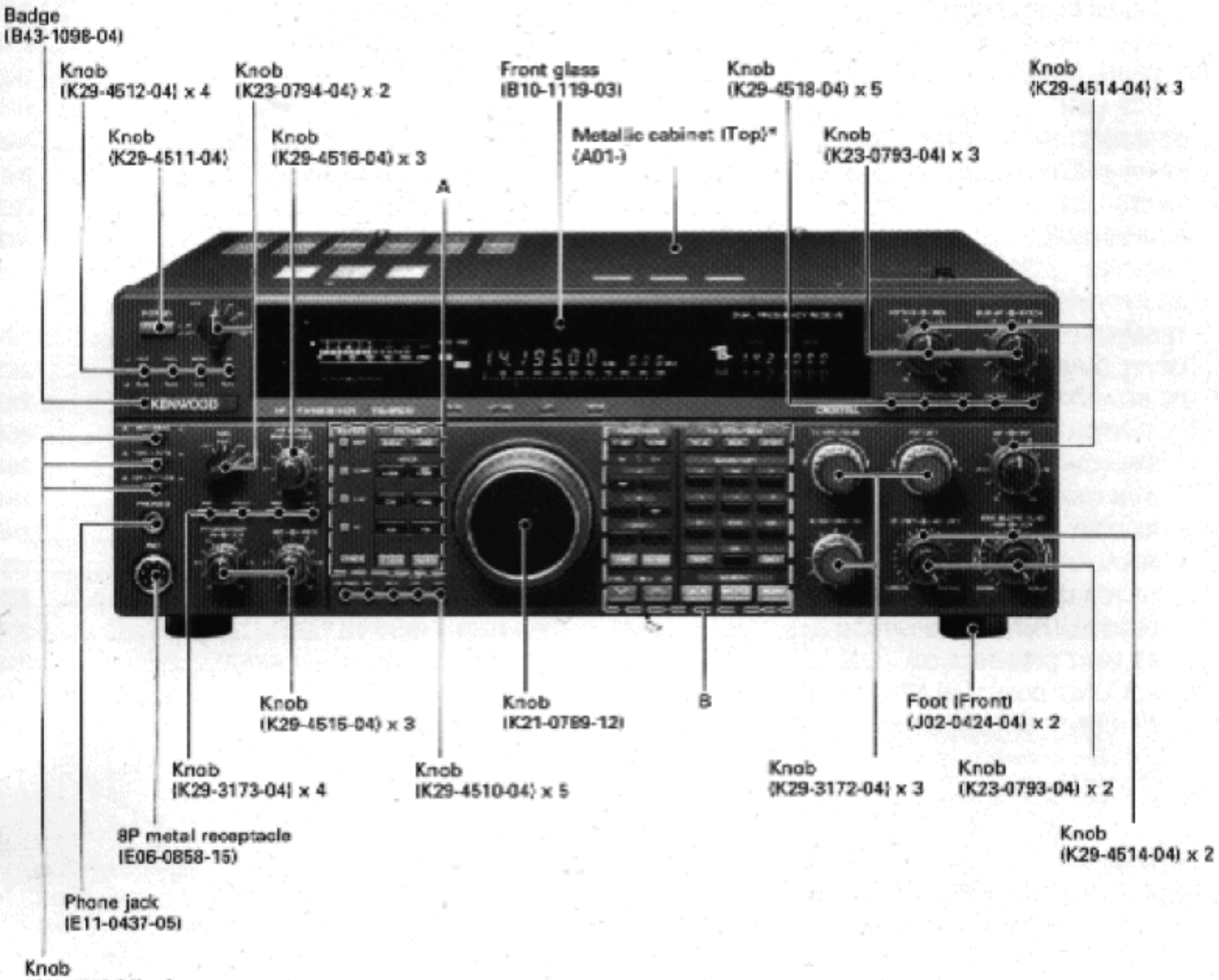
HF TRANSCEIVER

TS-950S/SD

SERVICE MANUAL

KENWOOD

B51-8018-00 (O) 1336



A

Knob (K29-3173-04)	Knob (K29-3192-03)	Knob (K29-3193-03)
Knob (K29-3173-04)	Knob (K29-3194-03)	Knob (K29-3195-03)
Knob (K29-3173-04)	Knob (K29-3196-03)	Knob (K29-3197-03)
Knob (K29-3173-04)	Knob (K29-3198-03)	Knob (K29-3199-03)
Knob (K29-3191-03)	Knob (K29-4501-03)	Knob (K29-4504-03)

B

Knob (K29-3189-03)	Knob (K29-3190-03)	Knob (K29-3186-03)	Knob (K29-3187-03)	Knob (K29-3188-03)
Knob (K29-3200-03)	Knob (K29-3200-03)	Knob (K29-3175-03)	Knob (K29-3176-03)	Knob (K29-3177-03)
Knob (K29-3200-03)	Knob (K29-3200-03)	Knob (K29-3178-03)	Knob (K29-3179-03)	Knob (K29-3180-03)
Knob (K29-3200-03)	Knob (K29-3200-03)	Knob (K29-3181-03)	Knob (K29-3182-03)	knob (K29-3183-03)
Knob (K29-4502-03)	Knob (K29-4503-03)	Knob (K29-3184-03)	Knob (K29-3174-03)	Knob (K29-3185-03)
Knob (K29-4508-04)	Knob (K29-4509-04)	Knob (K29-4505-04)	Knob (K29-4506-04)	Knob (K29-4507-04)

* Refer to parts list on page 96.

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CIRCUIT DESCRIPTION

Frequency Configuration

The TS-950 utilizes quadruple conversion for SSB, CW, AM, and FSK modes and triple conversion for FM mode. The transmitter utilizes double conversion in CW and FM modes and triple conversion in SSB, AM, and FSK modes.

Receiver and transmitter audio is routed through the Digital Signal Processing Unit when it is installed. This unit supplies either a simple 455 kHz carrier (FM Mode) or a modulated 455 kHz IF frequency in all other modes. Figure 1 shows the transmit and receive frequency configuration .

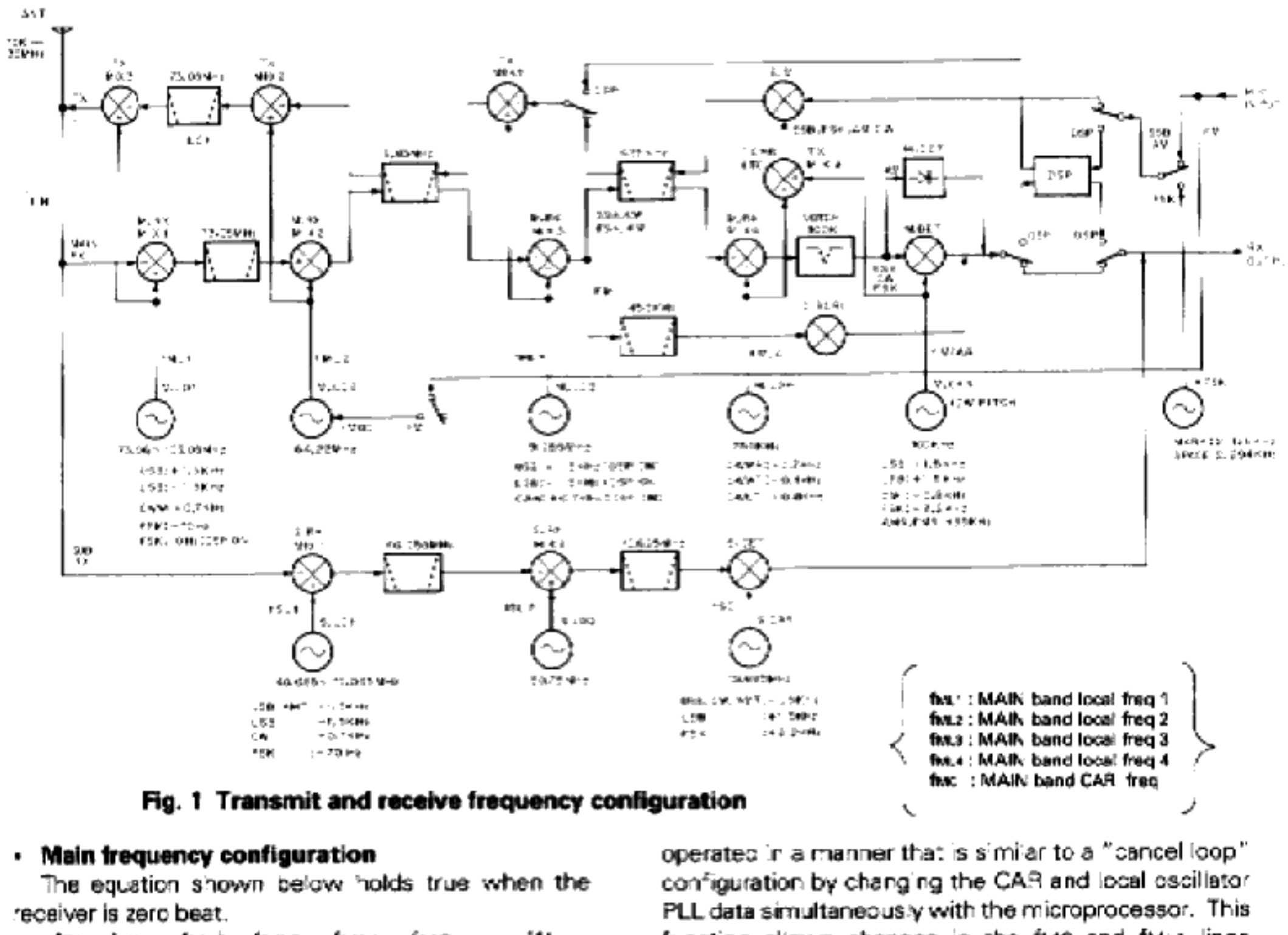

Fig. 1 Transmit and receive frequency configuration

• Main frequency configuration

The equation shown below holds true when the receiver is zero beat.

$$fIN = fML1 - fML2 - fML3 + fML4 - fMC \quad \ldots\ldots (1)$$

Since all these frequencies are generated by the PLL circuit (as shown in Figure 2), the receiver frequency is determined only by the reference fSTD and the PLL divide ratio. Therefore, the stability/accuracy of the reference frequency determines the overall frequency stability/accuracy of this transceiver. The stability/accuracy of the reference crystal oscillator used in the TS-950S is ±0 PPM (–10 to +50°C). The frequency stability is 0.5 PPM (–10 to +50°C) for the TS-950SD or when the optional temperature compensated crystal oscillator (TCXO), SO-1 or SO-2, is used with the TS-950S. When an external reference is used, the stability/accuracy of the transceiver will be determined by that external standard.

The TS-950 local oscillator and the CAR PLL circuits are independent of each other. However, they can be operated in a manner that is similar to a "cancel loop" configuration by changing the CAR and local oscillator PLL data simultaneously with the microprocessor. This function allows changes in the fMC and fML1 lines when the mode changes, and also allows the band width of the VBT and slope tune to be varied (fML4 and fML3, fML3 and fML1).

When used as a transmitter , the frequency is determined by the reference frequency (fSTD) and divide ratio. The display frequencies in the various modes are listed in Table 1. (In the FSK mode, the TS-950, unlike the TS-940, displays the mark transmitter frequency.)

The pitch of the incoming receive signal in the CW mode can be adjusted to suit the operators preference without changing the center frequency of the transceiver variable CW pitch system. Changes in the receiving pitch are directly related to the transmitter CW sidetone. This results in a easy zero beat procedure for the CW operator.

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Mode	Display frequency
USB, LSB	Carrier point frequency
CW	Transmit carrier frequency
FSK	Mark transmitter frequency
AM, FM	IF filter center frequency

Table 1 Display frequency in each mode

FSK transmission is normally performed in the LSB mode. The audio signal (mark = 2.128 kHz, space = 2.294 kHz) is obtained by dividing the reference frequency fSTD. The IF signal is shifted for both transmission and reception so that the mark/space signal passes through the center of the IF filter. The fML1 signal is shifted in transmit in order to display the mark frequency on the display.

FM transmission is performed directly on the fML2 signal by using the microphone audio to modulate the VCO0 signal.

For reception in AM and FM modes, the fMIC line is shifted by the VCO9 signal so that no carrier enters the IF.

When the DSP is connected, the fMIC and fML4 lines are used as output signals from the DSP unit in the transmit mode. Mode changes are performed by the fML3 line. The FSK mode differs from the AFSK mode since the signal supplied to the IF unit is obtained from the DSP directly, therefore changes in the signal that would normally be expected due to a change in the mode are not performed. Since the reference frequency applied to the DSP is supplied from the reference oscillator (fSTD) for the main unit, no changes to the operating frequency will occur when the DSP is connected.

- **Sub-Receiver frequency configuration**

The equation shown below holds true when the receiver is zero beat.

$$f_{IN} = f_{SL1} - f_{SL2} + f_{SC} \quad (2)$$

The crystal oscillator signal (fSL2) is applied to the PLL circuit in order to generate the fSL1 signal. The sub-receiver frequency, like the main receiver frequency stability/accuracy, is determined only by the reference fSTD and the PLL divide ratio. Likewise, when the unit is used for transmission (the sub receiver is turned off in the AM and FM modes), the frequency stability/accuracy is determined by the reference fSTD and the PLL divide ratio. The display frequencies in the various modes are the same as those described for the main frequency.

Since the sub-receiver works as a transmit frequency monitor, the IF frequency is shifted to that of the main display frequency in the transmit mode. In the AM and FM modes, the IF frequency equals the main IF frequency.

PLL Circuit

The TS-950 PLL circuit consists of a several loops (MLO1, SLO1) that cover a frequency range of 10 kHz to 30 MHz, in 10-Hz steps; a 20 MHz reference oscillator; and a PLL loop that is used to generate other local oscillator frequencies (MLO2 to MLO4) and CAR (MCAR, SCAR) signals. Figure 2 shows the PLL system frequency configuration. Division ratio data for each PLL loop is provided by a microprocessor. Each loop is a single crystal frequency control system: where the phase is compared with a unique reference frequency (fSTD).

Figure 3 is a PLL block diagram.

- **Reference oscillator circuit**

The reference frequency (fSTD) used for frequency control is generated by the 20-MHz crystal oscillator X1 and Q13 (2SC2714). Two outputs are provided, one is used as the reference for the PLL unit, and the other is divided in half by IC14 (M74_S90P) to produce a 10-MHz signal. This 10 MHz signal is used as the PLL reference signal (fREF) for the CAR unit, and is applied to the AF and DSP units as the PLL reference signal (fREF). The 10-MHz signal is also divided by five in IC14, and then divided in half by IC15 (TC4013BP) to generate a 1-MHz signal.

The reference signal oscillator circuit can be used as VCXO (Voltage Controlled Crystal Oscillator) by applying an external reference signal. The 1-MHz signal is divided by 100 in IC13 (MC14568BCP) to generate a 10 kHz comparison frequency. The 10-kHz (1 Vp-p) input from the EXT STD passes through amplifier Q12 (2SC2712) and is applied to IC13 where it is then used as the PLL reference signal. It is then compared in the phase comparator in order to lock the reference frequency (fSTD) of OSC1. The internal and external reference frequencies can be controlled by S1. OSC1 can be replaced with the optional SO-1 or SC-2 TCXO. These are controlled by switch S2.

The 20-MHz signal applied to the PLL unit is divided in half by IC9 (SN74LS73AN) to produce a 10-MHz signal. This signal is used as the PLL reference signal (fREF) for the PLL unit and is doubled by Q4 (2SC2714) to produce the 40-MHz reference signal (fREF).

- **Main LO1 (PLL unit/AF unit)**

PLL3, which is downstream from LO1, generates the 58 to 56MHz VCO3 signal. The 10-MHz reference signal (fREF) is applied to pin 5 of IC2 (CX7925B), and is divided by 5000 internally to produce a 2-kHz comparison frequency. The output from VCO3 is applied to pin 11 of IC2, and is divided by a value determined by N3, and is then compared with the 2-kHz signal in the phase comparator. The frequency of VCO3 is locked

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in 2-kHz steps. Division ratio data (N3) is provided by the digital unit as data (29000 to 28001) which corresponds to 0.00 to 9.99 kHz. When the RIT and XIT are used, the division ratio changes so that the frequency of oscillator VCO3 is shifted according to the setting of the RIT and XIT controls.

The output from PLL3 is divided by 20 in IC3 (M54459L), and is applied to pin 2 of IC4 (SN16913P) of MIX4. MIX4 combines the signal with the 10-MHz signal. The resulting signal passes through the bandpass filter to obtain a signal of 12.9 to 12.8 MHz. It is then applied to pin 2 of IC5 (SN16913P) of MIX3.

PLL2 which is in the center of LO1, generates the 49.5 to 44.5 MHz VCO2 signal. The 10-MHz reference oscillator frequency (fREF) is applied to pin 5 of IC6 (CX7925B), and is divided by 100 internally to produce a 100-kHz comparisor frequency. The output VCO2 is applied to pin 5 of IC5 of MIX3, where it is mixed with the signal generated by PLL3. The resulting signal passes through the bandpass filter to obtain a signal of 36.6 to 31.7 MHz. This signal is then applied to amplifier Q3 (2SC2714), and then to pin 11 of IC6. This signal is divided by a value determined by N2, and compared with the 100-kHz signal by the phase comparator. The output frequency of MIX3 is locked in 100-kHz steps. Divide ratio N2 is provided by the digital unit as data (366 to 317) which corresponds to 0.00 to 0.49 MHz and 0.50 to 0.99 MHz.

The output from PLL2 is divided by 10 in IC7 (MB467), and is applied to pin 2 of IC8 (SN16913P) of MIX2. MIX2 combines the signal with the 40-MHz signal. The resulting signal passes through the bandpass filter to generate a signal in the range of 35.05 to 35.55 MHz. This signal is applied to buffer amplifier Q5 (2SC2714), and is then routed to the AF unit.

PLL1, which is upstream of LO1, generates the 73.06 to 103.05 MHz VCO1 signal. It consists of four VCOs, Q1 thru Q4 (2SK210x4). The 10-MHz reference frequency (fREF) is applied to pin 5 of IC11 (CXD1225M), and is divided by 20 internally to produce a 500-kHz comparison frequency. The output from VCO1 is amplified by Q33 (2SC2714), and passes through the bandpass filter. One of the output signals is passed through buffer amplifier Q37 (2SC2996) and directed to the RF unit. The other output is applied to pin 5 of IC12 (SN76514N) of MIX1. The signal is then mixed with the signal generated by PLL2 and PLL3. The resulting signal passes through the bandpass filter to produce a signal in the range of 38 to 68 MHz. It then passes through buffer amplifiers Q34 and Q35 (2SC2714x2) and is applied to pin 11 of IC11. This signal is divided by a value that is determined by N1 internally, and compared with the 500-kHz signal by the phase comparator. The output frequency from MIX1 is locked in 500-kHz steps. Divide ratio N1 is provided by the digital unit as data (76 to 136) which corresponds to 10 kHz to 30 MHz. One of the four VCO1 signals is selected according to the VCO change data supplied by the digital unit.

The final output frequency of the main LO1 signal is 73.06 to 103.05 MHz in 10-Hz steps, and depends on the divide ratio data supplied by N1 to N3. This signal is supplied to the RF unit.

- **Main LO2 (AF unit)**

In PLL0, Q1 (2SK508NV) of VCO0 is used to generate a signal of 64.22 MHz. The 10-MHz reference frequency (fREF) is applied to pin 5 of IC13 (CXD1225M), and is divided by 500 (2000 in FM mode) internally to produce a 20-kHz (5-kHz in FM mode) comparison frequency. The output from VCO0 is applied to pin 11 of IC13, and is divided by 3211 (12844 in FM mode) internally. It is then compared with the 20-kHz (5-kHz in FM mode) reference signal by the phase comparator to lock the VCO0 frequency. Divide ratio data is supplied by the digital unit.

The output from PLL0 passes through buffer amplifier Q39 (2SC2714) and a low-pass filter and is applied to the IF unit as the main LO2 signal.

- **Main LO3 (CAR unit)**

In PLL6, VCO6 is used to generate a signal of approximately 71.5 MHz. The 10-MHz reference frequency (fREF) is applied to pin 5 of IC3 (CX7925B), and is divided by 5000 internally to produce a 2-kHz comparison frequency. The output from VCO6 is applied to pin 11 of IC3, and is divided by a value determined by N6 internally, and compared to the 2-kHz reference signal by the phase comparator in order to lock the VCO6 frequency. Divide ratio data N6 is provided by the digital unit. The bandwidth is changed and the carrier point is fine tuned by simultaneously changing the division ratios (ΔN6 = Δ2N3) of PLL6 and PLL3 via microprocessor control.

The output from PLL6 is divided by 100 internally in IC4 (M54459L) and applied to pin 2 of IC5 (SN16913P) of MIX7. In MIX7, it is combined with the 10-MHz reference signal. The resulting signal passes through the ceramic filter CF1 to obtain a signal of 9.285 MHz. The signal is further amplified by Q3 (2SC2714), and then applied to the IF unit as the main LO3 signal.

- **Main LO4 (CAR unit)**

In PLL5, VCO5 generates a signal of approximately 35.5 MHz. The 10-MHz reference frequency (fREF) is applied to pin 5 of IC1 (CX7925B), and is divided by 5000 internally to produce a 2-kHz comparison frequency. The output from VCO5 is applied to pin 11 of IC1, divided by a valued determined by N5 internally, and compared with the 2-kHz reference signal by the phase comparator to lock the VCO5 frequency. Divide-sion ratio data N5 is provided by the digital unit. The

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bandwidth is changed and the carrier point is fine tuned by simultaneously changing the division ratios (ΔN5 = −ΔN6) of PLL5 and PLL6 and (ΔN5 = Δ2N3) of PLL5 and PLL3 via microprocessor control. The division ratios are shifted in CW mode as well.

The output from PLL5 is divided by 100 in IC2 (M54459L) to generate a 355-kHz signal. This signal passes through buffer amplifier Q7 (2SC2712), and is applied to the signaling unit as the main LO4 signal.

- **Sub LO1 (PLL unit)**

In PLL8, downstream from LO1, VCO8 generates a signal from 109 to 107 MHz. The 10-MHz reference frequency (fREF) is applied to pin 5 of IC10 (CX7925B), and is divided by 5000 internally to produce a 2-kHz comparison frequency. The output from VCO8 is applied to pin 11 of IC10, divided by a value determined by N8 internally, and compared with the 2-kHz signal by the phase comparator locking the VCO8 frequency in 2-kHz steps. Divide ratio data N3 is transmitted from the digital unit as data (54500 to 53501) which corresponds to 0.00 to 9.99 kHz. Since the sub receiver section functions as a monitor circuit in the transmit mode, the division ratio is changed so that the VCO8 oscillator frequency is shifted when XIT is used.

The output from PLL8 is divided by 20 in IC11 (M54459L), and is applied to pin 2 of IC12 (SN16913P) of MIX12. MIX12 combines the signal with the 20-MHz reference oscillator signal. The resulting signal passes through a bandpass filter to obtain a signal of 25.45 to 25.35 MHz. This signal is divided by 10 in IC13 (MB467) and is applied to pin 2 of IC14 (SN16913P) of MIX11. MIX11 mixes the signal with the 10-MHz reference signal. The resulting signal passes through a bandpass filter to obtain a signal of 12.545 to 12.535 MHz. This signal is applied to pin 2 of IC15 (SN16913P) of MIX10. MIX10 mixes the signal with the 50.75-MHz signal from the sub LO2. The resulting signal passes through a bandpass filter to obtain a signal of 38.205 to 38.215 MHz. This signal is applied to pin 2 of IC16 (SN16913P) of MIX9.

In PLL7, which is upstream from LO1, VCO7 generates a signal of from 40.065 to 70.055 MHz. It consists of four VCOs, Q1 thru Q4 (2SK210x4). The 10-MHz reference frequency (fREF) is applied to pin 5 of IC17 (CX7925B), and is divided by 1000 internally to produce a 10-kHz comparison frequency. The output from VCO7 is amplified by Q13 (2SC2714), and passes through a bandpass filter. One of the outputs from this filter is applied to buffer amplifier Q14 (2SC2996) and is directed to the RF unit. The other output is applied to pin 5 of IC16 of MIX9. Here the signal is mixed with the signal generated by PLL8 and LO2 OSC2. The resulting signal passes through a low-pass filter to produce a signal of 1.86 to 31.85 MHz. It then passes through buffer amplifiers Q11 and Q12 (2SC2712x2) and is applied to pin 13 of IC17. This signal is divided by a value determined by N7 internally, and is compared with the 10-kHz reference signal by the phase comparator to lock the MIX9 output frequency in 10-kHz steps. Divide ratio data N7 is provided by the digital unit as data (186 to 3185) corresponding to 10 kHz to 30 MHz. The VCO change data of the four VCO7 VCO's is the same as that of VCO1. The A.LPF uses operational amplifier IC18 (NJM4558SD) and switches the loop constants A to D of VCO7.

The final output frequency of the sub LO1 signal is 40.065 to 70.005 MHz in 10-Hz steps, and depends on the divide ratios N7 and N8, and is applied to the RF unit.

- **Sub LO2 (PLL unit)**

The LO2 local oscillator signals are generated by the 50.75-MHz crystal oscillator (X1) and Q15 (2SC2714). One local oscillator signal is sent to the sub LO1 PLL loop and is applied to pin 5 of IC15 of MIX10. The other local oscillator signal passes through buffer amplifier Q17 (2SC2714) and a low-pass filter, and is directed to the IF unit as the sub LO2 signal. Local oscillator signals generated by the crystal oscillator circuit are applied to the PLL loop to cancel drift.

- **Main and sub CAR (CAR unit)**

In PLL4, VCO4 generates a signal of approximately 69.5 MHz. The 10-MHz reference frequency (fREF) is applied to pin 5 of IC6 (CX7925B), and is divided by 5000 internally to produce a 2-kHz comparison frequency. The output from VCO4 is applied to pin 11 of IC6, divided by a valued determined by N4 internally, and compared with the 2 kHz signal with by phase comparator locking VCO4. Divide ratio data N4 is provided by the digital unit. The mode of operation is changed and the carrier point is fine tuned by simultaneously changing division ratios (ΔN4 = Δ2N3) of PLL4 and PLL3 and division ratios (ΔN4 = Δ2N8) of PLL4 and PLL8 with the microprocessor. The division ratios are also shifted when the pitch control is changed in CW mode.

One of the outputs from PLL4 is divided by 100 by IC7 (M54459L) and applied to pin 2 of IC8 (SN16913P) of MIX13. In MIX13, it is combined with the 10-MHz reference signal. The resulting signal passes through ceramic filter CF2 to generate a signal of 10.695 MHz and then passes through amplifier Q5 (2SC2714), and is applied to the signal unit as the sub CAR. The other output is applied to pin 5 of IC10 (SN16913P) of MIX5 and used as part of the main CAR.

In PLL9, VCO9 generates a signal of approximately 59.5 MHz. The 10-MHz reference frequency (fREF) is applied to pin 5 of IC9 (CX7925B), and is divided by 5000 internally to produce a 2-kHz comparison frequency. The output from VCO9 is applied to pin 11 of IC9, divided by a value determined by N9 internally, and compared with the 2-kHz signal in the phase com-

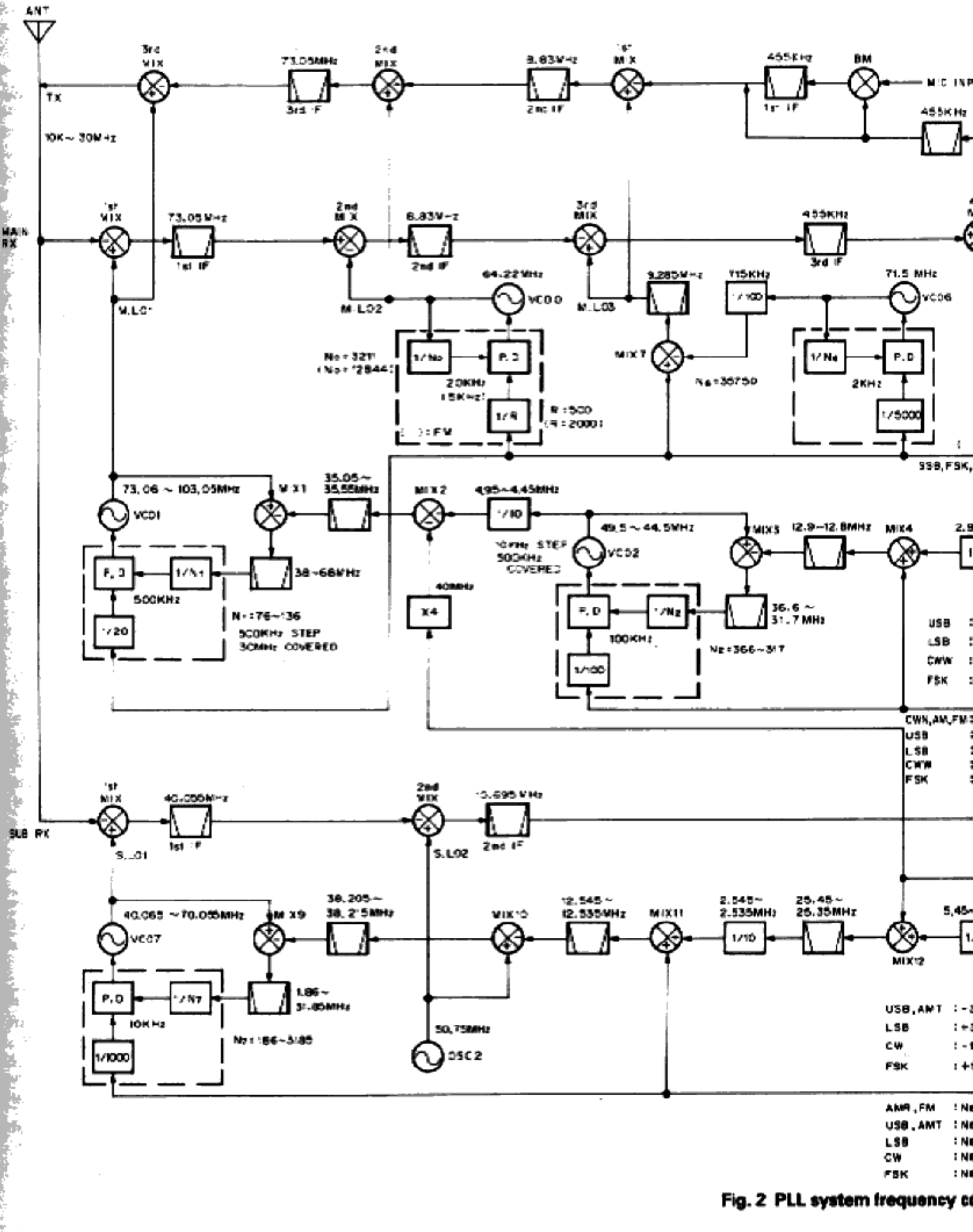
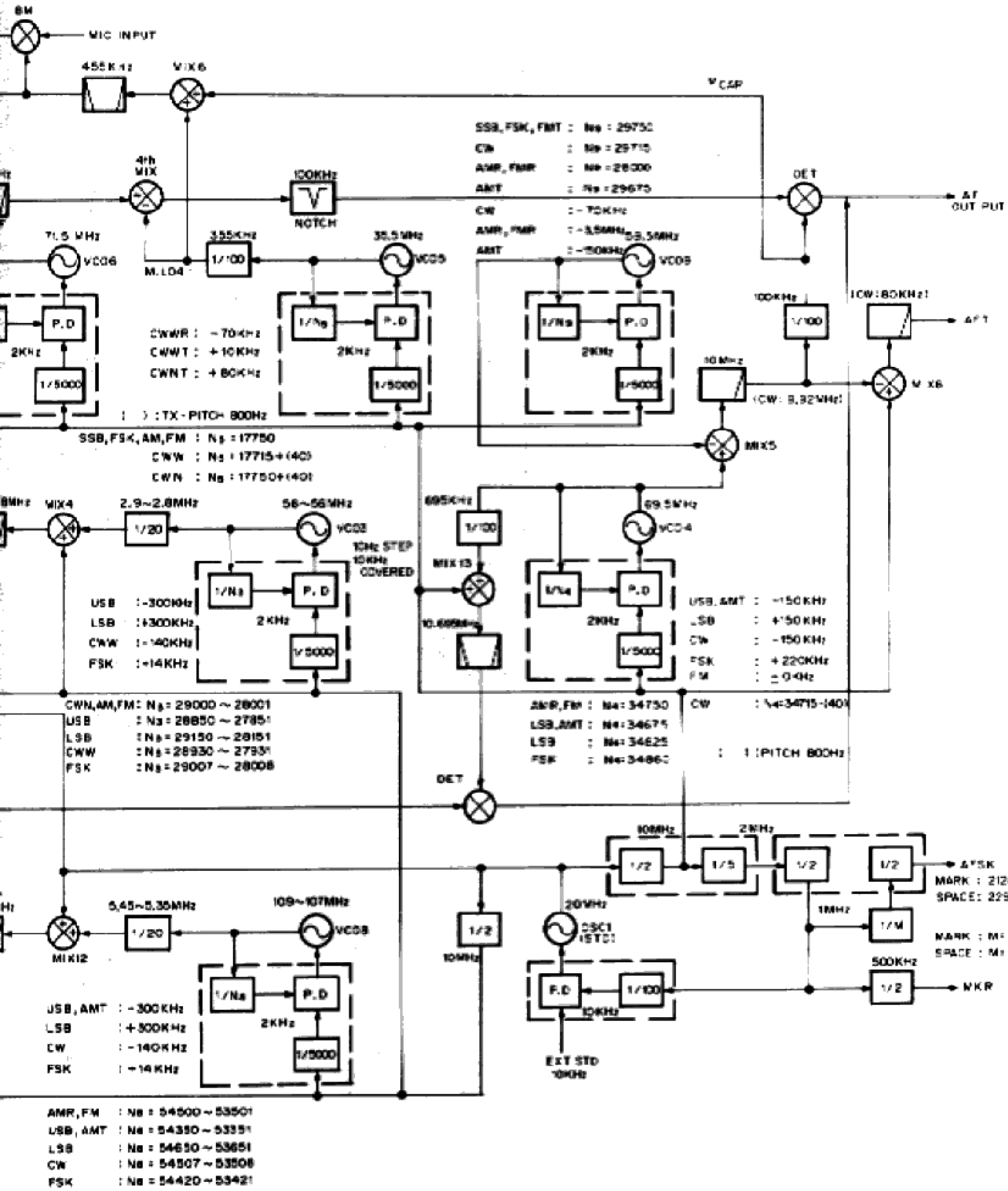


Fig. 2 PLL system frequency co

CUIT DESCRIPTION



tem frequency configuration

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DESCRIPTION

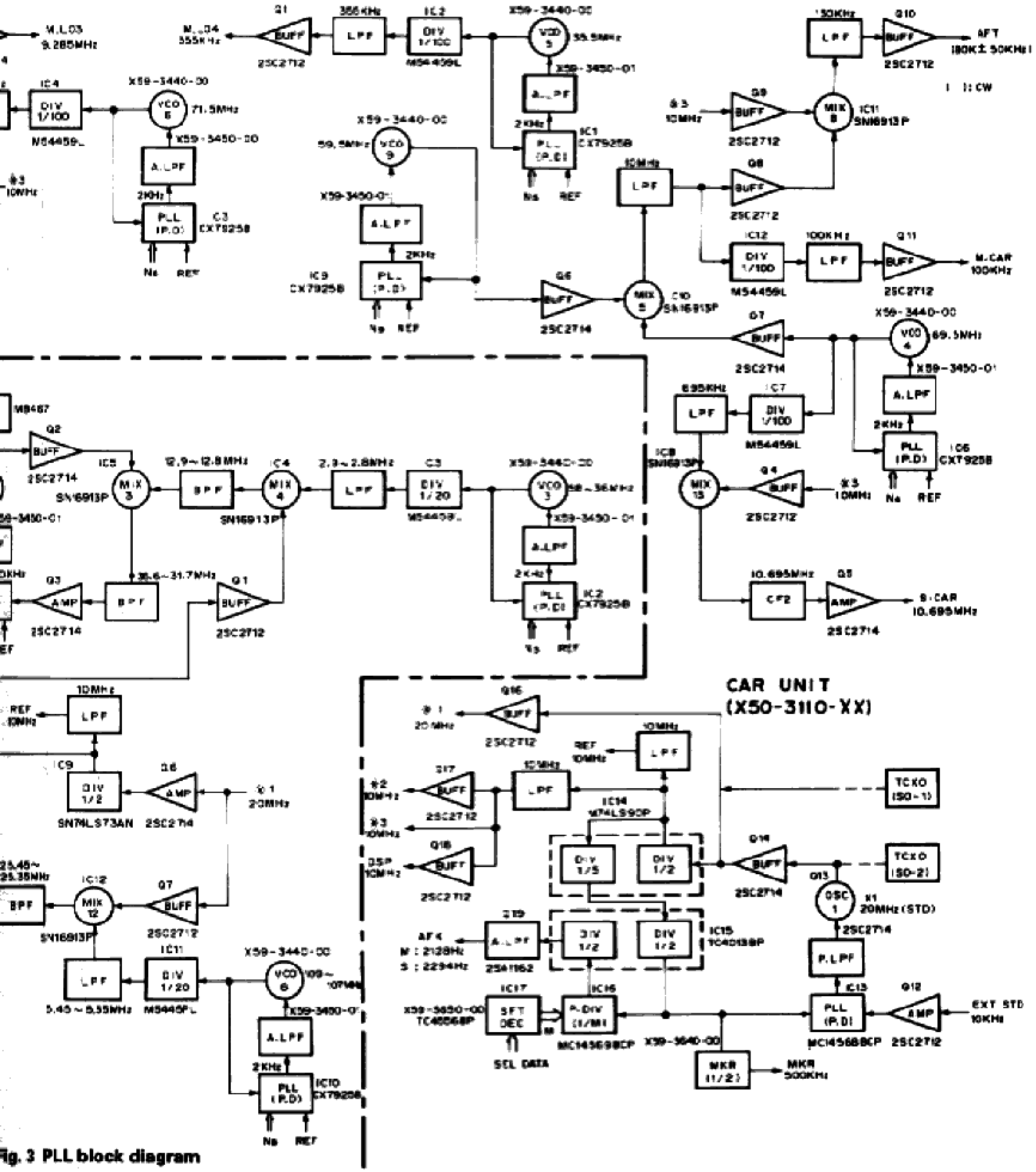

Fig. 3 PLL block diagram

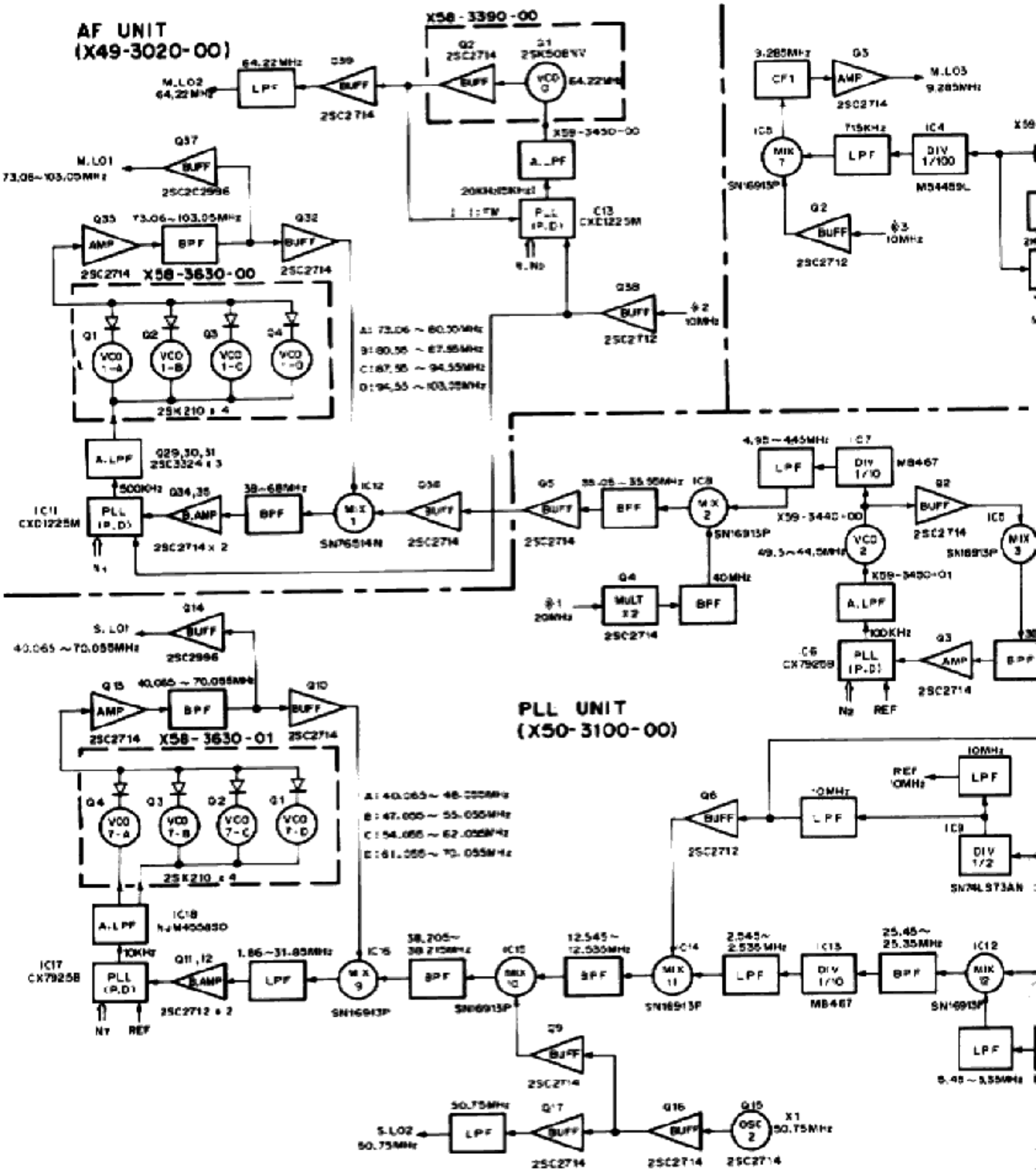

Fig. 3 PLL block di

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parator locking the VCO9. Divide ratio data N9 is provided by the digital unit. Division ratios are changed in CW, AM, and FM modes so that the VCO9 frequency is shifted as required.

The output from PLL9 is applied to pin 10 of MIX5. Here it is mixed with the output from PLL4, and passes through a low-pass filter to produce a 10-MHz (9.92-MHz in CW mode) signal. One output from PLL9 is divided by 100 by IC12 (M54459L) to generate a 100-kHz (99.2-kHz in CW mode) signal. The signal passes through buffer amplifier Q11 (2SC2712) and is applied to the signal unit as the main CAR.

The other output is applied to pin 2 of IC11 (SN16913PI of MIX8. MIX8 combines it with the 10-MHz reference signal. The signal passes thru a low-pass filter and is then converted to the 80±50 kHz AFT signal used by AF VBT in the CW mode. It then passes through buffer amplifier Q10 (2SC2712) and is applied to the AF unit.

- **Marker signal and AFSK signal**

The 1-MHz signal generated by the reference oscillator circuit of the CAR unit is applied to the MKR module and divided in half internally; the 500-kHz harmonic signal is then applied to the RF unit whenever the calibration (CAL) switch is turned on.

The 1-MHz signal is applied to programmable divider IC16 (MC14569BCP). The divides ratio of IC16 is interlocked with the mark/space condition of the RTTY key jack, and switched between 235/218. The actual shift width is controlled by the decoder output from IC17 (TC4556BP) and the SFT module according to the SFT data provided by the digital unit.

The output from IC16 is applied to IC15 (TC4013BP) and divided in half to make a duty ratio of 50%. This output is connected to the microphone amplifier circuit of the signal unit through the ALC PF of Q19 (2SA1162) to become the AFSK modulation signal. IC16 operation is halted in modes other than FSK mode, resulting in no AFSK signal.

