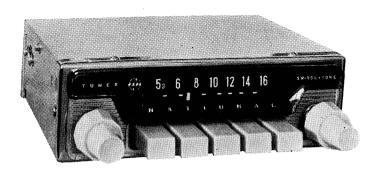


# **ALL TRANSISTOR CAR RADIO**



# MODEL AT-250 SERVICE NOTE





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MATSUSHITA COMMUNICATION INDUSTRIAL CO., LTD.
TSUNASHIMA YOKOHAMA JAPAN

#### 1. SPECIFICATIONS

Receiving system: class B push-pull output with one RF amplification

stage

Tuning: 5 push buttons

Reception band: 535 KC  $\sim$  1605 KC

Intermediate frequency: 455 KC

Sensitivity: under 20  $\mu$ V for 500 mW output

Selectivity: over 16 dB at  $\pm$  10 KC detuning

Frequency response: within  $-15\,dB$  at  $100\,c/s$ 

0 dB at 400 c/s

within -24 dB at 4000 c/s

Output power: 1.5 W

Power source voltage: 11~16V (13.5V standard)

Power consumption: approx. 5.5 W (13.5  $V \times 0.4 A$  at maximum output)

(170 mA: current drain without signal)

#### 2. COMPOSITION

Radio set 1 (See Section 2-1) Speaker box 1 (See Section 2-2)

Accessories 1 set (See Section 2-3)

\* This set works on 12V power source only.

As the set adopts class B push-pull circuit for the output stage, the current varies in proportion to the input signal. Therefore, even if the voltage is dropped to 12V with a voltage dropper, the set cannot be installed to the car equipped with 24V power source.

# 2-1 Radio Set (Weight: 1.4kg)

160

121

121

58 6 8 10 12 14 16

\_push buttons-

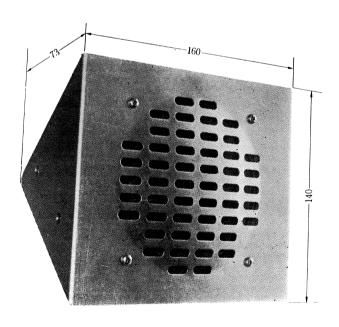
(Unit:  $\frac{m}{m}$ )

ON-OFF switch & volume control knob

# 2-2 Speaker Box (Weight: about 0.6 kg)

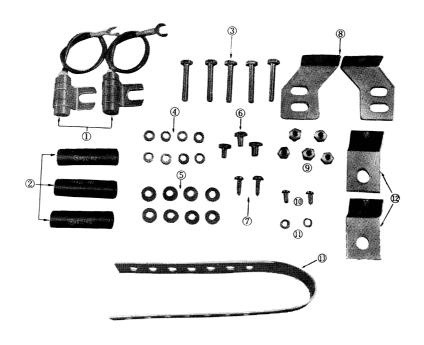
tuning knob

P-524S (Impedance:  $3.0 \Omega$ )



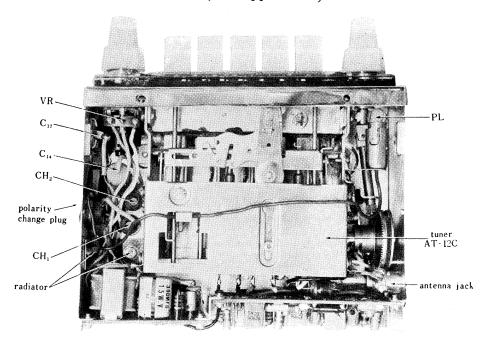
# 2-3 Accessories

No.	Item	Rating	Q'ty
1	Noise suppresser condenser	0. 5μ <b>F</b> 250 <b>V</b>	2
2	S-type noise suppresser		3
3	Hexagonal head screw.	$5$ mm $\varnothing \times 30$	5
4	Spring washer	5mm Ø	8
5	Washer	5 <i>mm</i> Ø	8
6	Hexagonal head screw	$5$ mm $\varnothing \times 8$	3
7	Wood screw	SC-15 ⊝ head	2
8	Mounting bracket B		1 each for left & right
9	Hexagonal nut	5mm Ø	5
10	Screw	$4_{\it mm} \varnothing \times 8 \oplus { m head}$	2
11	Spring washer	4mm Ø	2
12	Speaker bracket		2
13	Mounting bracket A		1

