440MHz FM TRANSCEIVER

TH-41BT

SERVICE MANUAL

KENWOOD

KENWOOD CORPORATION

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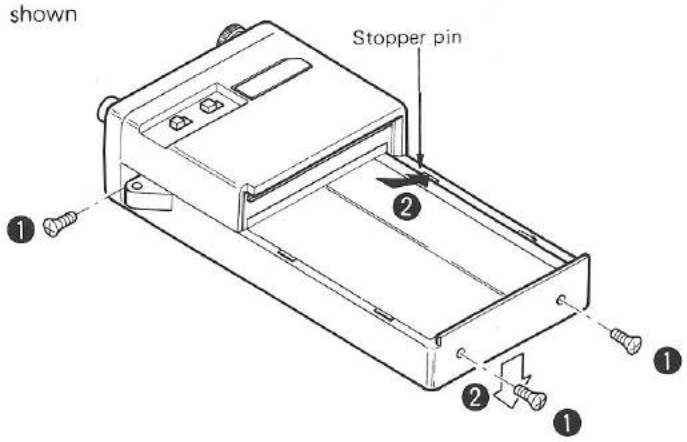
DISASSEMBLY

TOP CASE REMOVE METHOD

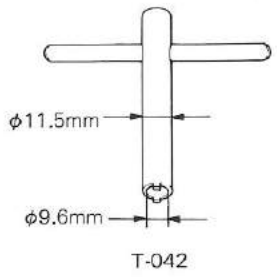
❶ Remove screw (M2 x 5) 3.
❷ Remove front case as allow mark direction holding the stop pin with something ⊖ screw driver as shown right.



FRONT PANEL REMOVE METHOD

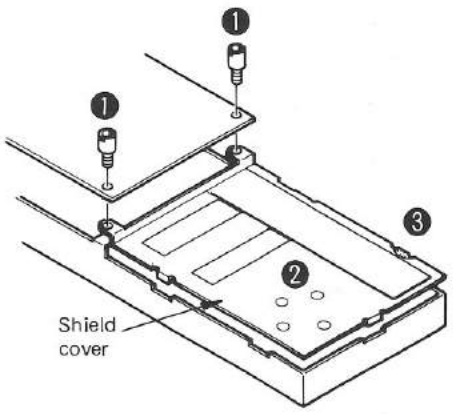
❶ Remove screw on RCA connector and AF, SQ knob.
❷ Remove screw (M2 x 8) 1.
❸ Remove front panel by push stopper with screw driver as shown below.

TOOL



SHIELD COVER REMOVE METHOD

❶ Remove the top boss which tightened the IF unit.
❷ Remove solder at four spots with solder wick.
❸ Remove solder heating spot with solding iron.



CIRCUIT DESCRIPTION

Model	Destination	Frequency range (MHz)	RPT-SHIFT Freq' (MHz)	TONE	Ref'
TH-41BT	K,M1	440.00 – 449.995	±5	67.0~250.3Hz EIA	
	M2	430.00 – 439.995			

K : U.S.A. M : Gen.

Table 1 Destination chart

RX Section

The TH-41BT Transceiver uses a superheterodyne receiver section. The first IF is 21.6MHz and the second IF is 455kHz. Ceramic filters are used in both IF's.

A received signal is RF amplified by Q1 and Q2 2SC2171H and filtered by BPF (Band Pass Filter) L6–L9. The BPF output is fed to first mixer Q3 : 2SC2671H where it is mixed with the first local oscillator Phase Locked Loop (PLL) output signal. The first mixer output passes through a 21.6MHz Monolithic Crystal Filter (MCF) become as the first IF signal. This signal is then amplified by Q4 : 2SC2714Y and applied to IF unit Q1 : MC3359P.

Item	Rating
Noninal center frequency (fo)	21.6MHz
Pass bandwidth	fo ± 7.5kHz or more at 3dB
Attenuation bandwidth	fo ± 25kHz or more at 18dB
Guaranteed attenuation	30dB or more within fo ±1MHz Spurious : 15dB or more at fo ~ fo +500kHz.
Ripple	0.5dB or less
Insertion loss	1.0dB or less
Terminal impedance	1.5kΩ/1.5pF

Table 2 MCF (L71-0247-05) (RF unit F1)

Item	Rating
Center frequency of 6dB bandwidth (fo)	455kHz ± 1.5kHz
6dB bandwidth	± 7.5kHz or more
40dB bandwidth	± 15kHz or less
Ripple	1.5dB or less (455 ± 5kHz)
Guaranteed attenuation	27dB or more within fo ± 100kHz
Insertion loss	6dB or less at 455kHz
Terminal impedance	1.5kΩ

Table 3 Ceramic filter (L72-0335-05) (IF unit F1)

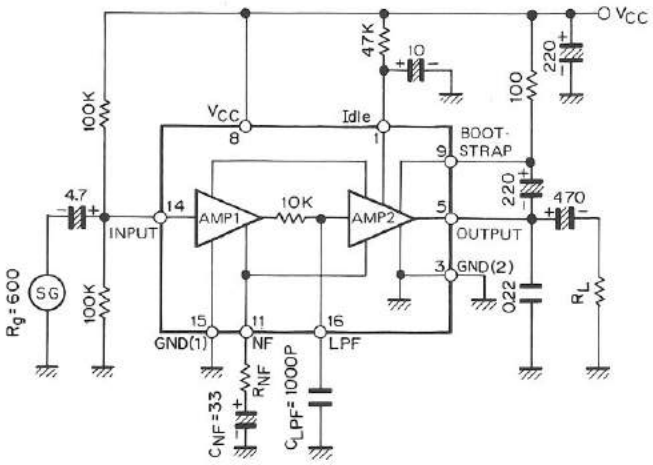


Fig. 1 TA7331F Block diagram (IF unit Q2)

IC Q1 contains the second mixer, second local oscillator, second IF amp and limiters, FM demodulator, squelch noise amp and associated control circuits.

The demodulated output from Q1 is first sent through the volume control VR1, and is then amplified by Q2 : TA7331F on the IF unit to drive the speaker.

Squelch rectifiers D1 and D2, which are external to Q1, detect the high frequency noise component from the demodulation output Q1. This signal is first applied to Q1 pin 12 via the squelch control VR2. The noise component input to pin 12 is amplified and output at pin 13. The output at pin 13 is rectified by D1 and D2 : 1N60A and fed to pin 14.

When rectified DC voltage is applied to pin 14, the squelch trigger circuit functions, pin 16 is grounded and Q4 : 2SC2412K and Q3 : 2SB698(E,F) turn off. When Q3 turns off, power to the AF amplifier IC : TA7331F is therefore audio output is off.

When a signal (carrier) is received, the noise normally present at the demodulator output is reduced and the squelch trigger circuit does not function. Therefore, Q4 and Q3 turn on, the AF IC is powered and audio output is available.

CIRCUIT DESCRIPTION

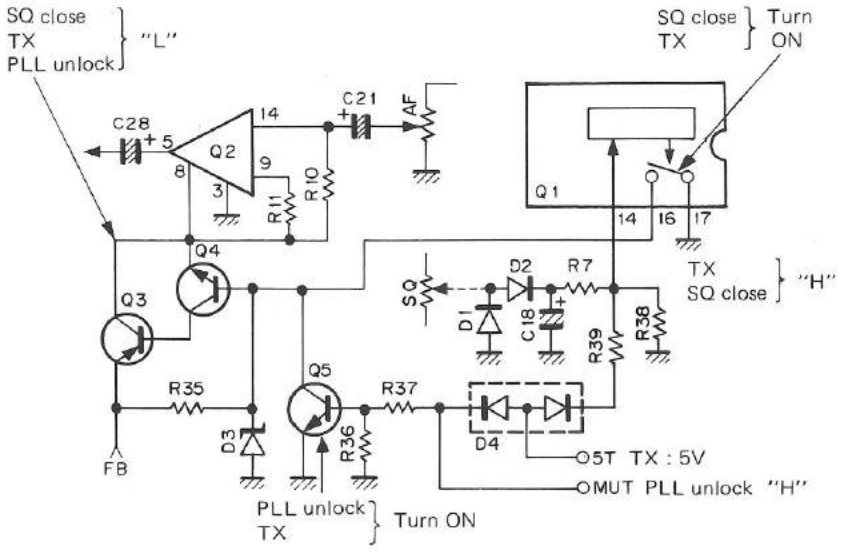


Fig. 2 Squelch-mute circuit

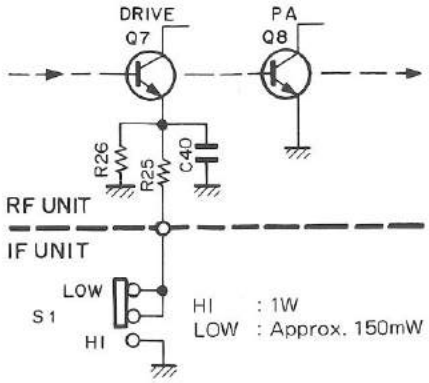


Fig. 3 Power select circuit

TX Section

The PLL VCO (Voltage Controlled Oscillator) frequency during transmission mode is 1/3 the actual transmitting frequency. The output of VCO buffer amp Q16 : 2SC2671H is tripled by Q5 : 2SC2671H and fed through BPF L11, L12 to obtain the final transmission frequency. The output from this BPF is fed to pre-driver Q6 : 2SC2671H and driver Q7 : 2SC3019 and is final amplified Q8 : 2SC2671H.

	VCBO	VEBO	VCEO	IC	PC	PC	Tj	Tstg	Ta
Test Conditions			RBE = ∞ Ω		Tc = 25°C				25 ± 3°C
Maximum Rating	35V	4V	17V	1A	10W		+175°C	−55 ~ +175°C	

Table 4 2SC3101 Max. rating (RF unit Q8)

The signals from either the microphone or AF circuits are amplified by mic amp Q6 : NJM4558M and this signal is applied to D14 : 1S2208 in the VCO circuit as modulation. Transmitter section peripheral circuit consist of the power output level selector circuit and generator circuit.

To select the power output level emitter resistor R25 (2.2Ω) for driver Q7 is controlled by Hi/Low switch S1 on IF unit. When R25 is grounded, the output power is about 1W. When R25 is opened, the output power becomes about 150mW (through R24, 26Ω).

The tone circuit is an oscillator circuit for repeater access. The system differs according to country.

1) In the TH-41BT, a DTMF (Dual-Tone Multi Frequency) system is used. When any key is depressed, the unit enters mode with DTMF modulation.

Programable tone encoder unit be installed in the TH-41BT. With a tone encoder installed, one of 37 standard EIA Tone frequencies between 67.00 and 250.3Hz can be output. When the tone switch is on, the programmed tone frequency is continuously output along with any voice or DTMF modulation.

#	EIA Specification Group	Hz	Program Lines (ON...1, OFF...0) 1	2	3	4	5	6	#	EIA Specification Group	Hz	Program Lines (ON...1, OFF...0) 1	2	3	4	5	6
1	A	67.0	1	1	1	1	1	1	21	A	141.3	1	0	0	0	0	0
2	B	71.9	1	1	1	1	0	1	22	B	146.2	0	1	1	1	0	1
3	C	74.4	1	1	1	0	1	1	23	A	151.4	0	1	1	1	0	0
4	A	77.0	1	1	1	1	0	0	24	B	156.7	0	1	1	0	0	1
5	C	79.7	1	1	0	1	1	1	25	A	162.2	0	1	1	0	0	0
6	B	82.5	1	1	1	0	0	1	26	B	167.9	0	1	0	1	0	1
7	C	85.4	1	1	0	0	1	1	27	A	173.8	0	1	0	1	0	0
8	A	88.5	1	1	1	0	0	0	28	B	179.9	0	1	0	0	0	1
9	C	91.5	1	0	1	1	1	1	29	A	186.2	0	1	0	0	0	0
10	B	94.8	1	1	0	1	0	1	30	B	192.8	0	0	1	1	0	1
11	A	100.0	1	1	0	1	0	0	31	A	203.5	0	0	1	1	0	0
12	B	103.5	1	1	0	0	0	1	32	B	210.7	0	0	1	0	0	1
13	A	107.2	1	1	0	0	0	0	33	A	218.1	0	0	1	0	0	0
14	B	110.9	1	0	1	1	0	1	34	B	225.7	0	0	0	1	0	1
15	A	114.8	1	0	1	1	0	0	35	A	233.6	0	0	0	1	0	0
16	B	118.8	1	0	1	0	0	1	36	B	241.8	0	0	0	0	0	1
17	A	123.0	1	0	1	0	0	0	37	A	250.3	0	0	0	0	0	0
18	B	127.3	1	0	0	1	0	1									
19	A	131.8	1	0	0	1	0	0									
20	B	136.5	1	0	0	0	0	1									

CIRCUIT DESCRIPTION

PLL Circuit

In the reception mode, the VCO operates at a frequency of 1/3 of the first local oscillator (139.4666–142.798333MHz [**K,M1** : 440.000–449.995MHz] 136.1333–139.4650 MHz [**M2** : 430.000–439.995MHz]). During reception, D13 turns ON to connect C105 into the oscillator circuit, which causes the oscillation frequency of the VCO to drop. In transmission mode, the VCO operates at a frequency of 1/3 the transmission frequency (146.666–149.99833MHz [**K,M1** : 440.000–449.995MHz] 143.3333–146.6650 MHz [**M2** : 430.000–439.995MHz]). The VCO output is amplified by Q15 : 2SC2714(Y) and mixed with the HET oscillator output at PLL mixer Q10 : 2SC2668(Y).

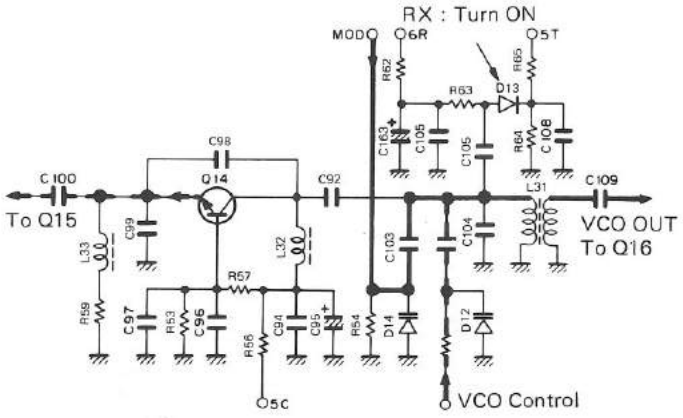


Fig. 4 VCO circuit

The HET oscillator Q9 : 2SC3121 outputs the crystal frequency as selected by the OFF-SET switch. The output from Q9 passes through BPF L26 and L27 and is now tripled the original crystal frequency.

PLL mixer Q10 output next passes through an Low Pass Filter (LPF) to obtain 3.333–6.6633MHz signal. This is amplified by Q11 : 2SC2668(Y) and input to programmable counter Q3 : TC9122P. The signal input to Q11 is divided by 1/1000 at 440.00MHz **K,M1** (430.00MHz **M2**) and 1/999 at 449.99MHz **K,M1** (439.99MHz **M2**) with the divide ratio being determined by the thumbwheel frequency selector switch (S2). Q3 output is compared with the comparator reference signal (3.3...kHz) by phase comparator Q13 : TC5081AP. The 6.8266MHz crystal oscillator standard is divided by 1/2048 by Q12 : TC5082P to obtain the reference frequency output.

The DC output from phase comparator Q13 is fed through passive Loop Filter (LPF) and fed to D12 : 1S2208 in the VCO circuit to control the VCO frequency.

PLL circuits peripheral circuits are the +5kHz shift circuit and the unlock detect circuit. The +5kHz shift circuit is used to obtain a 5kHz step for both TX and RX frequencies. When 5K switch S3 is off, D4–D7 in the PLL HET oscillator circuit are on and the TC12–TC15 and C155–C158 are shorted circuit. When the 5K switch is on, the diodes turn off and trimmers TC12–TC15 and capacitors C155–C158 are series connected to their crystals. When the capacitors are connected in series to the crystals, the oscillator frequency increases. The trimmers are now used to adjust the frequency +5kHz.

The unlock circuit will be described in the following Control circuits section.

