KENWOOD

SERVICE MANUAL

Model TS-670

FM-430, GC-10, VS-1

ALL MODE QUAD BANDER

CONTENTS

TS-670

SPECIFICATIONS

[General]

Transmit/receive frequency range:
40 m band: 7.0 — 7.1 MHz
15 m band: 21.0 — 21.45 MHz
10 m band: 28.0 — 29.7 MHz
6 m band: 50.0 — 54.0 MHz

Mode:
SSB (A3J), CW (A1), AM (A3) and FM (F3-option)
(50 MHz band only for AM transmission.)

Antenna impedance: 50 Ω

Supply voltage: 12 — 16 V DC
(Reference voltage: 13.8 V DC)

Power consumption:
Approx. 4 A at transmission
Approx. 1.1 A at reception with no signal

Dimensions: 270W(279)×96H(108)×260D(298) mm
Dimensions in ( ) are the maximum, including projections.

Weight: 5.4 kg

[Transmitter]

Final power input: SSB, CW, FM 10 W
AM 4 W
(50 MHz band only)

Modulation :
SSB: Balanced modulation
FM : Variable reactance direct shift
AM : Low level modulation

Carrier suppression: Better than 40 dB

Unwanted sideband suppression: Better than 50 dB

Unwanted radiation intensity:
7, 21, 28 MHz bands : Less than −40 dB
50 MHz band : Less than −60 dB
21 MHz band 5th higher harmonic: Less than −70 dB
50 MHz band 2nd higher harmonic: Less than −70 dB

Transmission frequency response (SSB): 400 — 2600 Hz
(better than −6 dB)

Maximum frequency deviation (FM): ±5 kHz
(FM-430 installed)

Microphone impedance: 500 Ω — 50 kΩ

[Receiver]

Circuitry: SSB, CW, AM : Single superheterodyne
: Double superheterodyne

Intermediate frequency: SSB, CW, AM: 8.83 MHz
FM: 1st IF 8.83 MHz
: 2nd IF 455 kHz

Sensitivity:
SSB, CW (10 dB S/N) : Less than −12 dBμ (0.25 μV)
AM (10 dB S/N) : Less than 6 dBμ (2 μV)
FM (30 dB S/N) : Less than 0 dBμ (1 μV)
(12 dB SINAD) : Less than −8 dBμ (0.4 μV)
With YK-88A inserted in AM mode.
With FM-430 inserted in FM mode.

Squelch sensitivity:
FM (28.50 MHz band) : Less than −10 dBμ (0.32 μV)
SSB, CW, AM : Less than 10 dBμ (3.2 μV)

Image ratio: More than 50 dB

IF reflection: More than 50 dB

Selectivity:

	−6	−60 dB
SSB, CW	2.5 kHz	6 kHz
AM*	6 kHz	11 kHz
FM**	12 kHz	22 kHz

* With YK-88A inserted.
** With FM-430 inserted.

RIT variable range: More than ±1.2 kHz

Audio output power: More than 1.5 W
(with 8 Ω load, 10% distortion)

Audio output impedance: 8 — 16 Ω

[Frequency Controller]

Frequency accuracy:
Within $\pm 10 \times 10^{-6}$ at room temperature
Within $\pm 30 \times 10^{-6}$ at 0°C — +50°C

Frequency stability (at reception):
Within $\pm 30 \times 10^{-6}$ at 0°C — +50°C.
Within ±300 Hz for up to 60 minutes after turn-on, and within 30 Hz for any 30 minute period thereafter.

■ Circuitry and ratings are subject to change without notice due to developments in technology.

■ GC-10, VS-1, VOX-4, FM-430, MB-430, SP-430 and PS-20 are optionally available.

CIRCUIT DESCRIPTION

OUTLINE

The TS-670 is a single conversion 4-band transceiver having an intermediate frequency of 8.83 MHz. In the FM reception mode double conversion at 455 KHz is employed.

The Phase Locked Loop (PLL) uses a digital variable frequency oscillator (VFO) control system at a 10 and 100 Hz step switching rate in all modes but FM, in which 10 KHz and 100 KHz switching is automatically selected by the transceivers microprocessor. Excluding only the FM receiver second conversion oscillator, all oscillator frequencies generated in this device are including the carrier injection frequencies controlled by and synthesized from a single reference frequency source of 24 MHz.

The main auxiliary functions include two VFOs, 80-channel memory, frequency specify function, memory scan, program scan, IF shift, RIT, NB, power control and other useful functions.

RECEPTION CIRCUIT CONFIGURATION

The TS-670 reception system uses a single conversion at IF 8.83 MHz in SSB, CW and AM modes. In the FM mode, double conversion is used with a second IF at 455 kHz.

The RF stage is divided into 50 MHz, 7 MHz, 21 MHz and 28 MHz, while the stage following the mixer is common.

The signal received by the antenna is fed through the Low Pass Filter (LPF) (common for both transmission and reception), which is relay switched according to band, and antenna relay RL1 on the Filter unit before being input to the RF unit PA terminal.

The signal is fed through broad-band transformer T1, RF attenuating relay RL2, 8.83 MHz trap T2 and T3, IF traps L2 to L4, and for 50 MHz Band, the signal is stepped up by antenna coil T4 and T5. It is then amplified by RF amp Q1 (2SK74 (L)) and fed through Band Pass Filter (BPF) T6 to T8 before being output from buffer amp Q2. HF signals are stepped up by broadband transformer T9, and then fed through either a 7, 21, or 28 MHz BPF : 7 MHz; T12, T15 and T18. 21 MHz; T11, T14 and T17. 28 MHz; T10, T13 and T16. It is then amplified by RF amp Q3 (3SK74 (L)) before being output from buffer amp Q4.

Both 50 MHz and HF signals are converted a balanced signal by broad-band transformer T20, then mixed with the local oscillator by common mixers Q5 and Q6 (3SK122(L) x 2) to become an 8.83 MHz intermediate frequency signal T19 is an 8.83 MHz trap.

This signal is fed through ceramic filter CF1, then amplified by the first IF amp Q7 (3SK73 GR), and fed through Noise Blanker (NB) gate diode D17 through D20 before being output to the IF unit via the RIF terminal in the SSB, CW and AM modes. In the FM mode, the signal is first fed through buffer amp Q8, and is then output to the FM unit through the FMI terminal. The noise blanker samples from the output of ceramic filter CF1, feeds this through buffer amp Q11 (2SK192 (Y)), then amplifies this by Q12, Q13 and Q14 the noise component is detected by diodes D23 and D24 before driving switching transistor Q15 to switch the NB gate.

The NB gate also serves as a blanking circuit to eliminate Phase Locked Loop (PLL) "click" noise when the Voltage Controled Oscillator (VCO) resets (Q9 and Q10).

The signal from the RF unit RIF terminal is fed to the IF unit RIF terminal through matching transformer L1 and through mode-selected Monolithic Crystal Filters (MCFs), and is then amplified by IF amps Q1 and Q4 (3SK73).

The signal in SSB and CW modes is detected by product detector D26 through D29 (1N60), amplified by audio pre-amp Q7 which is common to each mode, and fed through squelch switching transistor Q8 before being output to the gain control.

In the FM mode, the signal is detected by diode D25, then passed through buffer amp Q6 before being fed to pre-amp Q7.

In FM mode, the signal is mixed, amplified and detected in the FM unit, then fed through the IF unit FAF terminal before being input to pre-amp Q7.

The audio input to this pre-amplifier is switched by either D30, for the SSB and CW modes, D32 for the AM mode or D31 for the FM mode.

TRANSMISSION CIRCUIT CONFIGURATION

Like the reception system, the transmission system uses single conversion in the SSB, CW and AM modes, and uses double conversion in the FM mode.

In the SSB, CW and AM modes, audio from the MIC input terminal is amplified by Q34 on the IF unit, then fed through the mic gain control, and further amplified by Q35 before being input to balanced modulator Q36 (AN612).

In the SSB mode, the output from this modulator is Double Side Band, and after passing through the Monolithic Crystal Filter (MCF) YK-88S3 becomes an SSB signal.

In the AM and CW modes, modulator balance is lost by applying the DC voltage to pin 1 of this modulator. At this time, the amount of carrier to be injected is determined by varying the DC bias current to pin diode D44 (MI204). In the AM mode, the output from Q36 is fed through R5 (680 ohm). (However, when AM filter YK-88A is mounted, the signal is also fed through this filter.) In the CW mode, the output is fed through SSB filter YK-88S3. Each mode signal fed through the filter is amplified by transmitter IF amp Q24, then output to the RF unit.

In the FM mode, the audio signal fed through mic amp Q34 which is commonly used is fed to the FM unit where the signal is FM-modulated using the 8831.5 kHz carrier frequency, the out-put of which is input to No. 1 transmitter balanced mixers Q24 and Q25 (3SK122 x 2) of the RF unit.

The switching between the SSB, CW, AM signals and the FM signal is performed by switching diodes D32 and D38.

The ALC (Automatic Level Control) is performed on transmitter IF amp Q42 of the IF unit.

The transmitter signal from the IF unit is mixed with bandwise VCO output at first transmitter balanced mixers Q24 and

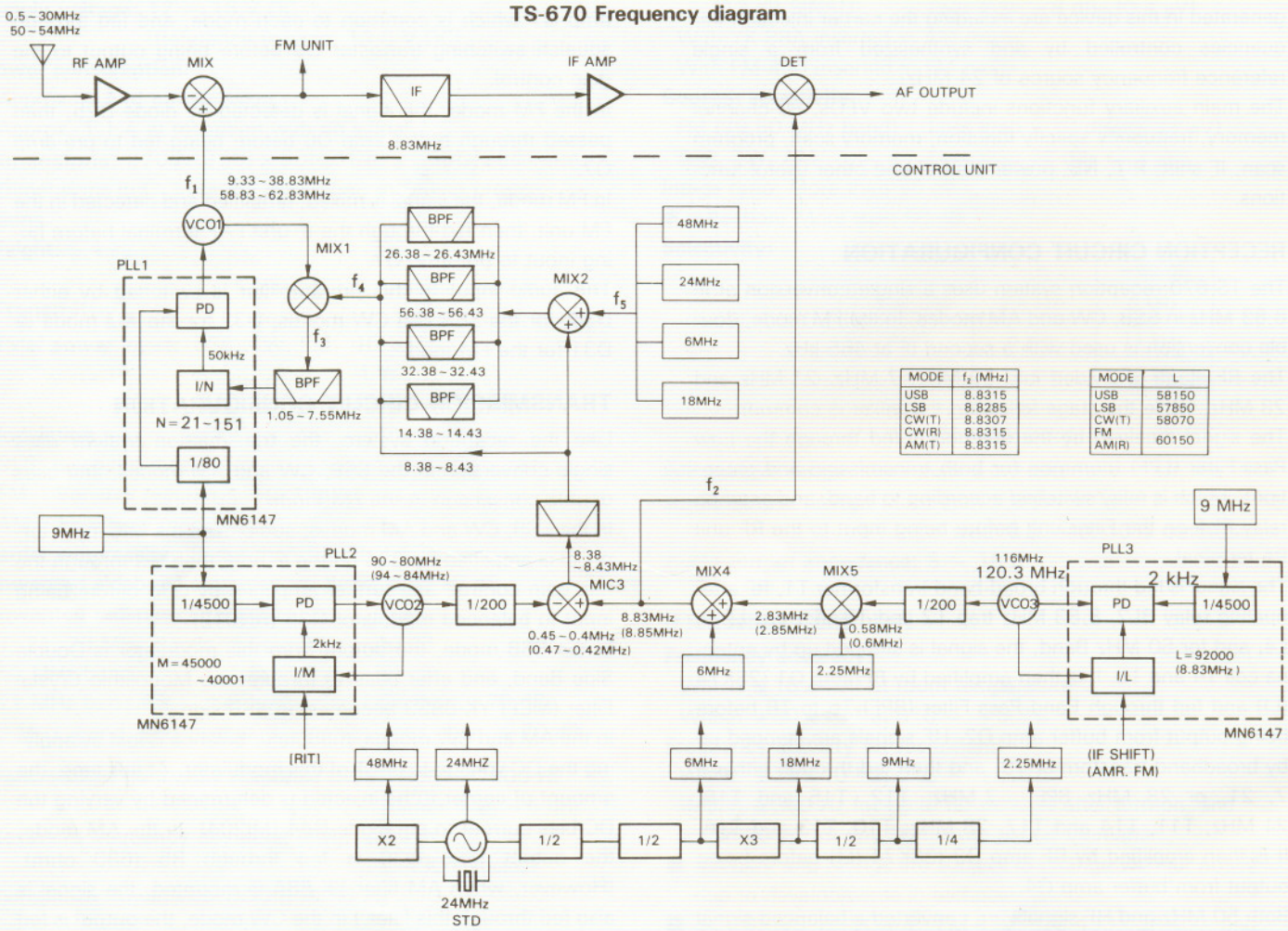
CIRCUIT DESCRIPTION

Q25, then branched into two signals; 50 MHz and 7, 21, 28 MHz signals. The 50 MHz signal is fed through BPF (T37 to T40), then amplified by transmitter amp Q29 (3SK73) and broad-band amplifiers Q30 and Q31 (2SC2086 x 2), and output as a 50 MHz signal. The 7, 21 and 28 MHz signals are fed through each band-wise BPF (common as in reception), then amplified by broad-band amp Q26 (3SK73), buffer amp Q27 and broad-band amp Q28 (2SC2086).

The amplified 50 MHz signal and 7, 21 and 28 MHz signals are switched by relay RL1, then become a drive output to the final unit.

The signal fed to the final unit is amplified by broad-band push-pull drive amps Q1 and Q2 (2SC1971 x 2), then further amplified by broad-band push-pull final amps Q3 and Q4 (2SC2509 x 2), and becomes a 10 W output. The RF output is fed through the band-wise LPFs in the filter unit, then fed to the antenna for output. The ALC and protection detection are performed at the antenna line after feeding through LPFs.

TS-670 Frequency diagram



MODE	f_2 (MHz)
USB	8.8315
LSB	8.8285
CW(T)	8.8307
CW(R)	8.8315
AM(T)	8.8315

MODE	L
USB	58150
LSB	57850
CW(T)	58070
FM	60150
AM(R)	

Item	Rating
Center frequency f_0	8830.7 kHz
Center frequency deviation	$f_0 \pm 150$ Hz at 6 dB
6 dB bandwidth	±250 Hz or more
60 dB bandwidth	±900 Hz or less
Ripple	2 dB or less
Loss	6 dB ± 2 dB
Guaranteed attenuation	80 dB or more within $f_0 \pm 2$ kHz to ±1 MHz
Input and output impedance	600 Ω/15pF

Table 1 CW crystal filter YK-88C (L71-0211-05) Option

Item	Rating
Center frequency f_0	8830.7 kHz
Center frequency deviation	$f_0 \pm 50$ Hz at 6 dB
6 dB bandwidth	±125 Hz or more
60 dB bandwidth	±600 Hz or less
Ripple	2 dB or less
Loss	8 dB ± 2 dB
Guaranteed attenuation	80 dB or more within $f_0 \pm 2$ kHz to ±1 MHz
Input and output impedance	600 Ω/15pF

Table 2 CW crystal filter YK-88CN (L71-0221-05) Option

CIRCUIT DESCRIPTION

PLL CIRCUIT

The PLL circuit of the TS-670 consists of 3 PLL circuits using a reference frequency of 24 MHz and all the frequencies are placed under the control of the 24 MHz reference oscillator. ICs 3, 4 and 13 are PLL ICs. A single package of these ICs (MN6147) contains the program divider, phase comparator, and frequency dividers for the reference signal.

The IC3 PLL has a reference comparison frequency of 2 kHz, and oscillates at 116 MHz (120 MHz during AM reception and FM reception). The 9 MHz signal obtained by dividing a 18 MHz signal by 2, the 3rd higher harmonic of 6 MHz which has been produced from a reference frequency of 24 MHz by dividing with 4, is further divided within the PLL to produce 2 kHz, which is in turn used as a reference comparison frequency. Frequency dividing ratios L are 58150 in USB, 57850 in LSB and 58070 in CW (during transmission) and 60150 during FM and AM (reception). The frequency dividing ratios are determined by the signals fed from data bus DB0 to DB3 of the CPU (IC19: TMP8049P-3034).

The 116 MHz (AM reception, FM 120 MHz) output is divided by a ratio 1/100 x 1/2 (IC5: M54459L, IC6-b: SN74LS112AN) to become 0.5815 MHz (0.6 MHz AM reception, FM) in USB mode, then mixed with a 2.5 MHz signal produced from the reference oscillator by MIX5 (IC7: SN161913P), fed through the BPF, and then mixed with the 6 MHz signal produced by the reference oscillator to obtain 8.8315 MHz in USB mode. This signal is fed through the buffer amp to become the CAR signal, and, on the other hand, it becomes a signal for other PLL. PLL IC4 has a reference comparison frequency of 2 kHz and oscillates at 90 to 80 MHz (AM reception, FM 94 to 84 MHz) in 2 kHz steps.

The 9 MHz signal obtained by the reference frequency is divided within the IC to produce a 2 kHz signal which is in turn used as a reference comparison frequency. The frequency dividing ratio M of the program divider is 45000 to 40001 and the frequency dividing setting signals for the IC are sent from data bus B0 to B3 of the CPU (IC19: TMP8049P-3034).

An output of 90 to 80 MHz (AM reception; FM 94 to 84 MHz) from VCO2 (Q24: 2SC1923) is divided by 1/100 x 1/2 (IC9: M54459L, IC6-a: SN74LS112AN) to become a 10 Hz step signal of 450 - 400 kHz (AM reception; FM 470 to 420 kHz). This signal is mixed with the 8.83 MHz PLL output of IC3 at MIX3 (IC10: SN16913P), then the resultant 8.38 to 8.43 MHz signal is fed through the ceramic filter and input to MIX2 (IC11: SN16913). This 8.38 to 8.43 MHz signal is either kept as it is or mixed with 48 MHz, 24 MHz, 6 MHz or 18 MHz signals generated by the reference oscillator, then input to the final PLL (IC13).

The final PLL IC13 oscillates at VCO frequencies (7, 21, 28 and 50 MHz amateur band frequencies plus 8.83 MHz) corresponding to respective amateur bands using a reference comparison frequency of 50 kHz. A reference comparison frequency of 50 kHz is obtained by dividing the 9 MHz signal generated from a reference frequency of 24 MHz within the PLL IC. Frequency dividing ratio N of the program divider is 31 to 151, and the frequency dividing ratio is given by data bus B0 to B3 of the CPU (IC19: TMP8049P-3034).

		BAND	Frequency range	VCO (f_1)	(f_2)	(f_4)	(f_5)
	①	05A	0.5～1.8MHz	9.33～10.63MHz	5.05～3.8MHz	14.38～14.43MHz	6 MHz
	②	2A	1.8～4 MHz	10.63～12.83MHz	2.25～4.4MHz	8.38～8.43MHz	—
	③	4A	4～6.6MHz	12.83～15.43MHz	4.45～7 MHz	8.38～8.43MHz	—
※	④	7A	6.6～8 MHz	15.43～16.83MHz	1.05～2.4MHz	14.38～14.43MHz	6 MHz
	⑤	8A	8～9.9MHz	16.83～18.73MHz	2.45～4.3MHz	14.38～14.43MHz	6 MHz
		10A	9.9～12 MHz	18.73～20.83MHz	4.35～6.4MHz	14.38～14.43MHz	6 MHz
	⑥	12A	12～16 MHz	20.83～24.83MHz	5.55～1.6MHz	26.38～26.43MHz	18MHz
	⑦	16A	16～21 MHz	24.83～29.83MHz	7.55～2.6MHz	32:38～32.43MHz	24MHz
※	⑧	21A	21～24.8MHz	29.83～33.63MHz	3.45～7.2MHz	26.38～26.43MHz	18MHz
※	⑨	28A	24.8～30 MHz	33.63～38.83MHz	1.25～6.4MHz	32.38～32.43MHz	24MHz
※	⑩	50A	50～54 MHz	58.83～62.83MHz	2.45～6.4MHz	56.38～56.43MHz	48MHz

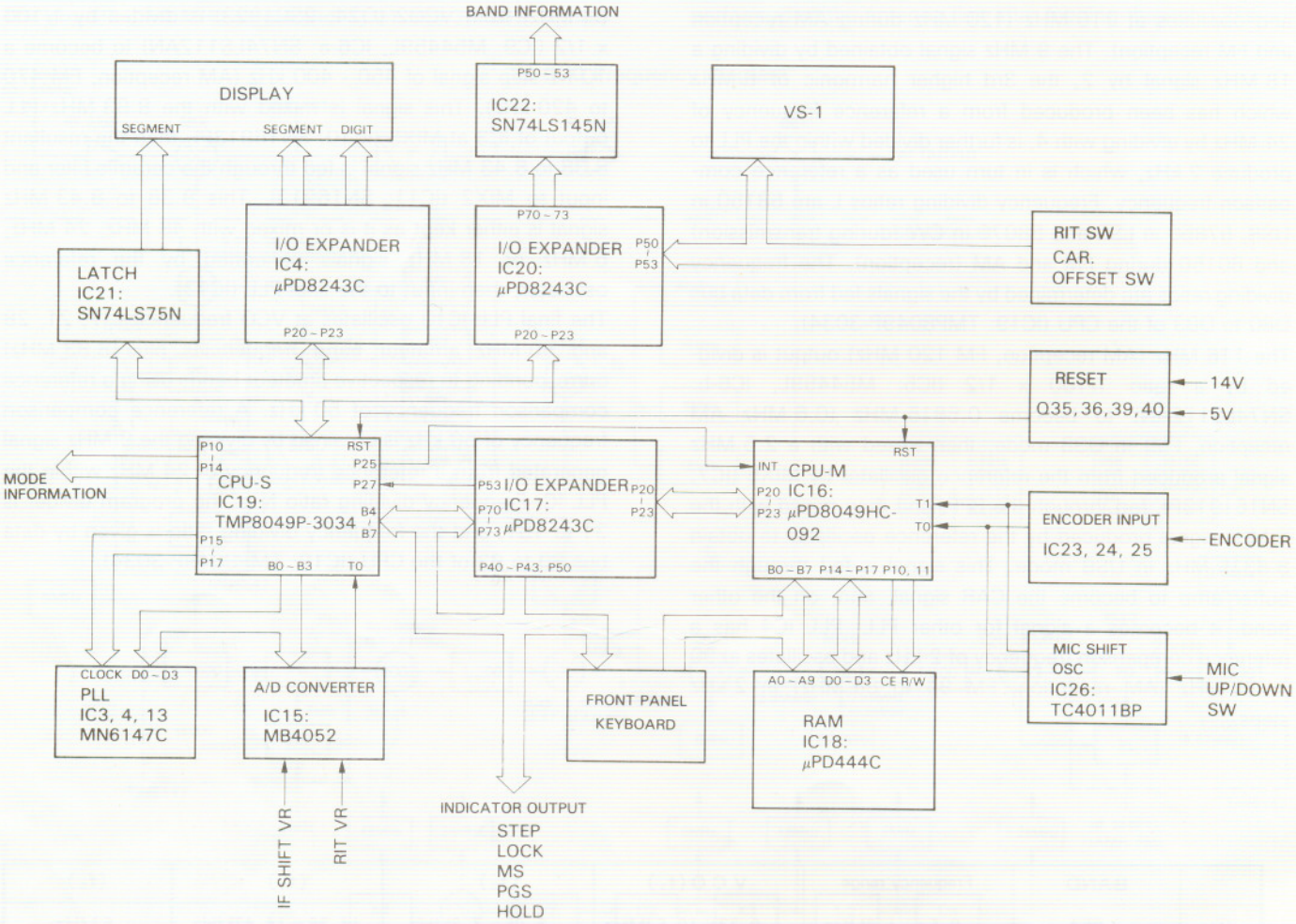
Note 1: * Mark, original installed (without GC-10)

Note 2: ⑤ Band has change VCO (f_1) only and RF has 8～12 MHz BPF.

CIRCUIT DESCRIPTION

The VCO consists of Q17, Q18, Q19 and Q20, and the VCO frequencies corresponding to 7, 21, 28 and 50 MHz are mixed with either one of the five corresponding frequencies 14.38 - 14.43 MHz, 32.38 - 32.43 MHz, 56.38 - 56.43 MHz, and 26.38 - 26.43 MHz (8.38 - 8.43 MHz is used when the general coverage unit is incorporated) generated by the previous MIX2, then fed through the BPF and input to the PLL IC where phase is compared with the 50 kHz signal obtained by using dividing ratio N of 31 to 151.

When the optional general coverage unit (GC-10) is incorporated, the outputs from the six VCOs within the GC-10 are fed to MIX1 where phase is compared with the 50 kHz signal just as in amateur bands.



TS-670 CONTROL BLOCK diagram

Item	Rating
Center frequency (f_0)	8831.5 kHz ± 250 kHz
−6 dB bandwidth	6 kHz
Attenuation bandwidth	11 kHz
Guaranteed attenuation	80 dB or more
Ripple	2 dB or less
Loss	3 dB ± 2 dB
Input and output impedance	600 Ω/15pF
Temperature	−10°C ~ +50°C

Table 3 AM crystal filter YK-88A (L71-0223-05) Option

Item	Rating
Norminal center frequency (f_0)	8.830 MHz
3 dB bandwidth	f_0 ± 5 kHz or more, total 25 kHz or more
20 dB bandwidth	90 kHz or less
Ripple (Within 3 dB bandwidth)	1 dB or less
Spurious response	14 dB or more within f_0 ± 1.5 MHz
Input and output impedance	330 Ω

Table 4 Ceramic filter (L72-0324-05) SFE8.83MF (RF unit, CF1)

CIRCUIT DESCRIPTION

DIGITAL CONTROL CIRCUIT

The controller of the TS-670 uses two 8-bit microprocessors (μPD8049HC-092, and TMP8049P-3034), and its peripheral circuits consist of three I/O expander ICs (μPD8243C), externally connected RAM (μPD444C), etc.

The two CPUs are connected with each other via 4-bit data bus and 2-bit control bus for data interchange.

The microprocessor clock operates at 8.1 MHz, which is oscillated by CPU-S (IC19). The clock pulse is also fed to the other CPU-M (IC16).

The CPU-M (IC16) performs decision and arithmetic operations with which to select the operating state of the unit, using the data from various switches on the panel and encoders, etc., determining the operating frequencies and modes. The determined frequencies and mode data are stored in the externally connected RAM (IC18) and at the same time transferred to the CPU-S (IC19).

To the CPU-M, the I/O expander IC17 is connected, from which control signals for various indicators are output and to which data from the keyboard switches on the front panel is input in matrixed form.

The CPU-S provides the digital frequency display based on the input frequency and mode data, and calculates frequency dividing ratio for each PLL circuit, then set data at PLL ICs (IC3, IC4 and IC13). At the same time, in order to control the external circuits, the CPU-S also outputs mode data and band data. The band data is output in 5-bit data consisting of 4-bit BCD and 1 bit. The 4-bit BCD data is fed through IC22 (SN74LS145N) where it is divided into 10 bands, and a total of 11-band data is output.

The encoder input circuit consists of the OR, exclusive NOR and NAND gates of IC23, IC24 and IC25; the input 250 pulses/revolution clock rate is multiplied by 4 to become 1000 pulses. The IC25 (TC4011BP) flip-flop circuit detects the direction of revolution of the rotary encoder.

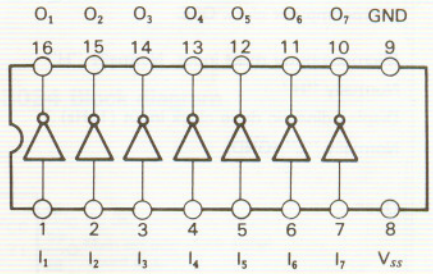
The non-stable multivibrator IC26 (TC4011BP) is an oscillatory circuit for frequency shift by the mic UP/DOWN switch and operates at approx. 55 Hz; this oscillatory frequency determines the shift speed. However, a 1-step feed has nothing to do with this oscillator but is internally processed by the microprocessor.

The RIT and IF shift of the TS-670 are varied by using potentiometers; these can be varied digitally in 10 Hz steps. In RIT mode, the actual frequency is also displayed. The DC voltages preset by potentiometers are divided into approx. 0 to 2.5 V by voltage dividers, then input to the A/D converter (IC15: MB4052) where the signals are converted into the 8-bit (256 steps) data before being input to the CPU-S, varying the frequency dividing ratio of the PLL circuit for control.