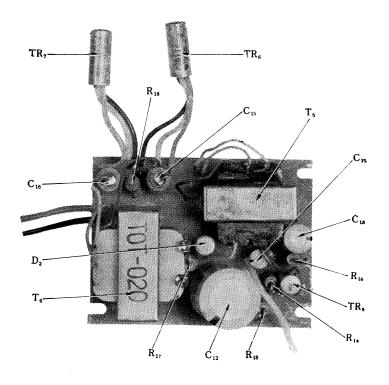


# 3. PARTS LOCATION

3-1 Inside of the Radio Set (the upper side)



# 3-2 Printed Circuit Board (P-250B)



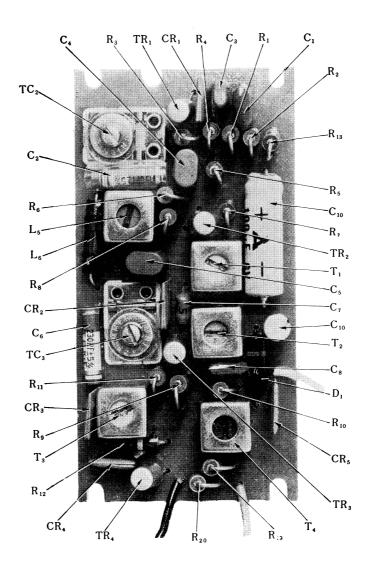
# 3-3 Printed Circuit Board (P-250A)

R: Resistor C: Condenser

TR: Transistor CR: Condenser & Resistor

T: Transformer TC: Trimmer condenser

L: Coil



#### 4. POLARITY CHANGE

Model AT-250 can be installed either in plus (+) earthed car or in minus (—) earthed car. Polarity can be changed by moving the polarity change plug located on the right side of the chassis.

The radio set is originally minus (-) earthed in factory.

(1) How to set the radio set for plus (+) earthed power source.

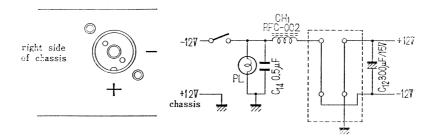


Fig. 4-1

(2) How to set the radio set for minus (—) earthed power source.

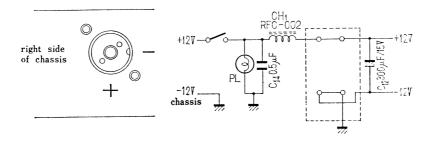


Fig. 4-2

#### 5. ALIGNMENT

#### 5-1 Preparations for Alignment

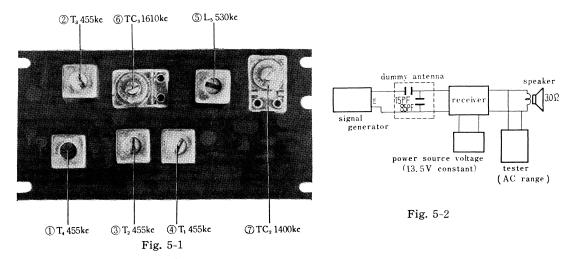
- 1) Regulate the power source voltage at the standard DC 13.5V constant.
- 2) Set the modulating frequency of the standard signal generator at 400 c/s. Modulation degree should be 30%.
- 3) The output of the signal generator should be as low as possible.
- 4) Set the volume control at its maximum position.
- 5) Dummy antenna should be set as shown in Fig. 5-2.

#### 5-2 Procedures of Alignment

Process	Alignment Part	Signal Frequency	Dial pointer position	Alignment
1.	$T_4$ (IFT-005)	455KC	Set it at the right end	Repeat the pro-
2.	T <sub>3</sub> (IFT-004)	//	"	cedures 1 to 4, 2 or 3 times so as
3.	$T_2$ (IF-22002)	"	"	to get the maxi- mum output.
4.	T <sub>1</sub> (IF-22001)	"	"	
5.	L <sub>5</sub> (OSC-006)	530KC	Set it at the left end	
6.	TC <sub>3</sub> (TT-70)	1610KC	Set it at the right end	
7.	TC <sub>2</sub> (TT-70)	1400KC	Set it at 1400KC point	Align to get the
8.	TC <sub>1</sub> (TL-70)	"	"	maximum output.

Note: When the radio set is installed in a car, or when the antenna is changed, never fail to align again the  $TC_1$  to get the maximum output receiving a program at or around 1400KC.