Item	Rating
Nominal center frequency	9.285MHz
3dB attenuation bandwidth	±5.0kHz or more at 9.285 MHz
Guaranteed attenuation	45dB or more at 8.830MHz (−455kHz) 45dB or more at 9.740MHz (+455kHz) 40dB or more at 10.715MHz (+1430kHz)
Insertion loss	6dB or less Formula = 20·log $\left(\frac{E'}{2.2E}\right)$
Ripple	1.0dB or less (within 3dB band)
Input and output impedance	330Ω
Voltage capacity	50V DC (1 minute)

Table 2 Ceramic filter (L72-0350-05) (CAR unit CF1)

Item	Rating
Center frequency (fo) (The center frequency must be the center of the 3dB band)	Within 10.700MHz ± 50kHz
3dB attenuation bandwidth	Within 15.0 ± 4.0kHz
20dB attenuation bandwidth	38.0kHz or less
Insertion loss	Within 8.0dB Formula = 20·log $\left(\frac{E1}{2.2E}\right)$
Ripple (within 3dB band)	1.0dB or less
Spurious attenuation (9 to 12MHz)	38dB or more
Voltage capacity (between pins)	50V DC (1 minute)
Input and output impedance	330Ω

Table 3 Ceramic filter (L72-0369-05) (CAR unit CF2)

Receiver Circuit Configuration

(Refer to block diagram on page 265, 266 and 267.)

The incoming receive signal from the antenna is passed through the transmit/receive selector circuit on the filter unit (X51-3060-XX). The signal is routed to the RX ANT OUT (RCA jack) on the rear panel, and is applied to the RF unit (X44-3100-00) ANT terminal through the rear cable. This signal is applied to the receiver bandpass filter through the RF attenuator (0 to 30 dB selectable) via relays K1 and K2 and the low-pass filter (30 MHz). The bandpass filter divides the receiver frequency range (up to 30 MHz) into 15 bands. The appropriate section is automatically selected by RX bandpass filter control data (RB0, 1, 2, 3) that is supplied from the digital unit (X46-3050-XX).

RX frequency (MHz)	RX BPF Data			
	RB3	RB2	RB1	RB0
0.0 – 0.5	1	0	0	1
0.5 – 1.6	0	1	0	0
1.6 – 3.0	0	0	1	1
3.0 – 4.0	0	1	1	0
4.0 – 7.0	0	1	1	1
7.0 – 7.5	1	0	0	0
7.5 – 10.0	0	1	0	1
10.0 – 10.5	1	1	1	0
10.5 – 14.0	1	0	1	0
14.0 – 14.5	0	0	0	0
14.5 – 18.0	1	0	1	1
18.0 – 21.0	1	1	0	0
21.0 – 21.5	0	0	0	1
21.5 – 24.5	1	1	0	1
24.5 – 30.0	0	0	1	0

Table 4 RX BPF selection data

The signal from the bandpass filter passes through the RF AGC circuit composed of PIN diodes D37 and D38 (MI1204). It is then amplified by the RF amplifiers Q5 (2SK125-5) and Q6 (2SK520). (When AIP is on, the signal is directed to RF buffer amplifier Q4 (2SK125) with unity gain, not to RF amplifiers Q5 and Q6.) The amplified signal is separated by L70 for use in the main and sub channels.

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The main received signal passes through buffer amplifier Q12 (2SK520) and a low-pass filter and is then mixed with the VCO signal in the first mixer Q13 to Q16 (2SK520). The output is converted into the first IF signal of 73.05 MHz. This signal is applied to the IF unit (X48-3060-00) from the MIF terminal (CN6) and is separated into two seperate channels. One of the channels passes through the buffer amplifier Q23 (2SC2714) and is combined with the HET signal (64.22 MHz) in mixer Q24 (3SK131) to generate an 8.83-MHz wide-band signal. This signal is routed from the rear as IF OUT, and is used as a signal for the panoramic display section of the SM-230 station monitor. The other signal passes through buffer amplifier Q44 (2SK520). Undesireable signal components are eliminated from the signal when it passes through the Monolithic Crystal Filter (MCF) XF2 with a bandwidth of 15-kHz. The signal is then applied to the second mixer Q15 and Q16 (2SK520), mixed with the HET signal (64.22 MHz), and converted into the second IF signal (8.83 MHz). This signal is also separated into two channels; one is supplied to the noise blanker of the AF unit (X49-3020-00), and the other is applied to the second IF signal filter circuit via the noise blanker gate composed of diodes D5 to D8 (RLS135).

This filter circuit utilizes wide-band LC filters L28 and L29, a 6-kHz MCF, and a 2.7-kHz MCF (XF3). The filter circuit permits the use of several optional filters (1.8-kHz and 500-Hz or 250-Hz). (The TS-950SD has these filters included as standard equipment.) These filters can be selected from the front panel via IC8 (TC9174F) of the signal unit (X57-3380-00).

The received signal from the second IF filter, is applied to the third mixer Q19 and Q20 (3SK131) where it is mixed with the HET signal (9.285 MHz). The resulting signal is then converted to the third IF signal (455 kHz) and is routed to the signal unit via the TR455 terminal (CN17).

This 455-kHz signal is then separated into two channels, FM and non-FM. In FM, the signal is amplified by Q1 (3SK131) and applied to the third IF filter circuit. This filter circuit utilizes a 6-kHz ceramic filter (CF1) and 2.7-kHz ceramic (crystal for the TS-950SD) filter (CF101). Two optional filters are available for this circuit; a 500-Hz and a 250-Hz. (The The TS-950SD type has these filters included as standard equipment.) These filters, like the filters for the second IF, may be selected from the front panel under the control of IC8.

Mode \ Filter	2nd IF filter 8.83-MHz	3rd IF filter 455-kHz
Non-FM	All filters (including LC filter)	Excluding 12 kHz
FM	No display (LC filter) only	12 kHz or 6 kHz

Table 5 Selection of filters by mode (option)

Mode \ Filter	8.83-MHz	455-kHz
SSB, CW, PSK	2.7-kHz	2.7-kHz
AM	6-kHz	6-kHz
FM	– (LC filter)	12-kHz

Table 6 Initial setting

	Display	S type	SD type
8.83 MHz	–	○ (LC filter)	○ (←)
	6 kHz	○ (MCF : L71-0356-05)	○ (←)
	2.7kHz	○ (MCF : L71-0222-05)	○ (←)
	1.8 kHz	△ (Not sold now)	△ (←)
	500 Hz*	△ (Crystal : YK-68C-1)	○ (←)
	270 Hz*	△ (Not sold now)	X
455 kHz	12 kHz (FM only)	○ (Ceramic : L72-0315-05)	○ (←)
	6 kHz	○ (Ceramic : L72-0319-05)	○ (←)
	2.7 kHz	○ (Ceramic : L72-0333-05)	○ (Crystal : YG-455S-1)
	500 Hz	△ (Crystal : YG-43EC-1)	○ (←)
	250 Hz	△ (Crystal : YG-455CN-1)	○ (←)

* : Only one of them is selectable.

○ : Standard
△ : Option
X : Not available

Table 7 Filters by type

The 455-kHz signal from the third IF filter is amplified by Q2 (3SK131), and is mixed with the CAR signal (455 kHz) in the fourth receive mixer Q3 (3SK131). The signal is converted into the fourth IF signal of 100 kHz, and passes through the notch filter circuit, and is then applied to Q4 (3SK131). The amplified output from Q4 becomes the AF signal after passing through the SSB/CW detector, and is applied to the SCAF terminal (CN7).

The output of Q2 is applied to Q22 (2SC2712), to become the squelch signal for non-FM receive modes by comparator IC2 (NJM2903M). The output of Q4 is also applied to Q10 (2SC2712) to produce the Automatic Gain Control AGC signal.

In the FM mode, the 455-kHz signal passes through IF buffer amplifier Q28 (2SC2712), and is applied to the third IF circuit. Either wide-band filter CF2, for a 12-kHz bandwidth, or narrow-band filter CF3, for a 6-kHz bandwidth, may be selected. The output is amplified by limiter amplifiers IC6 and IC7 (μPC577H), and then FM-detected by ceramic discriminator CF4.

The noise components, at approximately 40 kHz, are eliminated from the FM detector output, and a squelch circuit consisting of noise amplifier Q19 and Q20 (2SC2712) and comparator IC2 (b/2) produces an FM squelch control signal.

CIRCUIT DESCRIPTION

The FM AF signal passes through the de-emphasis circuit, and is then amplified by the FM AGC amplifier IC3 (μPC1158H2). If the deviation of the ANT input is 3 kHz or more, the circuit keeps the audio output constant and prevents large changes in volume. The FM AF signal and the AM AF signal detected by D21 and D22 (RLS73) are routed from the FAAF terminal.

The AF signal from the SCAF or FAAF terminal is applied to the AF unit (X49-3020-00). The AF signal from the SCAF terminal is routed differently from the signal from the FAAF terminal. The signal from the SCAF terminal is processed by the DSP and CW VBT circuit, and is then applied to the AF amplifier IC7 (a/2). The signal from the FAAF terminal is applied directly to the AF amplifier IC7 (a/2).

The sub receiver signal passes through buffer amplifier Q7 (2SK520) and the low-pass filter of the RF unit. The signal is mixed with the sub VCO signal in the first sub mixer Q6 to Q11 (2SK520), and the output is converted into the first sub IF signal of 40.055 MHz. The unwanted signal components are eliminated from the signal when it passes through the MCF XF1 with a 15-kHz bandwidth. When the monitor is on, the RF transmit signal is applied to the first sub mixer.

The signal applied to the IF unit from the SUB IF terminal (CN7) is amplified by Q1 (3SK131), mixed with the HET signal (50.7 MHz) in mixer Q2 and Q3 (2SK520), and converted to the second IF signal (10.695 MHz). This signal is separated into two channels; one is supplied to the noise blanker circuit, the other is amplified by the second IF amplifier Q5 (3SK131), which also acts as a noise blanking gate, and passes through the 10.695-MHz crystal filter XF1. The signal is further amplified by the second IF amplifiers Q9 and Q10 (3SK131), product-detected by IC1 (AN612), and routed from the SAF terminal (CN15) as an AF signal.

This sub AF signal is applied to the AF unit, where it is separated into two channels; one for sub reception and one for the monitor. For sub reception, the signal is applied to IC7 (b/2). For the monitor, the signal is routed to the monitor VR.

The main AF and sub AF signals are amplified separately by IC7, passed through the muting circuit Q8 and Q9 (2SD1757K), and are applied to the main and sub AF VR. In the CW mode, the sub AF can also be routed through the AF VBT circuit.

The AF signal that has passed through the AF VR is mixed with the signal that has passed through the monitor VR in IC8 (a/2; NJM4558M). The resulting signal is amplified and applied to the control unit (X53-3230-00) via the AF terminal (CN11), and amplified by the AF power amplifier IC7 (μPC2002V) in order to drive the speaker.

- **Filters ratings**

Item	Rating
Nominal center frequency	8.830MHz
3dB attenuation	±52kHz or more at 8.830MHz
Guaranteed attenuation	35dB or more at 9.285MHz (+455kHz) 45dB or more at 9.74MHz (+910kHz)
Insertion loss	6dB or less Formula = 20·log $\left(\frac{E1}{2 \cdot 2E}\right)$
Ripple	1.0dB or less (within 3dB band)
Input and output impedance	330Ω

Ceramic filter (L72-0351-05) (IF unit CF1)

Item	Rating
Nominal frequency	10.695MHz
Center frequency deviation	Within ±200Hz at 6dB
Passband width and attenuation bandwidth (minimum loss standard)	2.2kHz or more at 6dB ±7.5kHz or less at 20dB ±2.4kHz or less at 60dB
Ripple	2dB or less
Insertion loss	6dB or less
Guaranteed attenuation	60dB or more within ±40kHz
Input and output impedance	1.2kΩ ± 5% / 6pF ± 5%

MCF (L71-0249-05) (IF unit XF1)

Item	Rating
Nominal center frequency	73.05MHz
Pass bandwidth	±7.5kHz or more at 3dB
Attenuation bandwidth	±30kHz or less at 40dB
Ripple	1.0dB or less
Insertion loss	3.0dB or less
Guaranteed attenuation	70dB or more at fc + (300 to 1000) kHz 70dB or more at fc – (200 to 1000) kHz
Center frequency deviation	Within ±1.5kHz at 3dB
Input and output impedance	2kΩ ± 10%

MCF (L71-0401-05) (IF unit XF2)

Item	Rating
Nominal center frequency	8830kHz
Center frequency deviation	Within ±150Hz at 6dB
Passband width	±1.3kHz or more at 6dB
Attenuation bandwidth	±1.7kHz or less at 20dB ±2.6kHz or less at 60dB ±3.4kHz or less at 80dB
Ripple	2dB or less
Insertion loss	6dB or less
Guaranteed attenuation	80dB or more in the range ±3.4kHz to ±1MHz
Input and output impedance	600Ω / 15pF

MCF (L71-0222-05) (IF unit XF3)

CIRCUIT DESCRIPTION

Item	Rating
Nominal center frequency	455 ± 0.2kHz
6dB bandwidth	2.9 to 3.2kHz
60dB bandwidth	4.7kHz or less
Guaranteed attenuation	80dB or more at 0.1 to 1MHz
Spurious	40dB or more at 500 to 700kHz
Ripple (in 6dB band)	2dB or less
Insertion loss	6dB or less
Guaranteed attenuation	60dB or more within ±40kHz
Input and output impedance	2kΩ

Ceramic filter (L72-0333-05) (Filter unit CF1)

Item	Rating
Nominal center frequency	455kHz
6dB bandwidth	±6kHz or more (at 455kHz)
50dB bandwidth	±12.5kHz or less (at 455kHz)
Ripple (within 455 ± 4kHz)	3dB or less
Insertion loss	6dB or less
Guaranteed attenuation (within 455 ± 100kHz)	35dB or more
Input and output impedance	2.0kΩ

Ceramic filter (L72-0315-05) (Signal unit CF2)

Item	Rating
Nominal center frequency (fo)	8830kHz
Pass bandwidth	fo ± 3.0kHz or more at 6dB
Attenuation bandwidth	fo ± 16.0kHz or less at 80dB fo ± 13.0kHz or less at 60dB
Guaranteed attenuation	70dB or more within fo ± 1MHz
Ripple	Within 1.0dB
Insertion loss	Within 1.5dB
Input and output impedance	1850Ω / 2pF

MCF (L71-0266-05) (Filter unit XF1)

Item	Rating
Nominal center frequency (fc) and deviation	40.055MHz ± 0.75kHz or less
Pass bandwidth	fc ± 7.5kHz or more at 3dB
Attenuation bandwidth	30dB or more at fc ± 25kHz 60dB or more at fc ± 150kHz (Spurious : 30dB or more)
Guaranteed attenuation	60dB or more at fc ± 750kHz to fc ± 1000kHz
Ripple	1.5dB or less
Insertion loss	4dB or less
Input and output impedance	4.2kΩ / 4pF

MCF (L71-0275-05) (RF unit XF1)

Item	Rating
Nominal center frequency	455kHz
6dB bandwidth	±3kHz or more (at 455kHz)
50dB bandwidth	±9kHz or less (at 455kHz)
Ripple (within 455 ± 2kHz)	2dB or less
Insertion loss	6dB or less
Guaranteed attenuation (within 455 ± 100kHz)	60dB or more
Input and output impedance	2.0kΩ

Ceramic filter (L72-0319-05) (Signal unit CF1, 3, 5)

Item	Rating
Nominal center frequency	8830.0kHz
Center frequency deviation	Within ±70Hz at 6dB
Pass bandwidth	±250Hz or more at 6dB
Attenuation bandwidth	±900Hz or less at 60dB
Guaranteed attenuation	80dB or more within ±2kHz to ±1MHz
Ripple	2dB or less
Insertion loss	Within 5 ± 2dB
Input and output impedance	600Ω / 15pF

Crystal filter YK-88C-1 (L79-0847-05) : Option

Item	Rating
Nominal center frequency	455kHz
Center frequency deviation	Within 50Hz at 6dB
Pass bandwidth and Attenuation bandwidth	±250Hz or more at 6dB ±425Hz or less at 60dB
Guaranteed attenuation	80dB or more within 100Hz to 454.4kHz 80dB or more within 455.6kHz to 2MHz
Ripple	2dB or less
Insertion loss	6dB or less
Input and output impedance	2kΩ ± 5% / 15pF ± 5%

Crystal filter YG-455C-1 (L79-0888-05) : Option

Item	Rating
Nominal center frequency	455kHz
Center frequency deviation	Within 50Hz at 6dB
Pass bandwidth and Attenuation bandwidth	±125Hz or more at 6dB ±250Hz or less at 60dB
Guaranteed attenuation	80dB or more within 10Hz to 454.5kHz 80dB or more within 455.4kHz to 2MHz
Ripple	2dB or less
Insertion loss	6dB or less
Input and output impedance	2kΩ ± 5% / 15pF ± 5%

Crystal filter YG-455CN-1 (L71-0239-05) : Option

Item	Rating
Nominal center frequency	455kHz
Pass bandwidth and Attenuation bandwidth	±1.2kHz or more at 6dB ±1.5kHz or less at 20dB ±2.05kHz or less at 60dB ±2.1kHz or less at 66dB
Guaranteed attenuation	80dB or more within ±20kHz
Ripple	3dB or less
Insertion loss	6dB or less
Input and output impedance	2kΩ ± 5% / 15pF ± 5%

Crystal filter YG-455S-1 (L71-0292-05) : Option

CIRCUIT DESCRIPTION

• SLOPE-TUNE, IF VBT

Figure 4 shows the TS-950 SLOPE-TUNE and IF VBT receiver configuration.

The operating principle of SSB-SLOPE-TUNE circuit is explained first. When fML2, fML3, and fML4 in Figure 5 are at their normal frequencies, the synthesized bandwidth is indicated by A. When the frecuencies of fML3 and fML4 are lowered by an amount equal to Δf1, only the third IF filter (455-kHz band) shifts to position B. (The circuit is designed so that the PLL data lowers the frequencies of fML3 and fML4 equal to the value determined by Δf1.) The synthesized bandwidth is the overlapping portion of A and B. When the frequencies of fML2 and fML3 are lowered by an amount equal to Δf2, only the the second IF filter (8.83-MHz band) shifts to position C. The synthesized bandwidth is the overlapping portion of B and C. The SSB-SLOPE-TUNE allows these operations to be conducted independently, using two separate controls.

The frequencies are generated by the PLL circuit and controlled by the microprocessor. The amount of change in Δf1 and Δf2, is digitally tracked, allowing only the bandwidth to narrow without changing the center frequency of the composite passband.

We will now cover the operating principle of the SSB-SLOPE-TUNE circuits. These circuits are designed so the relationship between the frequency changes of PLL data are such that Δf2 = Δf1. The synthesized passband widths of the third IF filter (fIF3) and the second IF filter (fIF2) can thus be varied by a single control.

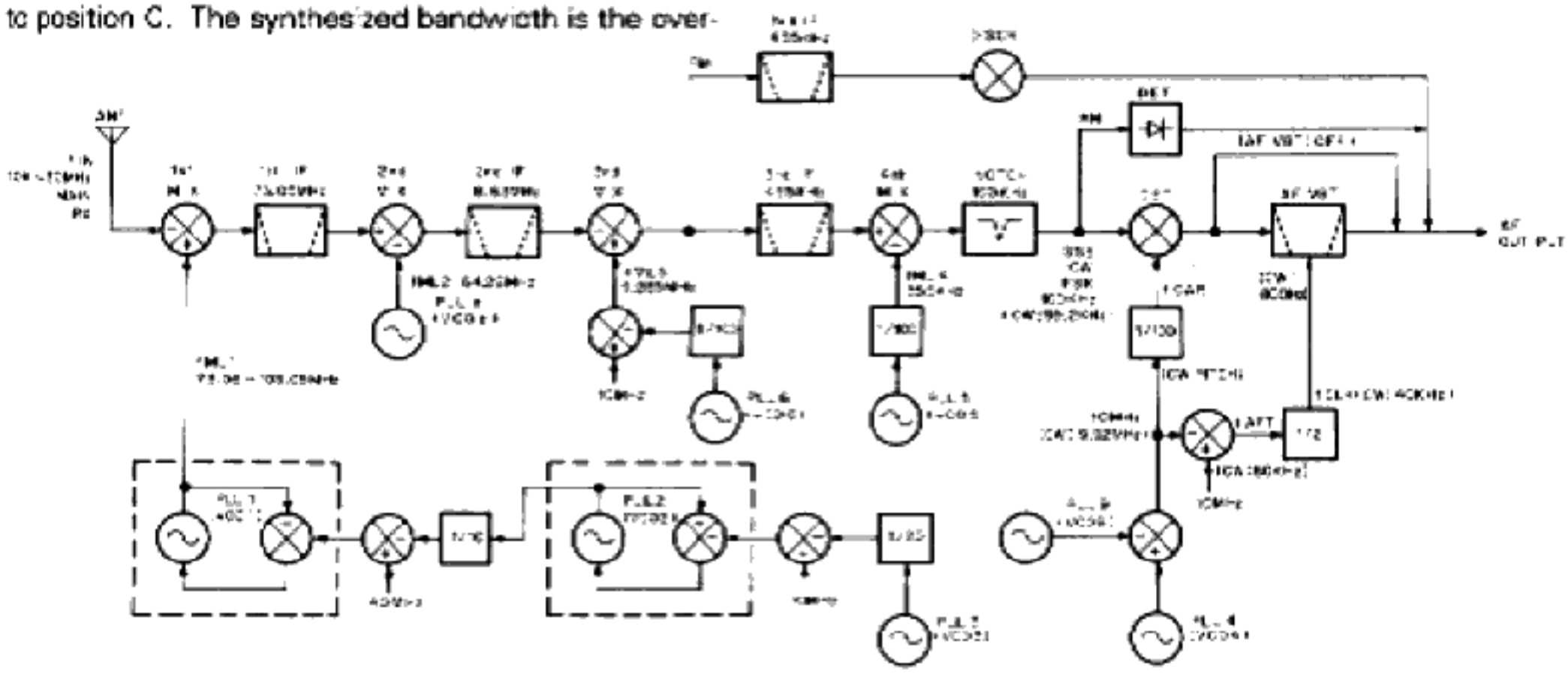


Fig. 4-a Main receiver frequency configuration

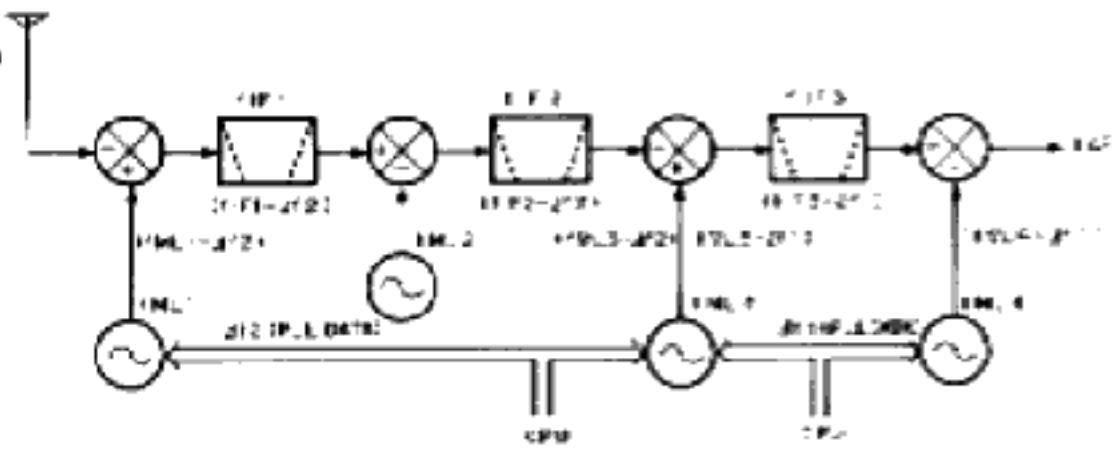


Fig. 4-b Band variable frequency configuration

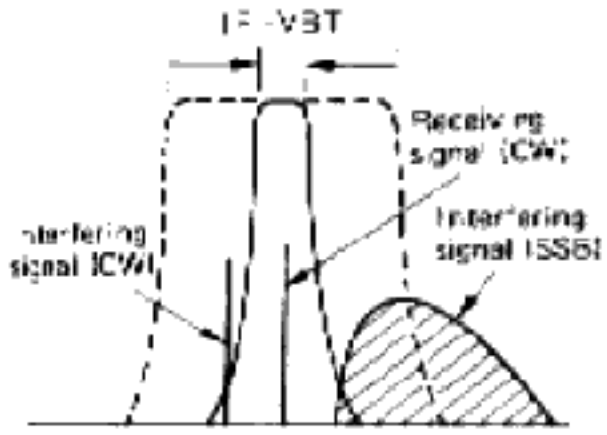


Fig. 4-c IF VBT

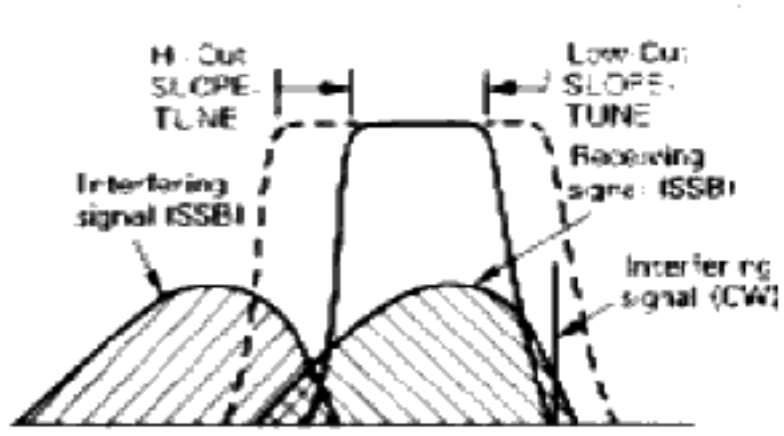


Fig. 4-d SSB-SLOPE-TUNE

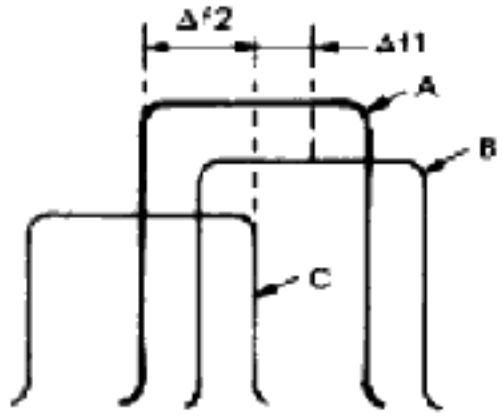


Fig. 5

CIRCUIT DESCRIPTION

- **Noise blanker circuits**

1) NB1

NB1 is a noise blanker circuit that has been designed for short-duration pulse noise, such as automobile ignition noise. The 8.83-MHz IF signal generated from the first main IF of 73.05 MHz is amplified by noise amplifiers Q40 (2SK210), Q41, Q42, and Q44 (2SC2712), passes through buffer amplifier Q45 (2SC2712), and is noise-detected by D30 (HSM88AS). This signal is used to switche Q47 (2SC2712), turns on Q48 (DTA124EK), and switches the main IF signal line according to the incoming noise pulses. The signal is also used to turn on Q48, which turns on IF unit Q8 and Q6 (2SC2712), and switches the sub IF signal lineccording to the main noise.

The 10.695-MHz IF signal generated from the first sub IF of 40.055 MHz is amplified by noise amplifiers Q26 (2SK210), Q27, Q28 and Q29 (2SC2714) of the IF unit, passes through buffer amplifier Q31 (2SC2714), and is noise-detected by D33 (HSM88AS). This signal is used to switche Q33 (2SC2712), turns on Q34 (DTA124EK), switches Q8 and Q6, and switches the sub IF signal line according to the incoming noise. The signal turns on Q34 (DTA124EK), and switches the main IF signal line ccording to the sub noise.

When NB1 turns on, a DC voltage is applied to the emitter of Q47 on the AF unit from threshold variable resistor VR12 for the main reciever. A corresponding DC voltage is applied to the emitter of Q33 on the IF unit from threshold variable resistor VR12 for the sub receiver. The effect of the NB circuit can be adjusted by changing these emitter voltages.

2) NB2

NB2 is a noise blanker circuit that is used to blank noise pulses with a comparatively long duration and a large pulse width, like the Russian woodpecker.

For the main receiver NB2 circuit, the noise signal amplified by noise amplifiers Q40, Q41, Q42, and Q44 of the AF unit is noise-detected by D28 (HSM88AS) in a manner very similar to that of NB1. The threshold voltage of emitter Q46 (2SC2712) is varied by VR12. The output from Q46 enters the NB2 module unit (X59-3350-00) and is used to generate the pulse width and period synchronized with the woodpecker noise.

For the sub receiver NB2 circuit, the noise signal amplified by noise amplifiers Q26, Q27, Q28, and Q29 is noise-detected by IF unit D32 (HSM88AS) in a manner very similar to that of NB1. The threshold voltage of emitter Q32 (2SC2712) is varied by VR12. The output from Q32 enters the NB2 module unit (X59-3350-00) and is used to generate the pulse width and period synchronized with the woodpecker noise.

The NB2 switching signal detected by the main IF, and the NB2 switching signal detected by the sub IF switch the main and sub IF signal lines in a manner very similar to NB1.

IC1 (TC4011BF), 1/4, 4/4, and 2/4, 3/4 in the module unit are set to a pulse width of 40 ms. Normally, woodpecker noise has a pulse width of 3 to 4 ms and a period of from 80 to 100 ms. Some woodpecker noises have a period of about 50 ms, although this is rare. Therefore, even a woodpecker noise signal, with a large pulse width can be blanked by switching the noise in 5-ms intervals. However, if a noise signal, with a period of several ms like an ignition noise is blanked at a 5 ms interval, the signal receive time becomes zero. To prevent this, a one-shot multi-vibrator composed of IC1 2/4 and 3/4 is provided so that the next pulse is not blanked for a period of 40 ms after the one shot is issued from 1/4 and 4/4.

CIRCUIT DESCRIPTION

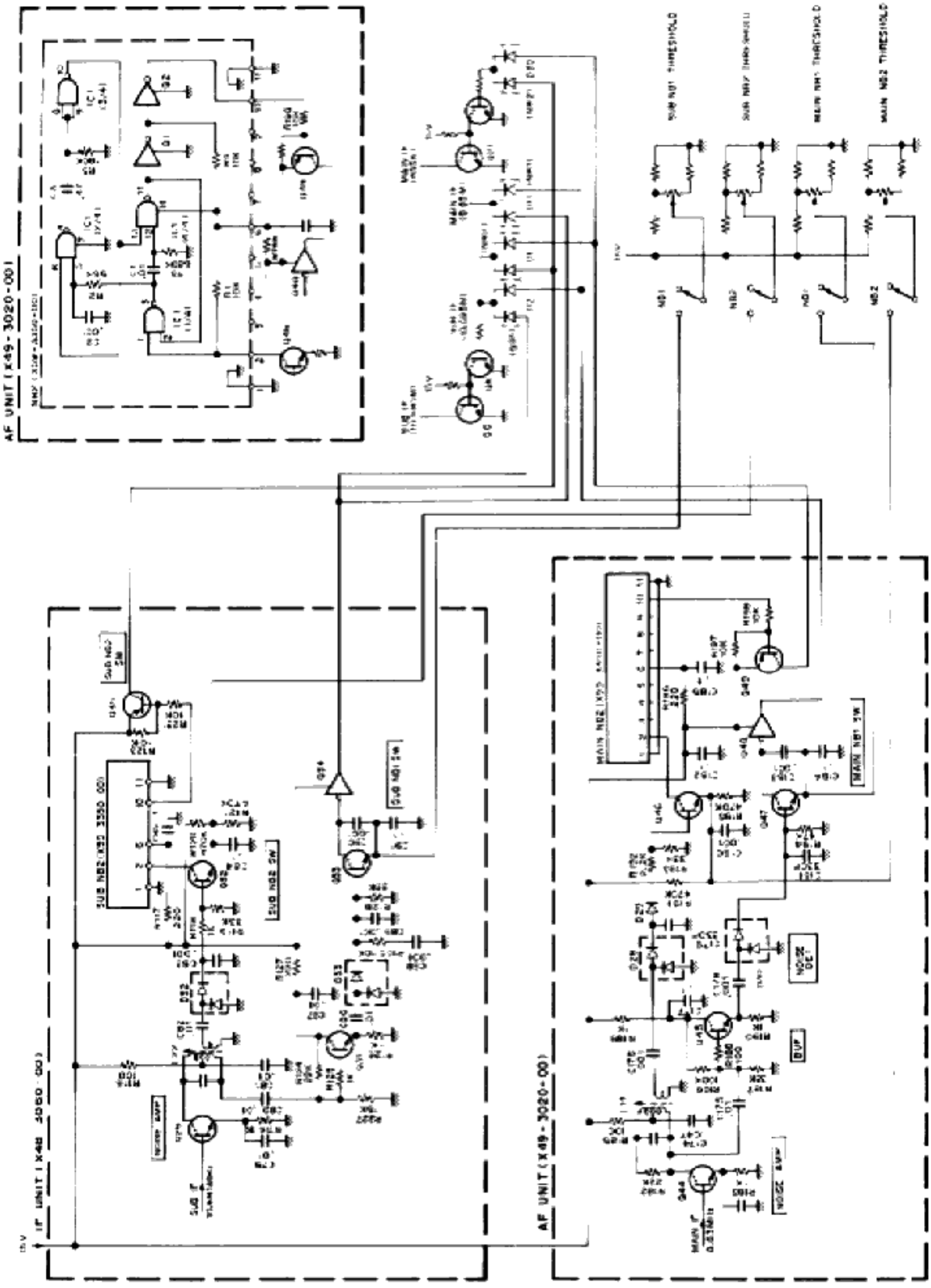


Fig. 6 Noise blanker circuit configuration

CIRCUIT DESCRIPTION

Transmitter Circuit Configuration

The transmitter system configuration is shown in Figure 7. The transmitter system operates as a triple conversion system in SSB, CW, and AM modes, and as a double conversion system in FM mode.

The audio signal from the microphone enters switch unit (A) (D/10) and switch unit (A) (H/10) from the microphone connector board. The signal is amplified by the MIC AMP module and passes through buffer amplifier Q17 (2SC2712) and splits into the SSB/AM MIC system, and the FM, VOX system. Inputs from the rear panel enter from the PHONE IN and ACC2 lines on the IF unit, are amplified by Q42 (2SC2712), and then matched with the input of Q17 on the switch unit (A) (H/10).

The SSB and AM MIC system of switch unit (A) (H/10) is routed to the MIC GAIN VR and the PROC IN VR on the same board. When the speech processor is turned on, with switch S59 of switch unit (A) (G/10), PROC IN is selected. When the speech processor is turned off, the MIC GAIN output is selected.

The FM and VOX signals of switch unit (A) (H/10) are switched to the FM and VOX systems by switch unit (A) (E/10). The FM signal enters the FM MIC AMP circuit of the AF unit, and the VOX signal enters the VOX circuit of the AF unit via the VOX GAIN VR of switch unit (A) (E/10).

The SSB and AM MIC signals enter the signal unit and are amplified by IC9 (TA7140P) to a level sufficient for modulation, and are then modulated by ring modulator D41 (ND487R1-3R) to produce a 455-kHz DSB signal. In the AM and CW modes, D41 is used as a carrier attenuator by applying DC bias to D41. The carrier level is adjusted by changing the level of VR11 CAR LEVEL VR on switch unit (A) (J/10). In the FM mode, the carrier level is set by VR6 (FMC) on the signal unit.

The DSB signal is amplified by Q12 (3SK131) on the signal unit, and is passed through ceramic filter CF101. The unwanted side band is eliminated in order to generate a 455-kHz SSB signal. The FM and FSK signals also pass through CF101. The CW and AM signals pass through CF1. The 455-kHz signal passes through buffer amplifiers Q26 and Q25 (2SC2712x2), and are routed from the signal unit.

Fig. 7 Transmitter circuit configuration

CIRCUIT DESCRIPTION

The speech processor can be turned on and off only in the SSB mode. In FSK, the processor is automatically switched into the circuit. When the speech processor is on, the SSB signal obtained from the output of Q26 is amplified by Q33 (2SC2712), and the components above a specific level are clipped. The resulting signal is amplified by Q30 (3SK131). The output level of the speech processor is varied by changing the second gate voltage of Q30. The output level is controlled by the PROC OUT control on switch unit (A) (H/10). The processor output from Q30 passes through ceramic filter CF5, and is output when processor Q25 is turned off by D60, D61, and D62 (RLS73x3). The signal then exits the signal unit.

The signal supplied from the signal unit enters the IF unit and is mixed with the third local oscillator signal of 9.285 MHz by Q41 (3SK131) to obtain an 8.83-MHz IF signal. This signal passes through ceramic filter CF1 with the NULL point set at 9.285 MHz, amplifier Q40 (2SC2712) for matching the signal to the next ceramic filter XF3 (YK-88S), and the 8.83-MHz IF filter. The SSB, FM, FSK signals passe through XF3 (YK-88S), and the CW and AM signals pass though the filter unit (C/3). The output from the filter is amplified by Q38 (3SK131). ALC is applied to Q38.

The output from Q38 is mixed with the second local oscillator signal of 64.22-MHz in Q36 and Q37 (3SK131x2) to generate a 73.05-MHz signal. This signal enters the RF unit from the IF unit.

In the RF unit, the signal passes through three LC bandpass filters, L93, L94, and L95, is mixed with the first local oscillator signal in Q20 and Q21 (3SK131x2), and is converted to the target transmit frequency. The output of Q20 and Q21 passes through a bandpass filter, which is split to three frequency ranges (7.5 MHz, 7.5 to 14.5 MHz, 14.5 to 30 MHz; the 7.5 MHz section covers all frequency below 7.5 MHz), amplified by Q22 (3SK131) and Q19 (2SK2954), and routed from the DRIVE OUT terminal on the rear panel. The signal enters the final unit via the DRIVE IN terminal through the jumper cable at the rear.

The signal is amplified by Q1 (2SC1971), Q2 and Q3 (2SC3133x2), Q4 (1/2, 2/2) (MRF429MP). Harmonics are eliminated from the signal by the filter unit, and the signal is emitted from the antenna.

FSK is based upon AFSK methods with the mark (2125 Hz) or space (2295 Hz) being generated by the carrier unit or the AFSK signal is input to signal unit IC9 and modulated by D41. In the FSK mode, the speech processor circuit works, providing 10- to 20-dB of compression, and also suppresses the difference in the levels between the mark and space signals.

The FM signal passes through buffer amplifier Q20 (2SC2712) and the FM MIC AMP module in the AF unit, and is used to modulate the second local oscillator.

- **ALC circuit**

The level of the forward wave voltage (VSF) detected in the filter unit may be adjusted by VR12 (VSF) on the control unit and is applied to the differential amplifier composed of Q10 and Q11 (2SC2712x2).

When VSF is applied to the base of Q10, the emitter voltages of Q10 and Q11 increase and the current through the base of Q11 decrease which causes the collector voltage of Q11 to rise. When this voltage exceeds the emitter voltage of Q1 (2SC2712) (about 1.8 V) stabilized by D1 (LT8001P), the current begins to flow thru the base of Q1, dropping the on the collector. The ALC time constant RC circuit is connected to this collector. The change in the collector voltage is shifted by aproximately 2.7 V by Q4 (2SK208) and D5 (RLZJ4.7B), and matched with the voltage for keying by Q5 (2SC2712) and D6 (RLS73) to generate the ALC voltage. This ALC voltage activates the ALC by lowering the second gate voltage of Q38 (3SK131) of the IF unit.

- **Power control circuit**

Power is controlled (reduced) by lowering the base voltage of Q11. As the base voltage of Q11 is decreased, the emitter voltages of Q10 and Q11 are decreased. This allows Q10 to be turned on even if the base voltage (VSF) of Q11 is low. That is, ALC works to lower the power even if the power is already relatively low.

When the power output is maximum, Q16 (DTC124EK) is on, Q12 and Q14 (DTC124EKx2) are off, and VR2 (PWR VR) of the switch unit (A) (H/10) is shorted. Therefore, the base voltage of Q11 has the value determined by voltage dividers R66, R67, and front panel PWR VR. When the PWR VR is turned to MIN, the base voltage of Q11 is lowered, and ALC begins with low power. When the PWR VR is set to MIN, VR10 (MIN) and the PWR VR of the control unit are parallel, and the MIN power setting can controlled by VR10.

For AT tuning, the power is lowered to about 10 W. The AT start signal (ATS) turns on Q14, and the base of Q11 is connected to ground via R72 to lower the power.

Q15 (DTC124EK) is used to turn off the PWR VR control to prevent the PWR VR from influencing tuning.

CIRCUIT DESCRIPTION

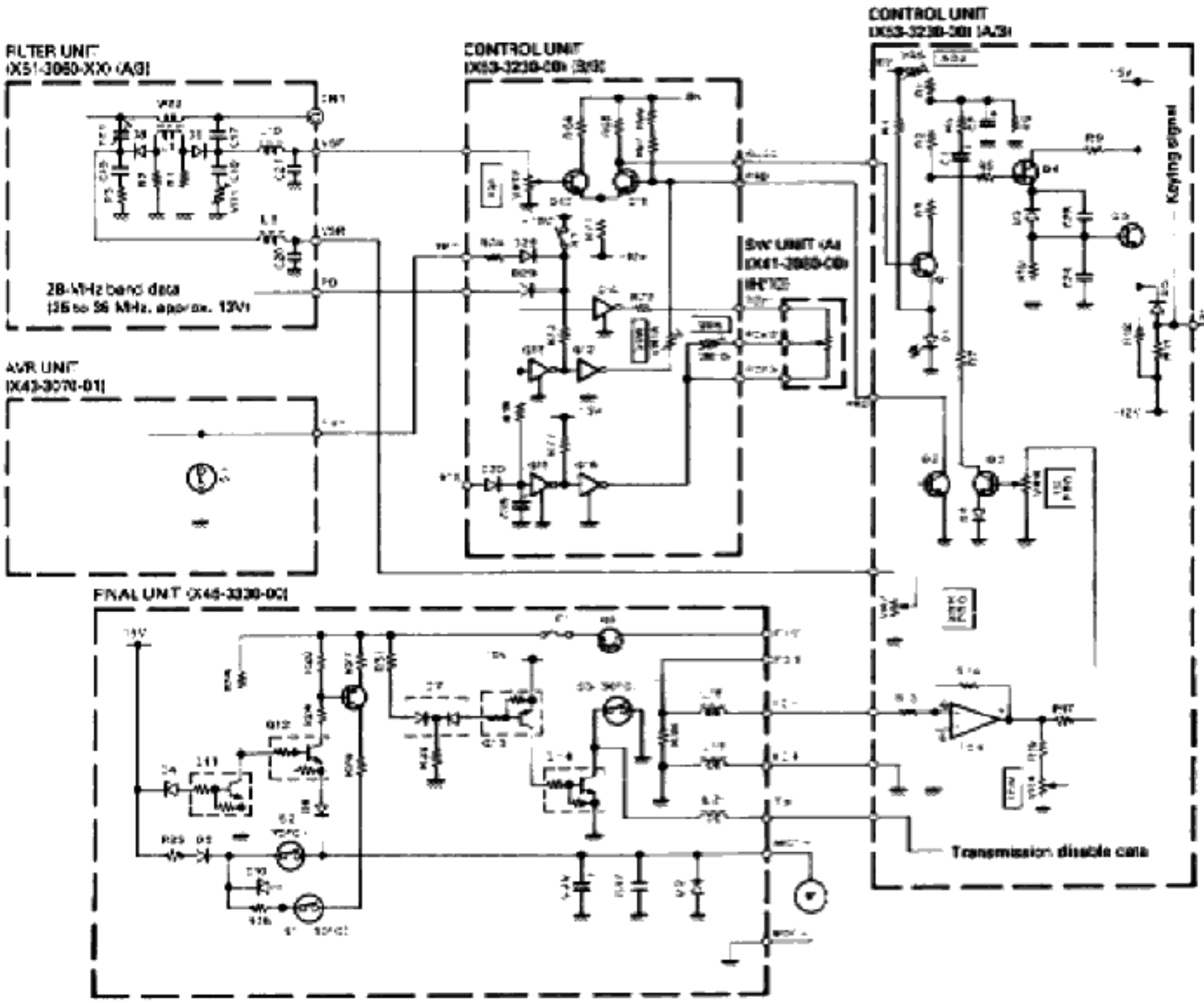


Fig. 8 ALC, power control and protection circuit

If the power output control is used only when ALC action begins, its range increases as the power output is lowered. Therefore, the switch unit (A) (H/10) PWR VR has two functions; one controls ALC, and the other changes the second gate voltage (PCV) of Q22 (3SK131) on the RF unit. By changing the gate voltage, the difference between the maximum and minimum gains is approximately 10 dB to prevent excessive ALC action when the power output is low.

