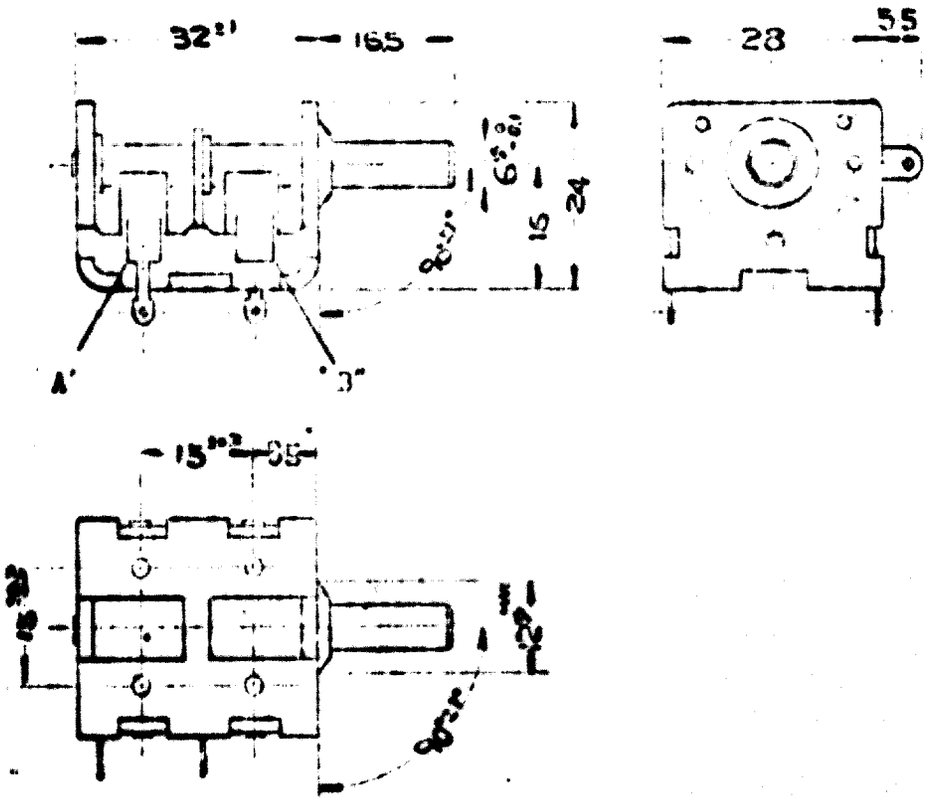


NO OF TURN : 4

CONDUCTOR : 1 mmϕ TINNED CU

TOLERANCE : $\pm$ 0.5

3.5.3 TUNING GANG CAPACITOR VC1-2



CAPACITANCE VS ANGULAR DISPLACEMENT :