μPA80C MAX Rating

Item	Symbol	Condition	Rating
Power voltage	V_{SS}	−60	V
Input voltage	V_I	−20	V
Output current	I_O	50	mA/unit
Ross	P_d	550	mW
Operating case temp.	T_{opr}	−25 ~ +75	°C
Storage temp.	T_{stg}	−40 ~ +125	°C

μPA80C Block diagram



Item	Rating
Center frequency f_0	455 kHz
3 dB bandwidth	$f_0 \pm 4.2$ kHz or more
6 dB bandwidth	$f_0 \pm 6$ kHz or more
60 dB bandwidth	$f_0 \pm 12$ kHz or less
Ripple (With $f_0 \pm 4.2$ kHz)	3 dB or less
Loss	6 dB or less
Guaranteed attenuation	50 dB or more within $f_0 \pm 100$ kHz
Spurious	25 dB or more within 0.1 MHz to 1 MHz
Input and output impedance	1.5 kΩ

Table 5 FM crystal filter CFV455F (L72-0342-05) (FM UNIT, CF1)

Item	Rating
Center frequency f_0	8830 kHz
Center frequency deviation	$f_0 \pm 150$ Hz at 6 dB
6 dB bandwidth	±1.2 kHz or more
60 dB bandwidth	±3.3 kHz or less
Ripple	2 dB or less
Loss	6 dB or less
Guaranteed attenuation	80 dB or more within $f_0 \pm 3$ kHz to ±1 MHz
Input and output impedance	600 Ω/15pF

Table 6 CW crystal filter YK-88S3 (L71-0245-05) (IF UNIT, XF1)

CIRCUIT DESCRIPTION

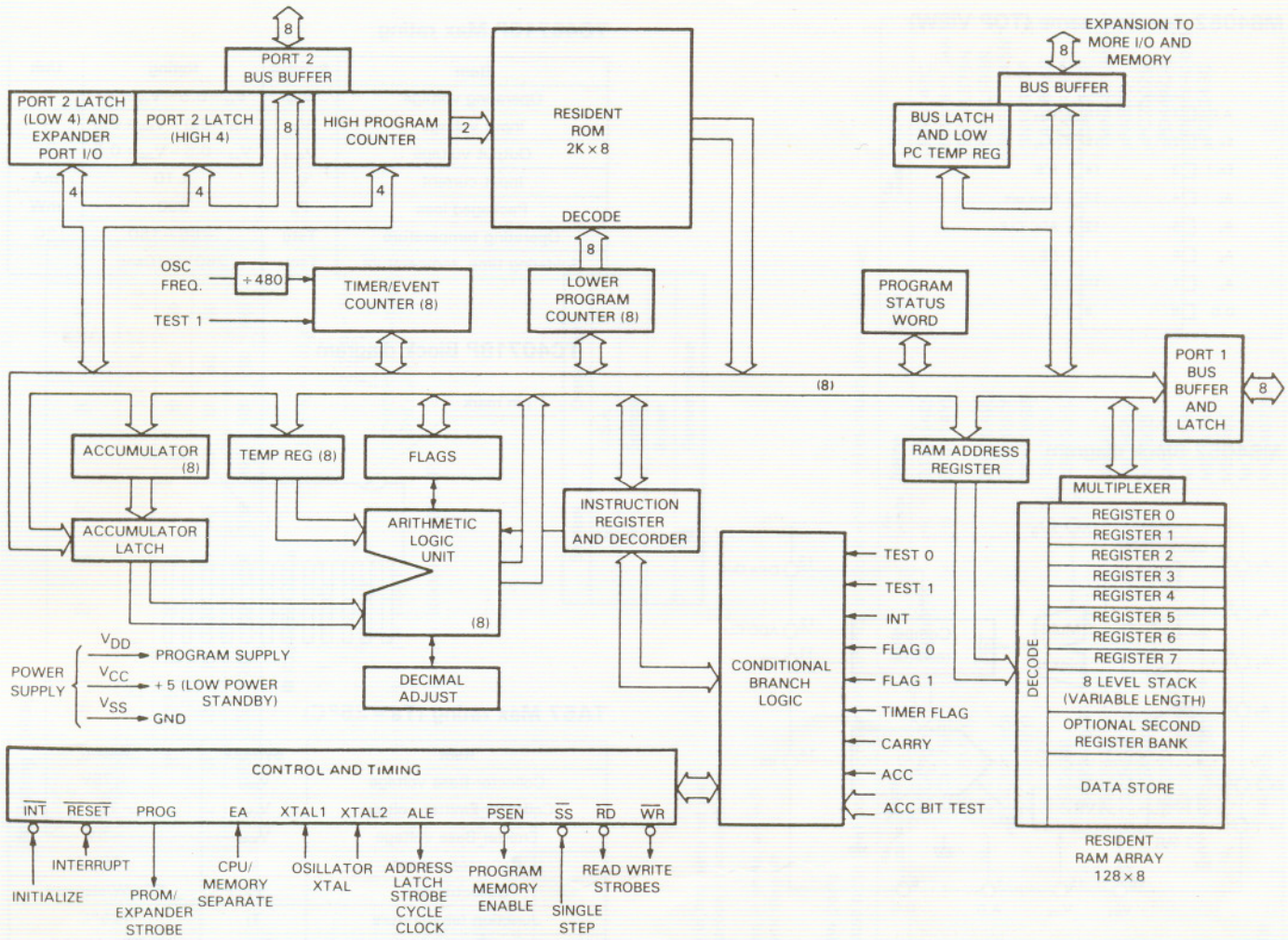
CPU-M IC6 (μPD 8049HC-092) Terminal function

Terminal No.	Symbol	Explanation	Terminal No.	Symbol	Explanation
1	TO	Encoder UP/DOWN signal input	21	P20	I/O EXPANDER control output (IC17)
2	X'tal 1	Microcomputer clock input	22	P21	
3	X'tal 2		23	P22	
4	RESET	Microcomputer reset input. Normally "H"	24	P23	
5	SS	Normally "H"	25	PROG	
6	INT	CPU-S control input	26	V_{DD}	5V Power supply
7	EA	Normaly "L"	27	P10	RAM CE output
8	RD	Open	28	P11	RAM R/W output READ: H WRITE: L
9	PSEN		29	P12	1MHz STEP SW input OFF: H ON: L
10	WR		30	P13	POWER DOWN input NORM: H
11	ALE		31	P14	RAM Date IN/OUTPUT
12	DB 0	Data input RAM address output (A0 ~ 7)	32	P15	
13	DB 1		33	P16	
14	DB 2		34	P17	
15	DB 3		35	P24	RAM Address output (A8)
16	DB 4		36	P25	RAM Address output (A9)
17	DB 5		37	P26	Encoder F.F. Reset output
18	DB 6		38	P27	TX signal input TX: L RX: H
19	DB 7		39	T 1	Encoder clock output
20	GND	GND terminal	40	V_{cc}	5V Power supply

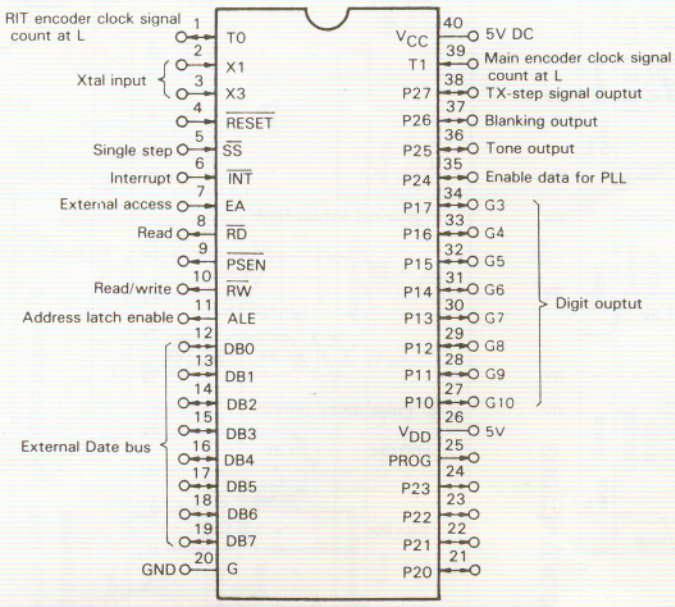
CPU-S IC19 (TMP8049P-3034) Terminal function

Terminal No.	Symbol	Explanation	Terminal No.	Symbol	Explanation
1	TO	A/D converter input	21	P20	I/O EXPANDER control output (IC20) LATCH IC data output
2	X'tal 1	Microcomputer clock OSC	22	P21	
3	X'tal 2		23	P22	
4	RESET	Microcomputer reset input. Normally "H"	24	P23	
5	SS	Normally "H"	25	PROG	
6	INT	Display dinamic drive clock input (1kHz)	26	V_{DD}	5V Power supply
7	EA	Normally "L" (GND)	27	P10	LSB MODE output Normally "H"
8	RD	Open	28	P11	USB
9	PSEN		29	P12	CW
10	WR		30	P13	AM
11	ALE		31	P14	FM
12	DB 0	PLL dividing ratio output A/D control output Data input	32	P15	PLL 1 clock output (IC13)
13	DB 1		33	P16	PLL 2 clock output (IC4)
14	DB 2		34	P17	PLL 3 clock output (IC3)
15	DB 3		35	P24	LATCH output
16	DB 4	CPU-M control bus (input)	36	P25	CPU-M control output
17	DB 5		37	P26	EXPANDER CHIP SELECT output
18	DB 6		38	P27	CPU-M control input
19	DB 7		39	T 1	PLL UNLOCK input NOR: H UNLOCK: L
20	GND	GND terminal	40	V_{cc}	5V Power supply

CIRCUIT DESCRIPTION



μPD8049HC-092/TM8049P-3034 Block diagram

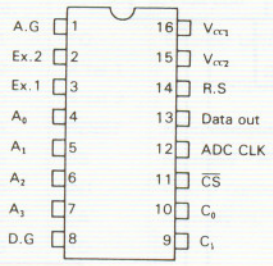


μPD8049HC-092/TMP8049P-3034 Terminal name

TS-670

CIRCUIT DESCRIPTION

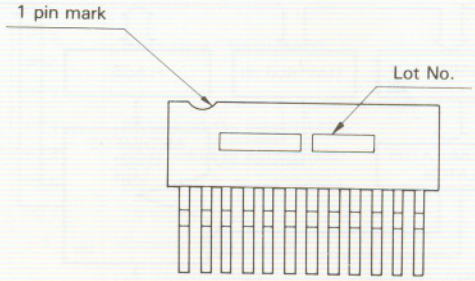
MB4052 Terminal name (TOP VIEW)



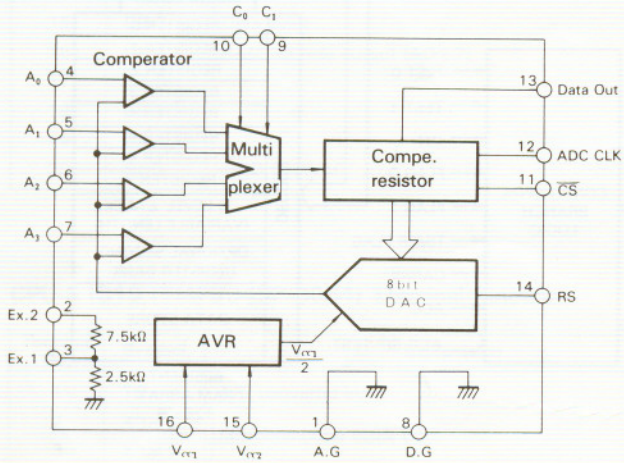
TC4071BP Max rating

Item	Symbol	Rating	Unit
Operating voltage	V_{DD}	$V_{SS}-0.5 \sim V_{SS}+20$	V
Input voltage	V_{IN}	$V_{SS}-0.5 \sim V_{DD}+0.5$	V
Output voltage	V_{OUT}	$V_{SS}-0.5 \sim V_{DD}+0.5$	V
Input current	I_{IN}	±10	mA
Packaged loss	P_D	300	mW
Operating temperature	Tstg	−65 ~ 150	°C
Soldering time, temperature	Tsol.	260°C·10sec	

TC4071BP Block diagram



MB4052 Block diagram

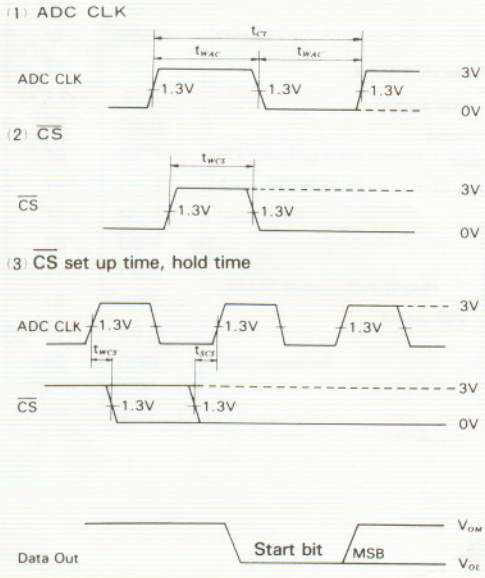


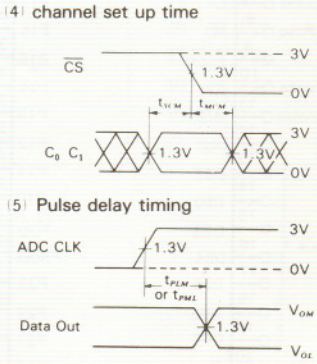
TA57 Max rating (Ta = 25°C)

Item	Symbol	Rating
Collector-Base voltage	V_{CBO}	−75V
Collector-Emitter voltage	V_{CER}	−75V*
Emitter-Base voltage	V_{EBO}	−5V
Collector current	I_C	−50mA
Collector loss	P_C	50mW/element
Junction temperature	Tj	125°C
Operating temperature	Tstg	−55 ~ 125°C

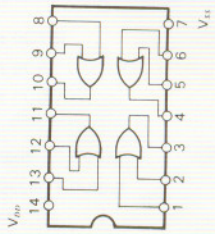
*R_{BE} = 10kΩ

MB4052 Wave form





TA57 Terminal diagram



CAPACITORS

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

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

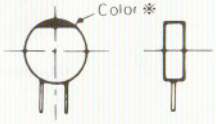
● Temperature coefficient

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

CC45



● 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

Less than 10 pF

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

Abbreviation		Abbreviation	
Cap	Capacitor	ML	Mylar
C	Ceramic	S	Styren
E	Electrolytic	T	Tantalum
MC	Mica		

Resistors not listed in this parts list are standard, fixed carbon composition, 1/4W or 1/8W
The resistance values, in ohms, are indicated on the schematic diagram.

● 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	–

● 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, 2nd number, Multiplier

Symbol	Destination
K	U.S.A.
W	Europe
T	Britain
M	General market

SEMICONDUCTORS

N : New parts
* : Please note that parts are sometimes not in stock and it takes much time to deliver.

Item	Remarks	Name
Diode		BA282
		IN60
		IS1007
		IS1587
		IS2208
		IS2588
		ISS101
		ISS133
		ISS1555
		1TT310TE
	N	MC921
		M1204
		MV13
		MV203
		V06B
Vari-cap Diode		1SV53A

Item	Remarks	Name
Zenner Diode		MTZ3.9JA
		MTZ4.3JA
		MTZ6.2JA
		MTZ7.3JC
		MTZ7.5JA
	N	MTZ8.2JB
		MTZ9.1JB
		MTZ10JA
		MTZ12JB
		WZ071
Photo-diode		LN66
TR	N	2SA562(Y)
		2SA733(R)
		2SA1015(Y)
		2SA1115(E)
		2SC460(B)

Item	Remarks	Name
		2SC496(Y)
		2SC1775(E)
		2SC1815(Y)
	N	2SC1907
		2SC1923(O)
		2SC1959(Y)
		2SC1971
		2SC2086
		2SC2240(GR)
		2SC2347
		2SC2458(Y)
		2SC2459(BL)
		2SC2509
		2SC2703(O,Y)
	N	2SC2787(L)
	N	TA57
Photo-TR		PN1265

Item	Remarks	Name
Digital-TR	N	DTA114ES
	N	DTC114YS
FET		2SK30A(O)
		2SK192(Y)
		3SK73(GR)
		3SK74(L)
		3SK122(L)
IC		AN612
		AN7805
		AN7808
		LM358P
		M54459L
		MB3614
	N	MB4052
		MC3357P
		MC14077B

Item	Remarks	Name
		MN6147C
		SN74LS11.2AN
		SN74LS75N
		SN74LS93N
		SN74LS145N
		SN16913P
		TA1061AP
		TC4011BP
		TC4071BP
		TMP8049P-3034
		μPA80C
		μPC2002V
		μPD444C-0
		μPD8049HC-092
		μPD8243C

TS-670 PARTS LIST

TS-670

Parts No.	Re-marks	Description	Q'ty	Ref No.
A01-0974-02		CASE (A)	1	
A01-0975-02		CASE (B)	1	
A20-2506-03	N	PANEL	1	
B05-0708-04		SP GRILE	1	
B10-0664-04	N	FRONT GLASS	1	
B30-0817-15		LAMP	1	
B31-0653-05	N	METER	1	
B39-0407-04		SPACER FOOT	2	
B40-3501-04	N	NAME PLATE KENWOOD	1	
B42-2378-04	N	FCC PLATE	1	K type only
B43-1007-04	N	BADGE KENWOOD	1	
B50-4115-00		INSTRUCTION MANUAL KENWOOD	1	
CE04W1A470M		ELECTRO 47 10V	1	
CK45F1H103Z		CERAMIC 0.01 50V	2	
CK45F1H473Z		CERAMIC 0.047 50V	1	
D09-0306-04			1	M type only
D09-0307-04			1	M type only
D40-0626-15		MECHANISM ASS'Y	1	
ERZD03DK331		SERGE ABSORB	2	
E04-0152-05		RF COAXIAL CABLE RECEPTACLE	2	
E06-0751-05		CYLINDRICAL RECEPTACLE REMOTE	1	
E07-0852-05		VOLTAGE SELECTOR PLUG	1	M type only
E08-0203-25		VOLTAGE SELECTOR SOCKET	1	
E30-1648-05		DC CABLE ASS'Y	1	
E31-0431-05		SPEAKER CABLE	1	
E31-2161-05		INSIDE CONNECTING WIRE	1	M type only
E40-0474-05		PIN ASS'Y	1	M type only
F05-4022-05		FUSE(4A)	1	
F05-4022-05		FUSE(4A)	1	
F10-1302-12	N*	SHIELDING PLATE	1	
F11-0858-03	N	SHIELDING CASE	1	
F15-0653-04	N	SHADE	1	
G02-0505-05		KNOB FITTING HARDWARE SPRING	3	
G09-0405-05		SPRING	1	
G11-0613-04	N	SOFT TAPE VFO	1	
G11-0609-04		SOFT TAPE MIC	2	M type only
G13-0666-04		CUSHION PANEL	2	
G13-0649-04		MOUNTING HARDWARE METER	2	
G53-0511-04		PACKING	4	
H01-4547-04		CARTON CASE (OUT)	1	
H03-2177-04		CARTON CASE (IN)	1	
H10-2588-02	N	POLYSTYRENE FOAM (F)	1	
H10-2589-02	N	POLYSTYRENE FOAM (R)	1	
H12-1315-04			1	
H25-0079-04		BAG 200X200	1	M type only
J02-0323-05		FOOT BOTTOM CASE	4	
J02-0407-04		FOOT METAL	1	
J02-0403-04		FOOT RUBBER	4	
J30-0534-04		SPACER (PLATE TYPE)	2	
J31-0141-04		COLLAR MIC	1	
J32-0781-04	N	BOSS 11.5CM	4	
J32-0782-04	N	BOSS 11CM	2	
J32-0786-04	N	BOSS 8.5CM POWER SW	2	
J61-0019-05		VINYL TIE	5	
J61-0408-05		VINYL TIE	5	
K01-0410-05		HANDLE	1	
K21-0768-04		MAIN KNOB	1	
K23-0710-04		KNOB AF RIT MIC	3	
K23-0721-04		KNOB SQL	1	
K27-0467-04	N	KNOB BAND	2	
K29-0741-24		KNOB RF GAIN,IF SHIF	3	
K29-0758-04		KNOB POWER	1	
K29-3001-04	N	KNOB 1MHZ RIT SEND	5	
K29-3002-04	N	KNOB VOICE NB ALC	3	
K29-0771-04		KNOB MAIN RING	1	
LM358P		IC	1	
LN01201C	N	DIODE RED	2	
LN01301C	N	DIODE GREEN	5	
LN01401C	N	DIODE UMBER	4	
LN66(R)		DIODE	2	
N09-0256-05		SCREW	4	
N09-0682-04	N	SCREW (ACS. MOUNTING BLACKET)	1	
N09-0646-04		SCREW M4X4	2	
N14-0509-05		NUT GND	1	
N14-0115-05		NUT GND	1	
N15-1040-46		FLAT WASHER GND	2	
N30-2004-46		PAN HD SCREW	2	
N30-2604-46		PAN HD SCREW	4	
N32-2604-46		FLAT HD SCREW	6	
N32-2606-46		FLAT HD SCREW	10	
N32-3006-46		FLAT HD SCREW	2	
N33-3006-41		ROUND FLAT SCREW	4	
N33-3006-45		ROUND FLAT SCREW	4	
N35-3004-41		BIND SCREW	16	
N35-3006-46		BIND SCREW	2	
N87-2608-46		TAPPING SCREW	2	
N87-3006-41		TAPPING SCREW	6	
N87-3006-46		TAPPING SCREW	16	
N87-3012-46		TAPPING SCREW	29	
N88-2605-46			2	
N88-3006-46		FLAT TAPPING SCREW	12	
PN126S		PHOTO TRANSISTOR	2	
RS14AB3A100J		METAL FILM 10 OHM 1W	1	
R12-2411-05		SEMI FIXED	2	
S31-2045-05			1	
S40-2437-05		PUSH SW POWER	1	
S50-1406-05		TACT SWTCH(UP,DOWN)	2	
S59-0421-05	N	KEYBOARD SWITCH	1	M type only
T03-0027-15		SPEAKER	1	
T91-0316-15		MIC	1	M type only
W02-0328-10		ENCODER ASS'Y	1	
W09-0323-05		LITHUM BATTERY CR2032	1	
X41-1550-00	N	SWITCH UNIT	1	
X44-1580-00	N	RF UNIT	1	
X45-1350-00	N	PA UNIT	1	
X48-1390-00	N	IF UNIT	1	
X51-1320-00	N	FILTER UNIT	1	
X53-1370-00	N	CONT UNIT	1	
X54-1800-00	N	DISP UNIT	1	
2SA1015(Y)		TR	1	
25D29		DIODE	1	M type only
490-0067-05		TAPE 3 MM	4	

SWITCH UNIT (X41-1550-00)

CK45F1H103Z		CERAMIC 0.01 50V	3	C , 7, 8, 9
CK45F1H473Z		CERAMIC 0.047 50V	4	C , 3, 4, 5, 6
C90-0817-05		FIXED ELECTRO	2	C , 1, 2
E06-0858-05		CYLINDRICAL RECEPTACLE 8P	1	
E08-0272-05		VOLTAGE SELECTOR SOCKET 2P	1	
E08-0373-05		VOLTAGE SELECTOR SOCKET 3P	1	
E11-0401-05		EARPHONE JACK EXT.SP	1	
E11-0413-05		PHONE JACK PHONES	1	
E11-0418-05		PHONE JACK 3P KEY JACK	1	
E23-0401-05		TERMINAL (INSIDE)	1	

Parts No.	Re-marks	Description	Q'ty	Ref No.
E40-0273-05		MINI CONNECTOR 2P	5	
E40-0373-05		MINI CONNECTOR 3P	2	
E40-0473-05		MINI CONNECTOR 4P	1	
E40-0673-05		MINI CONNECTOR 6P	1	
E40-0873-05		MINICONNECTOR 8P	1	
E40-0973-05		PIN ASS'Y 9P	1	
L15-0016-05		LOW-FREQUENCY COIL	1	CH , 1
R06-9407-05	N	POTENTIOMETER SQ	1	VR , 1
R12-1428-05	N	TRIM.POT. RVF6P01 1K	3	VR , 5, 7, 10
R12-3443-05	N	TRIM.POT. 10K	1	VR , 9
R12-4413-05	N	TRIM.POT. 50K	1	VR , 6
R12-1430-05		TRIM.POT. 3K	1	VR , 8
R19-3418-05	N	POTENTIOMETER	1	VR , 3
R19-3419-05	N	POTENTIOMETER	1	VR , 2
R19-3420-05	N	POTENTIOMETER	1	VR , 4
S40-2440-15		PUSH SW 2-2	7	S , 3, 4, 5, 6, 7, 8, 9
S40-2441-15		PUSH SW NON LOCK	1	S , 10
S50-2402-05	N	TACT SWITCH	2	S , 1, 2
U05B		DIODE	1	D , 1

RF UNIT (X44-1580-00)

Parts No.	Re-marks	Description	Q'ty	Ref No.
BA282		DIODE	5	D , 3, 32, 34, 35, 36
CC45UJ1H030C		CERAMIC 3P 50V	1	C ,101
CC45UJ1H120J		CERAMIC 12P 50V	1	C , 96
CC45SL1H0R5C		CERAMIC 0.5P 50V	1	C , 7
CC45SL1H121J		CERAMIC 120P 50V	1	C ,136
CC45CH1H040C		CERAMIC 4P 50V	2	C , 6,159
CC45SL1H010C		CERAMIC 1P 50V	1	C ,152
CC45CH1H050C		CERAMIC 5P 50V	3	C ,106,113,114
CC45UJ1H150J		CERAMIC 15P 50V	2	C , 99,100
CC45SL1H030C		CERAMIC 3P 50V	1	C , 71
CC45UJ1H180J		CERAMIC 18P 50V	5	C , 84, 85, 86, 90,102
CC45CH1H090D		CERAMIC 9P 50V	2	C ,105,150
CC45UJ1H220J		CERAMIC 22P 50V	1	C ,102
CC45SL1H331J		CERAMIC 330P 50V	1	C , 75
CC45SL1H470J		CERAMIC 47P 50V	2	C , 51, 52
CC45UJ1H270J		CERAMIC 27P 50V	2	C , 83, 91
CC45UJ1H300J		CERAMIC 30P 50V	1	C , 89
CC45RH1H120J		CERAMIC 12P 50V	2	C , 37,148
CC45UJ1H330J		CERAMIC 33P 50V	1	C , 94
CC45RH1H150J		CERAMIC 15P 50V	1	C ,175
CC45SL1H101J		CERAMIC 100P 50V	2	C ,139,160
CC45SL1H100D		CERAMIC 10P 50V	2	C , 57, 65
CC45SL1H151J		CERAMIC 150P 50V	2	C ,109,110
CC45UJ1H100D		CERAMIC 10P 50V	1	C , 95
CC45SL1H221J		CERAMIC 220P 50V	1	C ,111
CC45SL1H220J		CERAMIC 22P 50V	1	C , 38
CC45RH1H180J		CERAMIC 18P 50V	2	C ,176,177
CC45RH1H050C		CERAMIC 5P 50V	3	C ,153,173,174
CC45SL1H330J		CERAMIC 33P 50V	3	C , 8,117,119
CC45CH1H080D		CERAMIC 8P 50V	1	C , 14
CC45CH1H150J		CERAMIC 15P 50V	1	C , 13
CC45RH1H100D		CERAMIC 10P 50V	1	C , 15
CC45SL1H680J		CERAMIC 68P 50V	2	C ,118,166
CC45SL1H820J		CERAMIC 82P 50V	1	C ,145
CC45CH1H220J		CERAMIC 22P 50V	1	C ,149
CC45CH1H240J		CERAMIC 24P 50V	1	C ,151
CE04W1A470M		ELECTRO 47 10V	4	C , 88, 93, 98,104
CE04W1C100M		ELECTRO 10 16V	1	C , 55
CE04W1HR33M		ELECTRO 0.33 50V	1	C ,169
CE04W1H010M		ELECTRO 1 50V	1	C , 79
CE04W1H3R3M		ELECTRO 3.3 50V	1	C ,170
CK45F1H103Z		CERAMIC 0.01 50V	30	C , 5, 12, 20, 27, 31, 41, 48 , 53, 56, 63, 68, 76, 81,112
CK45F1H103Z		CERAMIC 0.01 50V		C ,115,121,124,125,128,130,133 ,146,156,157,158,162,164,168
CK45F1H103Z		CERAMIC 0.01 50V		C ,178,179
CK45F1H223Z		CERAMIC 0.022 50V	15	C , 19, 21, 22, 23, 29, 36, 45 , 50, 73,107,123,129,138,140
CK45F1H223Z		CERAMIC 0.022 50V		C ,165
CK45B1H471K		CERAMIC 470P 50V	2	C ,120,161
CK45B1H102K		CERAMIC 1000P 50V	4	C , 46, 67, 74,134
CK45F1H473Z		CERAMIC 0.047 50V	1	C , 35
CQ92M1H122K		MYLAR 1200P 50V	1	C , 2
CQ92M1H272K		MYLAR 2700P 50V	1	C , 3
CQ92M1H472K		MYLAR 4700P 50V	1	C , 4
C05-0030-15		TRIMMER 20PF	1	TC , 4
C05-0309-05		TRIMMER 40P	3	TC , 1, 2, 3
C90-0838-05		ELECTRO 1 50V	1	C , 60
C91-0117-05		CERAMIC CAP 0.01	30	C , 1, 10, 11, 16, 32, 34, 40 , 44, 47, 54, 58, 59, 62, 66
C91-0117-05		CERAMIC CAP 0.01		C , 70, 78, 87, 92, 97,103,116 ,122,132,135,141,142,147,155
C91-0117-05		CERAMIC CAP 0.01		C ,163,171
C91-1031-05	N	FIXED 1200P 50V	1	C , 30
C91-1008-05		CERAMIC 0.022	18	C , 17, 18, 24, 25, 26, 28, 39 , 42, 43, 49, 69, 72, 77, 82
C91-1008-05		CERAMIC 0.022		C ,108,126,127,143
C91-0119-05		CERAMIC 0.047 25V	4	C , 9, 33, 61, 80
DTA114E(S)	N	DIGITAL TR	6	Q , 33, 35, 36, 37, 38, 44
DTC114E(S)		DIGITAL TR	1	Q , 43
E23-0443-05		TERMINAL (INSIDE) TP	5	TP , 1, 2, 3, 4, 5
E31-2170-05		JUMPER WIRE	55	
E40-0273-05		MINI CONNECTOR 2P	11	
E40-0373-05		MINI CONNECTOR 3P	2	
E40-0473-05		MINI CONNECTOR 4P	1	
E40-0573-05		MINI CONNECTOR 5P	2	
E40-0673-05		MINI CONNECTOR 6P	1	
ITT310TE		VARI-CAP DIODE	4	D , 27, 29, 31, 33
J31-0503-05		BEADS	2	
J31-0502-04		COLLAR	8	
J42-0428-05		BUSHING	8	
J61-0408-05		VINYL TIE	1	
L19-0324-05		TRANSFORMER	2	T , 20, 32
L19-0328-05		TRANSFORMER	1	T , 36
L19-0344-05		TRANSFORMER	1	T , 1
L30-0506-05		IFT	1	T , 21
L30-0511-05		IFT	1	T , 25
L30-0512-05		IFT	1	T , 22
L32-0193-05		OSCILLATING COIL 7MHZ	1	T , 31
L32-0197-05		OSCILLATING COIL 21,28MHZ	2	T , 29, 30
L32-0639-05		OSCILLATING COIL 50MHZ	1	T , 28
L33-0222-05		CHOKE COIL	2	L , 39, 44
L34-0535-05		TUNING COIL	1	T , 26
L34-0536-05		TUNING COIL	2	T , 23, 27
L34-0558-05		TRAP COIL	1	T , 3
L34-0696-35		IN PUT COIL	1	T , 9
L34-0697-05		OUTPUT COIL	1	T , 33
L34-0908-05		TUNING COIL	2	L , 26, 27
L34-0942-05		TUNING COIL	1	T , 24
L34-0966-05		TRAP COIL	2	T , 2, 19
L34-1021-05		INPUT COIL	1	L , 41
L34-1022-05		OUTPUT COIL	1	L , 45
L34-2054-05		TUNING COIL 52MHZ	8	T , 4, 5, 6, 7, 8, 38, 39 , 40
L34-2055-05		TUNING COIL 52MHZH	2	T , 41, 42
L34-2205-05	N	TUNING COIL 52MHZ	1	T , 37
L34-2206-05	N	TRAP COIL 8.83MHZ	2	T , 34, 35
L34-3093-05	N	BPF COIL 28MHZ	2	T , 10, 16
L34-3094-05	N	BPF COIL 28MHZ	1	T , 13
L34-3095-05	N	BPF COIL 21MHZ	2	T , 11, 17
L34-3096-05	N	BPF COIL 21MHZ	1	T , 12
L34-3097-05	N	BPF COIL 7MHZ	1	T , 12
L34-3098-05	N	BPF COIL 7MHZ	1	T , 18
L34-3105-05	N	BPF COIL 7MHZ	1	T , 18
L40-1001-02		INDUCTOR 10 UH	3	L , 2, 3, 4
L40-1011-03		INDUCTOR 100 UH	1	L , 18

TS-670 PARTS LIST

Parts No.	Re-marks	Description			Q'ty	Ref No.
L40-1511-03		INDUCTOR	150 UH		8	L , 6, 9, 14, 16, 17, 32, 33 , 34
L40-3391-13		INDUCTOR	3.3 UH		1	L , 38
L40-4791-13		INDUCTOR	4.7 UH		1	L , 43
L40-1001-13		INDUCTOR	10 UH		1	L , 42
L40-4701-13		INDUCTOR	47 UH		1	L , 47
L40-1011-17	N	INDUCTOR	100 UH		2	L , 13, 29
L40-3982-14		INDUCTOR	0.39UH		2	L , 21, 22
L40-8282-14		INDUCTOR	0.82UH		2	L , 20, 23
L40-1092-14		INDUCTOR	1 UH		1	L , 40
L40-1592-14		INDUCTOR	1.5 UH		1	L , 10
L40-4701-14		INDUCTOR	47 UH		2	L , 15, 37
L40-1011-14		INDUCTOR	100 UH		15	L , 1, 5, 7, 8, 11, 12, 19 , 24, 28, 30, 31, 35, 36, 46
L40-1011-14		INDUCTOR	100 UH			L , 48
L40-2211-14		INDUCTOR	220 UH		1	L , 25
L72-0324-05		CERAMIC FILTER	8.83MHZ		1	CF , 1
MC921		DOUBLE DIODE			2	D , 40, 50
MV13		VARISTOR			2	D , 22, 25
MV203		VARISTOR			1	D , 48
R12-1429-05	N	TRIM.POT.	500		2	VR , 1, 2
R12-1430-05	N	TRIM.POT.	3K		2	VR , 3, 4
R12-7403-05		SEMI FIXED	RGS6-FAN 500K		1	VR , 5
R92-0150-05		JUMPER WIRE			20	
S51-1422-05	N	RELAY			2	RL , 1, 2
1N60		DIODE			3	D , 21, 23, 24
1SS133		DIODE			8	D , 26, 37, 38, 41, 42, 43, 44 , 46
1S1555		DIODE			9	D , 51, 52, 53, 54, 55, 56, 57 , 58, 59
1S1587		DIODE			16	D , 6, 8, 9, 11, 12, 13, 15 , 16, 17, 18, 19, 20, 28, 30
1S1587		DIODE				D , 45, 47
1S2588		DIODE			7	D , 1, 2, 4, 5, 7, 10, 14
2SA733(R)		TR			1	Q , 32
2SA562(Y)	N	TR			4	Q , 39, 40, 41, 42
2SA1115(E)		TR			1	Q , 34
2SC2787(L)	N	TR			3	Q , 17, 18, 19
2SC1923(O)		TR			1	Q , 23
2SC2086		TR			3	Q , 28, 30, 31
2SC2347		TR			1	Q , 21
2SC2458(Y)		TR	OR 2SC2603(E)		6	Q , 4, 8, 9, 10, 15, 16
2SC460(B)		TR			3	Q , 12, 13, 14
2SC1907	N	TR			3	Q , 2, 22, 27
2SK192(Y)		FET			1	Q , 11
2SK192A(GR)*N		FET			1	Q , 20
3SK73(GR)		FET			3	Q , 7, 26, 29
3SK74(L)		FET			2	Q , 1, 3
3SK122(L)		FET			4	Q , 5, 6, 24, 25

FINAL UNIT (X45-1350-00)

Parts No.	Re-marks	Description			Q'ty	Ref No.
CC45SL1H220J		CERAMIC	22P	50V	1	C , 1
CC45SL1H820J		CERAMIC	82P	50V	1	C , 6
CC45SL2H220J		CERAMIC	22P	500V	1	C , 30
CC45SL2H820J		CERAMIC	82P	500V	1	C , 11
CC45SL2H221J		CERAMIC	220P	500V	2	C , 27, 28
CC45SL2H331J		CERAMIC	330P	500V	1	C , 26
CC45SL2H151J		CERAMIC	150P	500V	1	C , 29
CE04W1C100M		ELECTRO	10	16V	2	C , 16, 20
CE04W1C221M		ELECTRO	220	16V	1	C , 9
CK45B1H102K		CERAMIC	1000P	50V	4	C , 12, 13, 14, 21
CK45F1H103Z		CERAMIC	0.01	50V	12	C , 2, 3, 4, 7, 8, 15, 17 , 18, 19, 22, 24, 25
CK45F1H103Z		CERAMIC	0.01	50V		C
CK45F1H223Z		CERAMIC	0.022	50V	2	C , 5, 10
C05-0043-05		TRIMMER	20P		1	TC , 1

