

# ST-SA50ES

## SERVICE MANUAL

US Model



### SPECIFICATIONS

#### FM tuner section

Frequency range	87.5 – 108.0 MHz
Antenna terminals	75 $\Omega$ , unbalanced
Intermediate frequency	10.7 MHz
Sensitivity	at 26 dB quieting (mono) 10.3 dBf, 0.9 $\mu$ V/75 $\Omega$ at 46 dB quieting (stereo) 38.5 dBf, 23 $\mu$ V/75 $\Omega$
Usable sensitivity (IHF)	10.3 dBf, 0.9 $\mu$ V/75 $\Omega$
S/N	at 40 kHz deviation 95 dB (mono), 86 dB (stereo)
Harmonic distortion	WIDE 0.008 % (mono), 0.02 % (stereo) NARROW 0.04 % (mono), 0.07 % (stereo)
Frequency response	15 Hz – 15 kHz ( $\pm$ 0.2 dB)
Separation	65 dB at 1 kHz
Selectivity	at 400 kHz WIDE 80 dB NARROW 90 dB at 300 kHz WIDE 45 dB NARROW 70 dB
Output	at 40 kHz deviation 600 mV

#### AM tuner section

Frequency range	AM : 530 – 1,710 kHz (10 kHz step)
Intermediate frequency	450 kHz
Usable sensitivity	(with AM loop antenna) 200 $\mu$ V/m
Signal-to-noise ratio	AM : 54 dB (50 mV/m, 1,050 kHz)
Harmonic distortion	0.3% (50 mV/m, 400 Hz)
Selectivity	50 dB

#### General

Power requirements	120 V, AC 60 Hz
Power consumption	13 W
Dimensions	16 <sup>15</sup> / <sub>16</sub> $\times$ 3 <sup>7</sup> / <sub>8</sub> $\times$ 13 <sup>3</sup> / <sub>8</sub> in. (430 $\times$ 98 $\times$ 340 mm)
Weight	9 lbs. 1 oz.(4.1 kg)
Supplied accessories	Audio cord (1) AM loop antenna (1) FM wire antenna (1) Antenna adapter (1)

Design and specifications are subject to change without notice.

FM STEREO FM-AM TUNER

SONY®



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## SAFETY CHECK-OUT

After correcting the original service problem, perform the following safety checks before releasing the set to the customer: Check the antenna terminals, metal trim, “metallized” knobs, screws, and all other exposed metal parts for AC leakage. Check leakage as described below.

### LEAKAGE

The AC leakage from any exposed metal part to earth ground and from all exposed metal parts to any exposed metal part having a return to chassis, must not exceed 0.5 mA (500 microamperes). Leakage current can be measured by any one of three methods.

1. A commercial leakage tester, such as the Simpson 229 or RCA WT-540A. Follow the manufacturers’ instructions to use these instruments.
2. A battery-operated AC milliammeter. The Data Precision 245 digital multimeter is suitable for this job.
3. Measuring the voltage drop across a resistor by means of a VOM or battery-operated AC voltmeter. The “limit” indication is 0.75 V, so analog meters must have an accurate low-voltage scale. The Simpson 250 and Sanwa SH-63Trd are examples of a passive VOM that is suitable. Nearly all battery operated digital multimeters that have a 2V AC range are suitable. (See Fig. A)

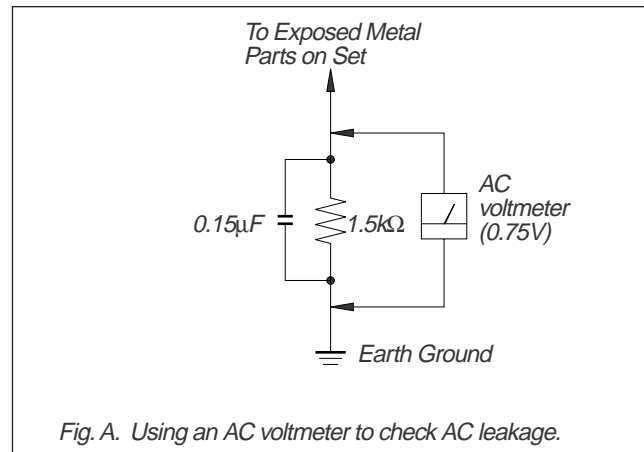


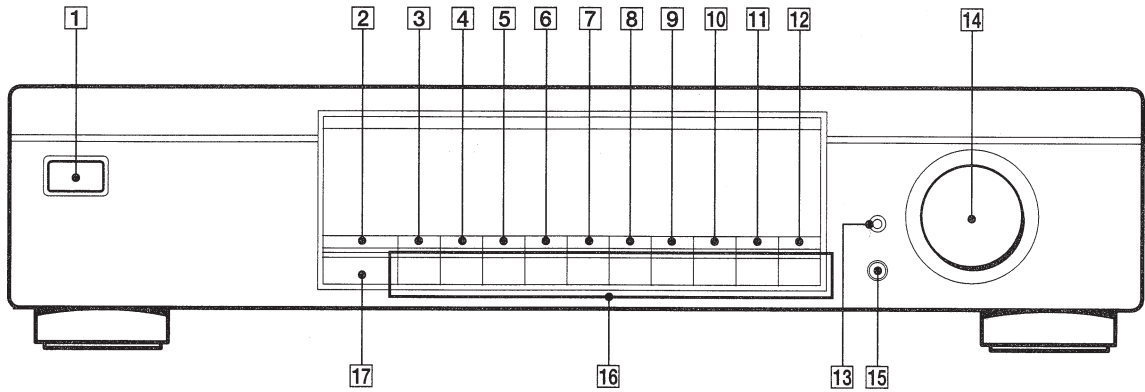
Fig. A. Using an AC voltmeter to check AC leakage.

### SAFETY-RELATED COMPONENT WARNING!!

COMPONENTS IDENTIFIED BY MARK  $\triangle$  OR DOTTED LINE WITH MARK  $\triangle$  ON THE SCHEMATIC DIAGRAMS AND IN THE PARTS LIST ARE CRITICAL TO SAFE OPERATION. REPLACE THESE COMPONENTS WITH SONY PARTS WHOSE PART NUMBERS APPEAR AS SHOWN IN THIS MANUAL OR IN SUPPLEMENTS PUBLISHED BY SONY.

# SECTION 1 GENERAL

## Location of Controls



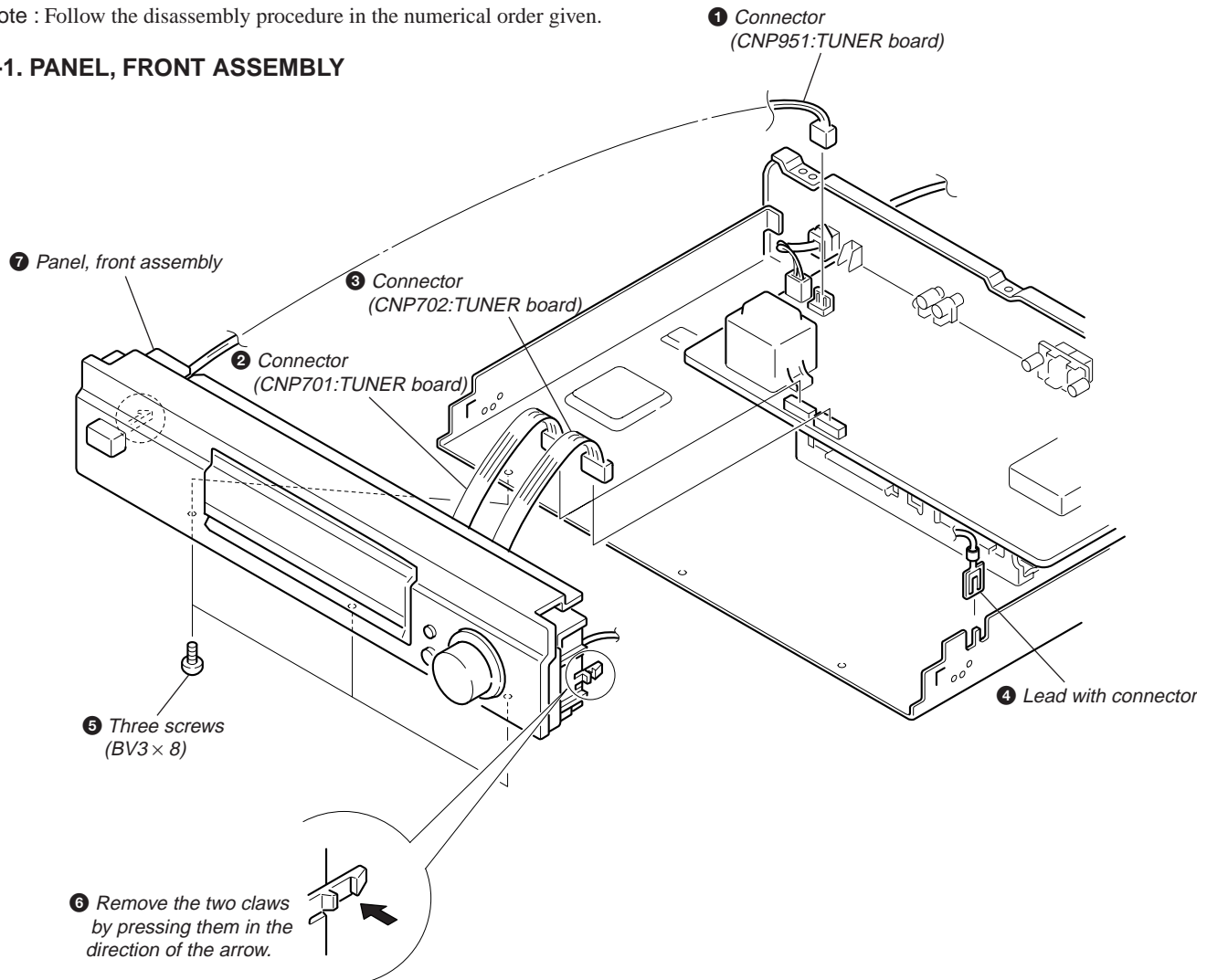
- 1** POWER switch (ⓐ)
- 2** DISPLAY button
- 3** ANTENNA button
- 4** ASM button
- 5** ANT ATT button
- 6** IF BAND button
- 7** FM MODE button
- 8** BAND button
- 9** MEMORY button

- 10** CHARACTER button
- 11** MENU button
- 12** RETURN button
- 13** TUNE MODE button
- 14** TUNING/SELECT knob
- 15** ENTER button
- 16** NUMBER buttons
- 17** SHIFT button

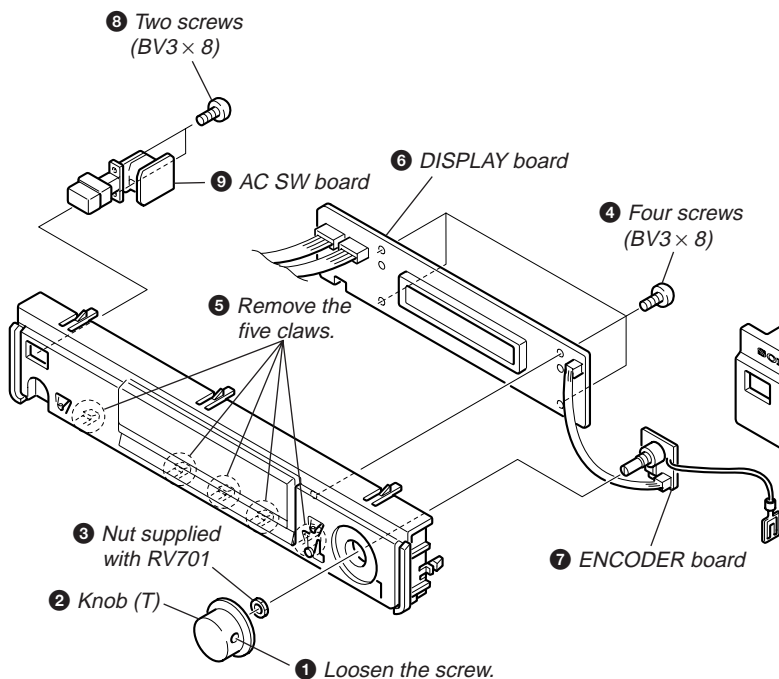
## SECTION 2 DISASSEMBLY

Note : Follow the disassembly procedure in the numerical order given.

