

STEREO FM TUNER **GAMMA I**

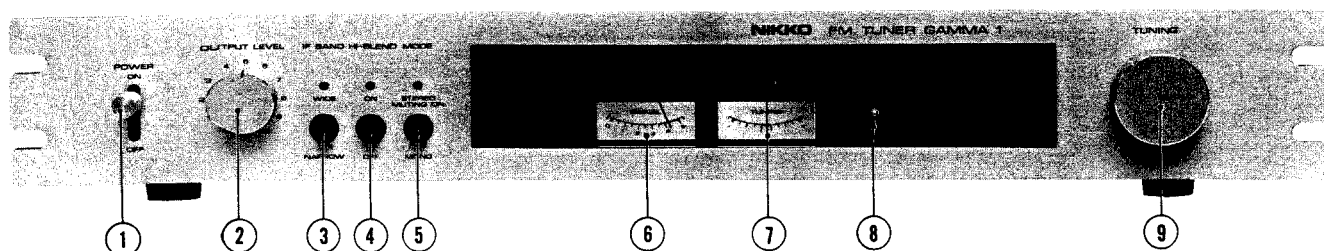


SERVICE MANUAL

W-TYPE UL and CSA type	120V AC
E-TYPE europe standard (universal) type	220/240V AC
N-TYPE DEMKO and SEMKO type	
D-TYPE DIN type	

NIKKO

EXPLANATION FOR FUNCTION OPERATION



1. POWER

To turn the tuner on and off.

2. OUTPUT LEVEL

This control determines the output level of the tuner.

3. IF BAND

This switch controls the selectivity of the IF band. When the signal being received is disturbed by nearby stations, press this switch to NARROW position for elimination of interference.

4. HI-BLEND

Press this switch to eliminate high frequency noise from incoming signals.

5. MODE

This switch is used to select the mode of reception. When it is set to MONO position, FM reception is heard in monaural and the Stereo Indicator lamp will be off.

This switch also functions as a muting switch. When selecting stations, set the switch to STEREO and interstation noise will be eliminated.

An indicating-lamp will light when the switch is in the STEREO position. Press this switch to MONO position for stations with weak signals.

6. SIGNAL METER

This meter indicates the signal strength of the FM station being received.

7. TUNING METER

This meter is used for accurate FM tuning. Turn the tuning knob to the desired station until the TUNING meter indicates the "center" position. At the same time, the SIGNAL meter will deflect maximum.

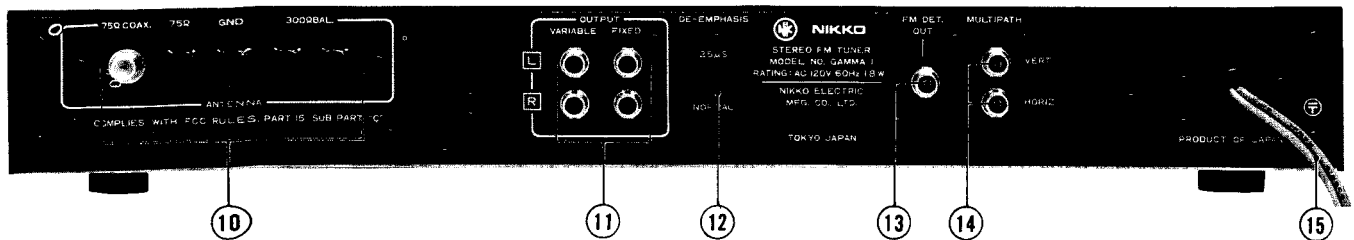
8. STEREO INDICATOR

This lamp will light when stereo reception is tuned accurately.

9. TUNING KNOB

Turn this knob to select the desired station. Observe both SIGNAL and TUNING meters for accurate readings.

TERMINALS ON REAR PANEL



10. ANTENNA

75 ohm UNBAL: For a 75 ohm coaxial cable connected to an outdoor antenna.

300 ohm BAL: For connection of a 300 ohm antenna. (T type)

11. OUTPUT

FIXED: The output level at this terminal is constant.
This terminal should be connected to your amplifier's input or the tape deck line input.

VARIABLE: The output level at this terminal can be varied by the OUTPUT LEVEL control, located on the front panel.

12. DE-EMPHASIS

Set this switch to the 25 μ s position when receiving FM Signals through a *Dolby System.

* Dolby is the trade mark of DOLBY LABORATORIES, INC.

13. DET. OUT. (Detector Output)

Audio signals from FM reception, before they enter the deemphasis circuit, are present at this DET. OUT. terminal. If and when a STANDARD 4-channel adaptor is available, it may be connected to this terminal.

14. MULTIPATH (Oscilloscope Jacks)

These are terminals to which an oscilloscope can be connected for checking multipath interference.

15. AC POWER CORD

Connect the AC power cord to the amplifier.

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SPECIFICATIONS

(W-TYPE, E-TYPE, N-TYPE)

SPECIFICATION RATINGS		UNIT	NOM. (NOR.)	LIMIT (NOR.)	NOM. (NARROW)	LIMIT (NARROW)
Usable Sensitivity		.dBf (μ V)	.9.3 (1.6)	15.2 (3.16)	.9.31 (1.6)	15.2 (3.16)
50 dB Quieting Sensitivity		.dBf (μ V)	.11.2 (2.0)	20.2 (5.6)	.11.2 (2.0)	20.2 (5.6)
Hum and Noise	MONO	.dB @ 65 dBf.	.78	72	.78	72
	STEREO	.dB @ 65 dBf.	.75	70	.75	70
T. H. Distortion	MONO	..%	.0.04	0.2	.0.1	0.5
	STEREO (L=-R)	..%	.0.08	0.3	.0.2	0.5
Capture Ratio		.dB	.1	2	.2	4
Alternate Channel Selectivity		.dB	.35	30 ⁺²⁰ / ₋₁₀	.80	70
Spurious Response Ratio		.dB	.110	100	.110	100
Image Response Ratio (98 MHz)		.dB	.110	100	.110	100
IF Response Ratio (98 MHz)		.dB	.110	100	.110	100
AM Suppression Ratio		.dB	.60	40	.60	40
Separation	(100 Hz) STEREO	.dB	.45	35	.35	25
	(1 kHz) STEREO	.dB	.52	35	.45	30
	(10 kHz) STEREO	.dB	.40	30	.30	20
Separation, Hi-Blend						
	(1 kHz) STEREO	.dB	.30	30 $\pm$ 5	.30	30 $\pm$ 5
Subcarrier Product Ratio	STEREO	.dB	.70	60	.70	60
Meter Sensitivity			.4.5	4.5 $\pm$ 0.3	.4.5	4.5 $\pm$ 0.3
Output Level (Fixed)		.Volts	.0.75	0.75 $\pm$ 2 dB	.0.75	0.75 $\pm$ 2 dB
FM Receiving Frequency		.MHz	.87.4-109	87.9-108.5	.87.4-109	87.9-108.5
Antenna Impedance			.300 ohm balanced & 75 ohm coaxial			

(D—TYPE)

SPECIFICATION RATINGS		UNIT	NOM. (NOR.)	LIMIT (NOR.)	NOM. (NARROW)	LIMIT (NARROW)
Usable Sensitivity @ 26 dB S/N		μV	.056	1.0	.056	1.0
50 dB Quieting Sensitivity		μV	.25	5.0	.25	5.0
Signal-to-Noise Ratio	MONO	dB @ 60 dB	.76	68	.76	68
	STEREO	dB @ 60 dB	.74	68	.74	68
T. H. Distortion	MONO	%	.006	0.2	.01	0.5
	STEREO (L=R)	%	.008	0.3	.02	0.5
Capture Ratio		dB	1	2	2	4
Alternate Channel Selectivity		dB	.35	35 ⁺²⁰ ₋₁₀	.80	70
Spurious Response Ratio		dB	.110	100	.110	100
Image Response Ratio (98 MHz)		dB	.110	100	.110	100
IF Response Ratio (98 MHz)		dB	.110	100	.110	100
AM Suppression Ratio		dB	.60	40	.60	40
Separation	(100 Hz) STEREO	dB	.45	35	.35	25
	(1 kHz) STEREO	dB	.52	35	.45	30
	(10 kHz) STEREO	dB	.40	30	.30	20
Separation, Hi-Blend						
	(1 kHz) STEREO	dB	.30	30 ± 5	.30	30 ± 5
Subcarrier Product Ratio	STEREO	dB	.70	60	.70	60
Meter Sensitivity			.45	4.5 ± 0.3	.45	4.5 ± 0.3
Output Level (Fixed)		Volts	.035	0.35 ± 2 dB	.035	0.35 ± 2 dB
FM Receiving Frequency		MHz	87.4—109	87.5—108.5	87.4—109	87.5—108.5
Antenna Impedance			300 ohm balanced & 75 ohm coaxial			

DISASSEMBLY

Note: Three digit numbers circled in this chapter (○) are represented by a (★) in the parts listing.

Cabinet Cover Removal

Remove eight tapping screws from the top and both sides of the metal cover as shown in Photo 1.

Bottom Plate Removal

Remove nine tapping screws from the bottom of the unit and lift away.

Power Transformer Removal

1. Remove two tapping screws (8, 9) (Photo 2).
2. Remove two tapping screws (10, 11) (Photo 2).
3. Disconnect all the power transformer cables before lifting out the power transformer.

* To reassemble, reverse the procedure.

Front Panel Removal

1. As indicated in Photo 2, disconnect three LED connectors from the LEDs mounted on the front plate by pulling them backward.
2. Remove POWER knob from the front of the unit by pulling it forward. Using a hexagon wrench, remove TUNING and OUTPUT LEVEL knobs from the front of the unit.
3. Remove two nuts (1, 2) (Photo 3) and lift out front panel.

* To reassemble, reverse the procedure.

Meter and Meter Lamp Replacement

1. Using long nose pliers, remove two push rivets (2, 3) (Photo 2).
2. Lift "BACK GND G2 PLATE" (1) (Photo 2) up and out of the unit.
3. Remove clamp spring before removing meters.
4. To replace meter lamps, disolder A & B (Photo 4).

* To reassemble, reverse the procedure.

IF and MPX/Regulator Circuit Parts Replacement

1. Remove "BACK GND G2 PLATE" (1) (Photo 2).
2. Remove four tapping screws (4 - 7) (Photo 2). Using a soldering iron, disconnect one cable (A) (Photo 2) from the wire wrapping pin. Lift the IF circuit board for service.
3. If necessary, disconnect three cables as follows:
Two cables (B & C) (Photo 2) from the wire wrapping pins and One cable (C) (Photo 4) from the bottom of the front end.

Dial Lamp Removal

1. Remove lamps from the REFLECTOR (light guide acrylic resin plate). (Photo 2)
- * To reassemble, reverse the procedure.

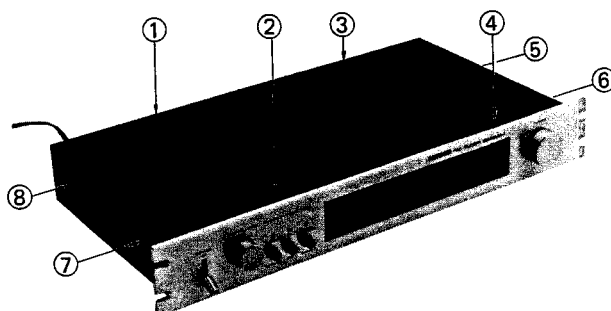


Photo 1

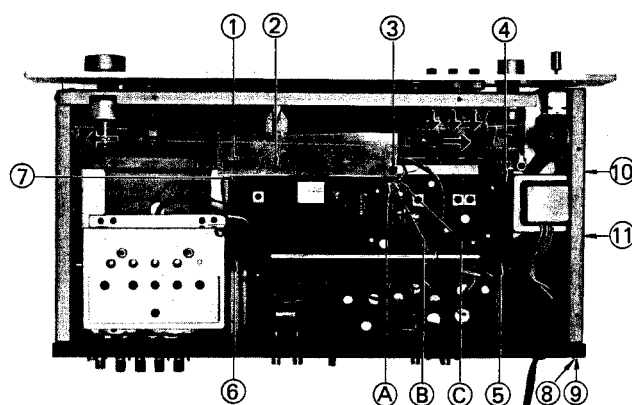


Photo 2



Photo 3

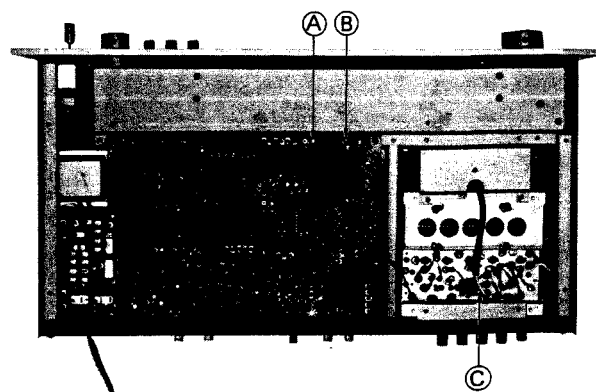


Photo 4

ALIGNMENT

Test Equipment

Allow a minimum of 10 minutes warm-up for test equipment and the tuner to be tested.