Parts No.	Re-marks	Description			Q'ty	Ref No.
E23-0401-05		TERMINAL (INSIDE)			1	
E23-0512-05		TERMINAL			1	
E31-2061-05		JUMPER WIRE			2	
F01-0761-03		HEAT SINK			1	
F20-0078-05		INSULATING PLATE			1	
J31-0505-04		COLLAR			6	
L19-0315-25		COIL			1	T , 1
L19-0325-05		COIL			1	T , 2
L19-0326-05		COIL			1	T , 3
L19-0327-05		COIL			1	T , 4
L33-0617-05		CHOKE COIL			1	L , 3
L33-0025-05		CHOKE COIL	1.3UH		3	L , 1, 2, 4
MV-5T		DIODE			1	D , 1
R12-0408-05		SEMI FIXED			1	VR , 2
R12-1422-05		SEMI FIXED			1	VR , 1
R92-0601-05		FIXED RESISTOR 0.22			1	R , 9
R92-0150-05		JUMPER WIRE			3	
SV03Y		DIODE			1	D , 2
2SC1971		TR			2	Q , 1, 2
2SC2509		TR			2	Q , 3, 4
2SC496(Y)		TR			1	Q , 5

IF UNIT (X48-1390-00)

Parts No.	Re-marks	Description			Q'ty	Ref No.
AN612		IC			1	Q , 36
AN7805		IC			1	Q , 26
AN7808		IC			1	Q , 27
CC45SL1H101J		CERAMIC	100P	50V	3	C , 44, 88, 89
CC45UJ1H150J		CERAMIC	15P	50V	1	C , 35
CC45SL1H221J		CERAMIC	220P	50V	1	C , 54
CC45SL1H050C		CERAMIC	5P	50V	1	C , 12
CC45SL1H100D		CERAMIC	10P	50V	1	C , 32
CC45SL1H150J		CERAMIC	15P	50V	2	C , 4, 13
CC45SL1H470J		CERAMIC	47P	50V	5	C , 53, 55,107,110,121
CE04W1C470M		ELECTRO	47	16V	1	C , 75
CE04W1H0R1M		ELECTRO	0.1	50V	1	C , 50
CE04W1HR22M		ELECTRO	0.22	50V	2	C , 61, 81
CE04W1HR47M		ELECTRO	0.47	50V	4	C , 38, 46, 59,140
CE04W1H010M		ELECTRO	1	50V	13	C , 44, 57, 72, 78, 80, 84, 86 , 92, 96, 98,125,126,130
CE04W1A470M		ELECTRO	47	10V	8	C , 43, 48, 51, 70, 90, 97, 99 ,105
CE04W1A221M		ELECTRO	220	10V	1	C , 95
CE04W1H4R7M		ELECTRO	4.7	50V	3	C , 45, 58, 47
CE04BW1HR22M		ELECTRO	0.22	50V	1	C , 49
CE04W1C100M		ELECTRO	10	16V	4	C , 64, 82, 94,113
CE04W1C220M		ELECTRO	22	16V	1	C , 73
CK45B1H471K		CERAMIC	470P	50V	1	C ,111
CK45B1H102K		CERAMIC	1000P	50V	5	C , 14, 26, 34,100,108
CK45F1H223Z		CERAMIC	0.022	50V	4	C , 18, 19, 30,123
CK45F1H103Z		CERAMIC	0.01	50V	2	C , 69,127
CQ92M1H222K		MYLAR	2200P	50V	4	C , 41,114,135,138
CQ92M1H822K		MYLAR	8200P	50V	1	C , 60
CQ92M1H103K		MYLAR	0.01	50V	3	C , 42,136,137
CQ92M1H123K		MYLAR	0.012	50V	4	C ,115,116,117,118
CQ92M1H153K		MYLAR	0.015	50V	1	C , 91
CQ92M1H333K		MYLAR	0.033	50V	2	C , 37, 62
CQ92M1H473K		MYLAR	0.047	50V	3	C , 63, 93,139
CQ92M1H104K		MYLAR	0.1	50V	1	C , 67
CS15E1VR22M		TANTALUM	0.22	35V	1	C , 31
C05-0030-15		TRIMMER	20PF		1	TC , 1
C90-0820-05		ELECTRO	470	16V	1	C , 66
C90-0864-05		FIXED ELECTRO	220	10V	1	C , 68
C90-0866-05		FIXED ELECTRO	470	6.3V	1	C , 65
C91-0769-05		FIXED CAP	0.01		33	C , 1, 2, 3, 5, 6, 7, 8 , 9, 10, 11, 16, 17, 20, 29

Parts No.	Re-marks	Description	Q'ty	Ref No.
C91-0769-05		FIXED CAP 0.01		C , 33, 36, 39, 56, 74, 77, 79 , 83, 87,101,102,103,106,109
C91-0769-05		FIXED CAP 0.01		C ,112,119,122,124,128
C91-0117-05			4	C , 52, 71, 85,132
C91-0119-05		CERAMIC CAP 0.047	6	C , 15, 28, 76,104, 34, 0, 0 , 0, 0, 0,141
C91-1008-05		CERAMIC CAP 0.023	1	C ,133
DTA114E(S)	N	DIGITAL TR	1	Q , 52
DTC114E(S)	N	DIGITAL TR	8	Q , 2, 21, 24, 29, 30, 31, 37 , 38
E29-0413-05		TERMINAL 1P	1	
E31-2170-05		JUMPER WIRE	52	
E40-0273-05		MINI CONNECTOR 2P	21	
E40-0373-05		MINI CONNECTOR 3P	4	
E40-0473-05		MINI CONNECTOR 4P	4	
E40-0573-05		MINI CONNECTOR 5P	2	
E40-0673-05		MINI CONNECTOR 6P	1	
E40-0773-05		PIN ASS'Y 7P	1	
F01-0784-03		HEAT SINK	1	
F20-0078-05		INSULATING PLATE	1	
F29-0014-05		INSULATING WASHER	1	
J31-0502-04		COLLAR	7	
J42-0428-05		BUSHING	7	
L34-0535-05		TUNING COIL	1	L , 10
L34-0536-05		TUNING COIL	1	L , 4
L34-0708-05		TUNING COIL	1	L , 1
L34-2077-05		TUNING COIL	1	L , 2
L40-1011-14		INDUCTOR 100 UH	1	L , 12
L40-3391-13		INDUCTOR 3.3 UH	1	L , 8
L40-1021-03		INDUCTOR 1 MH	1	L , 6
L40-1011-17		INDUCTOR 100 UH	2	L , 9, 11
L40-1511-14		INDUCTOR 150 UH	3	L , 5, 7, 14
L40-4711-14		INDUCTOR 470 UH	1	L , 13
L71-0245-05	N	CRYSTAL FILTER YK-88S3	1	XF , 1
MC921	N	DOUBLE DIODE	7	D , 66, 67, 68, 69, 70, 71, 72
MI204		DIODE	1	D , 44
MTZ4.3JA		ZENER DIODE 4.3V	1	D , 73
MTZ6.2JA		ZENER DIODE 6.2V	1	D , 40
MTZ9.1JB		ZENER DIODE 9.1V	1	D , 60
MTZ10JA		ZENER DIODE 10V	1	D , 38
MTZ12JB		ZENER DIODE 12V	1	D , 63
R12-1414-05		TRIM.POT. 1K OHM	1	VR , 1
R12-2409-05		SEMI FIXED 5 k	1	VR , 7
R12-3430-05		TRIM.POT. 10K OHM	3	VR , 3, 5, 8
R12-4408-05		SEMI FIXED 50 k	1	VR , 10
R12-7403-05		SEMI FIXED RGS6-FAN 500K	1	VR , 4
R12-2413-05		TRIM.POT. 5 k	2	VR , 2, 6
R12-3443-05		TRIM.POT. 10K	1	VR , 9
R92-0150-05		JUMPER WIRE	18	
UPC2002V		IC	1	Q , 25
V06B		DIODE	1	D , 61
1N60		DIODE	7	D , 25, 26, 27, 28, 29, 33, 34
1SS133		DIODE	8	D , 11, 13, 19, 20, 35, 47, 48 , 50
1S1555		DIODE	30	D , 1, 2, 12, 14, 16, 17, 18 , 21, 22, 23, 24, 30, 31, 32
1S1555		DIODE		D , 36, 37, 39, 43, 49, 51, 52 , 53, 54, 55, 56, 57, 58, 64
1S1555		DIODE		D , 65, 74
1S1555		DIODE	8	, 2, 12, 14, 16, 17, 37, 52 , 57
1S1587		DIODE	3	D , 9, 10, 46
1S1007		DIODE	6	D , 3, 4, 5, 6, 7, 8
1S2588		DIODE	1	D , 45

Parts No.	Re-marks	Description	Q'ty	Ref No.
2SA1115(E)		TR	1	Q , 23
2SA733(R)		TR	7	Q , 9, 10, 11, 12, 13, 14, 18
2SC2458(Y)		TR OR 2SC2603(E)	16	Q , 5, 15, 16, 20, 33, 39, 40 , 41, 43, 44, 45, 46, 47, 49
2SC2458(Y)		TR OR 2SC2603(E)		Q , 50, 51
2SC2459(BL)		TR	5	Q , 6, 7, 8, 34, 35
2SC2703(O,Y)		TR	2	Q , 28, 48
2SD880(Y)		TR	1	Q , 32
2SK192A(GR)		FET	1	Q , 22
2SK30A(O)		FET	2	Q , 17, 19
3SK73(GR)		FET	3	Q , 1, 4, 42

FILTER UNIT (X51-1320-00)

Parts No.	Re-marks	Description	Q'ty	Ref No.
CC45SL2H330J		CERAMIC 33P 500V	1	C , 16
CC45SL2H470J		CERAMIC 47P 500V	1	C , 14
CC45SL2H560J		CERAMIC 56P 500V	5	C , 22, 26, 33, 36, 38
CC45SL2H020C		CERAMIC 2P 500V	1	C , 46
CC45SL2H101J		CERAMIC 100P 500V	3	C , 7, 13, 17
CC45SL2H121J		CERAMIC 120P 500V	1	C , 5
CC45SL2H151J		CERAMIC 150P 500V	3	C , 9, 24, 44
CC45SL2H100D		CERAMIC 10P 500V	3	C , 18, 32, 41
CC45SL2H181J		CERAMIC 180P 500V	2	C , 4, 8
CC45SL2H221J		CERAMIC 220P 500V	2	C , 15, 47
CC45SL2H180J		CERAMIC 18P 500V	1	C , 27
CC45SL2H220J		CERAMIC 22P 500V	3	C , 34, 37, 39
CC45SL2H471J		CERAMIC 470P 500V	1	C , 6
CC45SL2H270J		CERAMIC 27P 500V	2	C , 31, 40
CE04W1HR47M		ELECTRO 0.47 50V	3	C , 53, 55, 61
CE04W1H010M		ELECTRO 1 50V	1	C , 56
CE04W1H3R3M		ELECTRO 3.3 50V	2	C , 51, 57
CE04W1C220M		ELECTRO 22 16V	1	C , 49
CK45B1H102K		CERAMIC 1000P 50V	5	C , 48, 65, 66, 67, 68
CK45F1H103Z		CERAMIC 0.01 50V	24	C , 1, 2, 3, 10, 11, 12, 19 , 20, 21, 28, 29, 30, 42, 43
CK45F1H103Z		CERAMIC 0.01 50V	24	C , 45, 50, 52, 54, 58, 59, 60 , 62, 63, 64
C05-0043-05		TRIMMER 20P	1	TC , 1
E04-0154-05		RF COAXIAL CABLE CONNECTOR RA	2	
E04-0157-05		RF COAXIAL CABLE RECEPTACLE	1	
E23-0430-05		TERMINAL (INSIDE)	1	
E40-0273-05		MINI CONNECTOR 2P	3	
E40-0673-05		MINI CONNECTOR 6P	1	
E40-0773-05		PIN ASS'Y 7P	1	
J31-0502-04		COLLAR	7	
J42-0428-05		BUSHING	7	
L34-3099-05	N	LPF COIL 7MHZ	2	L , 5, 6
L34-3100-05		LPF COIL 21MHZ	2	L , 9, 10
L34-3101-05	N	LPF COIL 28MHZ	2	L , 13, 14
L34-3102-05	N	LPF COIL 50MHZ	1	L , 18
L34-3103-05	N	LPF COIL 50MHZ	3	L , 17, 19, 20
L39-0410-15		COIL	1	T , 1
L40-1011-13		INDUCTOR 100 UH	4	L , 1, 2, 24, 30
L40-1011-14		INDUCTOR 100 UH	14	L , 3, 7, 11, 15, 21, 22, 23 , 25, 26, 27, 28, 29, 32, 33
MB3614		IC	1	IC , 1
MTZ6.2JB		ZENER DIODE	1	D , 17
R12-1418-05		SEMI FIXED	2	VR , 4, 5
R12-3434-05		TRIM.POT. 10K(B)3	1	VR , 3
R12-4411-05		TRIM.POT. 50K	2	VR , 1, 2
R92-0150-05		JUMPER WIRE	24	
S51-1420-05		RELAY DS-1 DC 12V	10	RL , 1, 2, 3, 4, 5, 6, 7 , 8, 9, 10
1N60		DIODE	2	D , 6, 7

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Parts No.	Re-marks	Description	Q'ty	Ref No.
1SS101		DIODE	3	D , 10, 15, 16
1S1555		DIODE	12	D , 1, 2, 3, 4, 5, 8, 9 , 11, 12, 13, 14, 18
1S1555		DIODE	12	D , 14, 18
112-503-2		DIODE	1	TH , 1
2SA562(Y)		TR	4	Q , 1, 2, 3, 4
2SA1115(E)		TR	1	Q , 5
2SC1815(Y)		TR	2	Q , 6, 7

CONTROL UNIT (X53-1370-00)

Parts No.	Re-marks	Description	Q'ty	Ref No.
CC45SL1H050C		CERAMIC 5P 50V	3	C , 7, 74,135
CC45CH1H0R5C		CERAMIC 0.5P 50V	3	C , 46, 98,112
CC45RH1H070D		CERAMIC 7P 50V	1	C , 71
CC45CH1H010C		CERAMIC 1P 50V	4	C , 20, 27, 51, 56
CC45RH1H120J		CERAMIC 12P 50V	1	C ,132
CC45SL1H100D		CERAMIC 10P 50V	5	C , 6, 9, 75,136,223
CC45CH1H020C		CERAMIC 2P 50V	3	C , 12, 33, 41
CC45RH1H150J		CERAMIC 15P 50V	3	C , 25, 26, 34
CC45RH1H180J		CERAMIC 18P 50V	1	C ,172
CC45SL1H150J		CERAMIC 15P 50V	1	C , 15
CC45RH1H220J		CERAMIC 22P 50V	5	C , 45, 47, 96, 97,131
CC45UJ1H050C		CERAMIC 5P 50V	1	C , 3
CC45UJ1H100D		CERAMIC 10P 50V	1	C , 5
CC45RH1H270J		CERAMIC 27P 50V	2	C ,168,174
CC45SL1H330J		CERAMIC 33P 50V	3	C , 31,101,103
CC45RH1H330J		CERAMIC 33P 50V	2	C , 50, 52
CC45CH1H150J		CERAMIC 15P 50V	2	C ,113,218
CC45CH1H180J		CERAMIC 18P 50V	1	C ,217
CC45RH1H390J		CERAMIC 39P 50V	2	C ,169,173
CC45SL1H470J		CERAMIC 47P 50V	2	C , 87, 89
CC45SL1H560J		CERAMIC 56P 50V	1	C ,102
CC45RH1H470J		CERAMIC 47P 50V	2	C ,170,171
CC45RH1H560J		CERAMIC 56P 50V	2	C ,110,111
CC45SL1H101J		CERAMIC 100P 50V	3	C , 24, 88,175
CC45RH1H030C		CERAMIC 3P 50V	1	C , 84,133
CC45SL1H151J		CERAMIC 150P 50V	6	C , 4, 17, 81, 83,141,143
CC45RH1H050C		CERAMIC 5P 50V	2	C , 73, 84
CC45TH1H100D		CERAMIC 10P 50V	1	C ,130
CC45TH1H120J		CERAMIC 12P 50V	1	C , 70
CC45TH1H390J		CERAMIC 39P 50V	1	C ,129
CE04W1C100M		ELECTRO 10 16V	1	C ,199
CE04W1A470M		ELECTRO 47 10V	7	C ,189,194,195,196,213,215,216
CE04W1A101M		ELECTRO 100 10V	5	C , 1, 68,125,185,192
CE04W1HR47M		ELECTRO 0.47 50V	1	C ,120
CE04W1H010M		ELECTRO 1 50V	2	C ,118,214
CE04W1H2R2M		ELECTRO 2.2 50V	1	C ,190
CE04W1H4R7M		ELECTRO 4.7 50V	1	C ,203
CK45B1H331K		CERAMIC 330P 50V	2	C , 82,142
CK45B1H102K		CERAMIC 1000P 50V	8	C ,114,115,119,151,164,179,197 ,198
CK45B1H222K		CERAMIC 2200P 50V	3	C , 69,126,187
CK45F1H103Z		CERAMIC 0.01 50V	30	C , 29, 36, 60, 61, 63, 76, 77 , 80, 85, 86, 90, 95, 99,100
CK45F1H103Z		CERAMIC 0.01 50V		C ,104,109,116,121,134,137,140 ,144,149,155,166,167,176,205
CK45F1H103Z		CERAMIC 0.01 50V		C ,212,219
CQ92M1H103K		MYLAR 0.01 50V	1	C , 66
CQ92M1H473K		MYLAR 0.047 50V	1	C ,123
CQ92M1H104K		MYLAR 0.1 50V	1	C ,182
CQ92M1H102K		MYLAR 1000P 50V	1	C ,122
CQ92M1H152K		MYLAR 1500P 50V	2	C , 65,181
C05-0309-05		TRIMMER 40P	1	TC , 1
C05-0030-15		TRIMMER 20PF	1	TC , 2
C90-0838-05		ELECTRO 1 50V	1	C ,202
C91-0119-05		CERAMIC 0.047 25V	35	C , 2, 16, 21, 22, 28, 32, 64 , 67, 72, 79, 91, 92, 93, 94
C91-0119-05		CERAMIC 0.047 25V		C ,117,124,127,128,139,145,146 ,147,148,152,160,177,180,183
C91-0119-05		CERAMIC 0.047 25V		C ,184,186,188,191,193,204,211
C91-0498-05		FIXED CAP 0.35P	1	C , 39
C91-0457-05		FIXED CAP 0.022	1	C ,201

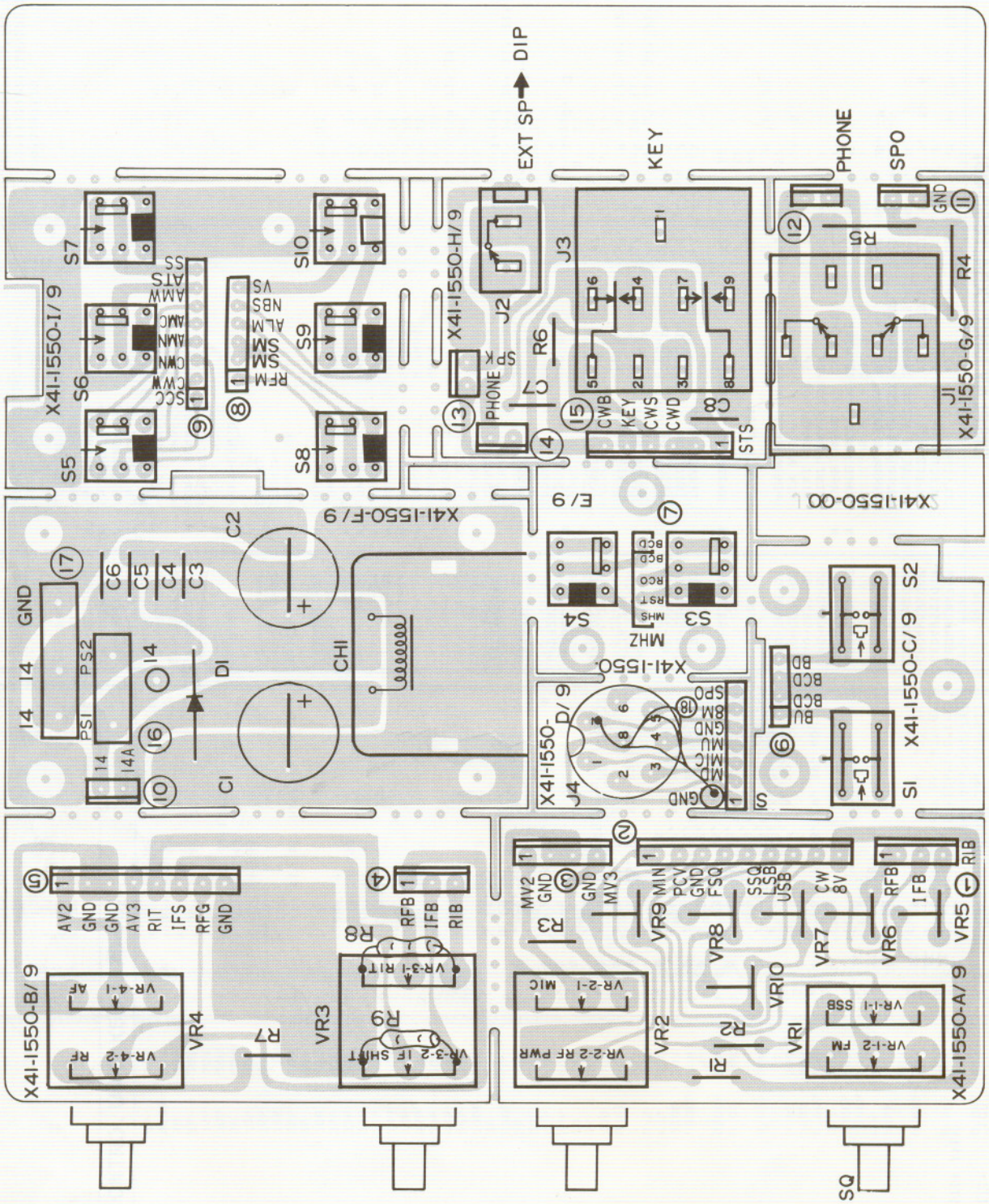
Parts No.	Re-marks	Description	Q'ty	Ref No.
C91-0769-05		FIXED CAP 0.01	38	C , 8, 10, 14, 23, 30, 35, 37 , 43, 44, 48, 49, 53, 54, 58
C91-0769-05		FIXED CAPACITOR0.01UF		C , 59, 62, 78,105,106,107,108 ,138,153,156,157,158,159,161
C91-0769-05		FIXED CAPACITOR0.01UF		C ,162,163,165,178,200,206,207 ,208,209,210
E23-0443-05		TERMINAL (INSIDE) TP	3	
E31-2170-05		JUMPER WIRE	81	
E40-5023-05	N	LP CONNECTOR 2P	3	
E40-5024-05	N	LP CONNECTOR 3P	1	
E40-5025-05	N	LP CONNECTOR 5P	2	
E40-5026-05	N	LP CONNECTOR 6P	1	
E40-0273-05		MINI CONNECTOR 2P	14	
E40-0373-05		MINI CONNECTOR 3P	5	
E40-0473-05		MINI CONNECTOR 4P	3	
E40-0673-05		MINI CONNECTOR 6P	1	
E40-0773-05		PIN ASS'Y 7P	2	
ITT310TE		VARI-CAP DIODE	1	D , 21
J31-0502-04		COLLAR	8	
J42-0428-05		BUSHING	8	
J61-0408-05		VINYL TIE	3	
L32-0666-05	N	OSCILLATING COIL	2	L , 6, 20
L34-2207-05	N	TUNING COIL 48MHZ	1	T , 1
L34-2208-05	N	TUNING COIL 24MHZ	4	T , 2, 5, 6, 7
L34-2209-05	N	TUNING COIL 6MHZ	2	T , 3, 4
L34-2211-05	N	TUNING COIL 56MHZ	3	T , 8, 9, 10
L34-2212-05	N	TUNING COIL 14MHZ	2	T , 15, 16
L34-2213-05	N	TUNING COIL 2.8MHZ	2	T , 17, 18
L34-2214-05	N	TUNING COIL 8.4MHZ	2	T , 21, 22
L34-0781-05		TUNING COIL 9MHZ	2	T , 19, 20
L34-3064-05		TUNING COIL	4	T , 11, 12, 13, 14
L34-3104-05	N	LPF COIL	2	T , 23, 24
L40-2201-13		INDUCTOR 22 UH	1	L , 32
L40-1801-03		INDUCTOR 18 UH	2	L , 24, 25
L40-1011-13		INDUCTOR 100 UH	7	L , 33, 34, 36, 37, 38, 39, 40
L40-2201-03		INDUCTOR 22 UH	2	L , 12, 13
L40-8201-03		INDUCTOR 82 MH	2	L , 10, 11
L40-1001-14		INDUCTOR 10 UH	1	L , 41
L40-1011-03		INDUCTOR 100 UH	2	L , 4, 18
L40-2711-03		INDUCTOR 270 UH	2	L , 21, 22
L40-3311-03		INDUCTOR 330 UH	2	L , 8, 9
L40-4711-03		INDUCTOR 470 UH	2	L , 5, 17
L40-1011-14		INDUCTOR 100 UH	7	L , 1, 2, 15, 16, 23, 29, 31
L40-1511-14		INDUCTOR 150 UH	3	L , 14, 26, 27
L40-2211-14		INDUCTOR 220 UH	6	L , 3, 7, 19, 28, 30, 35
L72-0343-05	N	CERAMIC FILTER 8.4MHZ	1	CF , 1
L77-1226-05	N	CRYSTAL 24MHZ	1	X , 1
L77-1257-05	N	CRYSTAL 8.1MHZ	1	X , 2
MB4052	N	IC	1	IC , 15
MC14077B		IC	1	IC , 24
MC911		DIODE	1	D , 56
MN6147C		IC	3	IC , 3, 4, 13
MTZ7.5JC		DIODE	1	D , 25
M54459L		IC	2	IC , 5, 9
R12-4411-05		TRIM.POT. 50K	1	VR , 1
R90-0511-05		RESISTOR BLOCK	2	RB , 1, 2
R90-0515-05		RESISTOR BLOCK 10K X 4	1	RB , 4
R90-0534-05		RESISTOR BLOCK 10K X 5	1	RB , 7
R90-0561-05		RESISTOR BLOCK 22K X 6	1	RB , 5
R90-0574-05	N	RESISTOR BLOCK 4.7K X 11	1	RB , 3
R90-0575-05	N	RESISTOR BLOCK 10K X 3	1	RB , 6
R92-0150-05		JUMPER WIRE	20	
SN16913P		IC	5	IC , 7, 8, 10, 11, 12
SN74LS75N		IC	1	IC , 21
SN74LS93N		IC OR M74LS93P	1	IC , 2
SN74LS112AN		IC OR M74LS112P	2	IC , 1, 6
SN74LS145N		IC OR M74LS145P	1	IC , 22

Parts No.	Re-marks	Description	Q'ty	Ref No.
S31-0401-05	N	DIP SWITCH 10P	1	
TA57	N	TRANSISTOR AREY	1	Q , 55
TC4011BP		IC	3	IC , 14, 25, 26
TC4071BP	N	IC	2	IC , 23, 27
TMP8049P-3034	N	IC	1	IC , 19
UPD8049HC-092	N	IC	1	IC , 16
UPD8243C		IC	2	IC , 17, 20
UPD444C-0		IC	1	IC , 18
1N60		DIODE	1	D , 38
1SS133		DIODE	6	D , 26, 27, 28, 29, 39, 40
1SV53A		DIODE	1	D , 20
1S1555		DIODE	48	D , 5, 6, 7, 8, 22, 23, 24
				, 30, 31, 32, 33, 34, 35, 36
1S1555		DIODE		D , 37, 41, 42, 43, 44, 45, 46
				, 47, 48, 49, 50, 51, 52, 53
1S1555		DIODE		D , 54, 55, 58, 59, 60, 61, 62
				, 63, 64, 65, 66, 67, 68, 69
1S1555		DIODE		D , 70, 71, 72, 73, 74, 75
1S1587		DIODE	12	D , 2, 3, 4, 9, 10, 12, 13
				, 14, 16, 17, 18, 19
1S2588		DIODE	3	D , 1, 11, 15
2SA1015(Y)		TR	7	Q , 35, 43, 50, 51, 52, 53, 54
2SC1923(O)		TR	4	Q , 9, 13, 14, 24
2SC1775(E)		TR	9	Q , 10, 11, 12, 21, 22, 23, 32
				, 33, 34
2SC460(B)		TR	3	Q , 1, 16, 17
2SC1959(Y)		TR	1	Q , 19
2SC1815(Y)		TR	30	Q , 2, 3, 4, 5, 6, 7, 8
				, 15, 18, 20, 25, 26, 27, 28
2SC1815(Y)		TR		Q , 29, 30, 31, 36, 37, 38, 39
				, 40, 41, 42, 44, 45, 46, 47
2SC1815(Y)		TR		Q , 48, 49

Parts No.	Re-marks	Description	Q'ty	Ref No.
DISPLAY UNIT (X54-1800-00)				
CE04W1A470M		ELECTRO 47 10V	1	C , 1
CE04W1C101M		ELECTRO 100 16V	1	C , 2
CE04W1V100M		ELECTRO 10 35V	3	C , 3, 5, 6
CQ92M1H103K		MYLAR 0.01 50V	1	C , 4
C90-0840-05		ELECTRIC BLOCK CAPACITOR	1	C , 7
C91-0119-05		CERAMIC CAP 0.047	2	C , 8, 9
E31-3024-05	N	TAPE CABLE 2 WIRE	1	
E31-3025-05	N	TAPE CABLE 10 WIRE	2	
E40-0273-05		MINI CONNECTOR 2P	1	
E40-0373-05		MINI CONNECTOR 3P	1	
E40-0773-05		PIN ASS'Y 7P	1	
E40-3008-05		PIN CONNECTOR 3P	1	
FIP11FM7	N	DISPLY TUBE	1	
J21-4133-04	N	HARDWARE FIXTURE	1	
L19-0323-05		TRANSFORMER	1	T , 1
L40-1011-14		INDUCTOR 100 UH	1	L , 2
L40-1011-13		INDUCTOR 100 UH	1	L , 1
MTZ8.2JB		ZENER DIODE 8.2V	1	D , 5
MTZ6.2JA		ZENER DIODE 6.2V	1	D , 6
R92-0150-05		JUMPER WIRE	17	
UPA80C	N	IC	3	IC , 1, 2, 3
UPD8243C		IC	1	IC , 4
1S1555		DIODE	4	D , 1, 2, 3, 4
2SC1959(Y)		TR	2	Q , 1, 2

TS-670 PC BOARD VIEW

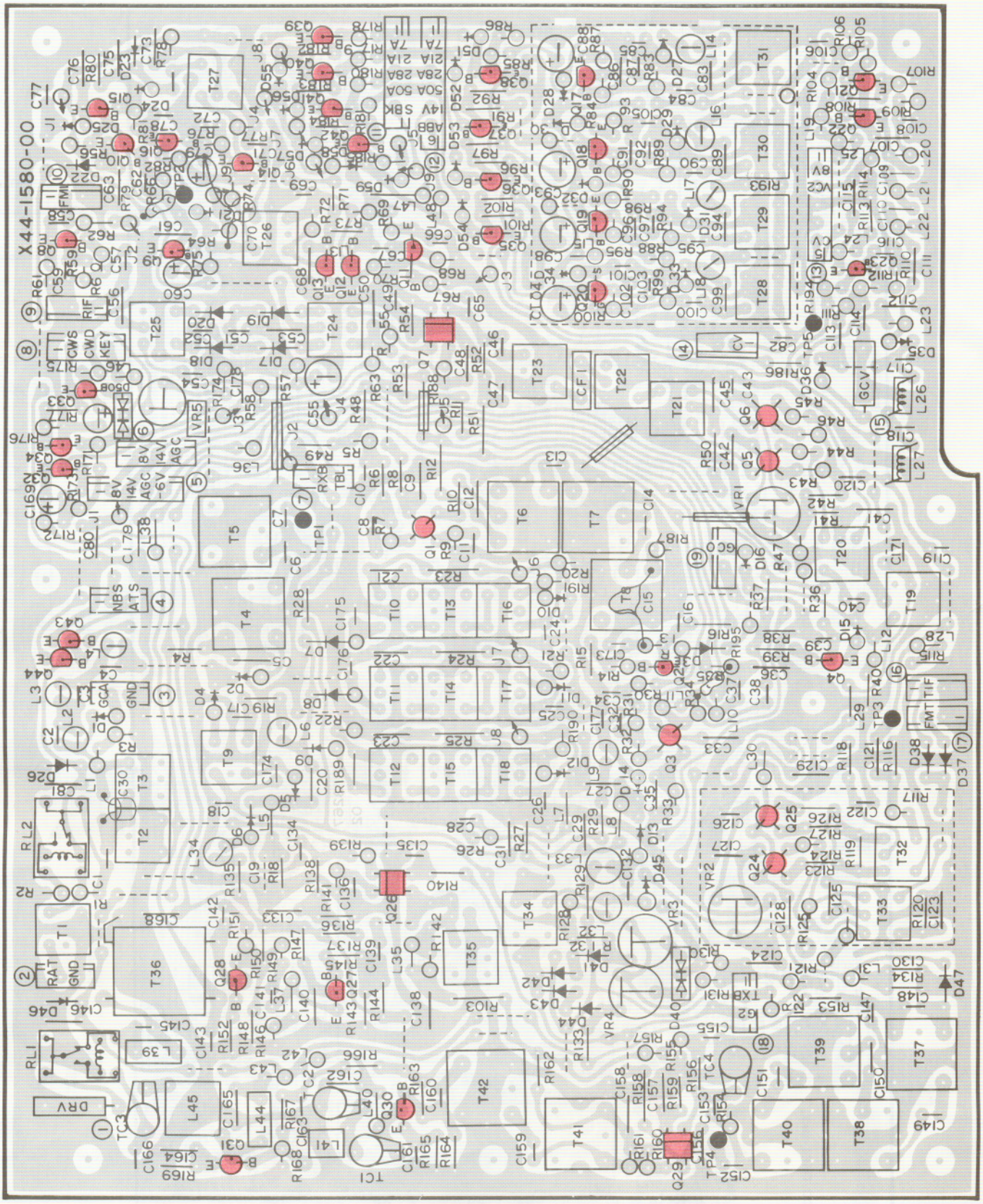
SWITCH UNIT (X41-1550-00) Component side view