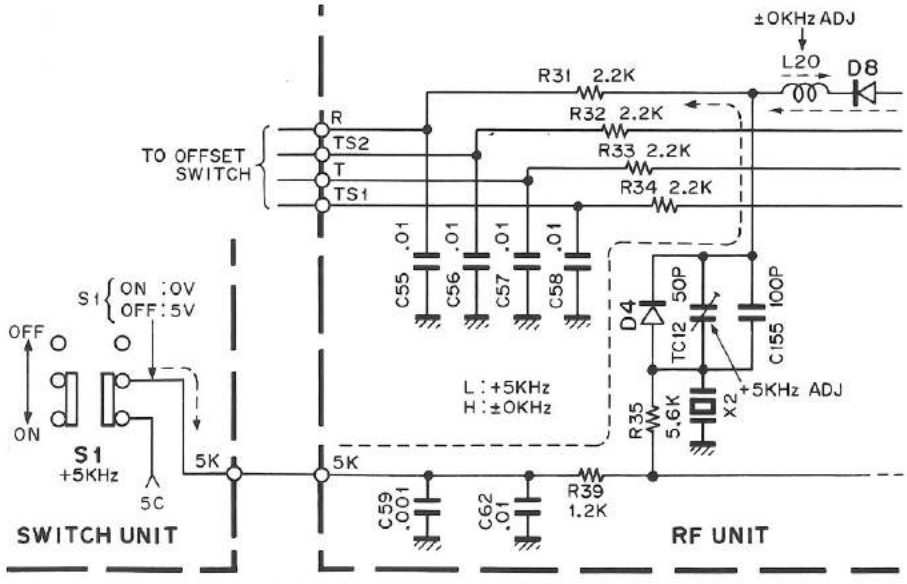
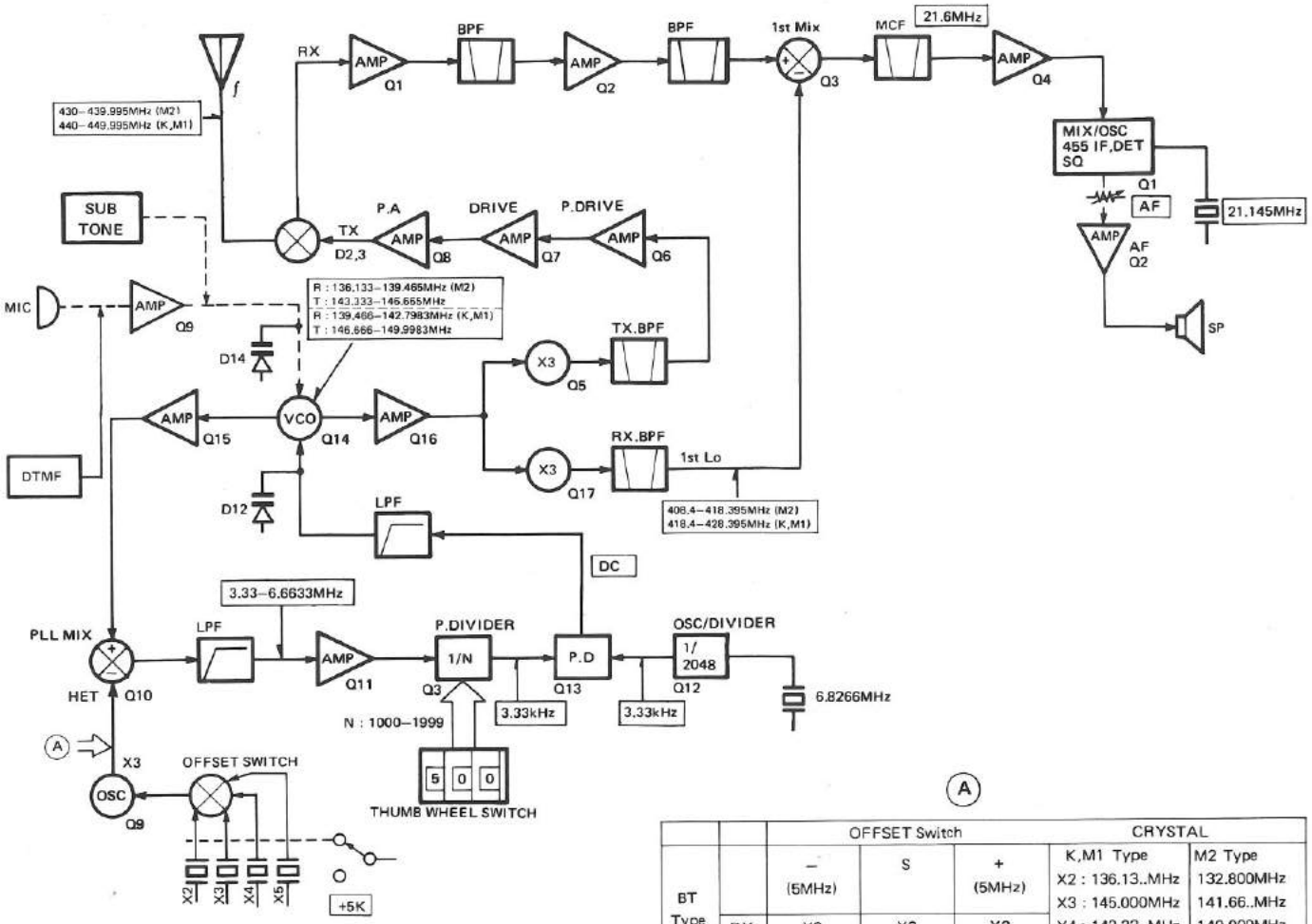


Fig. 5 +5kHz shift circuit (RX simplex mode)

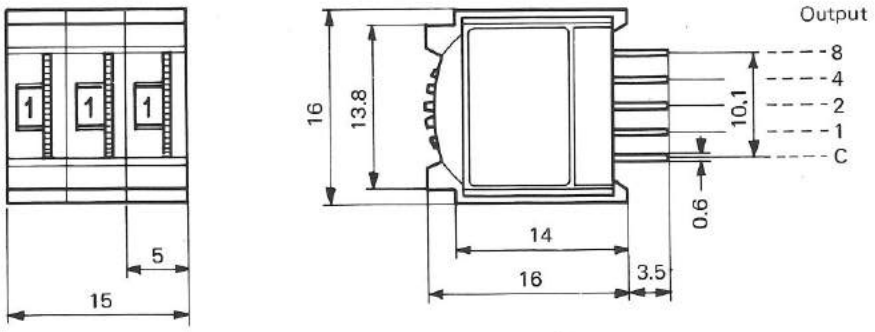
CIRCUIT DESCRIPTION



Ⓐ

BT Type		OFFSET Switch – (5MHz)	OFFSET Switch S	OFFSET Switch + (5MHz)	CRYSTAL K,M1 Type	CRYSTAL M2 Type
					X2 : 136.13..MHz	132.800MHz
					X3 : 145.000MHz	141.66..MHz
	RX	X2	X2	X2	X4 : 143.33..MHz	140.000MHz
	TX	X5	X4	X3	X5 : 141.66..MHz	138.33..MHz

Fig. 6 Frequency configuration



Dial \ Output	8	4	2	1
0				
1				•
2			•	
3			•	•
4		•		
5		•		•
6		•	•	
7		•	•	•
8	•			
9	•			•

• : Connect to the common pin

Fig. 7 Thumb wheel switch (S59-3401-05) (Switch unit S2)

CIRCUIT DESCRIPTION

Control Circuits

In the regulators and PTT controls control circuit, a 5C (5V always present, or Common) DC source is obtained from regulator Q19 : LVC517. The 5C source is supplied in both TX and RX modes and is also used as a reference voltage for the 6R (6V RX only), 5T (5V TX only) and AVR's (Automatic Voltage Regulators).

The 6R output from Q20 : 2SC1037K is supplied to the reception section and the 5T output from Q18 is supplied to the transmitter section.

When the PTT switch is depressed, Q7 : 2SA1037K and Q8 : 2SA2412K turn on and the TC line is grounded to place the unit in the TX mode.

	TC	Q23	Q26	Q22	Q24	6R	5T
RX	H	ON	OFF	ON	OFF	O	X
TX	L	OFF	ON	OFF	ON	X	O

Table 5 Function of power supply circuit

- PLL unlock circuit (If the PLL becomes unlocked for any reason), an unlock "H" signal is output from Q13 : TC5081AP pin 1. This unlock signal passes through D15 : MA152WA/2 to control Q23 and Q26 and forces into the reception mode.
  When the unlock signal is generated, "H" signal is fed to the MUT line through D15/2 to stop TX AF Output Muting.
- TX AF Output Muting
  In the transmission mode, the 5T signal is supplied to Q5 : 2SC2412K and Q1 : MC3359P via IF unit D4 : MA152WA to stop AF power output IC operation.

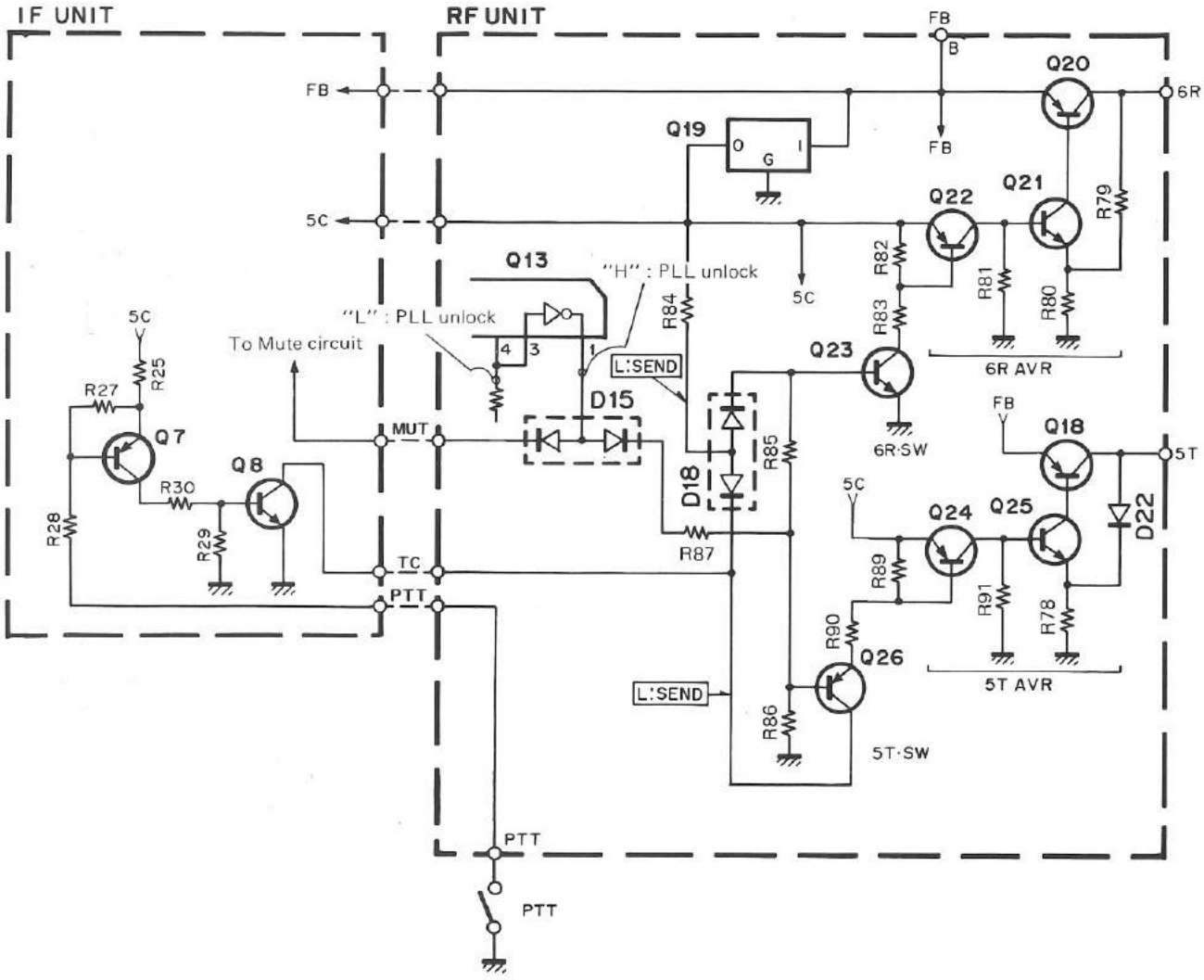


Fig. 8 Control circuit

CIRCUIT DESCRIPTION

Parts No.	W09-0334-05	W09-0335-05
Input power	AC 120V 60Hz 3W or less	AC 220V 50/60Hz 3W or less
Output	DC 8.7V 32mA at 0mA/13.5V or less	
Weight	Approx. 120g	Approx. 210g
Destination	U.S.A	Gen. M1,M2
Ref'		

Table 6 Charger specifications

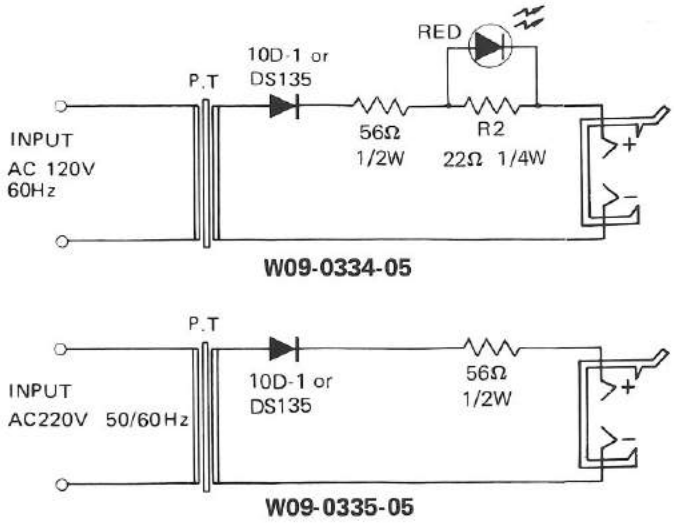
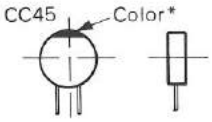


Fig. 9 Charger schematic diagram

PARTS LIST

CAPACITORS CC 45 TH 1H 220 J
1 2 3 4 5 6

1 = Type ..... ceramic, electrolyic, etc.
2 = Shape .....round, square, etc.
3 = Temp. coefficient
4 = Voltage rating
5 = Value
6 = Tolerance



- **Capacitor value**

0 1 0 = 1pF
1 0 0 = 10pF
1 0 1 = 100pF
1 0 2 = 1000pF = 0.001μF
1 0 3 = 0.01μF

2 2 0 = 22pF
1st number | Multiplier
2nd number

- **Temperature Coefficient**

1st Word	C	L	P	R	S	T	U
Color*	Black	Red	Orange	Yellow	Green	Blue	Violet
ppm/°C	0	−80	−150	−220	−330	−470	−750

2nd Word	G	H	J	K	L
ppm/°C	± 30	± 60	± 120	± 250	± 500

Example CC45TH = −470±60 ppm/°C

- **Tolerance**

Code	C	D	G	J	K	M	X	Z	P	No code
(%)	± 0.25	± 0.5	± 2	± 5	± 10	± 20	+40 −20	+80 −20	+100 −0	More than 10μF −10~+50 Less than 4.7μF −10~+75

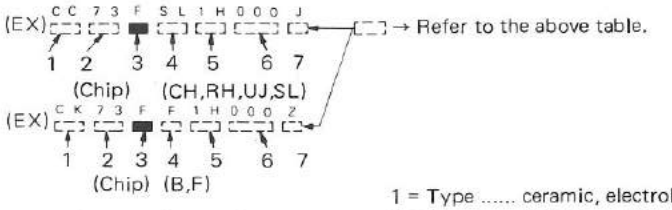
Code	B	C	D	F	G
(pF)	± 0.1	± 0.25	± 0.5	± 1	± 2

Less than 10 pF

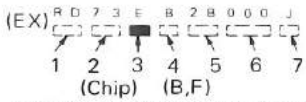
- **Rating voltage**

1st word \ 2nd word	A	B	C	D	E	F	G	H	J	K	V
0	1.0	1.25	1.6	2.0	2.5	3.15	4.0	5.0	6.3	8.0	–
1	10	12.5	16	20	25	31.5	40	50	63	80	35
2	100	125	160	200	250	315	400	500	630	800	–
3	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	–

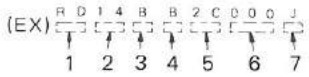
- **Chip capacitors**



- **Chip resistor (Carbon)**



- **Carbon resistor (Normal type)**



1 = Type ..... ceramic, electrolytic, etc.
2 = Shape ..... round, square, etc.
3 = Dimension
4 = Temp. coefficient
5 = Voltage rating
6 = Value
7 = Tolerance.