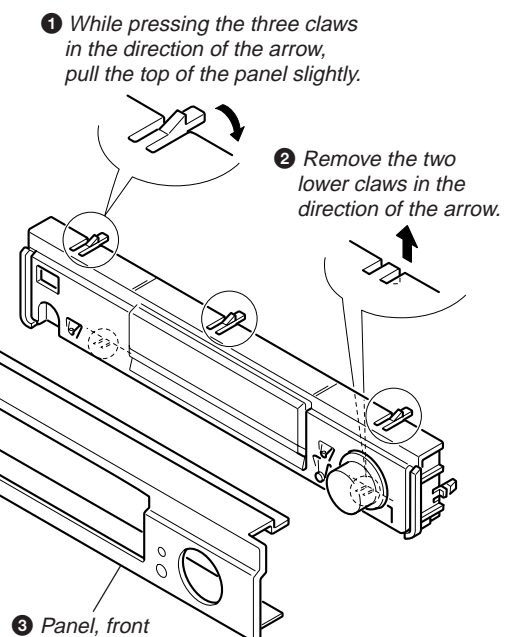
### 2-1. PANEL, FRONT ASSEMBLY



### 2-2. DISPLAY BOARD, ENCODER BOARD, AC SW BOARD



### 2-3. PANEL, FRONT



## SECTION 3 TEST MODE

### 1. Circuit Check Mode

1. Turn OFF the power.
2. While pressing **[4]** and **[MENU]** together, turn ON **[POWER]**.

- The items in the following table will be checked automatically in order every 2 seconds.

Display	Items	DISPLAY		NG
		FM RDS	AM	
Tuned	$\overline{\text{AST}}$ signal = LOW	OK or NG	/	IC251 NG, RV251 adjustments
IF Frq	IF COUNT OK	OK or NG	OK or NG	FE101, IC251 NG, or IF count buffer amp (Q251, Q401) NG
Sig Level	SI LEVEL $\geq$ 70dB	/	OK or NG	IC221 NG, RV221 adjustments
Stereo	$\overline{\text{ST}}$ signal = LOW	OK or NG	/	IC301 NG, RV301 adjustments

**NOTE :** The preset data will be erased when this test mode is used. Therefore, take down the data before setting this mode and preset the data again after completing operations in this mode.

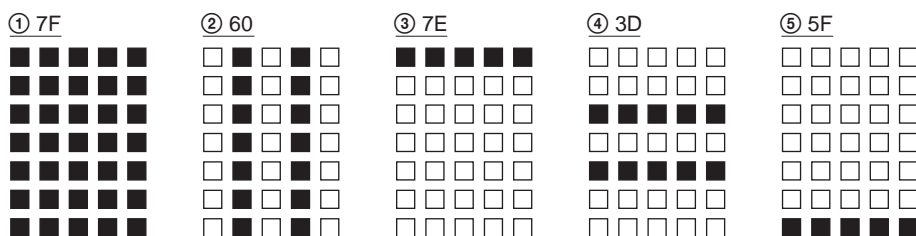
## 2. Display Tube Check and KEY Check mode

**NOTE :** Do not perform this check mode when replacing display tubes or excepting when replacing a microcomputer.

1. Turn OFF the power.
2. While pressing [1] and [MENU] together, turn ON [POWER].
3. While continuously pressing [1] and [MENU] together, check the following.

Microcomputer version indication (1 sec) → All light up "7F" → Dot area only "60" → Dot area only "7E"  
 ↓  
 Dot area only "5F" ← Dot area only "3D"

Indication test pattern



\* The indication test patterns from ② to ⑤ are indicated on only even grids.

The display changes every 1 sec.

4. Release [1] and [MENU]. The KEY CHECK mode will be set.
5. All key numbers will be displayed.  
Key Number : 24
6. Each time the key is pressed, the key number will be counted down.  
Each key will be counted only once, at the first time.
7. When all keys have been pressed, the process will end.

**NOTE :** As contents of the Factory Preset will be written into memory after completing this check mode, delete contents of memory according to 4. Forced RESET.

## 3. Entering the Factory Preset (In case perform just to write memory of the Factory Preset.)

1. Turn OFF the power.
2. While pressing [3] and [MENU] together, turn ON [POWER].

## 4. Forced RESET (Used to delete the contents of Factory Preset when it is written into the preset memory.)

Clears all the RAMs and sets the initial state

1. Turn OFF the power.
2. While pressing [5] and [MENU] together, turn ON [POWER].

## 5. How to select the frequency steps of the AM band

1. 9kHz step : while pressing [9], turn ON [POWER].
2. 10kHz step : while pressing [0], turn ON [POWER].

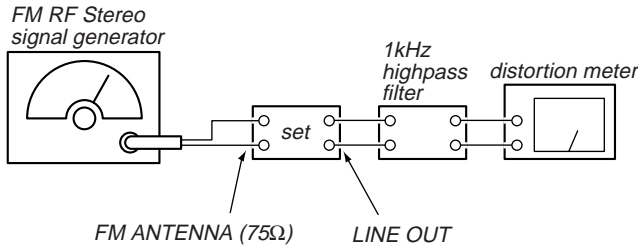
## SECTION 4 ELECTRICAL ADJUSTMENTS

### Precautions in Repairing

If the front end unit fails, it is difficult to repair the inner circuits, so replace the entire front end unit.

**FM SECTION**

**0dB = 1μV**



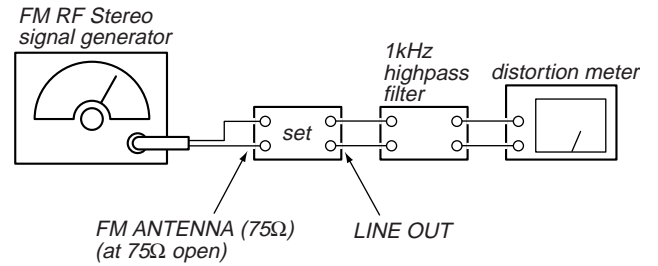
- Standard Setting of FM Stereo RF Signal Generator.

STEREO STANDARD SIGNAL	MONAURAL STANDARD SIGNAL
Carrier frequency : 98MHz	Carrier frequency:98MHz
Modulation : Audio 1kHz	Modulation :Audio 1kHz
Main channel (L+R) : 33.75kHz deviation	75kHz deviation
Sub channel (L-R) : 33.75kHz deviation	
Pilot : 7.5kHz Deviation	

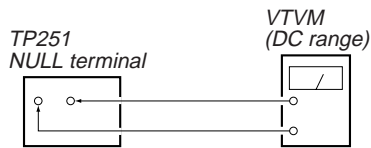
### FM Discriminator ADJUSTMENT (NULL and MONO Distortion Adjustment)

#### Setting:

IF BAND : WIDE



Modulation : Monaural Standard signal  
Output level : 6mV (76dBμ)



#### Procedure:

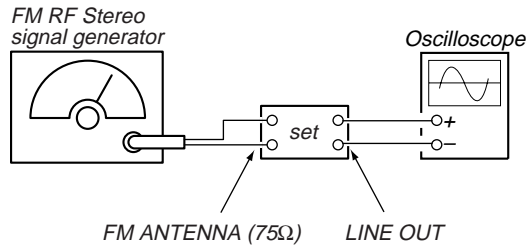
1. Tune the set to 98 MHz.
2. Adjust T252 for 0V reading on the VTVM.  
..... NULL
3. Adjust T253 for a minimum reading on the distortion meter.  
..... MONO Distortion (THD)
4. Repeat the adjustments of 2 and 3 several times.

**Note :** When replacing the ceramic filter, perform this alignment.

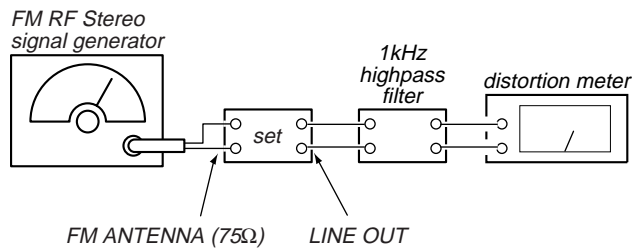
### Front End IFT/STEREO Distortion Rate Adjustment

#### Setting:

IF BAND : WIDE



Modulation : Monaural Standard signal  
Output level : 2.2μV (7dBμ) (at 75 Ω open)



Modulation : Stereo Standard signal  
Output level : 6mV (76dBμ) (at 75 Ω open)

#### Procedure:

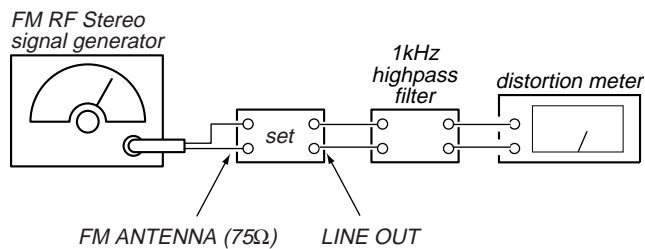
1. Tune the set to 98 MHz.
2. Remove the top cover of the front end (FE101).
3. Adjust IFT1 of the front end (FE101) to put the noise up-and-down and symmetrically on the waveform of the oscilloscope.
4. Adjust the front end (FE101) IFT1 to minimize the STEREO distortion rate.
5. Attach the removed top cover of the front end (FE101) as it was.

**Note** : Do not turn more than a half turn from the core position which is adjusted on the front end IFT adjustment.

### Narrow THD Adjustment

#### Setting:

IF BAND : NARROW



Modulation : Stereo Standard signal  
Output level : 6mV (76dBμ) (at 75 Ω open)

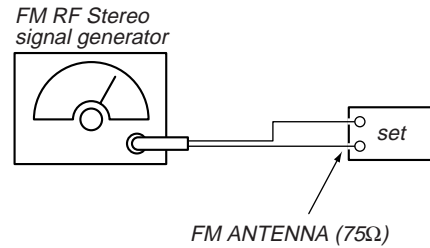
#### Procedure:

1. Tune the set to 98 MHz.
2. Set **[IF BAND]** switch to the NARROW position.
3. Set SSG output level to 80dBμ.
4. Adjust RV232 for a minimum reading on the distortion meter.

### Stereo Level Adjustment

#### Setting:

IF BAND : WIDE



Modulation : Stereo Standard signal  
Output level : 32μV (30dBμ) (at 75 Ω open)

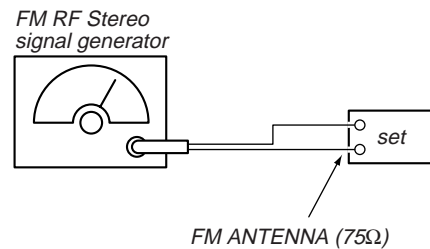
#### Procedure:

1. Tune the set to 98 MHz.
2. Adjust RV251 so that the "STEREO" indicator goes on.

### Narrow Gain Adjustment

#### Setting:

IF BAND : NARROW



Modulation : Stereo Standard signal  
Output level : 32μV (30dBμ) (at 75 Ω open)

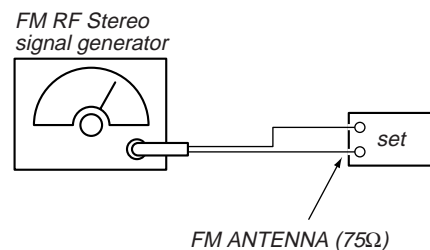
#### Procedure:

1. Tune the set to 98 MHz.
2. Set **[IF BAND]** switch to the NARROW position.
3. Adjust RV231 so that the "STEREO" indicator goes on.