A.D. (%)	CAPACITANCE (PF)
C (CLOSED)	18
25	13.3
50	8.4
75	3.5
100 (FULL OPENED)	0.05

TOLERANCE : SECTION 'A' ± 0.3PF, SECTION 'B' ± 0.5 PF

INSURATION : >100 MΩ AT D.C. 500 V

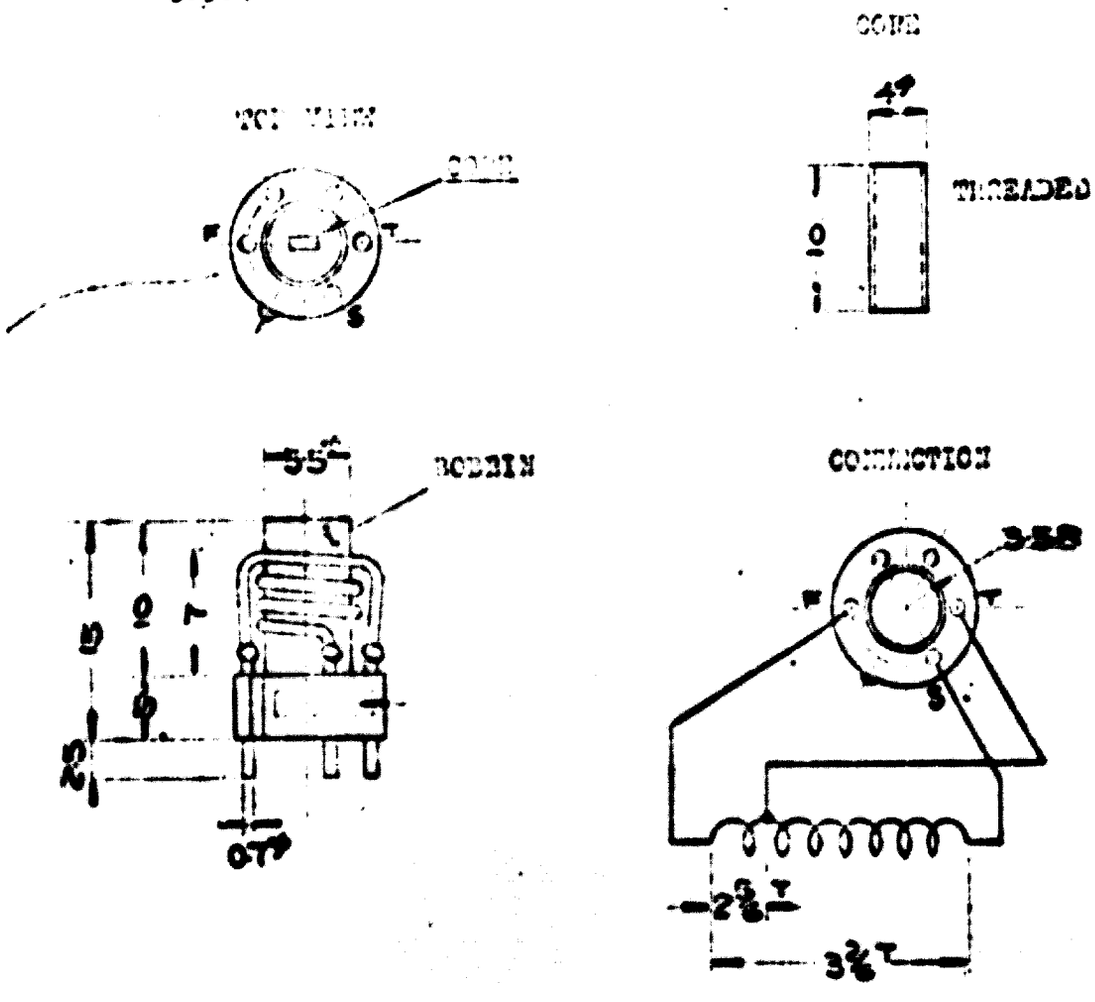
Q : >100 AT 10 MC, 100 MHz

TORQUE : 50 - 250 G.cm

ANGULAR DISP VS CAP : CAP. DECREASES WITH CLOCK WISE

MAX DISPLACEMENT : 180° ± 2°

3.5.4 OSCILLATOR COIL L4



CONDUCTOR : 0.5$^{\phi}$ TINNED CU

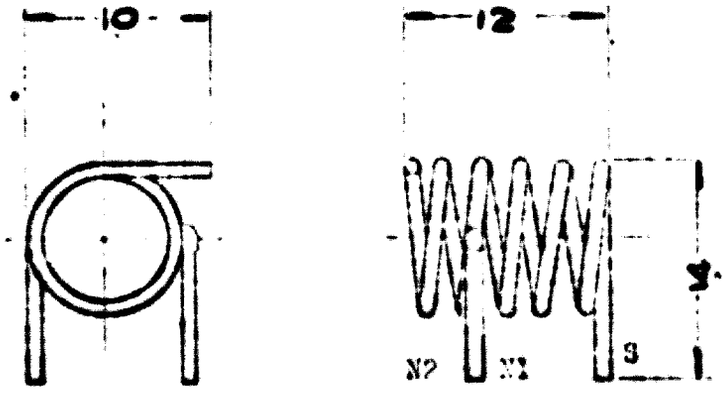
NO OF TURN : 3-2/6 TAPED
AT 2-5/6 TURN

BOBBIN : INNER THREADED FOR ADJ. OF CORE
POLYCARBONATE

CORE : TAIYO YUDEN CS TNC-10 OR EQU.