Dimension

Dimension code	L	W	T
Empty	5.6 ± 0.5	5.0 ± 0.5	Less than 2.0
E	3.2 ± 0.2	1.6 ± 0.2	Less than 1.25
F	2.0 ± 0.3	1.25 ± 0.2	Less than 1.25

Dimension

Dimension code	L	W	T	Wattage
E	3.2 ± 0.2	1.6 ± 0.2	0.57	2B
F	2.0 ± 0.3	1.25 ± 0.2	0.45	2A

Rating wattage

Cord	Wattage	Cord	Wattage	Cord	Wattage
2A	1/10W	2E	1/4W	3A	1W
2B	1/ 8W	2H	1/2W	3D	2W
2C	1/ 6W				

Dimension

PARTS LIST

SEMICONDUCTOR

N : New parts

Item	Re-marks	Part No.
Diode		1S2588
		1SS99
		1SS133
		1N60PSPA
		BA282
		MA856
		MI301
Vari-cap		1S2208
Zener Diode		MTZ6.8JB
LED		GL9PR24
Chip Diode		1S1555
		1SS181
		MA152WA
TR		2SB698(E,F)
		2SC2668(Y)
		2SC2671(H)
		2SC3019
		2SC3101
Chip TR		2SA1037K(R)
		2SA1037K(Q)
		2SA1162(GR)
		2SA1162(Y)
		2SC2412K(Q)
		2SC2712(Y)
		2SC2714(Y)
		2SC3121
IC		LR40872
		LVC517
		MC3359P
		MX315
		NJM4558M
	N	TA7331F
		TC5081AP
		TC5082P-G
		TC9122P

PARTS LIST

* New Parts
Parts without **Parts No.** are not supplied.
Les articles non mentionnes dans le **Parts No.** ne sont pas fournis.
Telle ohne **Parts No.** werden nicht geliefert.

Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
			TH-41BT			
1	1A		A02-0675-12	CASE (BOTTOM)		
2	3B	*	A02-0743-01	CASE (TOP) 440MHZ	KM1	
2	3B	*	A02-0744-01	CASE (TOP) 430MHZ	M2	
4	2A		A21-0768-12	DRESSING PANEL		
5	3B	*	A02-0745-05	CASE ASSY (UPPER)	KM1	
5	3B	*	A02-0746-05	CASE ASSY (UPPER)	M2	
-			A02-0695-13	DC ADAPTER CASE(W09-0344-05)		
7	1A	*	B42-2449-04	LABEL (FCC)		
8	3B		B04-0409-04	SP METAL		
9	3A		B05-0733-04	SP SARAN		
10	2B	*	B40-3678-04	MODEL NAME PLATE(440MHZ)	KM1	
10	2B	*	B40-3679-04	MODEL NAME PLATE(430MHZ)	M2	
11	1B		B42-2366-04	LABEL (HI/LOW,OFFSET)		
12	1D		B46-0410-10	WARRANTY CARD	K	
13	1D	*	B50-8132-00	INSTRUCTION MANUAL		
14	3B		B43-1088-04	BADGE		
15	2D		B42-2450-04	LABEL (FREQ)ACSY		
-			B40-3696-04	MODEL NAME PLATE		
-			B42-2344-08	LABEL (KEY BOARD)		
-			B42-2396-04	SERIAL LABEL		
C1			CC45SL1H560J	CERAMIC 56PF J		
C1			CC73FCH1E103K	CHIP C 0.010UF K		
C2			CE04CW0J100M	ELECTRO 10UF 6.3WV		
C2			CK45B1H102K	CERAMIC 1000PF K		
C3			CC73FCH1E103K	CHIP C 0.010UF K		
C3			CQ92M1H473K	MYLAR 0.047UF K		
C4			CE04CW0J100M	ELECTRO 10UF 6.3WV		
C5			CE04CW1C4R7M	ELECTRO 4.7UF 16WV		
C8			CK45F1H103Z	CERAMIC 0.010UF Z		
17	1A		E23-0432-04	TERMINAL (FOR JUNCTION)		
18	1B		E23-0458-04	TERMINAL (INSIDE)		
22	1B		F10-1314-14	SHIELDING PLATE		
24	2B		F11-0885-04	SHIELDING COVER		
25	1A		F19-0637-04	SWITCH MASK(A) HI/LOW		
26	1B		F19-0638-04	SWITCH MASK(B) OFFSET		
27	2A		F20-0520-04	INSULATING SHEET(B) SP		
-			F07-0859-04	COVER (ADAPTER)		
-			F11-0873-04	SHIELDING COVER(VCO)		
-			F20-0538-14	INSULATING BOARD		
32	1B		G13-0802-04	CUSHION		
33	2A		G13-0803-04	CUSHION (PTT)		
-			G10-0633-04	NON-WOVEN FABRIC		
-			G53-0515-04	PACKING (TONE IC)		
37	3C	*	H01-8033-03	ITEM CARTON BOX(440MHZ)	KM1	
37	3C	*	H01-8034-03	ITEM CARTON BOX(430MHZ)	M2	
38	3D		H10-2592-02	POLYSTYRENE FOAMED FIXTURE(BTM		
39	1C		H10-2598-02	POLYSTYRENE FOAMED FIXTURE(UPR		
40	2D		H25-0029-04	PROTECTION BAG (EARPHONE)		
41	2C		H25-0096-04	PROTECTION BAG (BATT)		
42	2D		H25-0703-14	PROTECTION BAG (MAIN)		

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46	2D		J25-3251-05	FLEXIBLE PCB (MAIN-SUB)		
48	1A,1B		J32-0785-14	BOSS		
49	3A		J39-0409-14	MIC SPACER		
50	2D		J69-0306-04	HAND STRAP		
51	3A		J69-0309-05	O RING (AF,SQL)		
-			J25-3469-05	FLEXIBLE PCB (KEY BOARD-TONE		
55	2A		K27-0468-04	KNOB(BUTTON)A TONE		
56	2A		K27-0469-04	KNOB(BUTTON)B +5KHZ		
57	2A		K29-3012-04	KNOB ASSY (A) AF		
58	3A		K29-3013-04	KNOB ASSY (B) SQL		
59	3A		K29-3014-14	KNOB(LEVER) PTT		
X1			L78-0010-05	CRYSTAL (3.58MHZ)		
A	1B		N09-0683-05	SCREW (M2X4)		
B	2A		N30-2004-41	PAN HEAD MACHINE SCREW(SW PCB)		
C	2B,3B		N33-2005-45	OVAL HEAD MACHINE SCREW(CASE)		
D	1A,1B		N35-2005-45	BINDING HEAD MACHINE SCREW		
E	3B		N39-2050-45	PAN HEAD MACHINE SCREW (CASE)		
F	2A		N39-2080-45	PAN HEAD MACHINE SCREW (PANEL)		
VR1			R12-3449-05	TRIMMING POT. (10K)		
S1			S59-6402-05	SWITCH (6P)		
79	3A		T07-0235-05	LOUDSPEAKER(FULLRANGE)		
80	2D		T18-0055-05	EARPHONE (ACSY)		
81	2D		T90-0341-05	ANTENNA (ACSY)		
82	3A		T91-0312-15	MICROPHONE		
D101			GL9PR24	LED		
Q1			2SC2412K(Q)	CHIP TRANSISTOR		
Q1			2SC2712(Y)	CHIP TRANSISTOR		
Q2			2SA1037K(Q)	CHIP TRANSISTOR		
Q2			2SA1162(Y)	CHIP TRANSISTOR		
Q3			LR40872	IC(TONE DIALER)		
90	2C		W09-0333-05	NI-CD BATTERY ASSY		
91	1C		W09-0334-15	BATTERY CHARGER(120V)ACSY	K	
91	1C		W09-0335-25	BATTERY CHARGER(220V)ACSY	M1M2	
96	2B		X41-1590-12	SWITCH UNIT		
97	2B		X44-1640-11	RF UNIT	KM1	
97	2B		X44-1640-71	RF UNIT	M2	
98	1A		X48-1410-12	IF UNIT	KM1	
98	1A		X48-1410-62	IF UNIT	M2	
-			X52-1320-11	TONE UNIT		
SWITCH UNIT (X41-1590-12)						
C1 -14			CK73FB1H102K	CHIP C 1000PF K		
C17 ,18			CK73FB1H102K	CHIP C 1000PF K		
L1		*	L33-0682-05	CHOKE COIL		
L2			L92-0110-05	BEASE CORE		
R2			RD14CB2C103J	RD 10K J 1/6W		
R6			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R7 -9			R92-0670-05	CHIP R 0 OHM		
R11			RD14CB2C101J	RD 100 J 1/6W		
VR1		*	R05-3427-15	POTENTIOMETER (10KB) AF		

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VR2		*	R05-3428-05	POTENTIOMETER (10KB) SOL		
S2		*	S59-3401-05	THUMB WHEEL SWITCH		
S3 ,4			S40-2445-05	PUSH SWITCH (SELF LOCK)		
Q3			TC9122P	IC		
RF UNIT (X44-1640-XX) (-11 : K,M1 -71 : M2)						
C1			CC73FCH1H040C	CHIP C 4.0PF C		
C2			CC73FCH1H080D	CHIP C 8.0PF D		
C3			CC73FCH1H220J	CHIP C 22PF J		
C4			CK73FB1H102K	CHIP C 1000PF K		
C5			CC73FCH1H050C	CHIP C 5.0PF C		
C6			CC73FCH1H0R5C	CHIP C 0.5PF C		
C7			CC73FCH1H080D	CHIP C 8.0PF D		
C8			CC73FCH1H150J	CHIP C 15PF J		
C9 -11			CK73FB1H102K	CHIP C 1000PF K		
C12			CC73FCH1H030C	CHIP C 3.0PF C		
C13			CC73FCH1HR75C	CHIP C 0.75PF C	M2	
C13			CC73FCH1H0R5C	CHIP C 0.5PF C	KM1	
C14			CC73FCH1H080D	CHIP C 8.0PF D		
C15			CC73FCH1H330J	CHIP C 33PF J		
C16			CC73FCH1H030C	CHIP C 3.0PF C		
C18			CK73FB1E103K	CHIP C 0.010UF K		
C19 ,20			CK73FB1H102K	CHIP C 1000PF K		
C21			CK73FB1E223K	CHIP C 0.022UF K		
C22			CK73FB1H102K	CHIP C 1000PF K		
C23			CC73FCH1H030C	CHIP C 3.0PF C		
C24 -26			CK73FB1H102K	CHIP C 1000PF K		
C27			CC73FCH1H050C	CHIP C 5.0PF C		
C28			CC73FCH1H010C	CHIP C 1.0PF C		
C29			CC73FCH1H070D	CHIP C 7.0PF D		
C30			CC73FCH1H100D	CHIP C 10PF D		
C31 -34			CK73FB1H102K	CHIP C 1000PF K		
C35			CC73FCH1H030C	CHIP C 3.0PF C		
C36			CC73FCH1H060D	CHIP C 6.0PF D		
C37			CC73FCH1H100D	CHIP C 10PF D		
C38 -41			CK73FB1H102K	CHIP C 1000PF K		
C42			CC73FCH1H030C	CHIP C 3.0PF C		
C43			CK73FB1H102K	CHIP C 1000PF K		
C44			CC73FCH1H220J	CHIP C 22PF J		
C45			CK73FB1H102K	CHIP C 1000PF K		
C46			CE04CW1C4R7M	ELECTRO 4.7UF 16WV		
C47			CK73FB1H102K	CHIP C 1000PF K		
C49 -51			CC73FCH1H050C	CHIP C 5.0PF C		
C52			CC73FCH1H080D	CHIP C 8.0PF D		
C53			CC73FCH1H150J	CHIP C 15PF J		
C54			CC45CH1H080D	CERAMIC 8.0PF D		
C55 -58			CK73FB1E103K	CHIP C 0.010UF K		
C59			CK73FB1H102K	CHIP C 1000PF K		
C60 -66			CK73FB1E103K	CHIP C 0.010UF K		
C67			CC73FTH1H470J	CHIP C 47PF J		
C68			CC73FTH1H220J	CHIP C 22PF J	KM1	
C68			CC73FTH1H270J	CHIP C 27PFF J	M2	
C69			CK73FB1H102K	CHIP C 1000PF K		
C70 ,71			CC73FCH1H070D	CHIP C 7.0PF D		

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C72			CC73FCH1HR75C	CHIP C	0.75PF	C		
C73			CC73FCH1H070D	CHIP C	7.0PF	D		
C74			CC73FCH1H030C	CHIP C	3.0PF	C		
C75 ,76			CK73FB1H102K	CHIP C	1000PF	K		
C77 ,78			CC73FCH1H390J	CHIP C	39PF	J		
C79 ,80			CK73FB1H471K	CHIP C	470PF	K		
C81 -83			CK73FB1H102K	CHIP C	1000PF	K		
C84			CE04CW1C100M	ELECTRO	10UF	16WV		
C85			CK73FB1H102K	CHIP C	1000PF	K		
C87 ,88			CC73FCH1H220J	CHIP C	22PF	J	KM1	
C87 ,88			CC73FCH1H390J	CHIP C	39PF	J	M2	
C89			CK73FB1H102K	CHIP C	1000PF	K		
C90			CE04CW0J100M	ELECTRO	10UF	6.3WV		
C91			CC73FCH1H0R5C	CHIP C	0.5PF	C		
C92			CC73FCH1H100D	CHIP C	10PF	D		
C93 ,94			CK73FB1H102K	CHIP C	1000PF	K		
C95			CE04CW1V2R2M	ELECTRO	2.2UF	35WV		
C96 ,97			CK73FB1H102K	CHIP C	1000PF	K		
C98			CC73FCH1H070D	CHIP C	7.0PF	D		
C99			CC73FCH1H100D	CHIP C	10PF	D		
C100			CC73FCH1H020C	CHIP C	2.0PF	C		
C101,102			CK73FB1H472K	CHIP C	4700PF	K		
C103			CC73FCH1H100D	CHIP C	10PF	D		
C104			CC73FCH1H040C	CHIP C	4.0PF	C	KM1	
C104			CC73FCH1H060D	CHIP C	6.0PF	D	M2	
C105			CC73FCH1H040C	CHIP C	4.0PF	C		
C106-108			CK73FB1H102K	CHIP C	1000PF	K		
C109			CC73FCH1H100D	CHIP C	10PF	D		
C110-112			CK73FB1H102K	CHIP C	1000PF	K		
C113			CC73FCH1H050C	CHIP C	5.0PF	C		
C114,115			CK73FB1H102K	CHIP C	1000PF	K		
C116			CC73FCH1H040C	CHIP C	4.0PF	C		
C117			CC73FCH1HR75C	CHIP C	0.75PF	C		
C118			CC73FCH1H080D	CHIP C	8.0PF	D		
C120			CK73FB1H102K	CHIP C	1000PF	K		
C121			CE04CW1C470M	ELECTRO	47UF	16WV		
C122			CE04CW1H010M	ELECTRO	1.0UF	50WV		
C123			C90-2012-05	ELECTRO	100UF	10WV		
C127			CK73FB1H102K	CHIP C	1000PF	K		
C129-132			CK73FB1H102K	CHIP C	1000PF	K		
C134			CE04CW0J100M	ELECTRO	10UF	6.3WV		
C135			CK73FB1H102K	CHIP C	1000PF	K		
C136			CS15E1A100M	TANTAL	10UF	10WV		
C137			CK73FB1E103K	CHIP C	0.010UF	K		
C139			CE04CW1A101M	ELECTRO	100UF	10WV		
C140-147			CK73FB1H102K	CHIP C	1000PF	K		
C148			CE04CW1A101M	ELECTRO	100UF	10WV		
C149-152			CK73FB1H102K	CHIP C	1000PF	K		
C154			CK73FB1H102K	CHIP C	1000PF	K		
C155			CC73FCH1H470J	CHIP C	47PF	J		
C156			CC73FCH1H820J	CHIP C	82PF	J		
C157			CC73FCH1H680J	CHIP C	68PF	J	KM1	
C158			CC73FCH1H680J	CHIP C	68PF	J	M2	
C158			CC73FCH1H820J	CHIP C	82PF	J	KM1	
C159-161			CK73FB1H102K	CHIP C	1000PF	K		