### FM Meter Level Adjustment

#### Setting:

IF BAND : WIDE



Modulation : Stereo Standard signal  
Output level : 3mV (76dBμ) (at 75 Ω open)

#### Procedure:

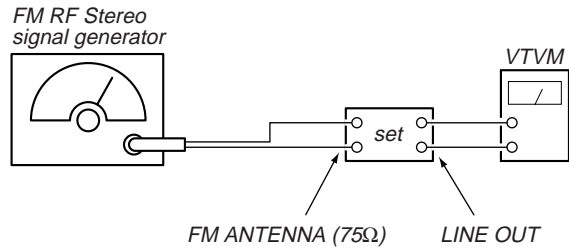
1. Tune the set to 98 MHz.
2. Press **[DISPLAY]** key to display the digital signal, then adjust RV221 to be displayed as "SIG 70dB".



### Stereo Separation Adjustment

#### Setting:

IF BAND : NARROW(NARROW SEPARATION)  
 WIDE (WIDE SEPARATION)



Modulation : Stereo Standard signal  
 Output level : 6mV (76dB $\mu$ ) (at 75  $\Omega$  open)

#### Procedure:

1. Set **IF BAND** switch to the NARROW position.

FM stereo Signal generator Output channel	Level meter connection	Level meter reading (dB)
L-CH	L-CH	Ⓐ
R-CH	L-CH	Ⓑ IF BAND WIDE : Adjust RV301 for minimum reading on VTVM IF BAND NARROW : Adjust RV302 for minimum reading on VTVM
R-CH	R-CH	Ⓒ
L-CH	R-CH	Ⓓ IF BAND WIDE : Adjust RV301 for minimum reading on VTVM IF BAND NARROW : Adjust RV302 for minimum reading on VTVM

L-CH Stereo separation : Ⓐ – Ⓑ

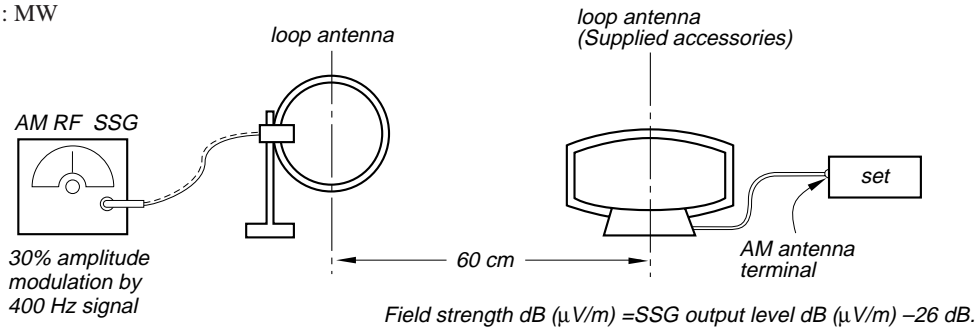
R-CH Stereo separation : Ⓒ – Ⓓ

The separations of both channels should be equal.

## AM SECTION

### Setting:

BAND : MW



### AM Meter Level Adjustment

#### Setting:

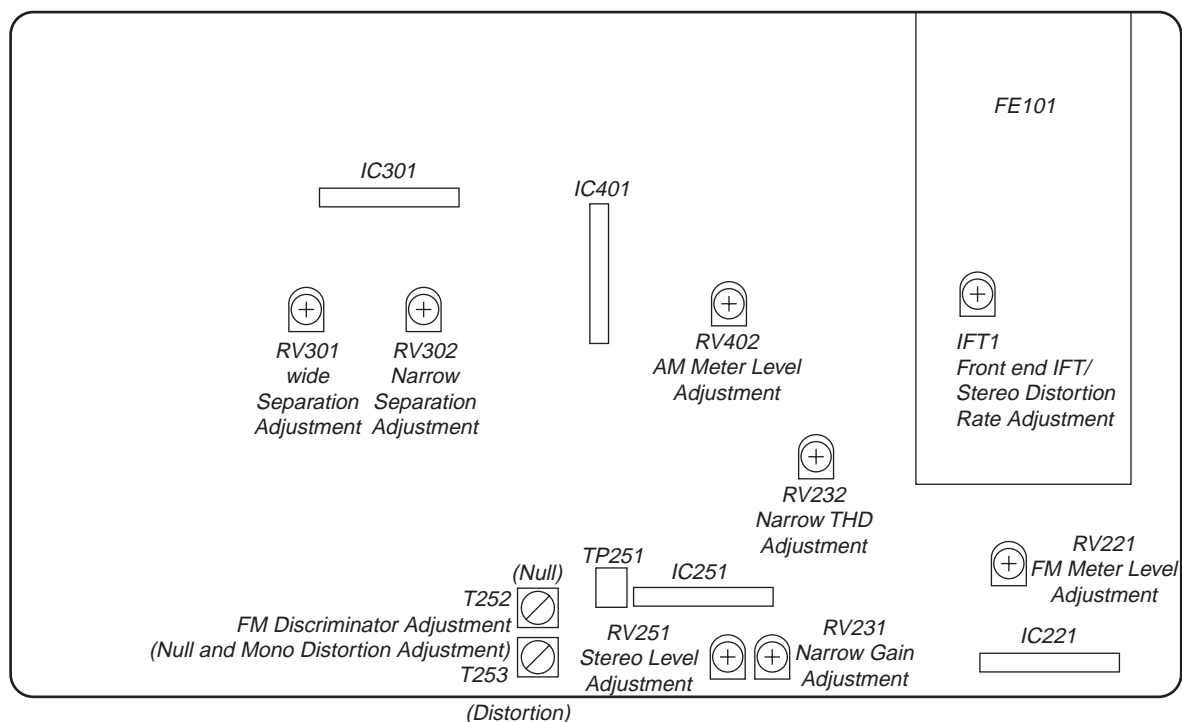
Carrier frequency : 1,050kHz

Modulation : 400Hz, 30% modulation

#### Procedure:

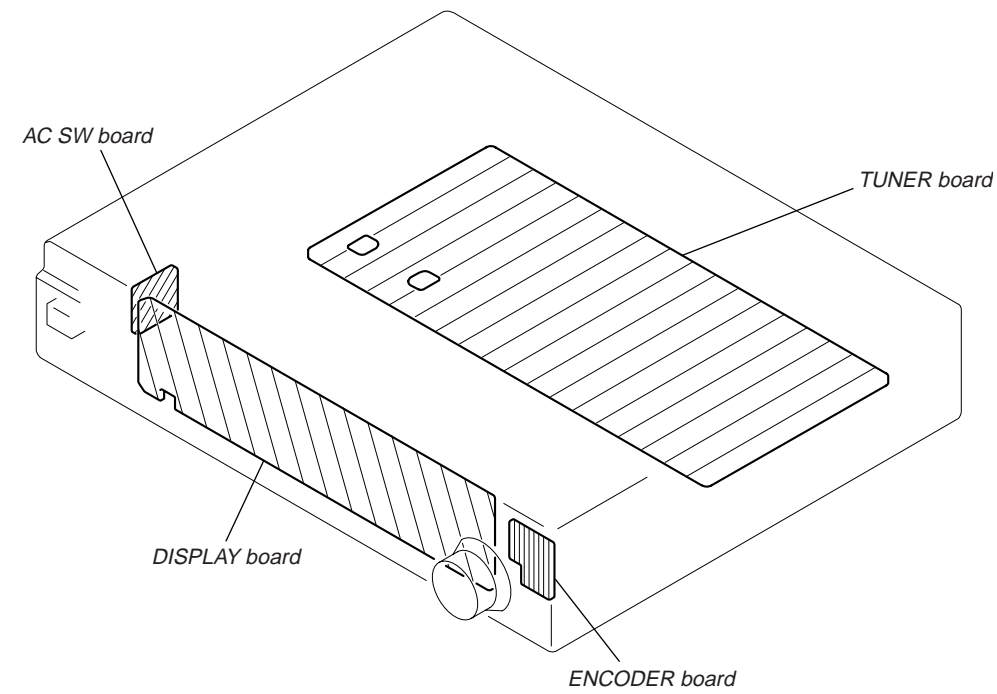
1. Set AM RF signal generator so that the AM antenna input level becomes  $74\text{dB}\mu\text{V/m}$ .
2. Adjust RV402 so that 1 to 10 indication bars light up on the signal meter.

#### Adjustment Location :





## SECTION 5 DIAGRAMS

### 5-1. CIRCUIT BOARD LOCATION








**THIS NOTE IS COMMON FOR PRINTED WIRING BOARDS AND SCHEMATIC DIAGRAMS.**  
(In addition to this, the necessary note is printed in each block.)



**Note on Schematic Diagram:**

- All capacitors are in  $\mu\text{F}$  unless otherwise noted. pF:  $\mu\mu\text{F}$  50 WV or less are not indicated except for electrolytics and tantalums.
- All resistors are in  $\Omega$  and  $\frac{1}{4}\text{W}$  or less unless otherwise specified.
- $\Delta$  : internal component.
-  : nonflammable resistor.
-  : panel designation.

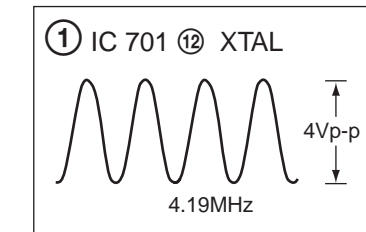
**Note:** The components identified by mark  $\Delta$  or dotted line with mark  $\Delta$  are critical for safety.  
Replace only with part number specified.

-  : B+ Line.
-  : B- Line.
-  : adjustment for repair.
- Voltages and waveforms are dc with respect to ground under no-signal (detuned) conditions.  
no mark : FM
- Voltages are taken with a VOM (Input impedance 10 M $\Omega$ ). Voltage variations may be noted due to normal production tolerances.
- Waveforms are taken with an oscilloscope. Voltage variations may be noted due to normal production tolerances.
- Circled numbers refer to waveforms.
- Signal path.  
 : FM  
 : AM