Maintain rated line voltage.

FM Stereo/Mono Signal Generator.

Vacuum Tube Voltmeter (VTVM)

Oscilloscope

Distortion Meter

Frequency Counter

FM Section Alignment

Connect test equipment as shown in Figure 1.

Connect FM Stereo/Mono signal generator through standard dummy antenna to FM antenna terminals of the tuner.

Connect VTVM, oscilloscope and distortion meter to OUTPUT terminals of the tuner with shielded cable.

Note: Adjust FM signal generator output level so that waveform on oscilloscope is uniform.

FM I-F Alignment

1. Set FM signal generator for 98 MHz.
2. Adjust the generator to ± 75 KHz deviation at 1000 Hz.
3. Switch:
 - a. IF BAND to "NARROW" position.
 - b. HI BLEND to "OFF" position.
 - c. MODE to "MONO" position.

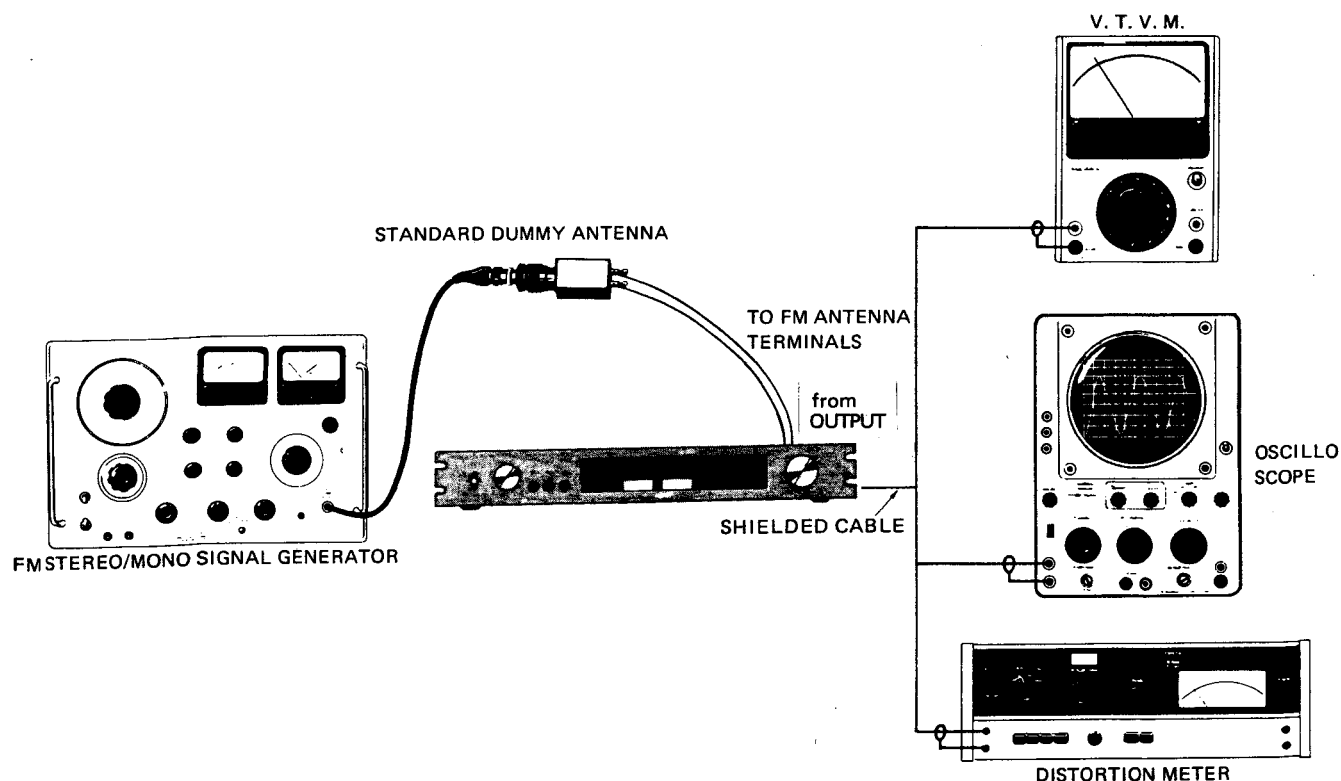


Figure 1. TEST EQUIPMENT

4. Tune the unit for outside of the FM bandwidth, then adjust T102 (Figure 2) until M1 (Center-of-Channel Tuning Meter) indicates mid-scale. Connect DC voltmeter to test point "TP" (Figure 2) and adjust T103 (green core) (Figure 2) for 0 ± 50 millivolts.
5. Attenuate generator output for $0 \sim 6$ dB. Tune the unit for 98 MHz modulated signal, then adjust "IF" transformer located in Front End (Figure 4) until M2 indicates maximum deflection.
6. Attenuate generator output for 60 dB and set IF BAND switch to "WIDE" position. Adjust T103 (red core, Figure 2) for minimum distortion. If M1 does not indicate mid-scale, repeat steps 3, 4 and 5.
7. Adjust R135 (Figure 2) until M1 indicates a " 4.5 ± 0.3 " meter reading.
8. Set IF BAND switch to "NARROW" position again and adjust R137 (Figure 3) until M2 indicates a " 4.5 ± 0.3 " meter reading.

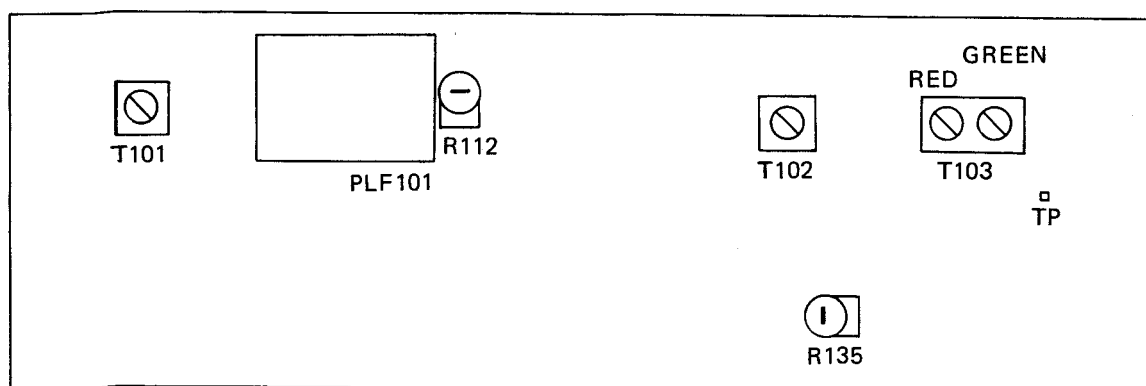


Figure 2. I-F CIRCUIT BOARD (TOP VIEW)

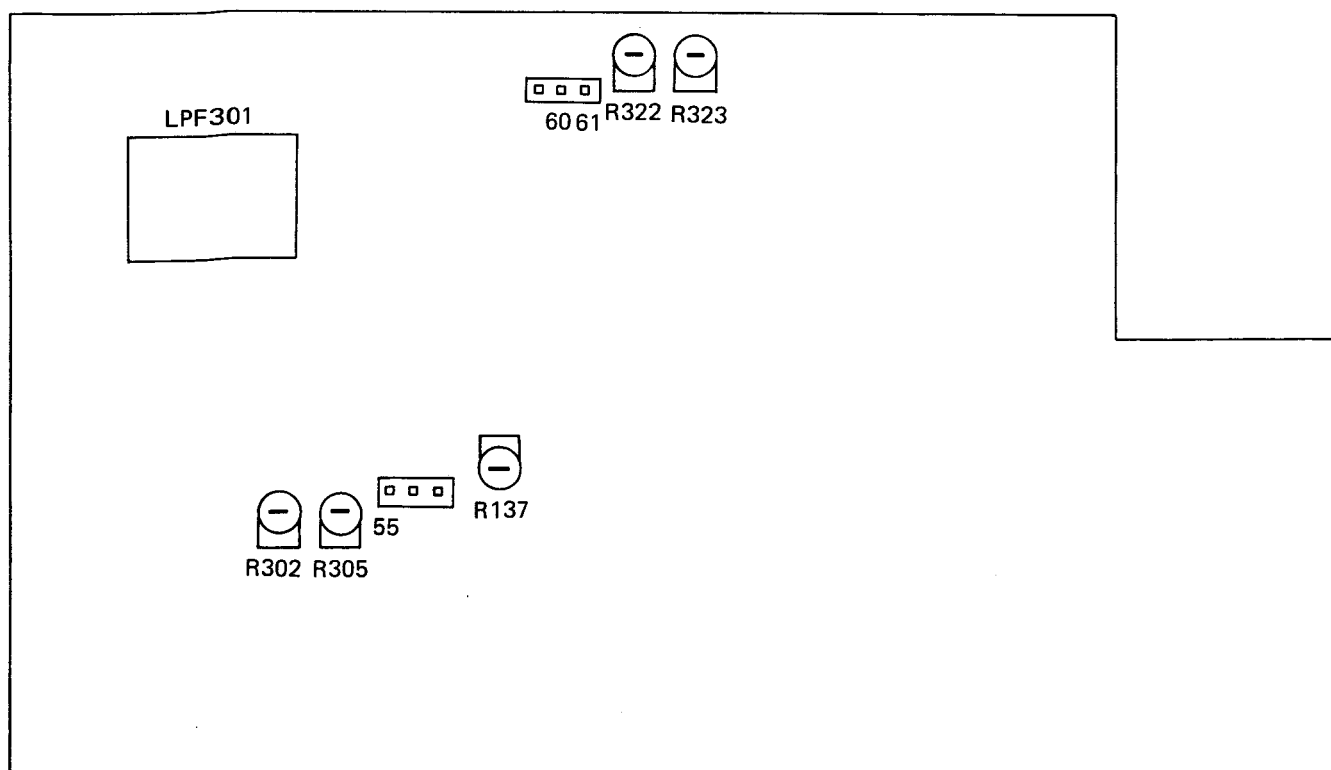


Figure 3. MPX/REGULATOR CIRCUIT BOARD (TOP VIEW)

FM Frequency Coverage and FM Tracking Alignment

These adjustments are factory preset and normally needs no further adjustment. However, if necessary proceed as follows:

1. Adjust FM signal generator to ± 75 KHz deviation at 1000 Hz.
2. Turn the tuning knob fully counterclockwise. If the dial pointer is not located on 87 MHz position of the dial scale, reset the dial pointer to this position.

STEP	GENERATOR	DIAL	ADJUSTMENT POINT	OSCILLOSCOPE	VTVM & M2
1	88 MHz	88 MHz	LO (Figure 4)	Maximum waveform	Maximum deflection
2	108 MHz	108 MHz	TCO (Figure 4)	Maximum waveform	Maximum deflection
3	88 MHz	88 MHz	LA (Figure 4) LR ₁ (Figure 4) LR ₂ (Figure 4) LR ₃ (Figure 4)	Maximum waveform	Maximum deflection
4	108 MHz	108 MHz	TCA (Figure 4) TCR ₁ (Figure 4) TCR ₂ (Figure 4) TCR ₃ (Figure 4)	Maximum waveform	Maximum deflection

3. Repeat adjustment of steps 1 and 2 two or three times.
4. Repeat adjustment of steps 3 and 4 once or twice.
5. Repeat adjustment of steps 1 and 2 once or twice.

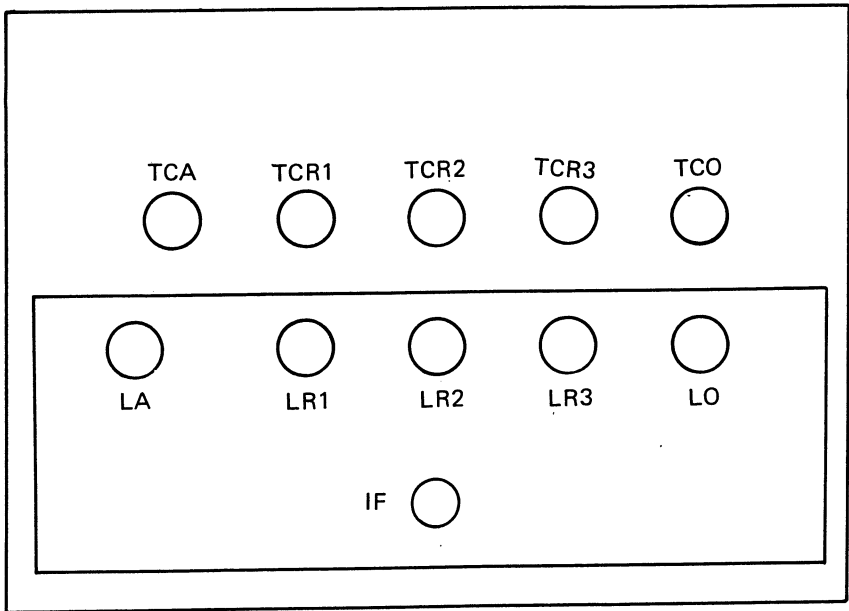


Figure 4. FM FRONT END (TOP VIEW)

FM MPX and Stereo Separation Alignment

Except in the case of IC103 (HA-11223) being replaced, no readjustments are required.