Terminal number

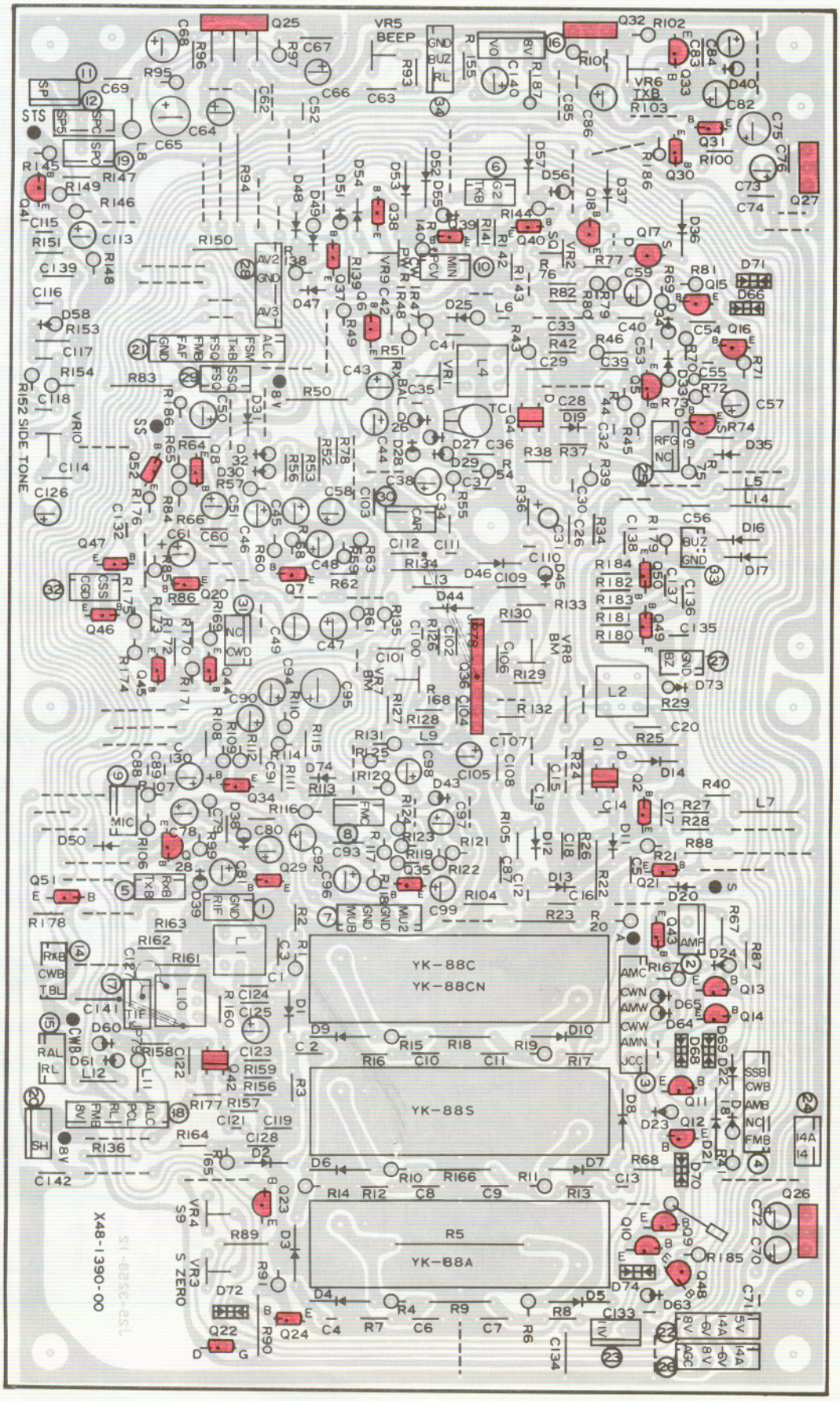
No.1 terminal

RF UNIT (X44-1580-00) Component side view

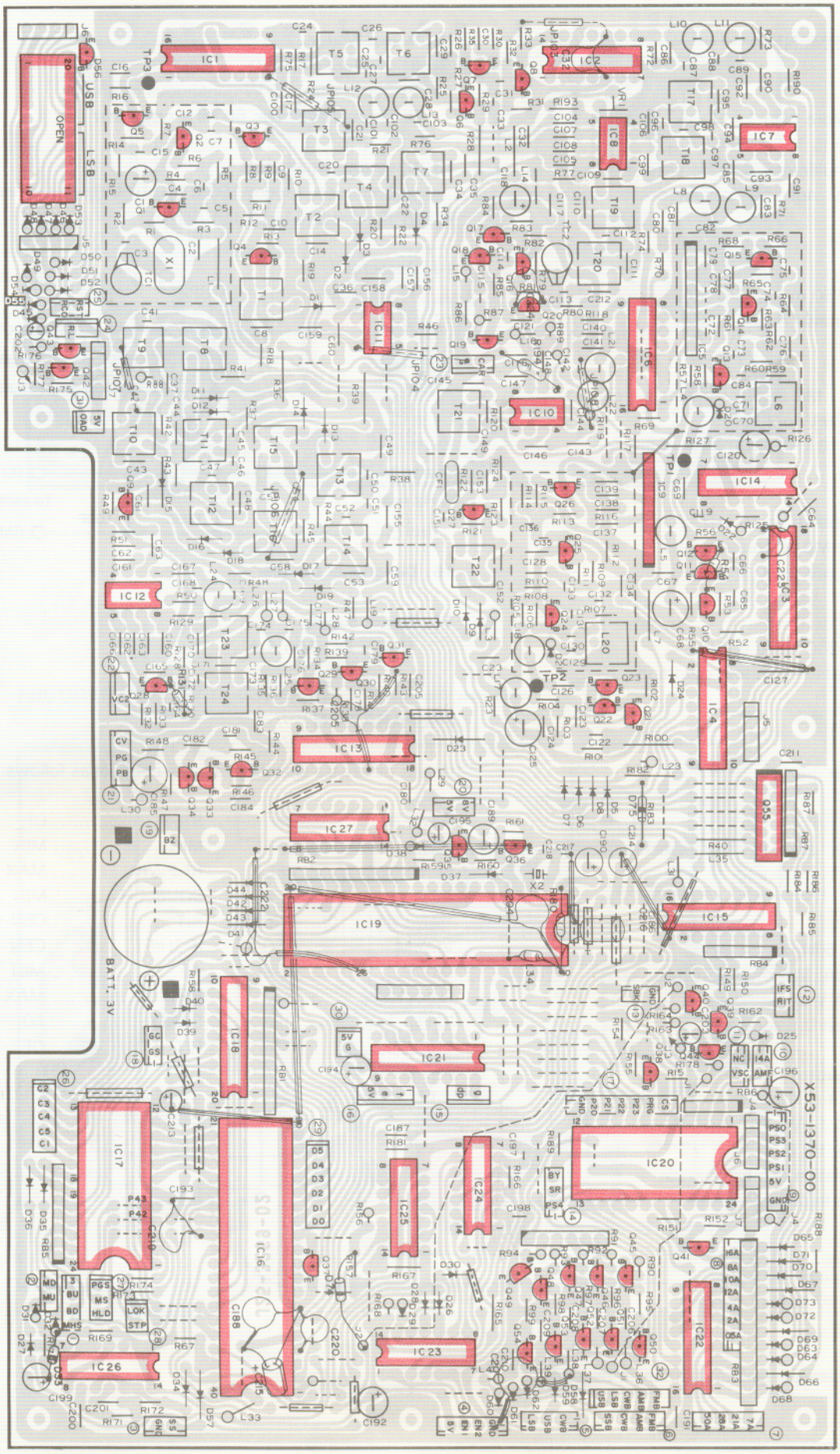


PC BOARD VIEW

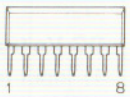
IF UNIT (X48-1390-00) Component side view



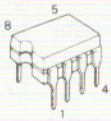
CONTROL UNIT (X53-1370-00) Component side view



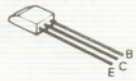
M54459L



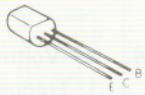
SN16913P



2SC460

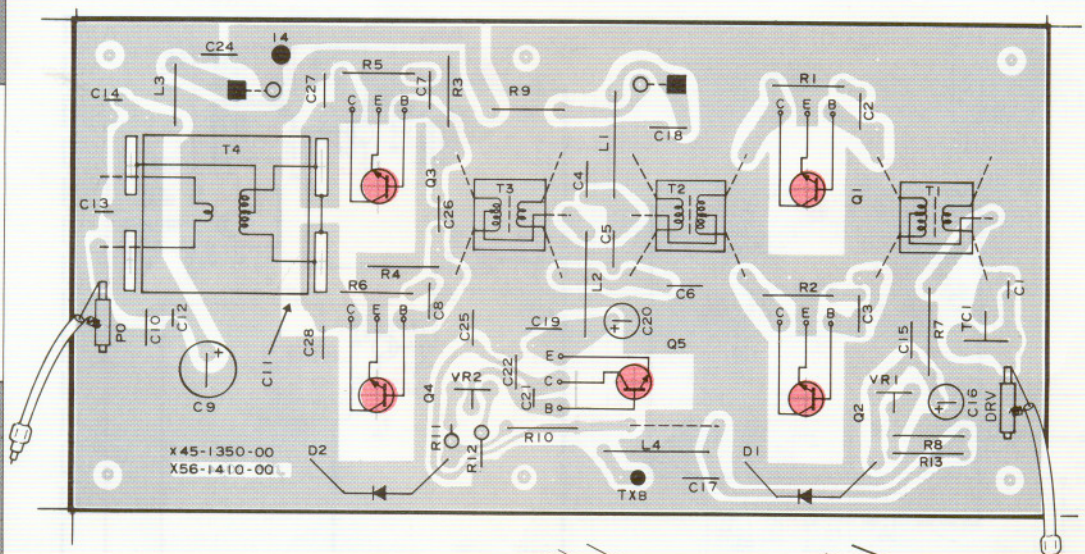


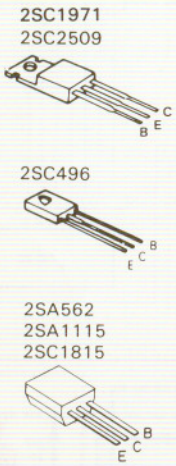
2SA1015
2SC1815
2SC1923
2SC1775



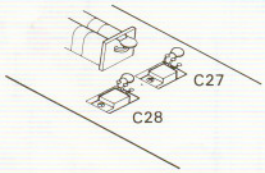
TS-670 PC BOARD VIEW

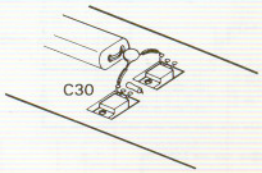
FINAL UNIT (X45-1350-00) Component side view





C11 Attachment method





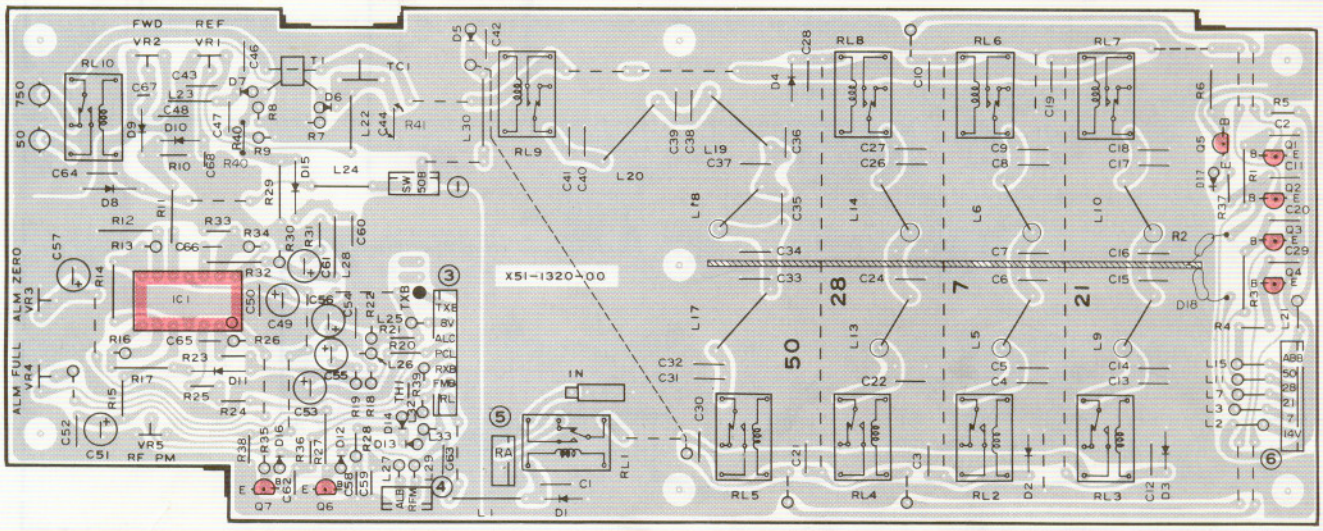
1 Cut wire short as possible on C11
2 Bend C11 as shown left after solder confirm not over edge.

C27 and C28 should be installed as shown above.
Do not install them as indicated in the PC board with silk printed pattern.

C30 should be installed externally and directly as shown above

(Cover the C30 leads with ilux tubes (212-1019-05); the leads length should be minimum.)

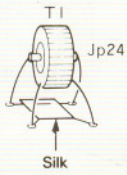
FILTER UNIT (X51-1320-00) Component side view



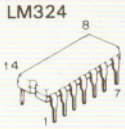
Q1 ~ 4 : 2SA562(Y) Q5 : 2SA1115(E) Q6, 7 : 2SC1815(Y) IC1 : MB3614 CR LM324 D1 ~ 5, 8, 11 ~ 14 : 1S1555 D6, 7 : 1N60 D9, 10, 15, 16 : 1SS101 D17 : MTZ3.9JA

Attachment method of L5, 6, 9, 10, 13, 14, 18.

Attachment method of JP24 as shown following.

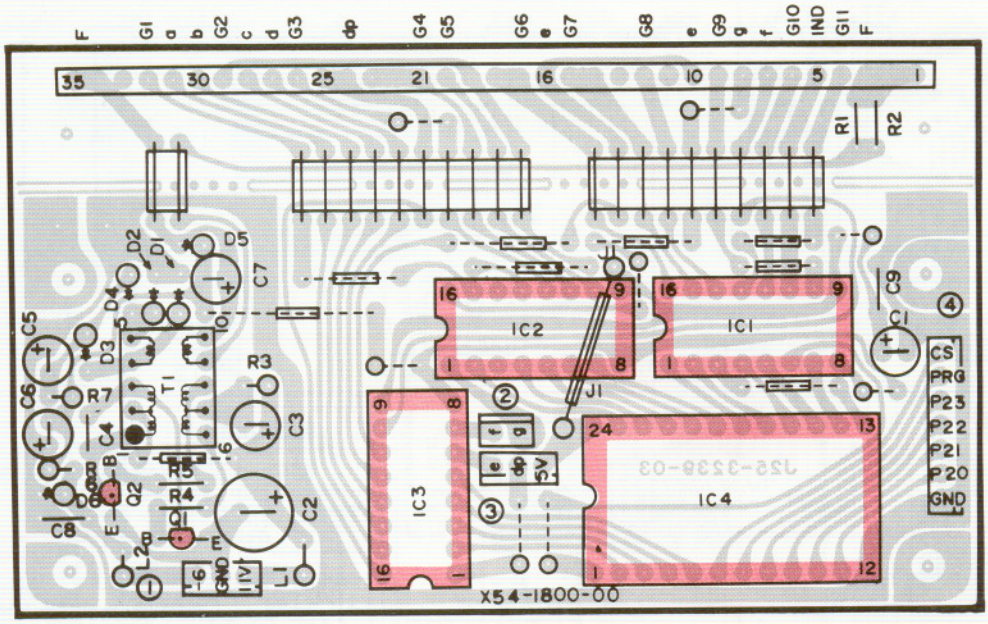


MB3614
LM324



3SK73(GR)

DISPLAY UNIT (X54-1800-00) Component side view



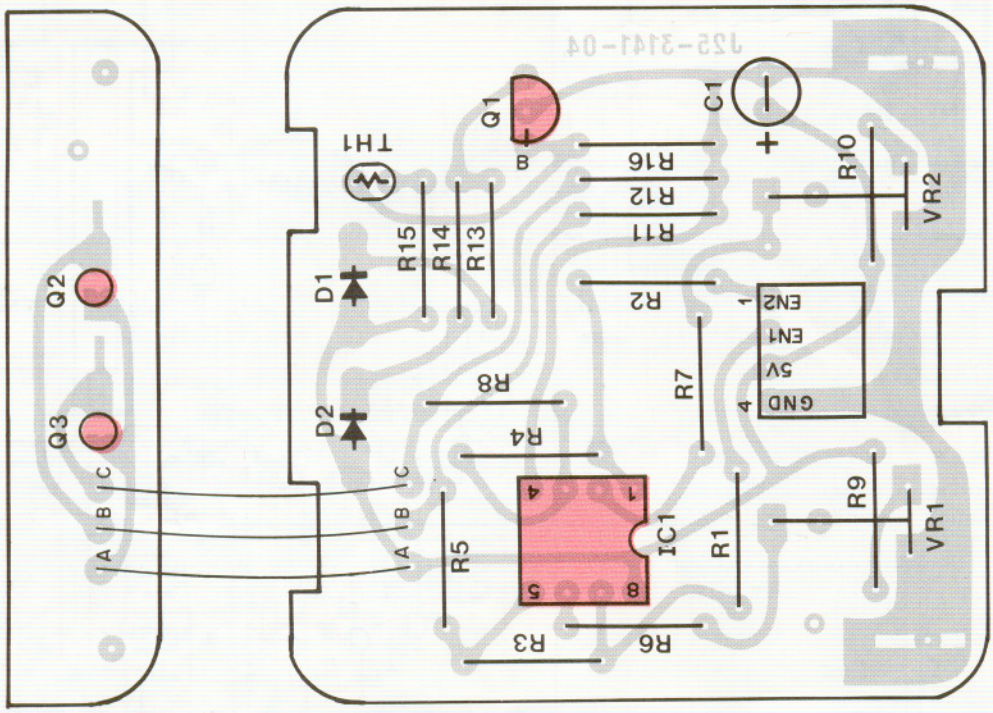
DISPLAY TUBE
FIP11FM7

Place	Character
G 1	RIT
G 2	—
G 3	+
G 4	AL
G 5	—
G 6	SPLIT
G 7	B
G 8	VFO
G 9	A
G10	T
G11	M. CH

IC4 (μPD8243C)

Terminal No.	Terminal name
24	Vcc
2	P40
3	P41
4	P42
5	P43
6	CS
7	PROG
8	P23
9	P22
10	P21
11	P20
12	GND
13	P70
14	P71
15	P72
16	P73
17	P63
18	P62
19	P61
20	P60
21	P53
22	P52
23	P51
1	P50

ENCODER UNIT (W02-0328-10) Component side view



ADJUSTMENT

REQUIRED TEST EQUIPMENT

1. DC Voltmeter
1) Input resistance: More than 1 MΩ
2) Voltage range: 1.5 to 1000 V AC/DC

NOTE: A high-precision multimeter may be used. However, accurate readings can not be obtained for high-impedance circuits.

2. DC Ammeter
1) Current range: 150 mA, 500 mA, 2 A, 10 A, High-precision ammeter may be used.

3. RF VTVM
1) Input impedance: 1 MΩ and less than 3 pF, min.
2) Voltage range: 10 mV to 300 V
3) Frequency range: 10 kHz ~ 100 MHz or greater

4. AF Voltmeter
1) Frequency range: 50 Hz to 10 kHz
2) Input resistance: 1 MΩ or greater
3) Voltage range: 10 mV to 30 V

5. AF Generator (AG)
1) Frequency range: 200 Hz to 5 kHz
2) Output: 1 mV or less ~ 1 V, low distortion

6. AF Dummy Load
1) Impedance: 8 Ω
2) Dissipation: 3 W or greater

7. Oscilloscope
Requires high sensitivity, and external synchroniszation capability.

8. Sweep Generator
1) Center frequency: 5 MHz ~ 60 MHz
2) Frequency deviation: Maximum ± 16 MHz
3) Output voltage:0.1 V or greater
4) Sweep rate: At least 0.5 sec/cm

9. Standard Signal Generator (SSG)
1) Frequency range: 8 to 60 MHz
2) Output: −20 dB/0.1 μV ~ 120 dB/1 V
3) Output impedance: 50 Ω
4) AM and FM modulation can be possible.

NOTE: Generator must be frequency stable.

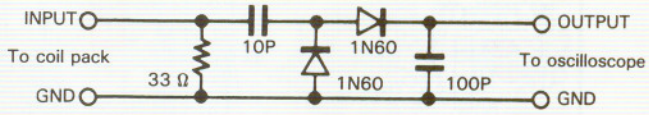
10. Frequency Counter
1) Minimum input voltage: 50 mV
2) Frequency range: 60 MHz or greater

11. Noise Generator
Must generate ignition noise containing harmonics beyond 60 MHz.

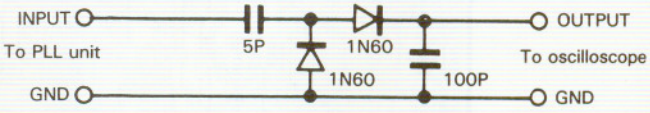
12. Power Meter
1) Impedance: 50 Ω
2) Dissipation: 15 W continuous or greater
3) Frequency limits: 60 MHz or greater

13. Spectrum Analyzer
1) Frequency range: 100 K to 110 MHz or greater
2) Bandwidth: 1 kHz to 3 MHz

14. Detector
1) For adjustment of TX BPF



2) For adjustment of PLL BPF



15. Directional Coupler

16. Power supply
13.8 V DC. Min 4 A

PREPARATION

Unless otherwise specified, set the controls as follows.

POWER	ON	STEP	OFF
NB	OFF	MIC	MIN
SEND/REC	REC	RF PWR	MAX
ATT	OFF	SQUELCH	MIN
NAR/WIDE	WIDE	RIT	CEN
VFO/M	VFO	IF SHIFT	CEN
MODE	VSB	AF	MIN
FUNCTION	A	RF	MAX
SPLIT	OFF	BAND	50
LOCK	OFF	RIT	OFF

ADJUSTMENT

VOLTAGE ADJUSTMENT

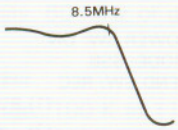
Item	Condition	Measurement			Adjustment			Specification	Remarks
		Test equipment	Unit	Terminal	Unit	Parts	Method		
Voltage adjustment and confirmation	POWER SW: ON MODE: SSB SEND SW: REC	DC VM	IF						
	(1) 8V			22 -1				8.55 ~ 9.45V	
	(2) −6V			22 -2				−5.9 ~ −6.1V	
	(3) 14V			22 -3				13.5V ± 0.3V	
	5V			22 -4				4.75 ~ 5.25V	
	(4) RFG			25 -1	SWITCH	VR6		2.6V $\pm^{0.05}_{0}$ V	
	(5) RXB			23 -2				11.0V ± 0.3V	
				5 -2				8.0V ~ 9.0V	
	(6) RXB			5 -2			SEND SW: ON	0V ON AIR (IND) lights	
	(7) RL			34 -3			SEND SW: ON	13.2V ± 0.2V	
							: OFF	0V ON AIR (IND) goes off	
	(8) TXB			5 -1	IF	VR6	SEND SW: ON	8.8V ± 0.1V	
	(9) TXB			5 -1			SEND SW: OFF	0V	
	(10) Li BATT		CONTROL	+				More than 3.0V	

CONTROL ADJUSTMENT

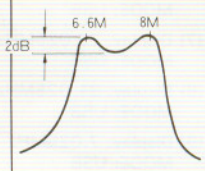
Item	Condition	Measurement			Adjustment			Specification	Remarks
		Test equipment	Unit	Terminal	Unit	Parts	Method		
1. Adjustment of standard oscillation	(1) Use syncroscope probe (2) 24MHz	F COUNTER	CONT	TP3	CONT	TC1	ADJ to 24.000.000Hz	± 7Hz	
2. Voltage adjustment and confirmation	(1) VCO3 (2) Display: 50.050.0MHz (3) MODE: FM	DC VM		TP1		L6	ADJ to 6.8V	6.8V (FM)	
								2.1V ± 0.3V (LSB)	Confirm
	(4) VCO2			TP2		L20	ADJ to 6.8V	6.8V (FM)	
								1.7V ± 0.3V (USB)	Confirm
3. CAR LEVEL	(1) CAR	RF V.M		Hot terminal		TC2	ADJ to 0.32V	0.32V (1.0V P-P)	
4. VCO COIL	(1) Display: 51.025MHz	RF VM	CONT	D3 ANODE	CONT	T1	ADJ to MAX output	About 0.32V	48MHz MATCHING COIL
	(2) Display: 28.025MHz					T2		About 0.2V	24MHz MATCHING COIL
	(3) Display: 7.025MHz					T3,4		About 0.25V	6MHz MATCHING COIL
	(4) Display: 21.025MHz			IC2 14		T5,6		About 0.54V	18MHz MATCHING COIL
	(5) Display: 21.025MHz			D3 ANODE		T7		About 0.2V	
	(6) Display: 50.025MHz MODE: USB			IC12 2		T8,9, 10		About 0.24V	48MHz BPF COIL
	(7) Display: 28.025MHz MODE: USB					T11,12		About 0.35V	24MHz BPF COIL
	(8) Display: 21.025MHz MODE: USB			IC12 3		T13,14		About 0.25V	18MHz BPF COIL
	(9) Display: 7.025MHz MODE: USB					T15,16		About 0.24V	6MHz BPF COIL
	(10) CAR output			IC8 1		T17,18		About 0.15V	2.83MHz BPF COIL
	(11) CAR output			Hot terminal		T19,20 TC2	ADJ to 0.32V	0.32V	8.831MHz BPF COIL
	(12) Display: 51.025MHz MODE: USB			D9 ANODE		T21,22	ADJ to MAX output	About 0.35V	0.15 ~ 0.4MHz BPF COIL

TS-670

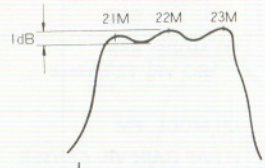
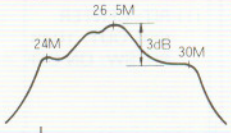
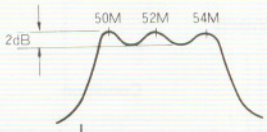
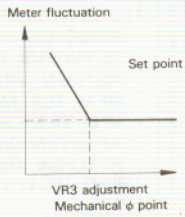
ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specification	Remarks
		Test equipment	Unit	Terminal	Unit	Parts	Method		
	(13) Display: 50.025MHz Connection •IC12 1 SWEEP •Q31 E Detector	SWEEP SCOPE	CONT	IC12 2 Q31 E	CONT	T23,24	Adjust to 8.5MHz as shown at right.		1.05 ~ 7.55MHz BPF COIL
5. Encoder adjustment	(1) Remove the VFO knob and motor-drive the encoder at approx. 300rpm.	SCOPE	CONT	4 -3					Point C may be located anywhere. When a motor is not available, manually turn the VFO to check the duty ratio.
	(2) EN1 duty ratio adjustment: Turn a motor CW and CCW.				Encoder	VR1			After adjusting with the VFO control turned CW, check that internals D and E are also identical when the VFO control is turned CCW.
	(3) EN2 duty ratio adjustment: Turn a motor in the both direction.			4 -2		VR2	Adjust until intervals D and E are equal to each other with point C placed at the center.		
6. VCO adjustment	(1) Voltage adjustment MODE: FM 7.990 7.499MHz	DC VM	RF	TP5	RF	T28	ADJ to 6.0V	6.0V	
	6 660 6.600MHz							1.5V ~ 2.5V	Confirm
	24 790 24.790MHz					T29	ADJ to 6.5V	6.5V	
	21 000 21.000MHz							1.3V ~ 2.2V	Confirm
	29 990 29.999MHz					T30	ADJ to 6.5V	6.5V	
	24 800 24.800MHz							1.3V ~ 2.2V	Confirm
	53 990 53.999MHz					T31	ADJ to 6.5V	6.5V	
	50 000 50.000MHz							1.3V ~	Confirm
	(2) All BAND 7.00MHz 53.000MHz	RF VM		TP3			Confirm all BAND by pushing BAND SW.	0.9V ~ 2 dB	Comfirm

RX ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specification	Remarks
		Test equipment	Unit	Terminal	Unit	Parts	Method		
1. RX B·P·F	(1) Display: 7 MHz BAND MODE: FM Connection •RF U 2 : SWEEP •RF U D3: DETECTOR •Preset core of RF U ,T2,T3,T19 att the way inside. P.S 1 : T2,3,19 is IF trap coil See item No. 4 2 : 7,12,28MHz BANDs are adjust under TX BPF	SWEEP SCOPE DETEC-TOR	RF	D3 (cathode)	RF		Confirm waveform as shown at right.	6.6M 8M 2dB 	Confirm

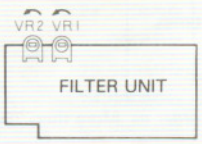
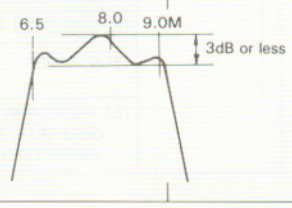
ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specification	Remarks
		Test equipment	Unit	Terminal	Unit	Parts	Method		
1. RX B·P·F	(2) Display: 21MHz BAND	SWEEP SCOPE DETECT-OR	RF	D3 (cathode)	RF		1dB 21M 22M	23M 	Confirm
	(3) Display: 28MHz BAND						24M 26.5M 3dB	30M 	Confirm
	(4) Display: 50MHz BAND					T4,5,6 7,8	2dB 50M 52M	54M 	Comfirm
2. NULL	(1) RF GAIN VR: CCW MAX IF SHIFT VR: CENTER	RF VM	IF	R46	IF	TC1 VR1	LEVEL MIN adjust back and forth.		
3. RX AMP	(1) Display: 7.150MHz MODE: CW SSG OUT: −6 dB RF GAIN VR: CW MAX	AF VM SSG SCOPE S.P		EXT.SP	IF	L1,2 L4	ADJ AF output MAX.		* L2 must realign at FTEM6 S. meter. * T24 will realign at NB alignment.
					RF	T20 T22 T23 T24 T25 VR1	ADJ AF output MAX. Repeat 2 ~ 3 times this ADJ.		
4. IF TRAP	(1) Display: 7.990MHz SSG display: 8.830MHz SSG ATT: 80dB	AFVM SSG SCOPE S.P	IF	EXT.SP	RF	T2,3 T19	Align to MIN order as T19, 2, 3.	More than 70dB	
5. NB AMP	(1) Display: 50MHz BAND ANT: NOISE GENERATOR NB SW: ON	N.G. SCOPE S.P	IF	EXT.SP	RF	T26,27 T24	•Adjust T26,27 to will work point decreasing N.G output. •Align slug out point.	Comfirm under high input (SSG + 30dB) and low input (SSG + 3 dB).	
6. S METER	(1) Display: 28.900.0MHz MODE: CW NO SIGNAL	SSG		S meter	IF	VR3	Set to mechanical start point.		
					RF	T9	ADJ AF output MAX.		
	(2) SSG OUT: 8dB	SSG	IF	S METER	IF	L2	S1 adjust CCW from peak (turn stug out)	S1 (8 ± 3dB)	Confirm
	(3) SSG OUT: 30dB					VR4	S9	S9 (30 ± 6dB)	
	(4) S-1, S-9						Adjust repeat (2,), (3).		
	(5) MODE: FM SSG OUT: 30dB (MOD 1kHz DEV 5kHz)				FM	VR2	Adjust at 52.010.00	RF meter "20" (30 ± 6dB)	