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C162			CC73FCH1H150J	CHIP C 15PF J		
C163			CE04CW1C4R7M	ELECTRO 4.7UF 16WV		
C164			CC73FCH1H030C	CHIP C 3.0PF C		
C165			CK73FB1H102K	CHIP C 1000PF K		
C166			CK73FB1E103K	CHIP C 0.010UF K		
TC1 -3			C05-0318-05	TRIMMING CAP (6PF)		
TC4 ,5			C05-0319-05	TRIMMING CAP (10PF)		
TC6 ,7			C05-0318-05	TRIMMING CAP (6PF)		
TC8			C05-0319-05	TRIMMING CAP (10PF)		
TC9			C05-0318-05	TRIMMING CAP (6PF)		
TC10,11			C05-0327-05	TRIMMING CAP (20PF)		
TC12-15			C05-0328-05	TRIMMING CAP (50PF)		
TC16,17			C05-0319-05	TRIMMING CAP (10PF)		
-			E23-0465-05	TERMINAL		
-			E23-0467-05	TERMINAL		
J1			E13-0165-15	RCA RECEPTACLE (ANT.J)		
-			F10-1329-04	SHIELDING PLATE		
-			F11-0872-04	SHIELDING COVER(VCO)		
F1			L71-0247-05	MCF (21.6MHZ)		
L1			L34-1102-05	COIL (3Ø,1.75T)		
L2			L34-1107-05	COIL (3Ø,2.25T)		
L3			L34-1053-05	COIL (4T)		
L4			L34-1059-05	COIL (3Ø,2.5T)		
L5			L34-1100-05	COIL		
L6 -9			L34-1101-05	COIL		
L10			L34-2228-05	COIL (21.6MHZ)		
L11			L34-1100-05	COIL		
L12			L34-1101-05	COIL		
L13 -15			L34-1103-05	COIL (3Ø,1.5T)		
L16			L34-1083-05	COIL (1.25T)		
L17			L34-1103-05	COIL (3Ø,1.5T)		
L18			L34-1083-05	COIL (1.25T)		
L19			L34-1112-05	COIL (2Ø,9.33T)		
L20 -23			L32-0637-05	OSCILLATING COIL		
L26 ,27			L34-2229-05	COIL (140MHZ)		
L28			L40-1011-16	SMALL FIXED INDUCTOR(100U)		
L29			L40-1501-16	SMALL FIXED INDUCTOR(15UH)		
L30			L40-4701-16	SMALL FIXED INDUCTOR(47UH)		
L31			L34-2230-05	COIL (VCO)		
L32			L40-3391-17	SMALL FIXED INDUCTOR(3.3UH)		
L33			L40-1092-17	SMALL FIXED INDUCTOR(1UH)		
L34			L19-0355-05	BALUN TRANSFORMER(6.5T)		
L35			L34-1103-05	COIL (3Ø,1.5T)		
L36 ,37			L34-1101-05	COIL		
L38			L40-1011-17	SMALL FIXED INDUCTOR(100UH)		
L39			L92-0110-05	FERRITE CORE		
L40			L40-2282-17	SMALL FIXED INDUCTOR(0.22UH)		
L41			L40-1001-16	SMALL FIXED INDUCTOR(10U)		
X1			L77-1241-05	CRYSTAL RESONATOR(6.826MHZ)	M2	
X1			L77-1289-05	CRYSTAL RESONATOR(6.8259MHZ)	KM1	
X2			L77-1242-05	CRYSTAL RESONATOR(44.266MHZ)	M2	
X2			L77-1250-05	CRYSTAL RESONATOR(45.377MHZ)	KM1	
X3			L77-1249-05	CRYSTAL RESONATOR(47.222MHZ)	M2	

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X3			L77-1252-05	CRYSTAL RESONATOR(48.333MHZ)	KM1	
X4			L77-1243-05	CRYSTAL RESONATOR(46.666MHZ)	M2	
X4			L77-1251-05	CRYSTAL RESONATOR(47.777MHZ)	KM1	
X5			L77-1248-05	CRYSTAL RESONATOR(46.111MHZ)	M2	
X5			L77-1249-05	CRYSTAL RESONATOR(47.222MHZ)	KM1	
JP1			R92-0150-05	JUMPER REST 0 OHM		
JP6 -9			R92-1061-05	JUMPER REST 0 OHM		
R1			RK73FB2A272J	CHIP R 2.7K J 1/10W		
R2			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R3			RK73FB2A470J	CHIP R 47 J 1/10W		
R4			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R5			RK73FB2A272J	CHIP R 2.7K J 1/10W		
R6			RK73FB2A330J	CHIP R 33 J 1/10W		
R7			RD14CB2C102J	RD 1.0K J 1/6W		
R8			RK73FB2A821J	CHIP R 820 J 1/10W		
R9			RD14BB2C123J	RD 12K J 1/6W		
R10			RK73FB2A563J	CHIP R 56K J 1/10W		
R11			RK73FB2A332J	CHIP R 3.3K J 1/10W		
R13			RK73FB2A471J	CHIP R 470 J 1/10W		
R14			RK73FB2A152J	CHIP R 1.5K J 1/10W		
R15			RK73FB2A334J	CHIP R 330K J 1/10W		
R16			RK73FB2A822J	CHIP R 8.2K J 1/10W		
R17			RK73FB2A331J	CHIP R 330 J 1/10W		
R18			RD14BB2C101J	RD 100 J 1/6W		
R19 ,20			RK73FB2A470J	CHIP R 47 J 1/10W		
R21			RK73FB2A101J	CHIP R 100 J 1/10W		
R22			RK73FB2A470J	CHIP R 47 J 1/10W		
R23			RK73FB2A100J	CHIP R 10 J 1/10W		
R24			RD14CB2C470J	RD 47 J 1/6W		
R25			RK73FB2A2R2J	CHIP R 2.2 J 1/10W		
R26			RK73FB2A680J	CHIP R 68 J 1/10W		
R27			RK73FB2A220J	CHIP R 22 J 1/10W		
R28			RD14CB2C220J	RD 22 J 1/6W		
R29			RK73FB2A151J	CHIP R 150 J 1/10W		
R30			RK73FB2A331J	CHIP R 330 J 1/10W		
R31 -34			RD14CB2C222J	RD 2.2K J 1/6W		
R35 -38			RK73FB2A562J	CHIP R 5.6K J 1/10W		
R39			RK73FB2A122J	CHIP R 1.2K J 1/10W		
R40			RK73FB2A332J	CHIP R 3.3K J 1/10W		
R41			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R42 ,43			RK73FB2A822J	CHIP R 8.2K J 1/10W		
R44			RK73FB2A273J	CHIP R 27K J 1/10W		
R45			RK73FB2A183J	CHIP R 18K J 1/10W		
R46			RK73FB2A821J	CHIP R 820 J 1/10W		
R47			RK73FB2A471J	CHIP R 470 J 1/10W		
R48			RD14BB2C560J	RD 56 J 1/6W		
R49			RK73FB2A103J	CHIP R 10K J 1/10W		
R50			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R51			RK73FB2A474J	CHIP R 470K J 1/10W		
R52			RK73FB2A471J	CHIP R 470 J 1/10W		
R53			RK73FB2A473J	CHIP R 47K J 1/10W		
R54			RK73FB2A562J	CHIP R 5.6K J 1/10W		
R55			RK73FB2A153J	CHIP R 15K J 1/10W		
R56			RK73FB2A122J	CHIP R 1.2K J 1/10W		
R57 ,58			RK73FB2A103J	CHIP R 10K J 1/10W		

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R59			RK73FB2A221J	CHIP R 220 J 1/10W		
R60			RK73FB2A334J	CHIP R 330K J 1/10W		
R61			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R62			RD14CB2C101J	RD 100 J 1/6W		
R63			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R64 ,65			RK73FB2A103J	CHIP R 10K J 1/10W		
R66			RK73FB2A331J	CHIP R 330 J 1/10W		
R67			RK73FB2A332J	CHIP R 3.3K J 1/10W		
R68			RD14BB2C154J	RD 150K J 1/6W		
R69			RK73FB2A104J	CHIP R 100K J 1/10W		
R70			RK73FB2A272J	CHIP R 2.7K J 1/10W		
R71			RK73FB2A562J	CHIP R 5.6K J 1/10W		
R72			RK73FB2A560J	CHIP R 56 J 1/10W		
R74			RK73FB2A154J	CHIP R 150K J 1/10W		
R75 ,76			RK73FB2A101J	CHIP R 100 J 1/10W		
R78			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R79			RK73FB2A332J	CHIP R 3.3K J 1/10W		
R80 ,81			RK73FB2A103J	CHIP R 10K J 1/10W		
R82			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R83			RK73FB2A223J	CHIP R 22K J 1/10W		
R84			RK73FB2A224J	CHIP R 220K J 1/10W		
R85 ,86			RK73FB2A473J	CHIP R 47K J 1/10W		
R87			RK73FB2A103J	CHIP R 10K J 1/10W		
R88			RK73FB2A331J	CHIP R 330 J 1/10W		
R89			RK73FB2A472J	CHIP R 4.7K J 1/10W		
R90			RK73FB2A223J	CHIP R 22K J 1/10W		
R91			RK73FB2A103J	CHIP R 10K J 1/10W		
R92			RK73FB2A562J	CHIP R 5.6K J 1/10W		
R93 ,94			RK73FB2A101J	CHIP R 100 J 1/10W		
R95			RK73FB2A473J	CHIP R 47K J 1/10W		
R96			RK73FB2A153J	CHIP R 15K J 1/10W		
R97			RK73FB2A2R2J	CHIP R 2.2 J 1/10W		
R98 ,99			R92-0670-05	CHIP R 0 OHM		
R100,101			RD14CB2C472J	RD 4.7K J 1/6W		
R102			RK73FB2A562J	CHIP R 5.6K J 1/10W		
R104			RD14BB2B102J	RD 1.0K J 1/8W		
R105			RK73FB2A470J	CHIP R 47 J 1/10W		
S1			S50-1425-05	TACT SWITCH (PTT)		
D1			1S1555	CHIP DIODE		
D2			MI301	DIODE		
D3			1S2588	DIODE		
D4 -7			MA856	DIODE		
D8 -11			BA282	DIODE		
D12			1S2208	VARICAP DIODE		
D13			MA856	DIODE		
D14			1S2208	VARICAP DIODE		
D15			MA152WA	CHIP DIODE		
D15			1SS181	CHIP DIODE		
D17			1SS133	DIODE		
D18			MA152WA	CHIP DIODE		
D18			1SS181	CHIP DIODE		
D20			1SS133	DIODE		
D22			1SS133	DIODE		

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D28			1SS99	DIODE		
Q1 -3			2SC2671(H)	TRANSISTOR		
Q4			2SC2714(Y)	CHIP TRANSISTOR		
Q5 ,6			2SC2671(H)	TRANSISTOR		
Q7			2SC3019	TRANSISTOR		
Q8			2SC3101	TRANSISTOR		
Q9			2SC2714(Y)	CHIP TRANSISTOR		
Q10 ,11			2SC2668(Y)	TRANSITOR		
Q12			TC5082P-G	IC		
Q13			TC5081AP	IC		
Q14 ,15			2SC3121	CHIP TRANSISTOR		
Q16			2SC2671(H)	TRANSISTOR		
Q17			2SC2668(Y)	TRANSITOR		
Q18			2SB698(E,F)	TRANSISTOR		
Q19			LVC517	IC(VOLTAGE REGULATOR)		
Q20			2SA1037K(Q)	CHIP TRANSISTOR		
Q20			2SA1162(Y)	CHIP TRANSISTOR		
Q21			2SC2412K(Q)	CHIP TRANSISTOR		
Q21			2SC2712(Y)	CHIP TRANSISTOR		
Q22			2SA1037K(R)	CHIP TRANSISTOR		
Q22			2SA1162(GR)	CHIP TRANSISTOR		
Q23			2SC2412K(Q)	CHIP TRANSISTOR		
Q23			2SC2712(Y)	CHIP TRANSISTOR		
Q24			2SA1037K(R)	CHIP TRANSISTOR		
Q24			2SA1162(GR)	CHIP TRANSISTOR		
Q25			2SC2412K(Q)	CHIP TRANSISTOR		
Q25			2SC2712(Y)	CHIP TRANSISTOR		
Q26			2SA1037K(Q)	CHIP TRANSISTOR		
Q26			2SA1162(Y)	CHIP TRANSISTOR		
Q27			2SC2412K(Q)	CHIP TRANSISTOR		
Q27			2SC2712(Y)	CHIP TRANSISTOR		
IF UNIT (X48-1410-XX) (-12 : K,M1 -62 : M2)						
C1			CK45B1H102K	CERAMIC 1000PF K		
C2			CC73FSL1H101J	CHIP C 100PF J		
C3			CC73FCH1H270J	CHIP C 27PF J		
C4			CK73FF1E473Z	CHIP C 0.047UF Z		
C5 ,6			C91-1037-05	CERAMIC 0.1UF K		
C7			CK73FB1H102K	CHIP C 1000PF K		
C8			CK73FF1E473Z	CHIP C 0.047UF Z		
C9			CC73FSL1H151J	CHIP C 150PF J		
C10			C90-0889-05	TANTAL 0.22UF 16WV		
C11			CK73FF1E473Z	CHIP C 0.047UF Z		
C12			CK73FB1H102K	CHIP C 1000PF K		
C13			CK73FB1E223K	CHIP C 0.022UF K		
C14 ,15			CK73FB1H102K	CHIP C 1000PF K		
C16			CC73FSL1H101J	CHIP C 100PF J		
C17			CK73FB1E223K	CHIP C 0.022UF K		
C18			C90-0894-05	TANTAL 0.47UF 16WV		
C19			CE04CW1V2R2M	ELECTRO 2.2UF 35WV		
C20			CK73FB1H102K	CHIP C 1000PF K		
C21			CE04CW1V2R2M	ELECTRO 2.2UF 35WV		
C22		*	C90-2007-05	TANTAL 3.3UF 16WV		
C23			CK73EB1E273K	CHIP C 0.027UF K		
C24			C90-0891-05	TANTAL 4.7UF 16WV		

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C25 ,26		*	C90-2012-05	ELECTRO 100UF 10WV		
C27			C91-1035-05	FILM 0.22UF 63WV		
C28		*	C90-2012-05	ELECTRO 100UF 10WV		
C29 -32			CK73FB1H102K	CHIP C 1000PF K		
C33			CE04CW1E3R3M	ELECTRO 3.3UF 25WV		
C34			CE04CW1H010M	ELECTRO 1.0UF 50WV		
C35			CK73FB1H102K	CHIP C 1000PF K		
C36 -38			CC73FSL1H101J	CHIP C 100PF J		
C39			C91-0428-05	MYLAR 0.033UF		
C40			CE04CW1A100M	ELECTRO 10UF 10WV		
C41			C91-0430-05	MYLAR 0.047UF K		
C42			CK73FB1H102K	CHIP C 1000PF K		
C43			CE04CW0J330M	ELECTRO 33UF 6.3WV		
C44			CE04CW1V2R2M	ELECTRO 2.2UF 35WV		
C45			CK73FB1H272K	CHIP C 2700PF K		
C46			CK73FB1H682K	CHIP C 6800PF K		
C47			CC73FSL1H391J	CHIP C 390PF J		
C48		*	C90-2006-05	TANTAL 0.33UF 16WV		
C49			CK73FB1H102K	CHIP C 1000PF K		
C50			CK45B1H102K	CERAMIC 1000PF K		
C51			CK73FB1H102K	CHIP C 1000PF K		
C52			CE04CW1A100M	ELECTRO 10UF 10WV		
C53 -62			CK73FB1H102K	CHIP C 1000PF K		
C65			CK73FF1E473Z	CHIP C 0.047UF Z		
C66			CK45B1H102K	CERAMIC 1000PF K		
C67			CK73FB1H102K	CHIP C 1000PF K		
J1		*	E11-0421-05	PHONE JACK		
J2		*	E11-0420-15	MIC JACK		
JP7		*	E23-0467-05	TEST PIN		
-		*	F20-0549-04	INSULATING BOARD		
F1			L72-0335-05	CERAMIC FILTER (CFU455E)		
L1			L34-2217-05	COIL (455KHZ)		
X1		*	L77-1253-05	CRYSTAL RESONATOR(21.145MHZ)		
JP1 ,2			R92-1061-05	JUMPER REST 0 OHM		
R1			RK73FB2A103J	CHIP R 10K J 1/10W		
R2 ,3			RK73FB2A223J	CHIP R 22K J 1/10W		
R4			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R5			RK73FB2A822J	CHIP R 8.2K J 1/10W		
R6			RK73FB2A334J	CHIP R 330K J 1/10W		
R7 ,8			RK73FB2A103J	CHIP R 10K J 1/10W		
R9			RD14CB2C104J	RD 100K J 1/6W		
R10			RK73FB2A104J	CHIP R 100K J 1/10W		
R11			RK73FB2A101J	CHIP R 100 J 1/10W		
R12			RK73FB2A470J	CHIP R 47 J 1/10W		
R13			RK73FB2A154J	CHIP R 150K J 1/10W		
R14			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R15			RD14CB2C103J	RD 10K J 1/6W		
R16			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R17			RD14CB2C103J	RD 10K J 1/6W		
R18			RD14BB2C473J	RD 47K J 1/6W		
R19			RK73FB2A102J	CHIP R 1.0K J 1/10W		
R20			RD14CB2C684J	RD 680K J 1/6W	M2	
R21			RD14CB2C333J	RD 33K J 1/6W		