1. SWITCH setting:
Set MODE switch to "STEREO MUTING ON" position and IF BAND to "WIDE" position.
2. To adjust a correct VCO, a buffer amplifier should be connected between VCO test point "55" and the frequency counter. This amplifier should have high input impedance, which is more than 470 k ohms at 76 kHz and gains about 40 dB.
3. Set FM signal generator to 108 MHz and attenuate its output for 60 dB.
4. Tune the unit for 108 MHz unmodulated signal and adjust R302 (Figure 3) for 75.93 to 76.07 kHz for correct VCO.
5. Adjust generator to ± 7.5 kHz deviation for 19 kHz pilot signal. Using VTVM, adjust R305 (Figure 3) so that test points "60" and "61" are at the same potential. (Less than 15 millivolts)
6. Adjust generator to ± 67.5 kHz deviation at 1000 Hz for L-channel and to ± 7.5 kHz deviation for 19 kHz pilot signal. Adjust R322 (Figure 3) for minimum output of R-channel.
7. Repeat step 6 for L-channel adjustment for R322.
8. Adjustments with R322, for both L and R channels should be equal.
9. Set IF BAND switch to "NARROW" position and adjust R323 (Figure 3) in the same procedure as steps 6, 7 and 8.
10. Set IF BAND switch to "WIDE" position and set generator for a stereo signal (L or R). Adjust R112 (Figure 2) for minimum distortion.

Note: To correctly adjust for stereo separation, you must first start in the WIDE position, then proceed to the NARROW position.

DIAL CORD INSTALLATION

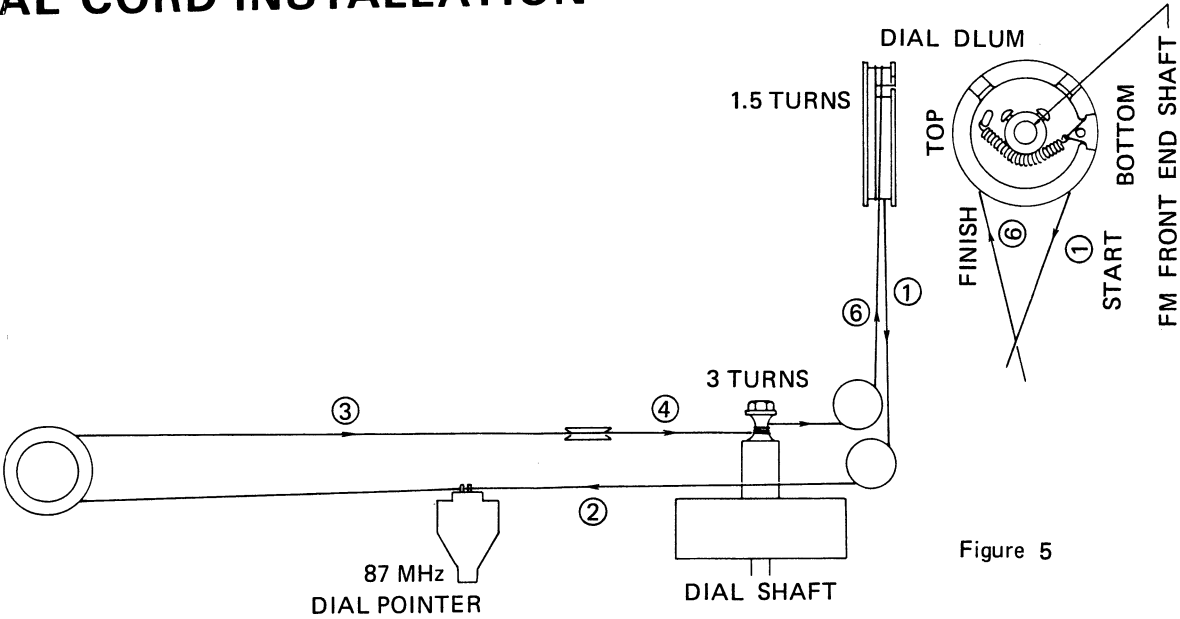


Figure 5

1. To remove "Side Angle Right", remove six tapping screws:
 - a. Two screws from the front edge of side angle.
 - b. Two screws from the right edge of the bottom plate.
 - c. Two screws from the right edge of the back panel.
2. Turn the FM Front end shaft to the left until the rotor of the variable capacitor is completely out of the stator. Locate the pin on dial drum in line with the FM front end shaft on vertical as shown in Figure 5.
3. String the dial drum and pulleys in the direction of arrows. (In circled number order.)
4. Fix dial pointer to the string at a reading of 87 MHz on the dial scale. (Step 2)

CIRCUIT BOARDS

- | | |
|----------------------------|--------------------------------------|
| ⑥ To FRONT END | ①⑨ To MULTIPATH GROUND (BACK PLATE) |
| ⑦ To FRONT END (GROUND) | ②⑩ To MULTIPATH HORIZ (BACK PLATE) |
| ⑧ To FRONT END | ②① To MULTIPATH VERT (BACK PLATE) |
| ⑨ To MPX/REGURATOR C. B. ⑨ | ②② To MPX/REGURATOR C. B. ②② |
| ⑩ To MPX/REGURATOR C. B. ⑩ | ②③ To MPX/REGURATOR C. B. ②③ |
| ⑪ To MPX/REGURATOR C. B. ⑪ | ②④ To FM DET OUT (BACK PLATE) |
| ⑫ To MPX/REGURATOR C. B. ⑫ | ②⑤ To FM DET OUT GROUND (BACK PLATE) |
| ⑬ To MPX/REGURATOR C. B. ⑬ | |
| ⑭ To S-METER ⊕ | |
| ⑮ To S-METER ⊖ | |
| ⑯ To MPX REGURATOR C. B. ⑯ | |
| ⑰ To T-METER ⊖ | |
| ⑱ To T-METER ⊕ | |

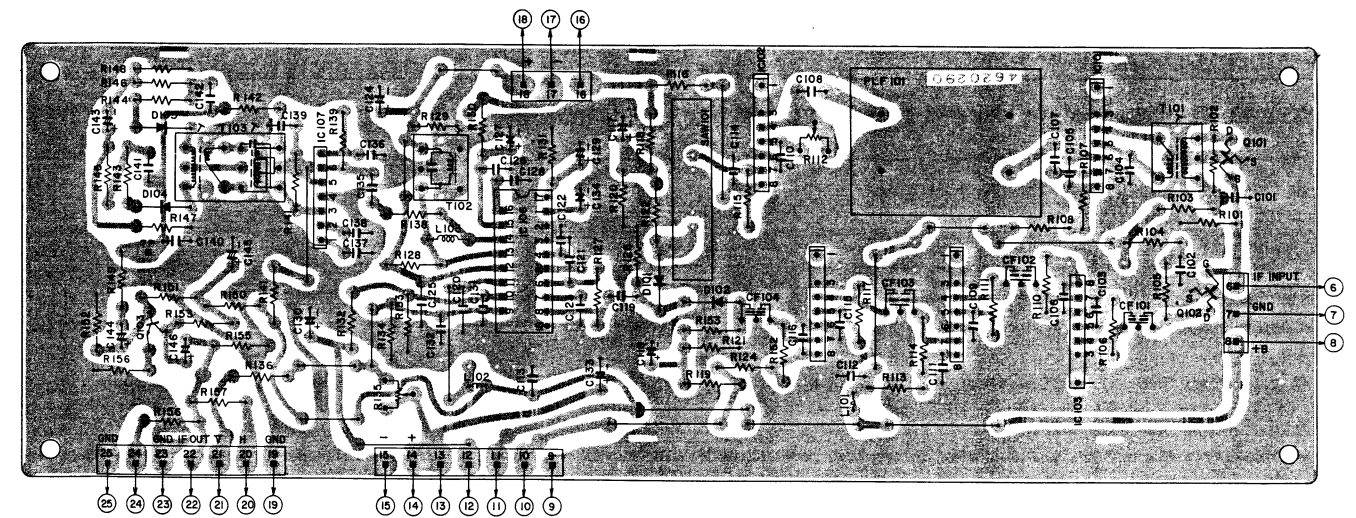


Figure 6. IF CIRCUIT BOARD (BOTTOM VIEW)

- | |
|--------------------------------------|
| ⑨ To I-F PCB |
| ⑩ To I-F C. B. ⑩ |
| ⑪ To I-F C. B. ⑪ |
| ⑫ To I-F C. B. ⑫ |
| ⑬ To I-F C. B. ⑬ |
| ⑯ To I-F C. B. ⑯ |
| ②② To I-F C. B. ②② |
| ②③ To I-F C. B. ②③ |
| ③① To LED 4 ⊕ |
| ③② To LED 4 ⊖ |
| ③③ To LAMP |
| ③④ To LAMP |
| ⑤① To R3 (OUTPUT LEVEL R) |
| ⑤② To OUTPUT FIXED R (BACK PLATE) |
| ⑤③ To GROUND (OUTPUT LEVEL) |
| ⑤④ To R2 (OUTPUT LEVEL L) |
| ⑤⑤ To OUTPUT FIXED L (BACK PLATE) |
| ⑤⑥ TEST POINT |
| ⑤⑦ To S5a DE-EMPHASIS L (BACK PLATE) |
| ⑤⑧ To S5b DE-EMPHASIS R (BACK PLATE) |

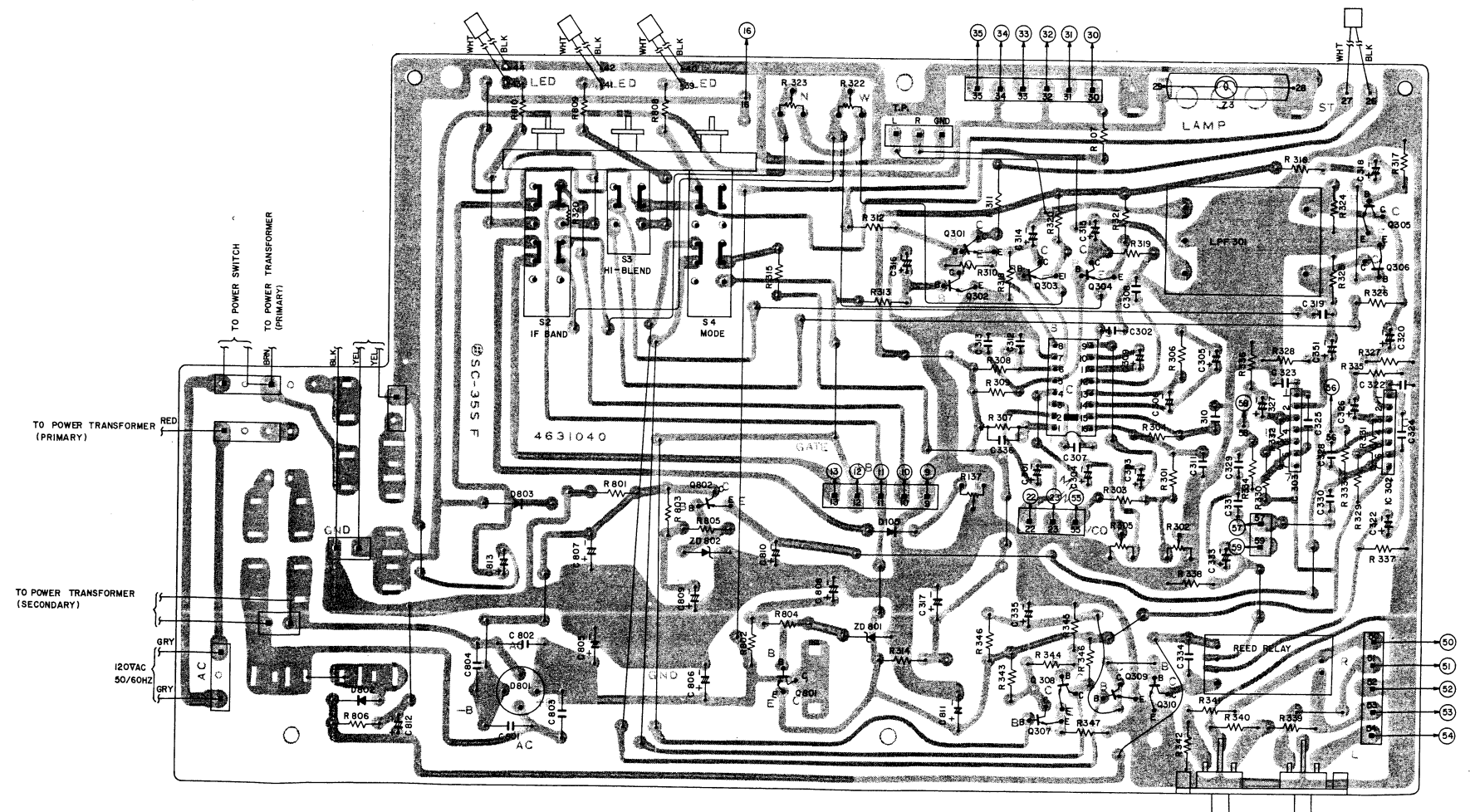
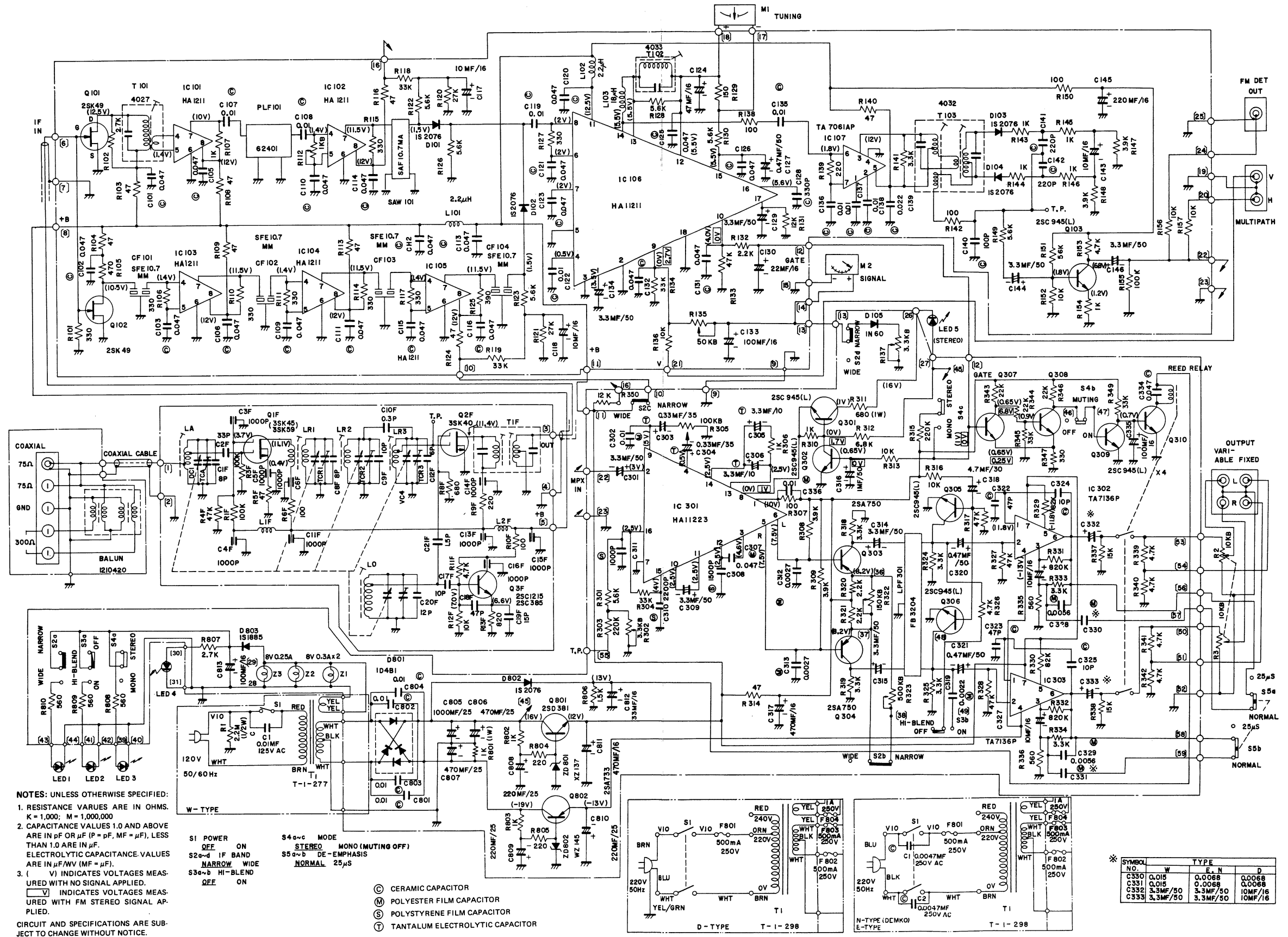