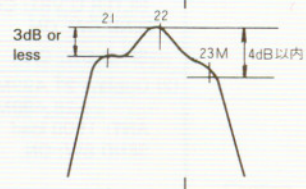
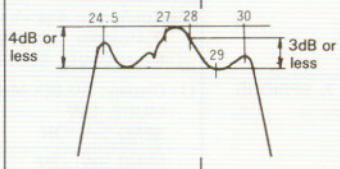
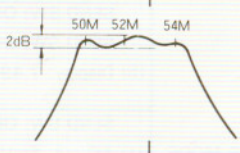
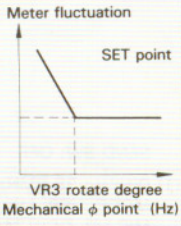
ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specification	Remarks
		Test equipment	Unit	Terminal	Unit	Parts	Method		
7. AGC	(1) SSG OUT: 30dB MODE: CW. AM : SSB							CW. AM→FAST SSB→SLOW	Confirm
8. SQ	(1) MODE: SSB SQ VR: 12 o'clock				IF	VR2	Adjust VR slowly and step at threshold.		Confirm
	(2) MODE: FM							8:30～9:30	
9. BEEP tone	(1) AF GAIN VR: CENTER BAND SW: UP AND DOWN Connect IF U 27 hot line to GND.	AF VM SCOPE		EXT.SP	IF	VR5	Adjust "PEE" tone.	100mV	
10. RIT	(1) RIT: CENTER SSG OUT: 10dB RIT SW: ON OFF				SW	VR5	RIT SW ON, OFF equal level	Same AF tone. RIT RIT ON, RIT IND light on.	
					FRONT PANEL	RIT VR		±1.1kHz	Comfirm
11. RF ATT							RF ATT ON, OFF	About 30dB DOWN	Comfirm

TX adjustment

Item	Condition	Measurement			Adjustment			Specification	Remarks
		Test equipment	Unit	Terminal	Unit	Parts	Method		
1. Base current	(1) Display: 28.800MHz MODE: USB MIC VR: CCW MAX RF PWR VR: CCW MAX FILTER U : VR1, VR2 CCW MAX  	DC AM	FINAL	A	FINAL	VR1	If adjustment to 300mA is not possible. 200mA or more at position where reduced about 10mA from about 10mA from VR MAX.	300mA (200～300mA)	
	SEND SW: ON			B		VR2		200mA	
	(2) SEND SW: OFF POWER SW: OFF								
	(3) POWER SW: ON								
2. POWER	(1) Display: 52.000.000MHz MODE: CW RF PWR VR: CW MAX FILTER U VR1,2: CW MAX RF U TC4: MAX CAP IF U VR9: CENTER RF U DRV Connect terminal SEND SW: ON FINAL U TC1: MAX CAP	POWER METER SCOPE		ANT (50-7)			•Adjust to MAX power output.		
					RF	TC1 2 3 T41 42	•Repeat adjust RF U TC1～3.		
					IF	L10			
					FINAL	TC1	If power is over 10W reduce to 10W with VR and adjust.		
	SEND SW: OFF								
3. TX·BPF	MODE: FM Connection RF U R123: SWEEP RF U VR2: CCW MAX RF U DRV: 50Ω DUMM and SPECTRUM ANALYZER	SWEEP SPECTRUM ANALYZER 50Ω DUMMY					Adjust us shown at right with MAX gain and band width.	*Following waveform has measured 2 dB/div scale.  	
	(1) Display: 7MHz BAND		RF	50Ω DUMMY	RF	T12 15 18	Slug out over 3 turn on RF U T34, 35		

ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specification	Remarks
		Test equipment	Unit	Terminal	Unit	Parts	Method		
	SEND SW: ON								
	(2) Display: 21MHz BAND					T11 14 17			
	(3) Display: 28MHz BAND				RF	T10 13 16			
	(4) Display: 50MHz BAND					TC3 2 T37 42	TC3,2 has adjusted for gain up.		
	SEND SW: OFF								
4. POWER SET	(1) Display: 53.999MHz MODE: USB AG OUT: 1.5kHz 10mV SEND SW: ON adjust power to 15W by MIC VR.	POWER METER AG AF VM		ANT 50～7	FILTER	VR2	Adjust to 11W	11W	
	(2) RF PWR VR: CCW				SW	VR9	Adjust to 1.5W	2.5W or less	
	(3) SEND SW: OFF								
	(4) MODE: CW RF PWR VR: CW MAX SEND SW: ON				IF	VR9	Adjust to 11W		
	SEND SW: OFF								
	(5) Confirm power each BAND edge.							10W～12W	
5. ALC METER	(1) MODE: USB MIC VR: CCW MAX RF PWR VR: CW MAX SEND SW: ON RF/ALC SW: ALC	POWER METER AG AF VM		METER	FILTER	VR3	Adjust mechanical ϕ point.		
	(2) AG out: 1.5kHz 5mV MIC VR: set to S1					VR4	AG out: increase 6dB from 5mV.	Adjust ALC full scale.	
	(3) MIC input: OFF RF PWR VR: CCW MAX							No ALC METER swing	Confirm
	SEND SW: OFF								

ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specification	Remarks
		Test equipment	Unit	Terminal	Unit	Parts	Method		
6. PROTECTION	(1) Display: 53.499MHz MODE: CW RF PWR: CW MAX FILTER U VR1: CCW MAX SEND SW: ON	POWER METER V METER		ANT (50-7) Both end of VR1	FILTER	TC1	Minimum voltage	About 100mV or less	
	SEND SW: OFF								
	(2) Display: 21.499MHz : 28.499MHz ANT: 150Ω load SEND SW: ON	POWER METER 150Ω LOAD 1m 1m SET — P — 150Ω (THRU TYPE)				VR1	Adjust VR1 to 9W another side of 28.499MHz or 21.499MHz high power side.	9W	
	SEND SW: OFF								
	(3) Confirm at 4 points 7.499MHz, 50.499MHz 52.499MHz, 53.499MHz							4W or more	
7. SPRIOUS	(1) Display: 50.000MHz MODE: CW SEND SW: ON	POWER METER SPE-ANA		ANT (7-50)	RF	VR2 VR4 T33	Adjust to minimize sprious at ±8.83MHz (Repeat VR2, 4 twice)		
	SEND SW: OFF								
	(2) Confirm at 52.990MHz							60dB or less	
	(3) Display: 53.999MHz MODE: AM SEND SW: ON				CONT	VR1	Adjust to MIN sprious at ±100kHz		
	(4) Display: 21.499MHz SEND SW: ON				RF	VR3	Adjust to minimize sprious.		
	SEND SW: OFF								
	(5) Display: 7.499MHz					T34,35	Adjust minimize sprious at ±1.33MHz. (Repeat T34, 35 twice)		
	SEND SW: OFF								
8. SSB MODE FREQUENCY RESPONSE	(1) AG out: 5mV 7~8mV AG 5mV 300Hz — 10K — 560Ω — MIC AG 5mV 2.700Hz — 10K SEND SW: ON MIC VR: 9 o'clock				CONTROL	DIP S/W	320 160 80 40 320 160 80 40 USB USB Frequency has set by DIP SW.	Adjust to cross each point.	
	SEND SW: OFF								
9. CAR BALANCE	(1) Display: 28.8MHz MODE: USB, LSB MIC VR: CCW MAX RF POWER VR: CW MAX SEND SW: ON	POWER METER SCOPE AG 2 SET AF VM		ANT (7-50)	IF	VR7 VR8	Adjust repeatedly to minimize.	−50dB or less	
	SEND SW: OFF								

ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specification	Remarks
		Test equipment	Unit	Terminal	Unit	Parts	Method		
10. TX. RF FREQ-ENCY ERROR	RF POWER: CCW MAX MODE: USB, LSB, CW	POWER METER F COUNTER	IF	30 -1	SW	 VR7 VR8 VR10	SEND: Adjust at OFF as ON frequency USB LSB CW	USB: LSB: TX.RX equal frequency CW: Same as USB frequency	
11. RF POWER METER	(1) MODE: FM RF PWR: CW MAX SEND SW: ON RF/ALC SW: RF	POWER METER		ANT METER	FILTER	VR5	RF PWR VR: Adjust to 10W.	RF METER "10".	Confirm
	(2) RF PWR VR: Adjust 2W						Confirm	RF METER 2W ± 1W	
	SEND SW: OFF								
12. HF: VHF LEVEL ERROR	(1) Display: 53.499MHz, 7.499MHz MODE: CW SEND SW: ON RF/AFC SW: ALC	POWER METER		METER	RF	TC4	Adjust to equal fluctuation on ALC meter between 53.499MHz and 7.499MHz	If 53.499 is low as 7.499 adjust to MAX and within 6dB.	
	SEND SW: OFF								
13. SIDE TONE	(1) MODE: CW AF GAIN VR: 12 o'clock KEY JACK: KEY SEND SW: ON	POWER METER AF VM		EXT.SP	IF	VR10	KEY DOWN	0.63V/8Ω about 800Hz Low distortion.	Confirm
14. CW BREAKE IN	(1) SEND SW: OFF				RF	VR5	KEY DOWN TIME CONSTANT VR5: CCW longer : CW shorter	Breake in time changeble. VR5: 5V ~ 2V	

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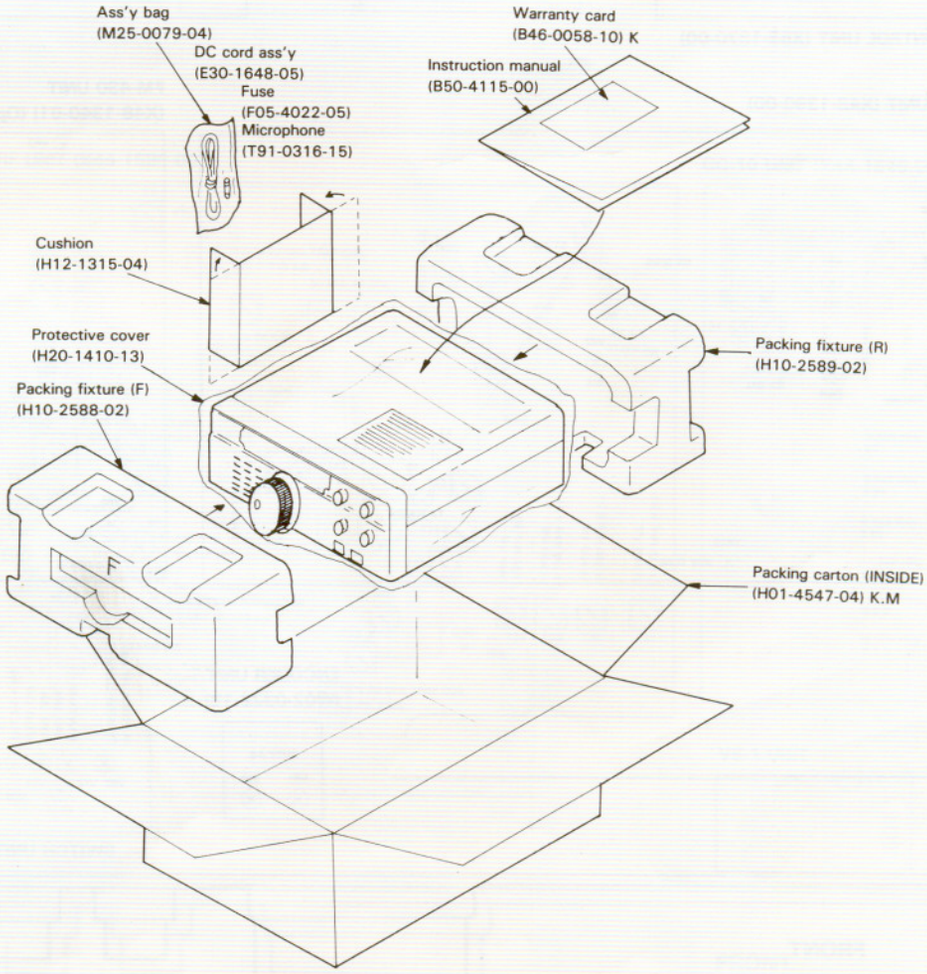
ADJUSTMENT

MICROPROCESSOR OPERATION CHECK

Item	Condition	Measurement			Adjustment			Specification	Remarks
		Test equipment	Unit	Terminal	Unit	Parts	Method		
1. BAND	(1) POWER PLUG: CONNECT : (13.8V) POWER: ON			Display				METER CAMP: light on VFO A 50.000.00	
	(2) UP: Push							Display: 51.000.00 Confirm "PEE" tone.	Confirm light dosen't change.
	(3) UP: Continue push							7.000.00→21.000.00→28.000.00 ↓ 29.000.00 ↓ 50.000.00 ↓ 53.000.00←52.000.00←51.000.00	
								Confirm continues display as above and "PEE" tone.	
	(4) DOWN: Push						Confirm light doesn't change.	Dislay changes down 1MHz or 1 BAND and "PEE" TONE.	
	(5) DOWN: Continue push							Back words of UP switch.	
6. FUNCTION	(1) ANT: 7 - 28, 50 ANTS A/B SW: VFO A and VFO B MODE: ULB	POWER METER SET	DISPLAY	DISPLAY			SEND SW OFF→ON→OFF	VFO A shows VFO A VFO B shows VFO B	
	SPLIT: ON A/B SW: VFO B						SEND SW OFF ↓ ON ↓ OFF	VFO B ↓ VFO A As display ↓ VFO B	
	A/B SW: VFO A							Back words function of VFO B	
	SPLIT SW: ON								
3. F. STEP	(1) F. STEP: OFF MODE: SSB, CW, AM						Confirm frequency change: CW: High freq. CCW: Low freq.	One knob rotate about 10kHz change	
	(2) F. STEP: ON							About 100kHz chage IND light on	
	(3) MODE: FM							About 100kHz change	
	(4) F. STEP: OFF							About 500kHz change IND light on	
4. F. LOCK	(1) F. LOCK: ON						Confirm by knob rotate.	Display doesn't change. IND light on	
	(2) F. LOCK: OFF							IND goes off	
5. MEMORY	(1) POWER OFF→ON HOLDING HOLD SW.							Display: VFO A : 50.000.00 : USB All RESET	
	(2) VFO/MEMO: ON						Confirm each memo by 10 KEY which frequency has same as entered previously.	Confirm all memo call back.	
	(3) MS: ON						Confirm at SEND SW ON, OFF.	Scan time: about 2 sec. each channel.	

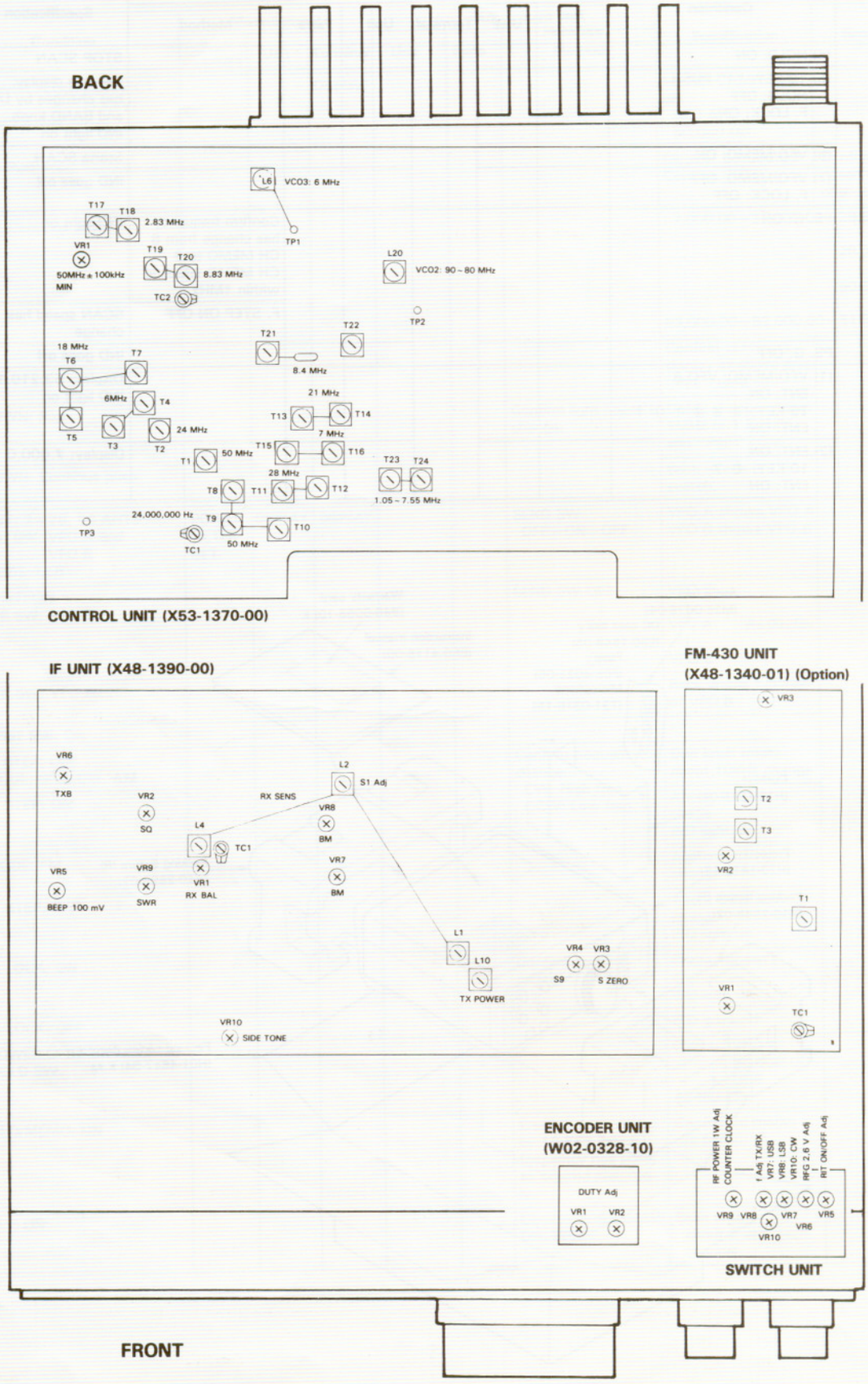
ADJUSTMENT/PACKING

Item	Condition	Measurement			Adjustment			Specification	Remarks
		Test equipment	Unit	Terminal	Unit	Parts	Method		
	(4) HOLD: ON							STOP SCAN	
	(5) 10 KEY: "1" PUSH HOLD: OFF F. LOCK: ON							Confirm display has changes by DIAL and BAND knob. IND light on	
	(6) VFO/MEMO: ON							Starts SCAN	
	(7) VFO/MEMO: OFF F. LOCK: OFF							IND goes off	
6. PROGRAM SCAN	PS. G: ON						Confirm frequency has change from 8 CH MEMO to 9 CH MEMO which is within 1MHz.	IND light on	
							F. STEP ON-OFF	SCAN speed has change	
	PS. G: OFF							IND goes off	
7. ENTER	(1) VFO/MEMO: VFO A ENT: ON 10 KEY: 5 3 2 1 0 1 ENT: ON							Display: 53.210.1 IND light on	
	(2) ENT: ON 10 KEY: 0 7 ENT: ON							Display: 7.000.0	



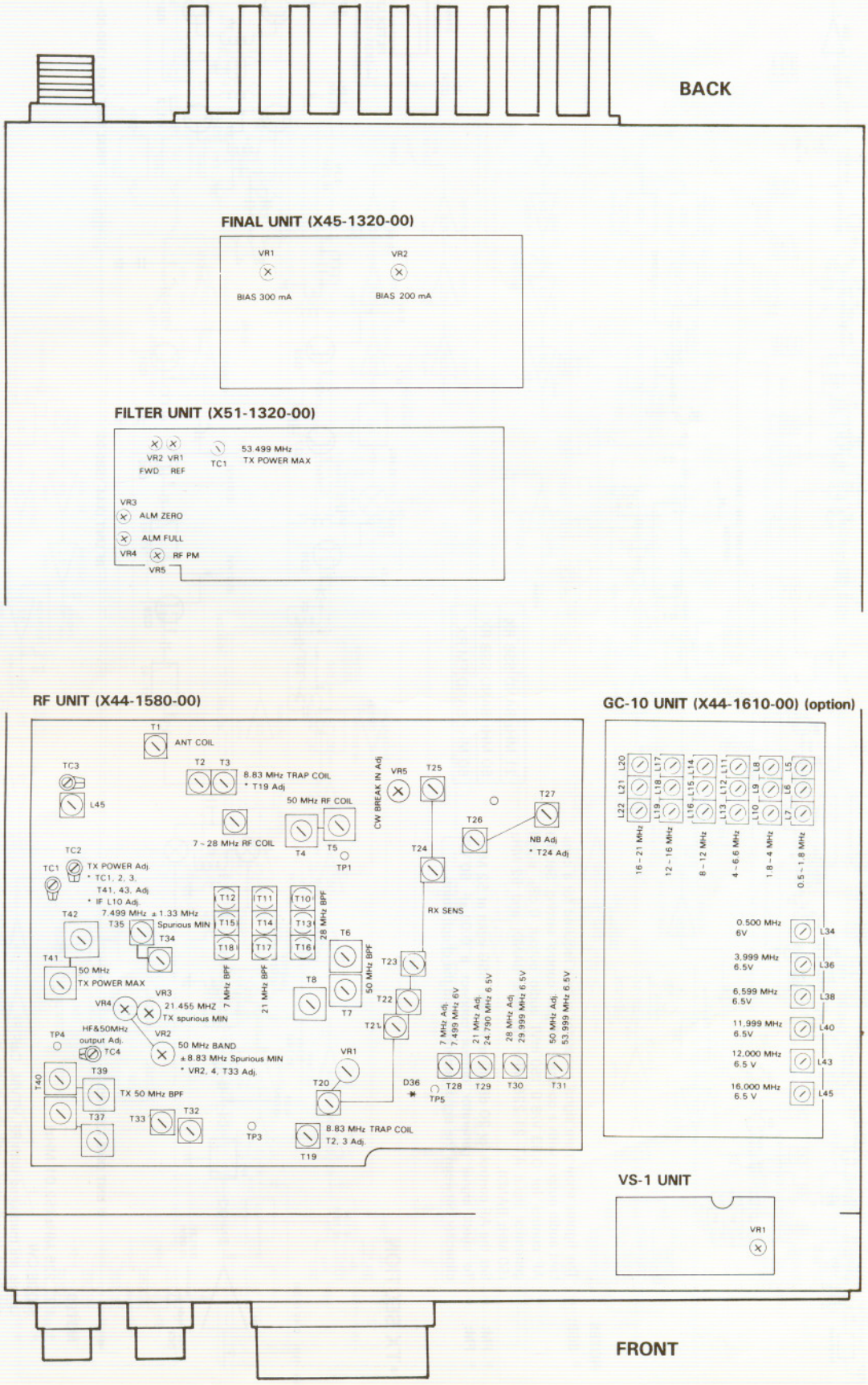
ADJUSTMENT

ADJUSTMENT PART LOCATION (TOP VIEW)



ADJUSTMENT

ADJUSTMENT PART LOCATION (BOTTOM VIEW)



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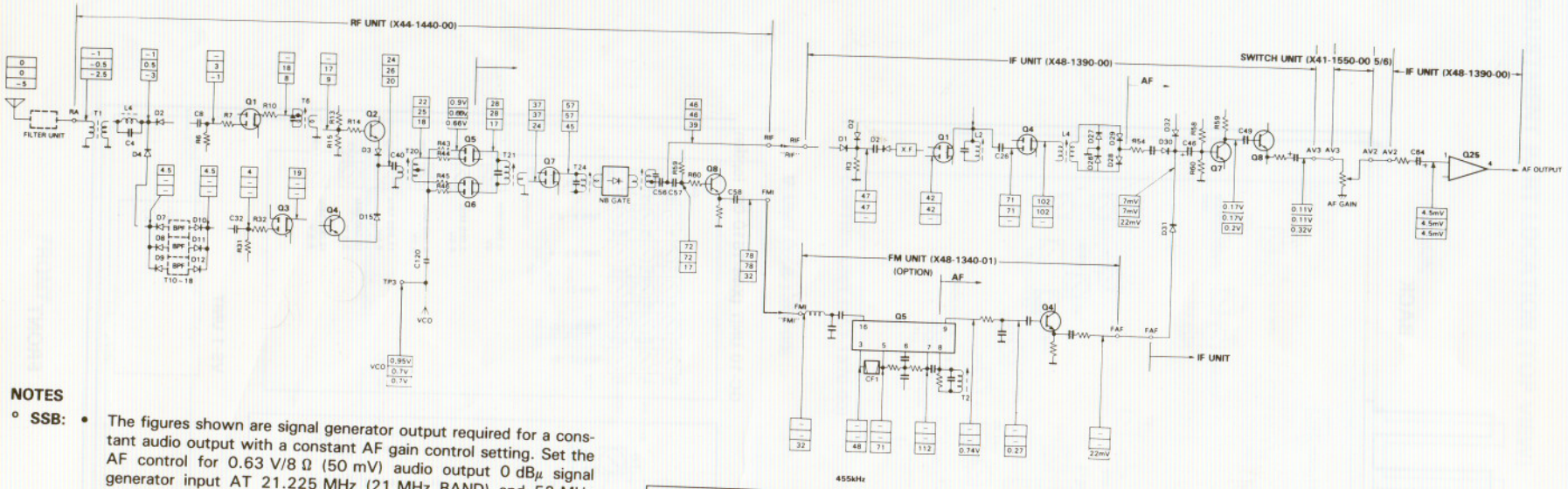
LEVEL DIAGRAM

• RX SECTION

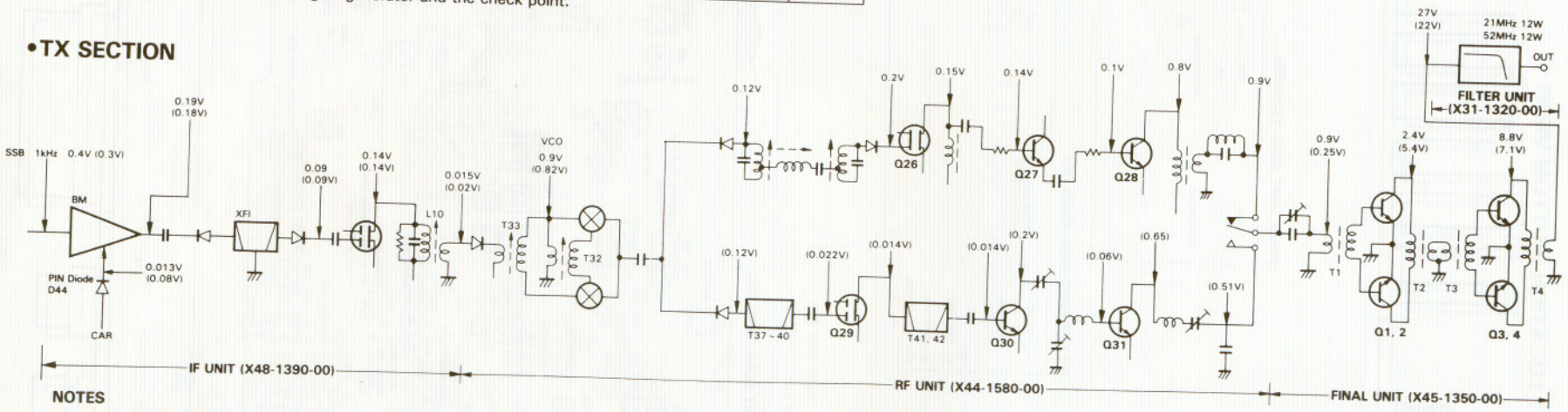


21 MHz BAND	SSB RX
50 MHz BAND	SSB RX
50 MHz BAND	FM RX

NOTES

- ° **SSB:** • The figures shown are signal generator output required for a constant audio output with a constant AF gain control setting. Set the AF control for 0.63 V/8 Ω (50 mV) audio output 0 dBμ signal generator input AT 21.225 MHz (21 MHz BAND) and 52 MHz (50 MHz BAND).
- ° **FM:** • Set the AF control for 20 dB NQ at FM and SSG input at 52 MHz.
- ° **FM:** • To inject signal generator output connect a 0.01 μF 50 WV capacitor between the signal generator and the check point.

•TX SECTION



NOTES

- ° f 21.225 MHz (52.01 MHz)
- ° MODE CW
- ° Levels are measured with RF VTVM. Carrier level is adjusted until the meter indicates the MAX ALC reading.
- ° A probe with a capacitance is less than 3 pF should be used and the ground should be made near the point of measurement.