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R22			RK73FB2A223J	CHIP R 22K J 1/10W		
R23 ,24			RK73FB2A223J	CHIP R 22K J 1/10W		
R25			RK73FB2A221J	CHIP R 220 J 1/10W		
R26			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R27			RK73FB2A103J	CHIP R 10K J 1/10W		
R28			RK73FB2A333J	CHIP R 33K J 1/10W		
R29			RK73FB2A152J	CHIP R 1.5K J 1/10W		
R30 ,31			RD14CB2C472J	RD 4.7K J 1/6W		
R32			RK73FB2A221J	CHIP R 220 J 1/10W		
R33 ,34			RK73FB2A222J	CHIP R 2.2K J 1/10W		
R35			RK73FB2A273J	CHIP R 27K J 1/10W		
R36			RK73FB2A473J	CHIP R 47K J 1/10W		
R37			RK73FB2A223J	CHIP R 22K J 1/10W		
R38 ,39			RK73FB2A473J	CHIP R 47K J 1/10W		
R40			RD14CB2C122J	RD 1.2K J 1/6W	KM1	
RB1			R90-0526-05	MULTI-COMP (27KX4)		
VR1		*	R12-3449-05	TRIMMING POT. (10K)		
S1			S31-1414-05	SLIDE SWITCH (H/L)		
S2		*	S31-2409-05	SLIDE SWITCH (OFFSET)		
D1 ,2			1N60PSPA	DIODE		
D3			MTZ6.8JB	ZENER DIODE		
D4			MA152WA	CHIP DIDE		
D5			1SS133	DIODE		
Q1			MC3359P	IC		
Q2		*	TA7331F	IC		
Q3			2SB698(E,F)	TRANSISTOR		
Q4 ,5			2SC2412K(Q)	CHIP TRANSISTOR		
Q4 ,5			2SC2712(Y)	CHIP TRANSISTOR		
Q6			NJM4558M	IC(OP AMP X2)		
Q7			2SA1037K(Q)	CHIP TRANSISTOR		
Q7			2SA1162(Y)	CHIP TRANSISTOR		
Q8			2SC2412K(Q)	CHIP TRANSISTOR		
Q8			2SC2712(Y)	CHIP TRANSISTOR		
TONE UNIT (X52-1320-11)						
C1 ,2			CC73FCH1H330J	CHIP C 33PF J		
C3			CK73FB1E103K	CHIP C 0.010UF K		
C4			C90-0888-05	CHIP TAN 0.1UF 16WV		
C5			CK73FB1E223K	CHIP C 0.022UF K		
C6			CE04CW1A100M	ELECTRO 10UF 10WV		
C7			CK73FB1H102K	CHIP C 1000PF K		
X1			L77-0982-05	CRYSTAL RESONATOR(1MHZ)		
R1			RK73FB2A105J	CHIP R 1.0M J 1/10W		
R2			RK73FB2A223J	CHIP R 22K J 1/10W		
R3			RK73FB2A473J	CHIP R 47K J 1/10W		
R4			RK73FB2A224J	CHIP R 220K J 1/10W		
R5			R92-0670-05	CHIP R 0 OHM		
R6			RK73FB2A103J	CHIP R 10K J 1/10W		
VR1			R12-3449-05	TRIMMING POT. (10K)		
Q1			MX315	IC(CTCSS TONE ENCODER)		
Q2			2SC2412K(Q)	CHIP TRANSISTOR		
Q2			2SC2712(Y)	CHIP TRANSISTOR		

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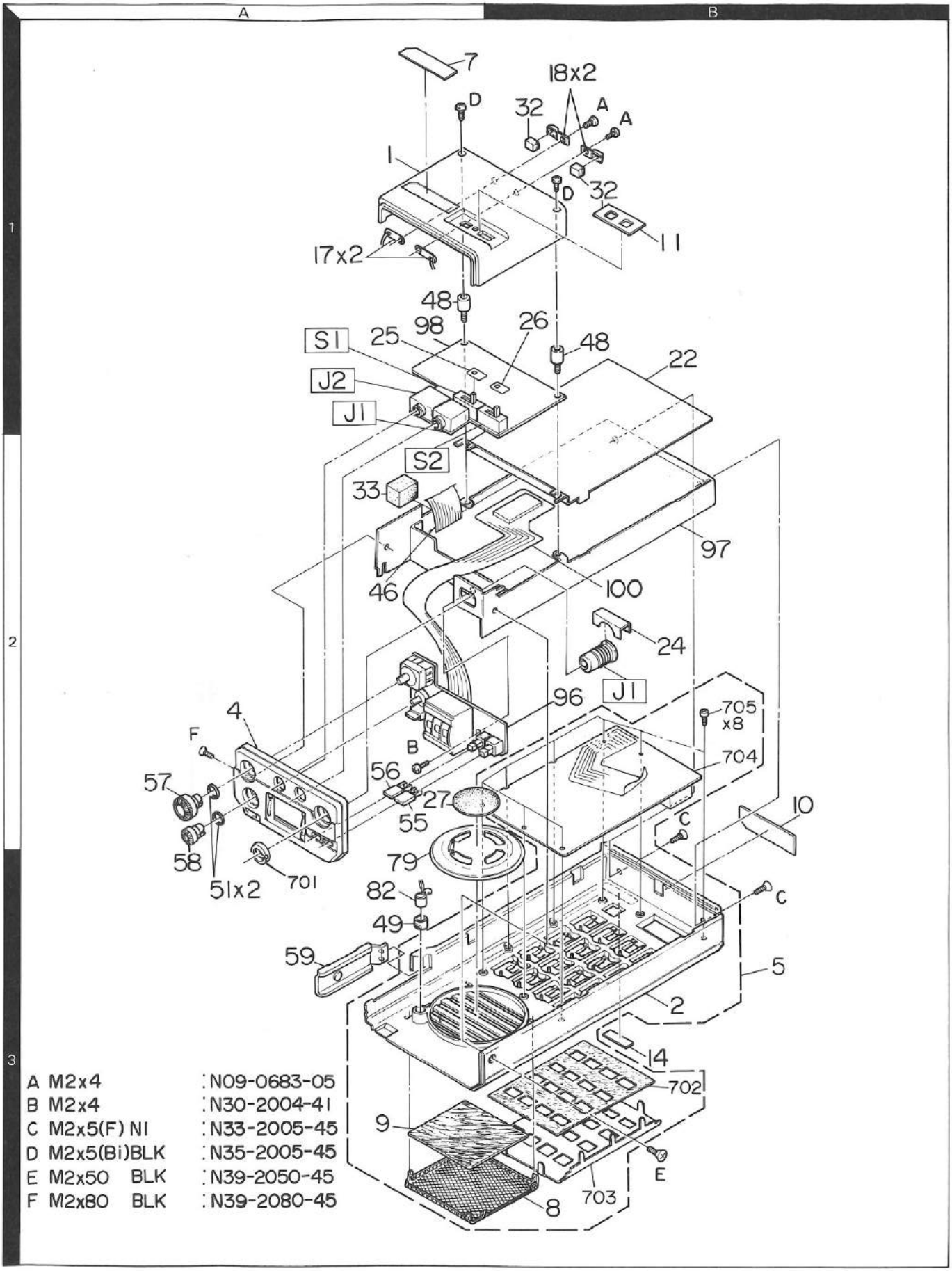
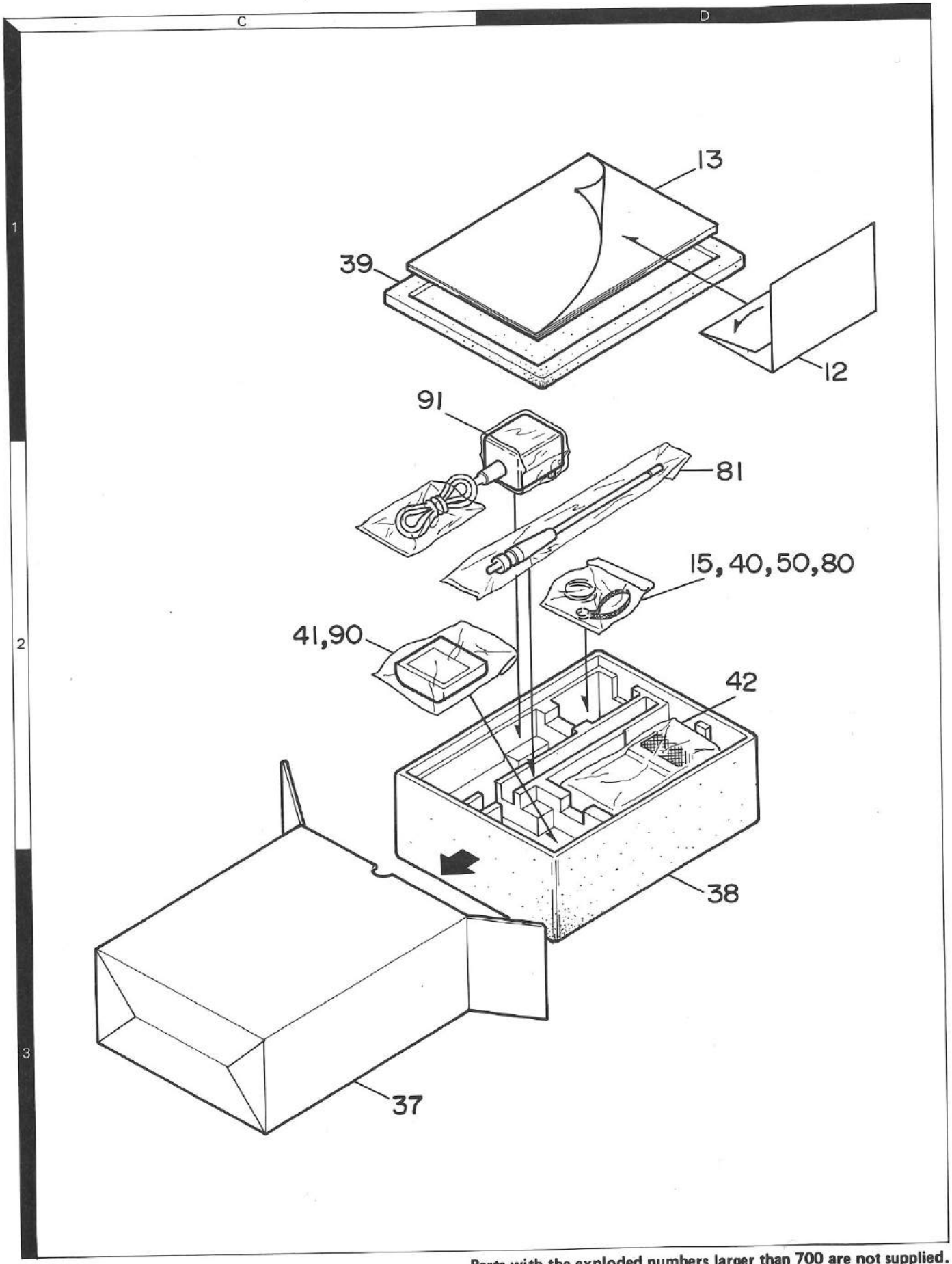
EXPLODED VIEW



A	M2x4	: N09-0683-05
B	M2x4	: N30-2004-41
C	M2x5(F) NI	: N33-2005-45
D	M2x5(Bi)BLK	: N35-2005-45
E	M2x50 BLK	: N39-2050-45
F	M2x80 BLK	: N39-2080-45

Parts with the exploded numbers larger than 700 are not supplied.

PACKING



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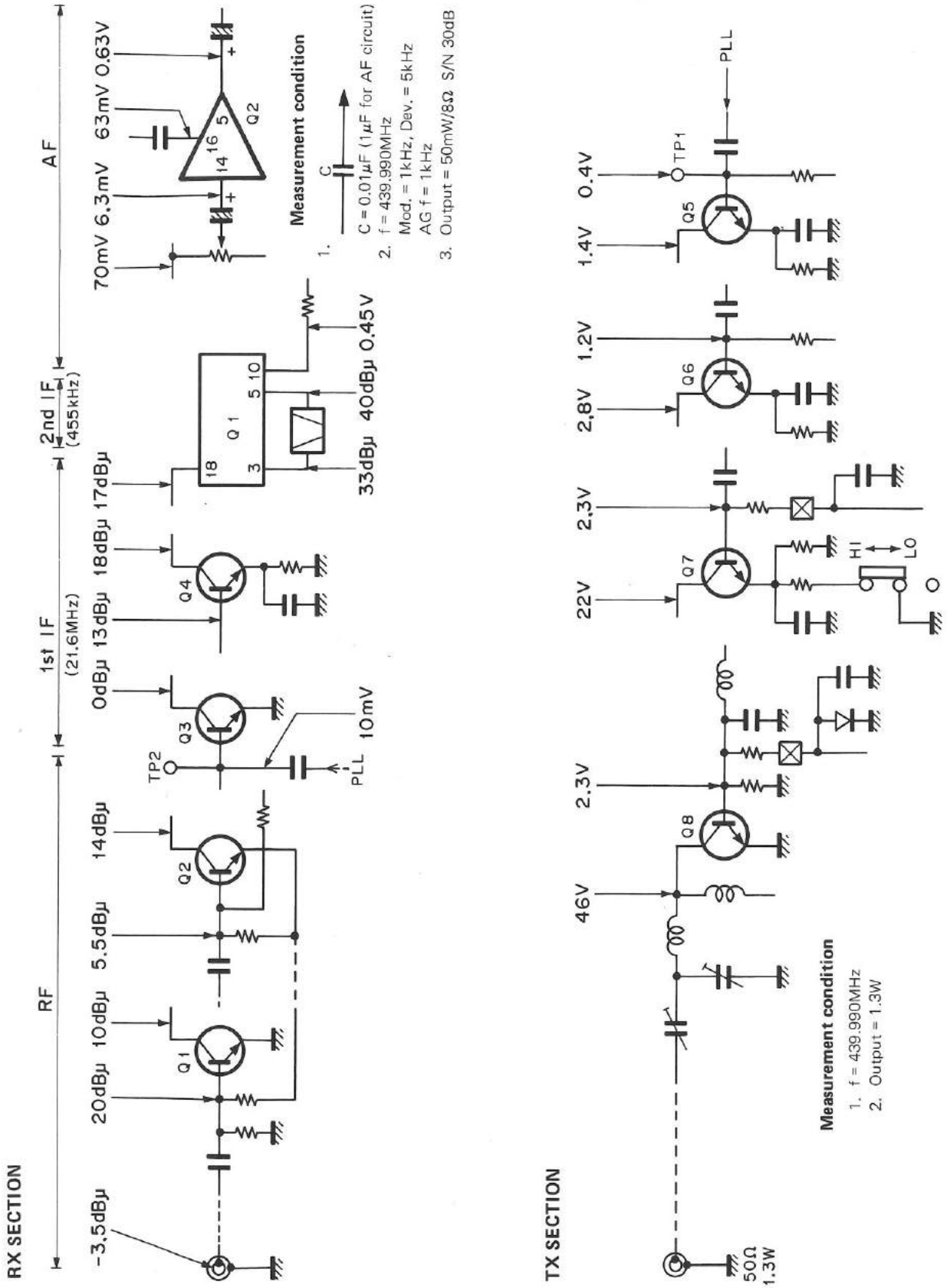
LEVEL DIAGRAM



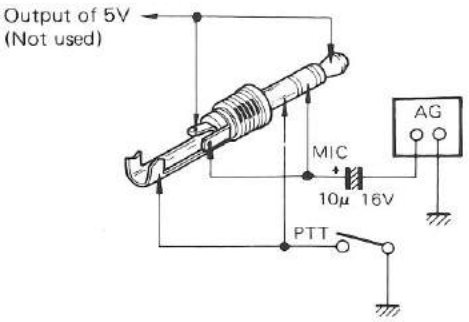
ADJUSTMENT

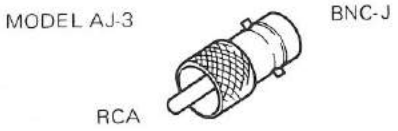
PREOPERATION

Unless otherwise specified. Set the controls as follows.

POWER/VOL ..... OFF
HI/LOW ..... HI
SQL ..... MIN

- When adjusting the trimmers or coils, use a non-induced adjusting rod of bakelite, etc.
- When adjusting the RX section never transmit to prevent SSG damage.
- Connect MIC connector as shown right.
- Uses following RCA-BNC adaptor plug (MODEL AJ-3) for ANT connection.
- The output level of SSG is indicated as SSG's open circuit.