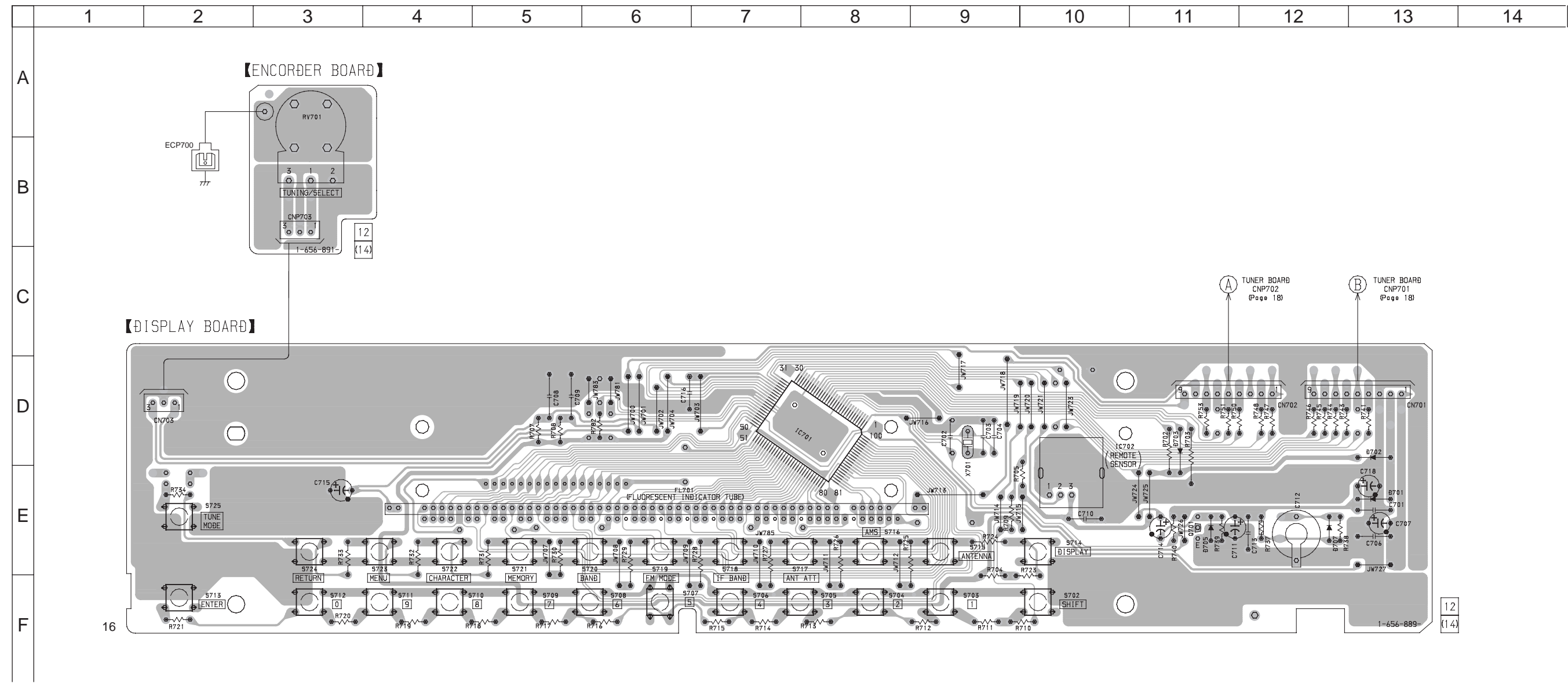
**Note on Printed Wiring Boards:**

-  : parts extracted from the component side.
- $\Delta$  : internal component.
-  : Pattern of the rear side.

• **Waveform**

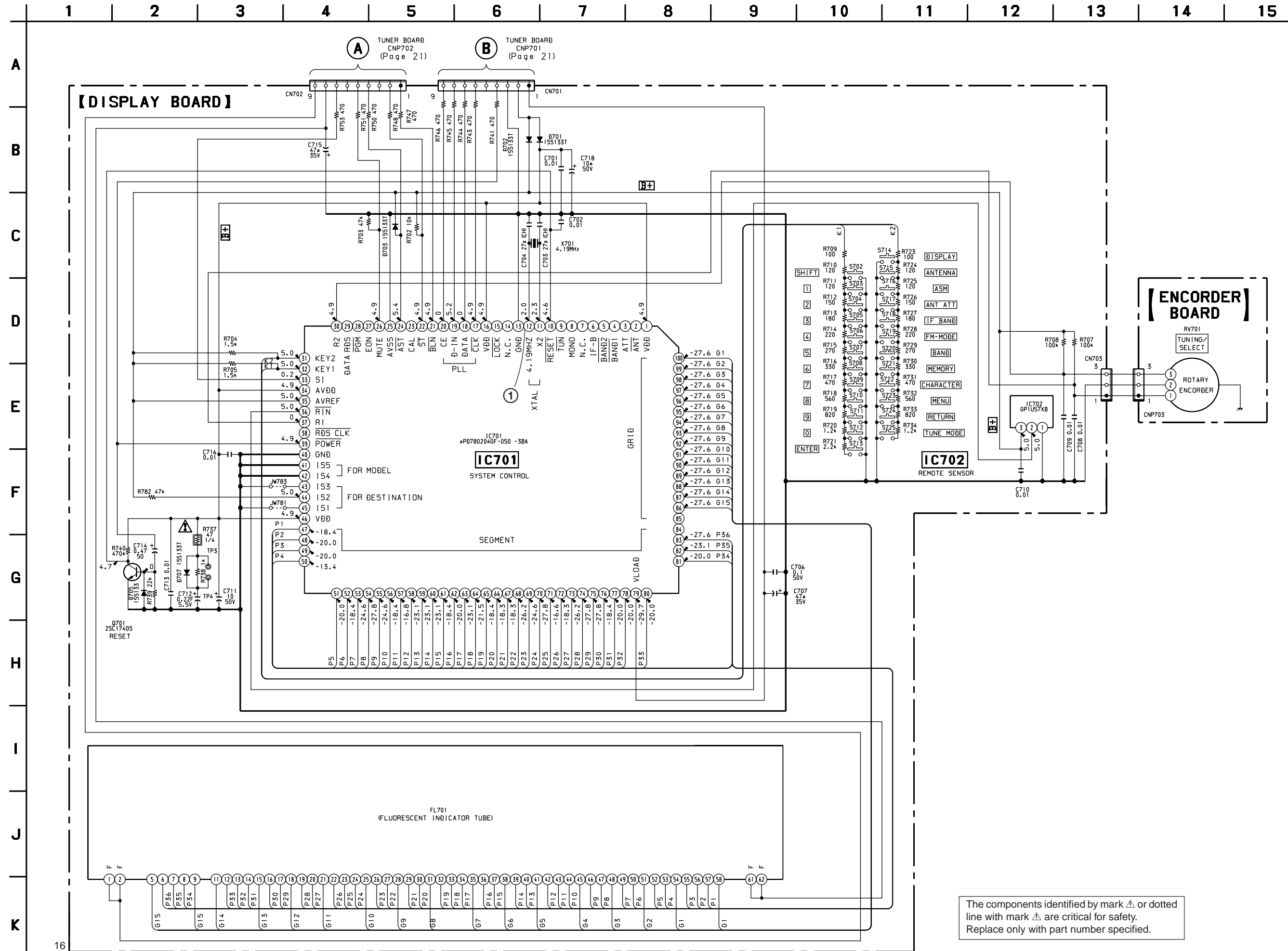


5-2. PRINTED WIRING BOARD – DISPLAY SECTION – • Refer to page 11 for Circuit Board Location.



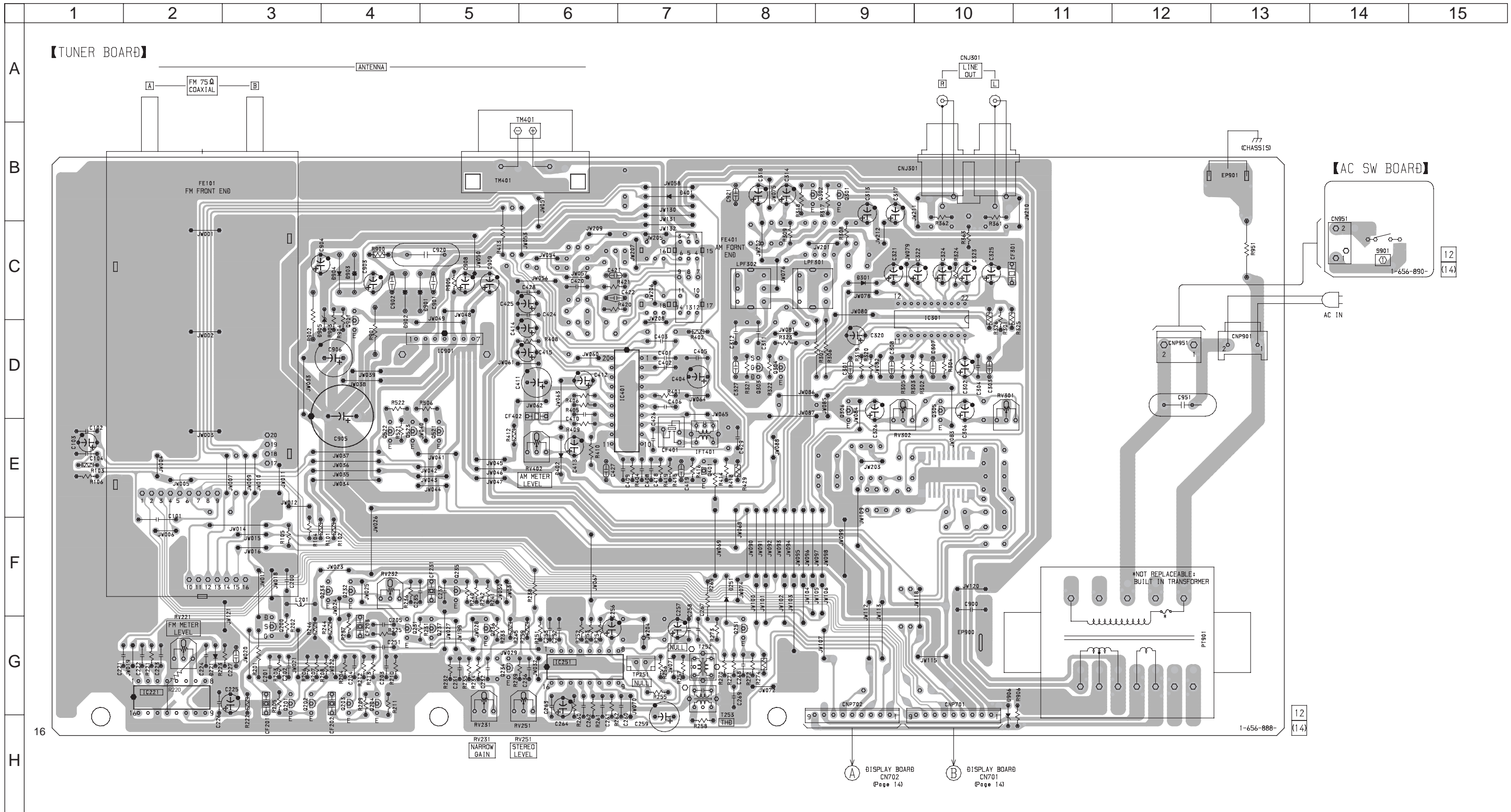
Ref. No.	Location
D701	E-13
D702	D-13
D703	D-11
D705	E-11
D707	E-12
IC701	D-8
IC702	E-10
Q701	E-11

5-3. SCHEMATIC DIAGRAM – DISPLAY SECTION – • Refer to page 12 for waveform. • Refer to page 23 for IC Pin Function.