NOTE : 1. FIX COIL WITH POLYSTYRENE ADHESIVE
2. TOLERANCE OF DIMENSIONS : $\pm$ 0.5

3.5.5 RF COIL L2



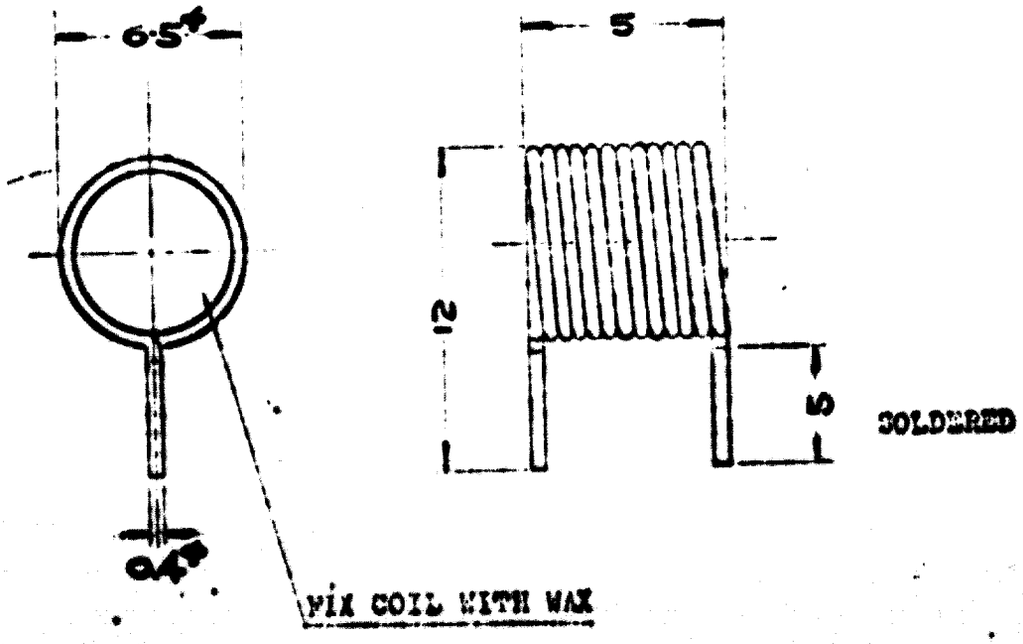
NO OF TURN : N1 ; 6-1/2
N2 ; 2-3/4

CONDUCTOR : 1.φ SILVERED

TOLERANCE OF DIMENSIONS : ± 0.5

NOTE : EACH END OF CONDUCTOR SHALL BE PRE-SOLDERED UP TO 5 mm.