The gain is also reduced during AT tuning. When the ATS signal arrives at the RF unit, PCV is grounded at Q25 (DTC124EK) to eliminate the influence of PWR VR, and the second gate voltage is made constant (nearly the same value as when the PWR VR is MIN).

- **Protection circuit**

1) SWR protection

When the reflected wave voltage (VSR) from the filter unit is raised by load variation or AT tuning, Q2 (2SC2712) of the control unit turnes on, and the voltage on the ALC time constant circuit is decreased. The power output is lowered by decreasing the drive to protect the final transistor.

CIRCUIT DESCRIPTION

2) IC protection

The final transistor collector current is detected via the voltage drop across R38 of the final unit. Since the detected voltage is negative, it is inverted and amplified by IC8 (NJM4558MI on the control unit. IC8 turns on Q3 (2SC2712), reduces the voltage on the A_C time constant circuit, and decreases the drive to limit the final transistor current.

When the fuse on the final unit blows, the 50-V AVR is turned off, TXI is grounded by D7 (MC92'), Q15 (DTA'24ES), and Q14 (DTC124ES), and disabling transmission.

- **Temperature protection**

If the final heat sink temperature rises to approximately 50°C, the temperature switch (S1) of the final unit turns on. Current then flows to the fan motor through R23 and D5 (1S1555), and R36 and D10 (UPZ4.7B), and the fan motor starts running at a low speed. D10 is a zener diode that produces the current necessary for starting the motor.

If the final heat sink temperature rises to approximately 70°C, temperature switch S2 turns on, and D10 and R36 are shorted. The voltage applied to the motor then increases and the fan motor runs at higher speed. If the sink temperature reaches 90°C through some failure, S3 turns on, TXI is grounded, and transmission is disabled.

If the power transformer temperature rises to approximately 80°C, temperature detection switch S1 of the AVR unit turns on and the power is lowered to protect the transformer.

- **Safety discharge cooling circuit**

70 to 80 V is applied to the electrolytic capacitor of the power supply whenever the power switch is turned on. This capacitor will not discharge immediately when the power switch is turned off. Since the voltage on the 15-V power supply soon falls when the power supply is turned off, the voltage remaining on this capacitor will be consumed by the fan motor.

The fall in voltage on the 15-V power supply line is detected by D4 (MTZ4.7JC) on the final unit. If the voltage drops to approximately 10 V, Q11 (DTC124ES) turns off, the collector voltage rises, and Q12 (DTC'43TS) turns on. When Q12 turns on, Q13 turns on allowing the voltage to discharge slowly through R27, Q13, R26, D6 keeping the fan on.

- **Monitor circuit**

1) Modes other than FM

The monitor circuit uses the sub receiver to receive and monitor the signals after conversion to the transmission frequency unlike conventional monitor circuits that monitor the IF signals. This monitor circuit produces the same audio signal that is transmitted and monitored by another receiver. (In the AM mode, the signal passes through the SSB filter for product detection.)

The signal taken from the bandpass filter output before Q33 of the RF unit is applied to the first mixer (Q8 to Q11) of the sub receiver via D49. Since the level might be too high, it is attenuated by Q37 when the signal is determined to be too large, and is further attenuated by Q4 in the IF unit. The amount of attenuation in the IF unit can be adjusted by VR1, and the degree of AGC can also be changed.

The sub receiver output SAF passes through IC6 (c/4) and IC10 (d/4) of the AF unit, and is applied to IC8 (a/2) via the monitor control. It is amplified and routed in the same manner as an signal. To cut off noise entering IC8 when transmissions are not monitored, analog switch IC6 (b/4) is shorted to ground until the monitor circuit is again turned on.

2) FM mode

The signal output (pin 2), having passed through the clipper and preemphasis circuit in the FM microphone amplifier circuit (X59-3000-03), is applied to the deemphasis circuit. The resulting signal passes through IC10 (c/4), applied to the IC10 (d/4) input (pin 10), and is amplified and routed as for the other modes.

CIRCUIT DESCRIPTION

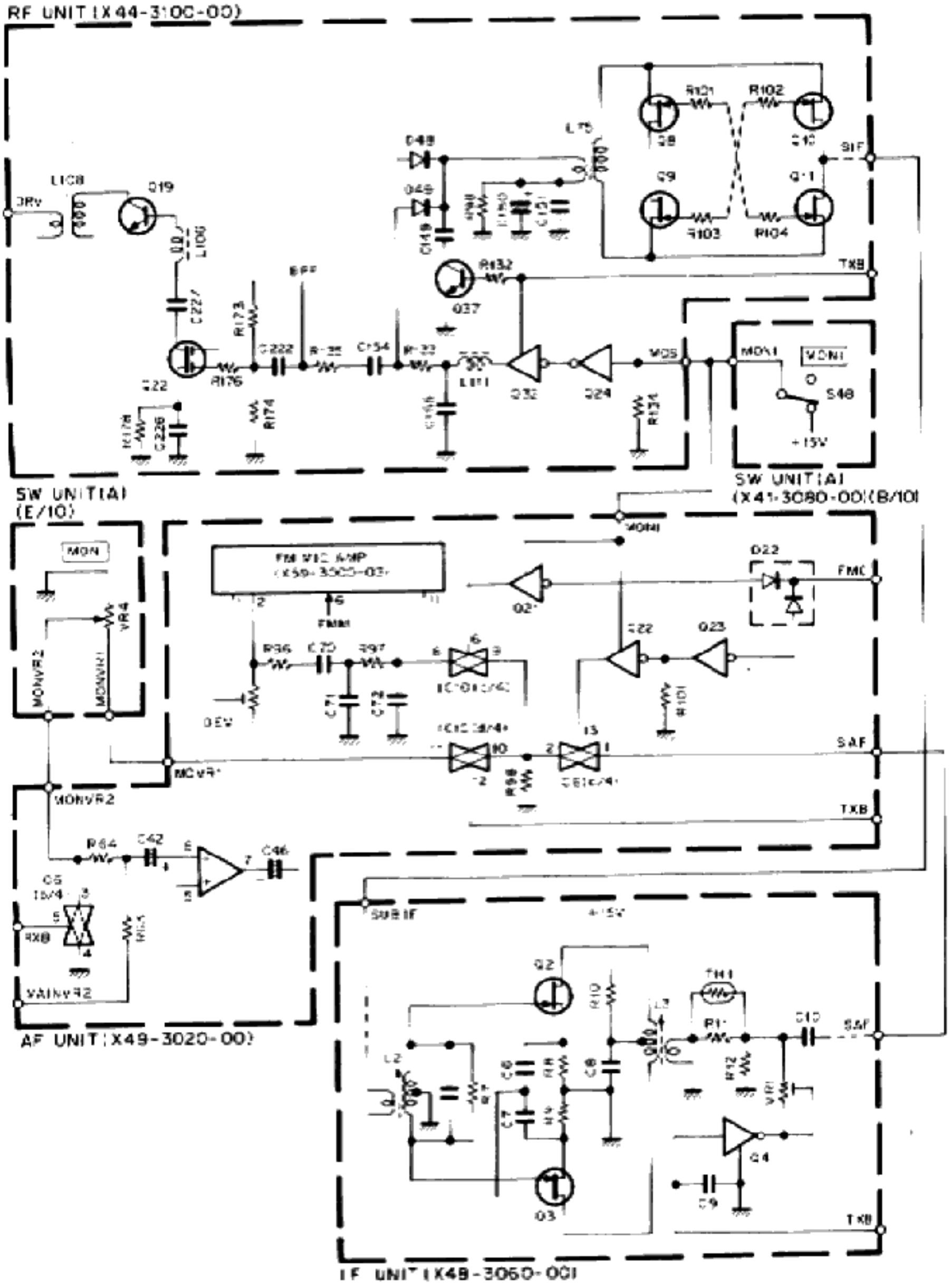


Fig. 9 Monitor circuit

CIRCUIT DESCRIPTION

• Side tone generation circuit

The AFT signal (80 kHz when the PITCH control is at the center; the frequency is changed within ±50 kHz by turning the control; 150 kHz in the SSB model) generated by the CAR unit is rectified by Q1. The square wave of 800±500 Hz divided to 1/100 by IC1 is applied to switched capacitor filter IC3 to obtain a sine wave interlocked with the CW receive pitch.

The 40±25 kHz obtained by dividing the AFT signal in halft with IC1 is sent to the clock that determines the center frequency of IC3.

Keying the transceiver switches Q7 via the KEY line from the control unit (high when the key is down). This forward biases muting transistor Q6 to produce the intermittent sine waves.

When the monitor is on, Q6 is biased through R27 and side tone is turned off.

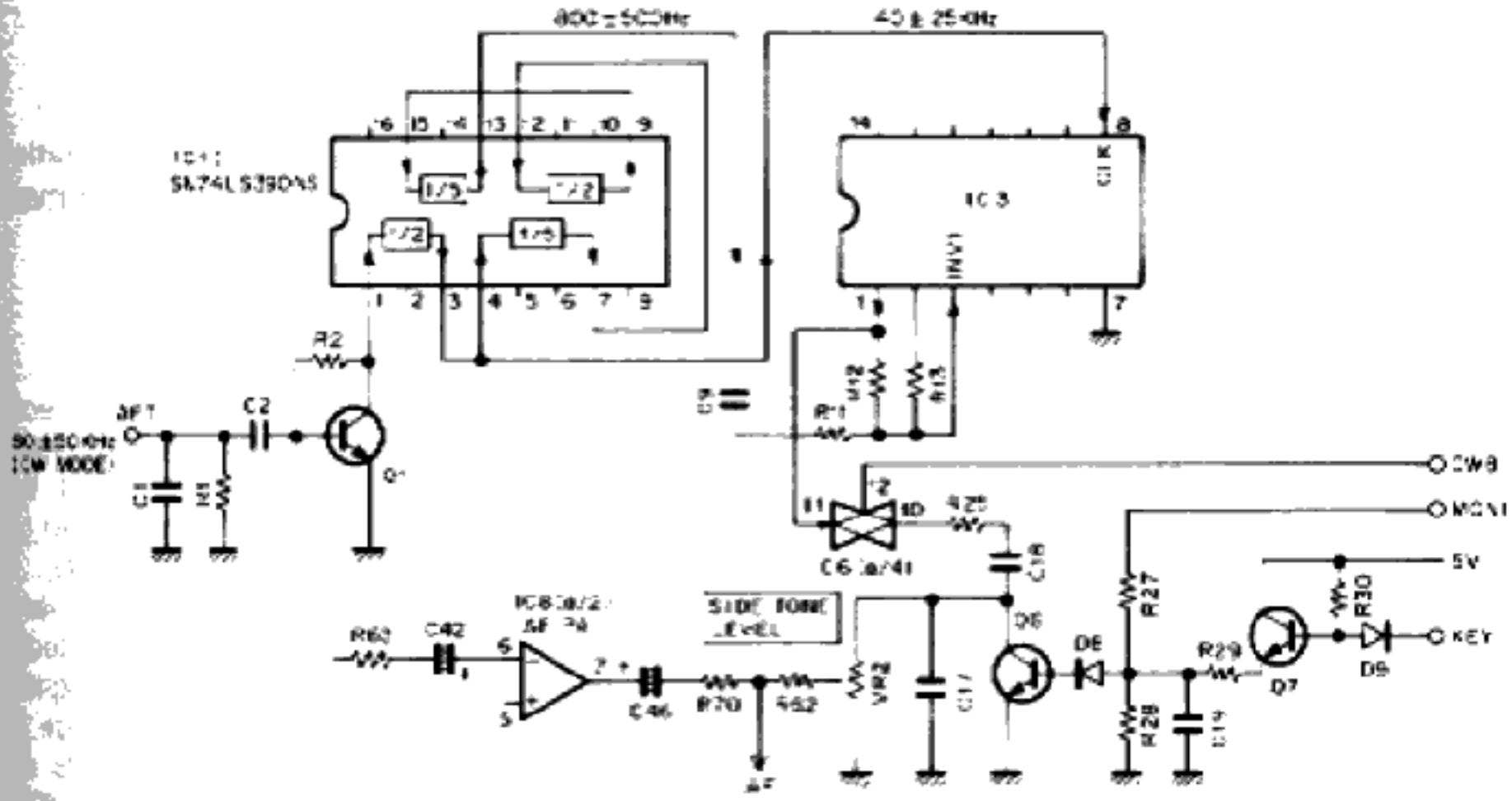


Fig. 10 Side tone circuit

• AF VBT circuit (AF unit)

Filter IC2 (MF10CCWM) is inserted into the AF amplifier circuit in order to eliminate radio interference. This circuit functions only in the CW mode when the AF TUNE switch is on.

The center frequency of this filter is changed when the pitch of the receiver side tone is varied with the PITCH control. The Q of the filter circuit can be changed in conjunction with the AF VBT control.

When SSBC or FSKC goes low in a mode other than FM or AM, Q3 turns on via D3, and C5 (a/4) and (b/4) turn on. When CWB goes high in the CW mode, IC5 (a/4) and (b/4) turn on via R20 and D1. (Preventing the signal from passing through filter IC2.)

If the AF TUNE button is pressed, AFTSW goes high, Q4 turns on, and IC5 (a/4) and (b/4) turn off. Since CWC is low, Q5 turns on and IC5 (c/4) and (d/4) turn on. The output of the filter circuit selected by IC2 is controlled by analog switch IC5.

The center frequency (fc) of the filter is 1/50 the clock frequency. 40±25 kHz is obtained by rectifying the AFT signal of 80±50 kHz (in the CW model with Q1 and dividing it in half with IC1. This signal is used as the clock in the same way as with the side-tone generation circuit, and fc is 800±500 Hz and is changed via the PITCH control.

The passband width can be varied with the AF VBT control that is connected between pins 17 and 18 of the main receiver. The passband width can be varied with potentiometer VR1 (10 kΩ) in the sub receiver. It can be adjusted to within ±100 Hz.

Filter IC (MF10CCWM), IC2, used here contains two blocks consisting of an active filter (IC3 (MF5CWM) used in the side tone circuit). Various additional filter configurations can be formed by using external resistors. The center frequency depends on the clock frequency. The filter characteristics and clock frequency can be adjusted and set at will according to the ratio of the external resistor values.

CIRCUIT DESCRIPTION

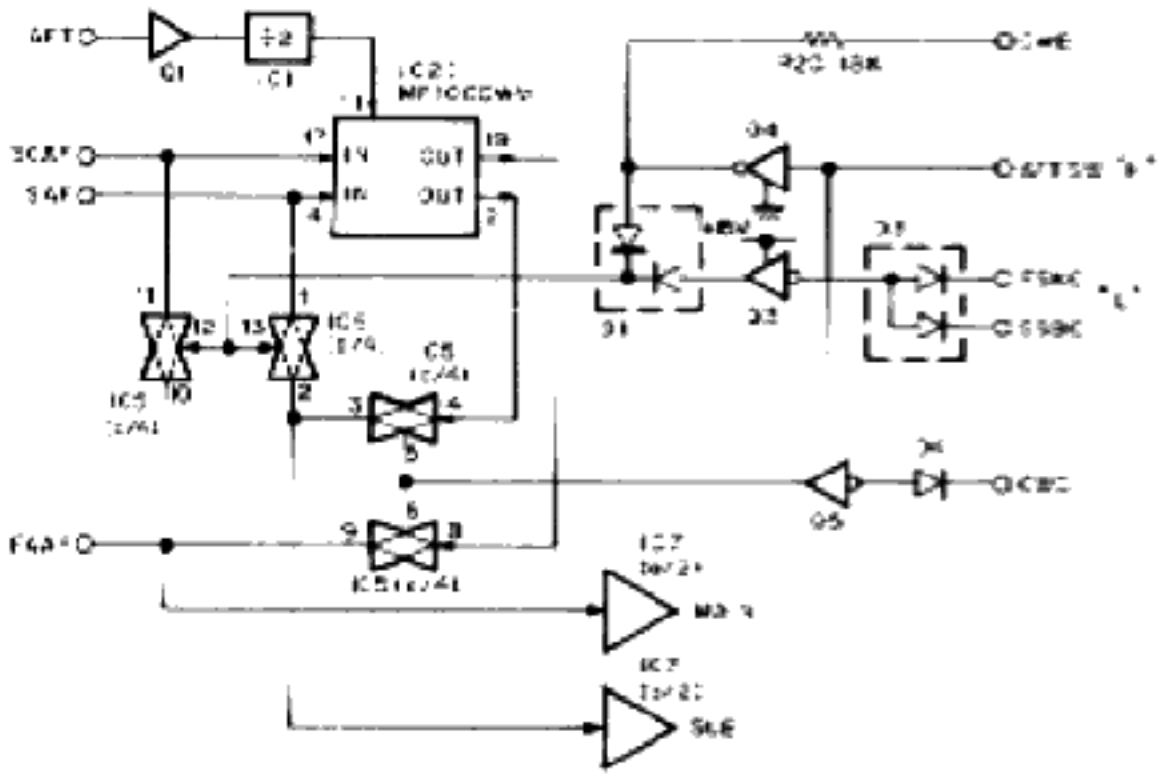
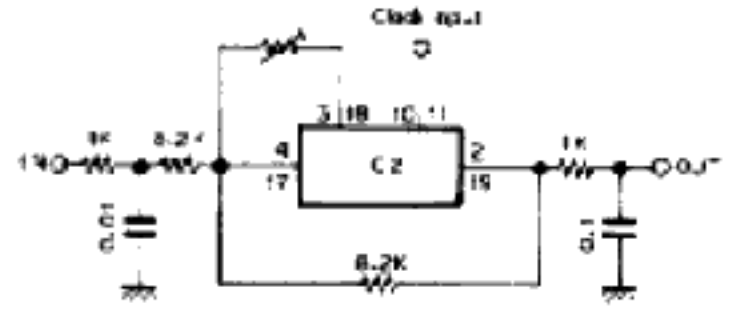


Fig. 11 AF VBT circuit



Terminal function of IC2

2, 19	:	Bandpass filter output
3, 18	:	Connection of resistor for changing Q
4, 17	:	Input
5, 16	:	Analog ground (+5 V)
7, 8	:	Power supply (+10 V)
10, 11	:	Clock input

Fig. 12 Basic configuration of IC2 (MF10CCWM)

- **Auto antenna tuner**

When the AUTO/THRU switch is set to AUTO, ATA goes low, the AUTO/THRU switching relay K1 closes, and the AT is inserted to prepare for tuning.

When the AT TUNE is turned on, ATS goes high and Q10 turns on. If the VSWR is greater than 1.2, Q7 also turns on. A pulse with the appropriate duty cycle for the VSWR is obtained from the pulse control circuit consisting of IC8 and IC7 (a/2) and is used to drive Q5 and turn Q4 on and off. This produces the motor control signal that controls the motor drive ICs (C4 and IC5). The output from the collector of Q7 is directed to the digital unit as an "OK" signal (low when tuning is completed) indicating the completion of AT tuning. ATS is also fed to the RF unit. The transmitter output during tuning is limited to aproximately 10 W.

The VSWR is calculated from the forward wave and reflected wave voltages VSF and VSR, and detected by filter unit L1 via the microprocessor in the digital unit. The VSWR is converted to an analog voltage in the range of 0 to 5 V according to the results of this calculation, and is then apolied to the VSWR line.

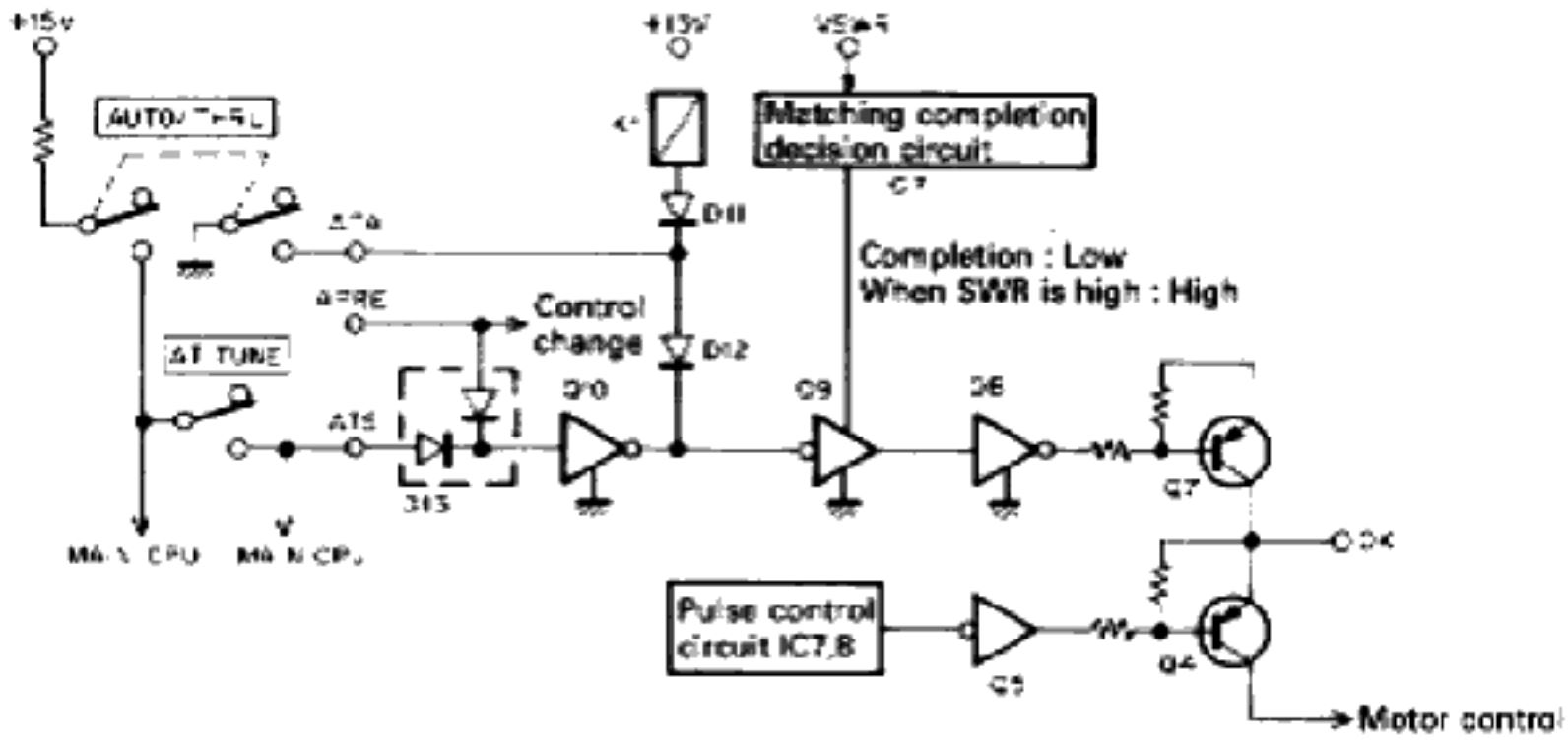


Fig. 13 Auto antenna tuner circuit

CIRCUIT DESCRIPTION

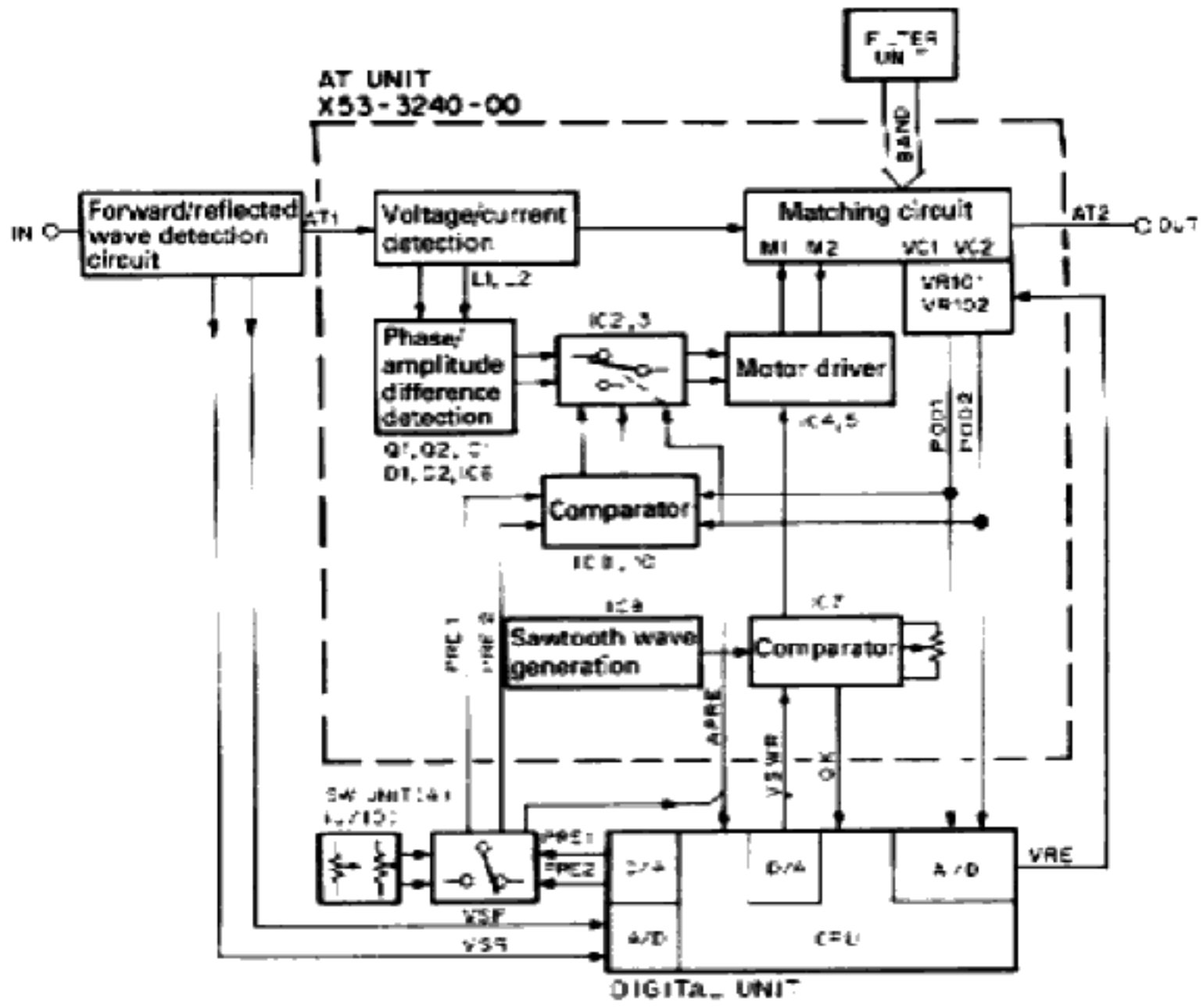


Fig. 14 Auto antenna tuner block diagram

1) Auto tuning mode

The transmitter power from the final unit, via the filter unit, passes through the current/voltage detection transformers L1 and L2, which make use of a toroidal core. The current and voltage components detected here are rectified by a waveform rectification circuit consisting of D4, Q1, and D7, and Q2, and are then phase-compared by IC1 (SN74S74N). The output signals from pins 6 and 9 of IC1 ($\overline{Q}$ and Q) pass through the switch by IC2 (TC4066BP), and are applied to motor drive IC (IC4). Variable capacitor VC1 is turned by motor M1 so that the phase difference of the voltage and current components decreases.

The voltage and current components detected by L1 and L2 are rectified by germanium diodes (1N60) D1 and D2, and are applied to the voltage comparison circuit IC6 (NJM2903S) as the amplitude component of the signal. The comparator output passes through the switch by IC3 (TC4066BP). Motor M2 is driven by another motor drive IC, IC5 (BA6109L2), which is used to turn variable capacitor VC2 in the direction that decreases the amplitude difference of the voltage and current components.

Therefore, variable capacitor VC1 adjusts the capacitance of the circuit so that the current and voltage phases match. Variable capacitor VC2 adjusts the resistance of the circuit so that the current and voltage amplitude difference decreases.

The voltage standing wave ratio (VSWR) is calculated by the digital unit from the forward wave and reflected wave that is detected by the filter unit. The VSWR signal, which is 0 to 5 V according to the calculated results, is applied to SWR comparison circuit IC7 (b/2). Voltage corresponding to an SWR of 1.2 is applied to the reference voltage pin (pin 7) of this comparison circuit via the potentiometer. When the actual SWR value is 1.2 or higher, the output pin (pin 8) of SWR comparison circuit IC7 (b/2) goes high, Q8 turns on, and motor drive voltage control transistor Q7 turns on. Emitter Q4 has approximately 15 V. This voltage is output to the digital unit as a signal indicating tuning (high) which lights the AT TUNE LED.

The sawtooth wave generated by IC8 (NE555C) is applied to the inverted input pin of IC7 (a/2). The VSWR signal that was described previously is applied to the non-inverted input. Therefore, as the SWR decreases, the output of IC7 (a/2) changes from a continuous waveform to a continuously changing pulse with a relatively small duty cycle. This waveform drives Q5 and Q4 as the motor drive voltage.

CIRCUIT DESCRIPTION

Through the use of these circuits, when the SWR is 3 : 1 or more, the motor runs at high speed since the duty cycle of the motor drive voltage pulse is 100%. When the SWR is approximately 2 : 1, the duty cycle becomes approximately 50%, and the motor runs at low speed.

The matching circuit used in the tuner is a T-type. The tap position from 1.8 to 30 MHz is controlled by eight relays, K101 to K108.

Position detection potentiometers VR101 and VR102 are linked to the rotation axes of variable capacitors VC1 and VC2 with a gear ratio of 1 : 1. Voltages of 0 to 5 V (POD1 and POD2) are generated according to the position of the variable capacitors. This position data is applied to variable capacitor angle control comparators IC9 and IC10, and is used as the reference voltage in the feedback control system which is used for preset tuning and manual tuning. The same signal is also directed to the A/D converter of the digital unit, and used for preset data and to signal the completion of tuning.

The potentiometer used here is not an control that rotates 360 degrees. Since the rotation angle of this potentiometer is limited, the rotation range is from the minimum capacity to the maximum capacity plus a little extra for headroom.

Through this control, like preset tuning, which will be described later, POD1 and POD2 are monitored by the microprocessor. If the lower limit voltage of 0.6 V or the upper limit voltage of 4.2 V is reached, the microprocessor detects that the voltage is close to one of its limits. To return the voltage to the opposite side, the APRE line is switched high. For VC1, if the voltage is close to the lower limit with respect to PRE1, the voltage near the upper limit is output. If the voltage is close to the upper limit with respect to PRE1, the voltage near the lower limit is output. The other variable capacitor VC2 outputs the voltage read by POC2 to PRE2 as it is.

If the variable capacitor voltage exceeds the specified limit, it is returned to the opposite limit. The other variable capacitor remains in the same position.

2) Manual tuning

When AUTO/MANUAL select switch S62 of the switch unit (A) (J/10) is set to MANU, the signal applied to PRE1 and PRE2 is switched to the manual tuning potentiometers VR8 and VR9 via analog switching IC, IC1. Simultaneously a high signal is applied to the APRE line, causing Q3 of the AT unit to turn on, and the control switches of IC2 and IC3 are switched to PRE1 and PRE2. Potentiometers VR8 and VR9 generate approximately 0.4 to 4.5 V, which is applied to another input of each variable capacitor angle control comparator, IC9 and IC10, and is compared with the position data. Feedback control is performed so that the voltages match.

3) Preset tuning

When auto or manual tuning ends (the OK signal changes from high to low), and the voltage of POD1 and POD2 is placed in memory as preset data for that band by the microprocessor. When the band is changed, even if tuning is performed in another band, VSWR and APRE go high, and preset tuning is performed by the feedback control system. If the microprocessor detects that PRE1 and PRE2 match POD1 and POD2, the VSWR returns to its original value (the last SWR value calculated), and APRE goes low. The auto control system becomes effective. (The initial preset data when the microprocessor is reset includes standard data for a 50Ω load on each band.)

CIRCUIT DESCRIPTION

• Standby control and timing

Standby control and timing are performed by the control unit (X53-3230-00). The input control signals include the following :

SS : Standby switch. Active low.
$\overline{SS}$: Inverted SS. Base for producing each timing voltage.
CSS : Standby signal to the microprocessor. Active low.
ATS : Standby signal from ANT TUNER. Active high.
ESS : Standby signal from the personal computer control. Active high.
KEY : Keying signal from the keyer. Active low.
KSW : Signal indicating whether a key is inserted in the key jack. GND: Key is inserted.
TXI : Transmission disable signal from the microprocessor. Low (Disabled.
VOXQ : Standby signal from VOX. Active high.

The output control signals include the following :

CTXB : Signal that generates TXB (transmission 15 V). Active high.
TXB : Transmission 15 V
KYB : Keying signal generated by keying. Active high.
CKY : Keying signal with timing. Active high.
RXB : 15 V in receive mode. Same timing as inverted TXB.
RBC : Receive control signal with timing. Active low.

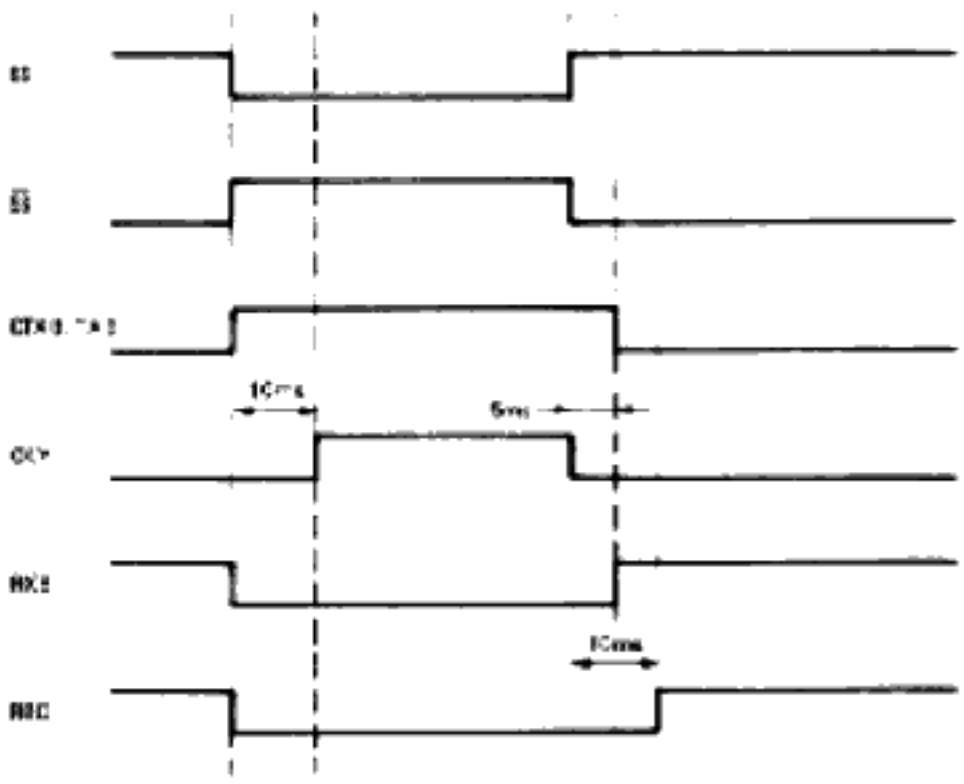


Fig. 15 Basic timing chart for standby

1) Manual standby (other than CW)

• RX to TX switching

Occurs when the standby switch is pressed and the SS line is grounded. If pin 5 (TXI) of the CWT module (X59-3660-00) is high transmit is possible, Q203 and Q202 in the module turn on and 15 V is applied to pin 2 from the collector of Q202. Voltage $\overline{SS}$ passes through pin 5 of IC13 and D16 and is applied to pin 2 of the TRX module (X59-3680-00) as CTXB. This signal turns on Q153 and Q152 and generates TXB from pin 5. The collector of Q152 goes high, Q154 turns on, Q155 and Q151 turn off, and RXB from collector of Q151 turns off.

• CKY generation

SS forces pin 2 of IC6 high, and triggers pin 4, the A input pin, of IC10 one-shot multi-vibrator. The $\overline{Q}$ output is low for 10 ms and then goes high. As a result of this pin 3 of IC6 goes low 10 ms after the standby switch is pressed. The signal is then applied to pin 11 of IC5, and the inverter output is felt on pin 10.

The CWB line applied to pin 13 of IC5 is high in the CW mode and is low in other modes. This causes the inverter output on pin 12 to always be high.

Pin 5 of IC4 is high during full break-in, turning the analog switch on. Pin 13 of IC4 is high during semi-break-in, turning the analog switch on. CKY is output 10 ms after SS with the same timing from pins 2 and 3 of IC4 regardless of semi-break-in or full break-in status.

The CKY signal is generated, and a bias is applied to the second transmit mixer. Meanwhile, the signal is applied to pin 4 of the ALC module (X59-3700-00) via D17, passed through integration circuit Q251 for waveform shaping, and matched with the negative ALC signal to produce the FET gate bias for the transmitter IF.

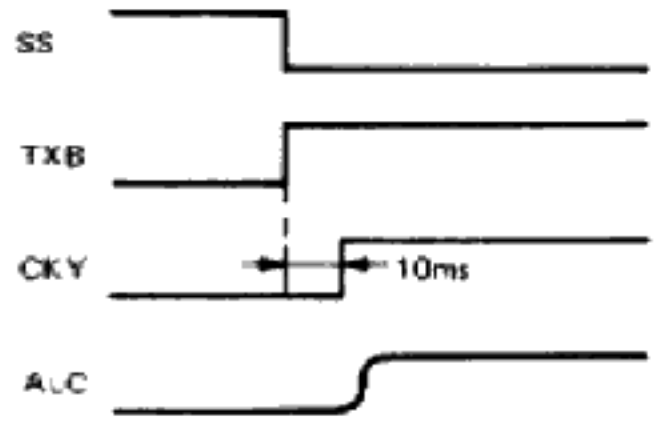


Fig. 16 CKY generation

CIRCUIT DESCRIPTION

- **TX to RX switching**

When the standby switch is turned off, Q203 and Q202 of the CWT mocule (X59-3660-00) are turned off, and the $\overline{SS}$ signal changes from high to low. D16's anode changes from high to low 5 ms after the $\overline{SS}$ signal changes since there is a 5-ms time constant circuit composed of R43, R44, and C37 attached to for the output of pin 2 of IC13.

Therefore, the cathode of D15 CTXB switches from transmit to receive , and TXB goes low 5 ms after the standby switch is turned off.

When TXB goes low, Q154 of the TRX module (X59-3660-00) turns off, Q155 and Q151 turn on, and RXB rises.

- **CKY down**

When $\overline{SS}$ goes low, pin 2 of IC6 goes low, pin 3 goes high, pin 10 of IC5 goes low, and the CKY output goes low. Thus, the CKY signal changes from high to low when the standby switch is turned off.

The ALC waveform output from the ALC module rises according to the time constant of the integration circuit.

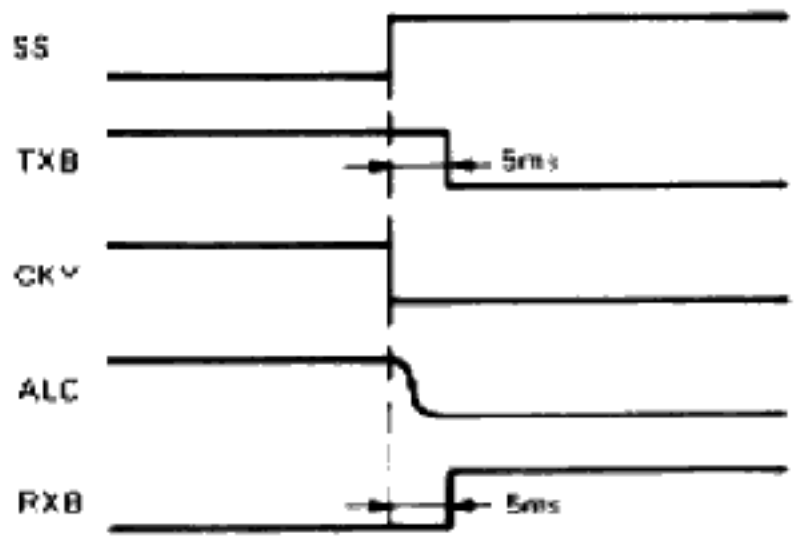


Fig. 17 CKY down

- **RBC generation**

When CTXB line changes from high to low, pins 9 and 11 of IC13 go low, and the NAND gate output at pin 4 changes from high to low 5 ms after CTXB goes low; i.e., RXB rises according to the time constant circuit provided ahead of pin 8 of the inverter output.

The RBC signal is connected to the base of an NPN transistor. This transistor switches the 455-kHz receive IF circuit to ground. The receiver operates only when RBC is low.

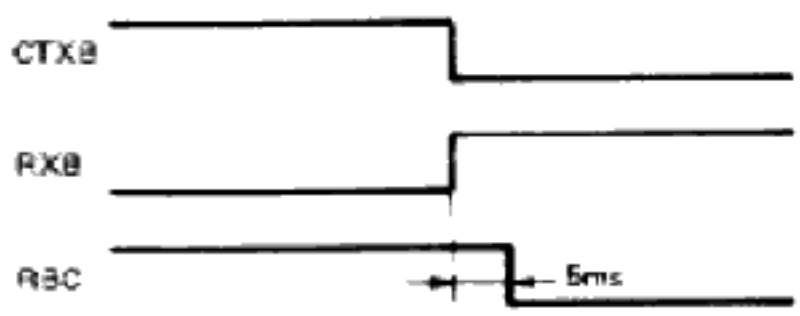


Fig. 18 RBC generation

- **PLL data and transmit/receive timing signal**

As explained earlier, the SS signal is used at the beginning of each operation. PLL data is switched, and diode switch and analog switch settings are changed to assure stable transmission and reception 10 ms after the SS line is grounded, until the last CKY timing signal for transmit has been generated, and for 5 ms after the RXB line rises, until the RBC line goes low.

2) Full break-in timing

- **Generation of the TXB signal at key down**

When the key is inserted into the key jack, pin 9 of the CWT module (X59-3660-00) is grounded, and the emitter of Q208 is grounded.

When the key is down, Q201, Q208, Q206, and Q207 turn on, causing the output of pin 6, KYB, to go high. The KYB signal passes through D11, D23, pins 1 and 2 of IC3, and D22, and forces the $\overline{SS}$ line high. Q7 is turned on via D10, and the CSS line is grounded to notify the microprocessor of the start of transmission.

When the transmit disable signal TXI is low in order to disable transmit, Q205 and Q204 of the CWT module (X59-3660-00) are turned on, and the CWB line is grounded. Q206 and Q207 are turned off, and the KYB line goes low. The $\overline{SS}$ line remains low during this period.

When the $\overline{SS}$ line again becomes high, the CTXB line goes high via D16; therefore, Q153 and Q152 of the TRX module (X59-3680-00) are turned on in order to generate the TXB signal. Meanwhile, Q154, Q155, and Q151 are turned off, and the RXB line switches low.

CIRCUIT DESCRIPTION

· CKY generation

When the $\overline{SS}$ line goes high, pin 2 of IC6 also goes high, and the $\overline{Q}$ output of IC10 goes high after a 10 ms delay. The output of pin 3 of IC6 goes low 10 ms after that.