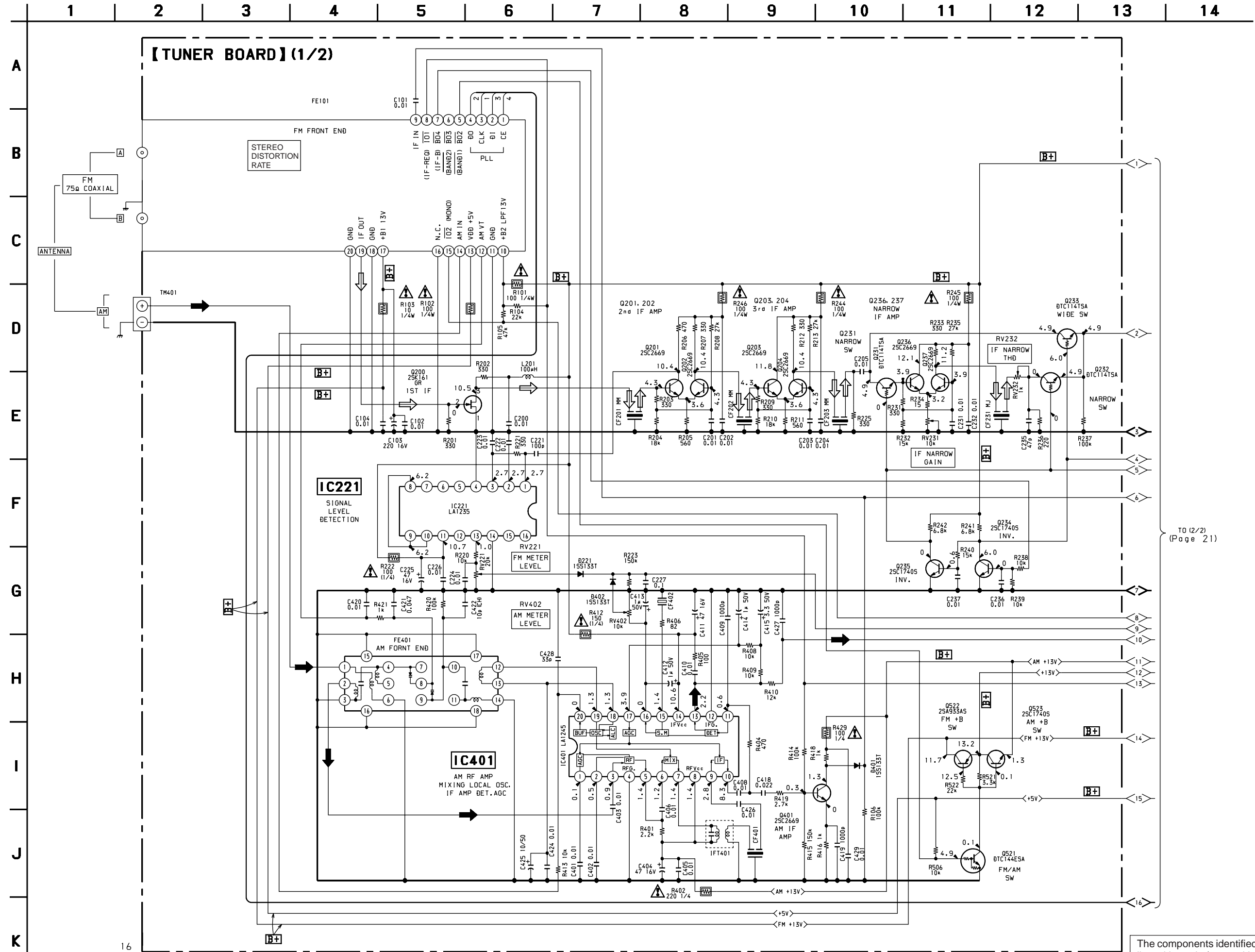


The components identified by mark  $\Delta$  or dotted line with mark  $\Delta$  are critical for safety. Replace only with part number specified.

5-4. PRINTED WIRING BOARD – TUNER SECTION – • Refer to page 11 for Circuit Board Location.



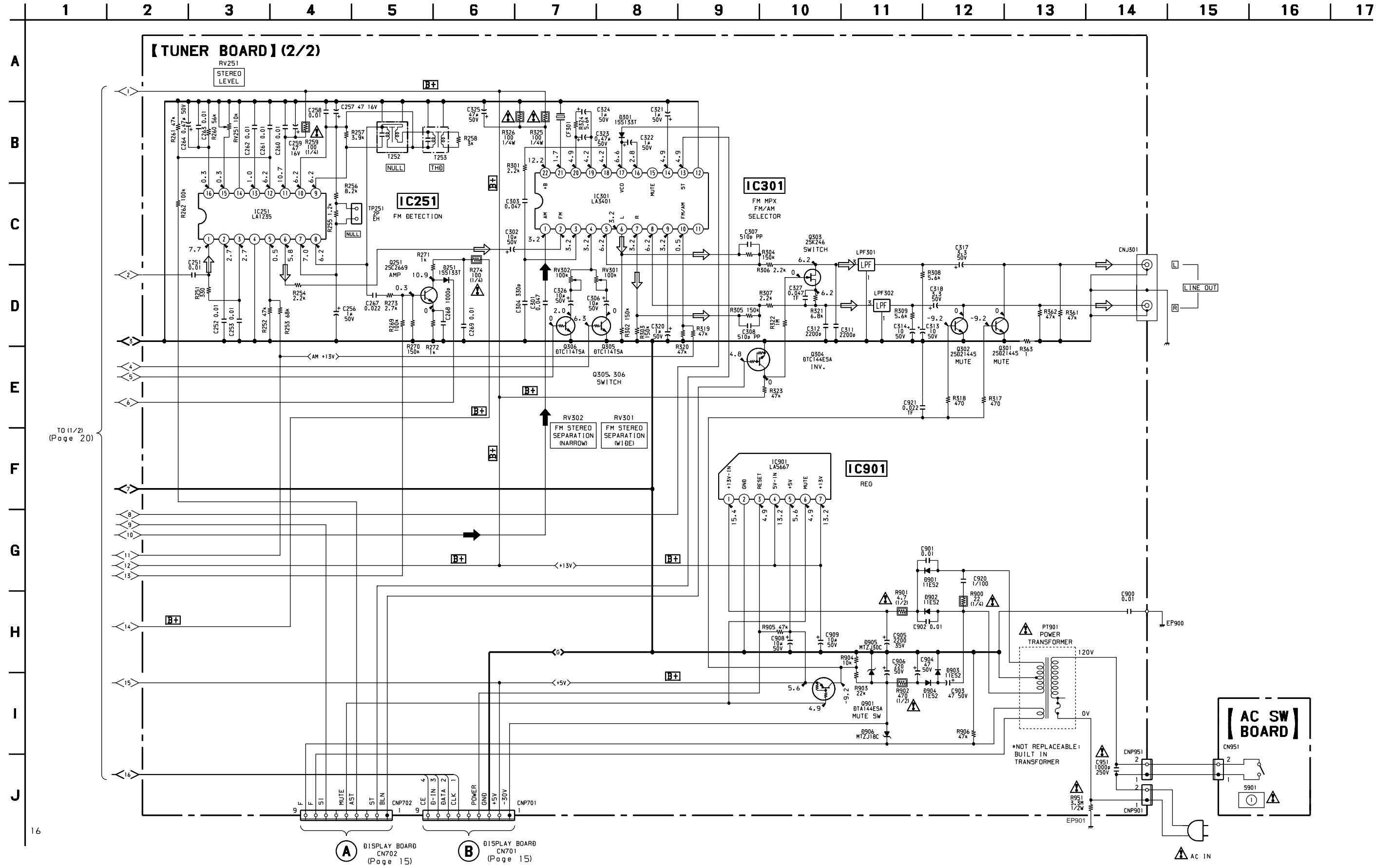
5-5. SCHEMATIC DIAGRAM – TUNER SECTION (1/2) – • Refer to page 24 for IC Block Diagrams.



TO (2/2)  
(Page 21)

The components identified by mark  $\Delta$  or dotted line with mark  $\Delta$  are critical for safety. Replace only with part number specified.

5-6. SCHEMATIC DIAGRAM – TUNER SECTION (2/2) – • Refer to page 24 for IC Block Diagrams.



TO (1/2)  
(Page 20)

The components identified by mark  $\Delta$  or dotted line with mark  $\Delta$  are critical for safety. Replace only with part number specified.



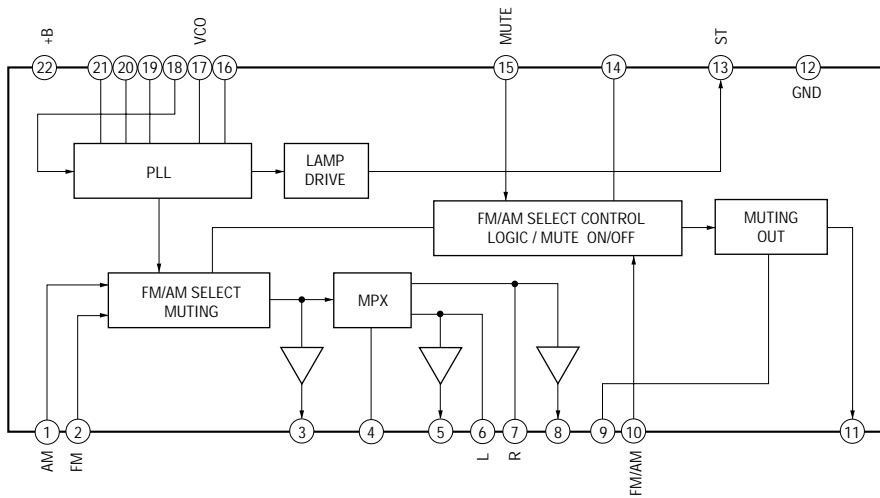
## 5-7. IC PIN FUNCTION (DISPLAY BOARD)

### • IC701 System Control ( $\mu$ PD780204GF-050-3BA)

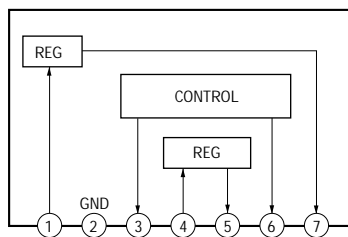
Pin No.	Pin Name	I/O	Function
1	VDD	—	Power supply (+5V).
2	$\overline{\text{ANT}}$	—	Not used. (Open)
3	$\overline{\text{ATT}}$	—	Not used. (Open)
4	$\overline{\text{BAND1}}$	—	Not used. (Open)
5	$\overline{\text{BAND2}}$	—	Not used. (Open)
6	IF-B	—	Not used. (Open)
7	NC	—	Not used. (Open)
8	MONO	—	Not used. (Open)
9	$\overline{\text{TUN}}$	—	Not used. (Open)
10	$\overline{\text{RESET}}$	I	System reset input.
11	X2	O	Oscillation signal output (4.19MHz).
12	X1	I	Oscillation signal input (4.19MHz).
13	GND	—	Ground.
14	NC	—	Not used. (Open)
15	$\overline{\text{LOCK}}$	—	Not used. (Open)
16	VDD	—	Power supply (+5V).
17	$\overline{\text{CLK}}$	O	PLL clock to FE101.
18	DATA	O	PLL data to FE101.
19	D-IN	I	PLL data from FE101.
20	CE	O	PLL Latch to FE101.
21	$\overline{\text{BLN}}$	—	Not used. (Open)
22	$\overline{\text{ST}}$	I	Stereo display detection.
23	CAL	—	Not used. (Open)
24	AST	I	Auto stop signal detection.
25	AVSS	—	Ground.(Analog)
26	MUTE	O	Muting signal output.
27	EON	—	Not used. (Open)
28	$\overline{\text{PGM}}$	—	Not used. (Open)
29	DATA RDS	—	Not used. (Open)
30	R2	O	Rotary encoder phase detection.
31	KEY 2	I	Key input.
32	KEY 1	I	Key input.
33	SI	I	Signal input.
34	AVDD	—	Analog power supply (+5V).
35	AVREF	I	Reference voltage (+5V).
36	$\overline{\text{RIN}}$	I	Remote control input.
37	R1	I	Rotary encoder number of rotation detection.
38	$\overline{\text{RDS CLK}}$	—	Not used. (Open)
39	$\overline{\text{POWER}}$	I	Power supply ON/OFF monitor.
40	GND	—	Ground.
41 to 45	IS 1 to 5	I	Model detection.
46	VDD	—	Power supply (+5V).
47 to 78	P1 to P32	O	Fluorescent indicator tube, segment drive.
79	V LOAD	—	Power supply (−30V).
80 to 83	P33 to P36	O	Drives indication tube.
84	P37	—	Not used. (Open)
85	G15	—	Not used. (Open)
86 to 100	G1 to G15	O	Fluorescent indicator tube, grid drive.