#### 5-3 Parts to Be Aligned and Signal Frequency



# 6. STANDARD VOLTAGES AT VARIOUS POINTS OF THE CIRCUIT

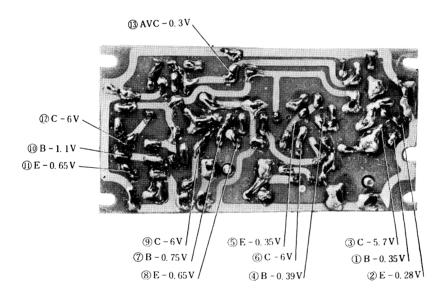
- 1) Given voltages are the standard ones indicated on a tester which has  $20K\Omega/V$  internal resistance.
- 2) The standard measuring points are on plus (+) side.
- 3) Given voltages under 0.5V are measured with a 1.5V range tester and those between  $0.5\sim2.5V$  with a 2.5V range tester.
- 4) The figure in  $\bigcirc$  indicates its position in the circuit diagram.

C: collector,

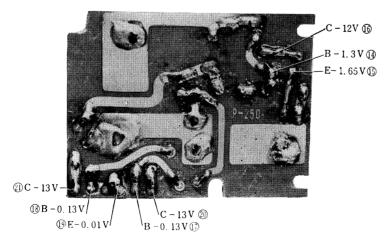
B: base,

E: emitter.

#### High frequency section



#### Low frequency section



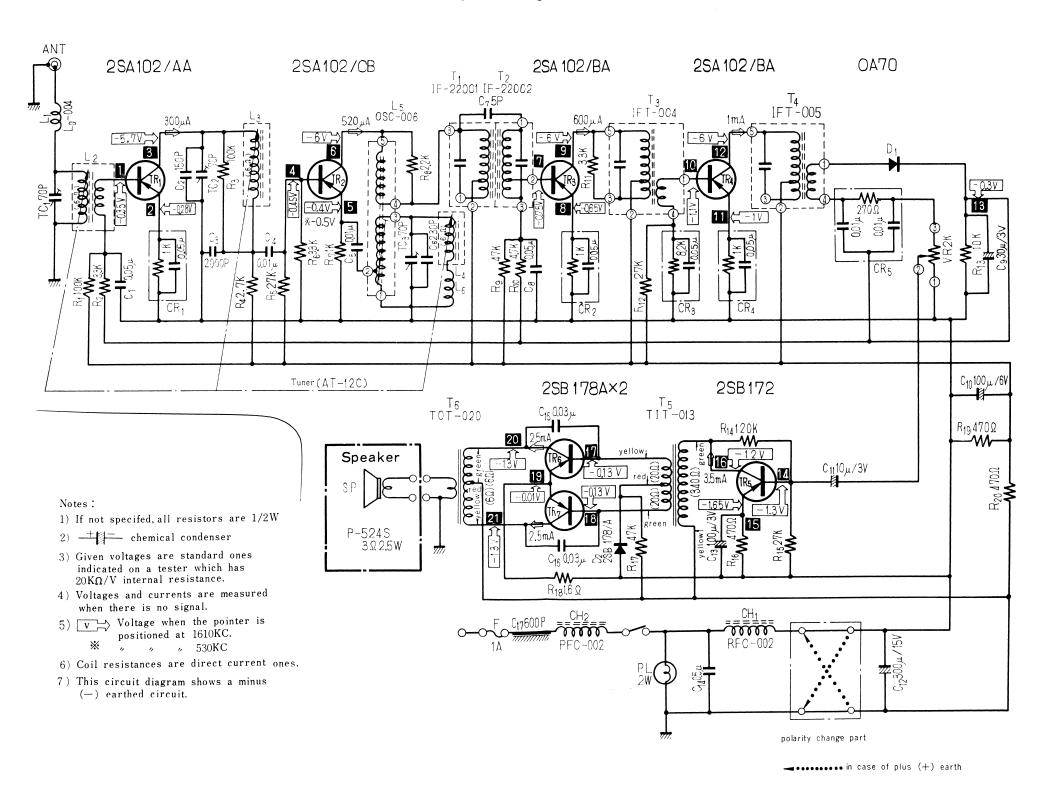
### 9. AT-250 PARTS LIST

Note: 1) For requirement of parts, please specify them by their type numbers.