BLOCK DIAGRAM

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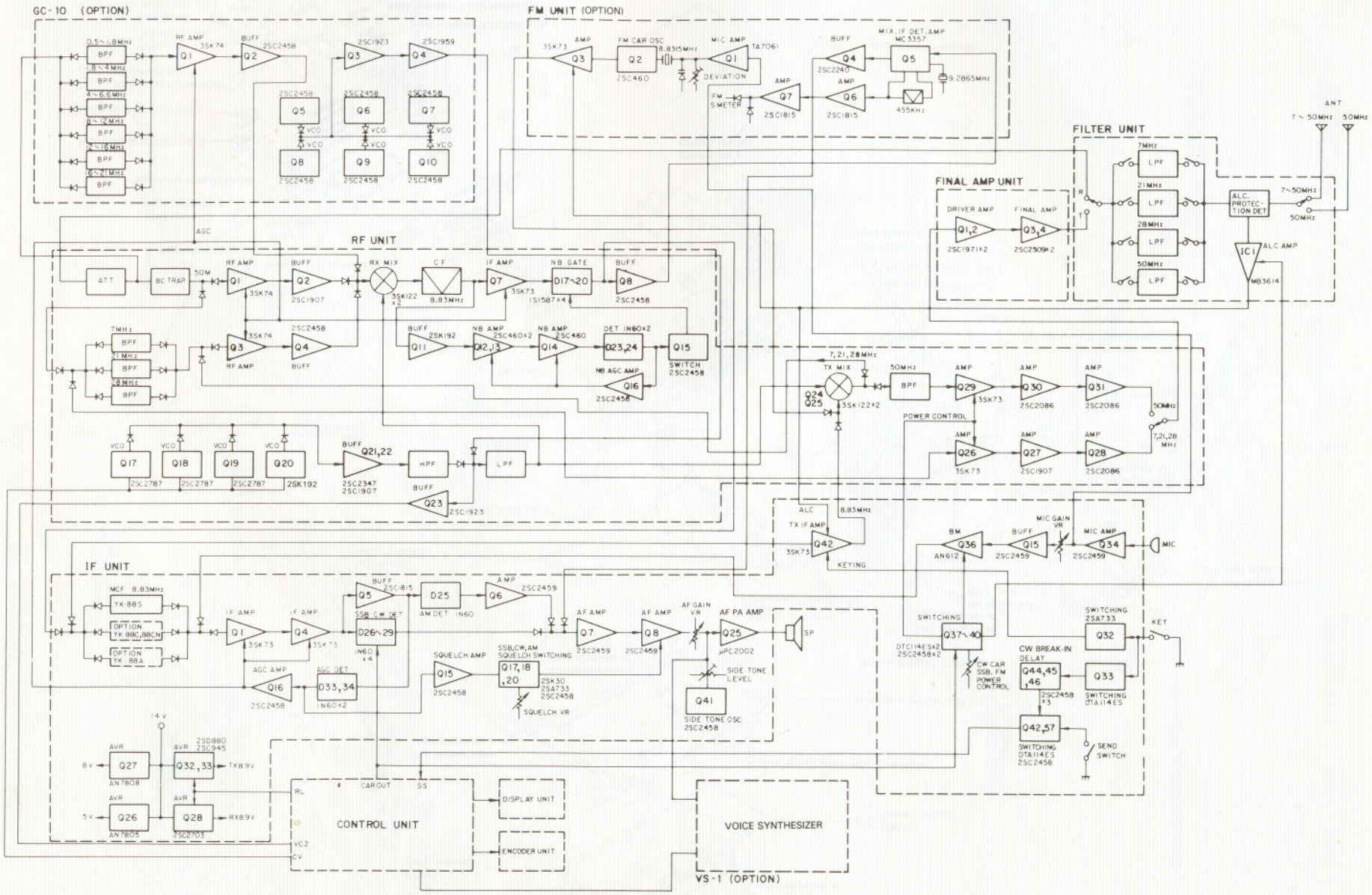
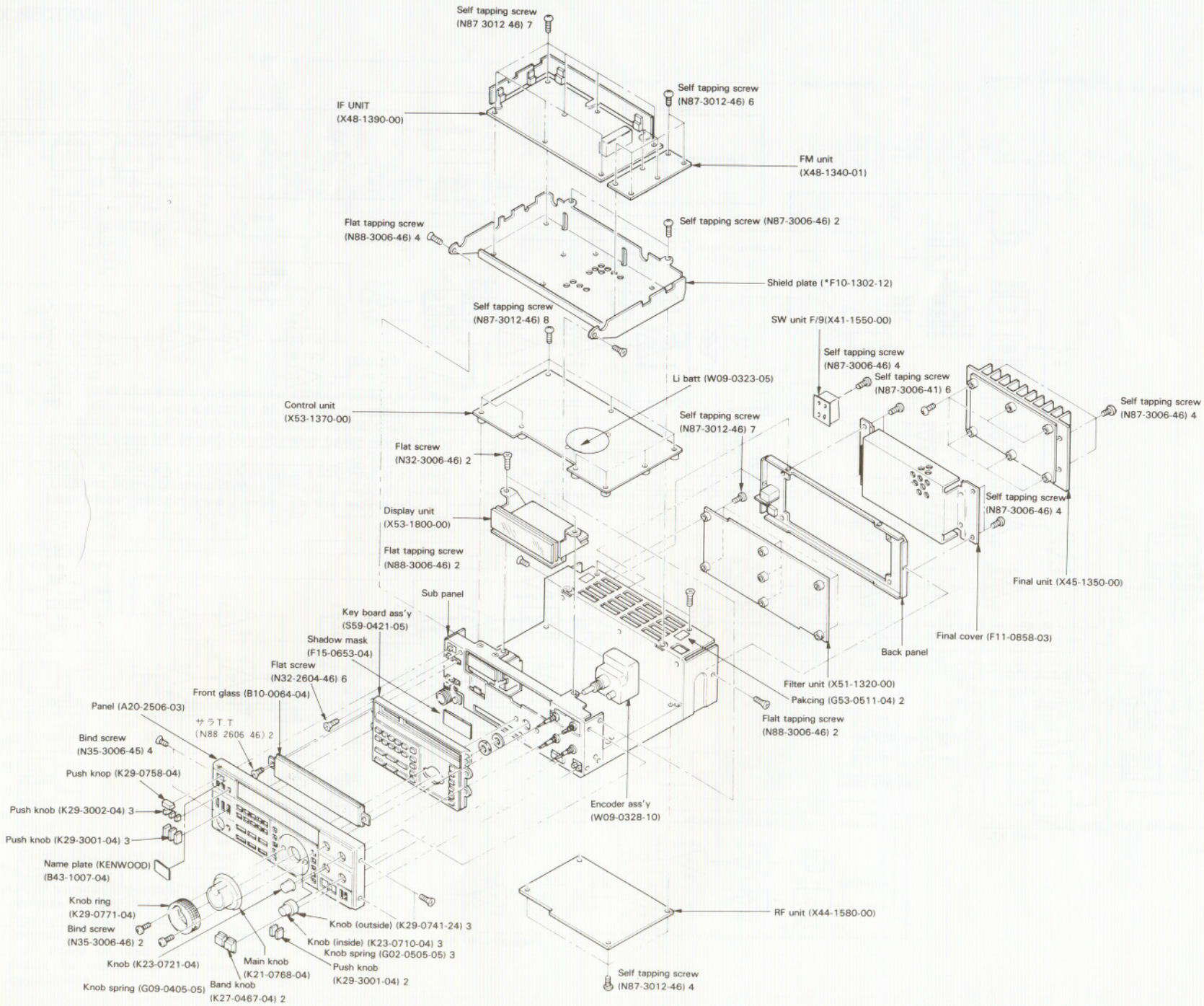
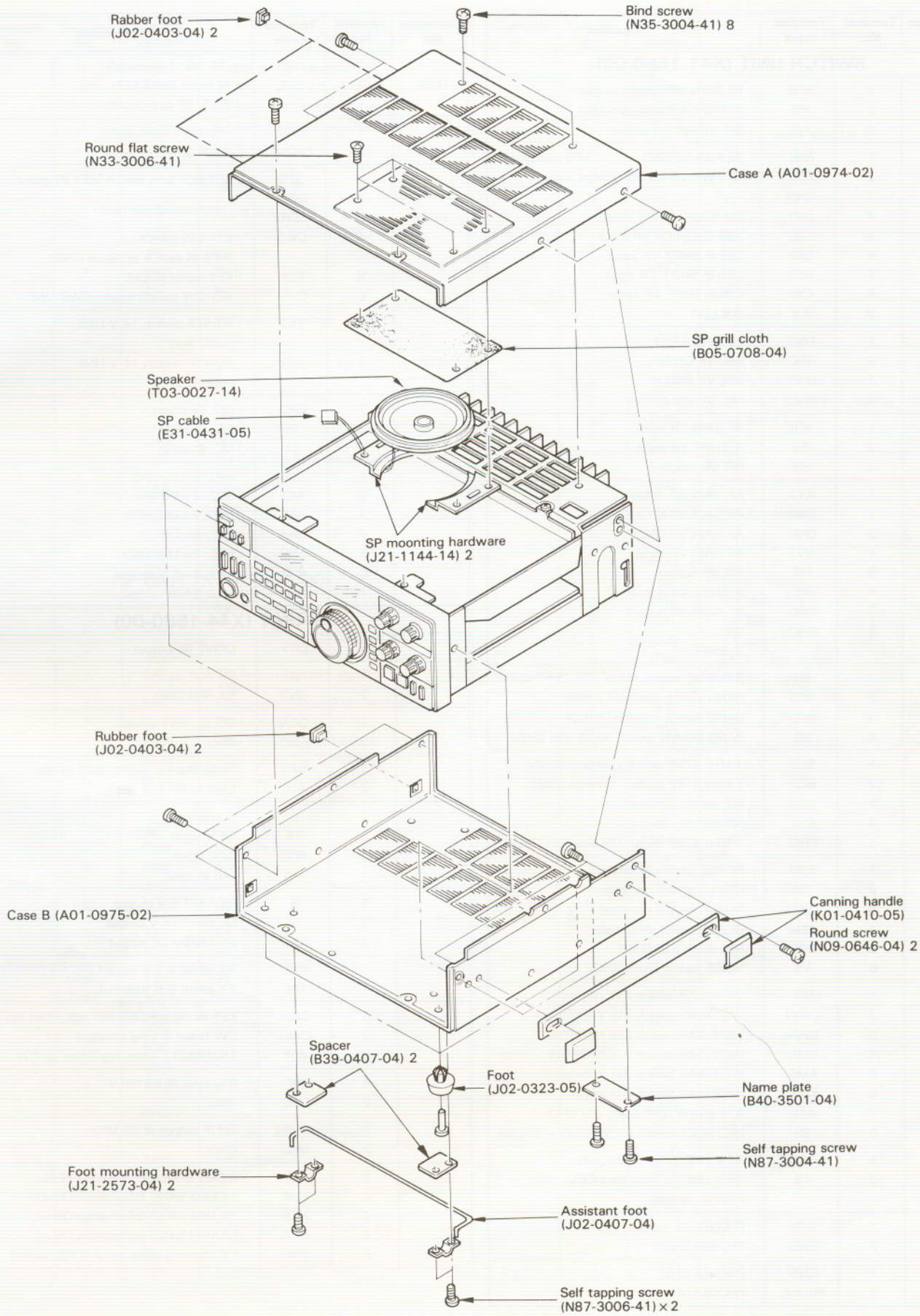


TS-670 DISASSEMBLY



DISASSEMBLY



TERMINAL FUNCTIONS

Connector No.	Terminal No.	Terminal name	Function
SWITCH UNIT (X41-1550-00)			
(A/9)	1	RFB	RF GAIN VR voltage output
	2	IFB	IF SHIFT VR voltage output
	3	RIB	RIT VR voltage output
(A/9)	1	MIN	RF PWR VR GND .....MIN voltage AOS
	2	PCV	RF PWR VR control voltage output
	3	GND	
	4	FSQ	FM SQUELCH VR input
	5	SSQ	SSB SQUELCH VR input
	6	LSB	LSB IF SHIFT VR input
	7	USB	USB IF SHIFT VR input
	8	CW	CW IF SHIFT VR input
	9	8 V	8 V LINE
(A/9)	1	MV2	MIC VR output
	2	GND	MIC VR GND
	3	GND	MIC VR GND
	4	MV3	MIC VR input
	1	RFB	RF GAIN VR input
	2	IFB	IF SHIFT VR input
	3	RIB	RIT VR input
	1	AV2	AF GAIN VR output
	2	GND	AF GAIN VR GND
	3	GND	AF GAIN VR GND
	4	AV3	AF GAIN VR input
	5	RIT	RIT VR output
	6	IFS	IF SHIFT VR output
	7	RFG	RF GAIN VR output
	8	GND	RIT / IF SHIFT VR GND
(C/9)	1	BU	BAND UP switch MAKE (ON CONTACT)
	2	BCD	BAND switch common (GND)
	3	BCD	BAND switch common (GND)
	4	BD	BAND DOWN switch MAKE (ON GND)
(E/9)	1	BCD	1 MHz STEP switch common (GND)
	2	BCD	1 MHz STEP switch common (GND)
	3	RCO	RIT switch common
	4	RST	RIT switch side
	5	MHS	1 MHz STEP switch ON side (ON GND)
(I/9)	1	RFM	RF/ALC switch RF meter
	2	SM	RF/ALC switch common
	3	SM	RF/ALC switch common
	4	ALM	RF/ALC switch ALC meter
	5	NBS	NB switch (ON GND)
	6	VS	VOICE switch (Push GND)
(I/9)	1	SCC	WIDE/NAR switch CW common
	2	CWW	WIDE/NAR switch CW WIDO
	3	CWN	WIDE/NAR switch CW NARROW
	4	AMN	WIDE/NAR switch AM NARROW
	5	AMC	WIDE/NAR switch AM common
	6	AMW	WIDE/NAR switch AM WIDE
	7	ATS	ATT switch (OFF open, ON GND)
	8	SS	REC/SEND switch (SEND GND) = SS LINE
(F/9)	1	14 A	14 V LINE (after choke coil)
	2	14	14 V LINE (in front choke coil = after POWER switch)
(G/9)	1	SPO	PHONES AF input
	2	GND	PHONES GND
(G/9)	1	GND	PHONES GND
	2	PHONE	PHONES SP output

Connector No.	Terminal No.	Terminal name	Function
(H/9)	1	GND	14 No. 1 (terminal)
	2	SPK	AF input (SPEAKER) (EXT. SP jack, input)
(H/9)	1	GND	13 No.1 (terminal)
	2	PHONE	inside SP AF output
(H/9)	1	STS	KEY side tone switch (KEY IN open)
	2	CWD	connected (terminal)
	3	CWD	
	4	CWS	KEY CW switch (KEY IN switch to No. 6 CWB)
	5	KEY	KEY signal output
	6	CWB	KEY CW switch input = CWB LINE
(F/9)	1	PS1	POWER switch 14 V LINE LOAD side
	2	PS2	POWER switch 14 V LINE outlet side
(F/9)	1	GND	DC: ⊖ input
	2	14	DC: ⊕ input
	3	14	DC: ⊕ input
(D/9)	1	SS	MIC: 2 = SS LINE
	2	MD	MIC: 3 = DOWN
	3	MIC	MIC: 1 = MIC HOT
	4	MU	MIC: 4 = UP
	5	GND	MIC: 7 = MIC GND
	6	8 M	MIC: 5 = 8 V source
	7	SPO	MIC: 6 = AF output
RF UNIT (X44-1580-00)			
	1	DRV	DRIVE RF output
	1	RAT	RX ANT input
	2	GND	RX ANT GND
	1	GCA	GC-10: ANT output
	2	GND	GND
	1	NBS	Noise Blanker switch GND to ON
	2	ATS	GND to RF ATT ON
	1	8	8 V input
	2	14	14 V input
	3	AGC	AGC input
	4	−6	−6 V input
	1	8	GC UNIT 8 V output
	2	14	GC UNIT 14 V output
	3	AGC	GC UNIT AGC output
	1	RXB	RX about 8.5 V input
	2	TBL	TX about 8.5 V output
	1	CWS	KEY IN signal•CWB has add when key in.
	2	CWD	CW Brake in time constant
	3	KEY	TRANSMITT when key down on CW
	1	RIF	IF output (8.83 MHz)
	2	GND	GND
	1	FMI	FM IF output (8.38 MHz)
	2	GND	GND
	1	7 A	7 MHz BAND information ON = L
	2	21 A	21 MHz BAND information ON = L
	3	28 A	28 MHz BAND information ON = L
	4	50 A	50 MHz BAND information ON = L
	5	SBK	RX Blanking pulse input at PLL switch

TERMINAL FUNCTIONS

Connector No.	Terminal No.	Terminal name	Function
	1	7 A	7 MHz BAND information
	2	21 A	21 MHz BAND information
	3	28 A	28 MHz BAND information
	4	50 A	50 MHz BAND information
	5	14	14 V input
	6	ABB	7, 21, 28, 50 MHz BAND USE = "H" (about 11.5 V)
	1	PB	PLL 8 V output
	2	VC2	VCO output to CONT UNIT
	3	PG	PLL GND
	4	GND	GND
	5	CV	VCO control voltage
	1	CV	VCO control voltage
	2	GND	GND
	1	GCV	VCO input from GC-10
	1	TIF	TX 8.83 MHz input
	2	GND	GND
	1	GND	GND
	2	FMT	FM TX 8.83 MHz input
	1	TXB	TX + 8.8 V
	2	G2	Gain control voltage on TX
	1	GCO	RF input from GC-10
	2	GND	GND
IF UNIT (X48-1390-00)			
	1	RIF	RX IF signal input
	2	GND	
	1	NC	
	2	AMF	AM Frequency shift signal
	1	AMC	Filter switch signal AM common
	2	CWN	Filter switch signal YK-88C
	3	AMW	Filter switch signal YK-88A
	4	CWW	Filter switch signal YK-88S
	5	AMN	Filter switch signal YK-88S
	6	SCC	Filter switch signal SSB, CW common
	1	SSB	SSB: 7 V
	2	CWB	CW: 7 V
	3	AMB	AM: 7 V
	4	NC	
	5	FMB	FM: 8 V
	1	TXB	TX: 8.8 V
	2	RXB	RX: 9 V
	1	TXB	TX: 8.8 V
	2	G2	RF UNIT TX FET AMP G2 Control voltage
	1	MV2	MIC VR 2
	2	GND	
	3	GND	
	4	MV3	MIC VR 3
	1	GND	
	2	FMC	FM UNIT MIC ANP output
	1	MIC	MIC input
	2	GND	
	1	PCV	Power control VR signal
	2	MIN	Power control MIN power set
	1	GND	
	2	SP	SPEAKER

Connector No.	Terminal No.	Terminal name	Function
	1	SPO	
	2	GND	
	3	SPJ	
	1	TBL	CW key down about 8 V
	2	CWB	CW, about 7 V
	3	RXB	RX, about 9 V
	1	RL	TX about 13 V Relay control voltage
	2	RAL	Remote ALC input
	1	VO	Voice synthesizer signal
	2	GND	
	3	8 V	DC 8 V
	1	TIF	TX output
	2	GND	
	1	ALC	ALC signal
	2	PCL	power control DC signal
	3	RL	TX about 13 V Relay control voltage
	4	FMB	FM about 8 V
	5	8 V	DC 8 V
	1	GND	
	2	SPO	
	1	SM	S meter signal
	2	NC	
	1	GND	
	2	FAF	FM AF signal
	3	FMB	FM about 8 V
	4	FSQ	FM SQ
	5	TXB	TX about 8.8 V
	6	FSM	FM S meter signal
	7	ALC	FM ALC signal
	1	8 V	DC 8 V
	2	−6	DC −6 V
	3	14 A	14 V after choke coil
	1	5 V	DC 5 V
	1	GND	
	2	11 V	DC 11 V Display
	1	14 A	14 V after choke coil
	2	14	14 V input
	1	RFG	RF gain control signal DC
	2	NC	
	1	AGC	AGC LINE
	2	8 V	DC 8 V
	3	−6	DC −6 V
	4	14 A	14 V after choke coil
	1	GND	
	2	BZ	BEEP TONE ON
	1	AV2	AF VR 2
	2	GND	
	3	GND	
	4	AV3	AF VR 3
	1	SSQ	SSB SQ VR
	2	FSQ	FM SQ VR
	1	GND	
	2	CAR	8.83 MHz Carrier input
	1	NC	
	2	CWD	CW Brake in time constant control

TERMINAL FUNCTIONS

Connector No.	Terminal No.	Terminal name	Function
	1	CGD	GND at control UNIT
	2	CSS	Stand By signal to control UNIT
	1	BUZ	BEEP TONE output
	2	GND	
	1	RL	TX of 13 V Relay control
	2	BUZ	BEEP Tone input
	3	GND	
IP	1	STS	KEY DOWN to SIDETONE ON
IP	1	SS	STAND BY
IP	1	8 V	DC 8 V
IP	1	CWB	CW about 7 V
FILTER UNIT (X51-1320-00)			
	1	SW	ANT switch: ON = 50B
	2	50B	50 MHz BAND Relay Source
	1	RL	TX about 13 V Relay control
	2	FMB	FM: about 8 V
	3	RXB	RX: about 9 V
	4	PCL	Power control VR change about 0.4 ~ 3 V
	5	ALC	ALC LINE: NO ALC about 2.7 V
	6	8 V	DC 8 V LINE
	7	TXB	TX about 8.8 V DC LINE
	1	RFM	RF meter control
	2	ALM	ALC meter control
	1	RA	RX ANT input
	2	E	GND
	1	ABB	AMATEUR BAND HAM = "H", ETC = "L"
	2	50	50 MHz BAND information
	3	28	28 BAND information
	4	21	21 BAND information
	5	7	7 BAND information
	6	14 V	14 V LINE
COAX		IN	Power input from FINAL
COAX		50	50 MHz ANT output
COAX		750	7 ~ 50 MHz ANT output
IP		TXB	TX about 8.8 V DC LINE
CONTROL UNIT (X53-1370-00)			
	1	MHS	1 MHz STEP by touch to GND
	2	BD	1 BAND or 1 MHz STEP DOWN by touch to GND
	3	BU	1 BAND ot 1 MHz STEP UP by touch to GND
	1	MU	MIC UP by GND
	2	MU	MIC DOWN by GND
	1	SS	STAND BY
	2	GND	GND
	1	GND	GND
	2	EN2	Encoder input
	3	EN1	
	4	5 V	5 V for Encoder

Connector No.	Terminal No.	Terminal name	Function
	1	CWB	CW MODE information + B
	2	USB	USB MODE information + B
	3	LSB	LSB MODE information + B
	1	FMB	FMB MODE information + B
	2	AMB	AM MODE information + B
	3	CWB	CW MODE information + B
	4	SSB	SSB MODE information + B
	1	7 A	7 MHz BAND information operate "L"
	2	21 A	21 MHz BAND information operate "L"
	3	28 A	28 MHz BAND information operate "L"
	4	50 A	50 MHz BAND information operate "L"
	1	05 A	0.5 MHz BAND information operate "L"
	2	2 A	2 MHz BAND information operate "L"
	3	4 A	4 MHz BAND information operate "L"
	i	12 A	12 MHz BAND information operate "L"
	5	10 A	10 MHz BAND information operate "L"
	6	8 A	8 MHz BAND information operate "L"
	7	16 A	16 MHz BAND information operate "L"
	1	PS0	VS-1 voice synthesizer address signal
	2	PS3	VS-1 voice synthesizer address signal
	3	PB2	VS-1 voice synthesizer address signal
	4	PS1	VS-1 voice synthesizer address signal
	5	5 V	5 V output
	6	GND	GND
	1	14 A	14 V input
	2	AMF	AM Frequency shift control
	1	(NC)	—
	2	VSC	VS-1 operate by GND
	1	IFS	IF shift control voltage input
	2	RIT	RIT control input
	1	SBK	RX Blanking pulse input at PLL switch
	2	(GND)	—
	1	PS4	VS-1 voice synthesizer address signal
	2	SR	Voice synthesizer start signal
	3	BY	Voice synthesizer ON = "H"
	1	dp	"d.p." data for display
	2	g	"g" data for display
	1	f	"f" data for display
	2	e	"e" data for display
	3	5 V	5 V output
	1	GND	GND
	2	P20	
	3	P21	expander control output
	4	P22	
	5	P23	
	6	PLG	clock output
	7	CS	chip selector output
	1	GS	GC-10 installation sencer
	2	GC	GC-10 installation sencer
	1	BZ	BEEP TONE control "L" = BEEP
	2	GND	GND
	1	5 V	5 V input
	2	8 V	8 V input

TERMINAL FUNCTIONS

Connector No.	Terminal No.	Terminal name	Function
	1	PB	PLL 8 V input
	2	PG	PLL GND
	3	CV	VCO control voltage output
	1	VC2	VCO RF voltage input
	2	GND	GND
	1	CAR	carrier output
	2	GND	GND
	1	RL	TX about +12 Relay control
	2	(GND)	—
	1	RC	RIT switch RIT works when toucher RC
	2	RS	and RS
	1	C2	
	2	C3	
	3	C4	MATRIX input of KEY BOARD
	4	C5	
	5	C1	
	1	PGS	Progrum scan IND output
	2	MS	Memory scan IND output
	3	HLD	Hold IND output
	1	LOK	lock IND output
	2	STP	Step IND output
	1	D6	
	2	D5	
	3	D4	MATRIX input of KEY BOARD
	4	D3	
	5	D2	
	6	D1	
	1	5 V	5 V output
	2	GND	GND
	1	OAD	"ON AIR" display
	2	5 V	5 V output
DISPLAY UNIT (X54-1880-00)			
	1	11 V	11 V LINE (DC-DC CONVERTER SOURCE)
	2	GND	0 V (DC-DC CONVERTER)
	3	−6	−6 V LINE (DC-DC CONVERTER output)
	1	f	"f" data for display
	2	g	"g" data for display
	1	5 V	5 V LINE
	2	dp	"d.p." (dot point) data for display
	3	e	"e" data for display
	1	CS	chip select input
	2	PRG	clock input
	3	P23	
	4	P22	expander control output
	5	P21	
	6	P20	
	7	GND	GND

TS-670

OPTION (GC-10)

GC-10 CIRCUIT DESCRIPTION

The GC-10 is an optional unit to be attached to the TS-670 to permit reception of 0.5 to 30 MHz (excluding certain frequencies).

The GC-10 consists of RF amp and 6 sets of BPFs, and six VCOs.

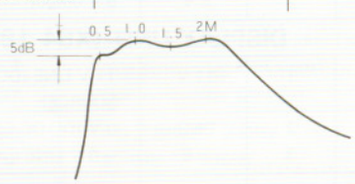
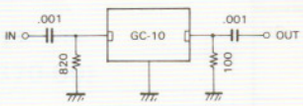
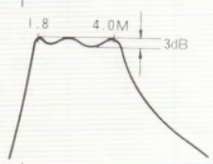
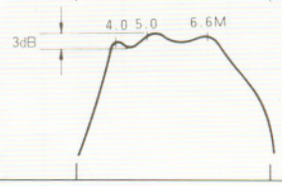
The RF signal is fed from the TS-670 via the RF attenuator, then each band is selected by switching diodes D1 to D12 (IS2588) and amplified by RF amp Q1 (3SK74), then fed through buffer amp Q2 before being input to the reception mixer of the TS-670.

Excluding the 0.5 to 1.8 MHz band, the medium frequency trap for other bands is inserted at the input.

The VCO output for each band is fed through buffer amps Q3 and Q4, then output to the reception mixer of the TS-670.

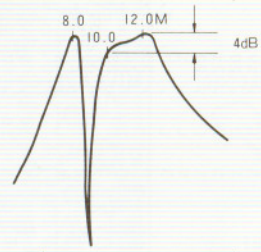
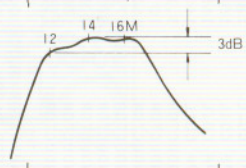
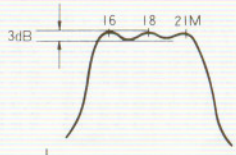
D31 is a circuit which permits the control unit to detect that the GC-10 is attached to the TS-670.

ADJUSTMENT

Item	Condition	Measurement				Adjustment		Specification	Remarks
		Test equipment	Unit	Terminal	Unit	Parts	Method		
1. VCO adjustment	Voltage adjustment MODE: FM	DC VM	GC	CV	GC				
	0.500MHz					L34		6.0V	
	1.790MHz							1.8 ~ 2.8V	Confirm
	3.990MHz					L36		6.5V	
	1.800MHz							1.8V ±0.5V	Confirm
	6.590MHz					L38		6.5V	
	4.000MHz							1.9V ±0.5V	Confirm
	11.990MHz					L40		6.5V	
	8.000MHz							1.7V ±0.5V	Confirm
	9.900MHz							2V ±0.5V	
	11.990MHz							5.7V ±0.5V	Confirm
	12.000MHz					L43		6.5V	
	15.990MHz							1.5V ±0.5V	Confirm
	16.000MHz					L45		6.5V	
	20.990MHz							1 ~ 1.9V	Confirm
2. RX BPF adjustment	(1) Display: 1MHz (0.5 ~ 1.799MHz) MODE: FM •Connect the sweep output to RF U 2 connector. •Connect the detector to the RF U D3 cathode.	SWEEP SCOPE DETECT-OR	RF	D3 (cathode)	GC	L5,6,7	Adjust as shown on the right. 		
	(2) Display: 2MHz (1.8 ~ 3.999MHz)					L8,9,10			
	(3) Display: 5MHz (4 ~ 6.599MHz)					L11,12 13			

OPTION (GC-10)

ADJUSTMENT

Item	Condition	Measurement				Adjustment		Specification	Remarks
		Test equipment	Unit	Terminal	Unit	Parts	Method		
3. RX BPF adjustment	(4) Display: 10MHz (8 ~ 11.999MHz)	SWEEP SCOPE DETECT-OR	RF	D3 (cathode)	GC	L14,15 16			
	(5) Display: 14MHz (12 ~ 15.999MHz)					L17,18 19			
	(6) Display: 18MHz (16 ~ 20.999MHz)					L20,21 22			

GC-10 SPECIFICATIONS

- **Reception frequency range** : 500 kHz ~ 30 MHz (Except around 8.83MHz)
- **Image ratio** : 40 dB or more*
- **IF disturbance ratio** : 40 dB or more*
  * Except 7.0 ~ 7.1 MHz, 21.0 ~ 21.45MHz and 28 ~ 29.7 MHz
- **Sensitivity**

Frequency \ Mode	SSB, CW (10 dB S/N)	AM (10 dB S/N)
0.5 ~ 1.8MHz	6 dBμ (2μV) or less	24 dBμ (16μV) or less
1.8 ~ 7MHz	−6 dBμ (0.5μV) or less	12 dBμ (4μV) or less
*7 ~ 7.1MHz	−12 dBμ (0.25μV) or less	6 dBμ (2μV) or less
7.1 ~ 8.3MHz	−6 dBμ (0.5μV) or less	12 dBμ (4μV) or less
9.5 ~ 21MHz	−6 dBμ (0.5μV) or less	12 dBμ (4μV) or less
*21 ~ 21.45MHz	−12 dBμ (0.25μV) or less	6 dBμ (2μV) or less
21.45 ~ 23MHz	−6 dBμ (0.5μV) or less	12 dBμ (4μV) or less
23 ~ 24.8MHz	4 dBμ (1.6μV) or less	22 dBμ (12.5μV) or less
*24.8 ~ 28MHz	−6 dBμ (0.5μ) or less	12 dBμ (4μV) or less
28 ~ 29.7MHz	−12 dBμ (0.25μV) or less	6 dBμ (2μV) or less
29.7 ~ 30MHz	−6 dBμ (0.5μV) or less	12 dBμ (4μV) or less

  * TS-670

- **Dimensions** : 71 mm width
  23 mm height
  135 mm depth
- **Weight** : Approx. 100 g

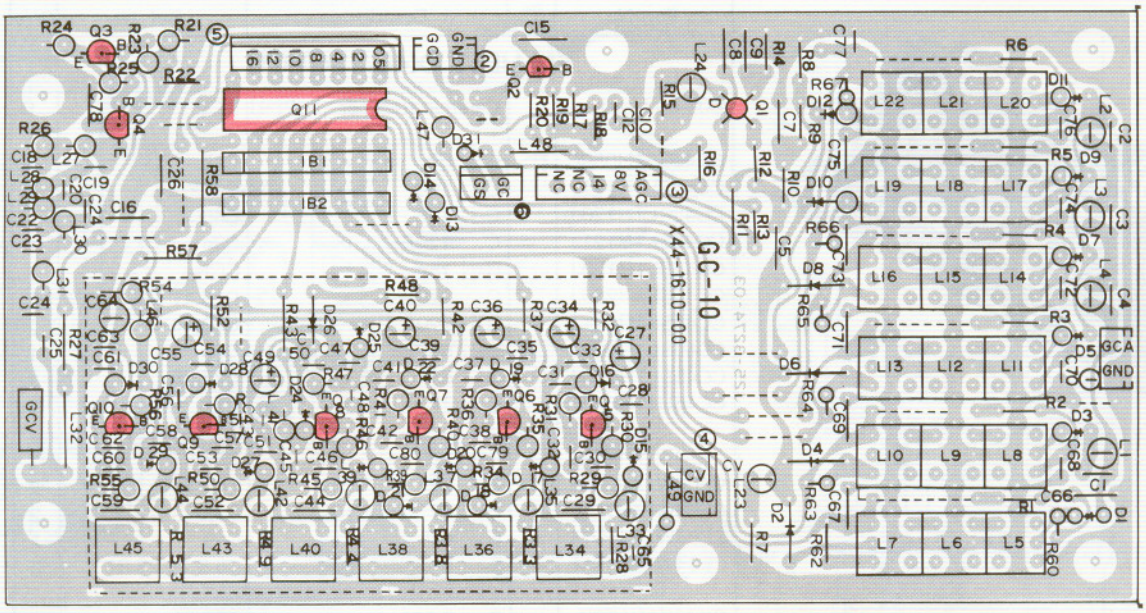
GC-10

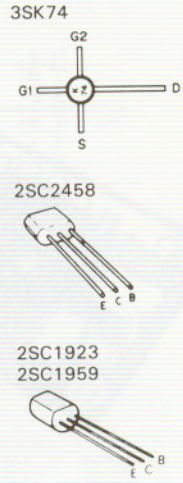
Parts No.	Re-marks	Description	Q'ty	Ref No.
B50-4140-00		OPERATIMG MANUAL	1	
H01-4567-03		CARTON (INSIDE)	1	
H03-2193-04		PACKING CASE OUTSIDE	110	
H12-1365-04		BUFFER	1	
J61-0408-05		VINYL TIE	3	
N87-3012-46		TAPPING SCREW	6	
X44-1610-00		GC UNIT	1	

GC-10 UNIT (X44-1610-00)