## 5-8. IC BLOCK DIAGRAMS (TUNER BOARD)

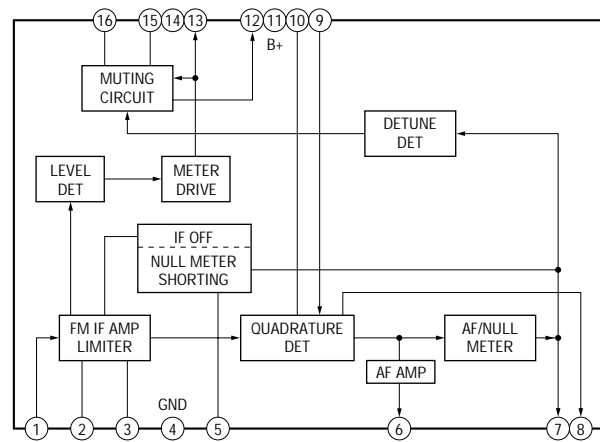
### IC301 LA3401



### IC901 LA5667



### IC221, IC251 LA1235



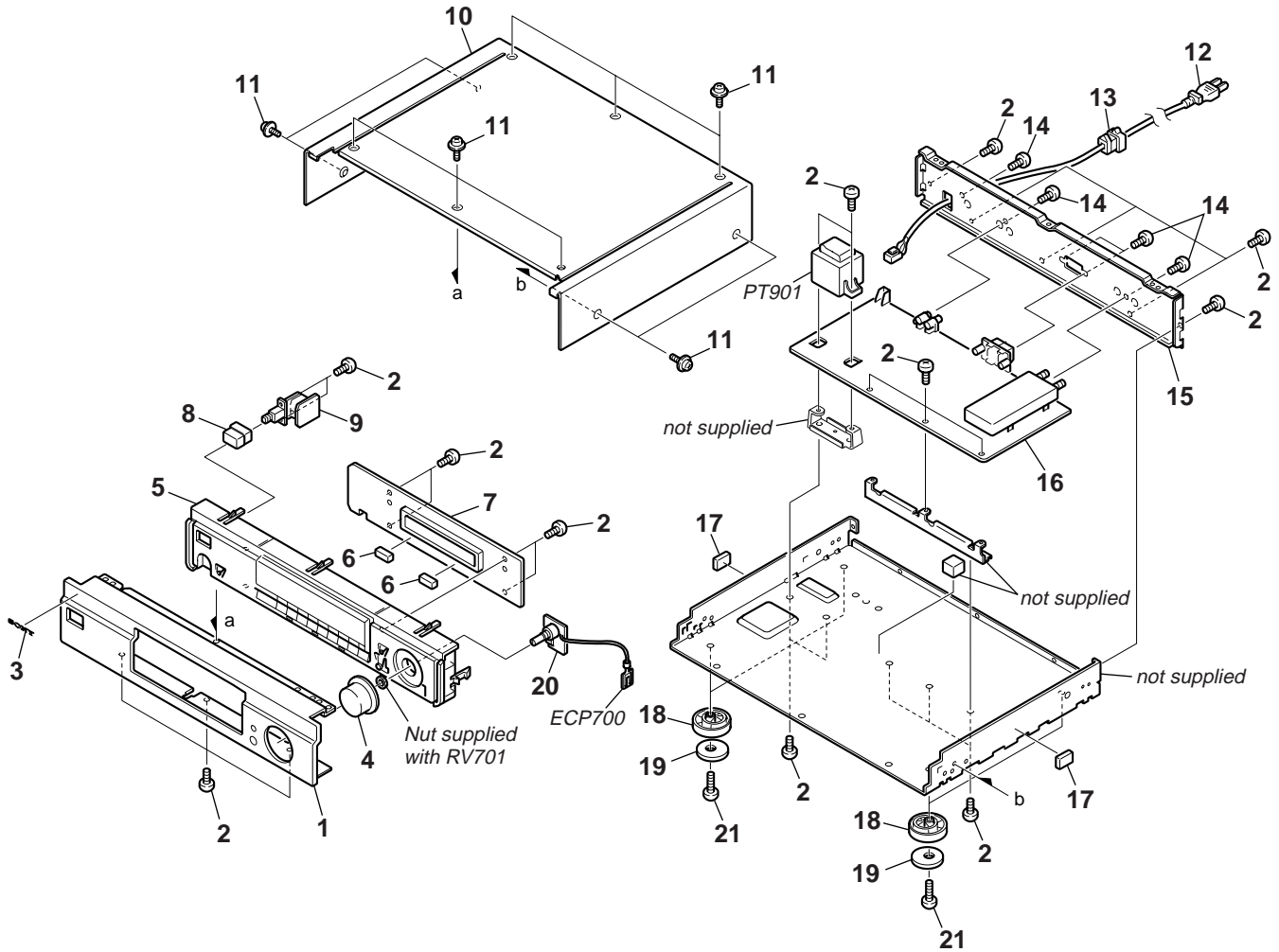
## SECTION 6 EXPLODED VIEW

**NOTE:**

- -XX, -X mean standardized parts, so they may have some differences from the original one.
- Items marked “\*” are not stocked since they are seldom required for routine service. Some delay should be anticipated when ordering these items.
- The mechanical parts with no reference number in the exploded views are not supplied.

The components identified by mark  $\Delta$  or dotted line with mark  $\Delta$  are critical for safety. Replace only with part number specified.

### 6-1. FRONT PANEL AND CASE SECTION



Ref. No.	Part No.	Description	Remarks	Ref. No.	Part No.	Description	Remarks
1	4-970-683-91	PANEL, FRONT		$\Delta$ 12	1-783-531-31	CORD, POWER	
2	4-974-510-01	SCREW(+BV 3 × 8 CU)		13	3-703-244-00	BUSHING (2104), CORD	
3	4-942-568-41	EMBLEM (NO.5), SONY		14	3-704-515-41	SCREW (BV/RING)	
4	4-218-054-01	KNOB(T)		* 15	4-994-272-12	PANEL, BACK	
5	X-4951-152-1	BASE ASSY, PANEL		16	A-4419-399-A	TUNER BOARD COMPLETE	
6	4-907-989-01	CUSHION (S)		17	4-910-502-01	CUSHION, ANTENNA	
7	A-4419-400-A	DISPLAY BOARD COMPLETE		18	4-970-123-03	FOOT(F50180S)	
8	4-998-790-01	KNOB,POWER		19	4-970-124-01	CUSHION (F50180S)	
* 9	1-656-890-12	AC SW BOARD		* 20	1-656-891-12	ENCODER BOARD	
10	4-974-321-61	CASE		21	7-685-650-79	SCREW +BVTP 3 × 16 TYPE2 TT(B)	
11	3-704-366-01	SCREW (CASE) (M3 × 8)		ECP700	1-690-880-41	LEAD (WITH CONNECTOR)	
				$\Delta$ PT901	1-423-858-11	TRANSFORMER,POWER	

## SECTION 7

# ELECTRICAL PARTS LIST

**AC SW**

**DISPLAY**

**NOTE:**

- Due to standardization, replacements in the parts list may be different from the parts specified in the diagrams or the components used on the set.
- -XX, -X mean standardized parts, so they may have some difference from the original one.
- Items marked “\*” are not stocked since they are seldom required for routine service. Some delay should be anticipated when ordering these items.

- CAPACITORS:  
uF:  $\mu$ F
- RESISTORS  
All resistors are in ohms.  
METAL: metal-film resistor  
METAL OXIDE: Metal Oxide-film resistor  
F: nonflammable
- COILS  
uH:  $\mu$ H

- SEMICONDUCTORS  
In each case, u:  $\mu$ , for example:  
uA...:  $\mu$ A..., uPA...,  $\mu$ PA...,  
uPB...,  $\mu$ PB..., uPC...,  $\mu$ PC...,  
uPD...,  $\mu$ PD...

When indicating parts by reference number, please include the board name.

The components identified by mark  $\Delta$  or dotted line with mark  $\Delta$  are critical for safety. Replace only with part number specified.

Ref. No.	Part No.	Description	Remarks	Ref. No.	Part No.	Description	Remarks
*	1-656-890-12	AC SW BOARD *****				< RESISTOR >	
		< SWITCH >		R702	1-249-429-11	CARBON 10K 5%	1/4W
				R703	1-249-437-11	CARBON 47K 5%	1/4W
				R704	1-249-419-11	CARBON 1.5K 5%	1/4W F
$\Delta$ S901	1-572-267-51	SWITCH, PUSH (AC POWER)(1 KEY)(POWER) *****		R705	1-249-419-11	CARBON 1.5K 5%	1/4W F
				R707	1-249-441-11	CARBON 100K 5%	1/4W
	A-4419-400-A	DISPLAY BOARD, COMPLETE *****		R708	1-249-441-11	CARBON 100K 5%	1/4W
				R709	1-247-807-31	CARBON 100 5%	1/4W
*	4-921-941-71	CUSHION (FL)		R710	1-249-406-11	CARBON 120 5%	1/4W F
*	4-945-292-01	HOLDER, INDICATION TUBE		R711	1-249-406-11	CARBON 120 5%	1/4W F
		< CAPACITOR >		R712	1-249-407-11	CARBON 150 5%	1/4W F
C701	1-162-306-11	CERAMIC 0.01uF 20%	16V	R713	1-249-408-11	CARBON 180 5%	1/4W F
C702	1-162-306-11	CERAMIC 0.01uF 20%	16V	R714	1-249-409-11	CARBON 220 5%	1/4W F
C703	1-162-209-31	CERAMIC 27PF 5%	50V	R715	1-249-410-11	CARBON 270 5%	1/4W F
C704	1-162-209-31	CERAMIC 27PF 5%	50V	R716	1-249-411-11	CARBON 330 5%	1/4W
C706	1-164-159-11	CERAMIC 0.1uF	50V	R717	1-249-413-11	CARBON 470 5%	1/4W F
C707	1-126-051-11	ELECT 47uF 20%	35V	R718	1-249-414-11	CARBON 560 5%	1/4W F
C708	1-162-306-11	CERAMIC 0.01uF 20%	16V	R719	1-249-416-11	CARBON 820 5%	1/4W F
C709	1-162-306-11	CERAMIC 0.01uF 20%	16V	R720	1-249-418-11	CARBON 1.2K 5%	1/4W F
C710	1-162-306-11	CERAMIC 0.01uF 20%	16V	R721	1-249-421-11	CARBON 2.2K 5%	1/4W F
C711	1-126-048-81	ELECT 10uF 20%	50V	R723	1-247-807-31	CARBON 100 5%	1/4W
C712	1-104-905-11	CAPACITOR 0.22F	5.5V	R724	1-249-406-11	CARBON 120 5%	1/4W F
C713	1-162-306-11	CERAMIC 0.01uF 20%	16V	R725	1-249-406-11	CARBON 120 5%	1/4W F
C714	1-126-043-11	ELECT 0.47uF 20%	50V	R726	1-249-407-11	CARBON 150 5%	1/4W F
C715	1-126-051-11	ELECT 47uF 20%	35V	R727	1-249-408-11	CARBON 180 5%	1/4W F
C716	1-162-306-11	CERAMIC 0.01uF 20%	16V	R728	1-249-409-11	CARBON 220 5%	1/4W F
C718	1-126-048-81	ELECT 10uF 20%	50V	R729	1-249-410-11	CARBON 270 5%	1/4W F
		< DIODE >		R730	1-249-411-11	CARBON 330 5%	1/4W
D701	8-719-911-19	DIODE 1SS119		R731	1-249-413-11	CARBON 470 5%	1/4W F
D702	8-719-911-19	DIODE 1SS119		R732	1-249-414-11	CARBON 560 5%	1/4W F
D703	8-719-911-19	DIODE 1SS119		R733	1-249-416-11	CARBON 820 5%	1/4W F
D705	8-719-911-19	DIODE 1SS119		R734	1-249-418-11	CARBON 1.2K 5%	1/4W F
D707	8-719-911-19	DIODE 1SS119		$\Delta$ R737	1-249-401-11	CARBON 47 5%	1/4W F
		< FLUORESCENT INDICATOR TUBE >		R738	1-249-417-11	CARBON 1K 5%	1/4W F
FL701	1-517-860-11	INDICATOR TUBE, FLUORESCENT		R739	1-249-433-11	CARBON 22K 5%	1/4W
		< IC >		R740	1-247-895-00	CARBON 470K 5%	1/4W
IC701	8-759-574-43	IC uPD780204GF-050-3BA		R741	1-249-413-11	CARBON 470 5%	1/4W F
IC702	8-749-923-43	IC GP1U57XB (REMOTE SENSOR)		R743	1-249-413-11	CARBON 470 5%	1/4W F
		< TRANSISTOR >		R744	1-249-413-11	CARBON 470 5%	1/4W F
Q701	8-729-119-78	TRANSISTOR 2SC403SP-51		R745	1-249-413-11	CARBON 470 5%	1/4W F
				R746	1-249-413-11	CARBON 470 5%	1/4W F
				R747	1-249-413-11	CARBON 470 5%	1/4W F
				R748	1-249-413-11	CARBON 470 5%	1/4W F
				R750	1-249-413-11	CARBON 470 5%	1/4W F
				R751	1-249-413-11	CARBON 470 5%	1/4W F
				R753	1-249-413-11	CARBON 470 5%	1/4W F
				R782	1-249-437-11	CARBON 47K 5%	1/4W