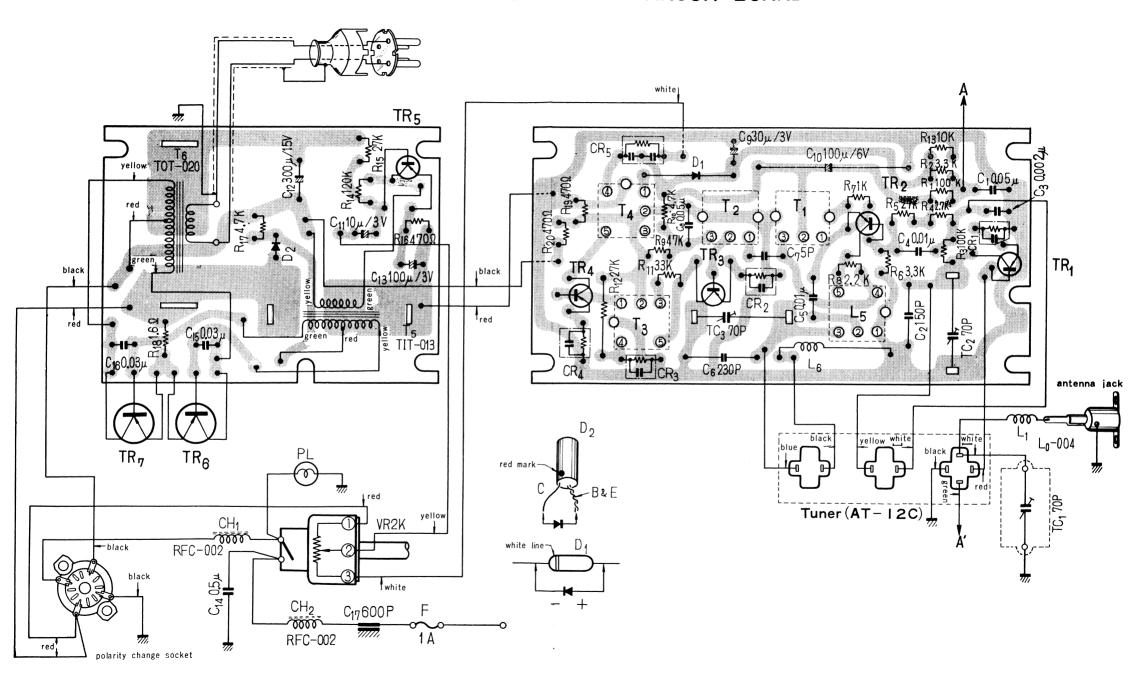
2) Principal parts are marked with \*.