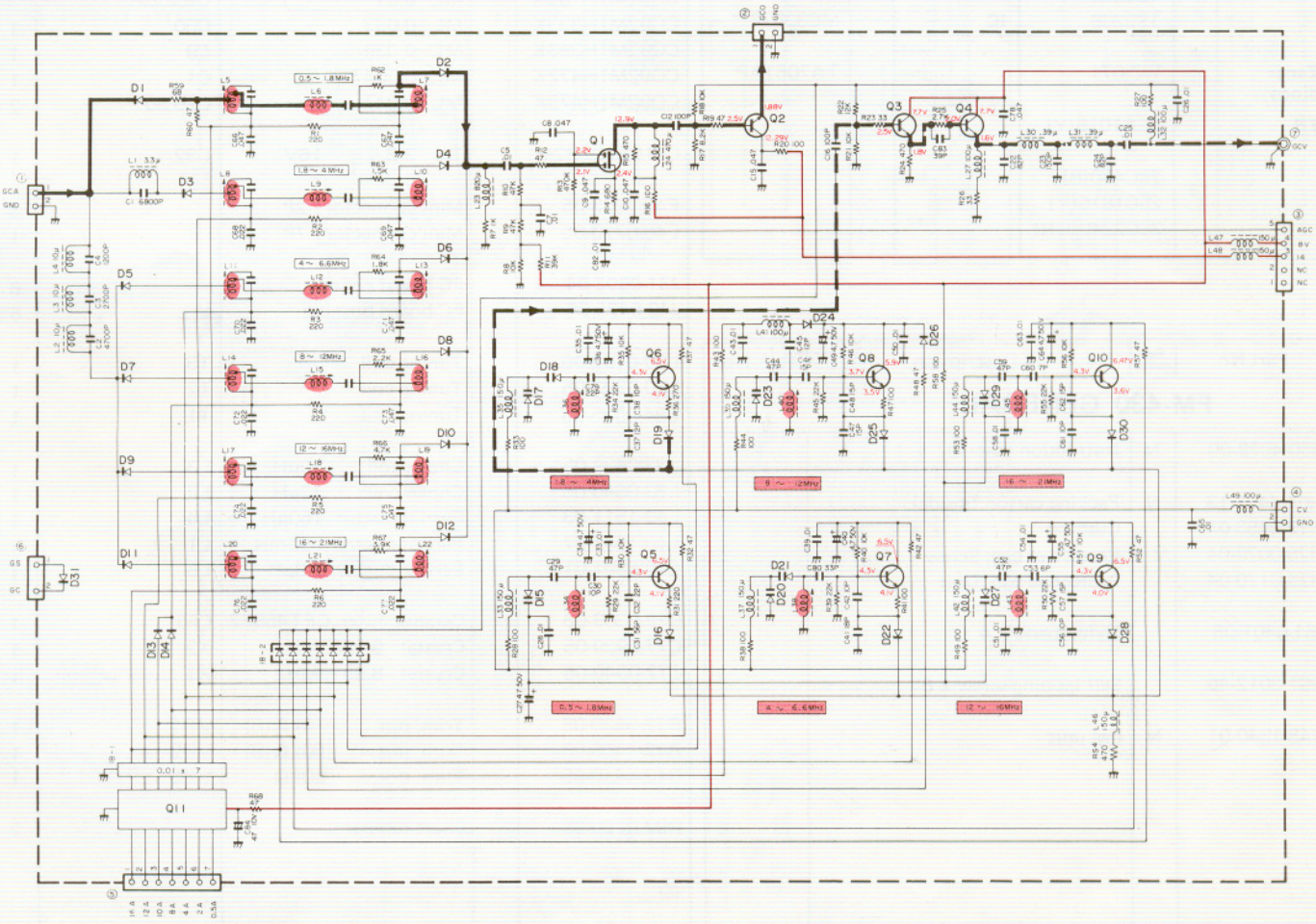
Parts No.	Re-marks	Description	Q'ty	Ref No.
CC45RH1H050C		CERAMIC 5P 50V	1	C , 38
CC45TH1H060D		CERAMIC 6P 50V	1	C , 53
CC45TH1H070D		CERAMIC 7P 50V	1	C , 60
CC45SL1H820J		CERAMIC 82P 50V	2	C , 22, 24
CC45RH1H100D		CERAMIC 10P 50V	3	C , 30, 32, 42
CC45SL1H101J		CERAMIC 100P 50V	2	C , 12, 16
CC45RH1H120J		CERAMIC 12P 50V	2	C , 37, 45
CC45TH1H150J		CERAMIC 15P 50V	1	C , 46
CC45SL1H151J		CERAMIC 150P 50V	1	C , 23
CC45RH1H180J		CERAMIC 18P 50V	1	C , 41
CC45RH1H220J		CERAMIC 22P 50V	1	C , 79
CC45UJ1H330J		CERAMIC 33P 50V	1	C , 80
CC45RH1H470J		CERAMIC 47P 50V	1	C , 29
CC45RH1H560J		CERAMIC 56P 50V	1	C , 31
CC45UJ1H100D		CERAMIC 10P 50V	2	C , 56, 61
CC45UJ1H150J		CERAMIC 15P 50V	4	C , 47, 48, 57, 62
CC45UJ1H470J		CERAMIC 47P 50V	3	C , 44, 52, 59
CE04W1A470M		ELECTRO 47 10V	7	C , 27, 34, 36, 40, 49, 55, 64
CK45F1H103Z		CERAMIC 0.01 50V	3	C , 5, 7, 26
CQ92M1H122K		MYLAR 1200P 50V	1	C , 4
CQ92M1H272K		MYLAR 2700P 50V	1	C , 3
CQ92M1H472K		MYLAR 4700P 50V	1	C , 2
CQ92M1H682K		MYLAR 6800P 50V	1	C , 1
C91-0117-05		CERAMIC CAP 0.01	12	C , 25, 28, 33, 35, 39, 43, 50 , 51, 54, 58, 63, 65
C91-1008-05		CERAMIC 0.022	6	C , 68, 70, 72, 74, 76, 77
C91-0119-05		CERAMIC 0.047 25V	11	C , 8, 9, 10, 15, 66, 67, 69 , 71, 73, 75, 78
E31-2170-05		JUMPER WIRE	13	
E40-0273-05		MINI CONNECTOR 2P	4	
E40-0573-05		MINI CONNECTOR 5P	1	
E40-0773-05		PIN ASS'Y 7P	1	
F11-0867-04		SHIELDING CASE	1	
ITT310TE		VARI-CAP DIODE	8	D , 15, 17, 18, 20, 21, 23, 27 , 29
J31-0502-04		COLLAR	6	
J42-0428-05		BUSHING	6	
L32-0195-05		OSCILLATING COIL	2	L , 40, 43
L32-0197-05		OSCILLATING COIL 21,28MHZ	1	L , 45
L32-0668-05	N	OSCILLATING COIL	1	L , 34
L32-0669-05	N	OSCILLATING COIL	1	L , 36
L32-0670-05	N	OSCILLATING COIL	1	L , 38
L34-3106-05	N	BPF COIL 05A	1	L , 5
L34-3107-05	N	BPF COIL 05B	1	L , 6
L34-3108-05	N	BPF COIL 05C	1	L , 7
L34-3109-05	N	BPF COIL 2A	1	L , 8
L34-3110-05	N	BPF COIL 2B	1	L , 9
L34-3111-05	N	BPF COIL 2C	1	L , 10
L34-3112-05	N	BPF COIL 4A	1	L , 11
L34-3113-05	N	BPF COIL 4B	1	L , 12
L34-3114-05	N	BPF COIL 4C	1	L , 13
L34-3115-05	N	BPF COIL 8A	1	L , 14
L34-3116-05	N	BPF COIL 8B	1	L , 15
L34-3117-05	N	BPF COIL 8C	1	L , 16
L34-3118-05	N	BPF COIL 12A	1	L , 17
L34-3119-05	N	BPF COIL 123B	1	L , 18
L34-3120-05	N	BPF COIL 12C	1	L , 19
L34-3121-05	N	BPF COIL 16A	1	L , 20
L34-3122-05	N	BPF COIL 16B	1	L , 21
L34-3123-05	N	BPF COIL 16C	1	L , 22
L40-3392-02		INDUCTOR 3.3 UH	1	L , 1
L40-1001-02		INDUCTOR 10 UH	3	L , 2, 3, 4
L40-1511-03		INDUCTOR 150 UH	6	L , 33, 35, 37, 39, 42, 44
L40-4711-03		INDUCTOR 470 UH	1	L , 24
L40-8211-07	N	INDUCTOR 820 UH	1	L , 23
L40-3982-14		INDUCTOR 0.39UH	2	L , 30, 31
L40-1011-14		INDUCTOR 100 UH	6	L , 27, 32, 41, 47, 48, 49
L40-1511-14		INDUCTOR 150 UH	1	L , 46
R90-0576-05	N	CAPACITOR BLOCK 0.01UF X 7	1	IB , 1
R90-0577-05	N	DIODE BLOCK 1S1555 X 7	1	IB , 2
R92-0150-05		JUMPER WIRE	7	
UPA80C		IC	1	Q , 11
1S1555		DIODE	4	D , 13, 14, 26, 31
1S1587		DIODE	6	D , 16, 19, 22, 25, 28, 30
1S2588		DIODE	13	D , 1, 2, 3, 4, 5, 6, 7 , 8, 9, 10, 11, 12, 24
2SC1923(O)		TR	1	Q , 3
2SC1959(Y)		TR	1	Q , 4
2SC2458(Y)		TR OR 2SC2603(E)	7	Q , 2, 5, 6, 7, 8, 9, 10
3SK74(L)		FET	1	Q , 1

OPTION (GC-10)





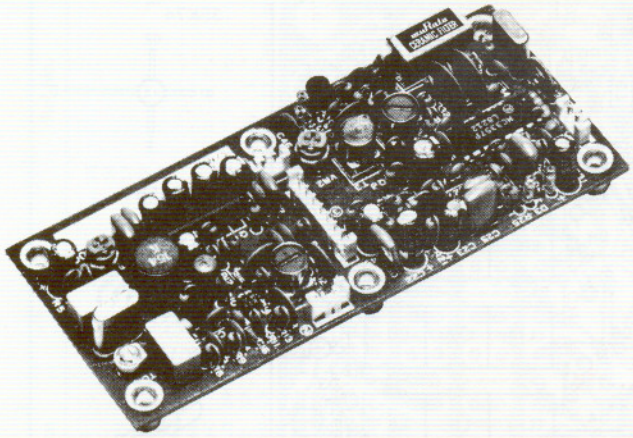
Q1 : 3SK74(L) Q2, 5～10 : 2SC2458(Y) Q3 : 2SC1923(O) Q4 : 2SC1959(Y) Q11 : μPC80C D1～12, 24 : 1S2588 D13, 14, 26, 31 : 1S1555 D15, 17, 18, 20, 21, 23, 27, 29 : 1TT310TE D16, 19, 22, 25, 28, 30 : 1S1587



TS-670

OPTION (FM-430)

OUTSIDE VIEW



PARTS LIST

SEMICONDUCTOR

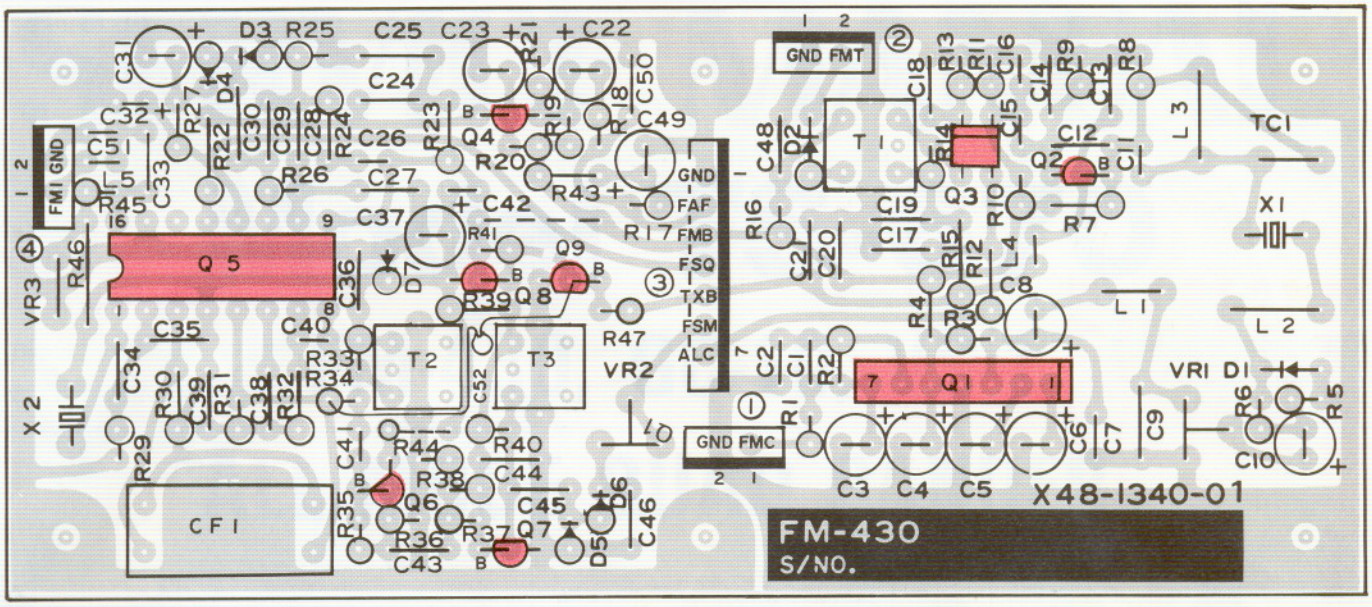
N : New parts

Item	Re-marks	Name	Item	Re-marks	Name
Diode		1N60	**FET**		3SK73(GR)
		1S1555			
		1S2208	**IC**		MC3357P
Zener diode		WZ-071			TA7061AP
TR		2SA1015(Y)			
		2SC460(B)			
		2SC1815(Y)			
		2SC2240(GR)			

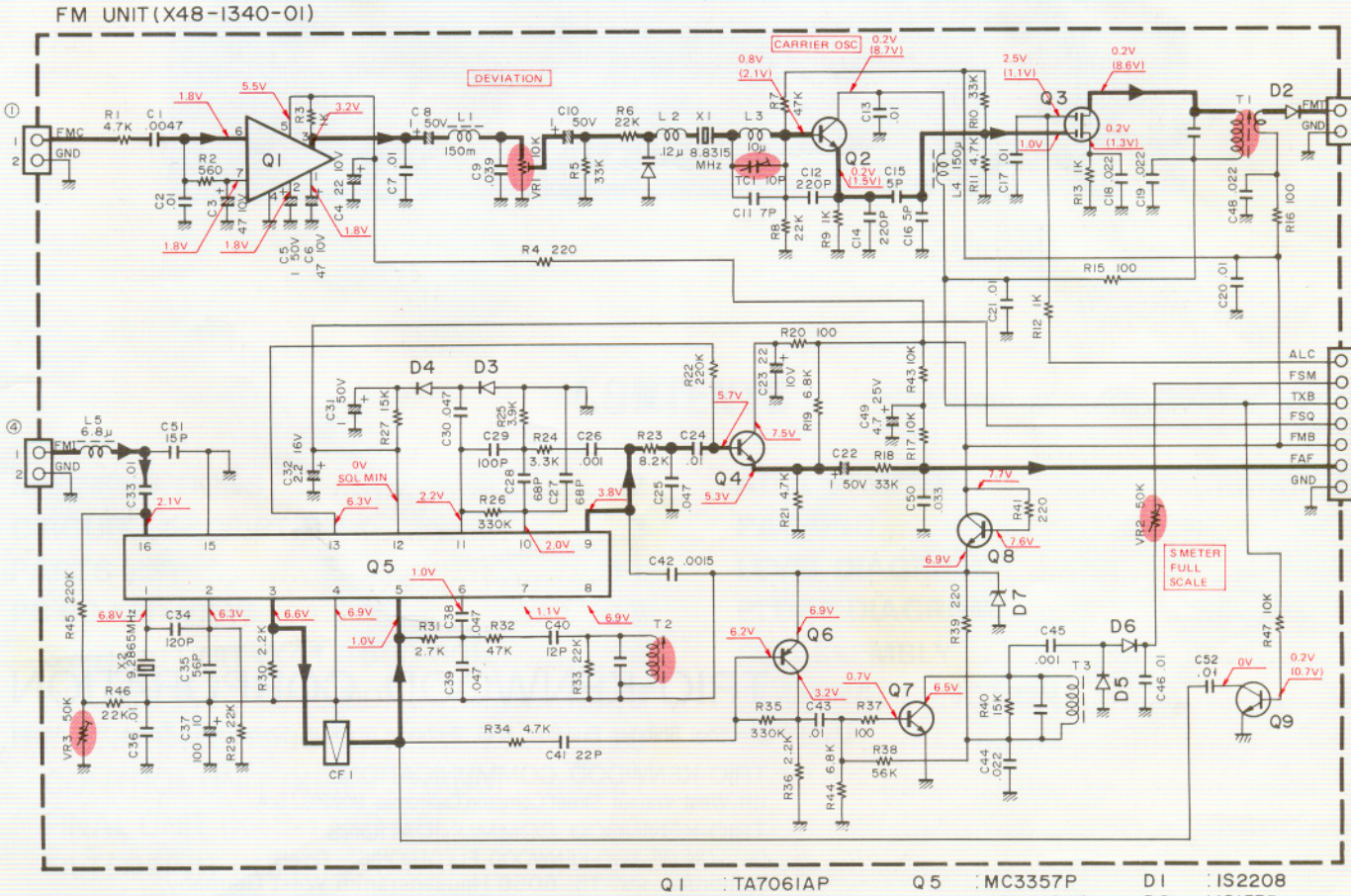
Part No.	Re-marks	Description	Ref. No.
FM-430 GENERAL			
B50-4029-00	N	Instruction manual	
H01-4471-13	N	Packing carton (inside)	
H12-0483-04		Cushion	
H25-0029-04		Protective bag, Screw	
H25-0120-04		Protective bag, Unit	
J61-0401-05		Nylon band x 4	
N87-3012-46		Self tapping screw x 6	
X48-1340-01	N	FM unit	

Part No.	Re-marks	Description	Ref. No.	Q'ty
FM UNIT (X48-1340-01)				
C05-0031-15		Ceramic trimmer 10P	TC1	1
CC45SL1H050C		C 5P	C15	1
CC45SL1H101J		C 100P	C29	1
CC45SL1H120J		C 12P	C40	1
CC45SL1H121J		C 120P	C34	1
CC45SL1H150J		C 15P	C51	1
CC45SL1H220J		C 22P	C16,41	2
CC45SL1H221J		C 220P	C12,14	2
CC45SL1H560J		C 56P	C35	1
CC45SL1H680J		C 68P	C27,28	2
CC45UJ1H070D		C 7P	C11	1
CE04W1A101M		E 100 10V	C37	1
CE04W1A220M		E 22 10V	C4,23	2
CE04W1A470M		E 47 10V	C3,6	2
CE04W1E4R7M		E 4.7 25V	C49	1
CE04W1H010M		E 1 50V	C5,8,10,22,31	5
CK45B1H102K		C 0.001	C26,45	2
CK45B1H152K		C 0.0015	C42	1
CK45F1H103Z		C 0.01	C13,17,20,21,33, 36,43,46	8
CK45F1H223Z		C 0.022	C18,19,44,48	4
CK45F1H473Z		C 0.047	C38,39	2
CQ92M1H103K		ML 0.01	C2,7,24	3
CQ92M1H333K		ML 0.033	C50	1
CQ92M1H393K		ML 0.039	C9	1
CQ92M1H472K		ML 0.0047	C1	1
CQ92M1H473K		ML 0.047	C25,30	2
CS15E1C2R2M		T 2.2 16V	C32	1
E40-0273-05		Mini connector 2P		3
E40-0773-05		Mini connector 7P		1
J31-0502-04		PC board collar		6
J42-0428-05		PC board bushing		6
L30-0199-06		Tuning coil	T3	1
L30-0503-05		Tuning coil	T2	1
L34-0535-05		Tuning coil	T1	1
L33-0639-05		Choke coil 10μH	L3	1
L33-0640-05		Choke coil 12μH	L2	1
L40-1511-03		Ferri-inductor 150μH	L4	1
L40-1541-27		Ferri-inductor 150mH	L1	1
L40-6891-01		Ferri-inductor 6.8μH	L5	1
C72-0309-06		Ceramic filter CFT455F2	CF1	1
C77-0939-05		Crystal 9.2865MHz	X2	1
C77-0940-05		Crystal 8.8315MHz	X1	1
R12-3430-05		Trim. pot. 10kΩ(B)	VR1	1
R12-4408-05		Trim. pot. 50kΩ(B)	VR2	1
R12-4410-05		Trim. pot. 50kΩ	VR3	1
R92-0150-05		Short jumper		2

OPTION (FM-430)

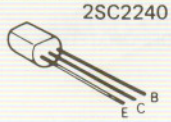


FM UNIT (X48-1340-01)

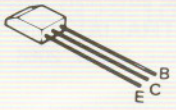


Q1	: TA7061AP	Q5	: MC3357P	D1	: IS2208
Q2	: 2SC460(B)	Q6	: 2SA1015(Y)	D2	: IS1555
Q3	: 3SK73(GR)	Q7～9	: 2SC1815(Y)	D3～6	: IN60
Q4	: 2SC2240(GR)			D7	: MTZ7.5JA

2SA1015 2SC1815
2SC2240



2SC460



TA7061AP

TS-670

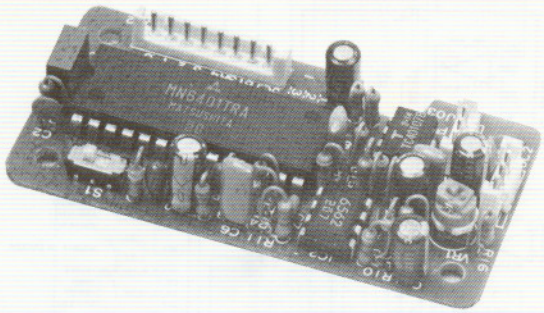
OPTION (VS-1 Voice synthesizer unit)

SPECIFICATIONS

Dimensions: W 70mm
H 15mm
D 35mm

Weight: 20g

OUTSIDE VIEW



PARTS LIST

Part No.	Remarks	Description	Ref. No.
B50-4035-00	N	Instruction manual	
CC45SL1H121J		C 120P x 2	C2,3
CE04W1A470M		E 47 10V	C1,14,15
CE04W1C100M		E 10 16V	C11
CE04W1HR22M		E 0.22 50V	C12
CK45B1H221K		C 220P x 2	C7,10
CQ92M1H332K		ML 0.0033 x 3	C6,8,9
CS15E1E010M		T 1 25V	C4
CS15E1V0R1M		T 0.1 35V	C5
C91-0131-05		C 0.01 (SP)	C13
E40-0273-05	△	Mini connector 2P W M	
E40-0373-05	△	Mini connector 3P W M	
E40-0373-05	△	Mini connector x 2 3P T	
E40-0873-05	△	Mini connector 8P W	
E40-5083-45	N	Mini connector 3P B	
H01-4481-03	N△	Packing carton (inside) M	
H01-4501-03	N△	Packing carton (inside) T	
H25-0029-04		Protective bag x 2	
L78-0006-05	N	Ceramic OSC	X1
N89-3006-46	.	Tapping screw x 4	
R12-4408-05		Trim. pot. 50kΩ	VR1
S31-1411-05	N	Slide switch	S1
AN6562	N	IC	IC2
MN6401TRA	N	IC	IC1
TC40107BP	N	IC	IC3

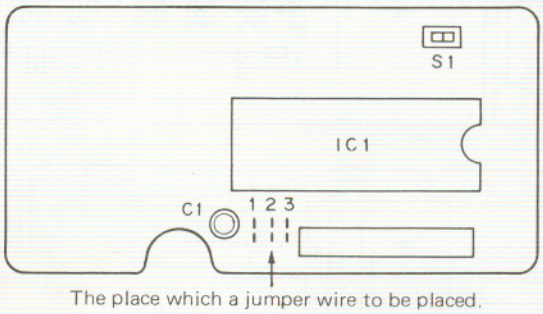
TALK SPEED SELECTION

Speed is factory set at "standard" talk speed. Three different speeds can be selected.

Note: When placing the jumper, solder carefully.

Jumper place \ Speed	Std. speed	30% more than Std.	60% more than Std.
1	X	X	○
2	X	X	○
3	X	○	X

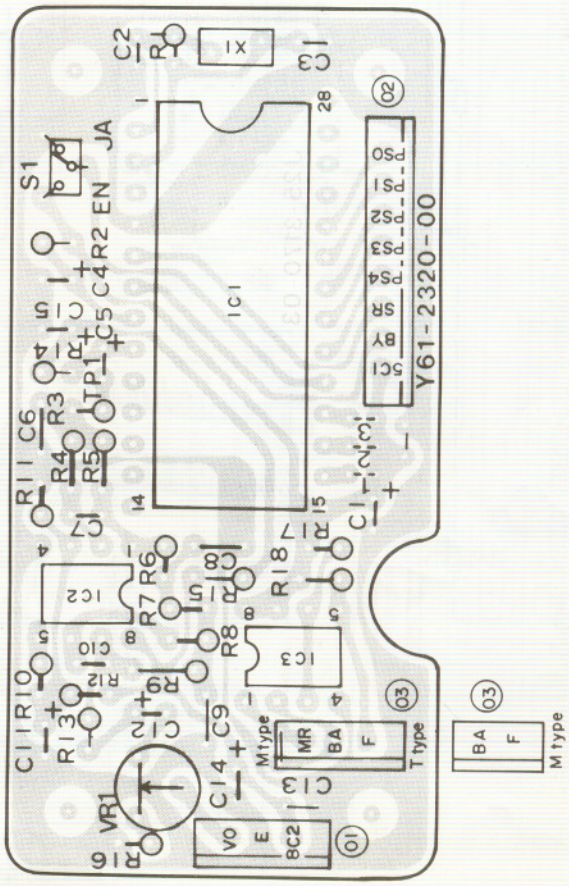
Symbol ○, denotes the place in which a jumper wire is placed.



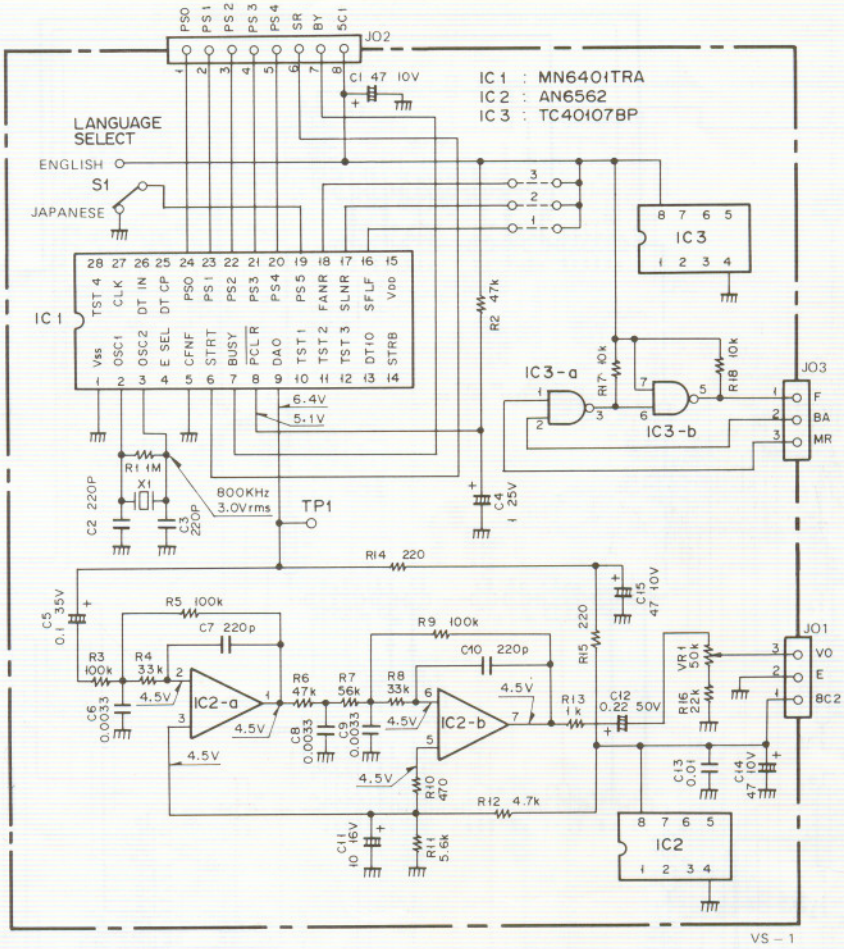
The place which a jumper wire to be placed.

PC BOARD VIEW

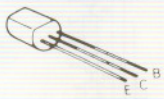
Component side view



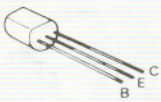
OPTION (VS-1)



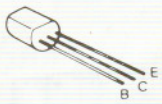
2SA1015 2SC1923
2SC1775 2SC1959
2SC1815 2SC2240



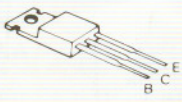
2SC2026
2SC2407
2SC2671



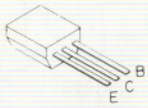
2SC2538



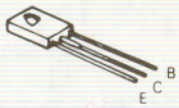
2SA1012



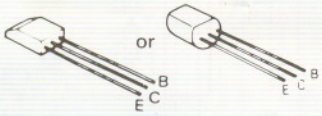
2SC2458
2SC2603



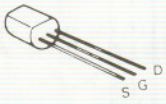
2SC496



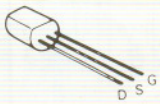
2SC460



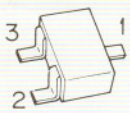
2SK30A
2SK125



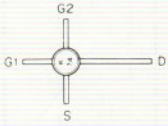
2SK192A



2SC2406TS



3SK74
3SK97
3SK114



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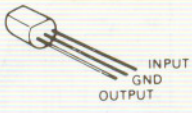
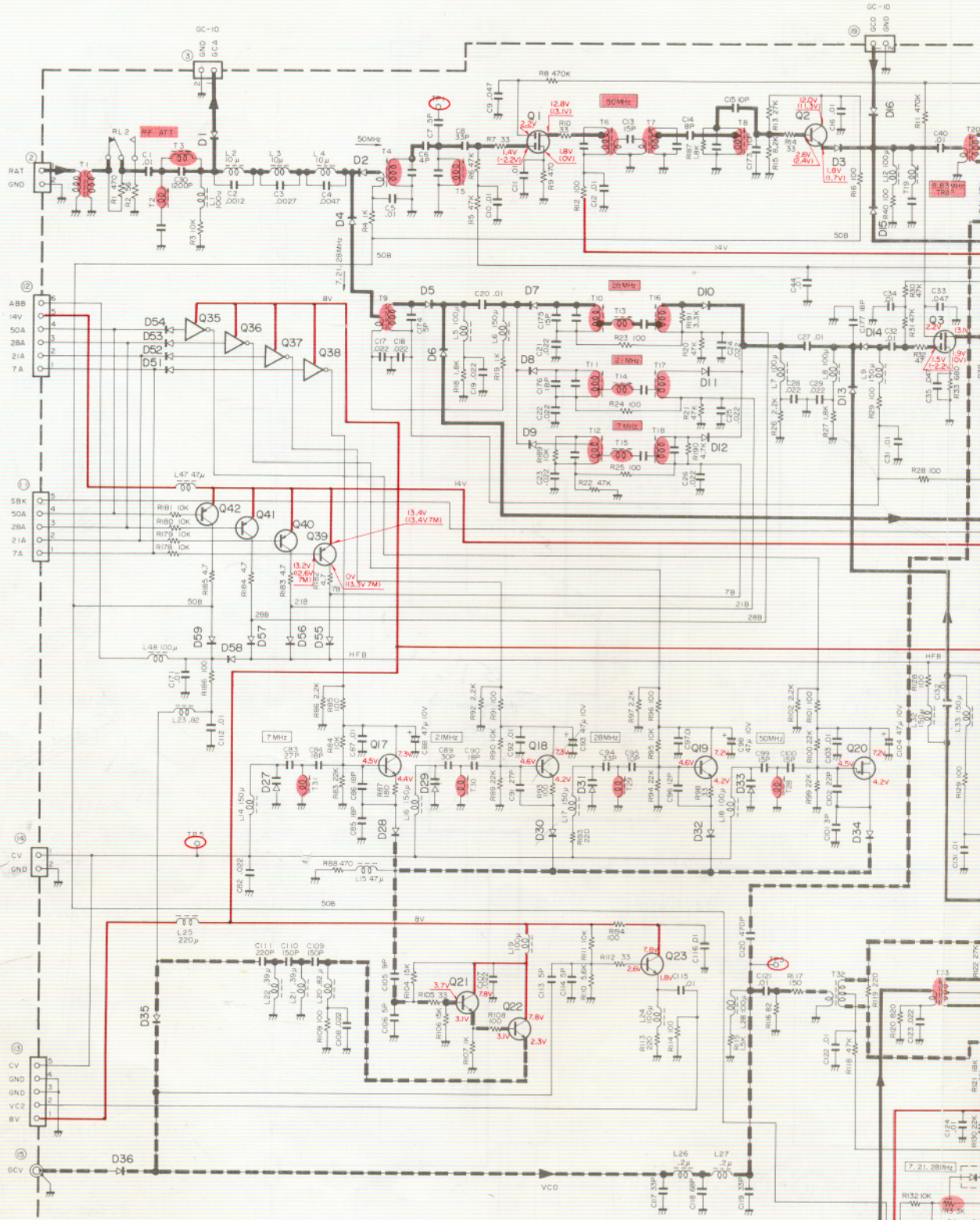
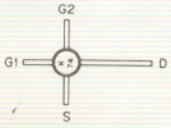


RF UNIT (X44-1580-00)



Q 1,3	: 3SK74(L)	Q 32	: 2SA733(R)	D22,25	: MV-13
Q 2,22,27	: 2SC1907	Q 33,35,36,37,38,44	: DTA114ES	D26,37,38,41,42,	: 1SS133
Q 4,8,15	: 2SC2458(Y)	Q 34	: 2SA1115(E)	43,44,46	
Q 5,6,24,25	: 3SK122(L)	Q 39,40,41,42	: 2SA562(Y)	D27,29,31,33	: 1TT310TE
Q 7, 26, 29	: 3SK73(GR)	Q 43	: DTC114ES	D 3,32,34,35,36	: BA282
Q 9,10,16	: 2SC2458(Y) or 2SC1815(Y)			D 40, 50	: MC921
Q 11	: 2SK192(Y)			D 48	: MV-203
Q12,13,14	: 2SC460 9)	D 1,2,4,5,7,10,14	: 1S2588	D51,52,53,54,55,	: 1S1555
Q17,18,19	: 2SC2787(L)	D 6,8,9,11,12,13,15,16,	: 1S1587	56,57,58,59	
Q20	: 2SK192A(GR)	17,18,19,20,28,30,45,47			
Q 21	: 2SC2347	D 21,23,24	: 1N60		
Q 23	: 2SC1923(0)				
Q 28,30,31	: 2SC2086				