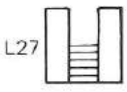
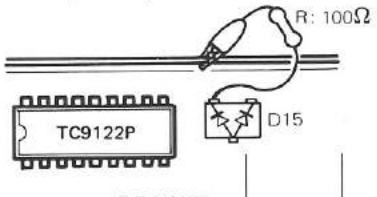




TX/RX Section (Common)

Item	Condition	Measurement			Adjustment			Specification/ Remarks
		Test-equipment	Unit	Ter-minal	Unit	Part	Method	
1. Voltage check	1) DC power supply : 7.2V	DC V.M	RF	FB				7.2V
	2) 5C			5C				5.0V
	3) 6R			6R				5.7V
	4) 5T PTT : ON			5T				4.9V
	5) Receiver							

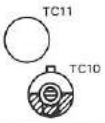
PLL Section

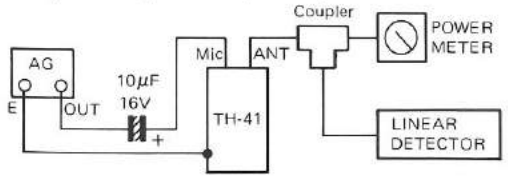
Item	Condition	Measurement			Adjustment			Specifications/ Remarks
		Test equipment	Unit	Ter-minal	Unit	Part	Method	
1. HET	1) f : any • Cut wire No. 1 or connect to GND at Q15 collector on RF unit. • Turn L27 slug all the way inside.  OFFSET switch : "S"	RFVTVM	RF	TP3	RF	L26, 27	MAX Repeat couple times.	Approx. 17mVrms
	2) Connect D15 cathode to GND via 100Ω resistor as shown right. Repeat each on TX/RX.	 RF UNIT				L27	Adjust to equal level on TX/RX.	Approx. 7.5mVrms
2. PLL voltage setting	1) f = 430.00MHz **(M2)** f = 440.00MHz **(K,M1)**	DC V.M	RF	TP4	RF	L31	1.1V	±0.1V
	2) Transmit						Confirm	1.6V **(M2)** 1.2V **(K,M1)** ±0.2V
	3) f = 439.99MHz **(M2)** f = 449.99MHz **(K,M1)**							4V or less
	4) Transmit							4.1V or less

ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/ Remarks
		Test-equipment	Unit	Ter-minal	Unit	Part	Method	
3. RX. f adjustment	1) OFFSET switch : "S" f = 435.00MHz **(M2)** f = 445.00MHz **(K,M1)**	f. counter	RF	TP2	RF	L20	413.400MHz **(M2)** 423.400MHz **(K,M1)** f−21.6MHz	±100Hz
	2) +5kHz switch : ON					TC12	413.405MHz **(M2)** 423.405MHz **(K,M1)**	

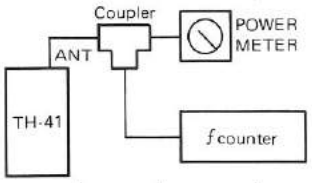
TX Section

Item	Condition	Measurement			Adjustment			Specifications/ Remarks
		Test-equipment	Unit	Ter-minal	Unit	Part	Method	
1. Power output adjustment	1) f = 430.00MHz **(M2)** f = 440.00MHz **(K,M1)** ANT : Connect a power meter HI/LO : HI Transmit Power supply : 7.2V	Power meter			RF	TC6, 7	MAX	
	2) f = 435.00MHz **(M2)** f = 445.00MHz **(K,M1)** TC10 Min position  	Power meter DC AM (1A)				TC8–11	MAX	1.2W or more 650mA or less
	3) f = 430.00MHz **(M2)** f = 440.00MHz HI/LO : HI						Confirm	1.0W or more 650mA or less
	HI/LO : LO							50mW or more 350mA or less
	4) f = 439.99MHz **(M2)** f = 449.99MHz **(K,M1)** HI/LO : HI							1.0W or more 650mA or less
	HI/LO : LO							50mW or more 350mA or less
2. Deviation adjustment	1) ANT : Power meter and linear detector, use capacitor. 10μF/16V between AG output to MIC terminal f = 435.00MHz **(M2)** f = 445.00MHz **(K,M1)** AG : 1kHz, 50mV Transmit	Power meter Linear detector			IF	VR1	4.5kHz	4.5kHz±0.1kHz
	2) AG : 1kHz, 5mV						Confirm	3–3.5kHz



ADJUSTMENT

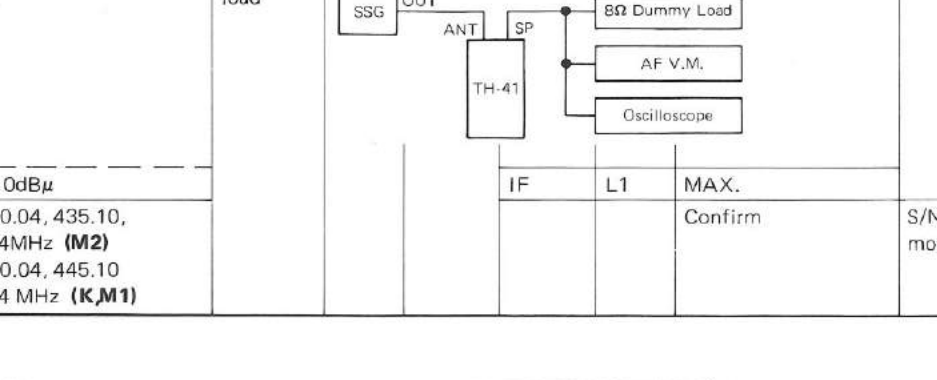
Item	Condition	Measurement			Adjustment			Specifications/ Remarks
		Test-equipment	Unit	Ter-minal	Unit	Part	Method	
3. Tone encoder	1) f = 435.00MHz **(M2)** f = 445.00MHz **(K,M1)** Transmit Push the "3" and "6" key.				DTMF	VR1	3.0kHz	±0.5kHz
			DTMF	T0			Confirm frq'	1471.9Hz±5Hz
	2) Push the "2" and "3" key. Transmit						Confirm Dev'	1.2kHz±0.5kHz
	3) Push the "1" and "2" key.			T0			Confirm frq'	701.3Hz±5Hz
4. SUB TONE	1) Transmit Tone switch : ON Linear detector : LPF (3kHz) ON				SUB TONE	VR1	0.5kHz	0.5–0.6kHz
5. TX. f adjustment	1) f = 435.00MHz **(M2)** f = 445.00MHz **(K,M1)** OFFSET switch : "S" Transmit	Power meter f. counter			RF	L22	435.00MHz **(M2)** 445.00MHz **(K,M1)**	Within ±100Hz
	2) +5kHz switch : ON					TC14	435.005MHz **(M2)** 445.005MHz **(K,M1)**	
	3) f = 439.98MHz **(M2)** f = 449.98MHz **(K,M1)** OFFSET switch : "–" Transmit					L23	434.98MHz **(M2)** 444.98MHz **(K,M1)** (f–5MHz)	
	4) +5kHz switch : ON					TC15	434.985MHz **(M2)** 444.985MHz **(K,M1)**	
	5) f = 430.00MHz **(M2)** f = 440.00MHz **(K,M1)** OFFSET switch : "+" Transmit					L21	435.00MHz **(M2)** 445.00MHz **(K,M1)** (f + 5MHz)	
	6) +5kHz switch : ON					TC13	435.005MHz **(M2)** 445.005MHz **(K,M1)**	



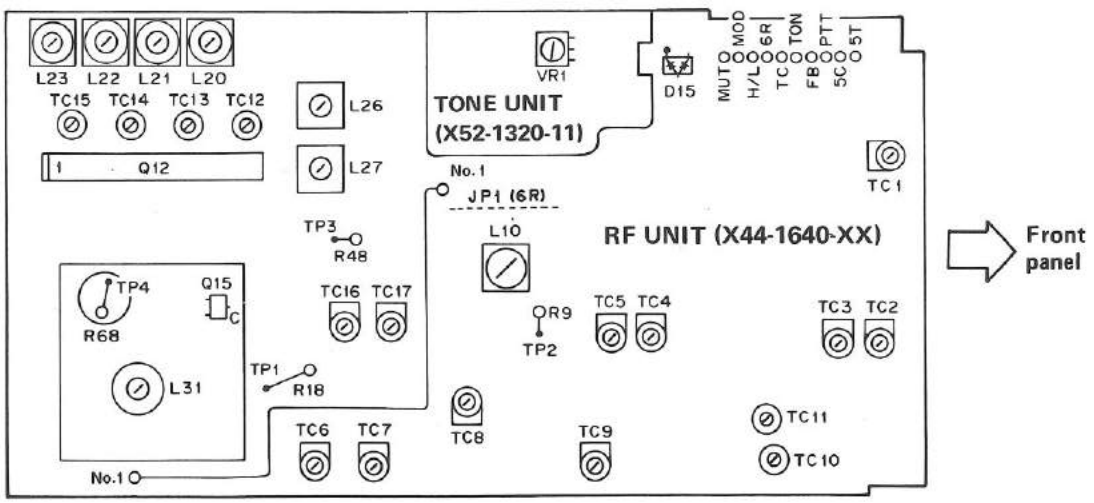
ADJUSTMENT

RX Section

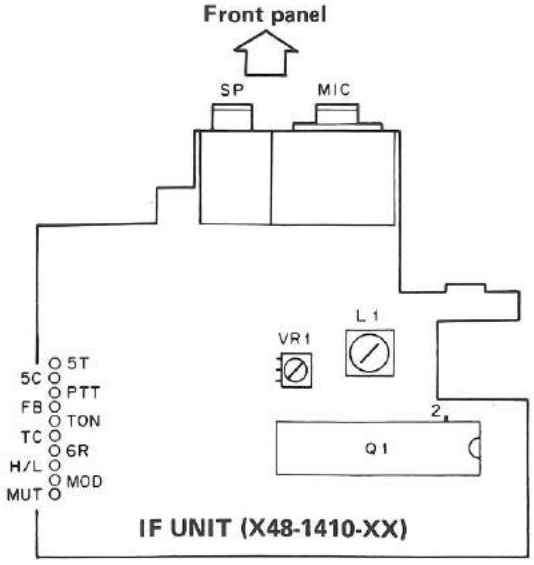
Item	Condition	Measurement			Adjustment			Specifications/ Remarks
		Test-equipment	Unit	Ter-minal	Unit	Part	Method	
1. Sensitivity	1) f : any	f. counter	IF	Q1–2			Confirm	21.145MHz±320Hz
	2) SSG : 435.10MHz **(M2)** 445.100MHz **(K,M1)** –6dBμMOD : 1kHz - DEV, 5kHz	SSG AF V.M Oscillo-scope 8Ω Dummy load		EXT.SP	RF	TC1–5 TC17, 16 L10	MAX.	
	SSG : 0dBμ				IF	L1	MAX.	
S/N	3) f = 430.04, 435.10, 439.94MHz **(M2)** f = 440.04, 445.10 449.94 MHz **(K,M1)**						Confirm	S/N 26dB or more