3.5.6 IF TRAP L3



NO OF TURN : 13

CONDUCTOR : POLYURETHANE INSULATED COPPER WIRE, 0.4mm

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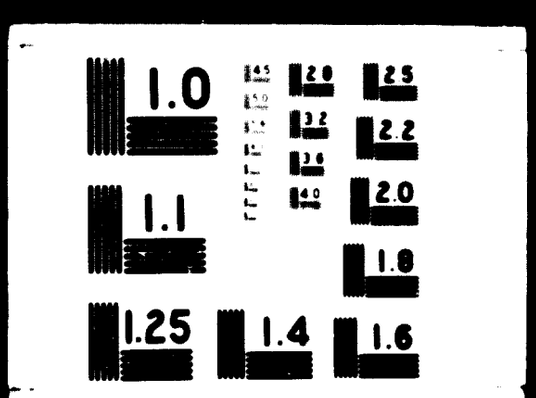
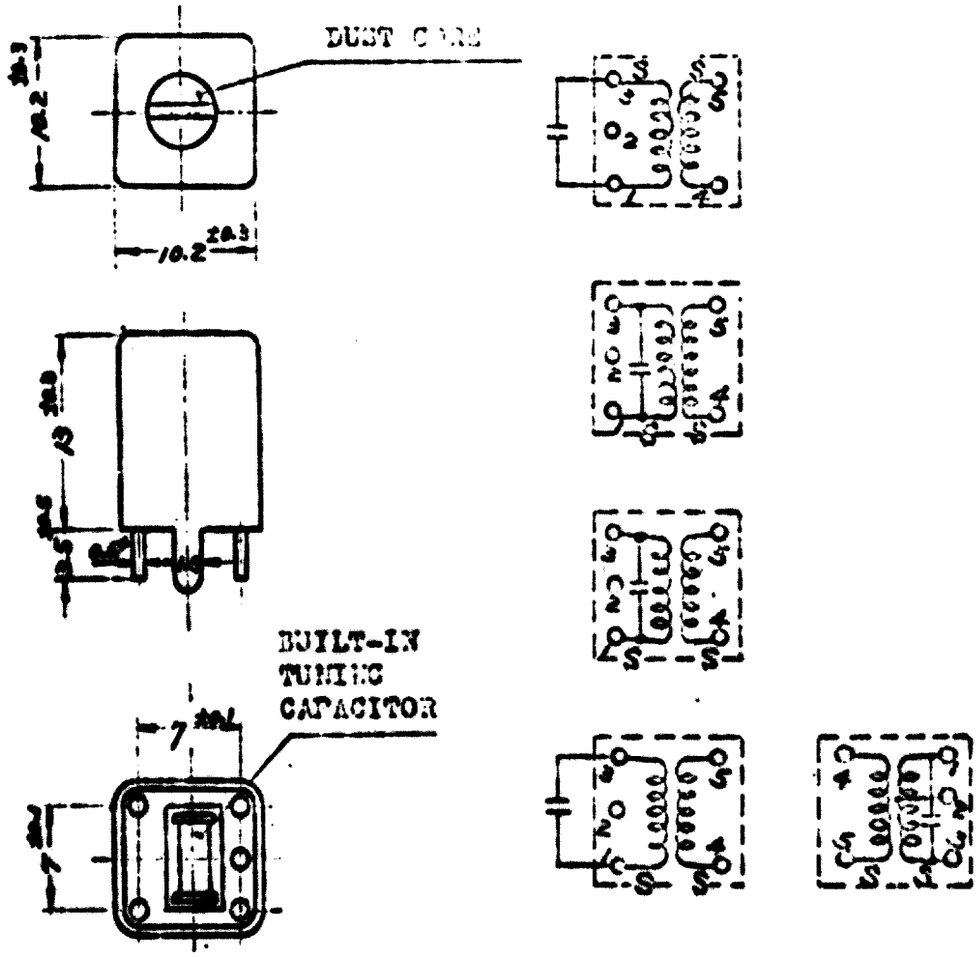
2 OF 2

DO

2755





	T1 (IFT-A)	T2 (IFT-B)	T3 (IFT-C)	T4 (IFT-D)	T5 (IFT-E)
Coloring	Yellow	White	Black	Blue	Pink
fo	fo ± 0.3 MHz				
Qo	90 ± 10				
Tuning capacitor	100 PF	50 PF*	50 PF*	30 PF	20 PF*
NO.OF turns	1-3 : 10T 4-5 : 1T	1-3 : 14T 4-5 : 2T	1-3 : 14T 4-5 : 1T	1-3 : 17T 4-5 : 4T	1-2 : 10T 2-3 : 10T 4-5 : 1T
Wire	0.1 , UEW				