The output of pin 10 of IC5 goes high and pin 5 of the analog switch of IC4 goes high when in FULL break-in operation. Pins 4 and 3 conduct, CKY goes high, and the second transmit mixer of the IF unit is keyed.

The CKY output enters the ALC module (X59-3700-00) via D15, passes through the integration circuit Q251 for waveform shaping, and is matched with the negative signal of ALC to produce the FET gate bias of the transmit IF.

· Generation of RXB when the key is up

When the key is up, the $\overline{SS}$ line goes low, and the anode of D16 also goes low. Meanwhile, Q7 turns off, and the CSS line goes high to notify the microprocessor of the start of reception.

Since there is a 5-ms time constant circuit composed of R43, R44, and C37 for the output of pin 2 of IC13, the output of pin 4 of IC13 goes from high to low 5 ms after the $\overline{SS}$ line switches. Therefore, CTXB goes low 5 ms after the key goes up, and with a similar delay for the TXB line.

When TXB falls, Q154 of the TRX module (X59-3680-00) is turned off, and Q155 and Q151 turn on, causing RXB to rise.

· CKY down

When the key is up, KYB and $\overline{SS}$ go low, pin 3 of the NAND gate of IC6 goes high, and thus the CKY line goes low.

· RBC generation

The RBC signal is generated in the same way as for manual standby. The RBC changes from high to low 5 ms after RXB rises when the key is released. The receiver operates only when RBC is low.

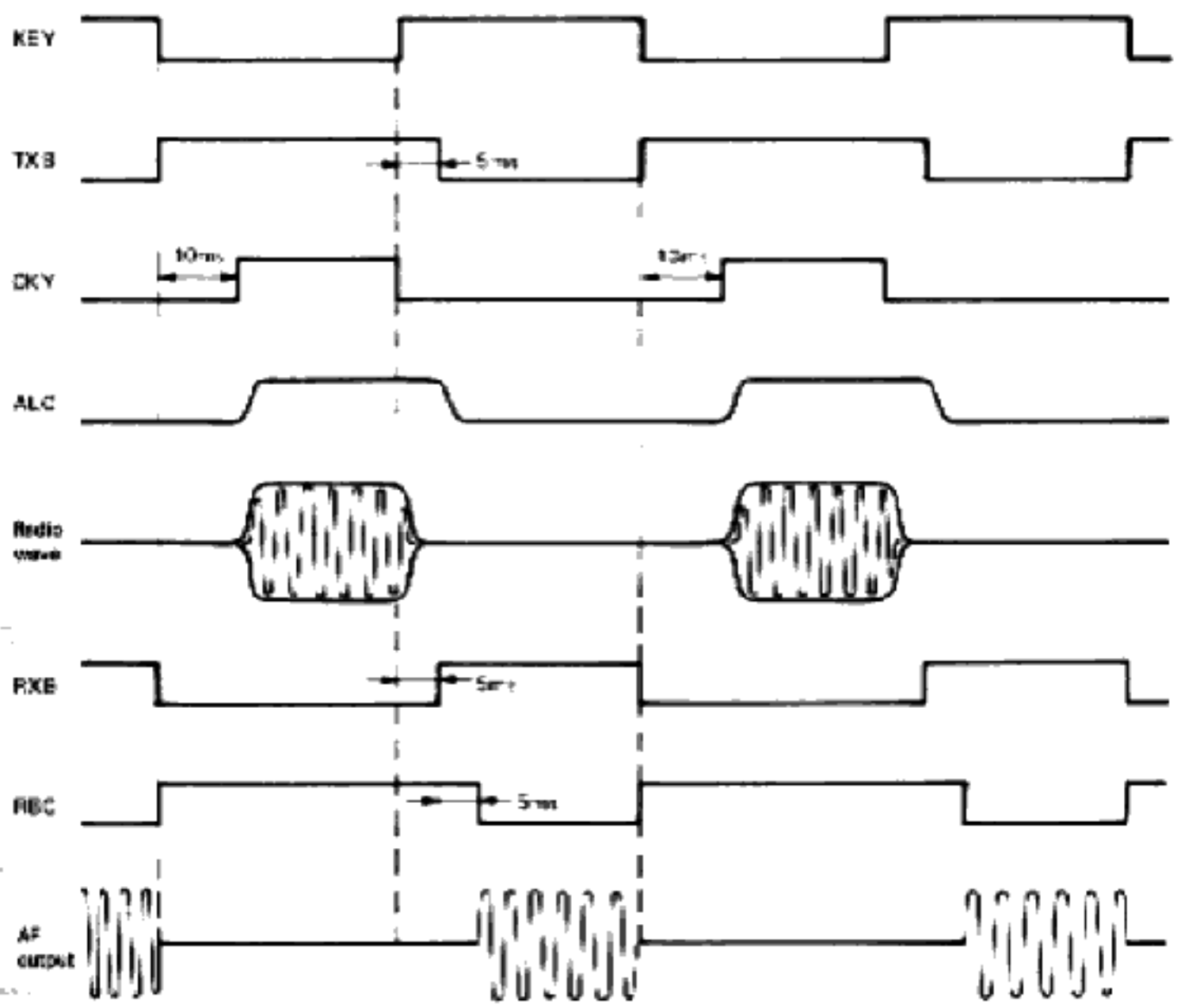


Fig. 19 Timing chart for full break-in

CIRCUIT DESCRIPTION

3) Timing for semi-break-in operation

- **Generation of the TXB signal when the key is depressed**

When the key is down, the $\overline{SS}$ line goes high in similar to the manner described for full break-in.

During semi-break-in operation, pin 5 of analog switch IC3 goes high, and pins 4 and 3 conduct. Q7 is turned on via D26, pins 4 and 3 of IC3, and D10 from the $\overline{SS}$ line; and CSS is grounded to notify the microprocessor of the start of transmission.

TXB is generated from CTXB via D16 from $\overline{SS}$.

- **CKY and transmission hold circuit**

The KYB signal produced by depressing the key triggers the A input pin of one-shot multi-vibrator IC10, and the Q output is high for a period of time.

Since pin 5 of analog switch IC3 is high, pins 4 and 3 conduct. Q7 is turned on via D10, pins 4 and 3 of IC3, and D10 from the Q output; and the CSS line is grounded. CSS is held low for the time determined by a time constant of the one-shot multi-vibrator, or the time constant for semi-break-in.

The KYB signal, having passed through D11, enters pin 11 of IC1, passes through the time constant circuit composed of R51, C38, and R52, and is applied to pin 1 of IC2's NAND gate from the IC1 inverter D21.

Pin 2 ($\overline{SS}$) of IC6 goes high through D27 and pins 4 and 3 of IC3 while the Q output of IC10 is high. The $\overline{SS}$ line is held high while IC10 is retriggered by the keying signal.

Therefore, pin 2 of IC6's NAND gate is high. The A input of the IC10 one-shot multi goes high unless $\overline{SS}$ changes 10 ms after $\overline{SS}$ is triggered for the first time $\overline{Q}$ goes high. Pin 1 of IC6 goes high, and pin 10 of IC5 and pin 2 of IC2 go high.

Therefore, the output of pin 3 of IC2, the signal keyed by KYB is generated from pin 2 of analog switch IC4 with a 5 ms delay time and becomes the CKY signal. When the hold time of the IC10 one-shot multi-vibrator has elapsed after the key is released, the Q pin goes low, and $\overline{SS}$ goes low, returning the unit to receive.

4) VOX operation

When one-shot multi-vibrator IC9 is triggered by the output of the VOX module (X59-1080-01) of the AF unit (X49-3020-00), the Q line output goes high and is connected to the control unit (X53-3230-00) by a harness. Q8 is turned on through pins 8 and 9 of analog switch IC3 from connector CN4 VOXQ pin of the control unit, and the SS line is grounded. Subsequent operations are the same as for manual standby.

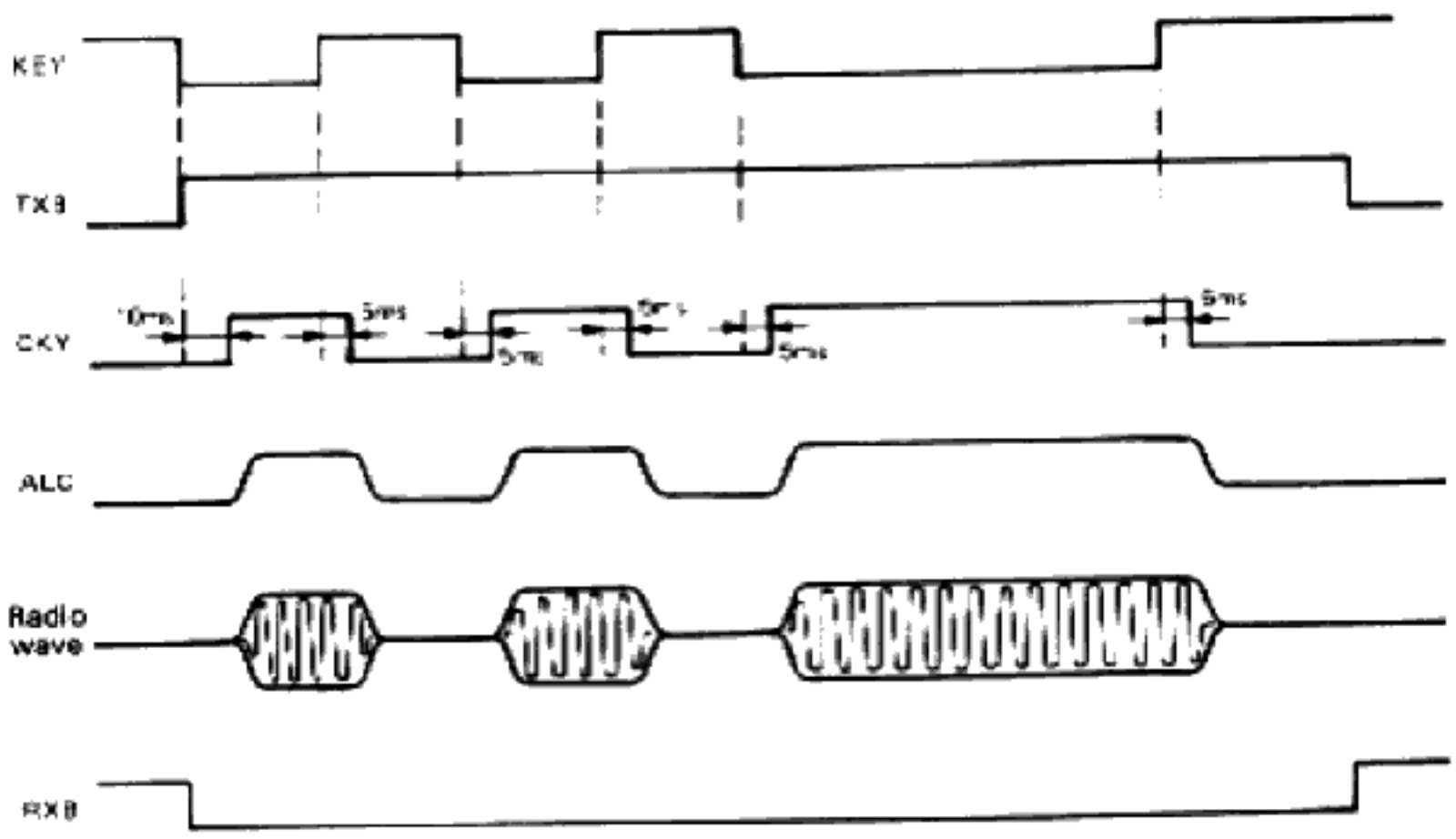


Fig. 20 Semi-break-in timing chart

CIRCUIT DESCRIPTION

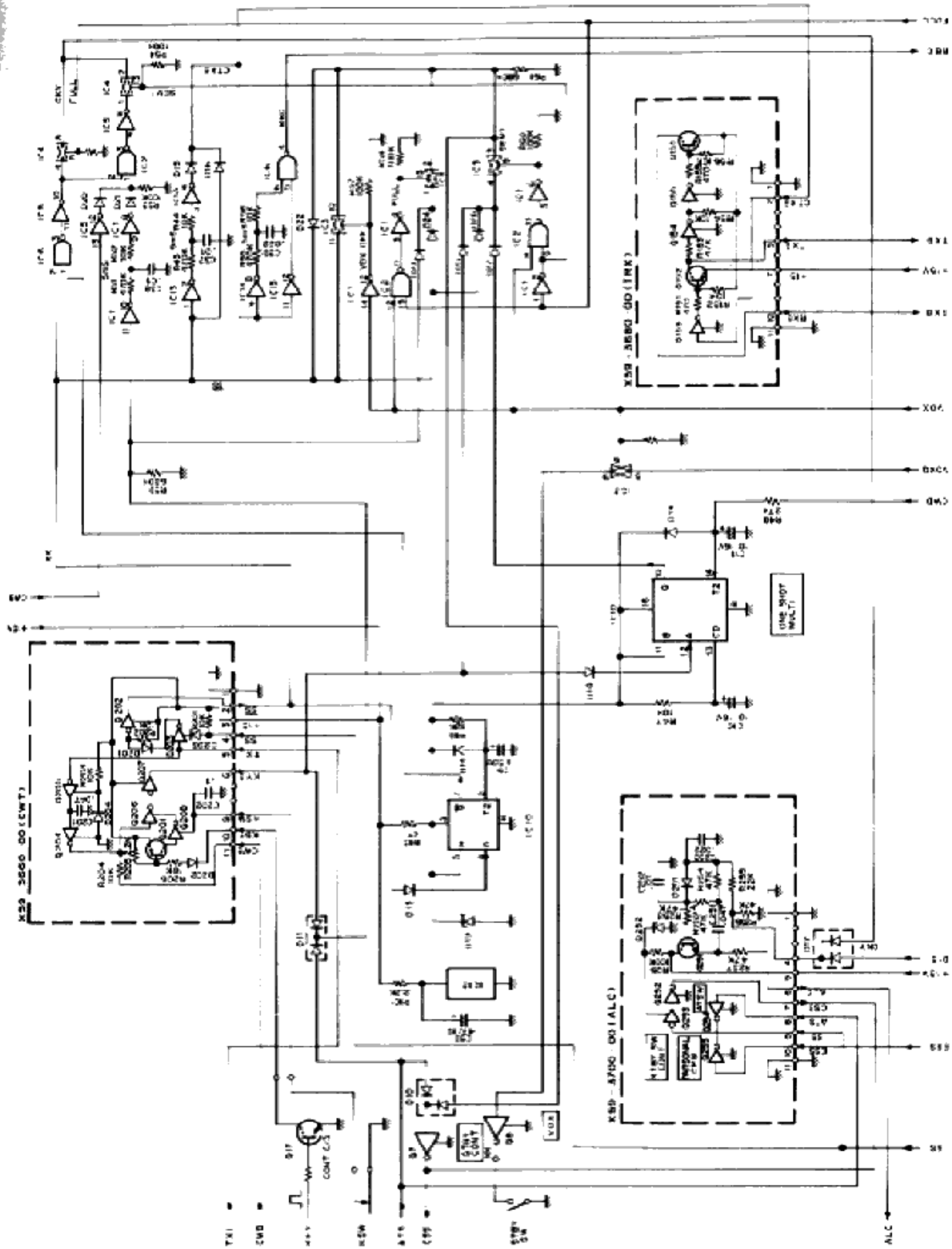


Fig. 21 Standby circuit

CIRCUIT DESCRIPTION

- **Electronic keyer circuit**

The TS-950 contains an electronic keyer circuit so that an electronic key, external electronic keyer or a squeeze paddle can be connected to the CW KEY jack on the rear panel. IC14 on the control unit (X53-3230-00) generates the CW Waveform, and is the major element of the electronic keyer circuit with variable speed and variable weight functions.

When the electronic key switch on the rear panel is off, the keyer circuit functions as a buffer and outputs the signal input from the dot pin to the standby circuit as it is. When the electronic key switch on the rear panel is on, the circuit outputs dot and dash codes according to the operation of the paddle connected to the CW KEY jack.

1) Variable weight function

Electronic keyer microprocessor IC14 has a variable weight function. For normal CW code, the dot/dash/space ratio is fixed at 1 : 3 : 1. This electronic keyer can vary the ratio of dot to dash.

When the auto switch is off, four ratios can be set according to manual weight data WT0 and WT1.

By default, Auto (OFF, WT0, WT1 = OFF, and Short point /Long point /Space is 1 /3 /1.

WT1	WT0	Short point/Long point/Space
OFF	OFF	1 : 3 : 1
OFF	ON	1 : 2.8 : 1
ON	OFF	1 : 3.2 : 1
ON	ON	1 : 3.4 : 1

Table 8

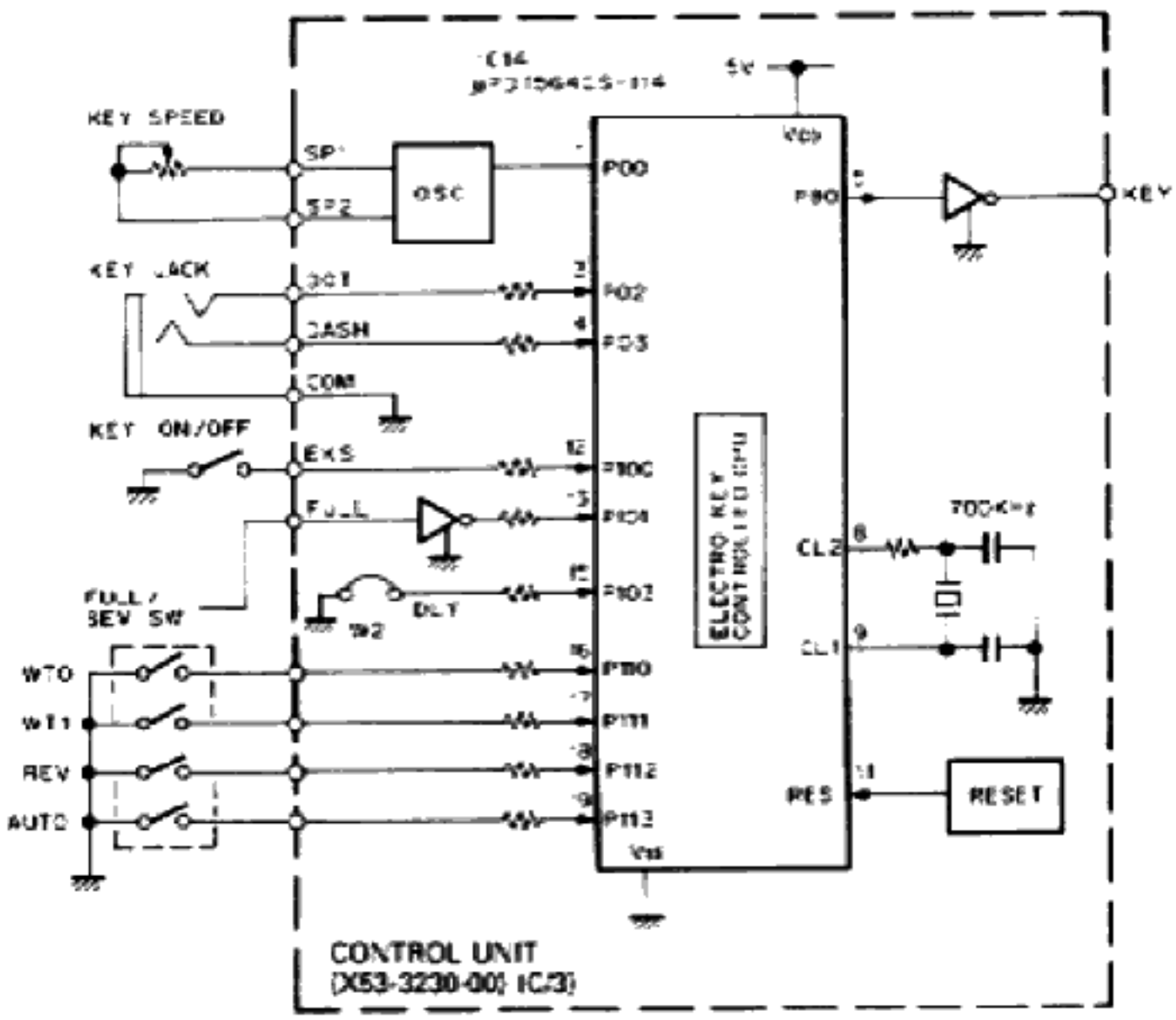
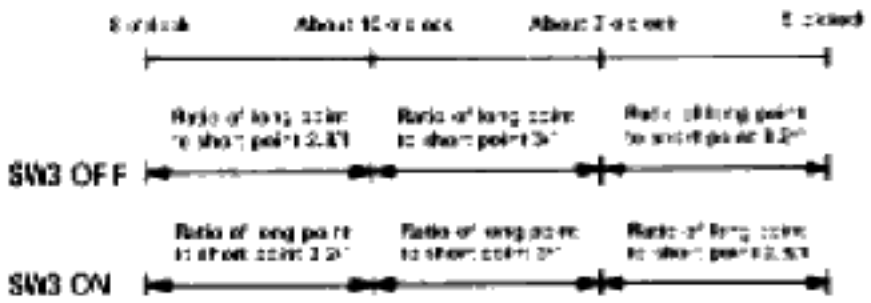
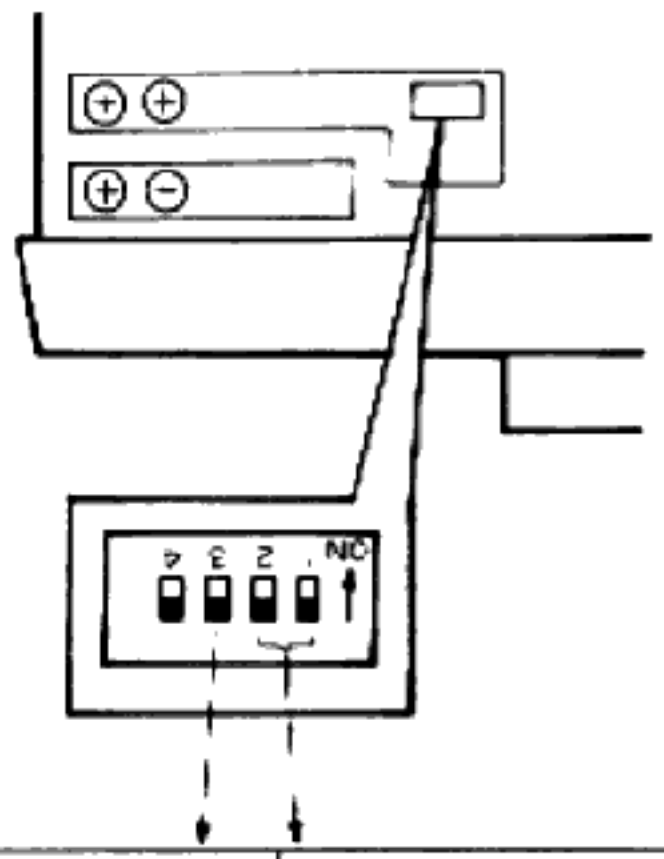


Fig. 22 Block diagram of electronic keyer

CIRCUIT DESCRIPTION

When the auto switch is turned on, the ratio of long point to short point is interlocked with the KEY SPEED VR and can be set automatically. As the keying speed increases, the speed is varied so that the long point is lengthened or shortened. This is selected by the REV switch.





SW4 : ON		SW4 : OFF		
SW3	Automatic setting of long point to short point	SW2	SW1	Fixed ratio of long point to short point
OFF	As the speed increases, the long point is lengthened.	OFF	OFF	1 : 1
		OFF	ON	28 : 1
ON	As the speed increases, the long point is shortened.	ON	OFF	32 : 1
		ON	ON	34 : 1

Fig. 23 Variable weight function by DIP switches

2) Full break-in correction function

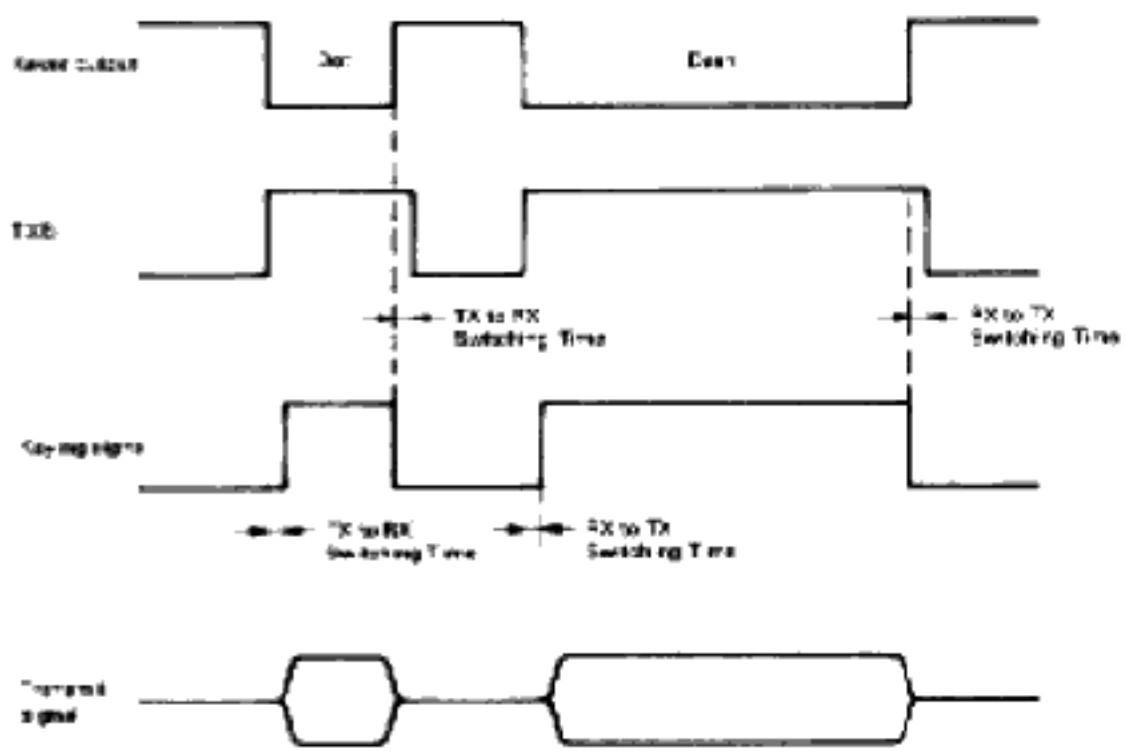
When full break-in operation is performed, the transmit time of the CW signal is shortened by the influence of the time constant of transmit/receive switching, even if keying is performed.

The electronic keyer has a full break-in correction function, which works automatically when the FULL/SEMI switch is set to FULL.

The full break-in correction function lengthens the CW waveform by 1/5 maintaining the dot time, shortens the space by 1/5 the dot time, and changes the duty cycle, while maintaining the lengths of the code and space constant. Thus the transmission signal is generated by taking the transmit/receive switching time into account.

The full break-in correction is effective for the weight-varied code as well.

Radio signal without full break-in correction



Radio signal with full break-in correction

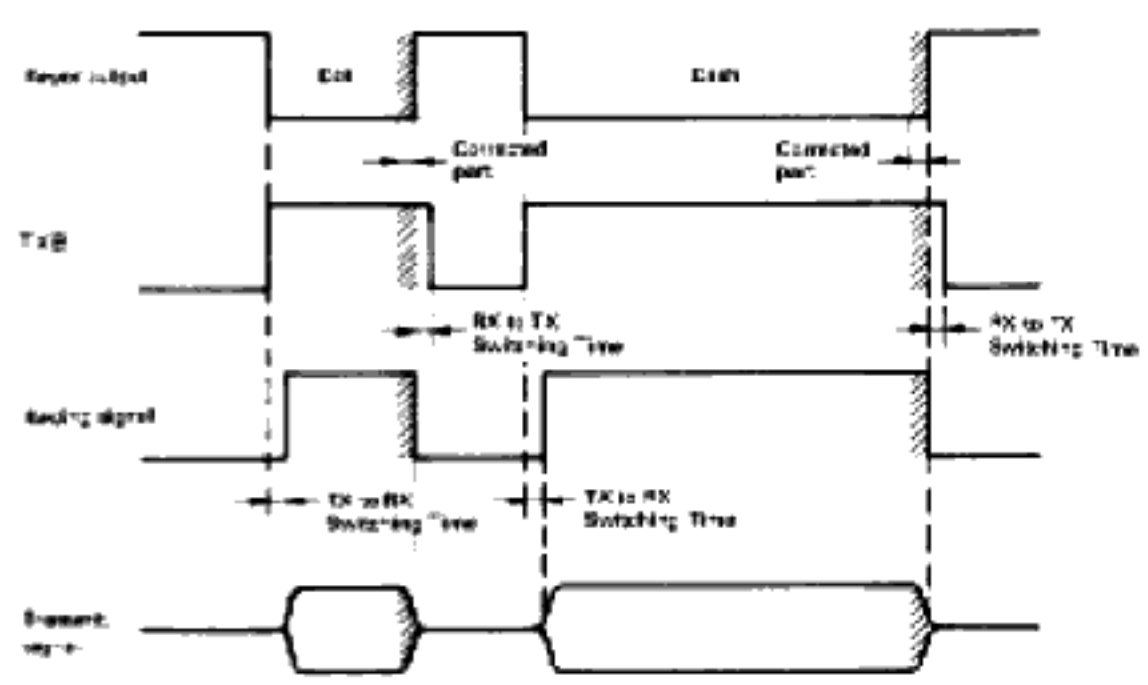


Fig. 24 Full break-in correction function timing chart

CIRCUIT DESCRIPTION

Digital control circuit

The TS-950 digital control circuit has a multple chip configuration centered around IC1 (µPD78C10GI, and consists of a 32K ROM (MBM27C256A), an 8K RAM (TC5564APL), and an I/O port (MB89363B, CXD1095Q). This circuit contro's about 40 different inputs and about 70 different outputs.

A large fluorescent display tube and sub CPU dedicated for the display are used so that the display can be controlled via serial data.

- **Encoder circuit**

Ultra-small magnetic rotary encoders are used as the main and sub encoders. The Mch click encoders that were used in the TS-680 and have gained users favor are installed. The encoder pulse is applied to gate array LZ92K37, and read via the CPU bus. The gate array is selected by the Y3 or Y4 lines. Encoder data is output to D0 to D7 by selecting encoders CK1, CK2 or CK3, and CK4 by A8 (gate array A0), and making RD active. IC12 is used to rectify the waveform.

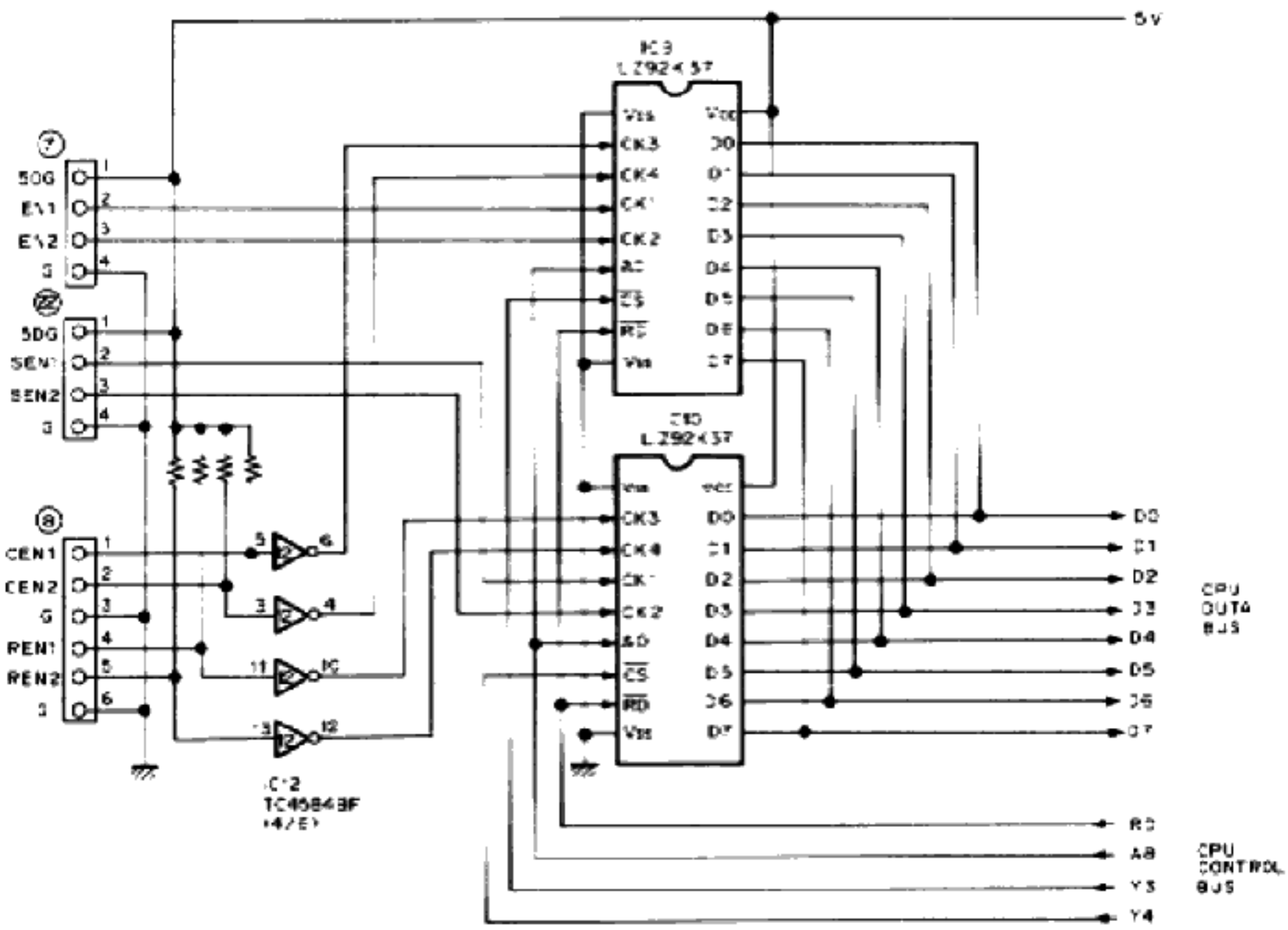


Fig. 25 Encoder circuit

CIRCUIT DESCRIPTION

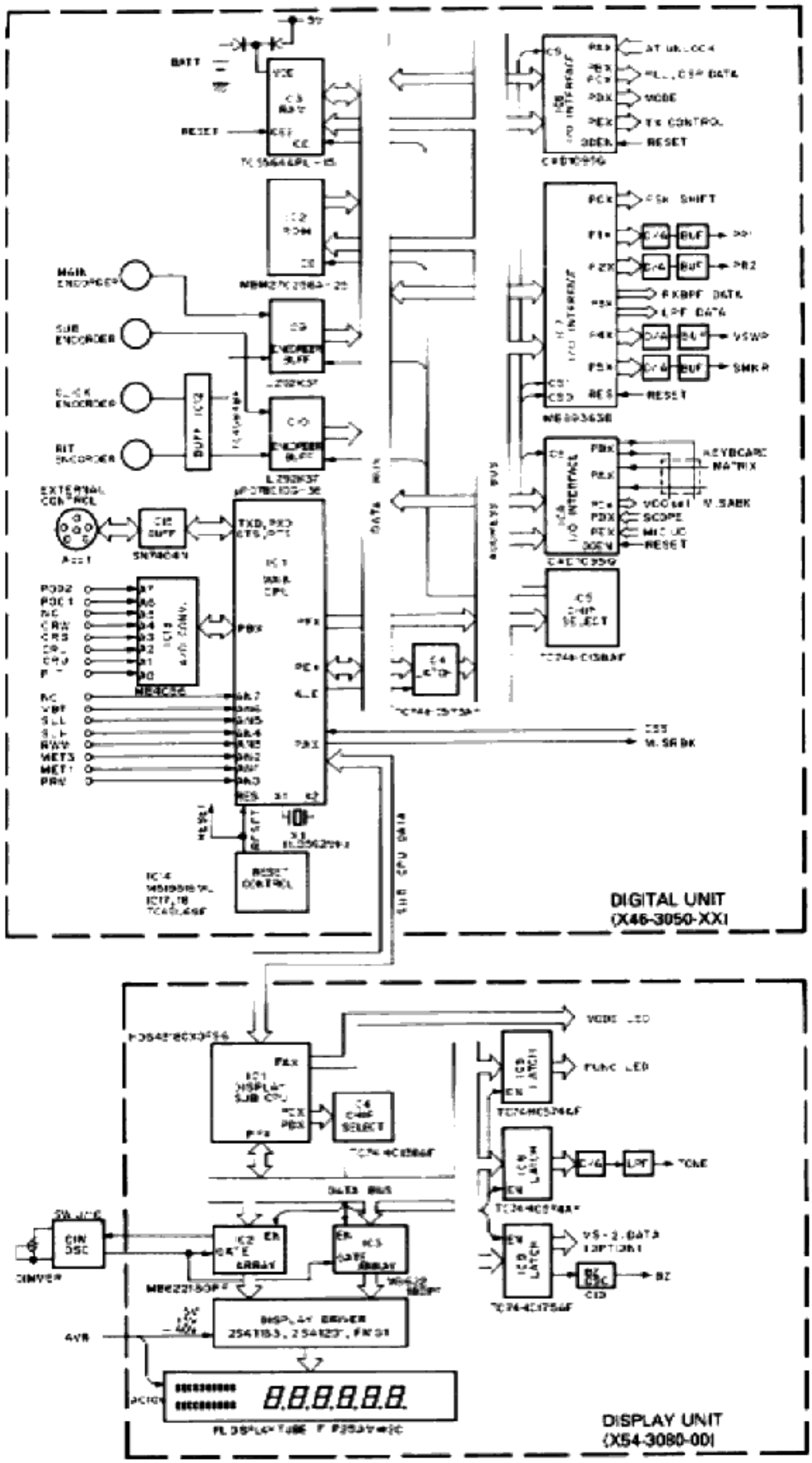


Fig. 26 Digital control block diagram

CIRCUIT DESCRIPTION

- **System reset**

The power supply voltage is detected by the dedicated reset IC M51951BML (IC14). If the voltage is found to be low, the IC outputs a RESET signal to the CPU and I/O to stop operation, and back up the RAM.

When the power supply voltage becomes normal (including power on), the reset is released, the CPU and I/O are initialized after the time constant set by R5 and C18, and operation resumes.

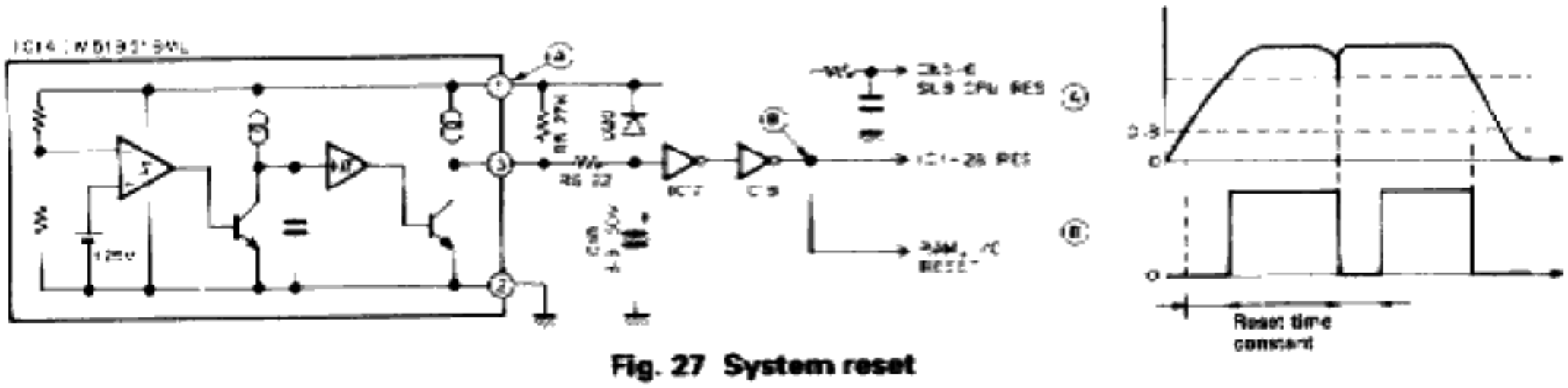


Fig. 27 System reset

- **Address control**

Since PD0 to PD7 of the main CPU have multiplexed address and data signals, the address signal is separated from the data signal by latching the address signal using the ALE signal provided by IC4 (TC74HC573AF).

PF0 to PF7 become the high-order data (A8 to A15) of the address. The address signal of A12 to A15 is used as a chip select signal for each IC by address decoder IC5 (TC74HC138AF).

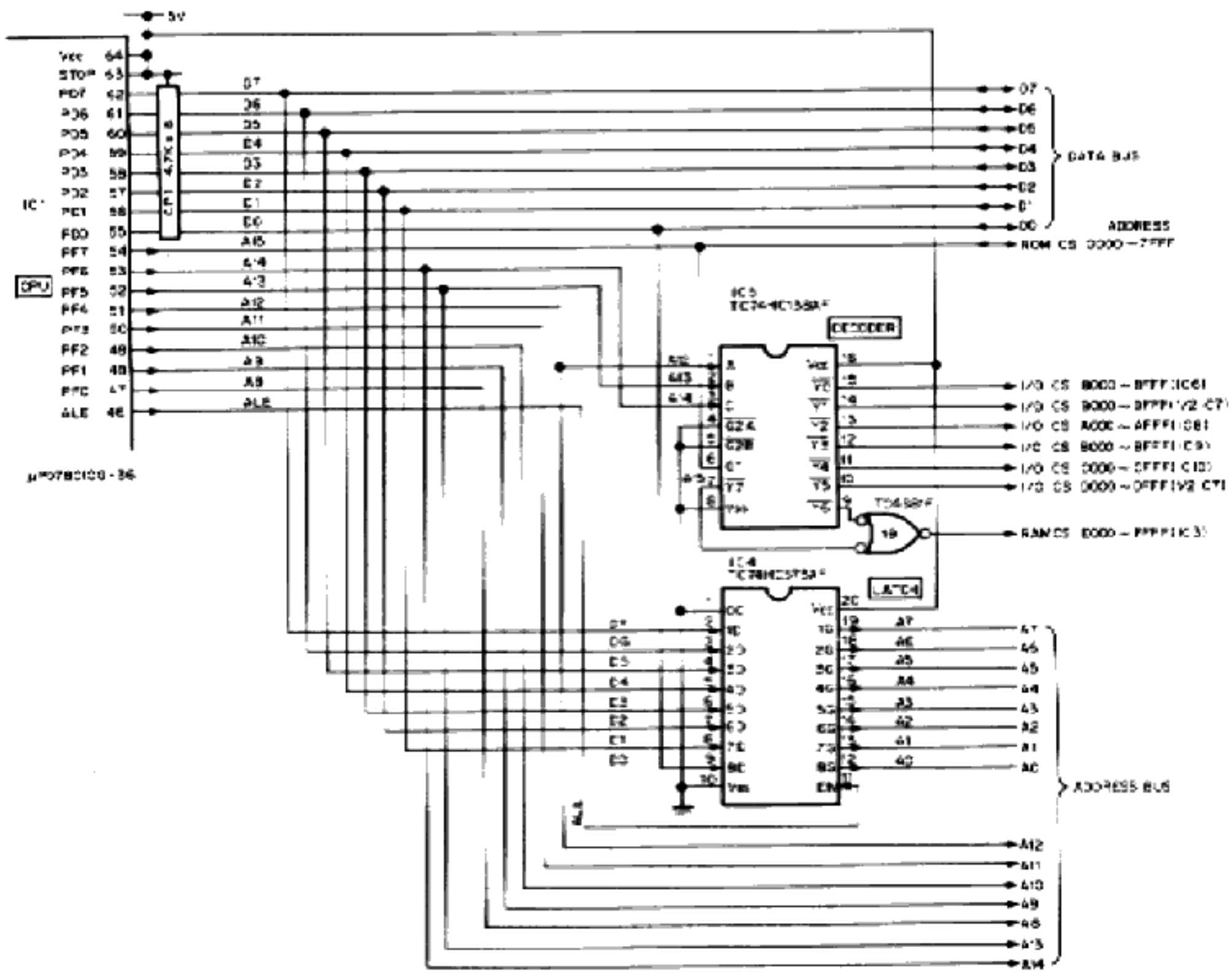


Fig. 28 Separation of address and data, address decoder circuit

CIRCUIT DESCRIPTION

- **Analog signal input**

The main CPU (µPD78C10G-36) incorporates an 8-channel A/D converter, and in addition, has makes use of IC13 (MB4056) for entering 14-channel analog signals. Incoming analog signals are converted to digital values, which are used as digital data.