Figure 7. MPX/REGURATOR CIRCUIT BOARD (BOTTOM VIEW)

OVERALL SCHEMATIC DIAGRAM



PARTS LOCATION

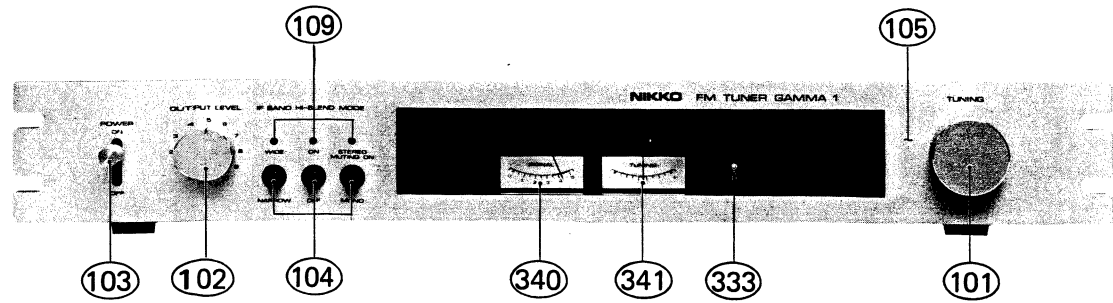


Photo 5

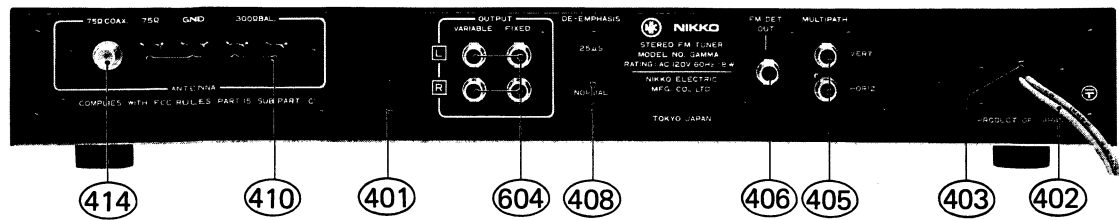


Photo 6

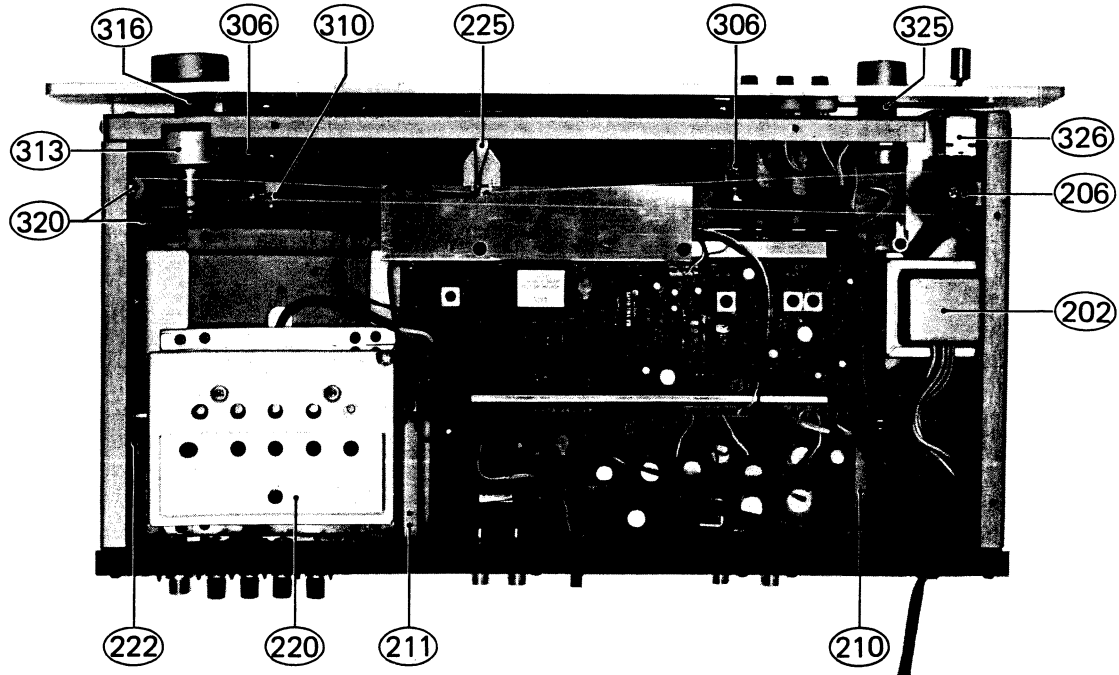


Photo 7

PARTS LIST

NOTES:

1. ★ The KEY NUMBER (#) marked with a (★) on parts list relate to number of three digits with a (○). (Photo 1 ~ 7).
2. + Numerals in file indicate the quantity of parts used in one type.
3. ++ TR : Transistor
FET : Field effect transistor
IC : Integrated circuit
VR : Volume control (Variable resistor)
RES : Carbon film fixed resistor
MORES : Metal oxide film fixed resistor
CEMRES : Cemented wirewound fixed resistor
FP : Flame proof
C-CAP : Ceramic capacitor
E-CAP : Aluminium electrolytic capacitor

M-CAP : Polyester film capacitor
S-CAP : Polystyrene film capacitor
T-CAP : Tantalum electrolytic capacitor
BP-CAP : Bipolar electrolytic capacitor

E-CAP, T-CAP and BP-CAP values (1 x 10uF) are in (1) uF, (10) V.

4. Assemblies and parts are subject to change without notice.
5. Parts ordering procedure:
Include in any order
a. Part number.
b. Part description.
c. Model number.
(Any of the above lacking from an order may delay shipment of that order.)

KEY NO.	SYMBOL NO.	TYPE ⁺	DESCRIPTION ⁺⁺	PART NO.
		W T I C R F C E		

PACKING MATERIALS & ACCESSORIES

001	1111	CARTON BOX	9825310
002	2222	STYROL PAD	9840660
003	1111	POLY SACK	9640680
004	111-	POLY SACK #1	9640590
005	111-	POLY SACK #13	9640320
006	---1	ENVELOPE (G)	9690170
007a	1---	INSTRUCTION MANUAL USA	960191E
007b	---	INSTRUCTION MANUAL Canada	960216E
007c	-11-	INSTRUCTION MANUAL K	960201K
007d	---1	INSTRUCTION MANUAL D	960204G
008	1---	WARRANTY CARD (N)	967003A
009	1111	POLISHING CLOTH	9690040
010	1111	SILICAGEL - dryer	9690010
011	1111	PIN PLUG CORD 2T	962012J
012	1111	Q-MATCH ANT (EX) - FM antenna	4581360

CABINET ASSEMBLY

(CHAMPAGNE-GOLD TYPE)

*101a	1111	KNOB 2GL-34 (tuning)	7851660	
*102a	1111	KNOB 2GL-23D (output level)	7851670	
*103	1111	KNOB PC-16 (power)	7850590	
*104	3333	PUSHBUTTON P8B (IF band, hi-brend, mode)	7851700	
*105a	1111	PNL - front panel (gold)	7883680	
106	↑	3333	PUSHBUTTON GUIDE (G)	7401360
107	↑	1111	DUST COVER 2442	7001760
*108	↑	1111	DIAL SMOKED GLASS	7802240
*109	3333	LED 3φ x 4.5 GD-4-207 RD	506001S	
110	3333	LED HOLDER	7903060	
*111a	1 - -	METAL COVER W	7820740	
111b	- 111	METAL COVER E-N-D	7820750	
*112	↑	4444	TFTS 4φ x 10 BLACK - screw	887410W
*113	↑	4444	W 4φ BLACK - washer	893104W
*114	↑	4444	PTS 3φ x 6 BLACK - screw	814306W
115	4444	FOOT (TG)	7401350	
116	↑	4444	PTS 3φ x 8 - screw	814308S
117	↑	2222	SN 9φ - nut	892249S
118	↑	2222	W 9φ - washer	893109S

(BLACK TYPE)

101b	1111	KNOB 2BK-34 (tuning)	7851750
102b	1111	KNOB 2BK-23D (output level)	7851770
103	1111	KNOB PC-16 (power)	7850590
104	3333	PUSHBUTTON P 8 B (IF band, hi-brend, mode)	7851700
105b	111-	PNL - front panel (black & white)	7883810
105c	---1	PNL - front panel (black & yellow)	7883800
106	↑	3333	BUTTON GUIDE (G)
107	↑	1111	DUST COVER 2442
108	↑	1111	DIAL SMOKED GLASS
109	3333	LED 3φ x 4.5 GD-4-207RD	506001S
110	3333	LED HOLDER	7903060
111a	1---	METAL COVER W	7820740
111b	-111	METAL COVER E-N-D	7820750
112	↑	4444	TFTS 4φ x 10 BLACK - screw
113	↑	4444	W 4φ BLACK - washer
114	↑	4444	PTS 3φ x 6 BLACK - screw
115	4444	FOOT (TG)	7401350
116	↑	4444	PTS 3φ x 8 - screw
117	↑	2222	SN 9φ - nut
118	↑	2222	W 9φ - washer

CHASSIS ASSEMBLY

((FRONT PLT ASS))
((BACK PLT ASS))