$\begin{array}{cccccccccccccccccccccccccccccccccccc$	No.	Name		Type N	o.	Note
TR <sub>9</sub> .TR <sub>4</sub>	TR <sub>1</sub>	transistor		2SA102/AA		
TR <sub>5</sub> "         2SA172/AD         Pair type transistor           D <sub>1</sub> diode         OA70         varistor           R <sub>1</sub> ·R <sub>2</sub> solid resistor         2SB178/A         varistor           R <sub>4</sub> "         ½W         RC½BFK         100KΩ           R <sub>4</sub> "         ½W         RC½BFK         2.7KΩ           R <sub>2</sub> ·R <sub>8</sub> "         ½W         RC½BFK         3.3KΩ           R <sub>7</sub> "         ½W         RC½BFK         33KΩ           R <sub>1</sub> "         ½W         RC½BFK         33KΩ           R <sub>8</sub> "         ½W         RC½BFK         2.2KΩ           R <sub>8</sub> "         ½W         RC½BFK         4.7KΩ           R <sub>10</sub> ·R <sub>17</sub> "         ½W         RC½BFK         4.7KΩ           R <sub>10</sub> ·R <sub>12</sub> ·R <sub>12</sub> ·R <sub>15</sub> "         ½W         RC½BFK         10KΩ           R <sub>13</sub> "         ½W         RC½BFK         10KΩ           R <sub>14</sub> "         ½W         RC½BFK         10KΩ           R <sub>18</sub> synthetic resin coated resistor         WR½RN         1.6Ω           *VR         volume control         2KΩ         MS-05603M	TR <sub>2</sub>	"		2SA102/CA		
TR <sub>6</sub> -TR <sub>7</sub> "         2SB178/A         Pair type transistor           D <sub>2</sub> transistor         2SB178/A         varistor           R <sub>1</sub> .R <sub>3</sub> solid resistor         ½W RC½BFK 100KΩ         varistor           R <sub>4</sub> "         ½W RC½BFK 2.7KΩ         x           R <sub>2</sub> .R <sub>8</sub> "         ½W RC½BFK 3.3KΩ         x           R <sub>7</sub> "         ½W RC½BFK 1KΩ         x           R <sub>11</sub> "         ½W RC½BFK 33KΩ         x           R <sub>11</sub> "         ½W RC½BFK 33KΩ         x           R <sub>8</sub> "         ½W RC½BFK 33KΩ         x           R <sub>9</sub> "         ½W RC½BFK 47KΩ         x           R <sub>10</sub> .R <sub>17</sub> "         ½W RC½BFK 47KΩ         x           R <sub>10</sub> .R <sub>17</sub> "         ½W RC½BFK 27KΩ         x           R <sub>13</sub> "         ½W RC½BFK 10KΩ         x           R <sub>14</sub> "         ½W RC½BFK	TR₃.TR₄	"		2SA102/BA		
TR <sub>6</sub> -TR <sub>7</sub>	TR <sub>5</sub>	"		2SA172/AD		
D₂         transistor         2SB178/A         varistor           R₁R₃         solid resistor         ½W         RC½BFK         100KΩ           R₄         "         ½W         RC½BFK         2.7KΩ           R₂R₃         "         ½W         RC½BFK         3.3KΩ           R₁         "         ½W         RC½BFK         1KΩ           R₁¹         "         ½W         RC½BFK         33KΩ           R₃         "         ½W         RC½BFK         2.2KΩ           R₃         "         ½W         RC½BFK         4.7KΩ           R₃         "         ½W         RC½BFK         4.7KΩ           R₃         "         ½W         RC½BFK         4.7KΩ           R₃,R₁²         "         ½W         RC½BFK         27KΩ           R₁₃         "         ½W         RC½BFK         10KΩ           R₁₃         "         "         WR½W         RC½BFK         10KΩ	TR <sub>6</sub> .TR <sub>7</sub>	"		2SB178/A		transistor
R1.R2         solid resistor         ½ W         RC½BFK         100KΩ           R4         "         ½ W         RC½BFK         2.7KΩ           R2.R6         "         ½ W         RC½BFK         3.3KΩ           R7         "         ½ W         RC½BFK         1KΩ           R11         "         ½ W         RC½BFK         33KΩ           R8         "         ½ W         RC½BFK         2.2KΩ           R9         "         ½ W         RC½BFK         4.7KΩ           R16,R17         "         ½ W         RC½BFK         4.7KΩ           R14         "         ½ W         RC½BFK         10KΩ           R13         "         ½ W         RC½BFK         10KΩ           R14         "         ½ W         RC½BFK         120KΩ           R14         "         ½ W         RC½BFK         120KΩ           WR18         synthetic resin coated resistor         WR½RN         1.6Ω           *VR         volume control         2KΩ         PNVM 24C₁37.5 2KΩDSG           C₁.C8         miler condenser         0.05μF         MS-05503M           C2         titanium condenser         150PF         CC-30	$\mathbf{D}_{1}$	diode		OA70		