IC1 : µPD78C10G-36 (CPU)

Port name	Signal name	Description
AN0	PRM	Processor meter voltage
AN1	MET1	S/RF meter voltage
AN2	MET3	ALC/IC meter voltage
AN3	RWM	Reflected wave meter voltage
AN4	SLH	Slope tune high cut amount voltage
AN5	SLL	Slope tune low cut amount voltage
AN6	VBT	VBT amount voltage
AN7	–	Not used

IC13 : MB4056 (A/D converter)

Port name	Signal name	Description
A0	PIT	CW pitch variable voltage
A1	CRU	USB carrier point variable voltage
A2	CRL	LSB carrier point variable voltage
A3	CRS	Sub receiver carrier point variable voltage
A4	CRW	Carrier variable voltage
A5	–	Not used
A6	PCD1	AT variable capacitor 1 position voltage
A7	PCD2	AT variable capacitor 2 position voltage

Table 9 Analog signal input

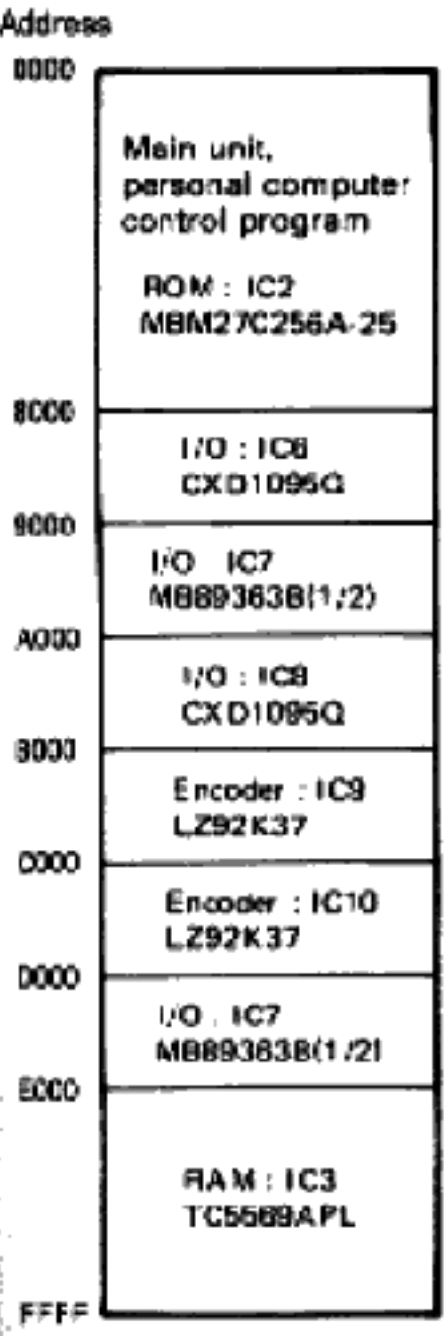


Fig. 29 Memory map

- **Display**

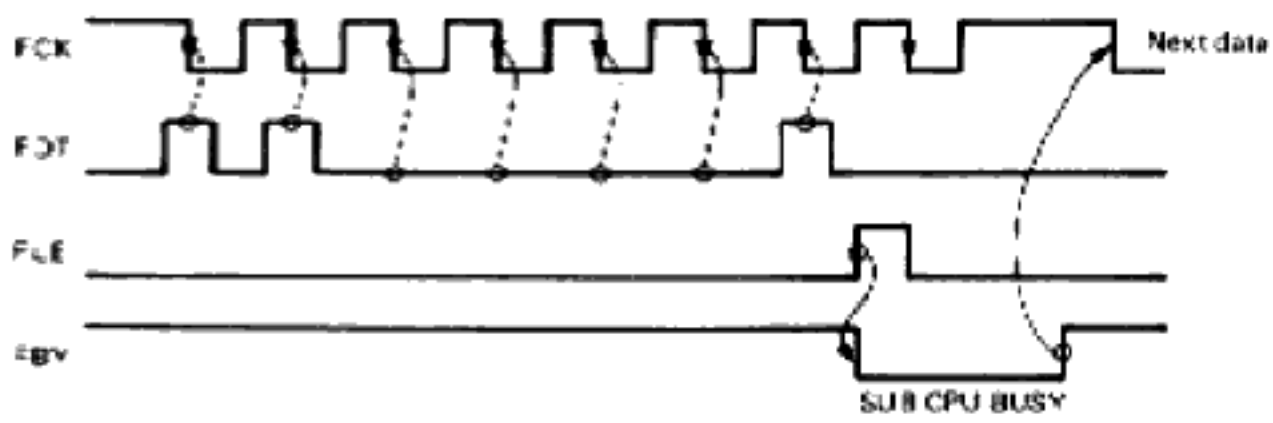
Since the TS-950 uses a large fluorescent display tube combined with a meter, a new sub CPU for the display drive has been developed. The sub CPU is located on the display unit (X54-3080-00), and is controlled by serial commands from the main CPU.

The work load on the main CPU can be decreased by making the main CPU send display data and control data to the sub CPU for display as a serial command, since the sub CPU lights the fluorescent display dynamically.

The sub CPU lights the fluorescent display dynamically according to the command data from the main CPU. Since there are 24 grids, including the meter and sub reception frequency, and the display scan speed is not sufficient to control the grids by itself, the grids are divided and scanned at high speed to avoid flickering. The sub CPU not only drives the display, but also performs other processing, such as repeater subtone synthesis, beeper tone, LED display, and optional VS-2 audio synthesis.

The power required to light the display is supplied by the power supply unit.

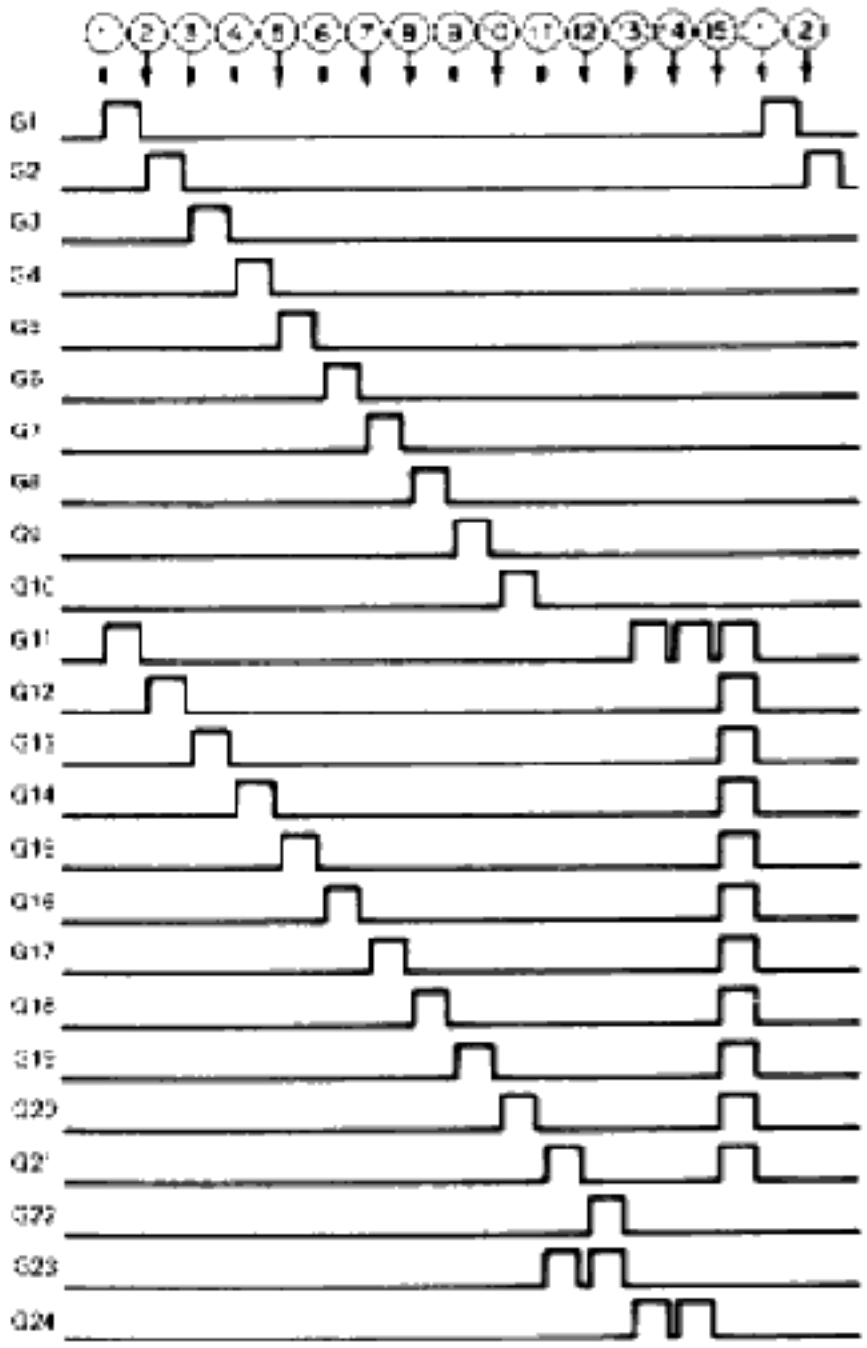
The dimmer functions by varying the duty cycle of the gate array output. A display enable signal is output from the LH pin (CN5-3) of the display unit each time one segment is displayed. This signal changes the duty cycle continuously with the one-shot multivibrator contained in NE555P of switch unit (A) (J/10), and changes the brightness through the gate array.



Serial data is sent from CN5- 8 FCK to CN5-9 FDT.
CN5-7 FLE : The command and number of data items are listed in the command table.
CN5-6 FBY : LSB is the first data, and the FLE (⎍) pulse is required for each byte.
When FBY is high after FLE (⎍), the next byte can be transferred.

Fig. 30 Sub CPU data transfer

CIRCUIT DESCRIPTION



[1] G1 : TX VFO 10Hz, SUB VFO 10Hz, G11 : RIT 10Hzg
[2] G2 : TX VFO 100Hz, SUB VFO 100Hz, G12 : RIT 100Hz
[3] G3 : TX VFO 1kHz, SUB VFO 1kHz, G13 : RIT 1kHz
[4] G4 : TX VFO 10kHz, SUB VFO 10kHz, G14 : "kHz" display
[5] G5 : TX VFO 100kHz, SUB VFO 100kHz, G15 : MAIN VFO 10Hz
[6] G6 : TX VFO 1MHz, SUB VFO 1MHz, G16 : MAIN VFO 100Hz
[7] G7 : TX VFO 10MHz, SUB VFO 10MHz, G17 : MAIN VFO 1kHz
[8] G8 : A, B, M function, G18 : MAIN VFO 10kHz
[9] G9 : Units digit in Mch, G19 : MAIN VFO 100kHz
[10] G10 : Tens digit in Mch, G20 : MAIN VFO 1MHz
[11] G23 : Upper meter, G21 : MAIN VFO 10MHz
[12] G23 : Upper meter, G22 : Filter select
[13] G24 : Lower meter, One of G11 to G21 (Analog scale red pointer)
[14] G24 : Lower meter, One of G11 to G21 (Analog scale red pointer)
[15] No display, All G11 to G21 (Analog scale)
[1] Repeat from [1]

In [11] to [14], the meters (upper and lower) and analog scale red pointer light twice to increase the intensity.
There is a blanking time (whole display off) when the display is switched during each scan. The lighting period is approximately 520 µs (Display illuminated: approximately 470 µs; blanking: approximately 50 µs).

Fig. 31 Timing chart for display lighting (grid only)

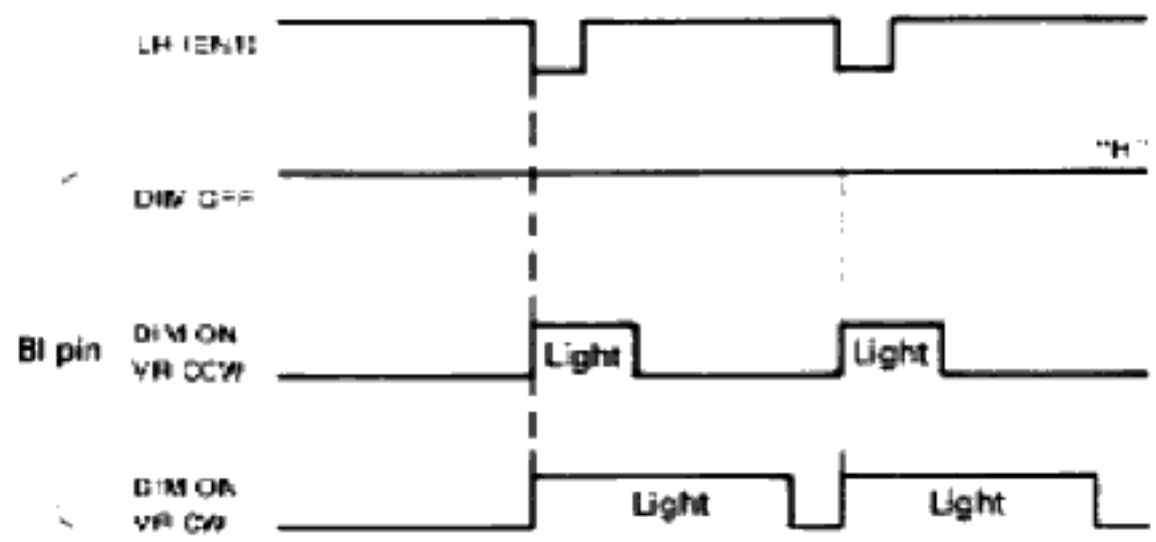


Fig. 32 LH and BI signals for dimmer

CIRCUIT DESCRIPTION

• PLL data

The TS-950 has 10 PLLs (11 PLLs when the DSP-10 is installed).

The main CPU provides PLL data to these PLLs according to the displayed frequency.

Main VFO PLL's	3
Sub VFO PLLs	2
Local oscillator PLL's for frequency conversion	3
Main carrier oscillator PLL	1
Sub carrier oscillator PLL	1
DSP sampling frequency PLL	1
(TS-950SD type or units with DSP-10)	

Since the data of these PLLs may be fixed, it is given only once when the power is switched on.

As the main encoder changes, VCO1, VCO2, and VCO3 change.

As the mode changes, VCO4, VCO8, and VCO9 change.

As the sub receiver frecuency changes, VCO7 and VCO8 change.

VCO5 and VCO6 change via data from the slope tune and VBT.

Ten PLL ICs, excluding the DSP, provide unlock data signals. If one of the PLLs should unlock, the display changes to "....." (decimal points only) to indicate that the PLL is unlocked. Unlockdata from each PLL is output to pin 8, A0, as UL data, so it can be checked.

Loop			VCO No.	IC	Ref. frequency/ Ref. division ratio	Variable division ratio	VCO oscillator frequency	Input terminal	Unlock signal
MAIN	LO1	Up	VCO1	AF unit (X49-3020-00) IC11 : CXD1225M	5KHz/20	76–135	73.06–109MHz	FMI (11 pin)	A0 (8 pin) "H" : Unlock
		Middle	VCO2	PLL unit (X53-3100-00) IC2 : CXD1925B	10KHz/100	356–317	46.5–44.5MHz	FMI (11 pin)	A0 (8 pin) "H" : Unlock
		Down	VCO3	PLL unit (X53-3100-00) IC3 : CXD1925B	2k/5KHz	25830–23001	55–56MHz	FMI (11 pin)	A0 (8 pin) "H" : Unlock
	LO2	2nd local oscillator	VCO8	AF unit (X49-3020-00) IC13 : CXD1225M	FM mode : 5k/20KHz Other than FM mode : 20k/50KHz	FM mode : 12544 Other than FM mode : 3211	Fixed at 64.22MHz	FMI (11 pin)	A0 (8 pin) "H" : Unlock
	LO3	3rd local oscillator	VCO6	CAR unit (X53-3110-00) IC3 : CXD1925B	2k/5KHz	Center 35750	Aprox. 71.5MHz	FMI (11 pin)	A0 (8 pin) "H" : Unlock
	LO4	4th local oscillator	VCO5	CAR unit (X53-3110-00) IC1 : CXD1925B	2k/5KHz	Center 17750	Aprox. 35.5MHz	FMI (11 pin)	A0 (8 pin) "H" : Unlock
	CAR		VCO9	CAR unit (X53-3110-00) IC9 : CXD1925B	2k/5KHz	Center 29750	Aprox. 59.5MHz	FMI (11 pin)	A0 (8 pin) "H" : Unlock
			VCO4	CAR unit (X53-3110-00) IC6 : CXD1925B	2k/5KHz	Center 34750	Aprox. 69.5MHz	FMI (11 pin)	A0 (8 pin) "H" : Unlock
SUB	LO	Up	VCO7	PLL unit (X53-3100-00) IC17 : CXD1925B	2k/5KHz	7185–3185	43.085–70.035MHz	AMI (13 pin)	A0 (8 pin) A0 (8 pin)
		Down	VCO8	PLL unit (X53-3100-00) IC10 : CXD1925B	2k/5KHz	54503–53507	109–107MHz	FMI (11 pin)	A0 (8 pin) "H" : Unlock
	CAR	MAIN CAR shared	VCO4 shared	CAR unit (X53-3110-00) IC6 : CXD1925B	2k/5KHz	Center 34750	Aprox. 69.5MHz	FMI (11 pin)	A0 (8 pin) "H" : Unlock
DSP	DSP		VCO11	DSP unit (X53-3260-00) IC34 : CXD1925B	54.3648/135	726	Fixed at 35.35MHz	FMI (11 pin)	

The input frequency for the reference frecuency of the PLL IC is 10KHz.

Table 10

CIRCUIT DESCRIPTION

• **Key scan**

The PA port and PB port of IC8 form a keyboard matrix. A scan signal (a negative pulse) is output from the PB port. One column corresponding to the PA port is selected, and the state of that switch is read. When the switch at the intersection of the matrix is pressed, the PA port bit goes low. Thus, which switch is pressed can be detected. Keys are software-debounced.

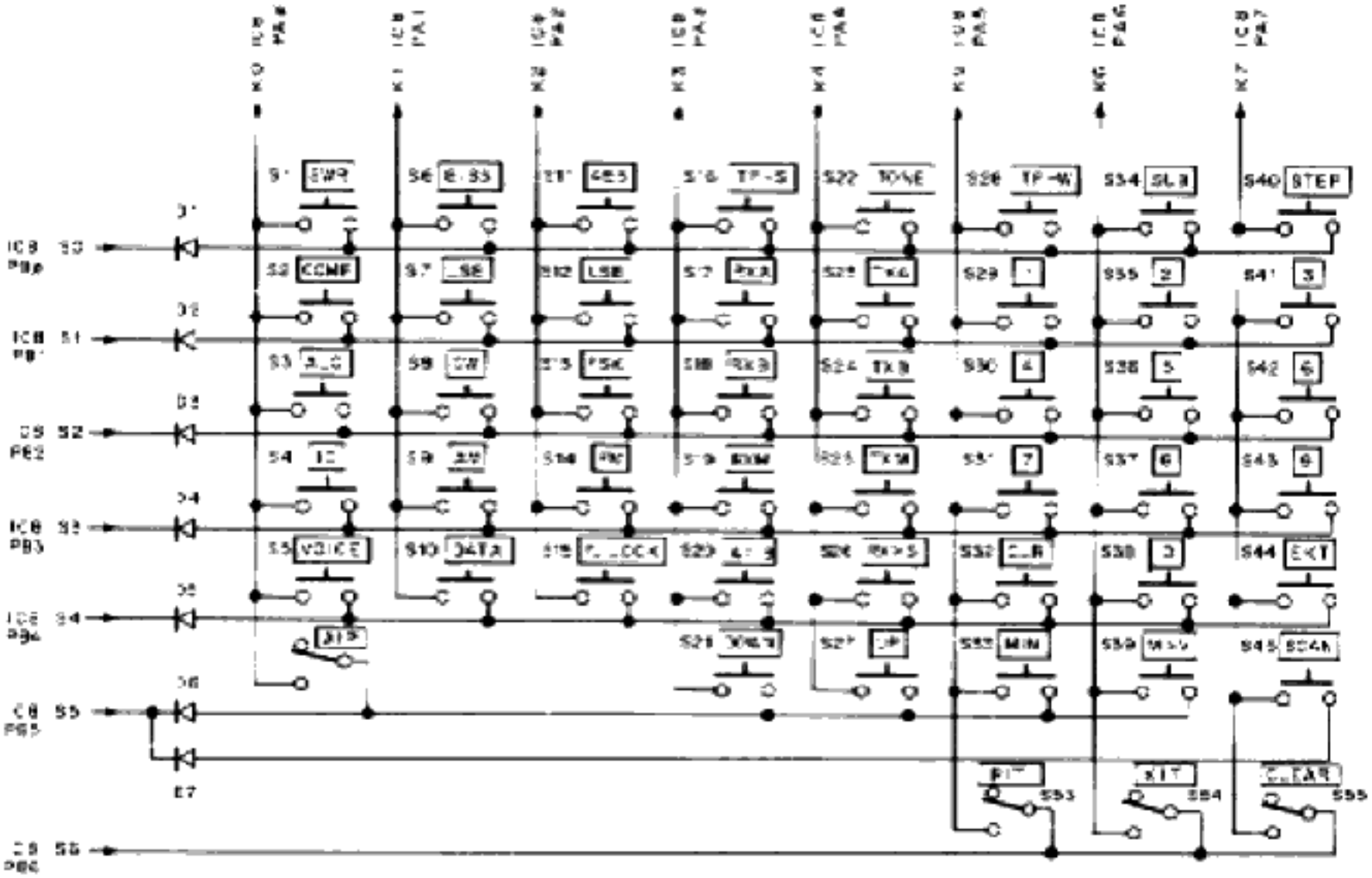


Fig. 33 Keyboard matrix

• **Bandscope signal**

The SM-230 Station monitor can be connected to the TS-950. The sub receiver frequency can be displayed as an intensity marker point on the SM-230 tube surface because of the simultaneous two band receive function of the main unit.

The digital unit outputs the difference between the main frequency and the sub frequency to the SM-230. The TS-950 receives bandscope scan width data from the SM-230, and outputs the sub reception frequency point at the position specified by the sweep width when the center of the tube surface is the main receive frequency. It then displays it by the intensity marker on the SM-230.

The resolution for each scan width is divided and sent by 100 divisions to the right and 100 divisions to the left from the center of the tube surface (a total of 200 divisions).

±25kHz : 50 kHz/200 = 250 Hz resolution

The main CPU controls the main and sub receiver frequency, and calculates the direction of the sub receiver frequency as compared to the main frequency (right or left from the center of the tube surface) and the difference between them. It is processed by the D/A converter, buffered, and output as a digital value according to the range and resolution. It is output to the SCOPE pin.

SMKC is the ON/OFF signal for sub reception. This signal turns the intensity marker on or off so that there is no intensity point when the sub receiver is off. The output is grounded by the open collector when the sub receiver is turned on.

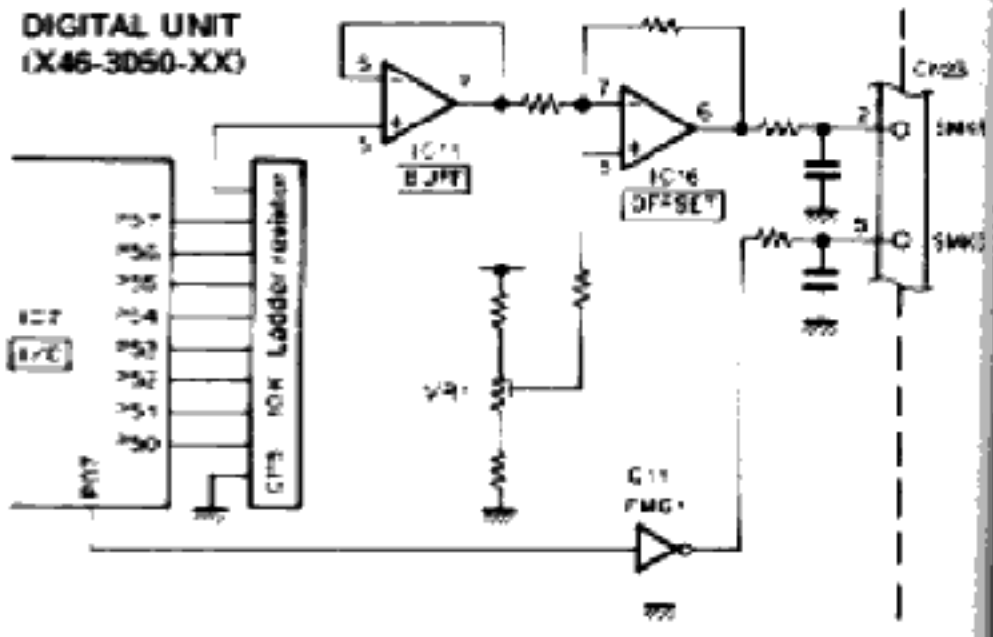


Fig. 34 Bandscope signal

CIRCUIT DESCRIPTION

• **AT control**

The AT band data is decoded by LPF data, and the AT tap is always switched. When the main unit begins transmission, the VSWR is calculated from the values of power and RWM (reverse power), and the VSWR signal is applied to the AT unit to display on the SWR meter and judge whether the AT tuning has been completed.

1) When AT auto switch is on

The AT unit controls the relay so that signals pass through the matching circuit, and places the AT control system in standby.

The main CPU takes the variable capacitor position set for the band from preset data, and drives it to that position. Even if the band changes, the CPU drives the capacitors to the preset position stored in memory, and waits for the next operation.

2) AT TUNE on by AT auto

When both AT Auto and AT Tune are pressed at the same time, the mode is changed to CW, the filter is set to 8.83 MHz 2.7 kHz, 455 kHz 2.7 kHz for transmission, and the AT tune mode is set.

Since transmit is initiated by AT TUNE, the main CPU outputs the VSWR signal and waits until the tune completion signal (OK signal) arrives from the AT unit. The AT unit enters the auto tune mode, and start tuning automatically.

The rotation angle of the variable capacitor is limited by the variable resistor connected to it. Therefore, if the variable capacitor approaches the mechanical limit of the variable resistor, the motor rotation is reversed towards the preset side from the detector side, in the same way as for the preset setting position, and the variable capacitor position is moved to the other end of the variable resistor range, and returned to the detector side. The main CPU continues tuning, and waits until a tuning completion signal arrives.

When manual presetting is performed, the motor rotation is switched from the detector side to the preset side, and the variable capacitor position is moved by potentiometers, R-tune and X-tune at the upper right of the set.

3) When the tuning is completed

When the AT unit outputs a tune completion signal (OK=Low), the main CPU updates preset data, making that variable capacitor position the new preset value.

4) When AT tuning is off

When AT Auto or AT Tune is released, the AT Tune mode is released. The mode and filter are returned to their values before AT tuning was initiated.

• **Receive bandpass filter selection (RF unit)**

The RF BPF signal (RB0 to RB3) from the digital unit is buffered by Q6 and Q7 of the digital unit, and is then forwarded to the RF unit. The RF unit obtains RF BPF data divided into 15 from 4 bits using two sets of BCD-to-Decimal decoders. Band data is given in the list. RF BPF data is 4-bit parallel data.

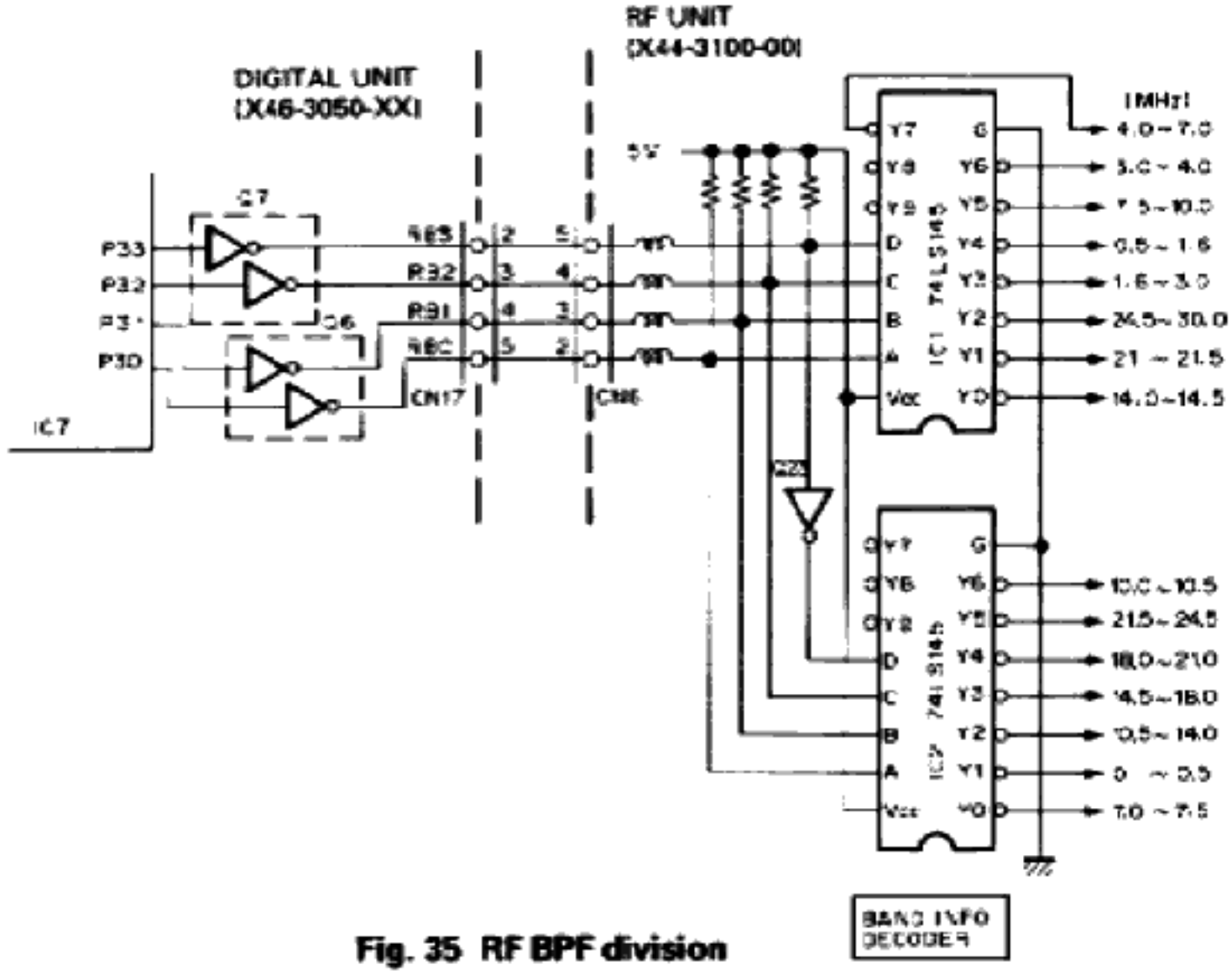


Fig. 35 RF BPF division

CIRCUIT DESCRIPTION

- **IF filter switching**
  (455 kHz : Signal unit, 8.83 MHz : IF unit)

The F filter switching signal from the digital unit is sent to the signa unit as 10-bit serial data. In the signal unit, serial-to-parallel converter IC8 (TC9'74F) converts the serial data to parallel data to select the 8.83-VHz filter and the 455 kHz IF filter. IF filter select data is stored in memory as a portion of the VFC data for each mode.

The optional IF filter data is set by S1 of the digital unit, so that filter positions without filters are not selected.

The 8.83 MHz 270-Hz filter has no dedicated connection pointed is mounted in the same place as the 8.83 MHz 500 Hz filter position. 500 Hz and 270 Hz are recognized by the DIP switch, but they cannot be used at the same time.

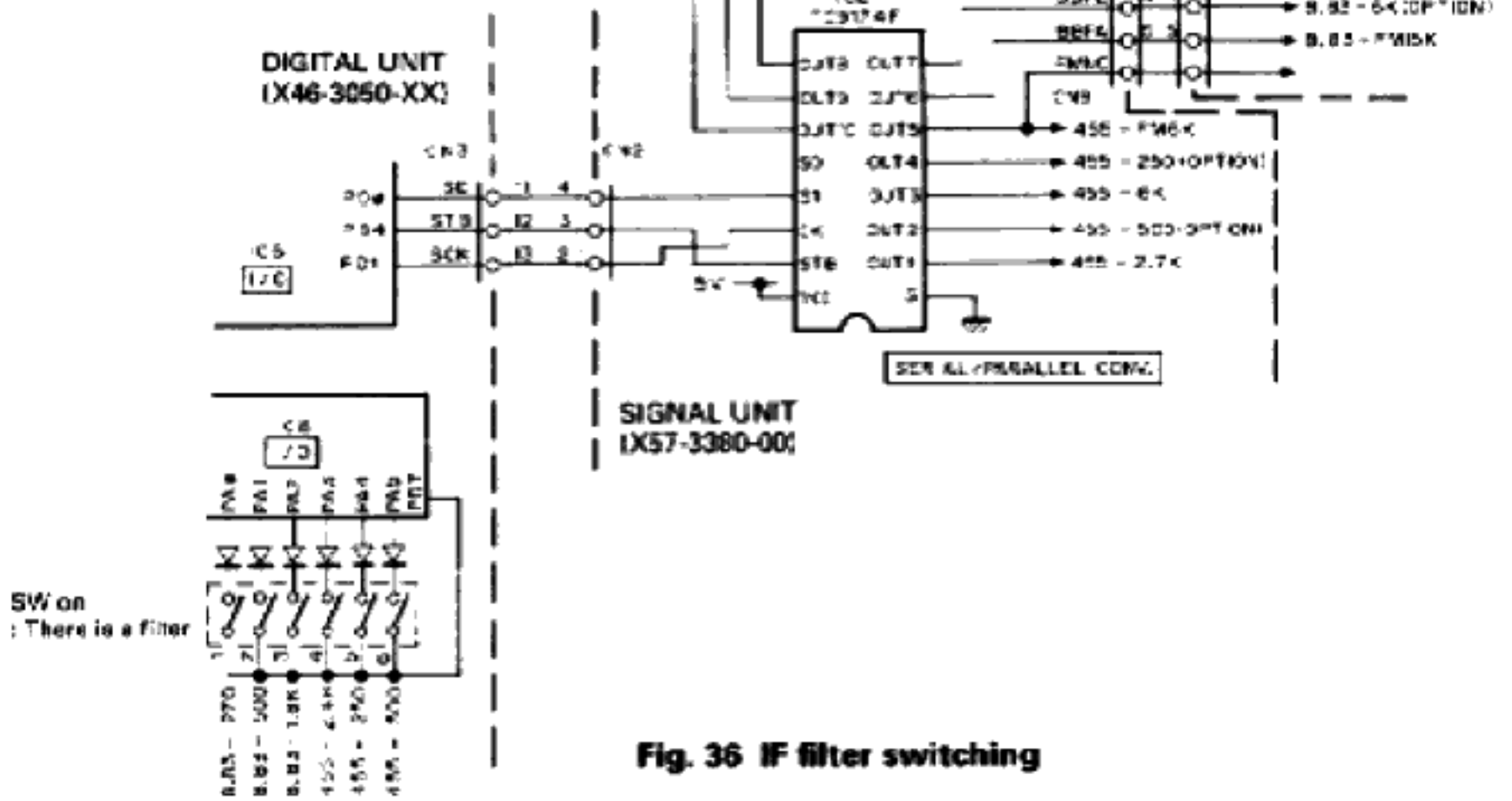


Fig. 36 IF filter switching

- **Transmit LPF, AT band data (LPF unit, AT unit)**

Transmitter system band data (LP0 to LP3) from the digital unit is buffered by Q8 and Q9 of the digital unit. The data is then forwarded to the filter unit. The select signal divided and decoded by the filter unit selects TX LPF in the filter unit and the AT BAND of the AT unit. For the appropriate band data, see the accompanying list.

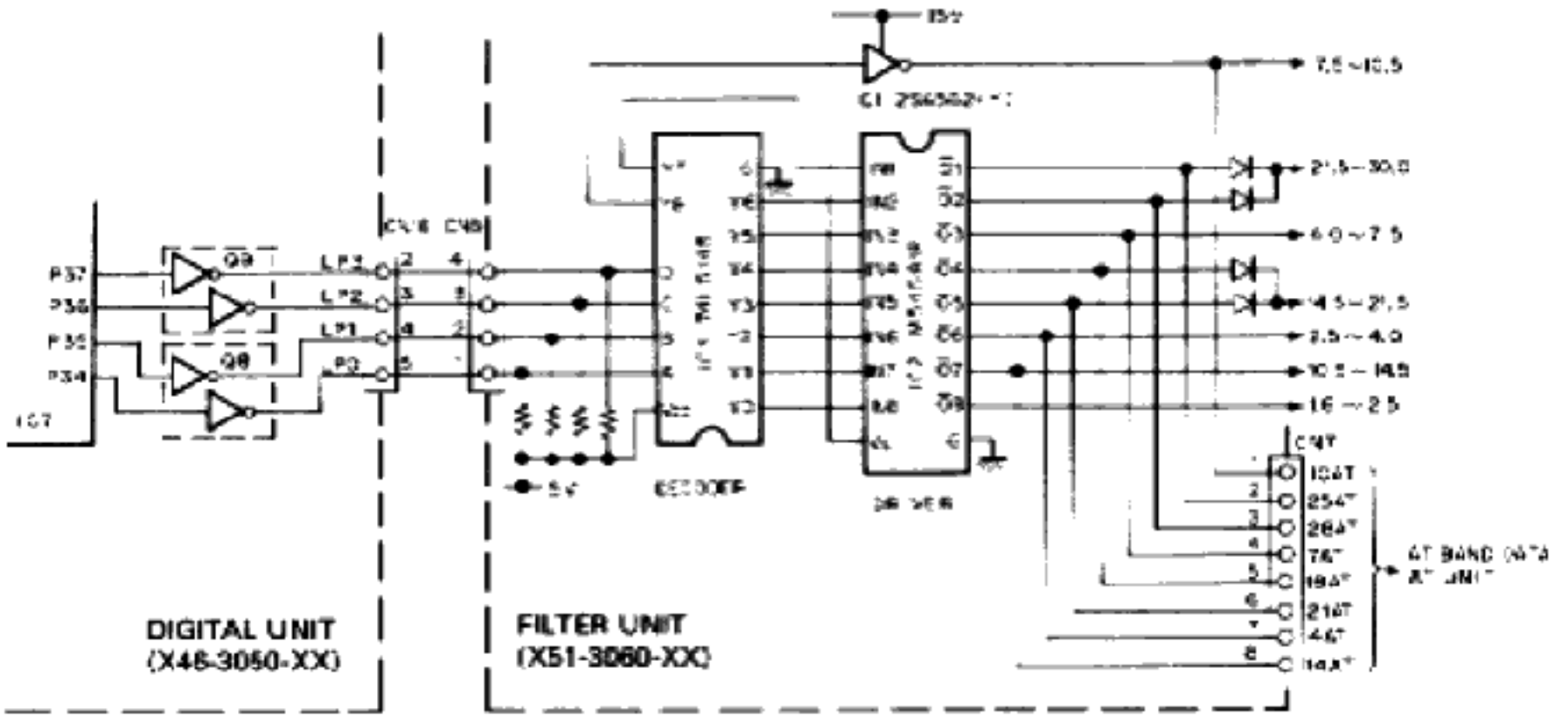


Fig. 37 Transmit LPF, AT band data

CIRCUIT DESCRIPTION

- **List of band data**

Note: VB, RB, and LP are the logic signals on the output pins of the I/O port.