*201		1111	SIDE ANGLE (L)	7226290
*202a		1 - - -	POWER TRANSFORMER T-1-277 120V	1102770
202b		- 1 - 1	POWER TRANSFORMER T-1-298 220V/240V	1102980
203	↑	2222	PT STP PLATE	7031290
204	↑	2222	PMS 4φx10 – screw	810410S
205		1111	PULLEY BRACKET (S)	7031400
*206	↑	1111	PULLEY 20φ	7400830
207	↑	1111	PULLEY SHAFT 4L	7120980
208	↑	4444	PTS 3φ x 6 – screw	814306S
209	↑	2222	PTS 3φ x 6 BLACK – screw	814306W
*210		1111	PCB ANGLE (L)	7226340
*211		1111	PCB ANGLE (R)	7226350
212	↑	4444	PTS 3φ x 6 BLACK – screw	814306W
213	↑	2222	PTS 3φ x 6 – screw	814306S
600			((MPX REG PCB ASS))	
214	↑	4444	PTS 3φ x 6 – screw	814306S
215	↑	2222	PTS 3φ x 10 BLACK – screw	814310W
216		1111	FRONT END HOLDER	8031440
217	↑	2222	PTS 3φ x 6 – screw	814306S
*218		1111	BOTTOM PLATE	7324750

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KEY NO.	SYMBOL NO.	TYPE*		DESCRIPTION**	PART NO.
		W-type E-type N-type D-type			
*219	↑	9999		PTS 3φ x 6 — screw	814306S
*220		1111		FRONT END FS114U13	4910070
221	↑	4444		PTS 3φ x 6 — screw	814306S
*222		1111		DIAL DRUM 37φ MK2	7400860
223	↑	1111		SPRING (R)	7440380
224		1111		DIAL CORD	4580430
*225		1111		NEEDLE — dial pointer	7860550
*226		1111		SIDE ANGLE (R)	7226310
227	↑	4444		PTS 3φ x 6 — screw	814306S
228	↑	2222		PTS 3φ x 6 BLACK — screw	814306W
500		(I-F PCB ASS))			
229	↑	4444		PTS 3φ x 8 — screw	814308S
230		1---		SHIELD PLATE (G)	7031550
231		- 111		SHIELD PLATE (D)	7031670
232		1111		LUG 1L-2P (R)	441120R
*233		1111		BACK GND G2 — plate	7226430
234	↑	2222		PUSH RIVET FNRP 3 x 3.5	7401190
235		2222		W 3φ — washer	893403S
FRONT PLATE ASSEMBLY					
301		1111		FRONT PLATE	7324740
302		1111		DIAL BACK	7226330
303		1111		SIDE BRACKET (L)	7031420
304		1111		SIDE BRACKET (R)	7031430
305		4444		PTS 3φ x 6 — screw	814306S
*306		2222		REFLECTOR — light guide acrylic resin plate	7401370
307		2222		LAMP 8V 0.3A BF352-54010A (dial scale)	5808120
308	↑	4444		PTS 3φ x 8 — screw	814308S
309		1111		PULLEY BRACKET (D)	7031380
*310		1111		PULLEY 9φ	7400790
311		1111		PULLEY SHAFT 4L	7120980
312	↑	2222		PTS 3φ x 6 — screw	814306S
*313		1111		DIAL SHAFT	7152360
314	↑	1111		W 9φ — washer	893109S
315	↑	1111		TW (I) 9φ — washer	893409U
*316		1111		NUT	7152350
317		1111		PULLEY HOLDER	7031410
318	↑	1111		PULLEY BRACKET (F)	7031390
319	↑	1111		PULLEY BRACKET (B)	7031370
*320	↑	2222		PULLEY 9φ	7400790
321	↑	2222		PULLEY SHAFT 4L	7120980
322	↑	7777		PTS 3φ x 6 — screw	814306S
323	R2, R3	1111		VR, V24L5GN25R, B10 Kohm x 2	4320770
324	↑	1111		W 8φ — washer	893108S
*325	↑	1111		SPACER 885	7152230
*326a	S1	1---		LV SW SY02 U74SF TV-3 (power) — lever switch	4025210
326b	S1	- 111		LV SW SY02 U80DV-S 27 (8) (power) — lever switch	4025150
327	↑	2222		PMS 3φ x 6 — screw	813036S
328a		1---		C-CAP 0.0047uF 125V AC	239472C
328b	-	- 222		C-CAP 0.0047uF 250V AC	239472E
329	↑	1222		C-CAP COVER (M)	7400980
330	R1	1---		RES 2.2 M ohm 10% ½W	325225K
331		1---		EARTH LUG	440000D
332	↑	1---		TW (I) 3φ — washer	893403U
333	↑	1---		PTS 3φ x 6 — screw	814306S
*334	↓	1111		LED 3φ x 4.5	506001S
335	↓	1111		LED HOLDER	7903060
336		1111		LED PLATE	7031640
337	↑	2222		PUSH RIVET 3 x 3.5	7401190
338		1111		SCALE HOLDER	7226320
339		1111		DIAL SCALE	7802230
340	↑	4444		PTS 3φ x 6 — screw	814306S
*341	M2	1111		METER (signal)	4582110
*342	M1	1111		METER (tuning)	4582120
343	↑	1111		CLAMP SPRING	744022A
BLACK PLATE ASSEMBLY					
401a		1---		BACK PLATE W	7324760
401b		- 111		BACK PLATE E-N-D	7324860
*402a		1---		PLUG CORD KP-2	606002J
402b		- 11-		PLUG CORD CEE-2T	600506J
402c		--- 1		PLUG CORD CEE-3T	601809A
*403a		1---		CORD STOPPER SR-3P-4	7400620
403b		- 11-		CORD STOPPER SR-4N-4	7400690
403c		--- 1		CORD STOPPER SR-6W-1	7400740
404a		1---		CORD BRACKET (W)	7031460
404b		- 111		CORD BRACKET (E)	7031680
*405		1111		WP PIN TERMINAL 2P (CE)	4442010
*406		1111		WP PIN TERMINAL 1P	4440190
407	↑	4444		PTS 3φ x 10 BLACK — screw	814310W
408	S5	1111		SLIDE SWITCH SL-13 (de-emphasis)	4020440
409	↑	2222		PMS 3φ x 6 BLACK — screw	810306W
*410		1111		ANTENNA TERMINAL 5P	4450540
411		1111		ANTENNA PCB	4620280
412		1111		BALUN COIL	1210420
413	↑	2222		PTS 3φ x 10 BLACK — screw	814310W
414		1111		COAXIAL PLUG P212B	4530530
415		1111		BACK PLATE ANGLE	7031450
416	↑	2222		PTS 3φ x 6 BLACK — screw	814306W
417		1111		EARTH LUG	440000D
418	↑	1111		TW (I) 3φ — washer	893403U
419	↑	1111		PMS 3φ x 6 — screw	810306W
420	↑	1111		IN 3φ — nut	892013S
I-F CIRCUIT BOARD					
500		1111		I-F PCB ASS — complete circuit board	9410400
		C101			
	~C106	6666	C-CAP 0.047uF 80, —20% 50V YG	231473Z	
	C107	1111	C-CAP 0.01uF 80, —20% 50V YG	231103Z	
	C108	1111	C-CAP 0.01uF 80, —20% 50V YG	231103Z	
	C109				
	~C116	8888	C-CAP 0.047uF 80, —20% 50V YG	231473Z	
	C117	1111	E-CAP 16R10uF	211220Q	
	C118	1111	E-CAP 16R10uF	211220Q	
	C119	1111	C-CAP 0.01uF 80, —20% 50V YG	231103Z	
	C120	1111	C-CAP 0.047uF 80, —20% 50V YG	231473Z	
	C121	1111	C-CAP 0.047uF 80, —20% 50V YG	231473Z	
	C122	1111	C-CAP 0.01uF 80, —20% 50V YG	231103Z	
	C123	1111	C-CAP 0.047uF 80, —20% 50V YG	231473Z	
	C124	1111	E-CAP 16R47uF	211225Q	
	C125	1111	C-CAP 0.047uF 80, —20% 50V YG	231473Z	
	C126	1111	C-CAP 0.047uF 80, —20% 50V YG	231473Z	
	C127	1111	E-CAP 50R0.47uF	211505Q	
	C128	1111	C-CAP 330pF 10% 50V SL	232331K	
	C129	1111	E-CAP 50R3.3uF	211513Q	
	C130	1111	E-CAP 16R22uF	211222Q	
	C131	1111	C-CAP 0.047uF 80, —20% 50V YG	231473Z	
	C132	1111	C-CAP 0.047uF 80, —20% 50V YG	231473Z	
	C133	1111	E-CAP 16R100uF	211230Q	
	C134	1111	E-CAP 50R3.3uF	211513Q	
	C135				
	~138	4444	C-CAP 0.01uF 80, —20% 50V YG	231103Z	

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KEY NO.	SYMBOL NO.	TYPE* W-type Z-type D-type	DESCRIPTION**	PART NO.	KEY NO.	SYMBOL NO.	TYPE* W-type Z-type D-type	DESCRIPTION**	PART NO.
	C139	1111	C-CAP 0.022uF 80, -20% 50V YG	231223Z		R143	1111	RES 1 Kohm 5% 1/4W	328102J
	C140	1111	C-CAP 100pF 10% 50V SL	232101K		R144	1111	RES 1 Kohm 5% 1/4W	328102J
	C141	1111	C-CAP 220pF 10% 50V SL	232221K		R145	1111	RES 1 Kohm 5% 1/4W	328102J
	C142	1111	C-CAP 220pF 10% 50V SL	232221K		R146	1111	RES 1 Kohm 5% 1/4W	328102J
	C143	1111	E-CAP 16R10uF	211220Q		R147	1111	RES 3.9 Kohm 5% 1/4W	328392J
	C144	1111	E-CAP 50R3.3uF	211513Q		R148	1111	RES 3.9 Kohm 5% 1/4W	328392J
	C145	1111	E-CAP 16R220uF	211232Q		R149	1111	RES 5.6 Kohm 5% 1/4W	328562J
	C146	1111	E-CAP 50R3.3uF	211513Q		R150	1111	RES 100 ohm 5% 1/4W	328101J
	CF101	1111	CERAMIC FILTER SFE10.7MM-A	1280410		R151	1111	RES 56 Kohm 5% 1/4W	328563J
	CF102	1111	CERAMIC FILTER SFE10.7MM-A	1280410		R152	1111	RES 10 Kohm 5% 1/4W	328103J
	CF103	1111	CERAMIC FILTER SFE10.7MM-A	1280410		R153	1111	RES 4.7 Kohm 5% 1/4W	328472J
	CF104	1111	CERAMIC FILTER SFE10.7MM-A	1280410		R154	1111	RES 1 Kohm 5% 1/4W	328102J
	D101					R155	1111	RES 100 Kohm 5% 1/4W	328104J
	~D104	4444	DIODE 1S2076	501019S		R156	1111	RES 10 Kohm 5% 1/4W	328103J
	IC101					R157	1111	RES 10 Kohm 5% 1/4W	328103J
	~IC105	5555	IC HA1211	518053S		SAW101	1111	FILTER SAF10.7MA1	1280370
	IC106	1111	IC HA11211	518052S		T101	1111	FM IFT - transformer	1240270
	IC107	1111	IC TA7061AP	518047S		T102	1111	FM IFT (BLK) - transformer	1240330
	L101	1111	INDUCTOR FL4H 2R2M 2.2uH 20%	1210860		T103	1111	FM DET SW10G - transformer	1240320
	L102	1111	INDUCTOR FL4H 2R2M 2.2uH 20%	1210860					
	L103	1111	INDUCTOR 180J RC-157 18uH 5%	1210850					
	PLF101	1111	P.L.FILTER 62401	1280350				MPX/REGULATOR CIRCUIT BOARD	
	Q101	1111	FET 2SK49	516018S					
	Q102	1111	FET 2SK49	516018S		600a	1---	MPX REG PCB ASS W - complete circuit board	9492420
	Q103	1111	TR 2SC945 (P, Q)	515077S		600b	-1--	MPX REG PCB ASS E - complete circuit board	9492530
	R101	1111	RES 330 ohm 5% 1/4W	328331J		600c	--1-	MPX REG PCB ASS N - complete circuit board	9492530
	R102	1111	RES 2.7 Kohm 5% 1/4W	328272J		600d	---1	MPX REG PCB ASS D - complete circuit board	9492520
	R103	1111	RES 47 ohm 5% 1/4W	328470J					
	R104	1111	RES 47 ohm 5% 1/4W	328470J					
	R105	1111	RES 470 ohm 5% 1/4W	328471J					
	R106	1111	RES 330 ohm 5% 1/4W	328331J					
	R107	1111	RES 1 Kohm 5% 1/4W	328102J					
	R108	1111	RES 47 ohm 5% 1/4W	328470J					
	R109	1111	RES 47 ohm 5% 1/4W	328470J					
	R110	1111	RES 330 ohm 5% 1/4W	328331J					
	R111	1111	RES 330 ohm 5% 1/4W	328331J					
	R112	1111	HVR, RVA-7B, 1 Kohm - potentiometer	4300750				(MPX SECTION)	
	R113	1111	RES 47 ohm 5% 1/4W	328470J		C301	1111	E-CAP 50R3.3uF	211513Q
	R114	1111	RES 330 ohm 5% 1/4W	328331J		C302	1111	M-CAP 0.01uF 10% 50V	222103K
	R115	1111	RES 330 ohm 5% 1/4W	328331J		C303	1111	T-CAP 35D0.33uF	252403M
	R116	1111	RES 47 ohm 5% 1/4W	328470J		C304	1111	T-CAP 35D0.33uF	252403M
	R117	1111	RES 330 ohm 5% 1/4W	328331J		C305	1111	T-CAP 10D3.3uF	252113M
	R118	1111	RES 33 Kohm 5% 1/4W	328333J		C306	1111	T-CAP 10D3.3uF	252113M
	R119	1111	RES 33 Kohm 5% 1/4W	328333J		C307	1111	M-CAP 0.047uF 10% 50V	222473K
	R120	1111	RES 27 Kohm 5% 1/4W	328273J		C308	1111	S-CAP 1500pF	223152V
	R121	1111	RES 27 Kohm 5% 1/4W	328273J		C309	1111	E-CAP 50R3.3uF	211513Q
	R122	1111	RES 5.6 Kohm 5% 1/4W	328562J		C310	1111	S-CAP 2200pF	223222V
	R123	1111	RES 5.6 Kohm 5% 1/4W	328562J		C311	1111	S-CAP 1000pF	223102V
	R124	1111	RES 47 ohm 5% 1/4W	328470J		C312	1111	M-CAP 0.0027uF	222272J
	R125	1111	RES 390 ohm 5% 1/4W	328391J		C313	1111	M-CAP 0.0027uF	222272J
	R126	1111	RES 5.6 Kohm 5% 1/4W	328562J		C314	1111	E-CAP 50R3.3uF	211513Q
	R127	1111	RES 330 ohm 5% 1/4W	328331J		C315	1111	E-CAP 50R3.3uF	211513Q
	R128	1111	RES 5.6 Kohm 5% 1/4W	328562J		C316	1111	E-CAP 50R1uF	211510Q
	R129	1111	RES 150 ohm 5% 1/4W	328151J					
	R130	1111	RES 5.6 Kohm 5% 1/4W	328562J		C318	1111	E-CAP 50R4.7uF	211515Q
	R131	1111	RES 12 Kohm 5% 1/4W	328123J		C319	1111	M-CAP 0.0022uF 10% 50V	222222K
	R132	1111	RES 2.2Kohm 5% 1/4W	328222J					
	R133	1111	RES 47 Kohm 5% 1/4W	328473J		C335	1111	E-CAP 16R470uF	211235V
	R134	1111	RES 33 Kohm 5% 1/4W	328333J		C336	1111	M-CAP 0.01uF 10% 50V	222103K
	R135	1111	HVR, RVA-7B, 50 Kohm - potentiometer	4300780		IC301	1111	IC HA11223	518054S
	R136	1111	RES 10 Kohm 5% 1/4W	328103J		LPF301	1111	LPF FB3204	1280360
	R138	1111	RES 100 ohm 5% 1/4W	328101J					
	R139	1111	RES 220 ohm 5% 1/4W	328221J		Q301	1111	TR 2SC945 (P, Q)	515077S
	R140	1111	RES 47 ohm 5% 1/4W	328470J		Q302	1111	TR 2SC945 (P, Q)	515077S
	R141	1111	RES 3.3 Kohm 5% 1/4W	328332J					
	R142	1111	RES 100 ohm 5% 1/4W	328101J					