R4       "       ½W       RC½BFK       2.7KΩ         R2.R6       "       ½W       RC½BFK       3.3KΩ         R7       "       ½W       RC½BFK       1KΩ         R11       "       ½W       RC½BFK       33KΩ         R8       "       ½W       RC½BFK       2.2KΩ         R8       "       ½W       RC½BFK       2.2KΩ         R9       "       ½W       RC½BFK       47KΩ         R17       "       ½W       RC½BFK       47KΩ         R17       "       ½W       RC½BFK       2.7KΩ         R13       "       ½W       RC½BFK       2.7KΩ         R14       "       ½W       RC½BFK       10KΩ         R14       "       ½W       RC½BFK       120KΩ         RR18       synthetic resin coated resistor       WR½RN       1.6Ω         *VR       volume control       2KΩ       PNVM 24C137.5 2KΩDSG         C1.C8       miler condenser       0.05μF       MS-05503M         C2       titanium condenser       150PF       CC-30       150PF         C3       miler condenser       0.00μF       NCA-3V10       NCA-3V10	$\mathbf{D_2}$	transistor		2SB178/A		varistor
R2.R6       "       ½W       RC½BFK       3.3KΩ         R7       "       ½W       RC½BFK       1KΩ         R11       "       ½W       RC½BFK       33KΩ         R8       "       ½W       RC½BFK       2.2KΩ         R9       "       ½W       RC½BFK       47KΩ         R10.R17       "       ½W       RC½BFK       47KΩ         R3.R12.R15       "       ½W       RC½BFK       10KΩ         R13       "       ½W       RC½BFK       120KΩ         R14       "       ½W       RC½BFK       120KΩ         *R16       synthetic resin coated resistor       WR½RN       1.6Ω         *VR       volume control       2KΩ       PNVM 24C137.5 2KΩDSG         *VR       volume condenser       0.05μF       MS-05503M         C2       titanium condenser       150PF       CC-30       150PF         C3       miler condenser       0.002μF       A-202K         C4.C5       "       "       5PF 50V         C6       titanium condenser       10μF 3V       NCA-3V10         C10       "       100μF 3V       NCA-6V100         C12       "       <	R <sub>1</sub> .R <sub>3</sub>	solid resistor	$\frac{1}{2}\mathbf{W}$	RC½BFK	$100 \mathrm{K}\Omega$	
R <sub>1</sub> "       ½W       RC½BFK       1KΩ         R <sub>1</sub> "       ½W       RC½BFK       33KΩ         R <sub>8</sub> "       ½W       RC½BFK       2.2KΩ         R <sub>9</sub> "       ½W       RC½BFK       47KΩ         R <sub>10</sub> .R <sub>17</sub> "       ½W       RC½BFK       47KΩ         R <sub>13</sub> "       ½W       RC½BFK       27KΩ         R <sub>13</sub> "       ½W       RC½BFK       10KΩ         R <sub>14</sub> "       ½W       RC½BFK       120KΩ         R <sub>16</sub> "       ½W       RC½BFK       470Ω         *R <sub>18</sub> synthetic resin coated resistor       WR½RN       1.6Ω         *VR       volume control       2KΩ       PNVM 24C <sub>1</sub> 37.5 2KΩDSG         K <sub>16</sub> miler condenser       0.05μF       MS-05503M         C <sub>2</sub> titanium condenser       150PF       CC-30       150PF         C <sub>3</sub> miler condenser       0.002μF       A-202K         C <sub>4</sub> C <sub>5</sub> "       CC-25       230PF         C <sub>7</sub> "       5PF 50V       Insulated ty         C <sub>10</sub> "       100μF 3V       NCA-3V10         C <sub>12</sub>	R <sub>4</sub>	"	$\frac{1}{2}\mathbf{W}$	RC½BFK	$2.7 \mathbf{K}\Omega$	
R1       "       ½W       RC½BFK       33KΩ         R8       "       ½W       RC½BFK       2.2KΩ         R9       "       ½W       RC½BFK       47KΩ         R10.R17       "       ½W       RC½BFK       47KΩ         Rs.R12.R15       "       ½W       RC½BFK       27KΩ         R13       "       ½W       RC½BFK       10KΩ         R14       "       ½W       RC½BFK       120KΩ         R16.R19.R20       "       ½W       RC½BFK       470Ω         *R18       synthetic resin coated resistor       WR½RN       1.6Ω         *VR       volume control       2KΩ       PNVM 24C₁37.5 2KΩDSG         C1.C8       miler condenser       0.05μF       MS-05503M         C2       titanium condenser       150PF       CC-30 150PF         C3       miler condenser       0.002μF       A-202K         C4.C5       "       CC-25 230PF         C7       "       5PF 50V       insulated ty         C10       "       100μF 3V       NCA-3V10         C12       "       300μF 15V       NCA-3V100         C13       "       100μF 3V       NCA-3V100	R <sub>2</sub> .R <sub>6</sub>	"	$\frac{1}{2}\mathbf{W}$	RC½BFK	$3.3K\Omega$	