NOTE : 1. INSULATION : 100MΩ AT 100 V, DC BETWEEN COILS AND COILS TO CASING

2. TREATED WITH MICRO - CRYSTAL WAX

3. * CAPACITOR BUILT-IN

3.6 ALIGNMENT PROCEDURE

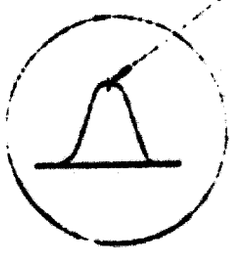
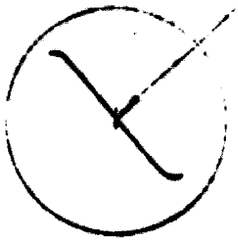
3,6,1 IF Section:

Test instrument Required;

(1) 10.7 MHz Sweep generator with marker generator
(2) Oscilloscope

General condition;

(1) Horizontal sweep of oscilloscope is synchronized with sweep generator
(2) Connect Sweep generator to test point TP2 through capacitor of 0.001uF
(3) Set tuning control of receiver under test at quiet point near 100 MHz

Step	Connect oscilloscope to	Adjust
1	To test point TP3 through diode and 10Kohm resistor in series as illustrated: Oscilloscope Diode 10Kohm To'TP3'	Adjust IFT-C, IFT-B & IFT-A for max. and symmetrical pattern centered at 10.7 MHz marker as illustrated. 10,7 MHz marker 
2	To test point TP4	Adjust IFT-D for max. gain and then IFT-E for best linearity of 'S' pattern centering at 10.7MHz marker as illustrated. 10.7 MHz marker 'S' Pattern 

3.6.2 RF Section

Test Instrument required:

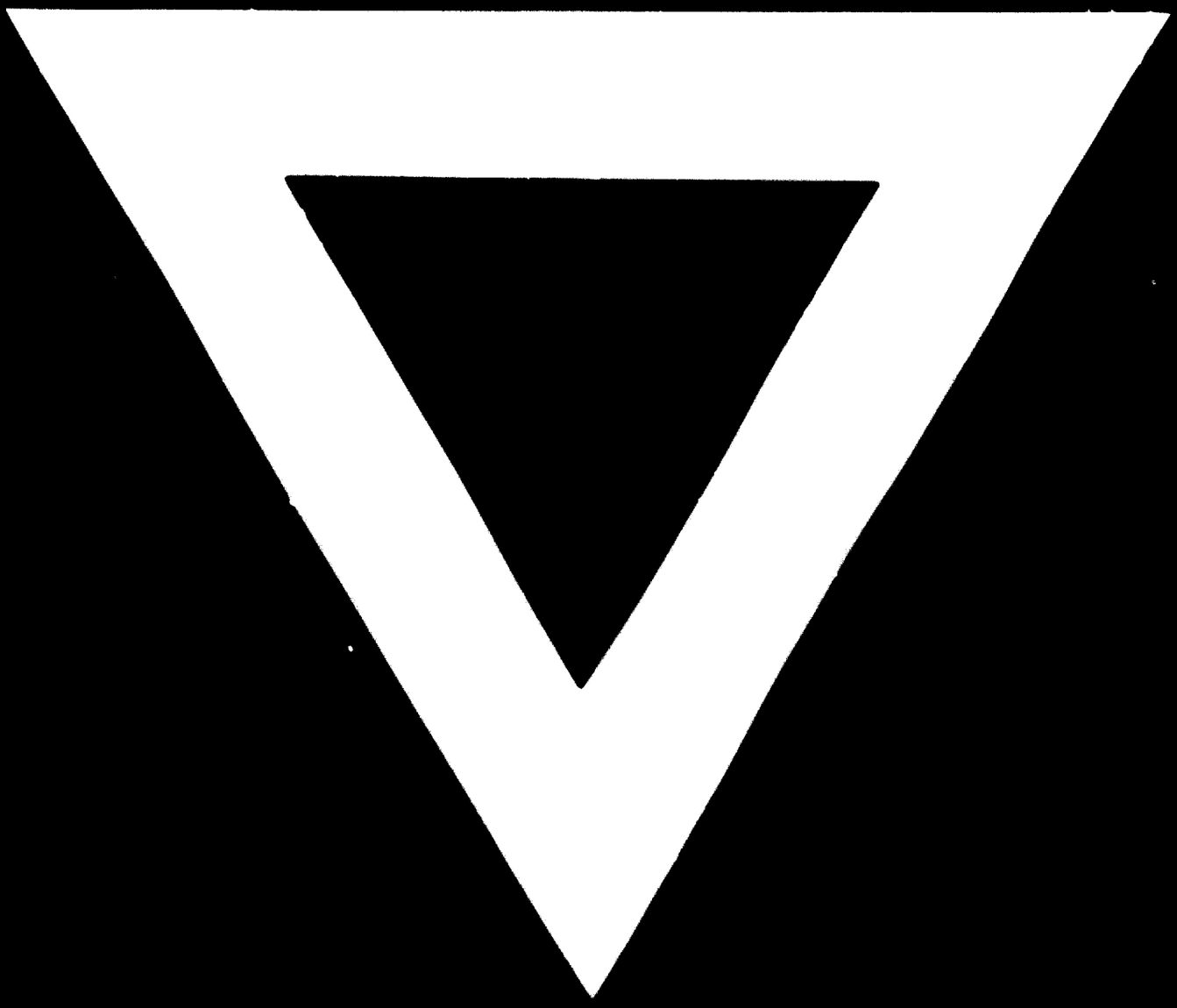
(1) VHF FM signal generator
(2) V.T.V.M.
(3) Connect signal generator to test point TP1 through capacitor of 0.001uF
(4) Connect V.T.V.M. to TP 5