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KEY NO.	SYMBOL NO.	TYPE* W-type-u E-type-u N-type-p D-type-g	DESCRIPTION**	PART NO.	KEY NO.	SYMBOL NO.	TYPE* W-type-u E-type-u N-type-p D-type-g	DESCRIPTION**	PART NO.
	Q303	1 1 1 1	TR 2SA750 (1) (E)	514088S		R340	1 1 1 1	RES 4.7 Kohm 5% ¼W	328472J
	Q304	1 1 1 1	TR 2SA750 (1) (E)	514088S		R341	1 1 1 1	RES 4.7 Kohm 5% ¼W	328472J
	Q305	1 1 1 1	TR 2SC945 Ⓛ (P, Q)	515077S		R342	1 1 1 1	RES 4.7 Kohm 5% ¼W	328472J
	Q306	1 1 1 1	TR 2SC945 Ⓛ (P, Q)	515077S					
	R301	1 1 1 1	RES 5.6 Kohm 5% ¼W	328562J					
	R302	1 1 1 1	HVR, RVG-10B, 3.3 Kohm — potentiometer	4300820					
	R303	1 1 1 1	RES 220 Kohm 5% ¼W	328224J					
	R304	1 1 1 1	RES 33 Kohm 5% ¼W	328333J				(MUTING SECTION)	
	R305	1 1 1 1	HVR, RVA-7B, 100 Kohm — potentiometer	4300790					
	R306	1 1 1 1	RES 1 Kohm 5% ¼W	328102J					
	R307	1 1 1 1	RES 100 ohm 5% ¼W	328101J		C334	1 1 1 1	C-CAP 0.047uF 80, —20% 50V YG	231473Z
	R308	1 1 1 1	RES 3.9 Kohm 5% ¼W	328392J		C335	1 1 1 1	E-CAP 16R100uF	211230Q
	R309	1 1 1 1	RES 3.9 Kohm 5% ¼W	328392J					
	R310	1 1 1 1	RES 1 Kohm 5% ¼W	328102J		Q307			
	R311	1 1 1 1	MO-RES 680 ohm 5% 1W	361681B		~Q310	4 4 4 4	TR 2SC945 L (P, Q)	515077S
	R312	1 1 1 1	RES 6.8 Kohm 5% ¼W	328682J					
	R313	1 1 1 1	RES 10 Kohm 5% ¼W	328103J		R343	1 1 1 1	RES 22 Kohm 5% ¼W	328223J
	R314	1 1 1 1	RES 47 ohm 5% ¼W	328470J		R344	1 1 1 1	RES 22 Kohm 5% ¼W	328223J
	R315	1 1 1 1	RES 220 Kohm 5% ¼W	328224J		R345	1 1 1 1	RES 33 Kohm 5% ¼W	328333J
	R316	1 1 1 1	RES 10 Kohm 5% ¼W	328103J		R346	1 1 1 1	RES 22 Kohm 5% ¼W	328223J
	R317	1 1 1 1	RES 47 Kohm 5% ¼W	328473J		R347	1 1 1 1	RES 330 Kohm 5% ¼W	328334J
	R318	1 1 1 1	RES 3.3 Kohm 5% ¼W	328332J					
	R319	1 1 1 1	RES 3.3 Kohm 5% ¼W	328332J		R349	1 1 1 1	RES 33 Kohm 5% ¼W	328333J
	R320	1 1 1 1	RES 2.2 Kohm 5% ¼W	328222J					
	R321	1 1 1 1	RES 2.2 Kohm 5% ¼W	328222J			1 1 1 1	REED RELAY URT-103	1700200
	R322	1 1 1 1	HVR, RVA-7B, 105 Kohm — potentiometer	4300800					
	R323	1 1 1 1	HVR, RVA-7B, 500 Kohm — potentiometer	4300810					
	R324	1 1 1 1	RES 3.3 Kohm 5% ¼W	328332J					
	R325	1 1 1 1	RES 3.3 Kohm 5% ¼W	328332J					
	R326	1 1 1 1	RES 4.7 Kohm 5% ¼W	328472J				(REGULATOR SECTION)	
	R350	1 1 1 1	RES 12 Kohm 5% ¼W	328123J					
			(FLAT AMP SECTION)						
						C801			
						~C804	4 4 4 4	C-CAP 0.01uF 100, —0% 500V	238103P
						C805	1 1 1 1	25R1000uF	211340V
						C806	1 1 1 1	25R470uF	211335V
						C807	1 1 1 1	25R470uF	211335V
						C808			
						~C810	3 3 3 3	25R220uF	211332V
						C811	1 1 1 1	16R470uF	211235V
						C812	1 1 1 1	16R33uF	211223Q
						C813	1 1 1 1	16R100uF	211230V
	C320	1 1 1 1	E-CAP 50R0.47uF	211505Q					
	C321	1 1 1 1	E-CAP 50R0.47uF	211505Q		D801	1 1 1 1	BRIDGE DIODE 1D4B1	560031S
	C322	1 1 1 1	C-CAP 47pF 10% 50V SL	232470K		D802	1 1 1 1	DIODE 1S2076	501019S
	C323	1 1 1 1	C-CAP 47pF 10% 50V SL	232470K		D803	1 1 1 1	DIODE 1S1885	560032S
	C324	1 1 1 1	C-CAP 10pF 10% 50V SL	232100K					
	C325	1 1 1 1	C-CAP 10pF 10% 50V SL	232100K		F801			
	C326	1 1 1 1	E-CAP 16R10uF	211220Q		~ F803	- 333	MIDGET FUSE (S) EAK 500 mA	4720310
	C327	1 1 1 1	E-CAP 16R10uF	211220Q		F804	- 111	MIDGET FUSE (S) EAK 1A	4720330
	C328	1 1 1 1	M-CAP 0.0056uF 5% 50V	222562J		↑	- 888	MIDGET FUSE HOLDER	7050430
	C329	1 1 1 1	M-CAP 0.0056uF 5% 50V	222562J					
	C330	1 - - -	M-CAP 0.015uF 5% 50V	222153J					
	C330	- 1 1 1	M-CAP 0.0068uF 5% 50V	222682J					
	C331	1 - - -	M-CAP 0.015uF 5% 50V	222153J					
	C331	- 1 1 1	M-CAP 0.0068uF 5% 50V	222682J					
	C332	1 1 1 -	E-CAP 50R3.3uF	211513Q					
	C332	- - - 1	E-CAP 16R10uF	211220Q		Q801	1 1 1 1	TR 2SD381 (L, M)	510038S
	C333	1 1 1 -	E-CAP 50R3.3uF	211513Q			1 1 1 1	HEATSINK (S10)	7081820
	C333	- - - 1	E-CAP 16R10uF	211220Q			1 1 1 1	PMS 3φ x 6 — screw	810306S
							1 1 1 1	TW (I) 3φ — washer	893403U
	IC302	1 1 1 1	IC TA7136P	518045S		Q802	1 1 1 1	TR 2SA733 (Q, R)	514074S
	IC303	1 1 1 1	IC TA7136P	518045S					
	R327	1 1 1 1	RES 47 Kohm 5% ¼W	328473J		R801	1 1 1 1	MO-RES 1 Kohm 5% 1W	361102J
	R328	1 1 1 1	RES 47 Kohm 5% ¼W	328473J		R802	1 1 1 1	RES 1 Kohm 5% ¼W	328102J
	R329	1 1 1 1	RES 82 Kohm 5% ¼W	328823J		R803	1 1 1 1	RES 1 Kohm 5% ¼W	328102J
	R330	1 1 1 1	RES 82 Kohm 5% ¼W	328823J		R804	1 1 1 1	RES 220 ohm 5% ¼W	328221J
	R331	1 1 1 1	RES 820 Kohm 5% ¼W	328824J		R805	1 1 1 1	RES 220 ohm 5% ¼W	328221J
	R332	1 1 1 1	RES 820 Kohm 5% ¼W	328824J		R806	1 1 1 1	RES 1.5 Kohm 5% ¼W	328152J
	R333	1 1 1 1	RES 3.3 Kohm 5% ¼W	328332J		R807	1 1 1 1	RES 2.7 Kohm 5% ¼W	328272J
	R334	1 1 1 1	RES 3.3 Kohm 5% ¼W	328332J		R808	1 1 1 1	RES 560 ohm 5% ¼W	328561J
	R335	1 1 1 1	RES 560 ohm 5% ¼W	328561J		R809	1 1 1 1	RES 560 ohm 5% ¼W	328561J
	R336	1 1 1 1	RES 560 ohm 5% ¼W	328561J		R810	1 1 1 1	RES 560 ohm 5% ¼W	328561J
	R337	1 1 1 1	RES 15 Kohm 5% ¼W	328153J					
	R338	1 1 1 1	RES 15 Kohm 5% ¼W	328153J		ZD801	1 1 1 1	ZENER DIODE XZ137	502037S
	R339	1 1 1 1	RES 4.7 Kohm 5% ¼W	328472J		ZD802	1 1 1 1	ZENER DIODE WZ145	502025S

PART ORDERING PROCEDURE ----- Include in any order : A. Part number, B. Part description, C. Model number.
(Any of the above lacking from an order may delay shipment of that order.)