Frequency (MHz)	VCOC N	VB VCO-B VBD	VBC	VBB	VBA	RB3	RB RX BPF RB2	RB1	RB0	LP LPF LP3	LP2	LP1	LP1
0.00000 - 0.49999	76	0	0	0	1	0	1	1	0	1	1	1	1
0.50000 - 0.99999	77	0	0	0	1	1	0	1	1	1	1	1	1
1.00000 - 1.49999	78	0	0	0	1	1	0	1	1	1	1	1	1
1.50000 - 1.82000	79	0	0	0	1	1	0	1	1	1	1	1	1
1.82001 - 1.99999	79	0	0	0	1	1	1	0	0	1	1	1	1
2.00000 - 2.4999	80	0	0	0	1	1	1	0	0	1	1	0	1
2.50000 - 2.99999	81	0	0	0	1	1	1	0	0	1	1	0	1
3.00000 - 3.49999	82	0	0	0	1	1	0	0	1	1	1	0	1
3.50000 - 3.99999	83	0	0	0	1	1	0	0	1	1	1	0	1
4.00000 - 4.49999	84	0	0	0	1	1	0	0	0	1	0	1	0
4.50000 - 4.99999	85	0	0	0	1	1	0	0	0	1	0	1	0
5.00000 - 5.49999	86	0	0	0	1	1	0	0	0	1	0	1	0
5.50000 - 5.99999	87	0	0	0	1	1	0	0	0	1	0	1	0
6.00000 - 6.49999	88	0	0	0	1	1	0	0	0	1	0	1	0
6.50000 - 6.99999	89	0	0	0	1	1	0	0	0	1	0	1	0
7.00000 - 7.49999	90	0	0	0	1	0	1	1	1	1	0	1	0
7.50000 - 7.99999	91	0	0	1	0	1	0	1	0	0	1	1	1
8.00000 - 8.49999	92	0	0	1	0	1	0	1	0	0	1	1	1
8.50000 - 8.99999	93	0	0	1	0	1	0	1	0	0	1	1	1
9.00000 - 9.49999	94	0	0	1	0	1	0	1	0	0	1	1	1
9.50000 - 9.99999	95	0	0	1	0	1	0	1	0	0	1	1	1
10.00000 - 10.49999	96	0	0	1	0	0	0	0	1	0	1	1	1
10.50000 - 10.99999	97	0	0	1	0	0	1	0	1	1	1	1	0
11.00000 - 11.49999	98	0	0	1	0	0	1	0	1	1	1	1	0
11.50000 - 11.99999	99	0	0	1	0	0	1	0	1	1	1	1	0
12.00000 - 12.49999	100	0	0	1	0	0	1	0	1	1	0	1	0
12.50000 - 12.99999	101	0	0	1	0	0	1	0	1	1	0	1	0
13.00000 - 13.49999	102	0	0	1	0	0	1	0	1	1	0	1	0
13.50000 - 13.99999	103	0	0	1	0	0	1	0	1	1	0	1	0
14.00000 - 14.49999	104	0	0	1	0	1	1	1	0	1	1	1	0
14.50000 - 14.99999	105	0	0	0	0	0	1	0	0	1	0	1	1
15.00000 - 15.49999	106	0	0	0	0	0	1	0	0	1	0	1	1
15.50000 - 15.99999	107	0	0	0	0	0	1	0	0	1	0	1	1
16.00000 - 16.49999	108	0	1	0	0	0	1	0	0	1	0	1	1
16.50000 - 16.99999	109	0	1	0	0	0	1	0	0	1	0	1	1
17.00000 - 17.49999	110	0	1	0	0	0	1	0	0	1	0	1	1
17.50000 - 17.99999	111	0	1	0	0	0	1	0	0	1	0	1	1
18.00000 - 18.49999	112	0	1	0	0	0	0	1	1	0	1	1	1
18.50000 - 18.99999	113	0	1	0	0	0	0	1	1	1	0	0	0
19.00000 - 19.49999	114	0	1	0	0	0	0	1	1	1	0	0	0
19.50000 - 19.99999	115	0	1	0	0	0	0	1	1	1	0	0	0
20.00000 - 20.49999	116	0	1	0	0	0	0	1	1	1	0	0	0
20.50000 - 20.99999	117	0	1	0	0	0	0	0	1	1	0	0	0
21.00000 - 21.49999	118	0	1	0	0	1	1	0	0	1	0	0	0
21.50000 - 21.49999	119	0	0	0	0	0	0	0	0	1	0	0	0
22.00000 - 22.49999	120	0	0	0	0	0	0	0	0	1	0	0	0
22.50000 - 22.99999	121	0	0	0	0	0	0	1	0	1	0	0	0
23.00000 - 23.49999	122	0	0	0	0	0	0	1	0	1	0	0	0
23.50000 - 23.99999	123	0	0	0	0	0	0	1	0	1	0	0	0
24.00000 - 24.49999	124	1	0	0	0	0	0	1	0	1	0	0	0
24.50000 - 24.99999	125	1	0	0	0	0	1	0	0	1	0	0	0
25.00000 - 25.49999	126	1	0	0	0	0	1	0	0	1	0	0	1
25.50000 - 25.99999	127	1	0	0	0	0	1	0	0	1	0	0	1
26.00000 - 26.49999	128	1	0	0	0	0	1	0	1	1	0	0	0
26.50000 - 26.99999	129	1	0	0	0	0	1	0	1	1	0	0	1
27.00000 - 27.49999	130	1	0	0	0	0	1	0	1	1	0	0	1
27.50000 - 27.99999	131	1	0	0	0	0	1	0	1	1	0	0	1
28.00000 - 28.49999	132	1	0	0	0	0	1	0	1	1	0	0	1
28.50000 - 28.99999	133	1	0	0	0	0	1	0	1	1	0	0	1
29.00000 - 29.49999	134	1	0	0	0	0	1	0	1	1	0	0	1
29.50000 - 29.99999	135	1	0	0	0	0	1	0	1	1	0	0	1
30.00000	136	1	0	0	0	0	1	0	1	1	0	0	1

CIRCUIT DESCRIPTION

• Functions of IC pins

1) MAIN CPU : µPD78C10G-36 (Digital unit IC1)

	Port name	Pin No.	Name	Function	I/O	Remarks
A port	PA0	1	FDT	Fluorescent display tube, LED display data	O	
	PA1	2	FCK	Fluorescent display tube, LED display data clock	O	
	PA2	3	FLE	Fluorescent display tube, LED display data enable	O	
	PA3	4	FBY	Fluorescent display tube, LED display data busy	I	"L": Busy, "H": Sub CPU is ready to receive
	PA4	5	MFBK	Main RF blanking	O	"H": Blanking
	PA5	6	SRBK	Sub RF blanking	O	"H": Blanking
	PA6	7	–	Not used		
	PA7	8	CSS	Transmit/receive control signal	I	"H": Reception, "L": Transmission
B port	PB0–PB2	9–11	C0–C2	External A/D (M34055) channel data	O	
	PB3	12	CS	External A/D chip select	O	"L": Chip select
	PB4	13	CLK	External A/D data clock	O	
	PB5,PB6	14,15	–	Not used		
	PB7	16	DO	External A/D data	I	
C port	PC0	17	TXD	Personal computer interface transmit signal	O	TTL level
	PC1	18	RXD	Personal computer interface receive signal	I	TTL level
	PC2	19	CTS	Personal computer interface transmission enable signal	I	TTL level
	PC3	20	–	Not used		
	PC4	21	RTS	Personal computer interface reception enable signal	O	TTL level
	PC5–PC7	22–24	–	Not used		
A/D port	AN7	41	–	Not used		
	AN6	40	VBT	A/D channel 6, VBT input	I	
	AN5	39	SLL	A/D channel 5, slope tune low-cut VR input	I	
	AN4	38	SLH	A/D channel 4, slope tune high-cut VR input		
	AN3	37	RWM	A/D channel 3, reflected wave voltage input		
	AN2	36	METS	A/D channel 2, ALC/ic meter voltage input		
	AN1	35	METI	A/D channel 1, Signal/RF meter voltage input		
	AN0	34	PFM	A/D channel 0, Processor meter voltage input		
Control signal	PD0–PD7	55–62	AD0–AD7	CPU address/data multiplex bus	I/O	
	PF0–PF7	47–54	A8–A15	CPU high-order address bus	O	
	ALE	46	ALE	Address/data separator signal	O	
	RD,WR	44,45	RD,WR	Read/Write signal	O	
	NMI	25	NMI	Nonmaskable interrupt		Always "H"
	MT,M0	27,29	MT,M0	External memory mode		Always "H"
	AVcc	43	AVcc	Power supply for A/D converter		
	AVREF	42	AVREF	Reference power supply for A/D converter		5V
	AVss	33	AVss	Ground for A/D converter		
	X1,X2	30,31	X1,X2	CPU clock crystal pin		
	RES	28	RES	CPU reset signal		"L": Reset
	STOP	63	STOP	CPU stop signal		Always "H"

2) Extended I/O : CXD1095Q (Digital unit IC6)

	Port name	Pin No.	Name	Function	I/O	Remarks
A port	PA0	54	OK	AT tune operation signal		"H": In operation
	PA1	55	MNS	AT manual/auto switch signal		"L": Auto, "H": Manual
	PA2	56	ATA	AT ON/auto OFF (through) switch signal		"L": ON, "H": OFF
	PA3	59	ATS	AT tune start switch signal		"L": Stop, "H": Start
	PA4	60	UL1	Unlock signal 1		"L": Unlock
	PA5	61	UL2	Unlock signal 2		
	PA6	62	UL3	Unlock signal 3		
	PA7	63	DS	DSP installation signal		"H": DSP installation

CIRCUIT DESCRIPTION

	Port name	Pin No.	Name	Function	I/O	Remarks
B port	PB0	64	MDA	DSP control data	O	For DSP and PLL in DSP
	PB1	3	MCK	DSP control data clock	O	For DSP and PLL in DSP
	PB2	4	MEN	DSP control data enable	O	For DSP
	PB3	5	MLE	DSP control data enable	O	For PLL in DSP
	PB4	6	STB	Serial-to-parallel conversion IC data enable	O	TC9174F
	PB5	7	HIPC	AP on/off signal	O	"L" : OFF, "H" : ON
	PB6	8	PCK	PLL control data clock	O	
	PB7	9	PDA	PLL control data	O	
C port	PC0	11	PLE7	PLL control data enable 7	O	For VCO7
	PC1	12	PLE6	PLL control data enable 6	O	For VCO6
	PC2	13	PLE8	PLL control data enable 8	O	For VCO8
	PC3	14	PLE5	PLL control data enable 5	O	For VCO5
	PC4	15	PLE3	PLL control data enable 3	O	For VCO3
	PC5	16	PLE9	PLL control data enable 9	O	For VCO9
	PC6	17	PLE2	PLL control data enable 2	O	For VCO2
	PC7	18	PLE4	PLL control data enable 4	O	For VCO4
D port	PD0	20	SD	Serial-to-parallel conversion IC data	O	TC9174F
	PD1	21	CK	Serial-to-parallel conversion IC data clock	O	
	PD2	22	DATC	DATA mode	O	"H" : Mode is selected
	PD3	23	FSKC	FSK mode	O	
	PD4	24	AMC	AM mode	O	
	PD5	27	CWC	CW mode	O	
	PD6	28	FMC	FM mode	O	
	PD7	29	SSBC	SSB mode	O	
E port	PE0	49	ALMS	METER select signal	O	"L" : S meter, "H" : ALC meter
	PE1	50	-	Not used		
	PE2	52	TX	Transmit disable signal	O	"H" : Transmit disable
	PE3	53	ESS	Personal computer interface transmission request signal	O	"H" : Transmission request
Control signal	D0~D7	30~32,35~39	D0~D7	Data bus	I/O	
	RD,WR	44,43	RD,WR	Read/Write signal	I	
	A0~A2	46~48	A0~A2	Port select signal	I	
	ODEN	41	ODEN	Output disable signal	I	When reset, all ports become input ports
	CS	45	CS	Chip select signal	I	

3) Extended I/O : MB89363B (Digital unit IC7)

	Port name	Pin No.	Name	Function	I/O	Remarks
A port (P0X)	P00	28	SLE1	FSK control shift data 1	O	
	P01	27	SLE2	FSK control shift data 2	O	
	P02	26	SLE3	FSK control shift data 3	O	
	P03	25	APRE	AT manual/auto signal	O	"L" : Manual, "H" : Auto
	P04–P06	23–21	-	Not used		
	P07	20	SMKC	SM-230 sub-marker control signal	O	"L" : OFF, "H" : ON
B port (P1X)	P10–P17	44–51	PRE1	AT variable capacitor 1 preset D/A data	O	
C port (P2X)	P20–P27	34–40,43	PRE2	AT variable capacitor 2 preset D/A data	O	
D port (P3X)	P30–P33	77–80	RB0–RB3	Receive band data	O	
	P34–P37	1–4	LP0–LP3	Transmit band data	O	
E port (P4X)	P40–P47	54–61	VSWR	AT SWR D/A data	O	
F port (P5X)	P50–P57	62,65–71	SMKR	SM-230 sub-marker D/A data	O	

CIRCUIT DESCRIPTION

	Port name	Pin No.	Name	Function	I/O	Remarks
Control signal	DB0~DB7	12~19	DB0~DB7	Data bus	I/O	
	RD,WR	76,5	RD,WR	Read/Write signal	I	
	RES	6	RES	Reset signal		"L" : Reset
	A0,A1	31,32	A0,A1	Port select signal		
	CS0	29	CS0	Chip select signal		"L" : P0X~P2X is select
	CS1	75	CS1	Chip select signal	I	"L" : P3X~P6X is select

4) Extended I/O : CXD1095Q (Digital unit IC8)

	Port name	Pin No.	Name	Function	I/O	Remarks
A port	PA0~PA7	54~63	K0~K7	Key input	I	
B port	PB0~PB7	64,3~9	S0~S7	Key matrix select signal	O	
C port	PC0	11	SABK	Sub AF blanking	O	"H" : Blanking
	PC1	12	MABK	Main AF blanking	O	"H" : Blanking
	PC2	13	PLE0	PLL control data enable 0	O	For VCO0
	PC3	14	PLE1	PLL control data enable 1	O	For VCO1
	PC4~PC7	15~18	VBA~VBD	PLL band data	O	
D port	PD0	20	RG1	SM-230 sweep width data 1	I	
	PD1	21	RG0	SM-230 sweep width data 0	I	
	PD2~PD6	22~28	-	Not used		
	PD7	29	FRS	Filter DIP switch select signal	O	
E port	PE0	49	MOS	Transmission monitor switch signal	I	"L" : OFF, "H" : ON
	PE1	50	-	Not used		
	PE2	52	MD	MIC down switch signal	O	"L" : ON
	PE3	53	MU	MIC up switch signal	O	"L" : ON
Control signal	D0~D7	30~32,35~39	D0~D7	Data bus	I/O	
	RD,WR	44,43	RD,WR	Read/Write signal		
	A0~A2	46~48	A0~A2	Port select signal		
	ODEN	41	ODEN	Output disable signal		When reset, all ports become input ports
	CS	45	CS	Chip select signal		

5) Extended I/O (A/D converter) : M64066 (Digital unit IC13)

	Port name	Pin No.	Name	Function	I/O	Remarks
A/D port	A0	2	PIT	A/D channel 0, pitch VR input	I	
	A1	3	CRL	A/D channel 1, carrier LSB VR input	I	
	A2	4	CRL	A/D channel 2, carrier LSB VR input	I	
	A3	5	CRS	A/D channel 3, carrier sub VR input	I	
	A4	6	CRW	A/D channel 4, carrier wincoe VR input	I	
	A5	7	-	Not used		
	A6	8	POD1	A/D channel 6, AF variable capacitor position VR1 input	I	
	A7	9	POD2	A/D channel 7, AF variable capacitor position VR2 input	I	
Control signal	C0~C2	12~14	C0~C2	Channel select signal	I	
	CLK	16	CLK	A/D data select signal	I	
	CS	15	CS	Chip select	I	
	DO	17	DO	A/D data	O	
	Vref	19	Vref	A/D reference power supply	O	5V
	RS	18	RS	Range select signal	I	Always "H"
	S/D	11	S/D	Conversion mode signal	I	Always "H"

CIRCUIT DESCRIPTION

6) SUB CPU : HD643180X0FS6 (Display unit IC1)

	Port name	Pin No.	Name	Function	I/O	Remarks
A port	PA0	54	LFSK	FSK mode LED	O	'H' : LED on
	PA1	55	LLSB	LSB mode LED	O	'H' : LED on
	PA2	56	LUSB	USB mode LED	O	'H' : LED on
	PA3	57	LFM	FM mode LED	O	'H' : LED on
	RXS	58	EDT	Sub CPU serial data input	I	
	CKS	59	FCK	Sub CPU serial clock input	I	
	PA6	60	LAM	AM mode LED	O	'H' : LED on
	PA7	61	LCW	CW mode LED	O	'H' : LED on
E port	PE0	23				
	PE1	24				
	PE2	25	BSY	VS-2 busy input	I	'H' : VS-2 busy
	PE3	28	TR	TX/RX input	I	'H' : TX, 'L' : RX
Control port	PC0~PC7	6~14	A0~A7	CPU low-order address bus	O	
	PD0~PD7	15~22	A8~A15	CPU high-order address bus	O	
	PF0~PF7	30~37	D0~D7	CUP data bus	I/O	
	NMI	1	NMI	Interrupt input for subtone synthesis		
	INT0~INT2	2~4	INT3~INT2	Not used	I	Fixed at 'H' level
	RTS	45	TXZ	1750 Hz tone control output	O	"ONE ON, f=1750 Hz, TX : 'H'
	MP0,MP1	72,73	MP0,MP1	CPU mode setting input	I	MP0 : 'L', MP1 : 'H' fixed
	BUSRQ	79	BUSRQ	Not used	I	Fixed "H" level
	WAIT	77	WAIT	Not used	I	Fixed "H" level
	EXta, Xtal	74,75	ExtalXtal	Crystal connection pin	I	f=11.5 MHz

7) Gate array : MB622180PF (Display unit IC2)

	Port name	Pin No.	Name	Function	I/O	Remarks
P0 port	P00	34	Pa1	Fluorescent display tube segment a1 drive output	O	For TX VFO display
	P01	35	Pb1	Fluorescent display tube segment b1 drive output	O	7 segments (upper right)
	P02	36	Pc1	Fluorescent display tube segment c1 drive output	O	'H' : Active
	P03	37	Pd1	Fluorescent display tube segment d1 drive output	O	
	P04	38	Pe1	Fluorescent display tube segment e1 drive output	O	
	P05	39	Pf1	Fluorescent display tube segment f1 drive output	O	
	P06	41	Pg1	Fluorescent display tube segment g1 drive output	O	
	P07	42	Ph1	Fluorescent display tube segment h1 drive output	O	
P1 port	P10	43	Pa2	Fluorescent display tube segment a2 drive output	O	For sub VFO display
	P11	44	Pb2	Fluorescent display tube segment b2 drive output	O	7 segments (yellow)
	P12	45	Pc2	Fluorescent display tube segment c2 drive output	O	"H" : Active
	P13	46	Pd2	Fluorescent display tube segment d2 drive output	O	
	P14	47	Pe2	Fluorescent display tube segment e2 drive output	O	
	P15	48	Pf2	Fluorescent display tube segment f2 drive output	O	
	P16	49	Pg2	Fluorescent display tube segment g2 drive output	O	
	P17	50	Ph2	Fluorescent display tube segment h2 drive output	O	
P2 port	P20	55	Pa3	Fluorescent display tube segment a3 drive output	O	For main VFO display
	P21	56	Pb3	Fluorescent display tube segment b3 drive output	O	7 segments (Center)
	P22	57	Pc3	Fluorescent display tube segment c3 drive output	O	"H" : Active
	P23	58	Pd3	Fluorescent display tube segment d3 drive output	O	
	P24	59	Pe3	Fluorescent display tube segment e3 drive output	O	
	P25	60	Pf3	Fluorescent display tube segment f3 drive output	O	
	P26	61	Pg3	Fluorescent display tube segment g3 drive output	O	
	P27	62	Ph3	Fluorescent display tube segment h3 drive output	O	

CIRCUIT DESCRIPTION

	Port name	Pin No.	Name	Function	I/O	Remarks
P3 port	P30	83	P1G	Fluorescent display tube grid 1G drive output	O	Grid select signal
	P31	84	P2G	Fluorescent display tube grid 2G drive output	O	The rightmost grid of the dispay
	P32	86	P3G	Fluorescent display tube grid 3G drive output	O	tube is 1 (1G).
	P33	87	P4G	Fluorescent display tube grid 4G drive output	O	"H" : Active
	P34	88	P5G	Fluorescent display tube grid 5G drive output	O	
	P35	89	P6G	Fluorescent display tube grid 6G drive output	O	
	P36	70	P7G	Fluorescent display tube grid 7G drive output	O	
	P37	71	P8G	Fluorescent display tube grid 8G drive output	O	
P4 port	P40	72	P9G	Fluorescent display tube grid 9G drive output	O	"H" : Active
	P41	73	P10G	Fluorescent display tube grid 10G drive output	O	
	P42	74	P11G	Fluorescent display tube grid 11G drive output	O	
	P43	75	P12G	Fluorescent display tube grid 12G drive output	O	
	P44	84	P13G	Fluorescent display tube grid 13G drive output	O	
	P45	85	P14G	Fluorescent display tube grid 14G drive output	O	
	P46	86	P15G	Fluorescent display tube grid 15G drive output	O	
	P47	87	P16G	Fluorescent display tube grid 16G drive output	O	
P5 port	P50	88	P17G	Fluorescent display tube grid 17G drive output	O	"H" : Active
	P51	89	P18G	Fluorescent display tube grid 18G drive output	O	
	P52	91	P19G	Fluorescent display tube grid 19G drive output	O	
	P53	92	P20G	Fluorescent display tube grid 20G drive output	O	
	P54	93	P21G	Fluorescent display tube grid 21G drive output	O	
	P55	94	P22G	Fluorescent display tube grid 22G drive output	O	
	P56	95	P23G	Fluorescent display tube grid 23G drive output	O	
	P57	96	P24G	Fluorescent display tube grid 24G drive output	O	
P6 port	P60	97	PA1	Fluorescent display tube segment A1 drive output	O	"H" : Active, analog scale
	P61	98	PA2	Fluorescent display tube segment A2 drive output	O	"H" : Active, for radpimar display
	P62	99	PB	Fluorescent display tube segment B drive output	O	"H" : Active
	P63	100	PC	Fluorescent display tube segment C drive output	O	
	P64	1	PD	Fluorescent display tube segment D drive output	O	
	P65	2	PE1	Fluorescent display tube segment E1 drive output	O	
	P66	5	PE2	Fluorescent display tube segment E2 drive output	O	
	P67	6	–	Not used		
P7 port	P70	7	PCC	Fluorescent display tube segment CC drive output	O	Meter scale select signal
	P71	8	PDC	Fluorescent display tube segment DC drive output	O	"H" : Active
	P72	9	PEE	Fluorescent display tube segment EE drive output	O	
	P73	10	PFF	Fluorescent display tube segment FF drive output	O	
	P74	11	Pi1	Fluorescent display tube segment i1 drive output	O	Red letter display segment
	P75	12	Pi3	Fluorescent display tube segment i3 drive output	O	"H" : Active
	P76	13	Pj3	Fluorescent display tube segment j3 drive output	O	For kHz display, "H" : Active
	P77	14	PALL	Fluorescent display tube segment ALL drive output	O	For analog scale display, "H" : Active
Control port	D0–D7	24–33	D0–D7	CPU data bus	I/O	
	A0–A2	21–23	A0–A2	CPU address bus	I	
	NRES	16	NRES	Reset input	I	"L" : Reset
	NRD	17	NRD	RD strobe	I	"L" : Read
	NWR	18	NWR	WR strobe	I	"L" : Write
	NCS1	19	NCS1	Chip select 1	I	"L" : Active
	NCS0	20	NCS0	Chip select 0	I	"L" : Active
	EN0	51	EN0	Output control 0	I	"H" : Active
	EN1	52	EN1	Output control 1	I	"H" : Active
	CKI	81	CKI	Display control flip-flop clock	I	
	NCLI	82	NCLI	Display control flip-flop clear	I	
	DOUT	83	DOUT	Display control flip-flop output	O	
	DIR0	76	DIR0	Port I/O specification 0	I	Fixed "L" level
	DIR1	77	DIR1	Port I/O specification 1	I	Fixed "L" level

CIRCUIT DESCRIPTION

6) Gate array : MB622180PF (Display unit IC3)

	Port name	Pin No.	Name	Function	I/O	Remarks
P0 port	P00	34	PPWR	Fluorescent display tube segment PWR drive output	O	Meter selection segment
	P01	35	PS	Fluorescent display tube segment S drive output	O	"H" : Active
	P02	36	PL30	Fluorescent display tube segment L30 drive output	O	Lower meter segment
	P03	37	PL29	Fluorescent display tube segment L29 drive output	O	"H" : Active
	P04	38	PL28	Fluorescent display tube segment L28 drive output	O	
	P05	39	PL27	Fluorescent display tube segment L27 drive output	O	
	P06	41	PL26	Fluorescent display tube segment L26 drive output	O	
	P07	42	PL25	Fluorescent display tube segment L25 drive output	O	
P1 port	P10	43	PL24	Fluorescent display tube segment L24 drive output	O	Lower meter segment
	P11	44	PL23	Fluorescent display tube segment L23 drive output	O	"H" : Active
	P12	45	PL22	Fluorescent display tube segment L22 drive output	O	
	P13	46	PL21	Fluorescent display tube segment L21 drive output	O	
	P14	47	PL20	Fluorescent display tube segment L20 drive output	O	
	P15	48	PL19	Fluorescent display tube segment L19 drive output	O	
	P16	49	PL18	Fluorescent display tube segment L18 drive output	O	
	P17	50	PL17	Fluorescent display tube segment L17 drive output	O	
P2 port	P20	55	PL16	Fluorescent display tube segment L16 drive output	O	Lower meter segment
	P21	56	PL15	Fluorescent display tube segment L15 drive output	O	"H" : Active
	P22	57	PL14	Fluorescent display tube segment L14 drive output	O	
	P23	58	PL13	Fluorescent display tube segment L13 drive output	O	
	P24	59	PL12	Fluorescent display tube segment L12 drive output	O	
	P25	60	PL11	Fluorescent display tube segment L11 drive output	O	
	P26	61	PL10	Fluorescent display tube segment L10 drive output	O	
	P27	62	PL9	Fluorescent display tube segment L9 drive output	O	
P3 port	P30	63	PL8	Fluorescent display tube segment L8 drive output	O	Lower meter segment
	P31	64	PL7	Fluorescent display tube segment L7 drive output	O	"H" : Active
	P32	66	PL6	Fluorescent display tube segment L6 drive output	O	
	P33	67	PL5	Fluorescent display tube segment L5 drive output	O	
	P34	68	PL4	Fluorescent display tube segment L4 drive output	O	
	P35	69	PL3	Fluorescent display tube segment L3 drive output	O	
	P36	70	PL2	Fluorescent display tube segment L2 drive output	O	
	P37	71	PL1	Fluorescent display tube segment L1 drive output	O	
P4 port	P40	72	PBB	Fluorescent display tube segment BB drive output	O	Meter scale selection
	P41	73	PAA	Fluorescent display tube segment AA drive output	O	"H" : Active
	P42	74	PU30	Fluorescent display tube segment U30 drive output	O	Upper meter segment
	P43	75	PU29	Fluorescent display tube segment U29 drive output	O	"H" : Active
	P44	84	PU28	Fluorescent display tube segment U28 drive output	O	
	P45	85	PU27	Fluorescent display tube segment U27 drive output	O	
	P46	86	PU26	Fluorescent display tube segment U26 drive output	O	
	P47	87	PU25	Fluorescent display tube segment U25 drive output	O	
P5 port	P50	88	PU24	Fluorescent display tube segment U24 drive output	O	Upper meter segment
	P51	89	PU23	Fluorescent display tube segment U23 drive output	O	"H" : Active
	P52	91	PU22	Fluorescent display tube segment U22 drive output	O	
	P53	92	PU21	Fluorescent display tube segment U21 drive output	O	
	P54	93	PU20	Fluorescent display tube segment U20 drive output	O	
	P55	94	PU19	Fluorescent display tube segment U19 drive output	O	
	P56	95	PU18	Fluorescent display tube segment U18 drive output	O	
	P57	96	PU17	Fluorescent display tube segment U17 drive output	O	

CIRCUIT DESCRIPTION

	Port name	Pin No.	Name	Function	I/O	Remarks
P6 port	P60	97	PU16	Fluorescent display tube segment U16 drive output	O	Upper meter segment
	P61	98	PU15	Fluorescent display tube segment U15 drive output	O	"H" : Active
	P62	99	PU14	Fluorescent display tube segment U14 drive output	O	
	P63	100	PU13	Fluorescent display tube segment U13 drive output	O	
	P64	1	PU12	Fluorescent display tube segment U12 drive output	O	
	P65	2	PU11	Fluorescent display tube segment U11 drive output	O	
	P66	5	PU10	Fluorescent display tube segment U10 drive output	O	
	P67	6	PU9	Fluorescent display tube segment U9 drive output	O	
P7 port	P70	7	PU8	Fluorescent display tube segment U8 drive output	O	Upper meter segment
	P71	8	PU7	Fluorescent display tube segment U7 drive output	O	"H" : Active
	P72	9	PU6	Fluorescent display tube segment U6 drive output	O	
	P73	10	PU5	Fluorescent display tube segment U5 drive output	O	
	P74	11	PU4	Fluorescent display tube segment U4 drive output	O	
	P75	12	PU3	Fluorescent display tube segment U3 drive output	O	
	P76	13	PU2	Fluorescent display tube segment U2 drive output	O	
	P77	14	PU1	Fluorescent display tube segment U1 drive output	O	
Control port	D0–D7	24–33	D0–D7	CPU data bus	I/O	
	A0–A2	21–23	A0–A2	CPU address bus	I	
	NRES	16	NRES	Reset input	I	"L" : Reset
	NRD	17	NRD	RD strobe	I	"L" : Read
	NWR	18	NWR	WR strobe	I	"L" : Write
	NCS1	19	NCS1	Chip select 1	I	"L" : Active
	NCS0	20	NCS0	Chip select 0	I	"L" : Active
	EN0	51	EN0	Output control 0	I	"H" : Active
	EN1	52	EN1	Output control 1	I	"H" : Active
	CKI	81	CKI	Main CPU busy control flip-flop clock	I	
	NCLI	82	NCLI	Main CPU busy control flip-flop clear	I	
	DOUT	83	DOUT	Main CPU busy control flip-flop output	O	
	DIR0	76	DIR0	Port I/O specification 0	I	Fixed "L" level
	DIR1	77	DIR1	Port I/O specification 1	I	Fixed "L" level

9| Latch : TC74HC574AF (Display unit IC5)

	Port name	Pin No.	Name	Function	I/O	Remarks
Q port	Q0	19	–	Not used	O	
	Q1	18	LTM	TX-M LED output	O	"H" : LED on
	Q2	17	LTA	TX-A LED output	O	"H" : LED on
	Q3	16	LTB	TX-B LED output	O	"H" : LED on
	Q4	15	LK1	Numeric keys 0 to 9 LED output	O	"H" : LED on
	Q5	14	LRM	RX-M LED output	O	"H" : LED on
	Q6	13	LRA	RX-A LED output	O	"H" : LED on
	Q7	12	LRB	RX-B LED output	O	"H" : LED on

CIRCUIT DESCRIPTION

AVR Unit

The power supply unit produces +15 V thru the use of a discrete IC; +5 V and –12 V via 3-pin regulator IC's, and –40 V thru the use of a zener diode and transistor.

The +15V circuit is avery similar to the +28V circuit of the TS-940. When the power is switched on, Q2 is turned on via start resistors R3 and R24 and current flows. A voltage is generated at R8 and R9. Error amplifier transistor Q4 is turned on while Q1 is turned on.

The circuit operates as a constant-voltage circuit with a reference voltage of 7.5 V which is produced by zener diode. Diode D2 (negative temperature coefficient) is used to compensate for the temperature (positive temperature coefficient) of this zener diode. A current of up to 5.5 A flows through Q2, resulting in a collector loss of approximately 35 W. R4 is a resistor that is used for stabilization, and has a current flow of approximately 100 mA to stabilize operation even if there is no load.

If the +15 V line is shorted, F1 (7.5-A quick-blow fusel blows to protect the circuit.

The +5 V is generated from the +15 V line by a 3-pin regulator IC.

–40 V is produced by two –20V zener diodes, and boosted by Q5. R13 is a protection resistor, and R14 and R23 are resistors for discharging C30 and C34.

When the temperature of the power supply radiator reaches 50°C, thermal switch S2 is turned on, and a fan start voltage of approximately 7 V is generated by Q4. The fan begins running at a low speed. When the temperature of the transformer rises to 80°C, S1 turns off, and Q3 turnes on. The fan voltage then becomes approximately 12 V, and the fan rotates at high speed, while a powerdown signal (approximately 5 V) is output. (CN5-1, TPT)

Digital Modulation Function

This transceiver is capable of providing the SSB, CW, AM and FSK modulation, generating or FM carrier, and providing the AF slope tune during the SSB receive by using the input signals from the microphone and a 16-bit A/D, D/A converter for CW and FSK keying and DSP (Digital Signal Processor).

- **Features of each mode**

1) SSB mode

Modulated waves of higher-quality than those in the SSB mode are obtained through modulation by the 10th phase-shift network that digitally theats signals.

2) CW mode

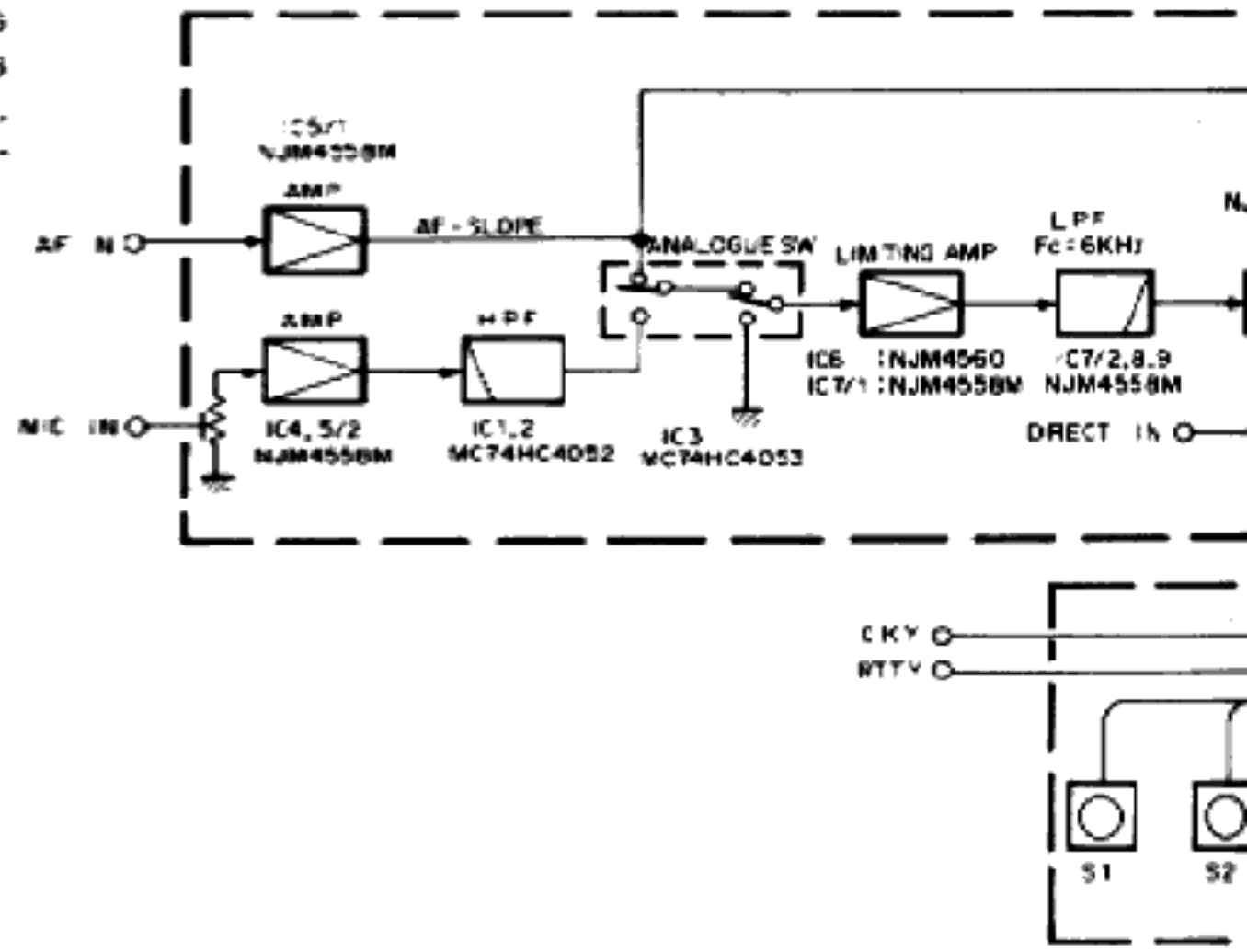
Excellent characteristics are obtained through digital form-restoration of the wave shape.

3) AM mode

Low-distortion modulated waves with excellent amplitude and group delay characteristics are obtained through digital modulation and by using the 84th FIR filter.

4) FM mode

Provides the high-quality 455 kHz carrier. DSP-10 does not provide modulation.



CIRCUIT DESCRIPTION

5) FSK mode

Excellent, low-distortion modulated waves are obtained through FSK modulation with continuous phasing after the digital form-restoration of the rising form and characteristic of the waveform.

6) SSB mode (received)

AF slope tuning is provided by the digital filter, to suit the slope of this transceiver.

DSP Unit

- **Outline and configuration**

The DSP-10 is provided to digitally process transmitter signals in the SSB, CW, AM, and FSK modes, and it is also used to provide AF-slope tuning in the SSB receive mode.

Figure 38 is a block diagram of the DSP-10. The DSP-10 consists of a digital unit, which performs digital signal processing; an analog unit, which processes analog signals and sends them to the digital unit, and converts the input from the digital unit back to analog signals; and a PLL unit, which generates clock pulses for managing the frequencies in the main unit and performing digital signal processing with an accurate sampling frequency.

1) Modulation

The MIC audio signal is applied to an input buffer where the low-frequency components are eliminated by a high-pass filter, composed of IC1 and IC2 (MC74HC4052F), which is used to limit the bandwidth of the signal. The output of the high-pass filter is routed through limiting amplifier IC6 (NJM4560MI and IC7/1 (NJM4558MI) to limit the input amplitude before the signal is applied to the A/D converter. Components of the signal outside the Nyquist band are eliminated by a low-pass filter consisting of IC7/2, IC8, and IC9 (NJM4558MI). The resulting signal is converted into a Pulse Coded Modulated (PCM) waveform by the sample and hold amplifier circuit consisting of IC10, IC11 (NJM0728MI, and Q1 (2SK508), and is then applied to the A/D converter IC12 (PCB78AP). The signal is then converted into a digital signal with a sampling frequency of 49.189 kHz by IC12 (PCM78AP). In the SSB and AM modes, the resulting digital signal is used as the modulating signal.

The leading and trailing edges of the shift data from CW keying and RTTY are checked by the DSP. When the edge of the waveform is detected, data regarding the square/cosine characteristics is read sequentially from the ROM. This data is used to either modulate the amplitude or frequency.

Note : 49.189 means 49.189189189... (recurring decimal).

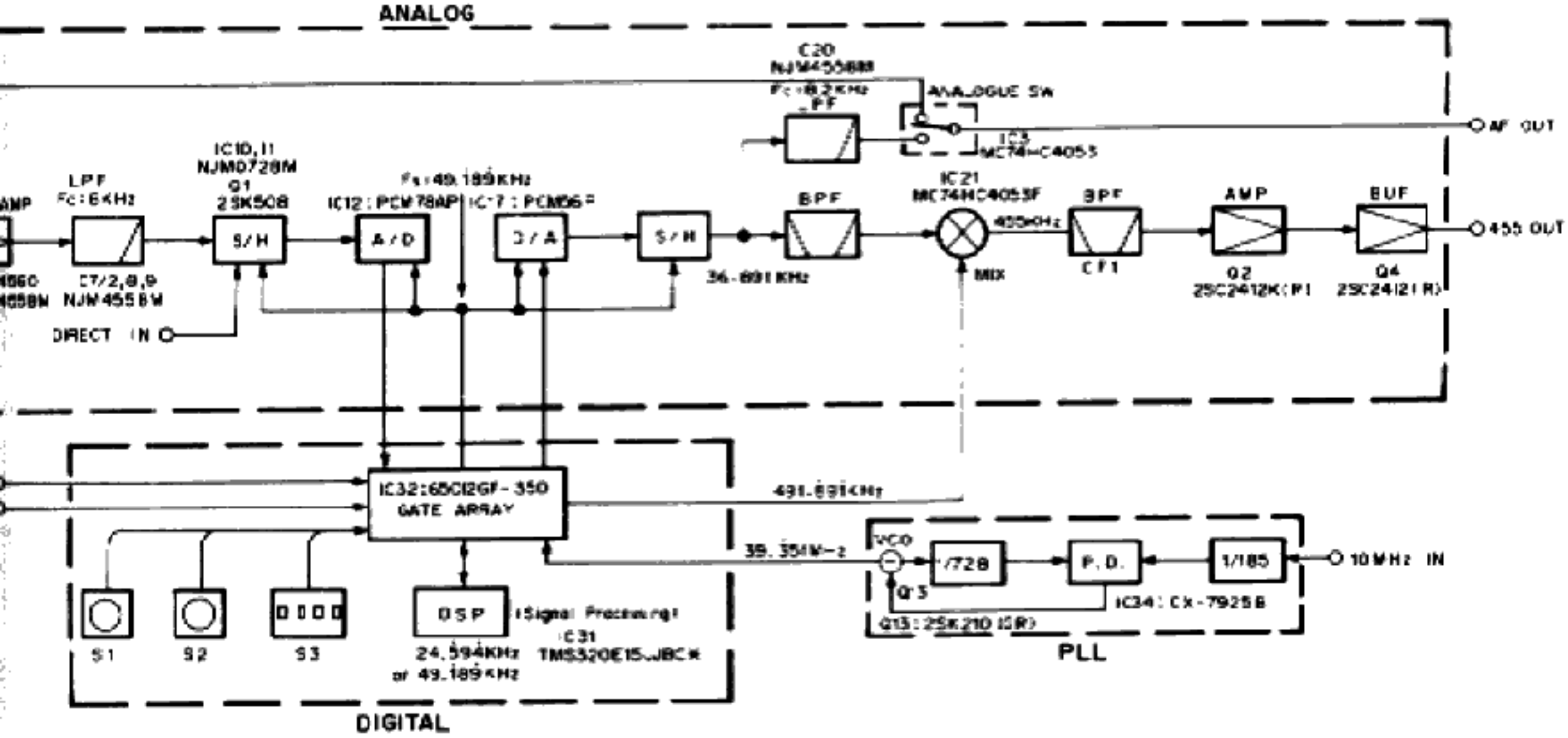


Fig. 38 DSP unit block diagram

CIRCUIT DESCRIPTION

The modulated waveform that has been digitally processed and supplied by the D/A converter IC17 (PCM58P) has a modulation spectrum rich in odd order harmonics that are 1/4 the sampling frequency (1/4, 3/4, 5/4, etc). A frequency of 36.891 kHz, which is 3/4 the sampling frequency, is taken by the bandpass filter and is mixed with a frequency of 491.891 kHz by IC21 (MC74HC4053FI in order to generate a signal of 455 kHz. The unwanted adjacent components of this signal are eliminated by ceramic filter CF1, amplified by Q2 (2SC2412K), and output from buffer amplifier Q4 (2SC2412K). In the CW and AM modes, the output level is reduced in order to match the level of the main unit.

Figure 39 shows the frequency spectrum of the MIC input, A/D input, D/A output, 36.891-kHz bandpass filter output, and 455-kHz output.

Item	Rating
Nominal center frequency (fo)	455kHz
3dB bandwidth	±5.0kHz or more (from 455kHz)
6dB bandwidth	±7.5kHz or more (from 455kHz)
70dB bandwidth	±12.5kHz or less (from 455kHz)
Guaranteed attenuation	80dB or more at 455± 100kHz 50dB or more at 0.1 to 1MHz
Ripple	3dB or less at 455±5.0kHz 6dB or less at 455±7.5kHz
Insertion loss	6dB or less
Voltage capacity (between pins)	50V DC (1 minute)
Input and output impedance	1.5kΩ

Table 11 Ceramic filter (L72-0375-05) (DSP unit CF1)

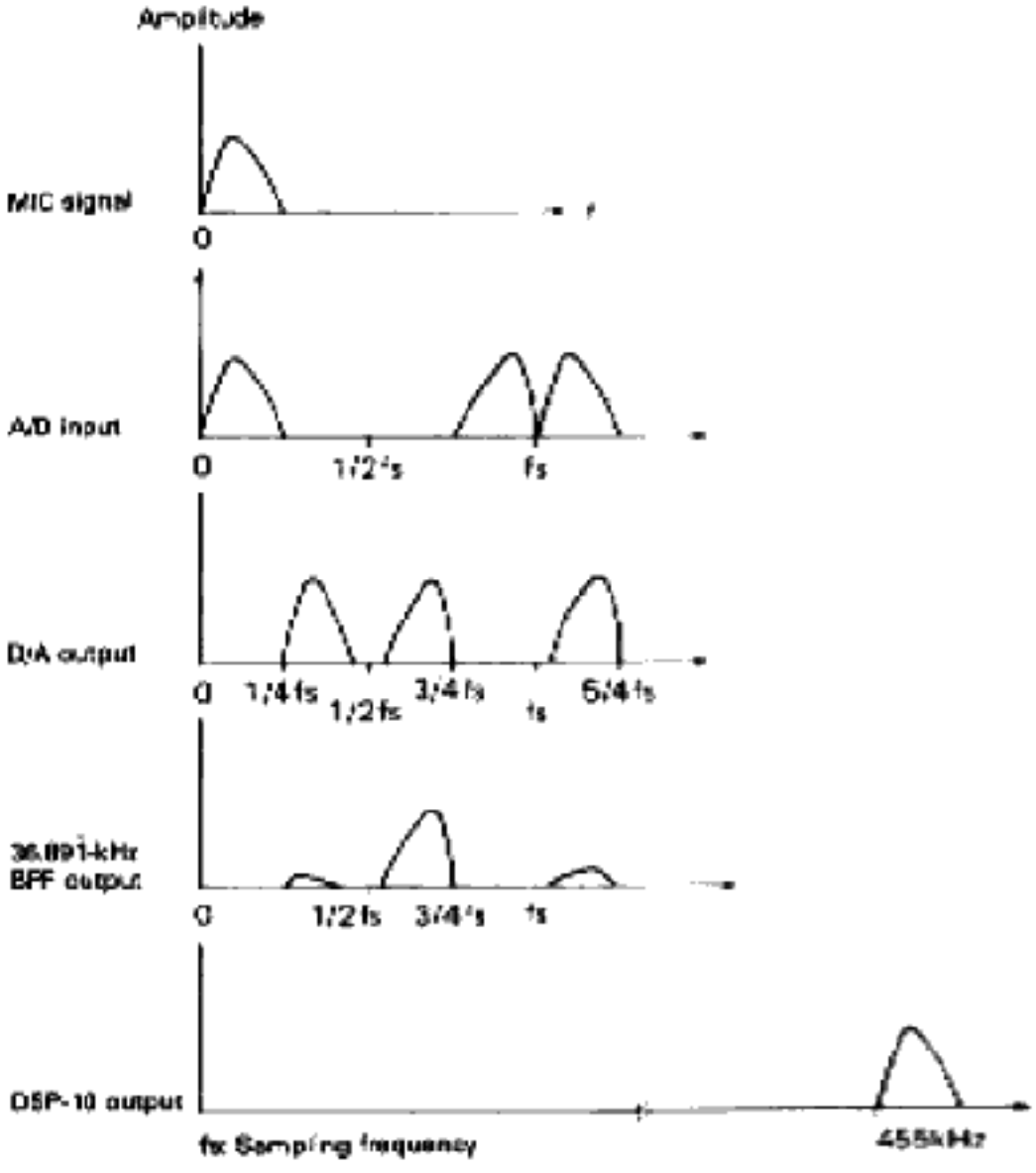


Fig. 39 Frequency spectrum in SSB mode

2) AF-SLOPE TUNE

The audio signal supplied from the input buffer amplifier IC5/1 (NJM4558M), like the MIC signal, is passed through the limiting amplifier in order to limit the level of the signal applied to the A/D converter. The signal then passes through the low-pass filter. This signal is then converted into a Pulse Code Modulated waveform by the sample and hold amplifier circuit before it is applied to the A/D converter. The signal is converted to a digital signal with a sampling frequency of 49.189 kHz by the A/D converter. Further processing of the signal is accomplished in the Digital unit. This signal is then applied to the D/A Converter IC17 where the now processed audio is obtained.