Step	Output of Sig. generator	Receiver & Setting	Adjust for max on V.T.V.M
1	85 MHz	Close	OSC coil
2	110 MHz	Full open	TC2, OSC. trimmer
3	86 MHz	88 MHz	RF coil
4	108 MHz	108 MHz	TC1, RF trimmer
	Repeat for best sensitivity		

			VCBO (V)	IC (mA)	VEBO (V)	PC (mW)	Tj (°C)	VCE (V)	IE	hfe	hib	hrb	hob	NF (dB)	Cob (PF)	rbb' (Ω)	fαb (MHz)	ICBO (mA)
MW Converter	2SA-201	Germanium PNP Alloy	-15	-15	-5	100	75	-6	-1	50	—	—	—	—	11	80	8	10
455KHz IF Amplifier	2SA-202	Germanium PNP Alloy	-15	-15	-5	100	75	-6	-1	55	—	—	—	—	11	90	12	10
SW. Oscillator Mixer, Converter	2SA-222	Germanium PNP Drift	-20	-10	—	50	75	—	—	—	—	—	—	—	2	70	67	15
FM RF Amplifer Converter	2SA-71	Germanium PNP Alloy Difused	-20	-10	-0.5	100	75	VCE -6	1	80					2	50	100	15
10.7MHz IF Amplifier	2SA-103	Germanium PNP Drift	-40	-10	-0.5	60	75	VCE -6	1	50					1.7	50	35	15
Audio Amplifier	2SB-186	Germanium PNP Alloy	-25	-50	-25	100	75	-6	1	120	34	4.5	0.3	8	25		1CKHz (fae)	15
Power Amplifier	2SB-187	Germanium PNP Alloy	-25	-50	-25	100	75	-6	1	100 (VCE=1.5V)*	33	3.2	0.3	—	—	—	1	15

			PIV (V)	VR (V)	IFM (mA)	Io (mA)	Isurge (mA)	Istg (oC)	IF mA	IR (uA)	C (PF)	Q
Detector	1S-188	Point Contact Germanium diodes	-40V	-35	150	50	500	-55~70	4 (VF=1V)	-75 (VR=10V)	0.8 (VR=-1V)	
AFC	1S-554	Silicon P-N Diffused Junction		20				-65~+150		1	14±4 (at 6V)	60 (at 20MHz, 10V)

*(IC=30mA)



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