**DISPLAY**

**ENCODER**

**TUNER**

Ref. No.	Part No.	Description	Remarks	Ref. No.	Part No.	Description	Remarks
		< SWITCH >					
S702	1-554-303-21	SWITCH, TACTILE(SHIFT)		C226	1-162-306-11	CERAMIC	0.01uF 20% 16V
S703	1-554-303-21	SWITCH, TACTILE(1)		C227	1-136-165-00	FILM	0.1uF 5% 50V
S704	1-554-303-21	SWITCH, TACTILE(2)		C231	1-162-306-11	CERAMIC	0.01uF 20% 16V
S705	1-554-303-21	SWITCH, TACTILE(3)		C232	1-162-306-11	CERAMIC	0.01uF 20% 16V
S706	1-554-303-21	SWITCH, TACTILE(4)		C235	1-162-215-31	CERAMIC	47PF 5% 50V
S707	1-554-303-21	SWITCH, TACTILE(5)		C236	1-162-306-11	CERAMIC	0.01uF 20% 16V
S708	1-554-303-21	SWITCH, TACTILE(6)		C237	1-162-306-11	CERAMIC	0.01uF 20% 16V
S709	1-554-303-21	SWITCH, TACTILE(7)		C251	1-162-306-11	CERAMIC	0.01uF 20% 16V
S710	1-554-303-21	SWITCH, TACTILE(8)		C252	1-162-306-11	CERAMIC	0.01uF 20% 16V
S711	1-554-303-21	SWITCH, TACTILE(9)		C253	1-162-306-11	CERAMIC	0.01uF 20% 16V
S712	1-554-303-21	SWITCH, TACTILE(0)		C256	1-126-044-11	ELECT	1uF 20% 50V
S713	1-554-303-21	SWITCH, TACTILE(ENTER)		C257	1-126-008-51	ELECT	47uF 20% 16V
S714	1-554-303-21	SWITCH, TACTILE(DISPLAY)		C258	1-162-306-11	CERAMIC	0.01uF 20% 16V
S715	1-554-303-21	SWITCH, TACTILE(ANTENNA)		C259	1-126-008-51	ELECT	47uF 20% 16V
S716	1-554-303-21	SWITCH, TACTILE(ASM)		C260	1-162-306-11	CERAMIC	0.01uF 20% 16V
S717	1-554-303-21	SWITCH, TACTILE(ANT ATT)		C261	1-162-306-11	CERAMIC	0.01uF 20% 16V
S718	1-554-303-21	SWITCH, TACTILE(IF BAND)		C262	1-162-306-11	CERAMIC	0.01uF 20% 16V
S719	1-554-303-21	SWITCH, TACTILE(FM MODE)		C263	1-162-306-11	CERAMIC	0.01uF 20% 16V
S720	1-554-303-21	SWITCH, TACTILE(BAND)		C264	1-126-043-11	ELECT	0.47uF 20% 50V
S721	1-554-303-21	SWITCH, TACTILE(MEMORY)		C267	1-161-494-00	CERAMIC	0.022uF 25V
S722	1-554-303-21	SWITCH, TACTILE(C character)		C268	1-162-294-31	CERAMIC	0.001uF 10% 50V
S723	1-554-303-21	SWITCH, TACTILE(MENU)		C269	1-162-306-11	CERAMIC	0.01uF 20% 16V
S724	1-554-303-21	SWITCH, TACTILE(RETURN)		C301	1-136-161-00	FILM	0.047uF 5% 50V
S725	1-554-303-21	SWITCH, TACTILE(TUNE MODE)		C302	1-126-048-81	ELECT	10uF 20% 50V
		< VIBRATOR >		C303	1-136-161-00	FILM	0.047uF 5% 50V
X701	1-760-422-11	VIBRATOR, CRYSTAL 4.19MHz		C304	1-162-288-31	CERAMIC	330PF 10% 50V
*****				C306	1-126-048-81	ELECT	10uF 20% 50V
*	1-656-891-12	ENCODER BOARD		C307	1-107-736-91	FILM	510PF 5% 100V
*****				C308	1-107-736-91	FILM	510PF 5% 100V
* ECP700	1-690-880-41	LEAD (WITH CONNECTOR)		C311	1-162-302-11	CERAMIC	0.0022uF 30% 16V
		< VARIABLE RESISTOR >		C312	1-162-302-11	CERAMIC	0.0022uF 30% 16V
RV701	1-466-336-21	ENCODER, ROTARY(TUNING/SELECT)		C313	1-126-048-81	ELECT	10uF 20% 50V
*****				C314	1-126-048-81	ELECT	10uF 20% 50V
A-4419-399-A		TUNER BOARD, COMPLETE		C317	1-126-046-11	ELECT	3.3uF 20% 50V
*****				C318	1-126-046-11	ELECT	3.3uF 20% 50V
7-682-548-09		SCREW(3 x 8)		C320	1-126-044-11	ELECT	1uF 20% 50V
		< CAPACITOR >		C321	1-126-044-11	ELECT	1uF 20% 50V
C101	1-162-306-11	CERAMIC	0.01uF 20% 16V	C322	1-126-044-11	ELECT	1uF 20% 50V
C102	1-162-306-11	CERAMIC	0.01uF 20% 16V	C323	1-126-043-11	ELECT	0.47uF 20% 50V
C103	1-126-024-11	ELECT	220uF 20% 16V	C324	1-126-044-11	ELECT	1uF 20% 50V
C104	1-162-306-11	CERAMIC	0.01uF 20% 16V	C325	1-126-051-11	ELECT	47uF 20% 50V
C200	1-162-306-11	CERAMIC	0.01uF 20% 16V	C326	1-126-048-81	ELECT	10uF 20% 50V
C201	1-162-306-11	CERAMIC	0.01uF 20% 16V	C327	1-136-161-00	FILM	0.047uF 5% 50V
C202	1-162-306-11	CERAMIC	0.01uF 20% 16V	C401	1-162-306-11	CERAMIC	0.01uF 20% 16V
C203	1-162-306-11	CERAMIC	0.01uF 20% 16V	C402	1-162-306-11	CERAMIC	0.01uF 20% 16V
C204	1-162-306-11	CERAMIC	0.01uF 20% 16V	C403	1-162-306-11	CERAMIC	0.01uF 20% 16V
C205	1-162-306-11	CERAMIC	0.01uF 20% 16V	C404	1-126-008-51	ELECT	47uF 20% 16V
C221	1-162-282-31	CERAMIC	100PF 10% 50V	C405	1-162-306-11	CERAMIC	0.01uF 20% 16V
C222	1-162-306-11	CERAMIC	0.01uF 20% 16V	C406	1-162-306-11	CERAMIC	0.01uF 20% 16V
C223	1-162-306-11	CERAMIC	0.01uF 20% 16V	C408	1-162-306-11	CERAMIC	0.01uF 20% 16V
C224	1-162-306-11	CERAMIC	0.01uF 20% 16V	C409	1-162-294-31	CERAMIC	0.001uF 10% 50V
C225	1-126-008-51	ELECT	47uF 20% 16V	C410	1-162-306-11	CERAMIC	0.01uF 20% 16V
				C411	1-126-008-51	ELECT	47uF 20% 16V
				C412	1-126-044-11	ELECT	1uF 20% 50V
				C413	1-126-044-11	ELECT	1uF 20% 50V
				C414	1-126-044-11	ELECT	1uF 20% 50V
				C415	1-126-046-11	ELECT	3.3uF 20% 50V
				C418	1-161-494-00	CERAMIC	0.022uF 25V
				C419	1-102-074-00	CERAMIC	0.001uF 10% 50V
				C420	1-162-306-11	CERAMIC	0.01uF 20% 16V