The PCM signal from the D/A converter is passed through low-pass filter IC20 (NJM4558M) to eliminate undesirable harmonics and smooth the signal. Its level is equalized with the input level, switched by analog switch IC3 (MC74HC4053F), and applied to the AF OUT terminal.

Figure 40 shows the frequency characteristics of the audio input, low-pass filter output, A/D input, D/A output, and resulting audio output.

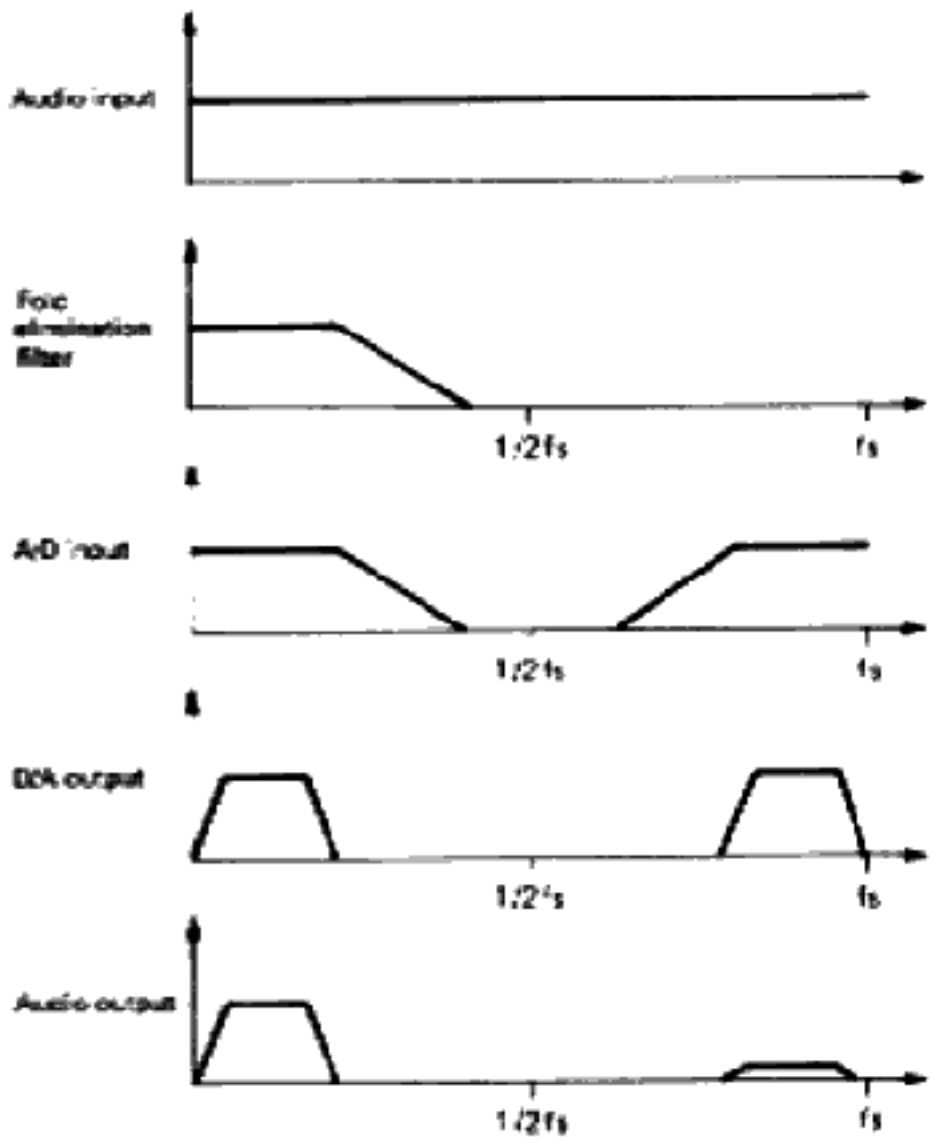


Fig. 40 Frequency characteristics of AF SLOPE TUNE

CIRCUIT DESCRIPTION

3) Frequencies

The DSP-10 reference signal of 10 MHz (1/2 the reference oscillator signal of 20 MHz) is multiplied by 728/185 in the DSP PLL unit. This signal is applied to gate array IC32 (µPD65012GF-350) of the digital unit as the 39.351-MHz internal reference signal.

The gate array divides the signal by 1/800 to generate a sampling clock of 49.189 kHz, and again divides the signal by 1/80 to generate a 491.891-kHz clock signal that is used for mixing.

The frequency of the harmonic free signal supplied by the D/A converter is 36.891 kHz, which is 3/4 the sampling frequency. The 455-kHz IF output is produced by taking the difference between this frequency and the 491.891 kHz mixing frequency.

- **PLL unit**

The PLL circuit is a relatively conventional PLL circuit that is used to obtain a fixed reference frequency that is used for each clock circuit used in the DSP unit.

The Phase Detector of the PLL circuit is IC34 (CX-7925BI. The incoming reference frequency of 10 MHz is amplified by amplifier Q12 and applied to pin 5 of IC34. Here the signal is divided by 1/185 in order to generate a comparison frequency of 54.054 kHz. The output from the VCO passes through buffer amplifier Q14, and is applied to pin 11 of IC34. Here it is divided by 1/728, and compared with the 54.054 kHz reference signal in order to lock the VCO.

Division ratio data is sent from the main unit via the digital unit on the DMA2, DCK2, and D_E2 lines. The PLL output is supplied to the digital unit via buffer amplifier Q15 where it is used as an internal reference.

$f_{DSPSTD} = 728/185 \times 1/2\ f_{STD} = 728/185 \times 10 \times 10^6$
$f_{MIX} = f_{DSPSTD}/80 \qquad f_S = f_{DSPSTD}/800$
$f_{455} = f_{MIX} - 3/4\ f_S$
$= 37/3200\ f_{DSPSTD} = 37/3200 \times 1456/37 \times 10^6$

- **Digital unit**

The digital unit consists of DSP IC31 (TMS320E15), gate array IC32 (µPD65012GF-350), write signal control IC36 (MM74HCT00M), reset IC33 (S-8054ALR-LN), and amplifier Q16 (2SC2714), which amplifies the internal reference to the necessary level before it is applied to the gate array.

1) DSP

A 25-MHz crystal oscillator signal is used for the DSP internal clock circuits. The DSP operates on an clock signal of 6.25-MHz (160 ns) which is 1/4 the crystal oscillator frequency.

Data is transferred between the A/D and D/A converters and signals are received from the main unit via the gate array.

2) Write signal control

Since it is possible that the DSP address data may become invalidated before the falling of control signals WE, MEN, and DEN, the WE control signal is gated by the DCLK line to prevent malfunctions of the gate array.

3) Internal reference signal amplifier

The internal reference signal from the PLL is amplified to approximately 3.6 Vp-p, raised to the appropriate DC bias level, and applied to the CLK line of the gate array.

4) Switches

S1, S2, and S3 are recognized by the DSP only when the mode is changed normally (i.e. when commands are received from the main unit). They are recognized only when the system is reset in the test mode. Therefore, changes in the settings of these switches do not become valid by just changing the switch settings. The only exception is the high-pass filter in the analog unit, it is controlled directly by S1.

5) Gate array

The gate array generates internal/external clock signals from the internal reference provided by the PLL; interfaces with the analog unit; generates the DSP reset signal; receives commands from the main unit to the DSP and input switches S1, S2, and S3.

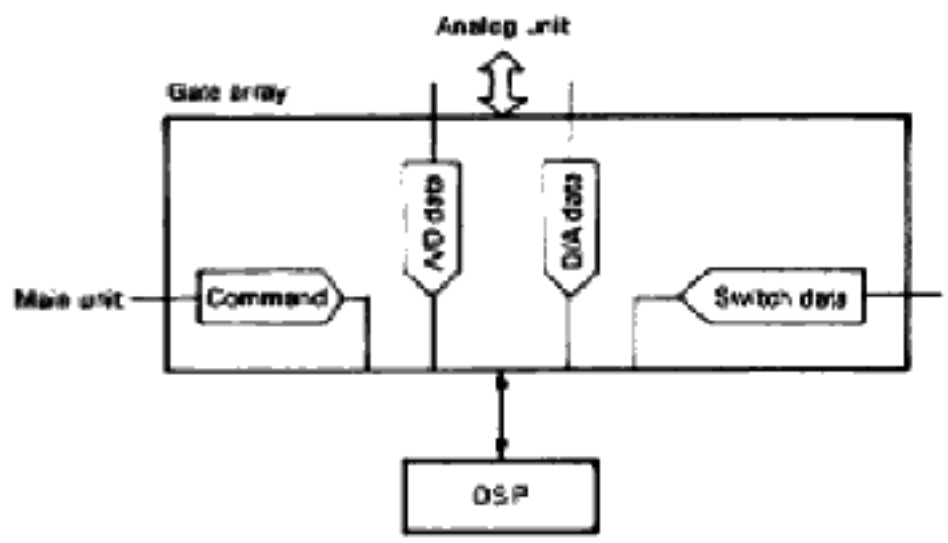


Fig. 41 Data flow in the digital unit

Reception of commands from the main unit

When MEN (MLE) is low, the MDA (ISD) data is read into the internal shift register synchronized with the leading edge of the MCK (ISC) signal. Data is latched in the internal buffer register by reading the 16 bit data and making MEN (MLE) high which generates an interrupt (NINT) to the DSP. The output from NINT is synchronized with the leading edge of the DCLK signal from the DSP.

CIRCUIT DESCRIPTION

- **Reset**

The leading edge of the reset signal applied to the NRS line from IC33 is delayed by the signal that is obtained by dividing the internal reference signal and is then applied to the NRES line.

The negative pulse to the NMR line is also delayed by the signal that is obtained by dividing the internal reference signal and is then applied to the NRES line.

The delay time in both cases is approximately 1.3 msec.

- **BIO signal**

The pulse that is synchronized with the sampling frequency, fs, is output to the BIO so that it is synchronized with the leading edge of the DCLK signal from the DSP.

The BIO signal output from the gate array is applied to the BIO line of the DSP. The DSP performs processing for each sample in synchronization with the BIO line.

- **Analog data and interface**

16-bit serial data read from the A/D converter: ADDT, CK17, CC

16-bit serial data written to the D/A converter: DADT, CK17, LEC

Data sample timing for sample hold amplifier: SH

Timing for output duty variable circuit: ANSW.

For ADDT, CK17, CC, DADT, CK17, LEC, SH, and ANSW, the timing is synchronized with the sampling period and is generated by the gate array.

The mixing clock (MIX) is turned off during AF-SLOPE operations.

MODE	MDO0	MDO1	MDO2
SSB	0	1	0
CW	1	1	0
AM	1	1	0
FM	0	1	0
FSK	0	1	0
AF SLOPE	0	0	0
RX other than SSB	0	1	0

Table 12 IC3, Q3 control (MDO0 to MDO2)

Cut-off	HPF1	HPF2
10	1	1
200	1	0
300	0	1
400	0	0

Table 13 HPF cut-off change (HPF1, 2)

Terminal		Function	Terminal		Function
Name	I/O		Name	I/O	
DBA–DBF	I/O	Data bus	MDO2	O	Low-pass filter input muting
A0–A2,A11	I	Address bus	SDT3	I	High-pass filter setting LSB
NWE	I	Write signal	SDT1	I	High-pass filter setting 2SB
NDEN	I	Read signal	SDT2	I	Low-pass filter setting LSB
NMEN	I	Memory recall	SDT3	I	Low-pass filter setting 2SB
BIO	C	Sampling timing	SDT4	I	CW leading edge characteristics
DCLK	I	DSP timing clock	SDT5	I	SSB ripple characteristics
NINT	C	DSP interrupt	SDT6	I	AF slope wide/narrow
NRES	C	DSP reset	SDT7	I	S3 extension
NRS	I	Gate array reset	SDT8	I	Test (TP5)
MIX	O	Clock for converting the D/A output to 455 kHz	SDT9	I	TXB
SH	O	Sample and hold amplifier sampling timing	KEY	I	CKY
LEC	O	D/A converter command	SFT	I	RTTY
ADDT	O	Data from A/D converter	SSD	I	Serial data for commands
CK17	O	Serial transmission clock	SSC	I	Serial clock for commands
CC	O	A/D converter command	SEN	I	Command data enable
DADT	O	Data to D/A converter	NMR	I	Manual reset input
ANSW	O	D/A output duty variable	CLK	I	Reference clock input
MDO0	O	DMIC-DAF1 change, DAF1-DAF2 through	NTST	I	For test
MDO1	O	ATT control	NTS2		

Table 14 Functions of gate array terminals

CIRCUIT DESCRIPTION

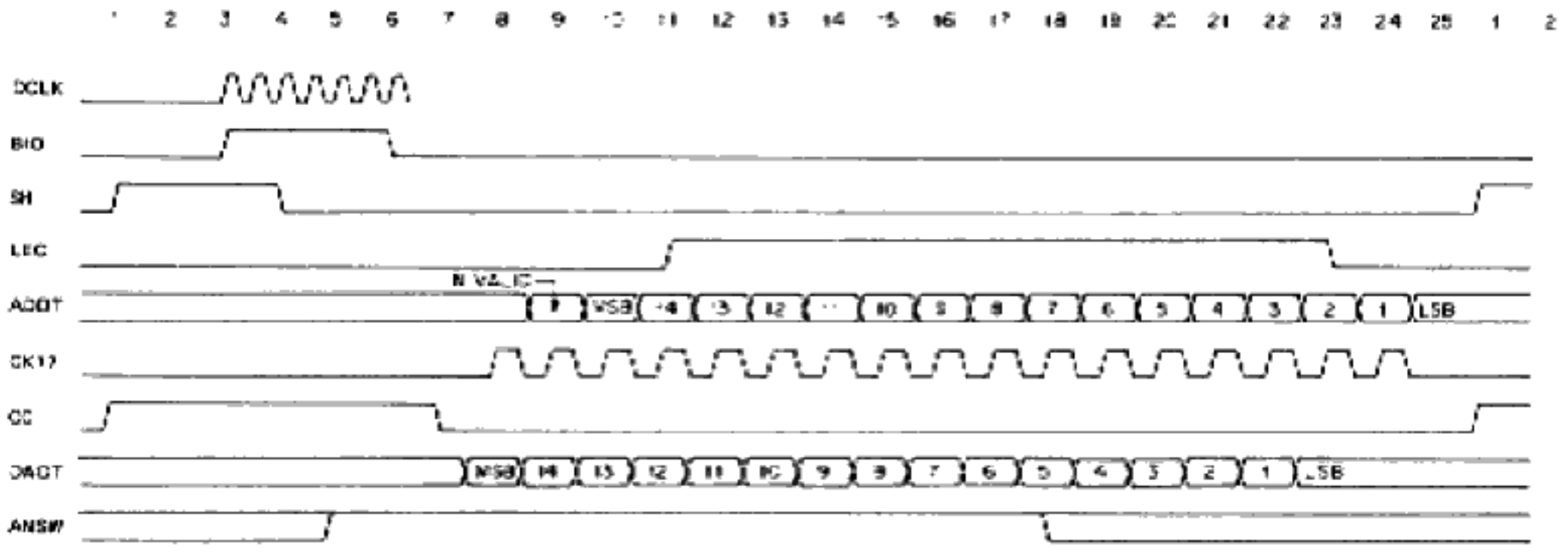


Fig. 42 Timing chart for gate array

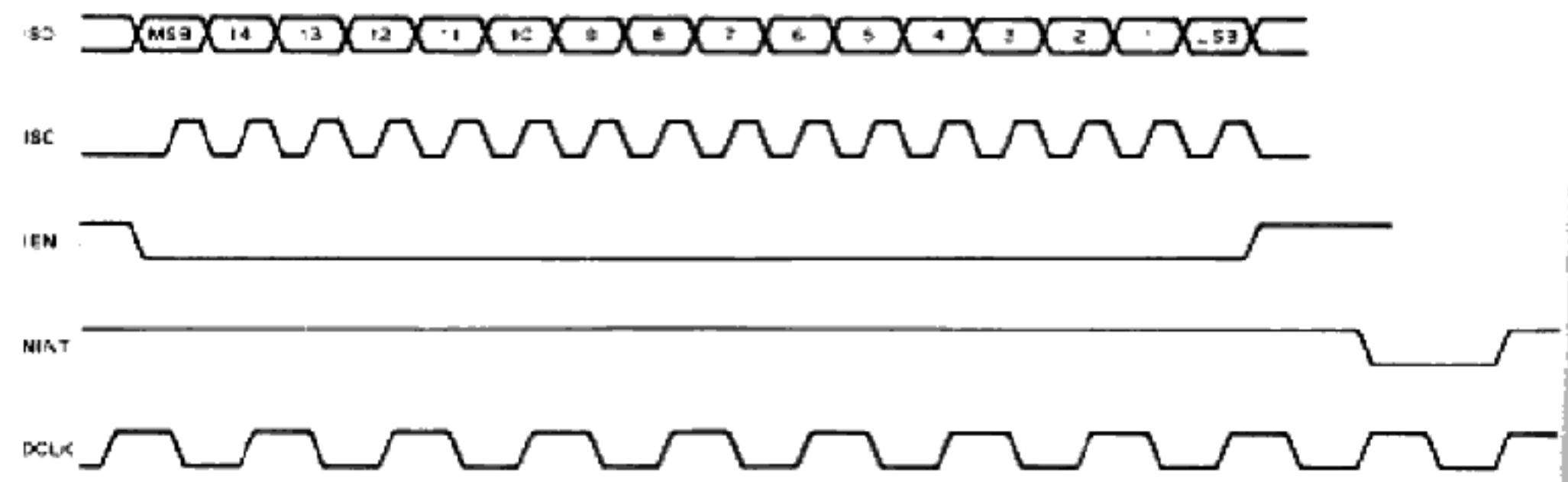


Fig. 43 Serial data entry and interrupt generation

CIRCUIT DESCRIPTION

• Analog unit

1) High-pass filter IC1, IC2 (MC74HC4052F)

The high-pass filter used for modulation processing is not a digital filter, but an analog filter because of the processing ability of the DSP. This high-pass filter allows to operator to program up to 4 different cut-off frequencies in order to select the desired tone.

S1	HPF1	HPF2	Y	X	Cut-off frequency (–3dB)
0, 4, 8	1	1	Y3	X3	75Hz
1, 5, 9	1	0	Y2	X2	185Hz
2, 6	0	1	Y1	X1	300Hz
3, 7	0	0	Y0	X0	400Hz

• MIC input high-pass filter

This active high-pass filter is configured as a fourth degree Butterworth filter and is controlled in four steps by IC1 and IC2.

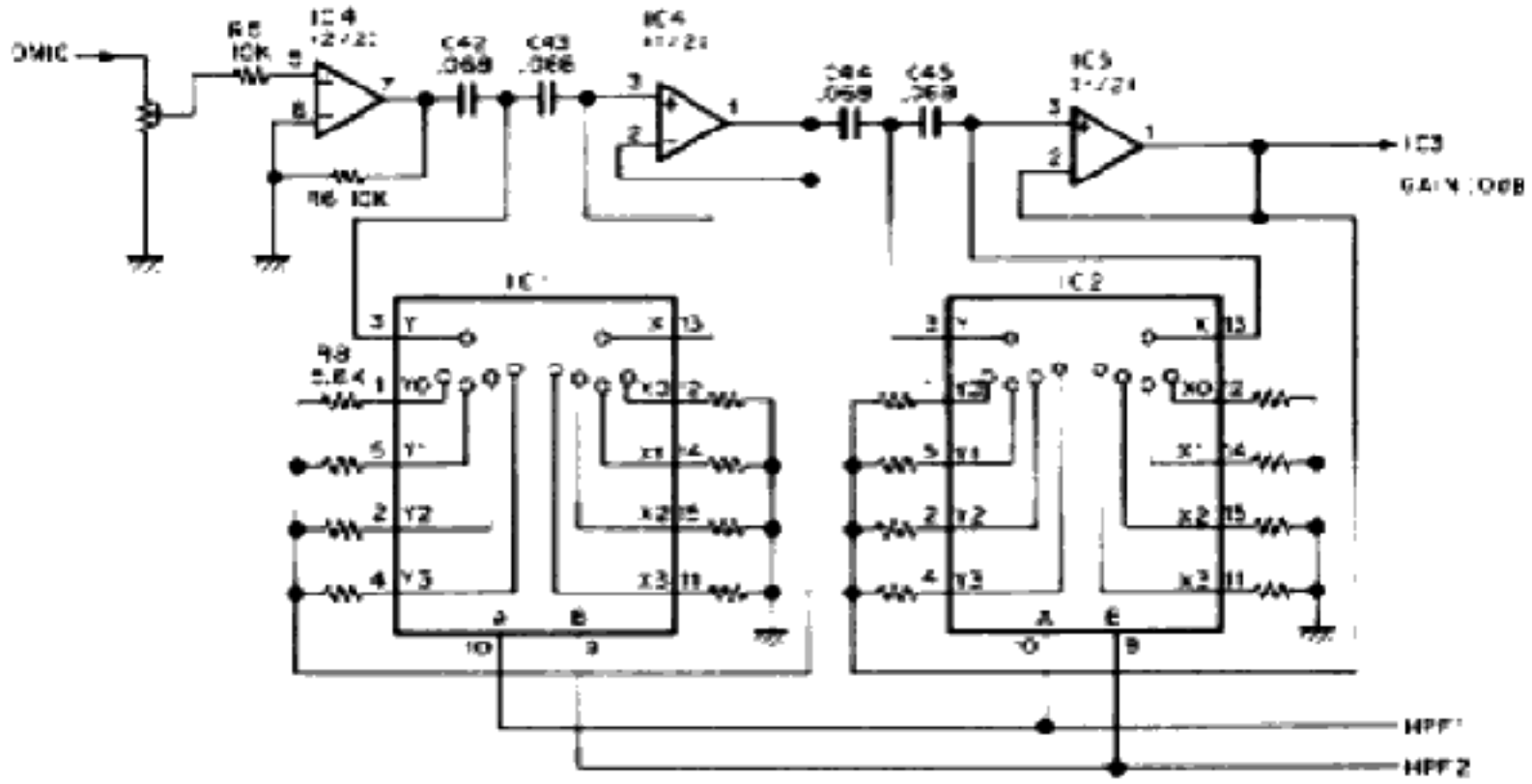


Fig. 44 MIC input high-pass filter

2) Limiting amplifier IC6 (NJM4560M), IC7/1 (NJM4558M)

When a signal with too much amplitude is applied to the A/D converter it is possible to experience large levels of distortion. To prevent this, the amplitude of the incoming signal is clipped by up to 3.2 Vp-p by a limiting amplifier to ensure that the level applied to the A/D converter (IC12 pin 1) does not exceed 6 Vp-p full scale.

When the output amplitude is between the specified limits (as illustrated in the accompanying diagram) the limiting amplifier operates as a 20-dB amplifier.

When the amplitude exceeds these limits, D2/1 turns on. When the amplitude exceeds Vc–, D2/2 turns on to clip the amplitude so that the output amplitude is between Vc+ and Vc–.

The shapes of the signal peaks become irregular because of the delay of the operational amplifier (IC6) and diode (D2), but this poses no problem.

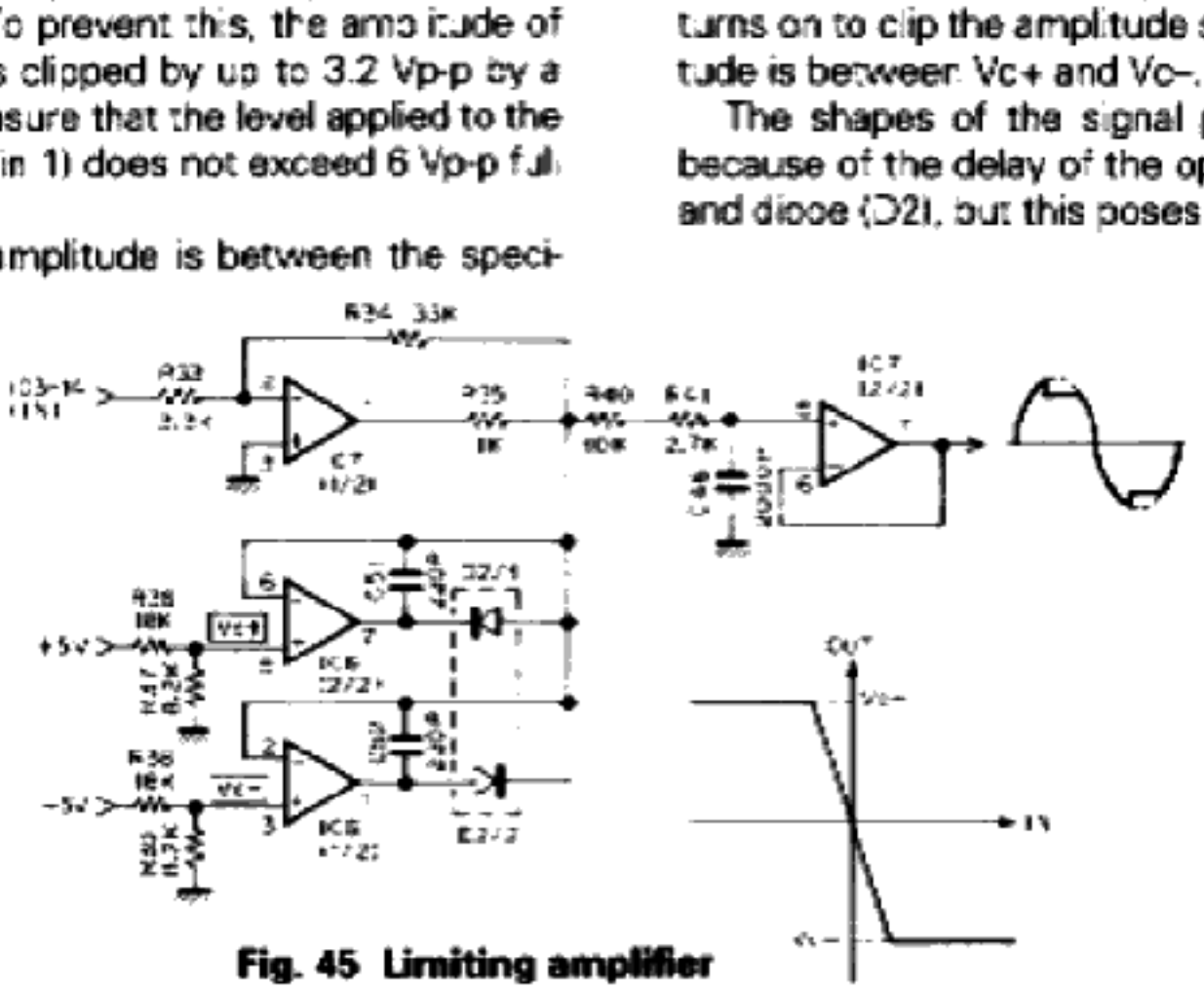


Fig. 45 Limiting amplifier

CIRCUIT DESCRIPTION

3) Sample and Hold

This is an integration type A/D converter that samples analog signals and keeps the input level of the A/D converter constant during the conversion process.

When 0 V is applied to the gate of Q1, Q1 turns on charging C53. When a negative voltage is applied to the gate of Q1, Q1 turns off the voltage during sampling is maintained at a constant level.

If Q1 is always on, the amplifier operates as an inversion amplifier whose gain is determined by R59 and R58. The gain is 0 dB.

R69 and R70 are protection resistors for IC10/1 and IC11/1.

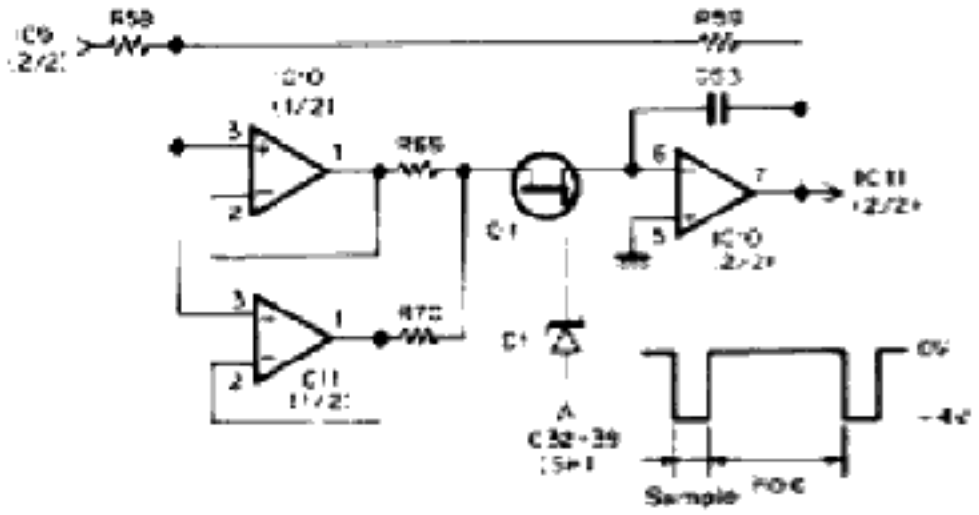


Fig. 46 Sample and hold circuit

4) LPF

This LPF is an sixth degree active Butterworth filter. This filter eliminates folded distortion and preverts signal-to-noise ratio reduction and distortion caused by the entry of unwanted signal components into the A/D converter.

5) D/A converter circuit

The D/A converter output is converted to the wedge type with a 50% duty during processing. The D/A converter output is distributed directly during AF-SLOPE operations. The frequency characteristics (aperture effect or early roll-off) of the D/A converter output are improved by taking the output with a 50% duty during processing.

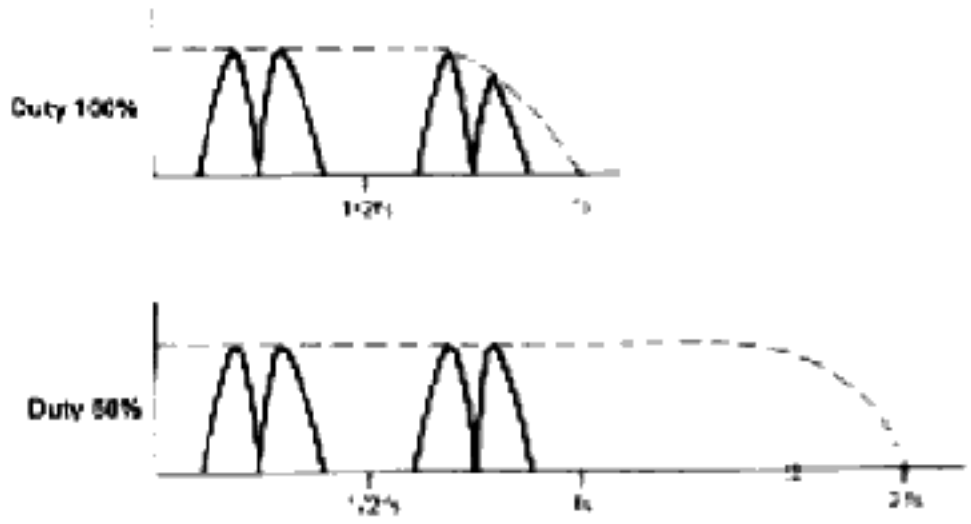


Fig. 47 Aperture effect

6) D/A output sampling circuit

Turns the D/A output on and off with the analog switch.

Turns the output on and off with a 50% duty during transmission in the SSB, CW, AM, and FM modes. Always on during AF-SLOPE TUNE. IC19 eliminates the analog switch output, and operates as a buffer amplifier.

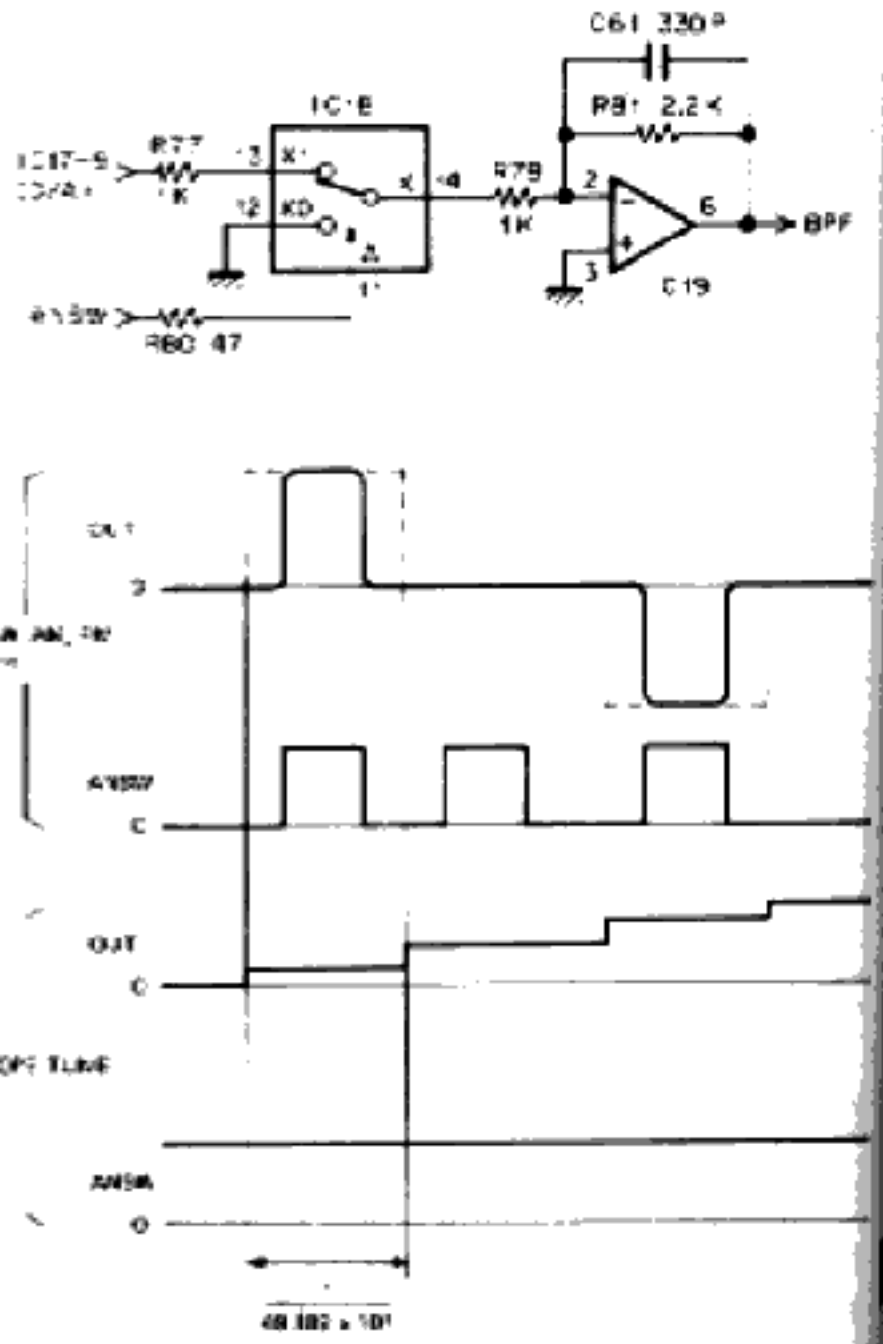


Fig. 48 D/A output sampling circuit

7) ATT

Turns on Q3 in the CW and AM modes, forming a voltage divider circuit on the output of Q2 that is composed of R96 and R97 to reduce the signal level applied to Q4.

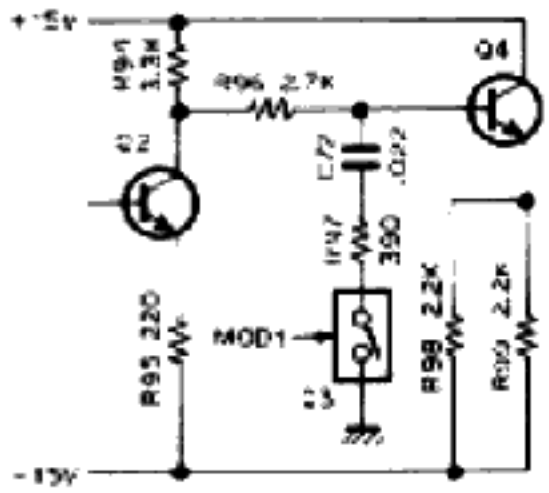


Fig. 49 ATT

CIRCUIT DESCRIPTION

8| Mixer

Combines the 36.891 kHz signal with the 491.891 kHz signal to produce the 455 kHz output. Q5 is an input buffer; Q6, an output buffer.

Since this mixer is used to combine square waves, it generates many harmonics of 491.891 kHz, but it does have the desirable characteristic of producing less distortion and noise than IC type mixers.

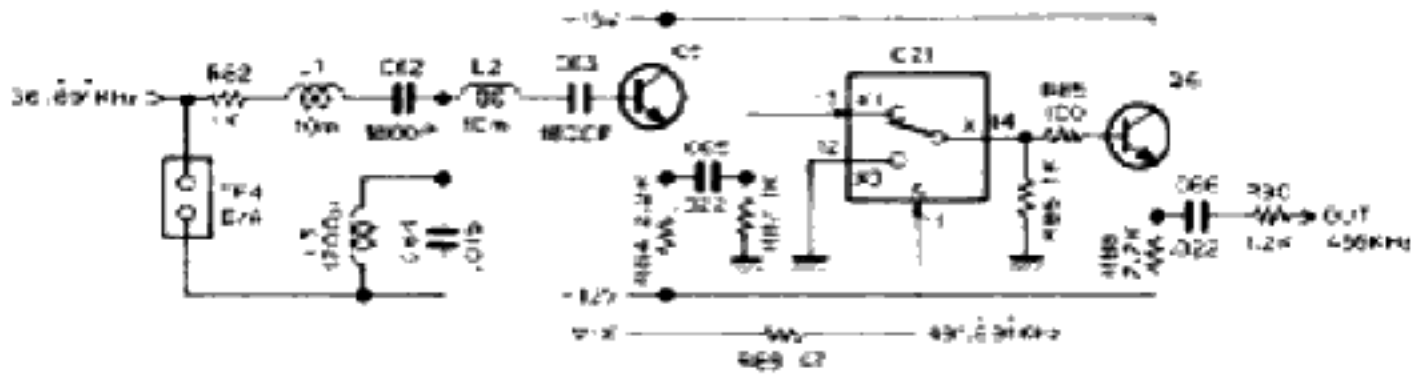


Fig. 50 Mixer

• Description of digital signal processing

The DSP-10 converts the analog signal to a digital signal to implement modulation and filtering by numeric means rather than using conventional RC circuits and analog ICs.

Since the modulation and filtering performed by the DSP-10 do not suffer from the inaccuracies of conventional analog processing methods is possible to provide ideal properties.

The DSP-10 uses a sampling frequency of 49.189 kHz for the A/D and D/A converters. When it is preferable to use a lower sampling frequency to reduce the processing time and improve performance, the sampling frequency is reduced by 1/2 or 1/4.

1) SSB modulation

• Overview of processing

Several different methods are available for digitally processing an SSB signal, they include the direct modulation method, the Weaver method, and the Hartley method. The DSP-10 uses the direct modulation method.

There are two generally accepted direct modulation methods: the filter method which removes the unnecessary sideband thru the use of an analog filter; or the method that suppresses the unnecessary sideband by generating a copy of the incoming audio signal that has had its phase shifted by 90 degrees thru the use of a phase shift network (PSN) and adding it with the original signal and carrier. Since the second method results in an SSB signal that has been obtained thru the use of phase shifts the use of a filter with steep cutoff characteristics, such as the ones used in the filter method, is not required. Therefore a higher sideband suppression ratio can be obtained from the low-frequency range using this broadband phase shifter. This method is far superior to the filter method in obtaining a wide frequency response. In the past this method has not been used much because it has been difficult to obtain a PSN (Phase Shift Network) with good characteristics due to variations in parts tolerances, circuit stability, and errors in circuit adjustment.

The DSP-10 uses the PSN method to generate SSB with good characteristics thru the use of an accurate, stable phase shifter obtained by digital signal processing.

The modulated signal from the A/D converter is applied to a LPF to limit the bandwidth. The signal is then split applied to the Phase shift network where the phase of the two signals is shifted by 90 degrees. The resulting signals, with a phase difference of 90 degrees, are mixed with carrier signals that are also 90 degrees out of phase with each other. The two resulting signals are then subtractively mixed to produce the SSB signal. The carrier of the SSB modulated wave is suppressed thru the use of a digitally controlled comb type filter and then exits the D/A converter.

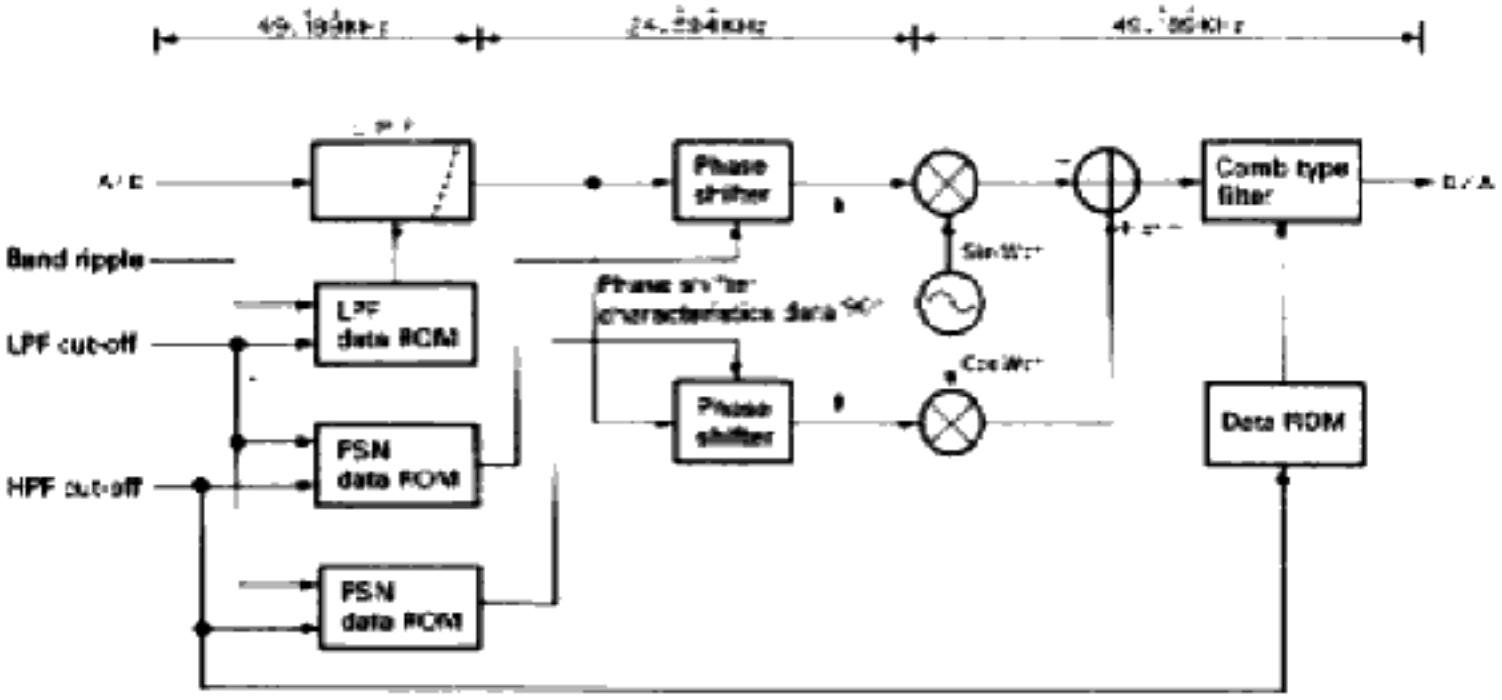


Fig. 51 SSB modulation block diagram

CIRCUIT DESCRIPTION

Functions

The LPF is a 5th order programmable Chebshev design.. It allows the cut-off frequencies to be changed in four steps and the ripple in the band to be selected between 0.01 dB and 1.6 dB. When the ripple is set for 0.01 dB, the group delay characteristics are primary, i.e., the sound quality is considered to be the most important. When the ripple is set for 1.6 dB, the transition band characteristics are primary, i.e., the band width is considered to be the most important.