KEY NO.	SYMBOL NO.	TYPE ⁺ W-type E-type N-type D-type	DESCRIPTION ⁺⁺	PART NO.
(THE OTHERS)				
	D105	11 11	DIODE 1N60P	500001G
	R137	11 11	HVR, RVA-7B, 3.3 Kohm — potentiometer	4300760
601	S2~S4	11 11	TR1 PUSH SW 6S562 — triple pushbutton switch (IF band, hi-blend, mode)	4040920

KEY NO.	SYMBOL NO.	TYPE ⁺ W-type E-type N-type D-type	DESCRIPTION ⁺⁺	PART NO.
602	Z3	1111	LAMP PL-8 8V 0.25A BF310-T6 (meters)	5808130
603	1	1111	SHIELD PLATE	7028700
★604		1111	CB PIN TERMINAL 2P x 2 (SE)	4444030
605		4444	MINI SOCKET 3021-2-N	4510090

SEMICONDUCTOR DATA

NOTE: Ge: Germanium Si: Silicon A: Alloy B: Base D: Diffused Dd: Double-diffused

DF: Drift-field E: Epitaxial G: Grown J: Junction

M: Mesa P: Planar Pd: Point-contact Td: Triple-diffused

TRANSISTORS

DEVICE TYPE	APPLICATIONS	STRUCTURE†	MAXIMUM RATINGS Absolute-Maximum Values: (T _A = 25°C unless otherwise specified)						ELECTRICAL CHARACTERISTICS Typical Values: (T _A = 25°C unless otherwise specified)															MANUFACTURE
			Collector-to-Base Voltage V _{CB0} (V)	Emitter-to-Base Voltage V _{EB0} (V)	Collector Current I _C (mA)	Collector Dissipation P _C (mW)	Junction Temperature T _J (°C)	Collector Cutoff Current I _{CBO} (μA)	V _{CE} (V)	Static Forward-Current Transfer Ratio h _{FE}	V _{CE} (V)	I _C (mA)	V _{CE(sat)} (V)	I _C (mA)	I _B (mA)	Gain-Bandwidth Product f _T f _{db} * (MHz)	V _{CE} (V)	I _C (mA)	Base Spreading Resistance r _{bb'} hie(r _{bb'}) * (Ω)	V _{CE} (V)	I _E (mA)	Output Capacitance C _{re} (pF)		
2SA733 (Q, R)	AF	PNP Si-E	-50	-5	-100	250	125	-0.1	-40	90 ~ 270	-6	-1	-0.1	-30	-3	180	-6	10				12	N E C	
2SA750 (I) (E)	AF; Low noise	PNP Si-E	-80	-5	-50	250	125	-0.05	-50	350 ~ 700	-3	-0.5	-0.82	-30	-3	100	-6	1				10	N E C	
2SC372 (Y)	RF; Conv., Mix., Osc.	NPN Si-E	35	4	100	200	125	0.5	18	120 ~ 240	12	2	0.4	10	1	80	10	1				3.5	TOSHIBA	
2SC385A	RF; Conv., Mix., Osc.	NPN Si-EP	30	3	20	200	125	0.5 max	15	20 min.	3	8				600 min.	10	-8	35	6	-2	1.5	TOSHIBA	
2SC416 (C)	RF; Conv., Mix., Osc.	NPN Si-P	30	5	100	200	125	0.5	18	100 ~ 200	12	2	0.6	10	1	230	12	2				1.8	HITACHI	
2SC785	RF; FM tuner	NPN Si-EP	40	4	20	100	125	0.5	18	25 ~ 140	6	1				500	6	-1	C _c : f _{bb'} = 10ps	6	-1	C _{re} = 0.65	TOSHIBA	
2SC945 L (Q, P)	AF	NPN Si-E	60	5	100	250	125	0.1	120	135 ~ 400	6	1	0.15	100	10	250	6	-10				3.5	N E C	
2SC1215	RF	NPN Si-EP	30	3	50	200	125	100	30	25 min.	10	2	0.1	10	1	1200	10	-10	C _c : f _{bb'} = 25ps max.				MATSUSHITA	
2SC1675 (L, M)	RF; Conv. Mix., Osc.	NPN Si-E	80	5	300	600	150	0.1	50	40 ~ 120	12	2	0.4 max.	10	1	250	10	-1	20	10	-1	2	TOSHIBA	
2SD235 (O)	AF; Power	NPN Si-DJ	50	10	3A	25W (T _C = 25°C)	150	100	20	70 ~ 140	5	0.5A	0.5	3A	0.3A	1	5	-0.5A				250	TOSHIBA	
2SD381 (L, M)	AF; Power	NPN Si-E	130	5	1.5A	20W (T _C = 25°C)	150	1	130	60 ~ 180	5	5	0.9	1A	0.1A	45	5	-0.1A				25	N E C	

FIELD EFFECT TRANSISTORS

DEVICE TYPE	APPLICATIONS	STRUCTURE †	MAXIMUM RATINGS Absolute-Maximum Values: (T _A = 25°C unless otherwise specified)					ELECTRICAL CHARACTERISTICS Typical Values: (T _A = 25°C unless otherwise specified)														MANUFACTURE	
			Gate-to-Drain Voltage	Gate-to-Source Voltage	Gate Current	Drain Current	Total Power Dissipation P _D	Channel Temperature T _J	Gate Leak Current	Gate to Drain Breakdown Voltage	Drain Current	Gate to Source Cutoff Voltage	Forward Transfer Admittance	Feed Back Capacitance	Power Gain (Common Source)	Noise Figure							
			V _{GD} (V)	V _{GS} (V)	I _G (mA)	I _D (mA)	P _D (mW)	T _J (°C)	Test Conditions	I _{GSS} (mA)	Test Conditions	V _{BR} GDO (V)	I _{DSS} (mA)	Test Conditions	V _{GS} (off) (V)	Test Conditions	M _{fs} (mS)	Test Conditions	C _{rss} (pF)	Test Conditions	G _{PS} (dB)		Test Conditions
2SK49 (F, H)	FM tuners, VHF tuners	Si, N-channel J-FET	-20			10	72 (T _A = 60°C)	80	V _{GS} = -0.5V V _{DS} = 0	50 max.			V _{GS} = 5V V _{DS} = 10V	1.5 ~ 6	V _{GS} = 5V V _{DS} = 10V	2.8	0.07	V _{GS} = 5V V _{DS} = 10V	18	V _{GS} = 5V V _{DS} = 10V	80 max.	N E C	
2SK51 (GR)	FM tuners, VHF tuners	Si, N-channel J-FET	-18			10		200	125	V _{GS} = -0.5V V _{DS} = 0	-10			V _{GS} = 10V V _{DS} = 0	5 ~ 10	V _{GS} = 10V V _{DS} = 0	9	0.15	V _{GS} = 10V V _{DS} = 0	18	V _{GS} = 10V V _{DS} = 0	3.5 max.	TOSHIBA
3SK40	FM tuners, VHF tuners	Si, N-channel dual gate MOS-FET		V _{GS1} = +7 V _{GS2} = +27		25	250	150	V _{GS1} = +25V V _{DS} = 0	I _{GSS} = 100			V _{GS1} = 10V V _{GS2} = +4V	4 ~ 25	V _{GS1} = 15V V _{GS2} = +4V	10	0.03	V _{GS1} = 15V V _{GS2} = +4V	18 min.	V _{GS1} = 15V V _{GS2} = +4V	4.5 min.	N E C	
3SK45	FM tuners, VHF tuners	Si, N-channel dual gate MOS-FET		V _{GS1} = +7 V _{GS2} = +27		35	330	175	V _{GS1} = +27V V _{DS} = 0	I _{GSS} = 20			V _{GS1} = 16V V _{GS2} = +4V	4 ~ 32	V _{GS1} = 15V V _{GS2} = +4V	14	0.02	V _{GS1} = 15V V _{GS2} = +4V	17 min.	V _{GS1} = 15V V _{GS2} = +4V	3.3 max.	HITACHI	
3SK59	FM tuners, VHF tuners	Si, N-channel depletion dual gate MOS-FET		V _{GS1} = +9 V _{GS2} = +29		30	300	150	V _{GS1} = +29V V _{DS} = 0	I _{GSS} = 250			V _{GS1} = 15V V _{GS2} = +4V	3 ~ 24	V _{GS1} = 15V V _{GS2} = +4V	20	0.03	V _{GS1} = 15V V _{GS2} = +4V	18 min.	V _{GS1} = 15V V _{GS2} = +4V	3.5 max.	TOSHIBA	

DIODES, LEDS

DEVIDE		EEDS		MAXIMUM RATINGS Absolute - Maximum Values: (T _A = 25°C unless otherwise specified)										ELECTRICAL CHARACTERISTICS Typical Values: (T _A = 25°C unless otherwise specified)										MANUFACTURE	
DEVICE TYPE	APPLICA- TION	STRUCTURE†	Reverse Surge Voltage	Peak Reverse Voltage	Reverse Voltage	Peak Forward Voltage	Peak Forward Current	Average Rectified Current	Forward Surge Current	Junction Tempera- ture	Total Power Dissipation	Forward Current I _F min	Test Condition	Forward Voltage V _F	Test Condition	Reverse Current I _R max	Test Condition								
			V _R surge (V)	V _{RM} (V)	V _R (V)	V _{FM} (V)	I _{FM} (mA)	I _O (mA)	I _F surge (A)	T _J (°C)	P _D (mW)	(mA)	V _F (V)	(V)	I _F (mA)	(μA)	V _R (V)								
VD1212							30				50			1.24 min. 1.34 max.	1.5		γF = -3.6 mV/°C (I _F = 1.5 mA)	N E C							
104B1	Rectifiers	Si-D Bridge		200				1.3A (T _A = 60°C)	60	150				1.2 max.	1.5A	400	200	TOSHIBA							
1N60	FM Detectors	Si-P		35	25		150	50	0.5	70		4	1			75	10	HITACHI							
1S1885	Rectifiers	Si-A		100		70		1A (T _A = 65°C)	60					1.2	1.5A	10	100	TOSHIBA							
1S2076	Detectors Modulators	Si-P		35	30	35	450	150	1	175	250			0.8	10	1	30	HITACHI							
GD-4- 207RD	L E D							I _F = 50		100	100			1.5 min. 2.0 max.	20	100	3	STANLEY							
TLR109	L E D	GaP			4			I _F = 25		75	75			2.1 typ. 2.8 max.	20	5	4	TYP. 3.0 mcd. (I _F = 15 mA)	TOSHIBA						

ZENER DIODES

ZENER DIODES																	
DEVICE TYPE	APPLICATION	STRUCTURE†	MAXIMUM RATINGS Absolute – Maximum Values: (T _A = 25° C unless otherwise specified)			ELECTRICAL CHARACTERISTICS Typical Values: (T _A = 25° C unless otherwise specified)											MANUFACTURE
			Total Power Dissipation	Zener Current	Junction Temperature	Zener Voltage				Differential Resistance			Temperature Coefficient		Reverse Current		
						V _Z	Test Condition	r _d	Test Condition	γ _Z	Test Condition	I _R	Test Condition				
														MIN (V)	TYP (V)	MAX (V)	
RD5, 6E (B)		Si, P	400			5.3	6.3	20	25	20			5	1.5		NEC	
RD15E (B)		Si, P	400			13.8	15.6	10	30	10			2	11		NEC	
WZ145			500		175	13.9	14.5	15.1	5	15	5	0.076	1	11		JRC	
XZ137			500		175	13.3	13.7	14.1	5	15	5	0.073	1	11		JRC	

INTEGRATED CIRCUIT (HA11211)

■ ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

Item	Symbol	Ratings	Unit
Supply Voltage	V _{CC}	13	V
Power Dissipation	P _T *	730	mW
Operating Temperature	T _{opr}	-20 to +70	°C
Storage Temperature	T _{stg}	-55 to +125	°C

* Value at Ta = 60°C

■ ELECTRICAL CHARACTERISTICS (Ta=25°C) DC CHARACTERISTICS (V_{CC}=12V, Non-signal)

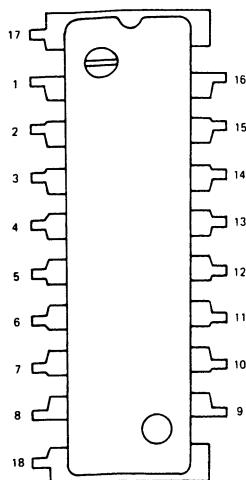
Item	Symbol	Typical Value	Unit
Pin 1 (AM IF Bypass)	V ₁	2.7	V
Pin 4 (AM IF Input)	V ₄	0.7	V
Pin 6 (FM IF Input DC Feedback)	V ₆	1.9	V
Pin 7 (FM IF Input DC Feedback)	V ₇	1.9	V
Pin 8 (FM IF Input)	V ₈	1.9	V
Pin 10 (Muting Control Voltage)	V ₁₀	5.4	V
Pin 12 (Reference)	V ₁₂	5.6	V
Pin 15 (AFC)	V ₁₅	5.6	V
Pin 16 (Audio Out.)	V ₁₆	5.6	V

■ AC CHARACTERISTICS (Notes 1)