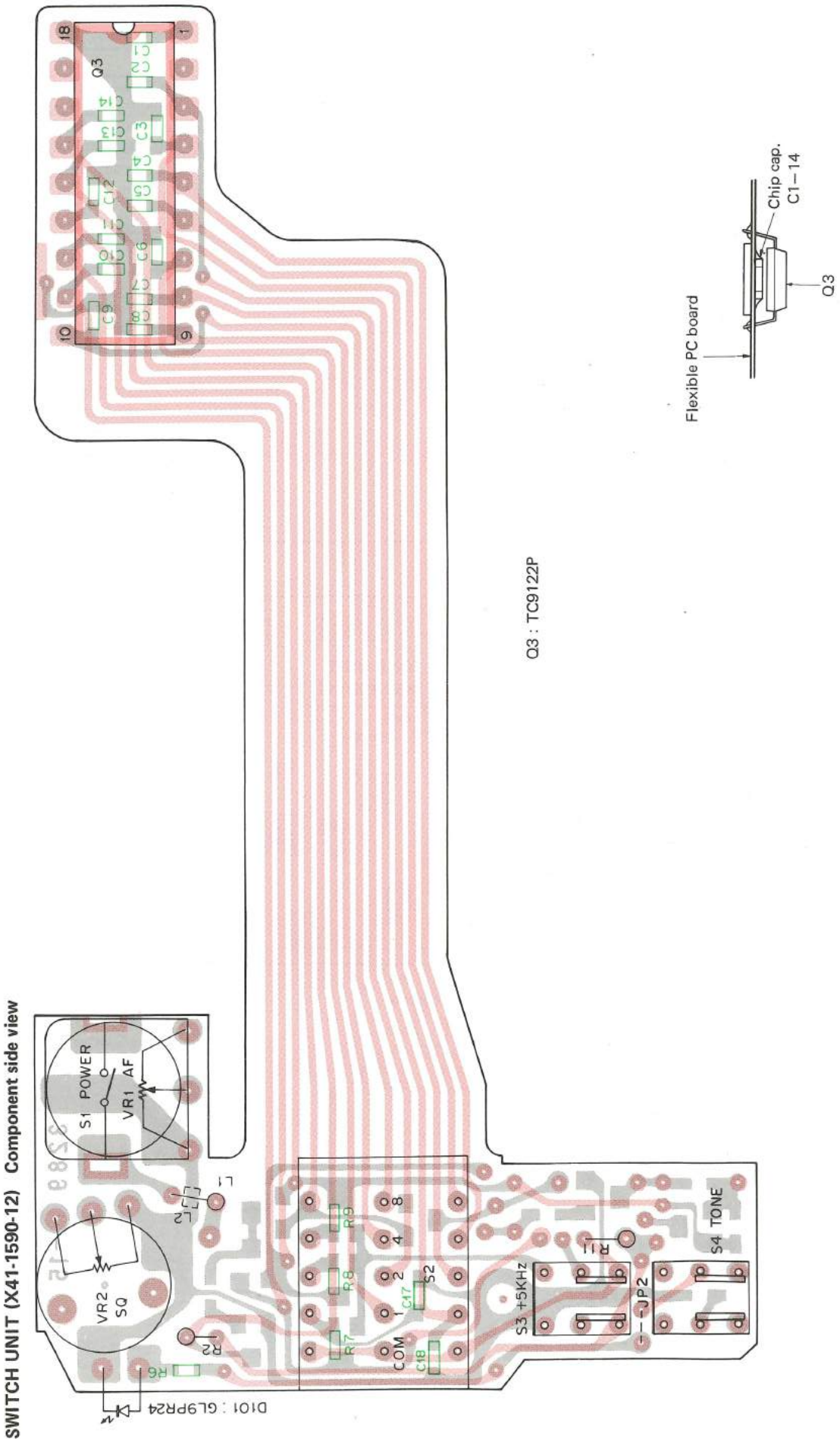
TOP VIEW



BOTTOM VIEW



TH-41BT PC BOARD VIEW



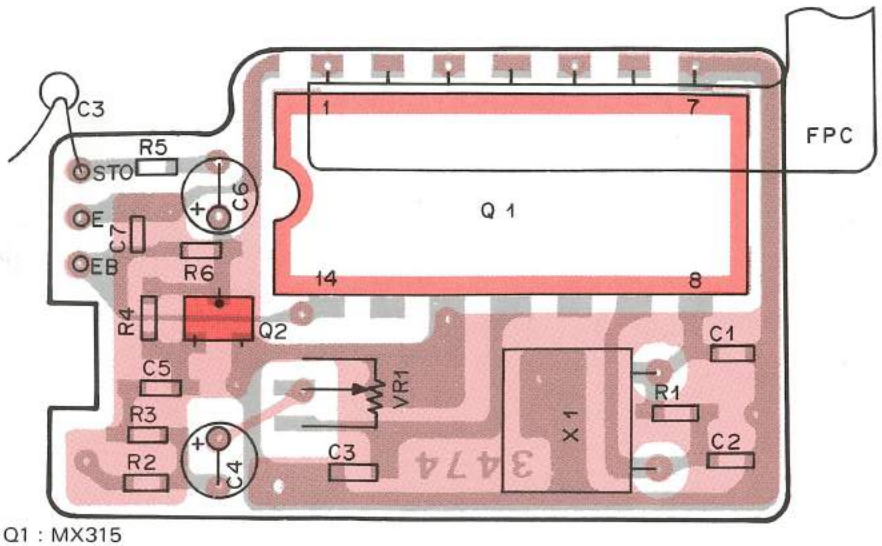
Q3 : TC9122P

SWITCH UNIT (X41-1590-12) Component side view

PC BOARD VIEW TH-41BT

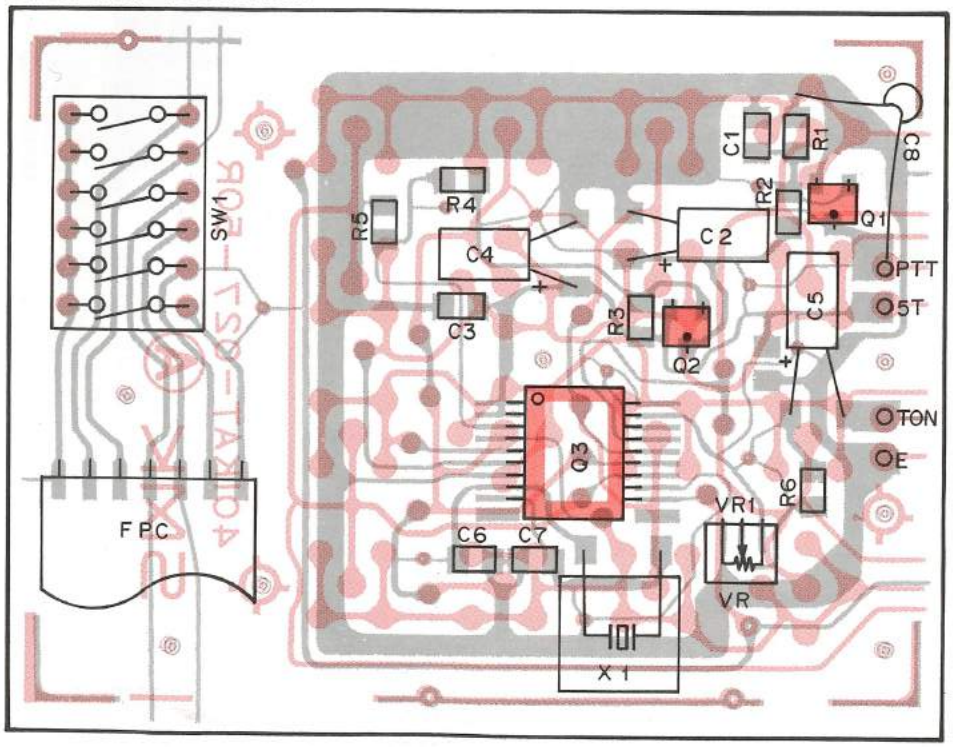
TONE UNIT(X52-1320-11) Foil side view

2SA1037K
2SA1162
2SC2412K
2SC2712



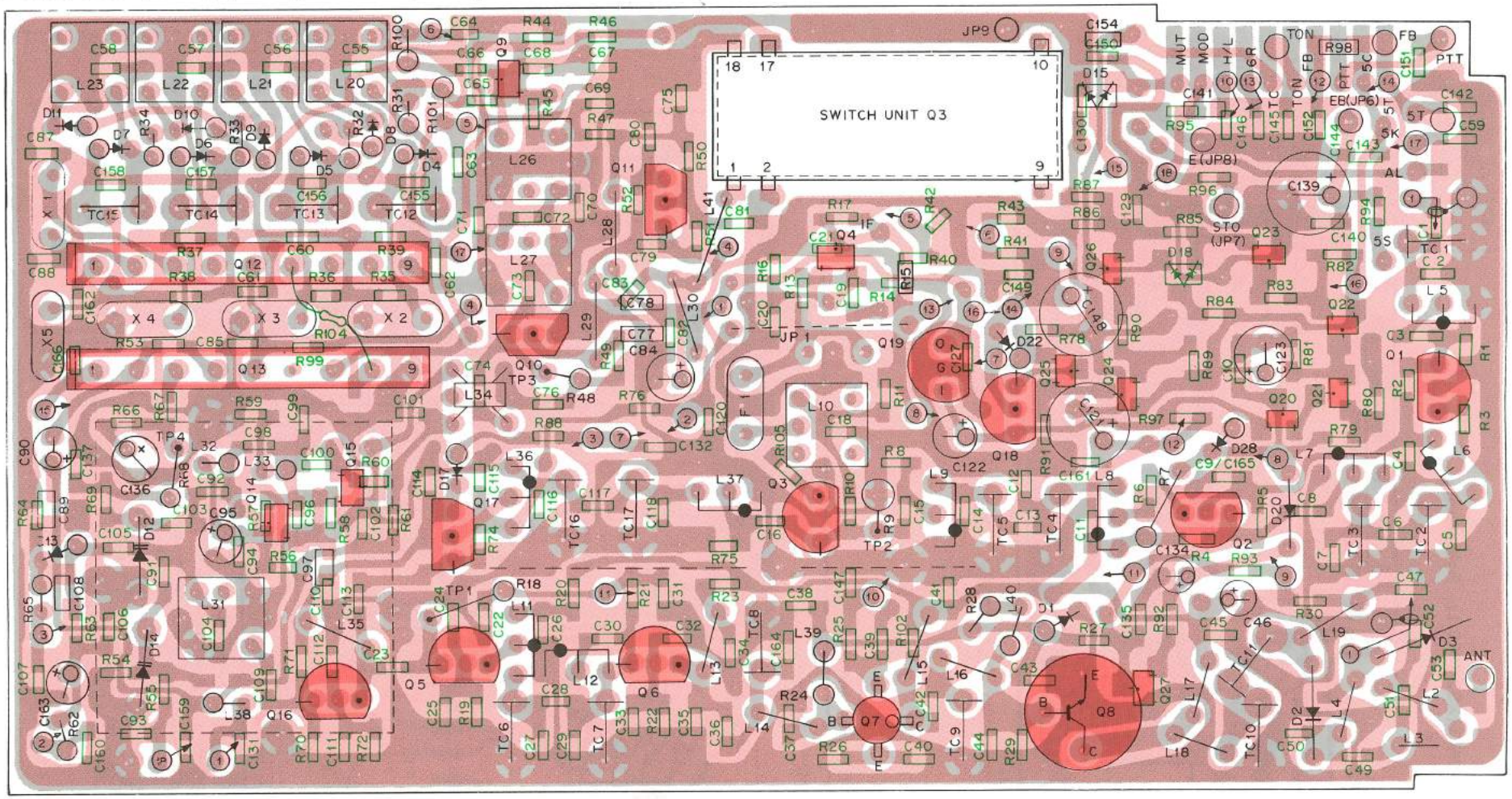
Q1 : MX315
Q2 : 2SC2412K(Q) or 2SC2712(Y)

DTMF UNIT Foil side view

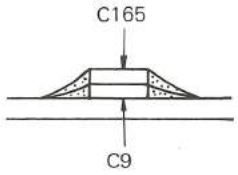


Q1 : 2SC2412K(Q) or 2SC2712(Y)
Q2 : 2SA1037K(Q) or 2SA1162(Y)
Q3 : LR40872

RF UNIT (X44-1640-XX) (-11 : K,M1 -71 : M2) Component side view



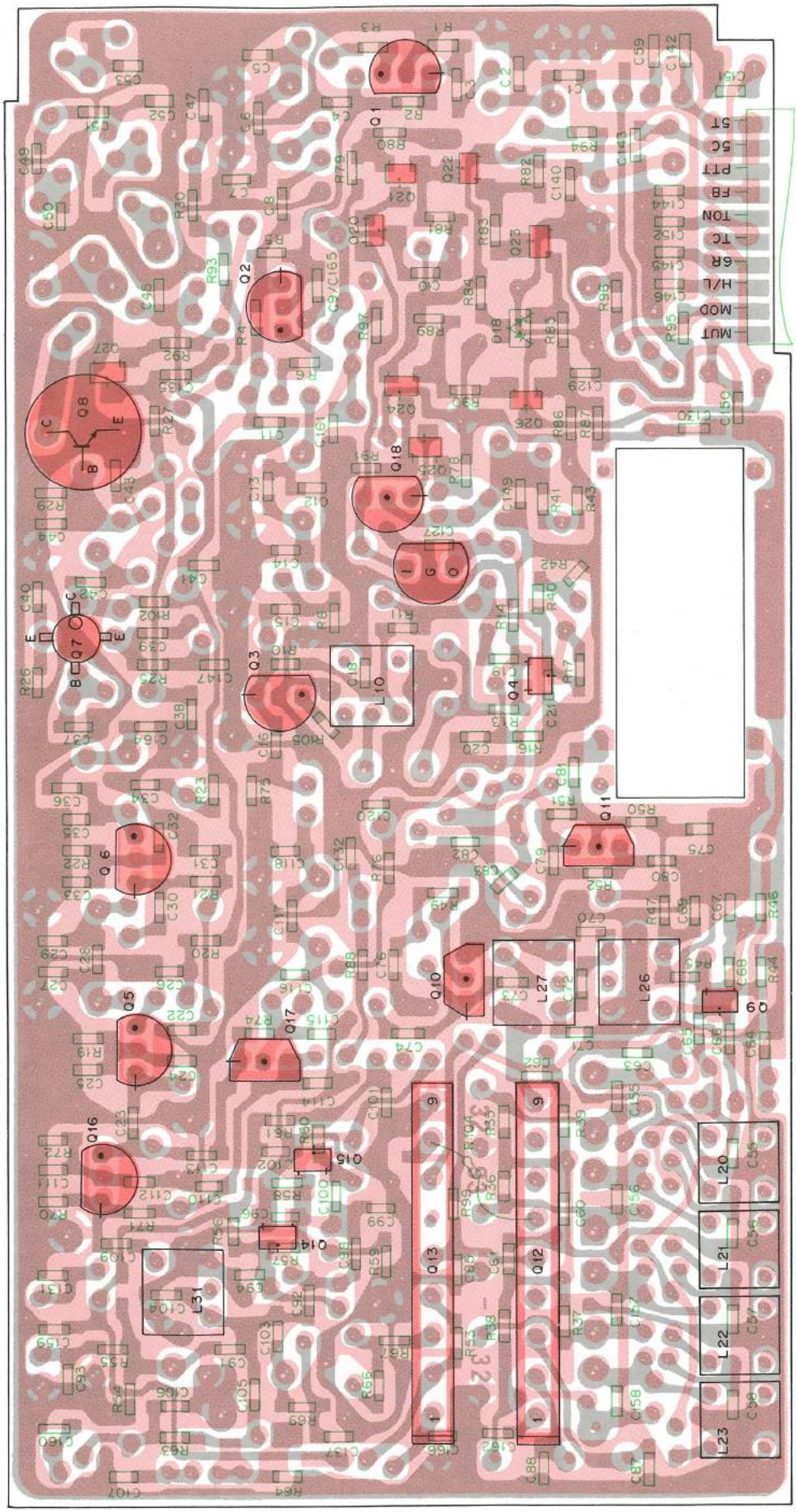
Q1–3,5,6,16 : 2SC2671(H) Q4,9 : 2SC2714(Y) Q7 : 2SC3019 Q8 : 2SC3101 Q10,11,17 : 2SC2668(Y) Q12 : TC5082P Q13 : TC5081AP Q14,15 : 2SC3121
Q18 : 2SB698(E,F) Q19 : LVC517 Q20,26 : 2SA1037K(Q) or 2SA1162(Y) Q21,23,25,27 : 2SC2412K (Q) or 2SC2712(Y) Q22,24 : 2SA1037K(R) or 2SA1162(G)
D1 : 1S1555 D2 : MI301 D3 : 1S2588 D4–7,13 : MA856 D8–11 : BA282 D12,14 : 1S2208 D15,18 : 1SS181 or MA152WA D17,20,22 : 1SS133 D28 : 1SS99



TC1–9,16,17

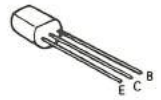
TC10–15

PC BOARD VIEW TH-41BT

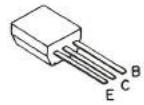


RF UNIT (X44-1640-XX) (-11 : K,M1 -71 : M2) Foil side view

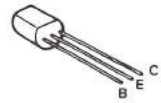
2SB698



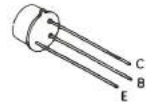
2SC2668



2SC2671

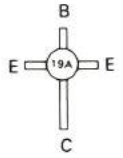


2SC3101

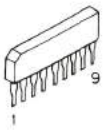


LVC517

2SC3019

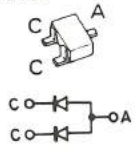


TC5081AP
TC5082P



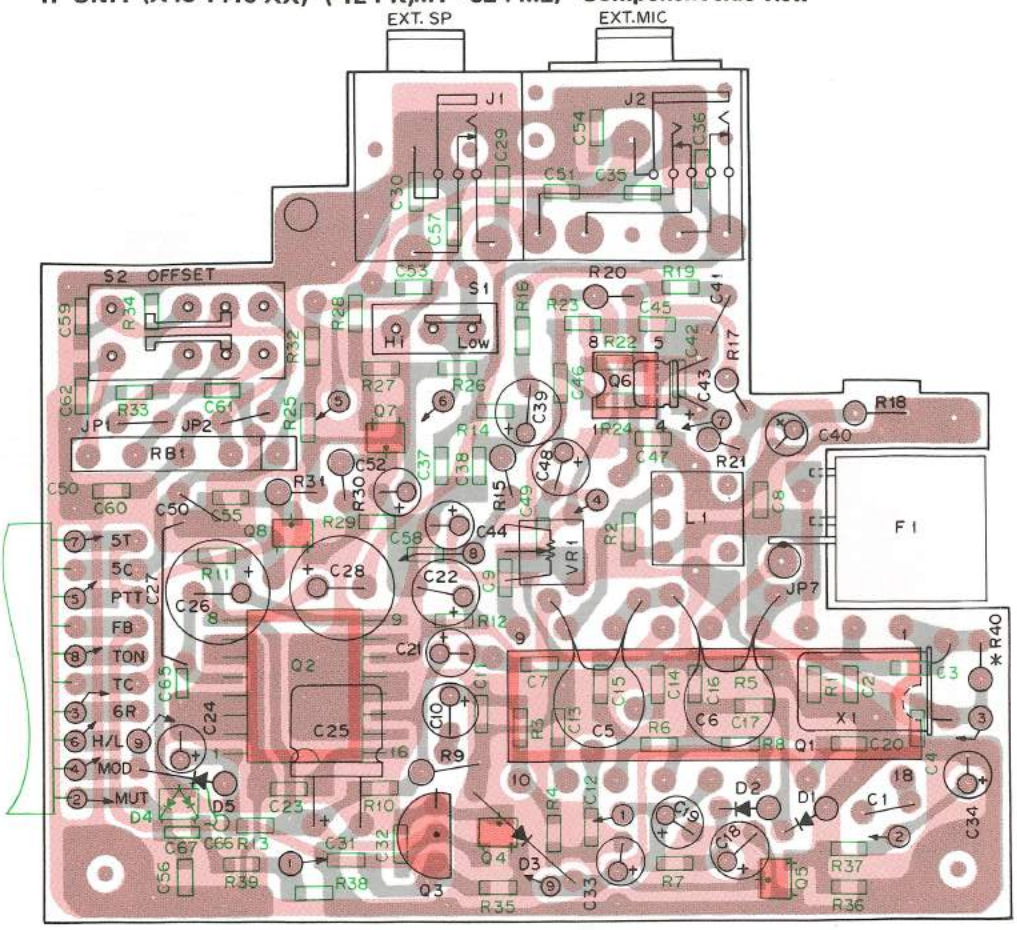
2SA1037K
2SA1162
2SC2412K
2SC2712
2SC2714
2SC3121

MA152WA
1SS181



TH-41BT PC BOARD VIEW

IF UNIT (X48-1410-XX) (-12 : K,M1 -62 : M2) Component side view



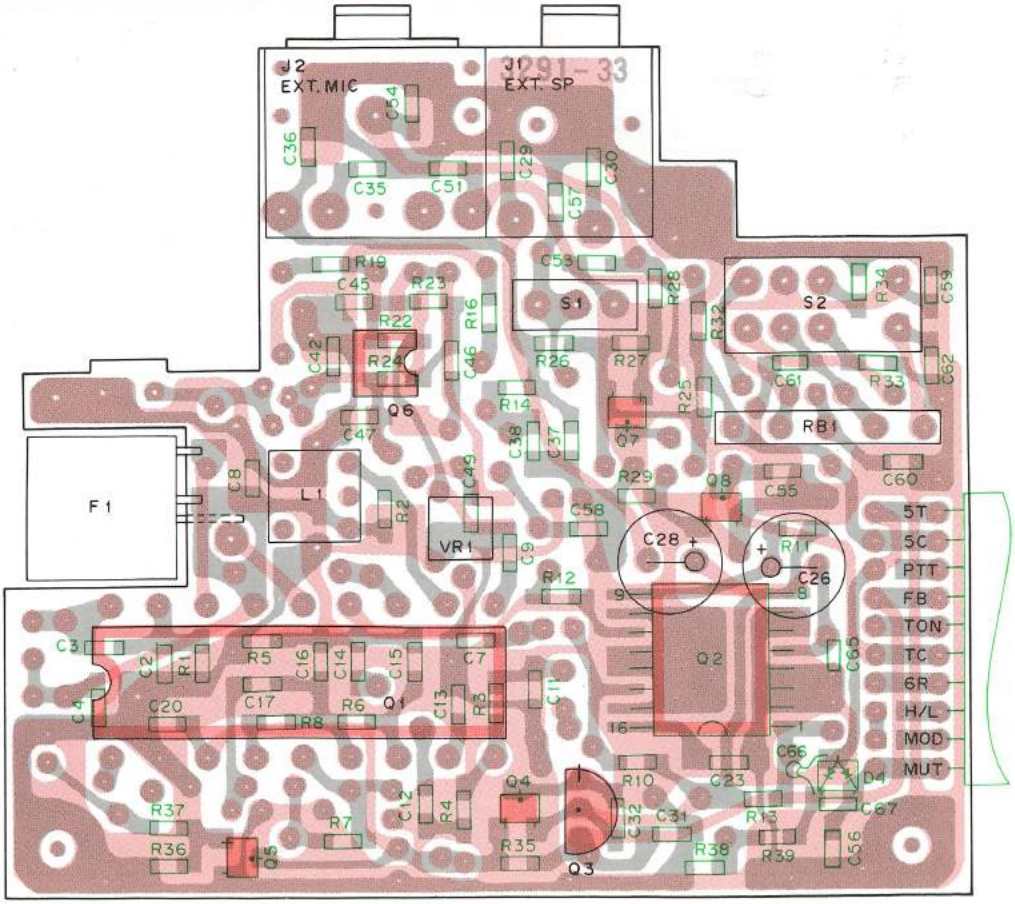
	K,M1	M2
R40	O	X

O : Used, X : Not used

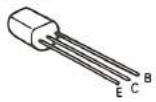
Q1 : MC3359P
Q2 : TA7331F
Q3 : 2SB698(E,F)
Q4,5,8 : 2SC2412K(Q) or 2SC2712(Y)
Q6 : NJM4558M
Q7 : 2SA1037K(Q) or 2SA1162(Y)

D1,2 : 1N60A
D3 : MTZ6.8JB
D4 : MA152WA
D5 : 1SS133

IF UNIT (X48-1410-XX) (-12 : K,M1 -62 : M2) Foil side view

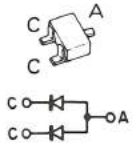


2SB698



2SA1037K
2SA1162
2SC2412K
2SC2712

MA152WA



SCHEMATIC DIAGRAM TH-41BT

Signal line — Control line — Common DC line

Voltage measurement conditions f = 439.99MHz, RX no signal, ( ) : TX.