R <sub>9</sub> "       ½W       RC½BFK       2.2KΩ         R <sub>9</sub> "       ½W       RC½BFK       47KΩ         R <sub>10</sub> ·R <sub>17</sub> "       ½W       RC½BFK       47KΩ         R <sub>5</sub> ·R <sub>12</sub> ·R <sub>15</sub> "       ½W       RC½BFK       27KΩ         R <sub>13</sub> "       ½W       RC½BFK       10KΩ         R <sub>14</sub> "       ½W       RC½BFK       120KΩ         *R <sub>16</sub> ·R <sub>19</sub> ·R <sub>20</sub> "       ½W       RC½BFK       470Ω         **R <sub>18</sub> synthetic resin coated resistor       WR½RN       1.6Ω         **VR       volume control       2KΩ       PNVM 24C <sub>1</sub> 37.5 2KΩDSG         C <sub>1</sub> ·C <sub>6</sub> miler condenser       0.05μF       MS-05503M         C <sub>2</sub> titanium condenser       150PF       CC-30 150PF         C <sub>3</sub> miler condenser       0.002μF       A-202K         C <sub>4</sub> ·C <sub>5</sub> "       CC-25 230PF         C <sub>7</sub> "       5PF 50V       insulated ty         C <sub>9</sub> ·C <sub>11</sub> chemical condenser       10μF 3V       NCA-3V10         C <sub>12</sub> "       300μF 15V       NCA-3V100         C <sub>13</sub> "       100μF 3V       NCA-3V100         C <sub>14</sub>	R <sub>7</sub>	"	$\frac{1}{2}\mathbf{W}$	RC½BFK	$1 \mathrm{K} \Omega$	
R <sub>10</sub> , R <sub>17</sub> "       ½W       RC½BFK       47ΚΩ         R <sub>10</sub> , R <sub>17</sub> "       ½W       RC½BFK       4.7ΚΩ         R <sub>3</sub> , R <sub>12</sub> , R <sub>15</sub> "       ½W       RC½BFK       27ΚΩ         R <sub>13</sub> "       ½W       RC½BFK       10ΚΩ         R <sub>14</sub> "       ½W       RC½BFK       120ΚΩ         R <sub>16</sub> , R <sub>19</sub> , R <sub>20</sub> "       ½W       RC½BFK       470Ω         *R <sub>18</sub> synthetic resin coated resistor       WR½RN       1,6Ω         *VR       volume control       2KΩ       PNVM 24C <sub>1</sub> 37.5 2KΩDSG         C <sub>1</sub> .C <sub>8</sub> miler condenser       0.05μF       MS-05503M         C <sub>2</sub> titanium condenser       150PF       CC-30 150PF         C <sub>3</sub> miler condenser       0.002μF       A-202K         C <sub>4</sub> .C <sub>5</sub> "       "       5PF 50V       insulated ty         C <sub>9</sub> .C <sub>11</sub> chemical condenser       10μF 3V       NCA-3V10       NCA-3V10         C <sub>10</sub> "       300μF 15V       NCA-15V300       NCA-3V100         C <sub>13</sub> "       100μF 3V       NCA-3V100       NCA-3V100         C <sub>14</sub> MP tubular condenser       0.5μF       MAPR-1504M	R 1 1	"	$\frac{1}{2}\mathbf{W}$	RC½BFK	$33$ K $\Omega$	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	R <sub>8</sub>	"	$\frac{1}{2}\mathbf{W}$	RC½BFK	$2.2\mathrm{K}\Omega$	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	R <sub>9</sub>	"	$\frac{1}{2}\mathbf{W}$	RC½BFK	$47 \mathrm{K}\Omega$	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	R <sub>10</sub> .R <sub>17</sub>	"	$\frac{1}{2}W$	RC½BFK	4.7KΩ	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	R <sub>5</sub> .R <sub>12</sub> .R <sub>15</sub>	"	$\frac{1}{2}$ W	RC½BFK	$27 \mathrm{K}\Omega$	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	R <sub>13</sub>	"	$\frac{1}{2}$ W	RC½BFK	$10 \mathrm{K}\Omega$	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	R <sub>14</sub>	"	$\frac{1}{2}W$	RC½BFK	$120 \mathrm{K}\Omega$	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$R_{16}.R_{19}.R_{20}$	"	$\frac{1}{2}W$	RC½BFK	$470\Omega$	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	*R <sub>18</sub>	synthetic resin coated	resistor	WR½RN	1.62	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	*VR	volume control	$2\mathbf{K}\Omega$	PNVM 24C <sub>1</sub> 37.	5 2KΩDSG	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	C <sub>1</sub> .C <sub>8</sub>	miler condenser	$0.05 \mu \mathrm{F}$	MS-05503M		
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	C <sub>2</sub>	titanium condenser	150 <b>PF</b>	CC-30 150PF		
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	C <sub>3</sub>	miler condenser	$0.002 \mu \mathrm{F}$	A-202K		
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	C <sub>4</sub> .C <sub>5</sub>	"				
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	C <sub>6</sub>	titanium condenser	230PF	CC-25 230PF		•
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	C <sub>7</sub>	"	5 <b>PF</b> 50 <b>V</b>			insulated type
$C_{12}$	C <sub>9</sub> .C <sub>11</sub>	chemical condenser	$10\mu F$ 3V	NCA-3V10		
$C_{13}$	C <sub>10</sub>	"	100µF 6V	NCA-6 V 100		
$C_{14}$ MP tubular condenser $0.5\mu F$ MAPR-1504M $C_{15}.C_{16}$ " $0.03\mu F$ MPBS-2303M	C <sub>12</sub>	"	$300\mu F$ 15V	NCA-15 V 300		
$C_{15}.C_{16}$ " $0.03\mu F$ MPBS-2303M	C <sub>13</sub>	"	100µF 3V	NCA-3V100		
	C14	MP tubular condenser	0.5 <b>µF</b>	MAPR-1504M		
C <sub>17</sub> spark plate 600PF	C <sub>15</sub> .C <sub>16</sub>	"	$0.03 \mu \mathrm{F}$	MPBS-2303M		
	C <sub>17</sub>	spark plate	600PF			