# TUNER

Ref. No.	Part No.	Description	Remarks	Ref. No.	Part No.	Description	Remarks
C421	1-136-161-00	FILM	0.047uF 5%			< IC >	
C422	1-102-508-91	CERAMIC	10PF 0.5PF				
C424	1-162-306-11	CERAMIC	0.01uF 20%	IC221	8-759-812-35	IC LA1235	
C425	1-126-048-81	ELECT	10uF 20%	IC251	8-759-812-35	IC LA1235	
C426	1-162-306-11	CERAMIC	0.01uF 20%	IC301	8-759-801-80	IC LA3401	
				IC401	8-759-812-45	IC LA1245	
C427	1-102-074-00	CERAMIC	0.001uF 10%	IC901	8-759-820-09	IC LA5667	
C428	1-162-211-31	CERAMIC	33PF 5%			< IFT >	
C429	1-162-306-11	CERAMIC	0.01uF 20%				
C900	1-162-306-11	CERAMIC	0.01uF 20%	IFT401	1-404-326-00	TRANSFORMER, IF	
C901	1-101-004-00	CERAMIC	0.01uF 50V			< COIL >	
C902	1-101-004-00	CERAMIC	0.01uF 50V				
C903	1-126-051-11	ELECT	47uF 20%				
C904	1-126-051-11	ELECT	47uF 20%	L201	1-410-521-11	INDUCTOR 100uH	
C905	1-115-819-11	ELECT	2200uF 20%			< FILTER >	
C906	1-126-053-11	ELECT	220uF 20%				
C908	1-126-048-81	ELECT	10uF 20%	LPF301	1-235-164-00	FILTER, LOW PASS	
C909	1-126-048-81	ELECT	10uF 20%	LPF302	1-235-164-00	FILTER, LOW PASS	
C920	1-130-789-00	FILM	1uF 5%			< TRANSFORMER >	
C921	1-136-157-00	FILM	0.022uF 5%				
△C951	1-113-915-11	CERAMIC	0.001uF 20%	△PT901	1-423-858-11	TRANSFORMER, POWER	
		< FILTER >				< TRANSISTOR >	
CF201	1-567-393-11	FILTER, CERAMIC		Q200	8-729-216-13	TRANSISTOR	2SK161-GR
CF202	1-567-393-11	FILTER, CERAMIC		Q201	8-729-230-99	TRANSISTOR	2SC2669-OY
CF203	1-567-393-11	FILTER, CERAMIC		Q202	8-729-230-99	TRANSISTOR	2SC2669-OY
CF231	1-567-107-71	FILTER, CERAMIC		Q203	8-729-230-99	TRANSISTOR	2SC2669-OY
CF301	1-567-250-11	OSCILLATOR, CERAMIC		Q204	8-729-230-99	TRANSISTOR	2SC2669-OY
CF401	1-527-826-00	FILTER, CERAMIC		Q231	8-729-029-68	TRANSISTOR	DTC114TSA
CF402	1-527-981-00	FILTER, CERAMIC		Q232	8-729-029-68	TRANSISTOR	DTC114TSA
		< JACK >		Q233	8-729-029-68	TRANSISTOR	DTC114TSA
CNJ301	1-568-250-21	JACK, PIN 2P(LINE OUT)		Q234	8-729-119-78	TRANSISTOR	2SC403SP-51
		< CONNECTOR >		Q235	8-729-119-78	TRANSISTOR	2SC403SP-51
CNP701	1-766-282-11	PIN, CONNECTOR (PC BOARD) 9P		Q236	8-729-230-99	TRANSISTOR	2SC2669-OY
CNP702	1-766-282-11	PIN, CONNECTOR (PC BOARD) 9P		Q237	8-729-230-99	TRANSISTOR	2SC2669-OY
* CNP901	1-580-230-11	PIN, CONNECTOR (PC BOARD) 2P		Q251	8-729-230-99	TRANSISTOR	2SC2669-OY
CNP951	1-564-321-00	PIN, CONNECTOR 2P		Q301	8-729-922-37	TRANSISTOR	2SD2144S
		< DIODE >		Q302	8-729-922-37	TRANSISTOR	2SD2144S
D221	8-719-911-19	DIODE 1SS119		Q303	8-729-202-67	TRANSISTOR	2SK246-GR3
D251	8-719-911-19	DIODE 1SS119		Q304	8-729-030-02	TRANSISTOR	DTC144ESA
D301	8-719-911-19	DIODE 1SS119		Q305	8-729-029-68	TRANSISTOR	DTC114TSA
D401	8-719-911-19	DIODE 1SS119		Q306	8-729-029-68	TRANSISTOR	DTC114TSA
D402	8-719-911-19	DIODE 1SS119		Q401	8-729-230-99	TRANSISTOR	2SC2669-OY
D901	8-719-024-99	DIODE 11ES2-NTA2B		Q521	8-729-030-02	TRANSISTOR	DTC144ESA
D902	8-719-024-99	DIODE 11ES2-NTA2B		Q522	8-729-026-39	TRANSISTOR	2SA933AS-QRT
D903	8-719-024-99	DIODE 11ES2-NTA2B		Q523	8-729-119-78	TRANSISTOR	2SC403SP-51
D904	8-719-024-99	DIODE 11ES2-NTA2B		Q901	8-729-029-56	TRANSISTOR	DTA144ESA
D905	8-719-982-31	DIODE MTZJ-36B				< RESISTOR >	
D906	8-719-947-70	DIODE MTZJ-T-72-18C		△R101	1-249-405-11	CARBON	100 5% 1/4W F
		< EARTH >		△R102	1-249-405-11	CARBON	100 5% 1/4W F
EP900	4-957-933-01	PLATE, GROUND		△R103	1-249-393-11	CARBON	10 5% 1/4W F
		< FRONT END >		R104	1-249-433-11	CARBON	22K 5% 1/4W
FE101	1-693-449-11	FRONT END		R105	1-249-437-11	CARBON	47K 5% 1/4W
FE401	1-234-264-11	ENCAPSULATED COMPONENT		R106	1-249-441-11	CARBON	100K 5% 1/4W
				R201	1-249-411-11	CARBON	330 5% 1/4W
				R202	1-249-411-11	CARBON	330 5% 1/4W
				R203	1-249-411-11	CARBON	330 5% 1/4W
				R204	1-249-432-11	CARBON	18K 5% 1/4W

The components identified by mark △ or dotted line with mark △ are critical for safety. Replace only with part number specified.

# TUNER

Ref. No.	Part No.	Description	Remarks	Ref. No.	Part No.	Description	Remarks
R205	1-249-414-11	CARBON	560 5% 1/4W F	R321	1-249-427-11	CARBON	6.8K 5% 1/4W F
R206	1-249-413-11	CARBON	470 5% 1/4W F	R322	1-247-903-00	CARBON	1M 5% 1/4W
R207	1-249-411-11	CARBON	330 5% 1/4W	R323	1-249-437-11	CARBON	47K 5% 1/4W
R208	1-249-434-11	CARBON	27K 5% 1/4W	R324	1-249-426-11	CARBON	5.6K 5% 1/4W
R209	1-249-411-11	CARBON	330 5% 1/4W	△R325	1-249-405-11	CARBON	100 5% 1/4W F
R210	1-249-432-11	CARBON	18K 5% 1/4W	△R326	1-249-405-11	CARBON	100 5% 1/4W F
R211	1-249-414-11	CARBON	560 5% 1/4W F	R361	1-249-437-11	CARBON	47K 5% 1/4W
R212	1-249-411-11	CARBON	330 5% 1/4W	R362	1-249-437-11	CARBON	47K 5% 1/4W
R213	1-249-434-11	CARBON	27K 5% 1/4W	R363	1-249-381-11	CARBON	1 5% 1/4W F
R220	1-249-429-11	CARBON	10K 5% 1/4W	R401	1-249-421-11	CARBON	2.2K 5% 1/4W F
R221	1-249-411-11	CARBON	330 5% 1/4W	△R402	1-249-409-11	CARBON	220 5% 1/4W F
△R222	1-249-405-11	CARBON	100 5% 1/4W F	R404	1-249-413-11	CARBON	470 5% 1/4W F
R223	1-247-883-00	CARBON	150K 5% 1/4W	R405	1-247-807-31	CARBON	100 5% 1/4W
R225	1-249-411-11	CARBON	330 5% 1/4W	R406	1-249-404-00	CARBON	82 5% 1/4W F
R231	1-249-411-11	CARBON	330 5% 1/4W	R408	1-249-429-11	CARBON	10K 5% 1/4W
R232	1-249-431-11	CARBON	15K 5% 1/4W	R409	1-249-429-11	CARBON	10K 5% 1/4W
R233	1-249-411-11	CARBON	330 5% 1/4W	R410	1-249-430-11	CARBON	12K 5% 1/4W
R234	1-249-395-11	CARBON	15 5% 1/4W F	△R412	1-249-407-11	CARBON	150 5% 1/4W F
R235	1-249-434-11	CARBON	27K 5% 1/4W	R413	1-249-429-11	CARBON	10K 5% 1/4W
R236	1-249-409-11	CARBON	220 5% 1/4W F	R414	1-249-441-11	CARBON	100K 5% 1/4W
R237	1-249-441-11	CARBON	100K 5% 1/4W	R415	1-247-883-00	CARBON	150K 5% 1/4W
R238	1-249-429-11	CARBON	10K 5% 1/4W	R416	1-249-417-11	CARBON	1K 5% 1/4W F
R239	1-249-429-11	CARBON	10K 5% 1/4W	R418	1-249-417-11	CARBON	1K 5% 1/4W F
R240	1-249-431-11	CARBON	15K 5% 1/4W	R419	1-249-422-11	CARBON	2.7K 5% 1/4W F
R241	1-249-427-11	CARBON	6.8K 5% 1/4W F	R420	1-249-441-11	CARBON	100K 5% 1/4W
R242	1-249-427-11	CARBON	6.8K 5% 1/4W F	R421	1-249-417-11	CARBON	1K 5% 1/4W F
△R244	1-249-405-11	CARBON	100 5% 1/4W F	△R429	1-249-405-11	CARBON	100 5% 1/4W F
△R245	1-249-405-11	CARBON	100 5% 1/4W F	R506	1-249-429-11	CARBON	10K 5% 1/4W
△R246	1-249-405-11	CARBON	100 5% 1/4W F	R521	1-247-843-11	CARBON	3.3K 5% 1/4W
R251	1-249-411-11	CARBON	330 5% 1/4W	R522	1-249-433-11	CARBON	22K 5% 1/4W
R252	1-249-437-11	CARBON	47K 5% 1/4W	△R900	1-249-397-11	CARBON	22 5% 1/4W F
R253	1-249-439-11	CARBON	68K 5% 1/4W	△R901	1-249-482-11	CARBON	4.7 5% 1/2W F
R254	1-249-421-11	CARBON	2.2K 5% 1/4W F	△R902	1-247-747-11	CARBON	470 5% 1/2W F
R255	1-249-418-11	CARBON	1.2K 5% 1/4W F	R903	1-249-433-11	CARBON	22K 5% 1/4W
R256	1-249-428-11	CARBON	8.2K 5% 1/4W F	R904	1-249-429-11	CARBON	10K 5% 1/4W
R257	1-249-424-11	CARBON	3.9K 5% 1/4W F	R905	1-249-437-11	CARBON	47K 5% 1/4W
R258	1-247-842-11	CARBON	3K 5% 1/4W	R906	1-249-437-11	CARBON	47K 5% 1/4W
△R259	1-249-405-11	CARBON	100 5% 1/4W F	R951	1-219-237-91	SOLID	3.3M 20% 1/2W
R260	1-249-438-11	CARBON	56K 5% 1/4W			< VARIABLE RESISTOR >	
R261	1-249-437-11	CARBON	47K 5% 1/4W				
R262	1-249-441-11	CARBON	100K 5% 1/4W	RV221	1-237-460-11	RES, ADJ, CARBON 20K	
R269	1-249-441-11	CARBON	100K 5% 1/4W	RV231	1-237-459-11	RES, ADJ, CARBON 10K	
R270	1-247-883-00	CARBON	150K 5% 1/4W	RV232	1-237-456-11	RES, ADJ, CARBON 1K	
R271	1-249-417-11	CARBON	1K 5% 1/4W F	RV251	1-237-459-11	RES, ADJ, CARBON 10K	
R272	1-249-417-11	CARBON	1K 5% 1/4W F	RV301	1-237-462-11	RES, ADJ, CARBON 100K	
R273	1-249-422-11	CARBON	2.7K 5% 1/4W F	RV302	1-237-462-11	RES, ADJ, CARBON 100K	
△R274	1-249-405-11	CARBON	100 5% 1/4W F	RV402	1-237-459-11	RES, ADJ, CARBON 10K	
R301	1-249-421-11	CARBON	2.2K 5% 1/4W F			< COIL >	
R302	1-247-883-00	CARBON	150K 5% 1/4W				
R303	1-247-883-00	CARBON	150K 5% 1/4W	T252	1-404-845-11	COIL, DISCRI (PRIMARY)	
R304	1-247-883-00	CARBON	150K 5% 1/4W	T253	1-404-846-11	COIL, DISCRI (SECONDARY)	
R305	1-247-883-00	CARBON	150K 5% 1/4W			< TERMINAL >	
R306	1-249-421-11	CARBON	2.2K 5% 1/4W F				
R307	1-249-421-11	CARBON	2.2K 5% 1/4W F	TM401	1-537-897-11	TERMINAL BOARD,PUSH(ANTENNA)2P	
R308	1-249-426-11	CARBON	5.6K 5% 1/4W			< TEST PIN >	
R309	1-249-426-11	CARBON	5.6K 5% 1/4W				
R317	1-249-413-11	CARBON	470 5% 1/4W F				
R318	1-249-413-11	CARBON	470 5% 1/4W F	* TP251	1-565-513-11	PIN, CONNECTOR 2P	
R319	1-249-437-11	CARBON	47K 5% 1/4W			*****	
R320	1-249-437-11	CARBON	47K 5% 1/4W				

The components identified by mark △ or dotted line with mark △ are critical for safety. Replace only with part number specified.

# ST-SA50ES

<u>Ref. No.</u>	<u>Part No.</u>	<u>Description</u>	<u>Remarks</u>
		MISCELLANEOUS *****	

△ 12	1-783-531-31	CORD,POWER	
△ PT901	1-423-858-11	TRANSFORMER,POWER	

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ACCESSORIES & PACKING MATERIALS  
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1-417-141-11	MATCHING TRANSFORMER, ANTENNA
1-501-224-00	ANTENNA, FEEDER
1-501-761-41	ANTENNA, LOOP
1-590-925-31	AUDIO CORD
3-861-346-11	MANUAL, INSTRUCTION(ENGLISH)

The components identified by mark △ or dotted line with mark △ are critical for safety.  
Replace only with part number specified.