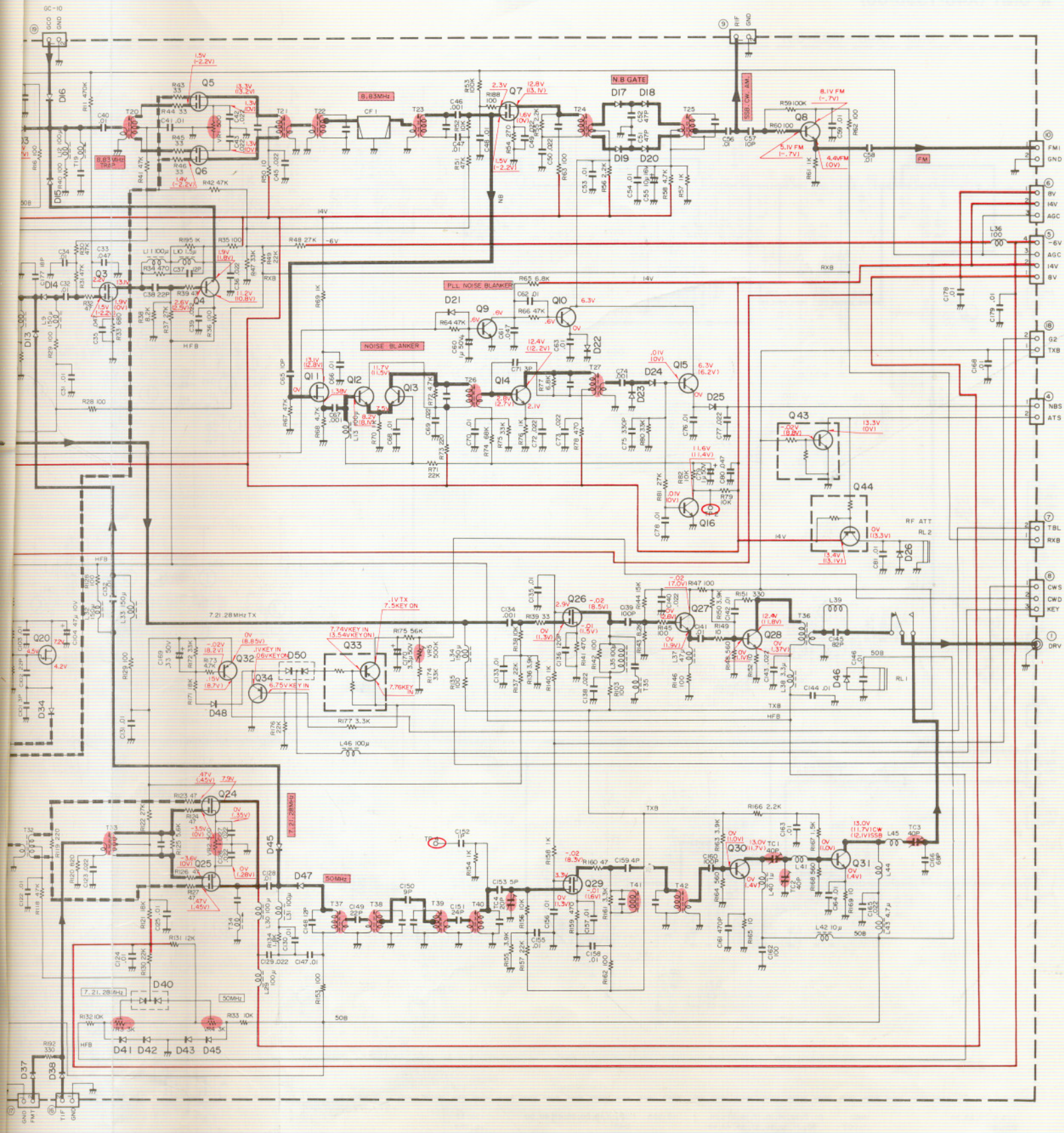
3SK74
3SK122

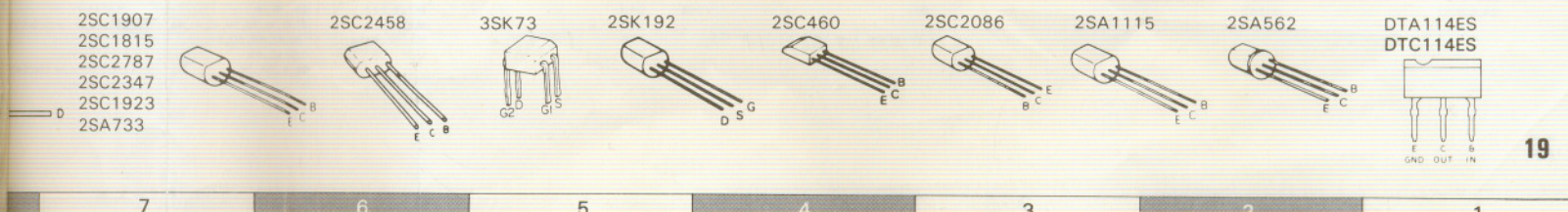


2SC1907
2SC1815
2SC2787
2SC2347
2SC1923
2SA733

13 12 11 10 9 8 7

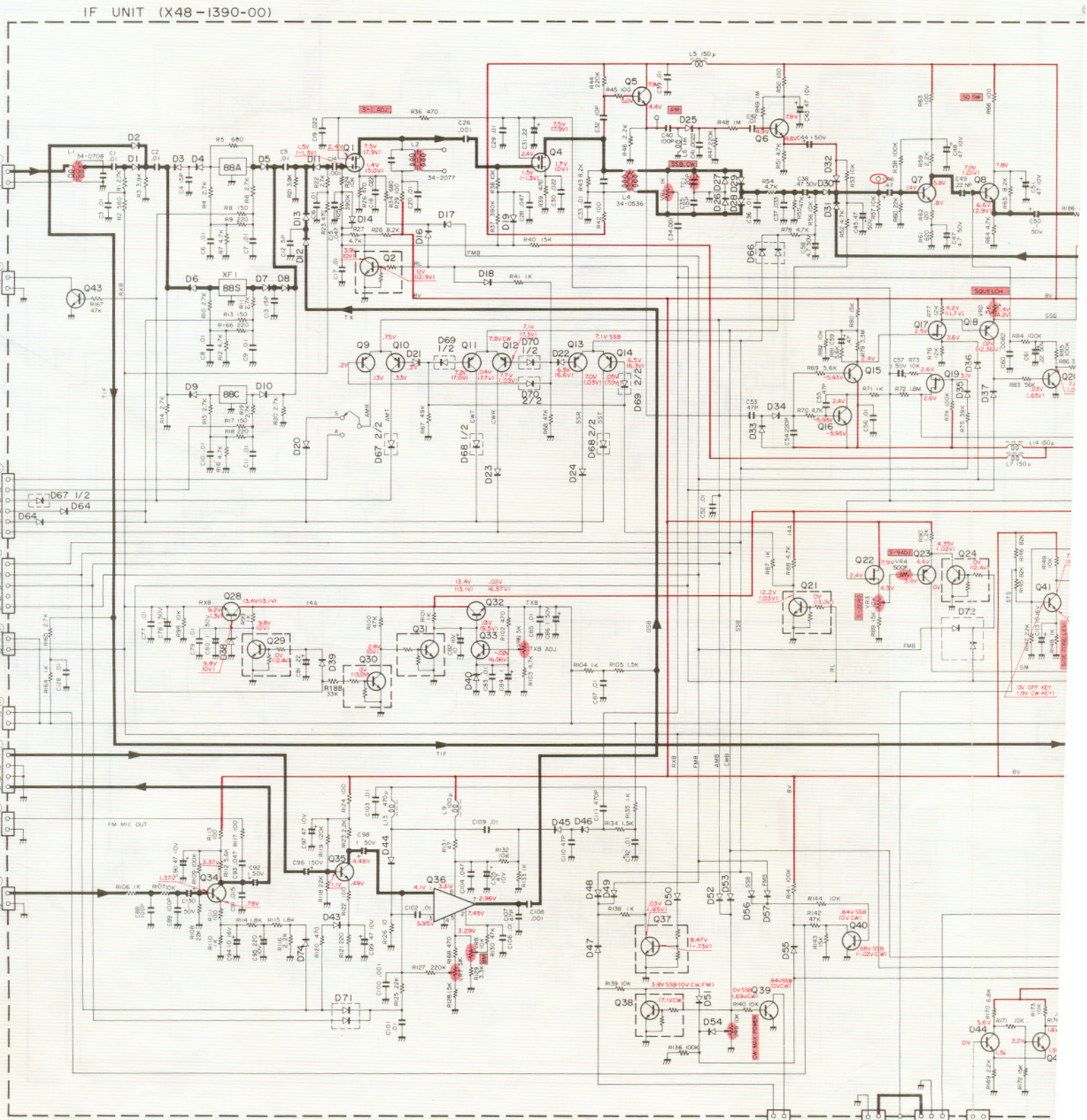
SCHEMATIC DIAGRAM TS-670



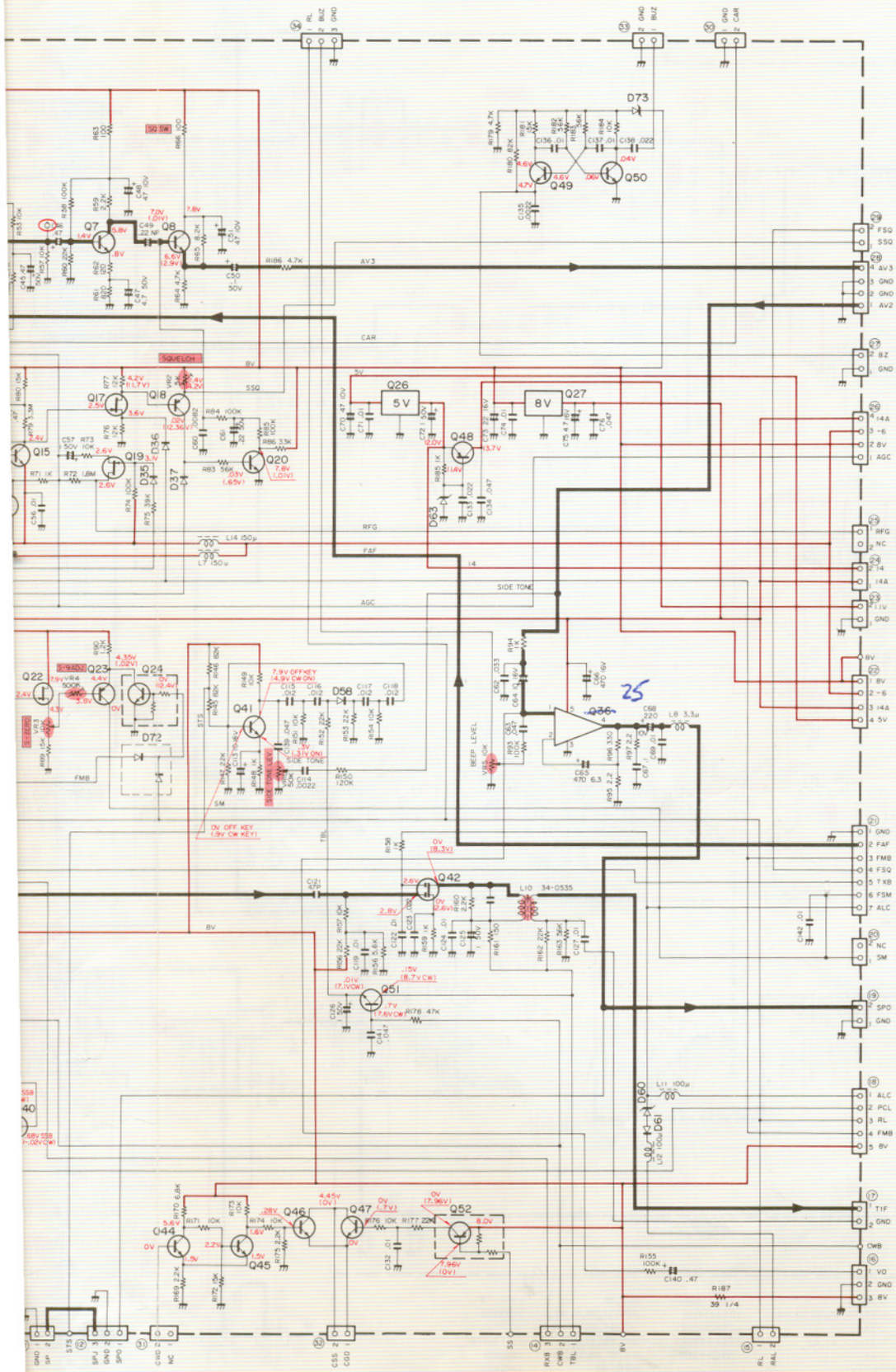


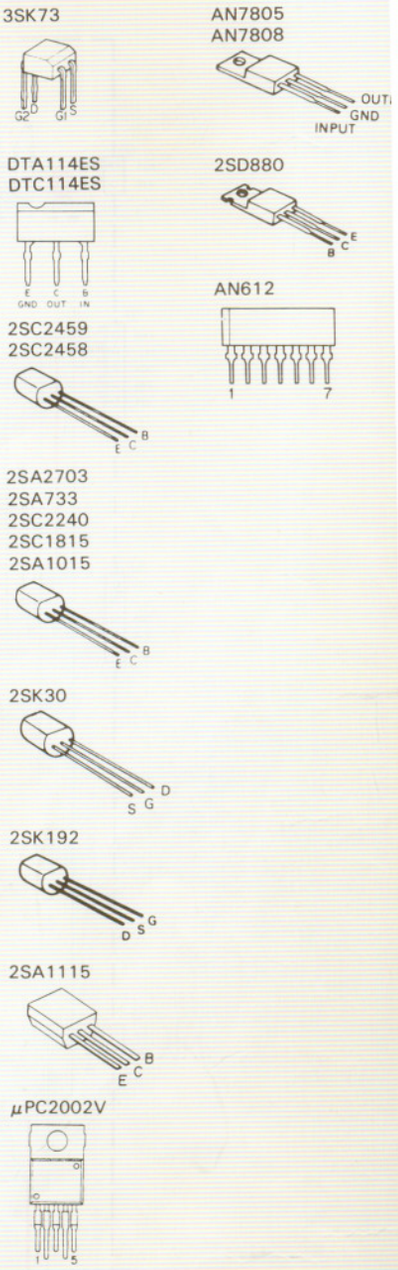
TS-670 SCHEMATIC DIAGRAM

IF UNIT (X48-1390-00)

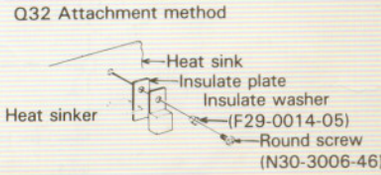


D25 ~ 29, 33, 34 : 1N60
D3 ~ 8 : 1S1007
D66 ~ 72 : MC921
D4, 6, 9, 10 : 1S1587
D1, 2, 12, 14, 16, 17, 18, 21 ~ 24, 30, 31, 32, 36, 37, 39, 43, 49, 51 ~ 58, 64, 65, 74 : 1S1555
D11, 13, 19, 20, 35, 47, 48, 50 : 1SS133
D45 : 1S2588
D44 : M1204
D61 : V06B
D73 : MTZ4.3JA
D40 : MTZ6.2JA
D60 : MTZ9.1JB
D38 : MTZ10JA
D63 : MTZ12JB
Q23 : 2SA1115(E) or
Q9 14, 18 : 2SA733(R)
Q5, 15, 16, 33, 39, 40, 41, 44, 46, 47, 49, 50, 51 : 2SC2458(Y) or
Q20, 43, 45 : 2SC2458(Y)
Q6, 8, 34, 36 : 2SC2459(BL)
Q7 : 2SC2459(BL)



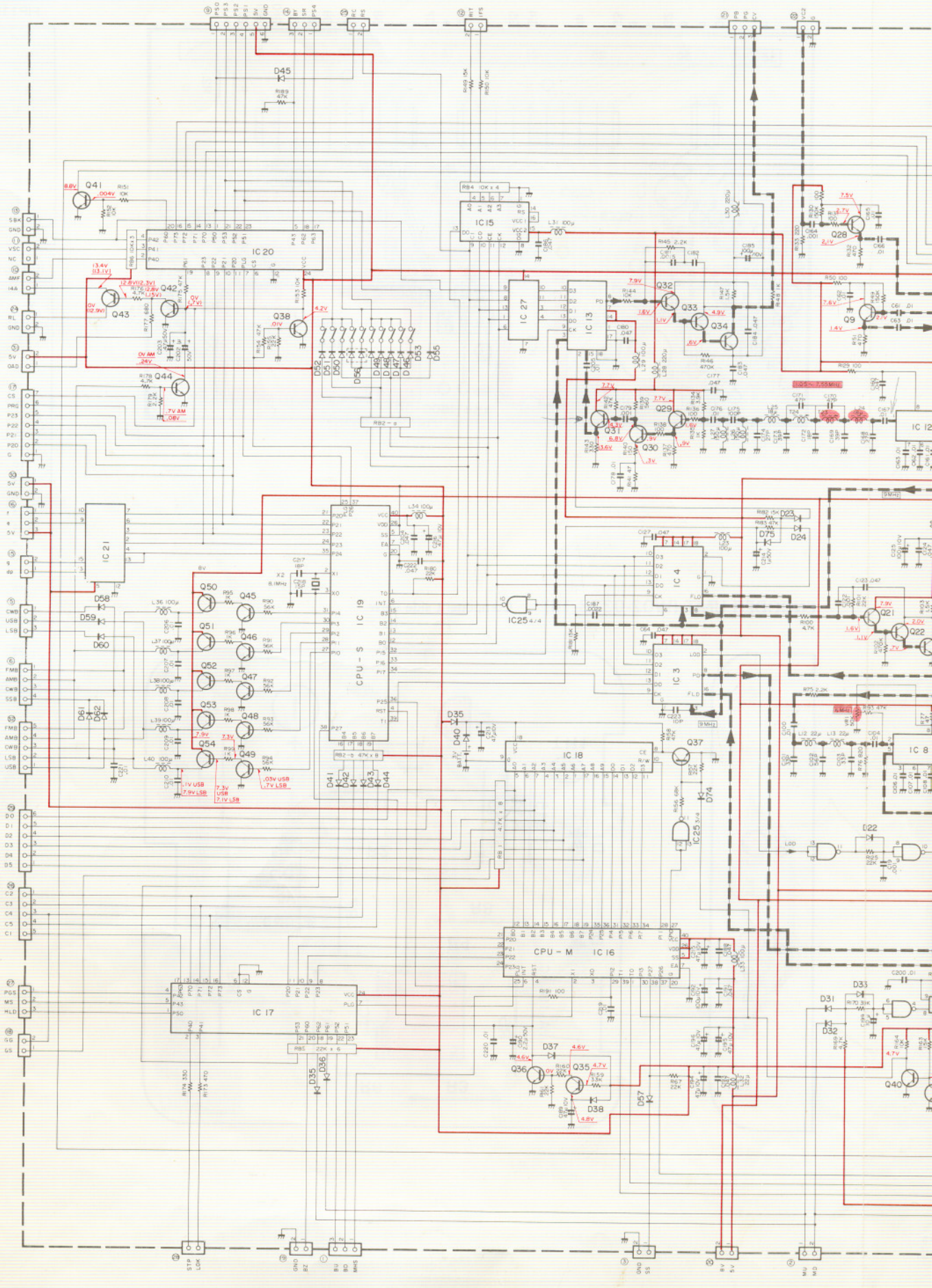


Q32 Attachment method

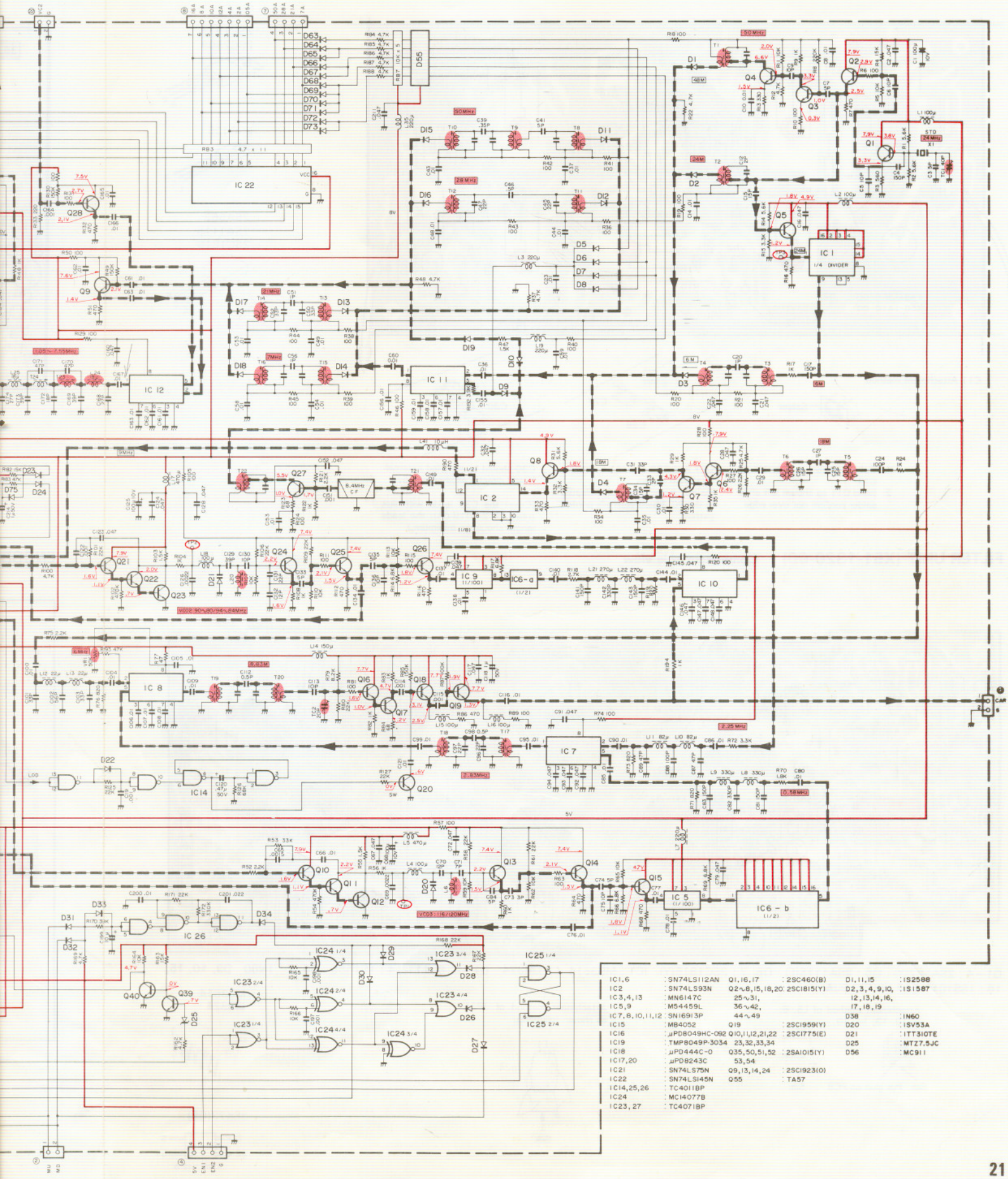


Q23	: 2SA1115(E) or 2SA1015(Y)	Q28,48	: 2SC2703(O,Y)	Q52	: DTA114ES
Q9 14,18	: 2SA733(R)	Q32	: 2SD880(Y)	Q36	: AN612
Q5,15,16,33,39,40,41,44, 46,47,49,50,51	: 2SC2458(Y) or 2SC1815(Y)	Q22	: 2SK192A(GR)	Q26	: AN7805
Q20,43,45	: 2SC2458(Y)	Q17,19	: 2SK30A(O)	Q27	: AN7808
Q6,8,34,36	: 2SC2459(BL) or 2SC2240(GR)	Q1,4,42	: 3SK73(GR)	Q25	: μPC2002V
Q7	: 2SC2459(BL)	Q2,21,24,29,30,31,37,38	: DTC114ES		

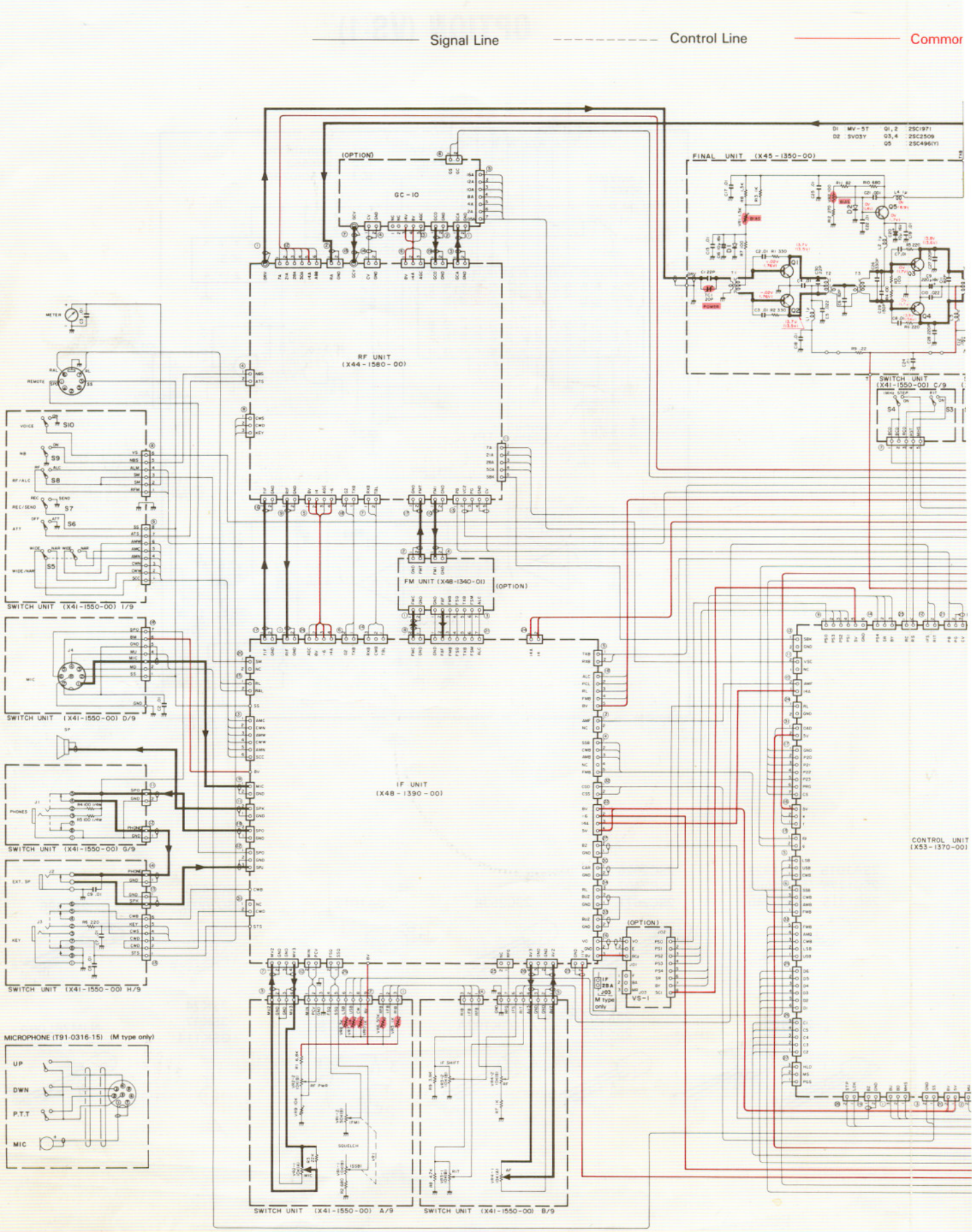
CONTROL UNIT (X53-1370-00)



SCHEMATIC DIAGRAM TS-670

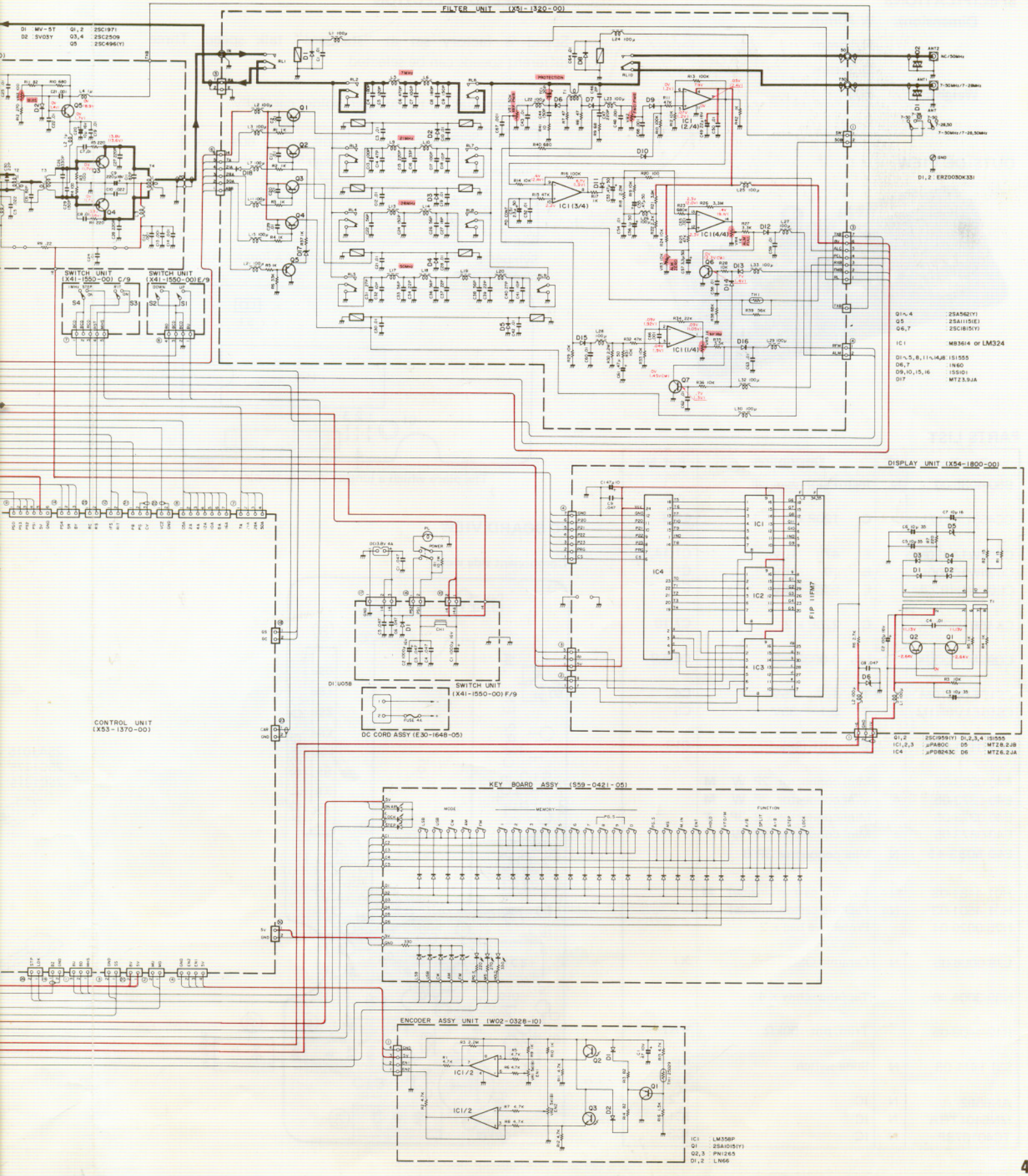


IC1,6	: SN74LS112AN	Q1,16,17	: 2SC460(B)	D1,11,15	: 1S2588
IC2	: SN74LS93N	Q2∿8,15,18,20	: 2SC1815(Y)	D2,3,4,9,10, 12,13,14,16, 17,18,19	: 1S1587
IC3,4,13	: MN6147C	25∿31, 36∿42, 44∿49			
IC5,9	: M54459L				
IC7,8,10,11,12	: SN16913P				
IC15	: MB4052	Q19	: 2SC1959(Y)	D38	: 1N60
IC16	: μPD8049HC-092	Q10,11,12,21,22	: 2SC1775(E)	D20	: 1SV53A
IC19	: TMP8049P-3034	23,32,33,34		D21	: 1TT310TE
IC18	: μPD444C-0	Q35,50,51,52	: 2SA1015(Y)	D25	: MTZ7.5JC
IC17,20	: μPD8243C	53,54		D56	: MC911
IC21	: SN74LS75N	Q9,13,14,24	: 2SC1923(O)		
IC22	: SN74LS145N	Q55	: TA57		
IC14,25,26	: TC4011BP				
IC24	: MC14077B				
IC23,27	: TC4071BP				


Signal Line
Control Line
Commor
D1 MV-5T Q1,2 2SC1971
D2 SV03Y Q3,4 2SC2509
Q5 2SC496(Y)
FINAL UNIT (X45-1350-00)
(OPTION)
GC-10
RF UNIT
(X44-1580-00)
FM UNIT (X48-1340-01)
(OPTION)
IF UNIT
(X48-1390-00)
SWITCH UNIT (X41-1550-00) C/9
SWITCH UNIT (X41-1550-00) 1/9
SWITCH UNIT (X41-1550-00) D/9
SWITCH UNIT (X41-1550-00) G/9
SWITCH UNIT (X41-1550-00) H/9
SWITCH UNIT (X41-1550-00) A/9
SWITCH UNIT (X41-1550-00) B/9
CONTROL UNIT
(X53-1370-00)
(OPTION)
VS-1
M type only
MICROPHONE (T91-0316-15) (M type only)
UP
DWN
P.T.T
MIC
METER
REMOTE
VOICE
NB
RF/ALC
REC/SEND
ATT
WIDE/NAR
MIC
PHONES
EXT. SP
KEY
SQUELCH
IF SHIFT

SCHEMATIC DIAGRAM TS-670

Common DC Line



TS-670

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