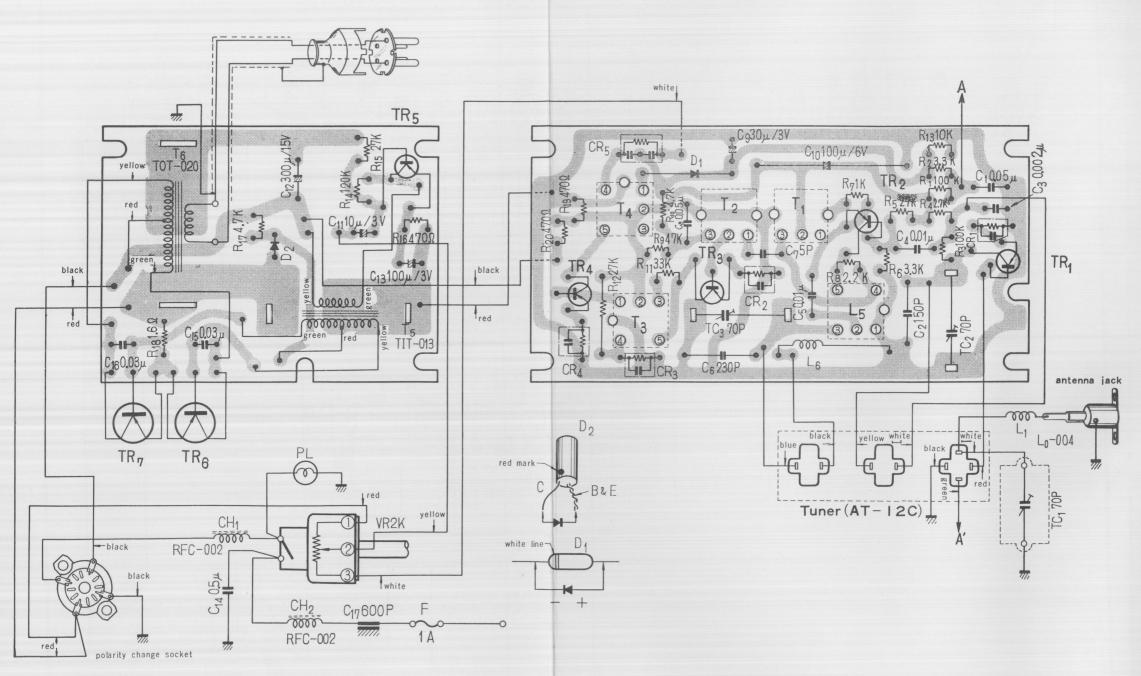
### AT-250 CIRCUIT DIAGRAM



# AT-250 PRINTED CIRCUIT BOARD



# AT-250 PRINTED CIRCUIT BOARD



No.	Name	Type No.	Note
*CR <sub>1</sub> .CR <sub>2</sub> .CR <sub>4</sub>	Condenser & resistor $1 \text{K}\Omega \ 0.05 \mu \text{F}$	RC 11010KYZ	
*CR <sub>3</sub>	$^{\prime\prime}$ 8.2K $\Omega$ 0.05 $\mu$ F	RC 11018KYZ	
*CR <sub>5</sub>	$^{\prime\prime}$ 270 $\Omega$ 0.01 $\mu$ F $\times$ 2	RC 12004MYZ	
*TC <sub>1</sub>	trimmer condenser	TL-70	
*TC <sub>2</sub> .TC <sub>3</sub>	"	TT-70	
*L <sub>1</sub>	loading coil	$L_0-004$	
$L_2.L_3.L_4$	tuner	AT-12C	
$L_5$	oscillating coil	OSC-006	
$L_6$	oscillating series coil	FC-23M3	
*T <sub>1</sub>	intermediate frequency transformer	IF-22001	1st IFT
*T <sub>2</sub>	"	IF-22002	2nd IFT
*T <sub>3</sub>	"	IFT-004	3rd IFT
*T <sub>4</sub>	"	IFT-005	4th IFT
*T <sub>5</sub>	input transformer	TIT-013	
*T <sub>6</sub>	output transformer	TOT-020	
*CH <sub>1</sub> .CH <sub>2</sub>	hush choke coil	RF-002	
*SP	speaker	P-524S	3Ω, 2.5W
F	fuse	1A glass tube type	
PL	pilot lamp	FL-002 (12V 2w)	
	dial plate		
	dial knob		
	antenna jack		
	4P speaker plug		
	4P socket		
	polarity change socket SM-033		
	" plug 4P-GP		