IF UNIT (X48-1410-XX) (-12 : K, M1 -62 : M2)

RF UNIT (X44-1640-XX) (-11 : K, M1 -71 : M2)

Q1 : MC3359P
Q2 : TA7331F
Q3 : 2SB698(E,F)
Q4,5,8 : 2SC2412K(Q) or 2SC2712(Y)
Q6 : NJM4558M
Q7 : 2SA1037K(Q) or 2SA1162(Y)
D1,2 : 1N60A
D3 : MTZ6.8JB
D4 : MA152WA
D5 : 1SS133

SWITCH UNIT (X41-1590-12)

Q3 : TC9122P

DTMF UNIT

Q1 : 2SC2412K(Q) or 2SC2712(Y)
Q2 : 2SA1037K(Q) or 2SA1162(Y)
Q3 : LR40872

	K,M1	M2
X2	45.377MHz	44.266MHz
X3	48.333MHz	47.222MHz
X4	47.777MHz	46.666MHz
X5	47.222MHz	46.111MHz
C13	0.5P	0.75P
C68	22P	27P
C87,88	22P	39P
C104	4P	6P
C158	82P	68P

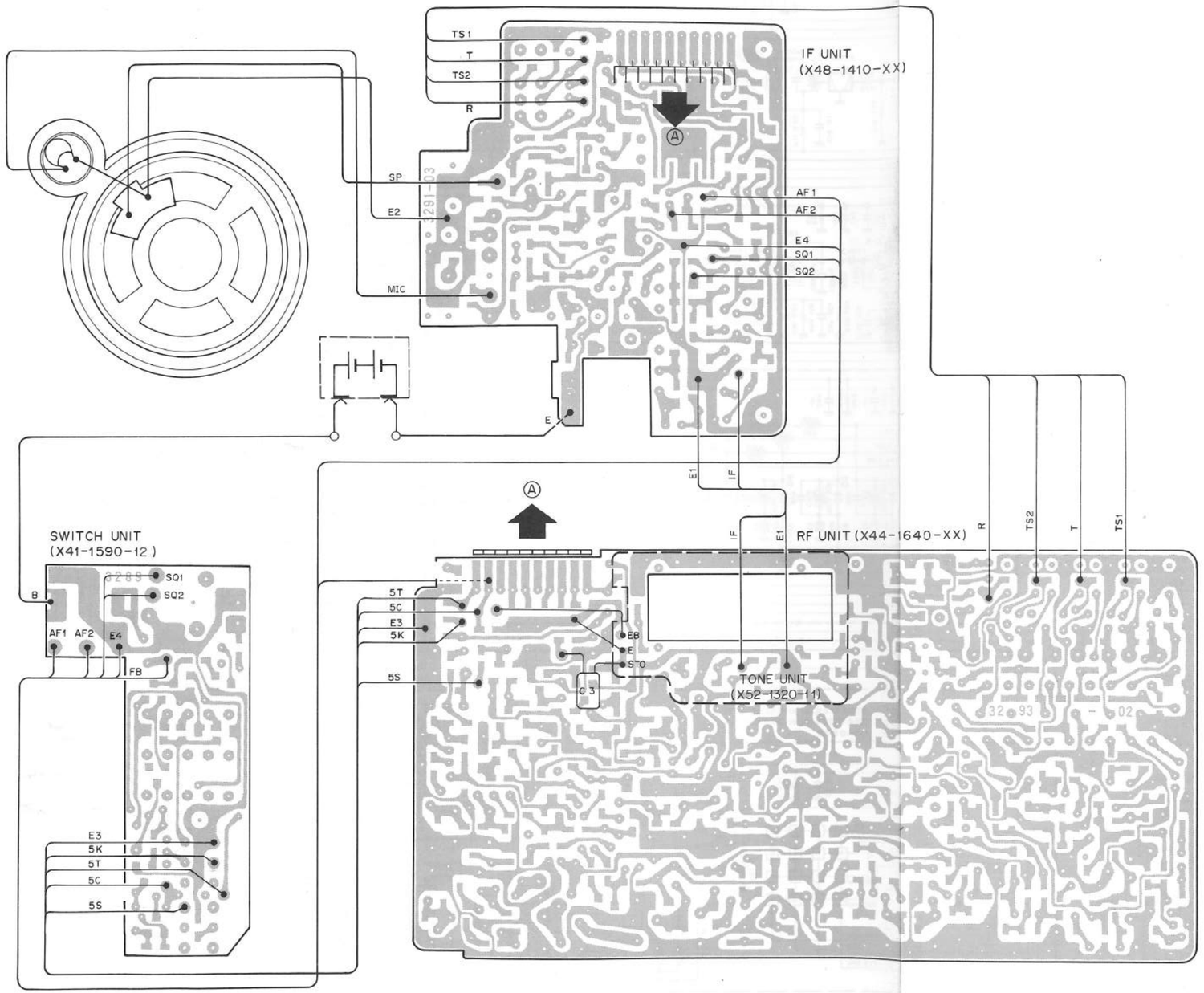
Q1~3, 5, 6, 16 : 2SC2671(H) / 2SC2714(Y)
Q4, 9 : 2SC3019
Q7 : 2SC3101
Q8 : 2SC2668(Y)
Q10, 11, 17 : TC5082P
Q12 : TC5081AP
Q13 : 2SC3121
Q14, 15 : 2SB698(E,F)
Q16 : LVC517
Q18 : 2SA1037K(Q) or 2SA1162(Y)
Q19 : 2SC2412K(Q) or 2SC2712(Y)
Q20, 26 : 2SA1037K(R) or 2SA1162(G)
Q21, 23, 25, 27 : 2SC2412K(Q) or 2SC2712(Y)
Q22, 24 : 2SA1037K(R) or 2SA1162(G)
D1 : 1S1555
D2 : MI301
D3 : 1S2588
D4~7, 13 : MA856
D8~11 : BA282
D12, 14 : 1S2208
D15, 18 : 1SS181 or MA152WA
D17, 20, 22 : 1SS133
D28 : 1SS99

Q1 : MX315
Q2 : 2SC2412K(Q) or 2SC2712(Y)

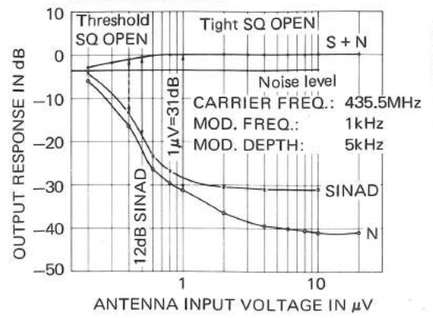
TONE UNIT (X52-1320-11)

TH-41BT (K, M1, M2)

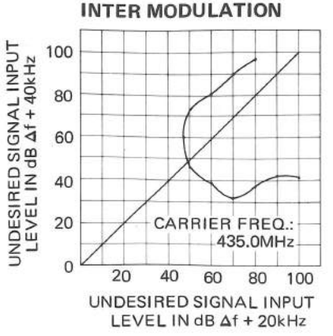
WIRING/REFERENCE DATA



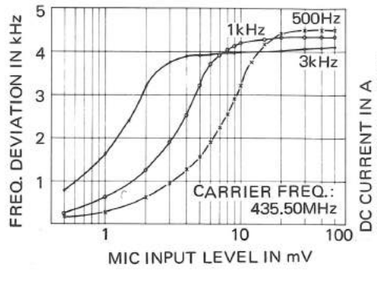
RX SENSITIVITY



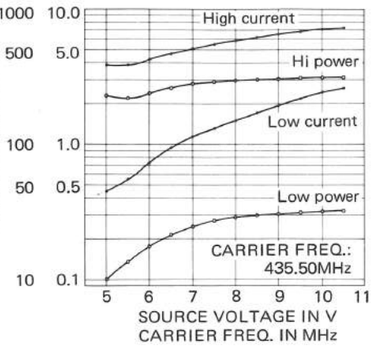
INTER MODULATION



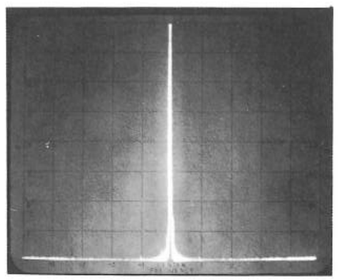
DEVIATION



OUTPUT POWER

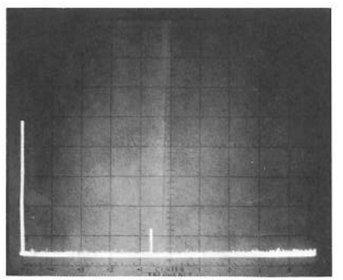


NEAR SPURIOUS RESPONSE



CARRIER FREQ.:	435.00MHz
RF POWER:	1.3W
SCAN WIDTH:	5MHz/DIV
BAND WIDTH:	30kHz
SCAN TIME:	0.5 SEC
VIDEO FILTER:	10kHz
INPUT ATT.:	0dB
LOG REF LEVEL:	−18dBm
	10dB/DIV

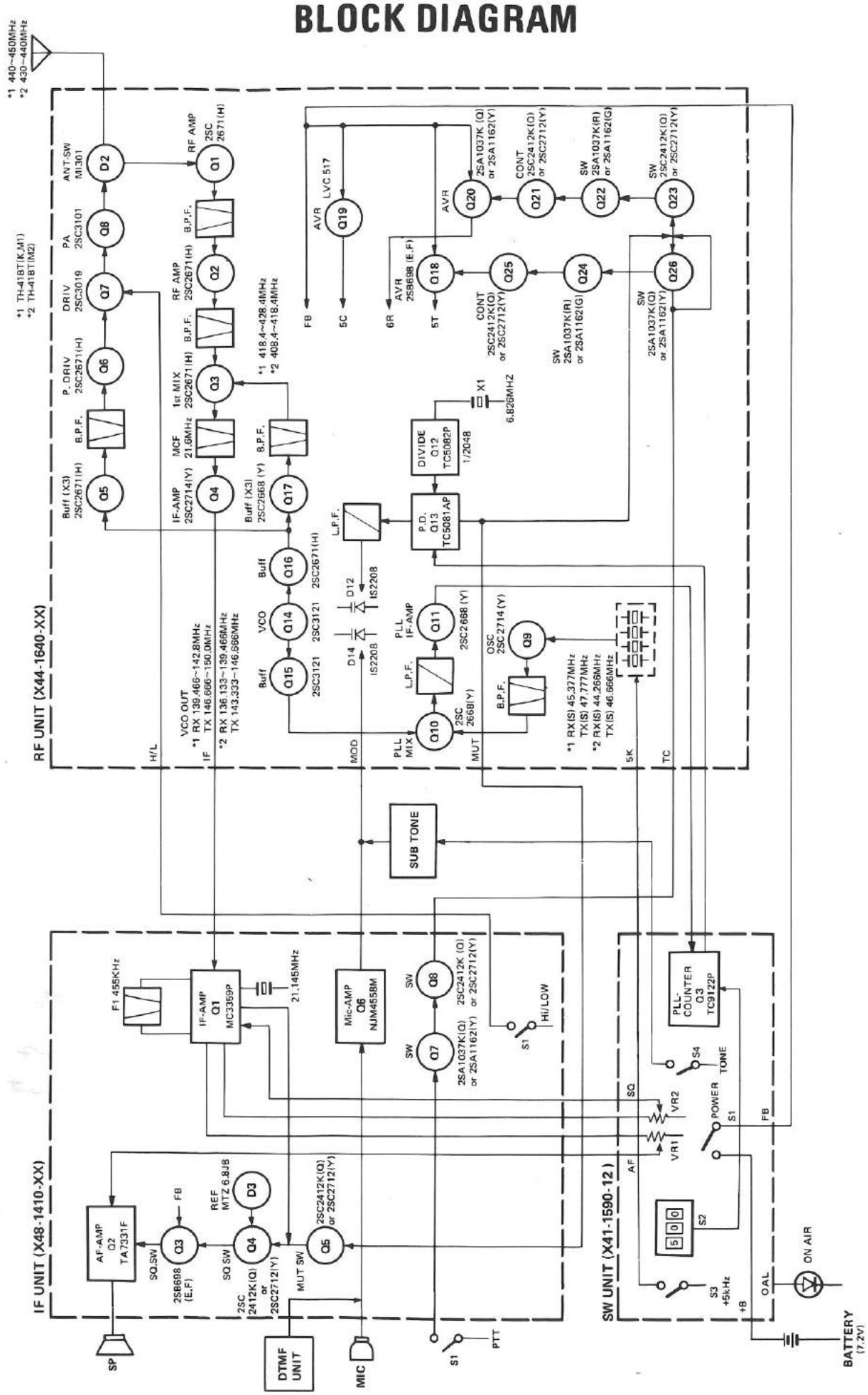
HARMONICS SPURIOUS RESPONSE



CARRIER FREQ.:	435.00MHz
RF POWER:	1.3W
SCAN WIDTH:	100MHz/DIV
BAND WIDTH:	30kHz
SCAN TIME:	2 SEC
VIDEO FILTER:	10kHz
INPUT ATT.:	0dB
LOG REF LEVEL:	−18dBm
	10dB/DIV

The fundamental signal is reduced by HPF. (fc : 550MHz)

BLOCK DIAGRAM



SPECIFICATIONS

General

Frequency range	430 – 440MHz (430MHz version) 440 – 450MHz (440MHz version)
Signal type	F3 (FM)
Operating temperature	−20°C ~ +50°C
Antenna impedance	50Ω
Power supply voltage	5.8V – 10.0V (rating voltage ; 7.2V)
Power consumption	At reception standby ; Less than 30mA At transmission (Hi) ; Less than 650mA (Low) ; About 350mA
Dimensions	57 (65.5) W x 120 (127.5) H x 28 (32) D mm The numbers in the parenthesis include projections parts.
Weight	Approx. 290g (including antenna and Ni-Cd battery PB-21)

Transmitter section

Output power	Hi ; 1.0W, Low ; approx. 150mW
Modulation system	Reactance modulation
Max. frequency deviation	±5kHz
Unwanted reflection	Less than −60dB
Microphone	Condenser type

Receiver section

Reception system	Double superheterodyne
Intermediate frequency	1st ; 21.6MHz, 2nd ; 455kHz
Sensitivity	S/N more than 26dB at −6dBμ (0.5μV) input 12dB SINAD ; less than −12dBμ (0.25μV)
Squelch sensitivity	Less than 0.25μV
Selectivity	−6dB at more than 12kHz −40dB at less than 28kHz
AF output	More than 250mW (8Ω load, distortion 10%)

Design and specifications subject to change without notice.

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