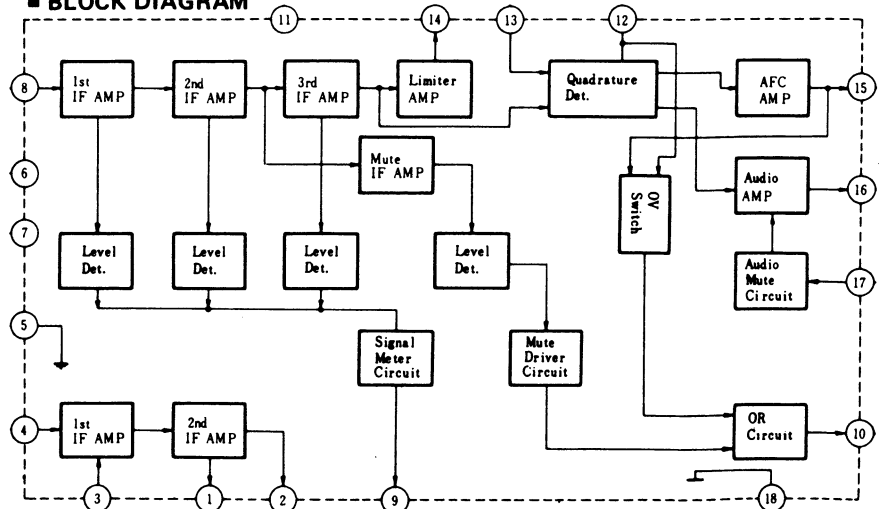
Item		Symbol	Test Condition	min	typ	max	Unit
Total Current Drain		I_{11}	$V_{in}=100\text{dB}\mu$, M_{UTE} ; ON	—	38.5	56.2	mA
FM	Limiting Sensitivity	$V_{in\ Lim}$	$V_{in}=-3\text{dB}$ point from output voltage when $100\text{dB}\mu$ input	—	31	37	$\text{dB}\mu$
	Recovered AF Voltage	$V_{O1\ AF}$		270	450	700	mVrms
	Total Harmonic Distortion	$T.H.D_1$		—	0.04	0.1	%
	Signal-to-noise Ratio	$(S+N/N)_1$		73	79	—	dB
	AM Rejection Ratio	AMR	$V_{in}=100\text{dB}\mu$, FM; 400Hz, $\Delta f=75\text{kHz}$, AM; 1kHz $m=0.3$	—	55	—	dB
	Muting Sensitivity	$V_{in}(M_{UTE})$	$V_{10}=1.4\text{V}$	43	48	53	$\text{dB}\mu$
	Muting Attenuation	$M_{UTE\ ATT}$	$V_{17}=2\text{V}$	73	80	—	dB
	Muting Bandwidth	$BW(M_{UTE})$	$V_{10}=1.4\text{V}$ (Note 3)	78	130	220	kHz
	Meter Swing	$V_{9\ 70}$ $V_{9\ 100}$	$V_{in}=70\text{dB}\mu$ $V_{in}=100\text{dB}\mu$	0.5 3.0	1.8 4.4	— —	V V
AM	Recovered AF Voltage	$V_{O2\ AF}$		55	82	125	mVrms
	Total Harmonic Distortion	$T.H.D_2$		—	0.5	2.0	%
	Signal -to-noise Ratio	$(S+N/N)_2$		44	50	—	dB
	IF AGC Figure of Merit	AGC (FOM)	$V_{in}=\text{Voltage difference from }84\text{dB}\mu\text{ input, when }10\text{dB output down}$	—	48	—	dB
	Input Impedance	R_{in}		—	0.9	—	k Ω

Note : 1. Unless otherwise specified, test conditions are : V_{CC} = 12V
FM : f_{IF} = 10.7MHz, f_{mod} = 400Hz, Δf = 75kHz and V_{in} = 100dBμ
AM : f_{IF} = 455kHz, f_{mod} = 400Hz, m = 0.3 and V_{in} = 64dBμ
Test circuit is shown below.
2. Test point of V_{in} is :
FM : point A in test circuit, so that the voltage between pin 8 and ground is a half of V_{in} at point A.
AM : point B
3. BW_{mute} is tested under sampling of AQL = 1.0%

■ TERMINAL GUIDE (TOP VIEW)



■ BLOCK DIAGRAM



INTEGRATED CIRCUIT (HA11223)

■ ABSOLUTE MAXIMUM RATINGS ($T_a=25^{\circ}\text{C}$)

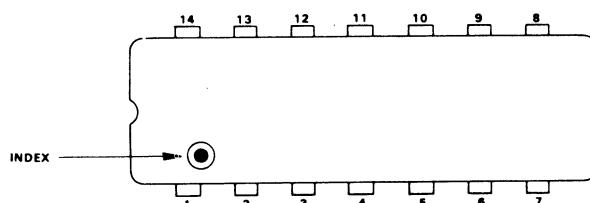
Item	Symbol	Rating	Unit
Supply Voltage	V_{CC}	16	V
Power Dissipation*	P_T	500	mW
Operating Temperature	T_{opr}	-20 to +75	$^{\circ}\text{C}$
Storage Temperature	T_{stg}	-55 to +125	$^{\circ}\text{C}$
Lamp Drive Current	Continuous	75	mA
	Peak	100	

*Value at $T_a=75^{\circ}\text{C}$

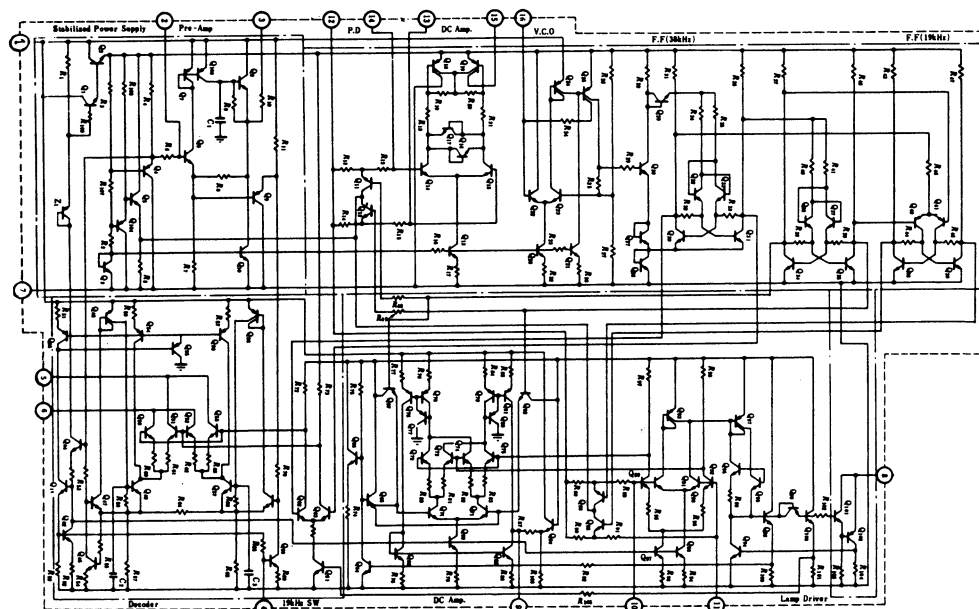
■ ELECTRICAL CHARACTERISTICS ($V_{CC}=13\text{V}$, $f=1\text{kHz}$, $T_a=25^{\circ}\text{C}$ unless otherwise noted)

Item	Symbol	Test Condition	min	typ	max	Unit
Input Impedance	Z_{in}		30	75	—	k Ω
Channel Separation	Sep	$P=30\text{mV}$, $L+R=270\text{mV}$	100Hz	—	40	dB
			1kHz	35	45	
			10kHz	—	40	
Stereo Total Harmonic Distortion	$ST, T.H.D$	$P=30\text{mV}$, $L+R=270\text{mV}$	100Hz	—	0.04	%
			1kHz	—	0.02	
			10kHz	—	0.05	
Output Voltage	V_{out}	$V_{in}=300\text{mV}$	185	240	310	mV
Channel Balance	C.B	$V_{in}=300\text{mV}$	—	0	—	dB
Monaural Total Harmonic Distortion	$Mono, T.H.D$	$V_{in}=300\text{mV}$	—	0.01	0.08	%
Pilot Level for Lamp ON	$L(ON)$		8	11.5	15	mV
Stereo Lamp Hysteresis			—	4	—	dB
Carrier Leak	C.L	$P=30\text{mV}$, $L+R=270\text{mV}$	19kHz	55	60	dB
			38kHz	—	35	
SCA Rejection Ratio	SCA R_{s1}	$P=30\text{mV}$, $L+R=270\text{mV}$; $SCA=30\text{mV}$, $f_{SCA}=67\text{kHz}$	—	80	—	dB
Signal-to-noise Ratio	S/N	$V_{in}=300\text{mV}$, $R_g=4.7\text{k}\Omega$	80	86	—	dB
Capture Range	C.R	$P=30\text{mV}$	—	± 3.5	—	%
Max Input Signal	V_{in}	$P=10\%$, $L+R=90\%$, $T.H.D \leq 0.5\%$	—	1.2	—	V
Total Current Drain	I_T		—	17	—	mA

■ TERMINAL GUIDE (TOP VIEW)



■ SCHEMATIC DIAGRAM



INTEGRATED CIRCUIT (HA1211)

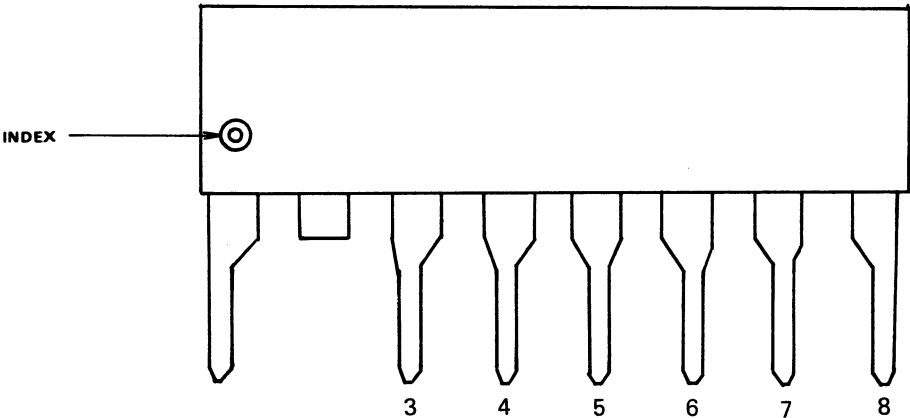
■ ABSOLUTE MAXIMUM RATINGS (Ta= 25°C)

Item	Symbol	Rating	Unit
Supply Voltage	$\bar{V}_{cc}$	20	V
Input Voltage	V_{in}	± 5	V
Power Dissipation	P_T	200	mW
Operating Temperature	T_{opr}	- 20 to + 70	°C
Storage Temperature	T_{stg}	- 55 to + 125	°C

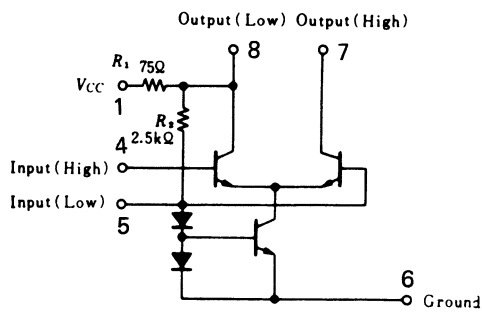
■ ELECTRICAL CHARACTERISTICS (Vcc= 12V, Ta= 25°C)

Item	Symbol	Test Condition	min	typ	max	Unit
Power Dissipation	P_T		—	110	170	mW
DC Total Current	I_T		5.4	9.15	14.1	mA
Power Gain	PG	$f = 10.7\text{MHz}$	27	31	—	dB
Forward Transadmittance	$ y_f $	$V_{in} = 10\text{mVrms}, f = 10.7\text{MHz}$	—	30	—	mS
Reverse Transadmittance	$ y_r $		—	0.002	—	mS
Input Conductance	g_i		—	0.4	—	mS
Input Capacitance	C_i		—	7.0	—	pF
Output Conductance	g_o		—	0.03	—	mS
Output Capacitance	C_o		—	2.5	—	pF
Noise Figure	NF	$f = 10.7\text{MHz}$	—	6	—	dB

■ TERMINAL GUIDE (TOP VIEW)



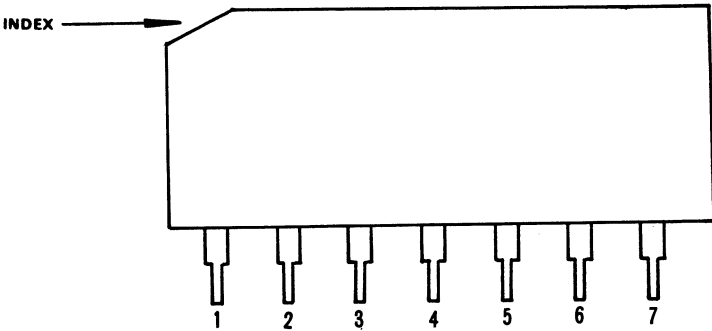
■ CIRCUIT SCHEMATIC



INTEGRATED CIRCUIT (TA7136P)

DEVICE TYPE	APPLICATION	ABSOLUTE MAXIMUM RATINGS (T _A = 25 °C)				ELECTRICAL CHARACTERISTICS(T _A =25 °C) Typical Values				Manufacture
		Supply Voltage	Power Dissipation	Operating Temperature Range	Storage Temperature Range	Supply Current	Voltage Gain (Open Loop)	Maximum Output Voltage	Equivalent Input Noise Voltage	
		(V)	(mW)	(°C)	(°C)	(mA)	(dB)	(Vrms)	(μ Vrms)	
TA7136P	Preamplifier	40	400	-25 75	-55 125	3.1	92	7.0	1.0	TOSHIBA

Terminal Guide (Side View)



Schematic Diagram