The DSP-10 uses two 5th order phase shifters, each consisting of five all-range passing-type phase shifters connected vertically to obtain sideband suppression characteristics of 70 dB or more. To further improve the sideband suppression characteristics, the degree of phase shift is increased or the 90-degree bandwidth of the phase shifter is narrowed.

Increasing the degree of the phase shifter is not desirable because the group delay characteristics deteriorate and faster processing is recuired. The DSP-10 implements the optimum characteristics for each transmit band by changing the design band ratio and frequency of the phase shifter by a combination of a high-pass filter and a low-pass filter.

Table 15 lists the various of high-pass filters and low-pass filters combinations which are selected to improve the sideband suppression ratio when the bandwidth is narrow.

Theoretically, there is no carrier leakage by the digital multiplier. However, it does occurs due to the offset voltage that is generated by the noise procuced in the processing of the phase shifter. To prevent this, the DSP-10 uses a digital comb-type filter to suppress carriers. Whenever MIC input is present, this filter makes the carrier leakage below measurable levels.

The cut-off of the high-pass filter for suppressing the leakage on the opposite sideband of the phase shifter is the overall cut-off of the analog high-pass filter and comb-type filter.

HPF	LPF	Phase shifter band
110	2600, 2760	80~3435Hz/70dB
	2920, 3100	75~4296Hz/70dB
200	2600, 2760	129~3696Hz/74dB
	2900, 3100	75~4296Hz/70dB
300	2600, 2760 2900, 3100	190~5423Hz/74dB
400	2600, 2760 2900, 3100	220~6923Hz/74dB

Note
The bandwidth of the phase shifter are those before quantization, and therefore do not exactly match the actual bandwidths.

Table 15

2) CW

The 455-kHz carrier is generated or stopped according to the data supplied by the keying device. The DSP detects the leading edge (KEY down) and trailing edge (KEY up) of the keying signal, reads data from the internal square cosine characteristics ROM, modulates the amplitude according to the data, and obtains the shaped CW output.

A filter with square/cosine characteristics is used to shape the waveform for data communication. The filter has the advantage that it reduces the questionable status (0 or 1) at the data change point caused by overshooting of waveforms, and decreases the bandwidth caused by data change.

It is difficult for an analog filter with these characteristics to name equivalent amplitude characteristics, and it must have linear phase. Therefore, it can have only approximate characteristics. In addition, this filter is very complicated. The DSP-10 provides good transmit waveforms, in which even steep CW waveforms have no KEY clicks, without having to resort to the use of analog filters.

When the CW spectrum of the DSP-10 is viewed with a spectrum analyzer, the spectrum is concentrated at the carrier. Since the transmission bandwidth is narrow, there is less influence even when the receiver passes signals through a narrow-band filter than before.

The CW leading edge characteristic is normally 2 msec. The operator can select from several values between 2 msec and 4 msec.

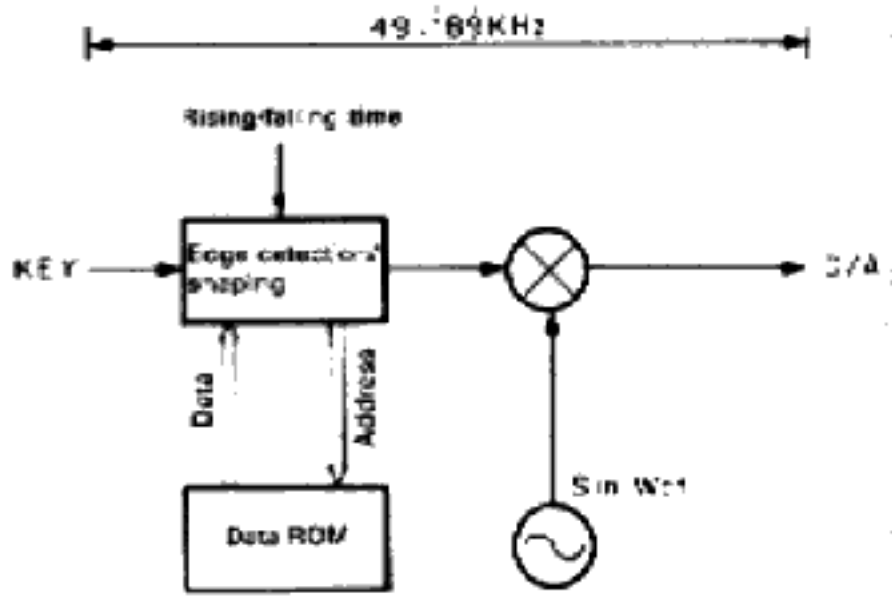


Fig. 52 CW block diagram

CIRCUIT DESCRIPTION

3) AM

The bandwidth of the modulating signal from the A/D converter is limited by the low-pass filter, given a specific offset, and is multiplied by the carrier to produce the modulated AM signal.

The low-pass filter is an Finite Impulse Response (FIR) digital filter of the 84th degree, which provides good frequency characteristics and flat group delay characteristics. Additionally, since linear modulation processing is performed with a digital multiplier, modulated waves with little distortion are obtained up to levels of 100% modulation.

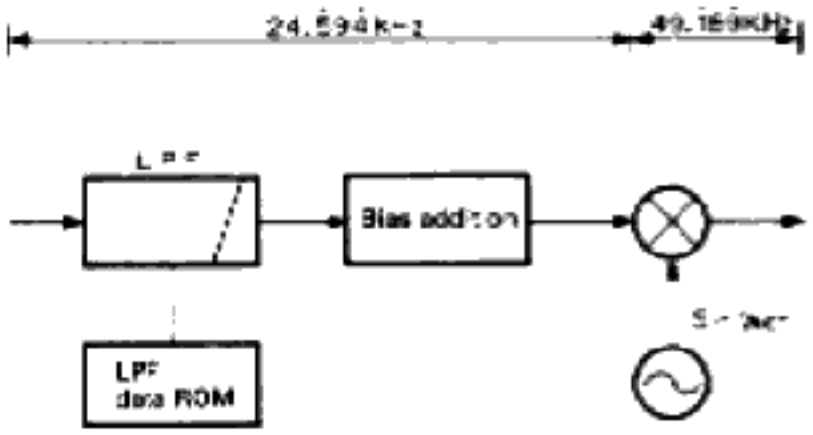


Fig. 53 AM modulation block diagram

4) FSK

The mark and space frequencies are generated directly by digital signal processing according to the frequency shift data from the RTTY line (DDS).

The DSP detects the leading and trailing edges of the shift signal. The DSP reads the data from the internal square cosine characteristics ROM and obtains the shaped FSK as the DDS frequency data. The mark frequency does not greatly interfere with the space frequency because of the square cosine waveform shaping characteristics, as in the CW mode, and because FSK modulation is performed with continuous phases. There is, therefore, less character change or bit errors when demodulating the signal.

Strictly speaking, the actual shift width is not 170,200, 425, and 850, but 171.129, 201.152, 426.322, and 849.642 due to the frequency steps that can be generated by the DSP. This should not prove to be of any practical concern.

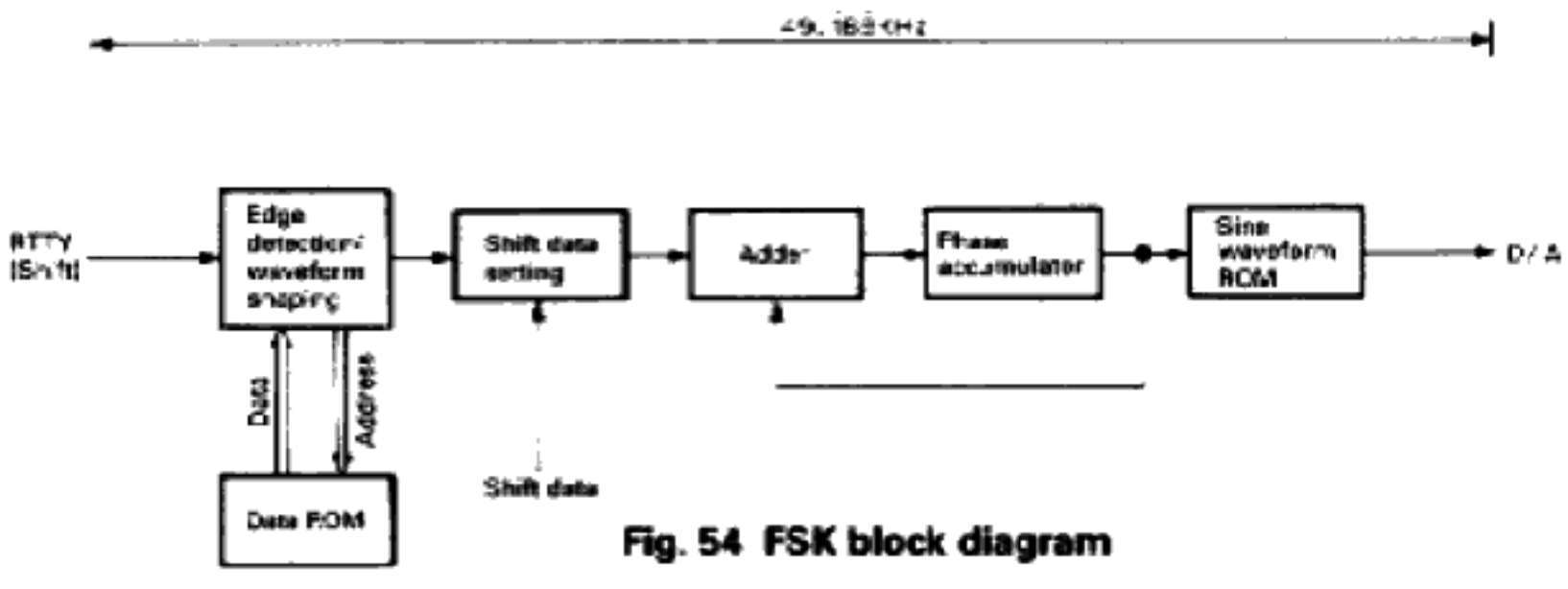


Fig. 54 FSK block diagram

5) AF-SLOPE TUNE

Interlocked with the SSB-SLOPE TUNE control of the main unit, this functions as the AF-SLOPE TUNE for the audio band.

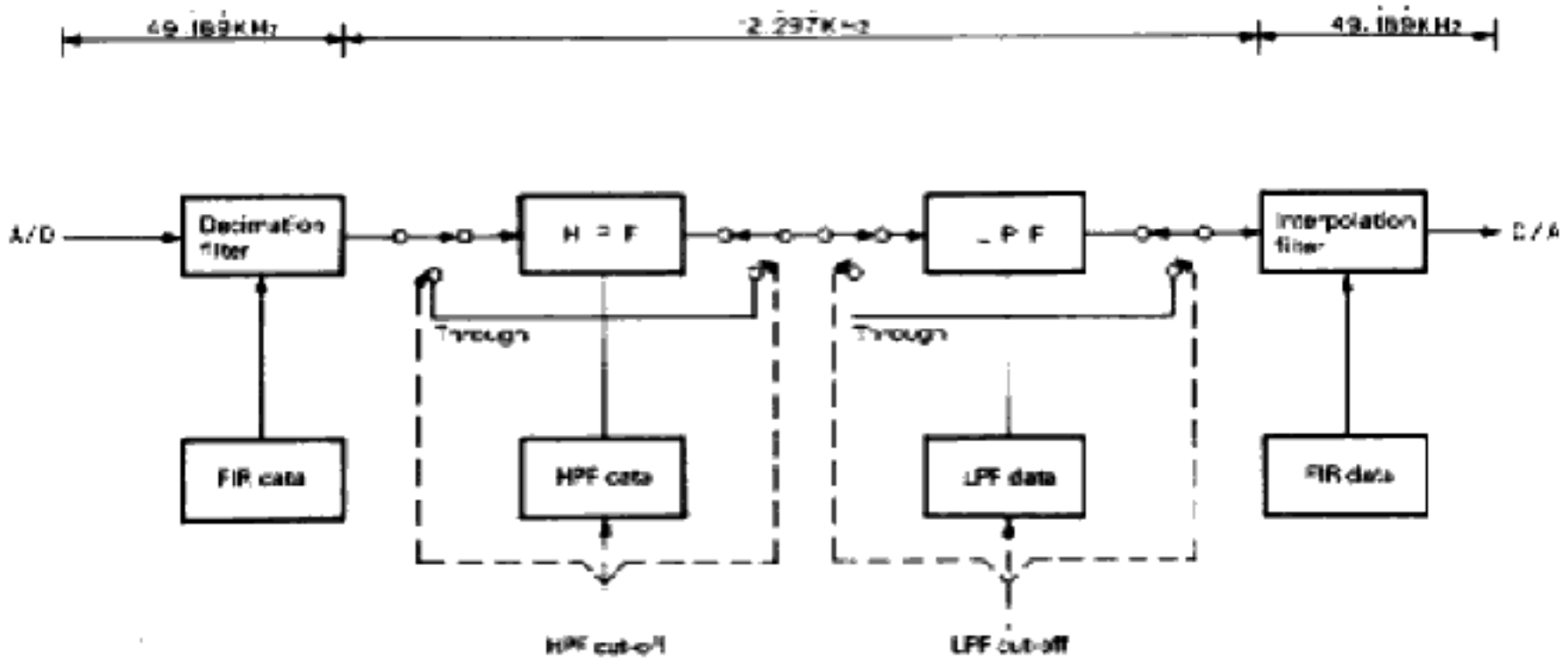


Fig. 55 AF SLOPE TUNE block diagram

CIRCUIT DESCRIPTION

· **Overview of processing**

The digital audio signal from the A/D converter is converted into 1/4 the sampling frequency by the decimation filter, and is then processed by the high-pass and low-pass filters. The signal is then returned to the original sampling frequency by the interpolation filter, and transmitted from the D/A converter.

· **Functions**

The decimation filter and interpolation filter are composed of 20th degree FIR filters.

The high-pass filter is a simultaneous 4th order Chebeshev filter. The low-pass filter is a simultaneous 6th order Chebeshev filter.

The ripple bandwidth of the high-pass filter is 0.1 dB, and that of the low-pass filter is 0.000' dB. These characteristics assure flat frequency characteristics and reduce variations in the group delay characteristics near the cut-off frequency.

The sampling frecuencies for the high-pass filter and low-pass filter are reduced by 1/4 to shorten the processing time. This helps provide ample processing time for both the high-pass filter and low-pass filter and improves performance.

The cut-off frequencies of the high-pass filter and low-pass filter are controlled according to data from the main unit, and operate interlocked with the slope tune controls of the main unit. The bandwidth can be narrowed by two clicks with the SLOPE TUNE control on the main unit by operating the DSP-10 switch.

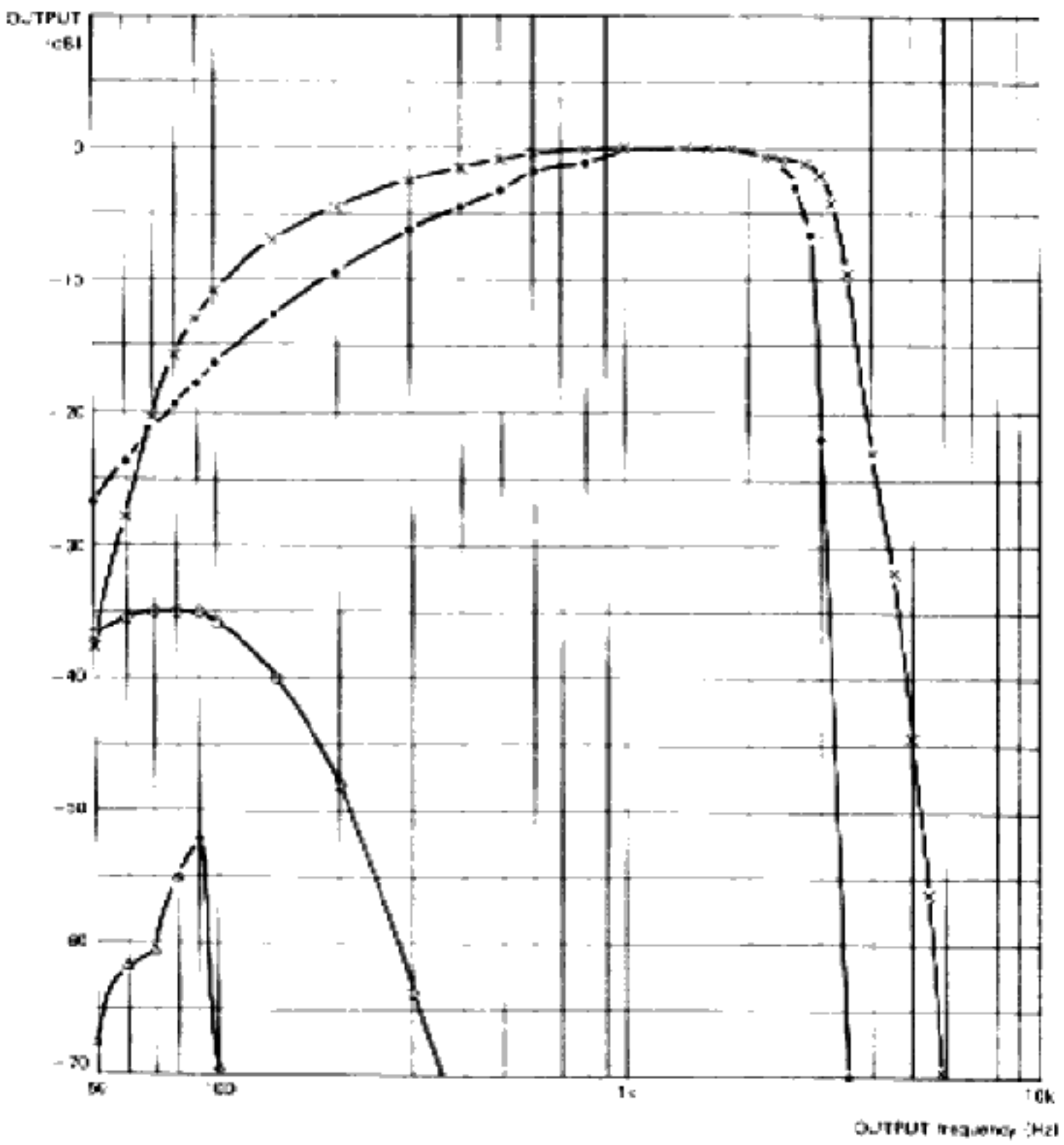


Fig. 56 TS-950SD SSB frequency response

CIRCUIT DESCRIPTION

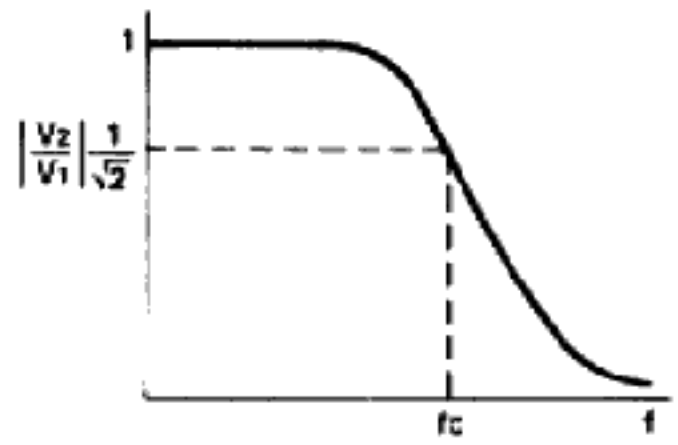
• Reference data

1) Butterworth characteristic

The ratio of input voltage V1 and output voltage V2 is given by the equation (1).

$$\left|\frac{V_2}{V_1}\right| = \frac{1}{\sqrt{1+(f/fc)^{2n}}} \quad \cdots\cdots (1)$$

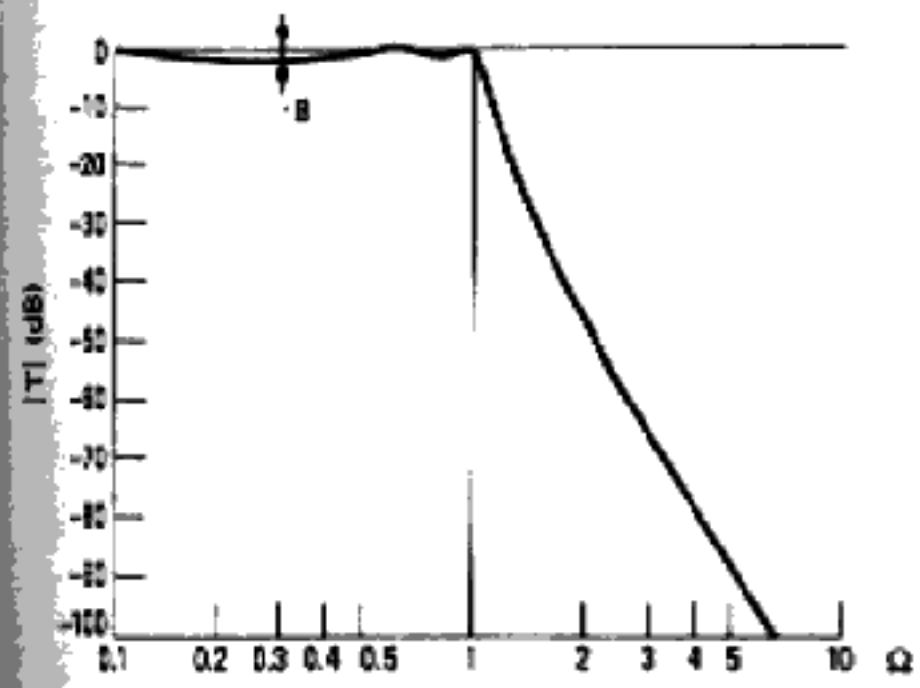
V2/V1 becomes (1) when f < fc and decreases when f > fc. As the figure below shows, this functions as a low-pass filter with fc as a boarder. This is called the Butterworth characteristic and is representative of filter characteristics. The fc is called a cutoff frequency.



Low-pass characteristic

2) Tchebycheff characteristic

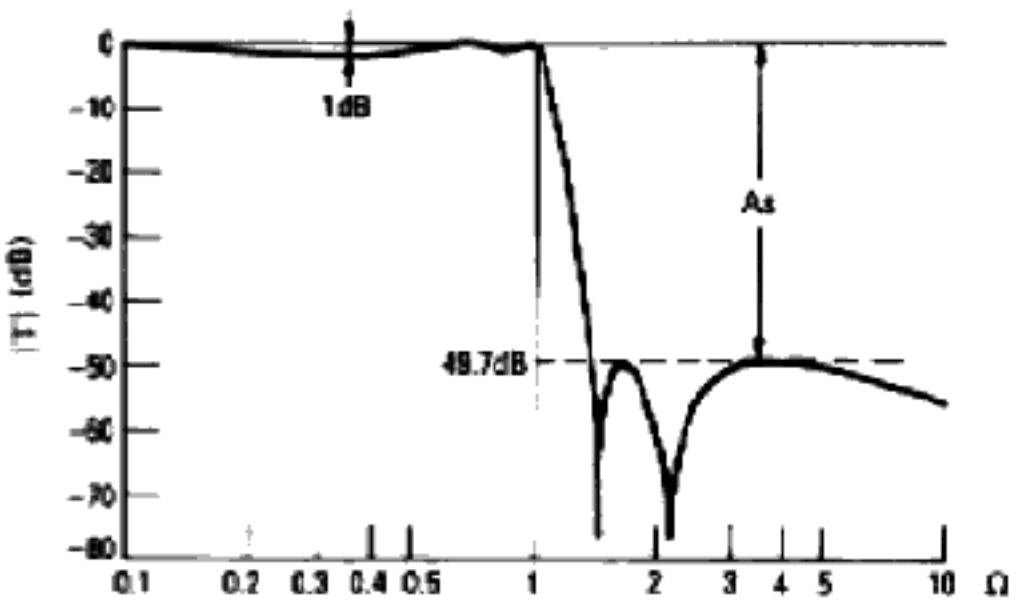
A Butterworth characteristic has a flat response in the passband, but can have a sharp cutoff when the passband contains ripple. A characteristic that contains an equal ripple in the passband is called a Tchebycheff characteristic. The maximum cutoff can be obtained with respect to the ripple in the given passband. The amplitude of a five-degree Tchebycheff characteristic having 1 dB of ripple in the band is shown in the figure below.



Amplitude of five-degree Tchebycheff characteristic

3) Simultaneous Tchebycheff characteristic

All amplitudes of the characteristics described above decrease when attenuation decreases. At that time, the transfer function is represented by the reciprocal of a polynomial expression. When the numerator of the transfer function is also represented by a polynomial expression and transmission zero points are set to some attenuation bands, an even sharper cutoff can be obtained. A characteristic that contains equal ripple in the passband and attenuation band is called a simultaneous Tchebycheff caracteristic. The sharpest cutoff characteristic can be obtained with respect to the given degree, allowable ripple in the passband, and minimum attenuation in the attenuation band. The five-degree amplitude characteristic when the ripple in the passband is 1 dB and minimum attenuation, as in the attenuation band is approximately 50 dB as shown below.



Amplitude of simultaneous Tchebycheff characteristic

4) Nyquist band

When a signal is sampled using sampling frequency fs in accordance with the sampling theorem, sampled signal f (t) can be reproduced by interpolating a sampled signal if its band is 1/2 fs. A band of 1/2 fs is called the Nyquist band.

5) Transition band characteristic

This indicates the situation in which the band transits from passband to stopband.

6) IIR LPF (IIR filter)

This is suitable for manufacturing a filter having a sharp cutoff. This filter can be designed by converting the transfer function of an analog filter.

7) FIR filter

This filter has a perfectly linear phase, stable operation, and improved singal-to-noise ratio (SNR).

8) Decimation filter

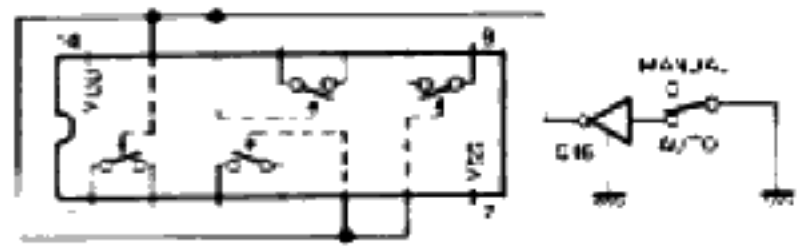
This filter is used to decimate data when a signal is converted to a low sampling frequency.

9) Interpolation filter

This filter is used to interpolate data when a signal is converted to a high sampling frequency.

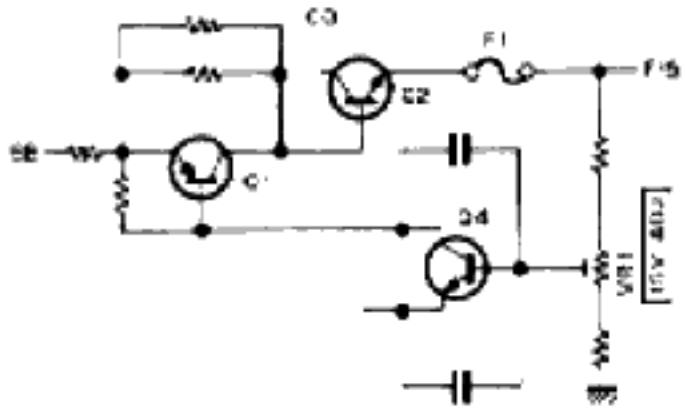
DESCRIPTION OF COMPONENTS

SWITCH UNIT (A) (X41-3080-00)

Components	Use/Function	Operation/Condition/Compatibility
IC1	AT AUTO/MAMU signal select	
IC2	One shot-multi vibrator.	For dimmer adjust.
Q1	FM LED driver	LFM (CN6). Active "H"
Q2	AM LED driver	LAM (CN6). Active "H"
Q3	CW LED driver	LCW (CN6). Active "H"
Q4	USB LED driver	LUSB (CN6). Active "H"
Q5	LSB LED driver	LLSB (CN6). Active "H"
Q6	FSK LED driver	LFSK (CN6). Active "H"
Q7	TA LED driver	LTA (CN6). Active "H"
Q8	RM LED driver	LRM (CN6). Active "H"
Q9	RA LED driver	LRA (CN6). Active "H"
Q10	TM LED driver	LTM (CN6). Active "H"
Q11	TB LED driver	LTB (CN6). Active "H"
Q12	RB LED driver	LRB (CN6). Active "H"
Q13~15	Key pad LED driver	LK1 (CN6). Active "H"
Q16	Driver	Analog gate (IC1) select.
Q17	Buffer	
D1~7	Reverse current prevention	
D8	AIP LED	HIPC (CN1). Active "L"
D9	NOTCH LED	LNOT (CN1). Active "H"
D10	AT TUNE LED	LMTA (CN1). Active "H"
D11	ON AIR LED	LONB (CN1). Active "H"
D12	D8 protection	D12 get to reverse bias when HIPC become "H".
D13	AVR	+10V.
D14	Reverse current prevention	

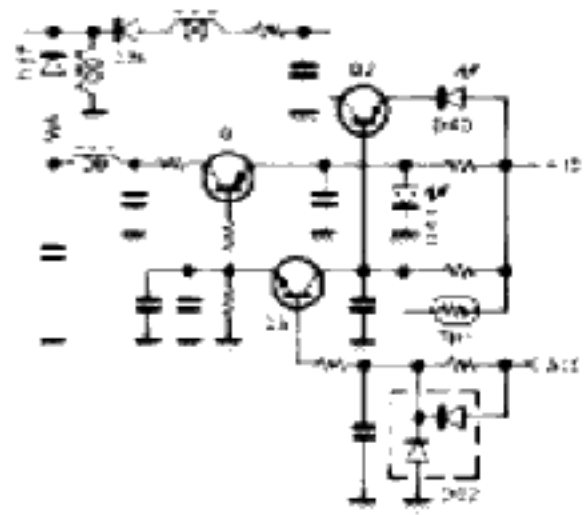
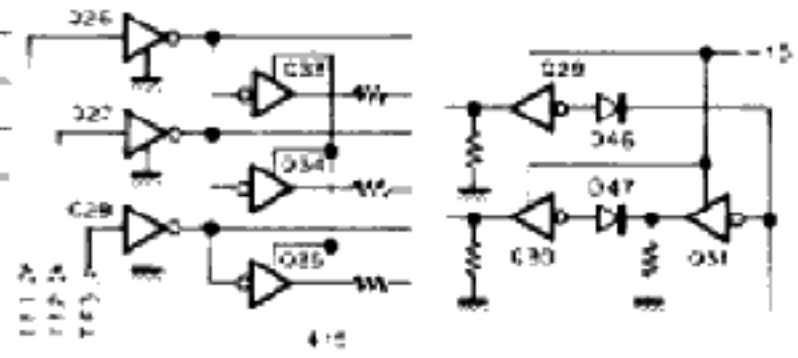
AVR UNIT (X43-3070-01) (A/6) ~ (E/6)

Components	Use/Function	Operation/Condition/Compatibility
IC1	+5V AVR	+5V voltage supply for digital unit.
IC2	+5V AVR	+5V voltage supply for PLL unit.
IC3	+5V AVR	+5V voltage supply for DSP unit.
IC4	−12V AVR	−12V voltage supply for each PC board.
Q1	Pre drive	Drive to Q2 device.
Q2	Series-passed transistor	+5V voltage supply for each PC board.
Q3	Fan motor "HIGH" switch	Fan motor turned to "HIGH" position.
Q4	An error amplifier	Amplified voltage error of the +15V voltage supply
Q5	−40V AVR	−40V voltage supply for FL tube.
D1	Voltage rectifier	Base bias for Q1.
D2	Temperature compensation	Cancel to D1 voltage change from temperature changing.
D3	+15V AVR reference voltage	+7.5V.
D4	Fan turned start voltage	Make a voltage when the fan turned on.
D5	Voltage rectifier	−40V.
D6	Voltage rectifier	−12V
D7,8	Occur −40V voltage	−20V x 2.
D9	Voltage rectifier	−58V voltage for final unit.
D10	Voltage rectifier	+15V.



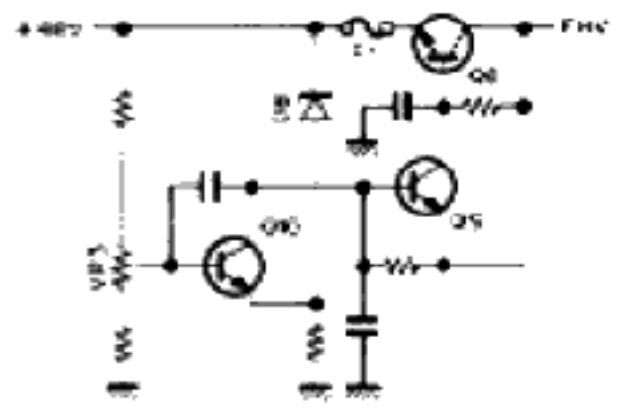
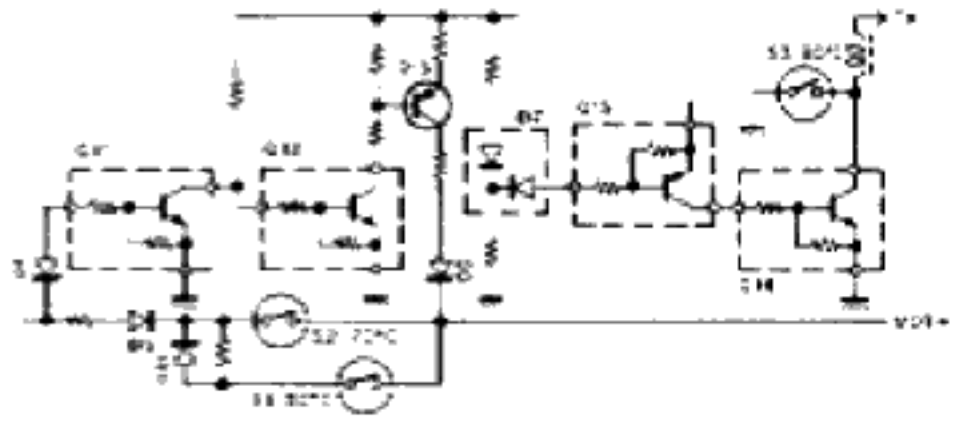
DESCRIPTION OF COMPONENTS

RF UNIT (X44-3100-00)

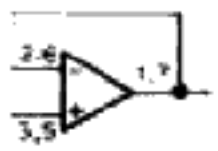
Components	Use/Function	Operation/Condition/Compatibility
IC1,2	Band information decoder	Open collector. Active "L"
Q1~3	RF AGC amplifier	
Q4	AIP amplifier	
Q5,6	RF amplifie	
Q7	Buffer	
Q9~11	RX SUB 1st mixer	Convert receive frequency into 40.055MHz.
Q12	Buffer	
Q13~16	RX MAIN 1st mixer	Convert receive frequency into 73.05MHz.
Q17	SUB VCO amplifier	
Q19	MAIN VCO amplifier	
Q19	TX DRIVE amplifier	RF output of RF unit : 10dBm or more
Q20,21	TX 3rd mixer	Convert 73.05MHz into transmission frequency.
Q22	TX amplifier	
Q23	Switching	When R83 become "H", output to "L".
Q24	Switching	On in MONITOR operation.
Q25	Switching	On in AT TUNE
Q26~28	Switching	Transmission filter select.
Q29~31	Switching	AF turned on and off select.
Q32	Switching	On in MONITOR operation.
Q33~35	Switching	Bias of mixer circuit select.
Q37	Switching	ATT in MONITOR operation. 
D1,2	Relay surge voltage absorption	D1 : 10dB ATT D2 : 20dB ATT
D3	Voltage regulator	Voltage supply of IC1 and IC2 (5V).
D4,5	Lightning surge protection	
D6~35	RX BPF select.	
D36	Switching	MARKER circuit switch.
D37,38	AF AGC	AGC circuit pin diode.
D39	Switching	Frequency range 0.5MHz ess and more select.
D40	Voltage shift	
D41	Voltage regulator	
D42~45	Switching	AIP turned on and off select.
D46,47	Reverse current prevention	
D48,49	Switching	MONITOR turned on and off.
D50,51	Switching	MAIN VCO transmission and receive select.
D52~57	Switching	TX BPF select.
D58~60	Reverse current prevention	TX mixer circuit bias.
D61	Reverse current prevention	Decide to gain of the POWER CONTROL or AT TUNE
D62	Reverse current prevention	
D63	Lightning surge protection	
D64	Switching	MARKER circuit switching.

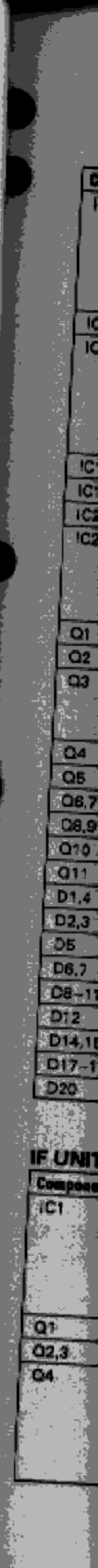
DESCRIPTION OF COMPONENTS

FINAL UNIT (X45-3330-00)

Components	Use/Function	Operation/Condition/Compatibility
Q1	Pre-drive amplifier	HF wide range amplifier
Q2,3	Driver amplifier	Push-pull wide range amplifier
Q4,5	Final amplifier	Push-pull wide range amplifier
Q6	Drive bias voltage supply	
Q7	Final bias voltage supply	
Q8~10	AVR	Final +48V. 
Q11~13	Switching	Fan motor control.
Q14,15	Switching	Transmission stop when irregular voltage of 50V. 
D1	Temperature compensation	Pre-driver temperature detection.
D2	Temperature compensation	Drive temperature detection.
D3	Temperature compensation	Final temperature detection.
D4	15V voltage detection	
D5,6	Reverse current prevention	
D7	Switching	Transmission stop when irregular voltage of 50V.
D8	AVR	50V AVR reference voltage.
D9	Surge absorption	For fan motor.
D10	AVR	Voltage drop protection when S1 switch turned on.

DIGITAL UNIT (X46-3050-XX) -11 : K,P -21 : M -61 : W -62 : W2 -71 : X

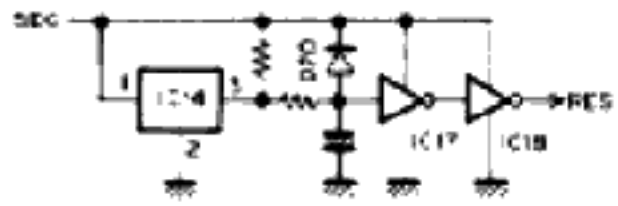
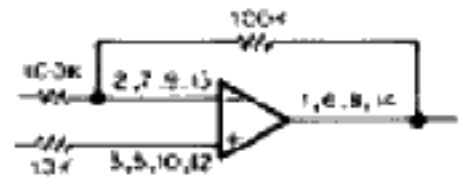
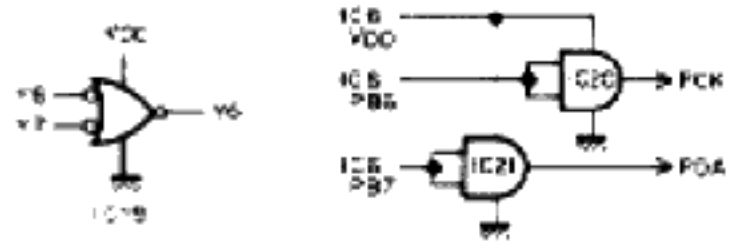
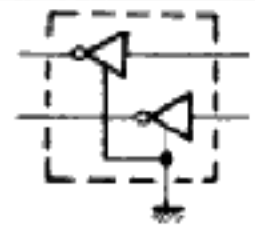
Components	Use/Function	Operation/Condition/Compatibility
IC1	CPU	8 bit microprocessor.
IC2	ROM	32K x 8 bit.
IC3	RAM	8K x 8 bit.
IC4	Address latch	Multiplexer address/address latch of data output.
IC5	Address decoder	Convert address signal into each IC chip select signal.
IC6	I/O port	8 bit x 4, 4 bit x 1
IC7	I/O port	8 bit x 8.
IC8	I/O port	8 bit x 4, 4 bit x 1
IC9	Encoder gate array	MAIN, CLOCK count of the encoder.
IC10	Encoder gate array	SUB, BIT/BIT count of the encoder.
IC11	Buffer	D/A converter output. 
IC12	Inverter	Encoder shape wave circuit.
IC13	A/D converter	8 bit, 8 channel.



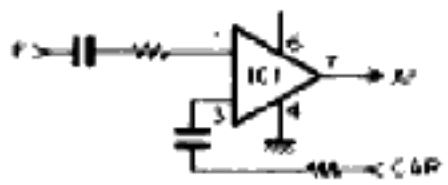
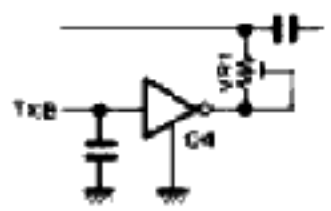
IF UNIT

Compone
IC1
Q1
Q2,3
Q4

DESCRIPTION OF COMPONENTS

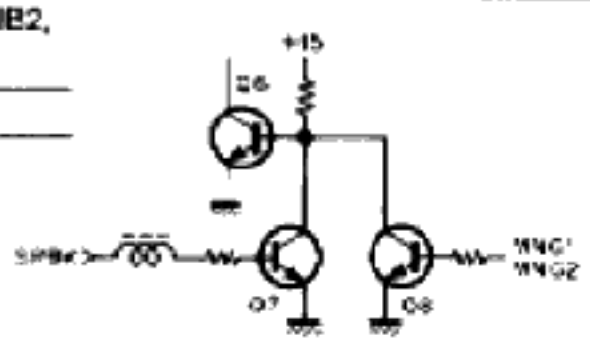
Components	Use/Function	Operation/Condition/Compatibility
IC14	System reset	Reset pulse generator. 
IC15	Serial buffer	Parsonal computer interface I/O buffer.
IC16	Buffer	D/A converter output. 
IC17,18	Reset buffer	Reset signal buffer
IC19	Chip select decoder	Chip select mixer for RAM.
IC20	Data buffer	PLL clock pulse buffer.
IC21	Data buffer	PLL data pulse buffer. 
Q1	Mode signal switching	DATA mode, FSK mode.
Q2	Mode signal switching	AM mode, CW mode.
Q3	Mode signal switching	FM mode, SSB mode. 
Q4	Signal switching	AIP signal mixer select, ALMS signal (MET3 meter select)
Q5	TXI signal switching	Transmission band indication signal.
Q6,7	RX band signal switching	RBC – RB3.
Q8,9	LPF signal switching	LP0 – LP3.
Q10	APRE signal switching	AT preset signal.
Q11	SMKC signal switching	Sub marker signal turn on and off. Marker on : active "L"
D1,4	Back-up voltage select switch	
D2,3	Protection diode	MIC UP/DOWN.
D5	Switching	Antenna tuner auto/through signal.
D6,7	Switching	Option filter DS switch.
D8–11	Protection diode	A/D converter input protection.
D12	Switching	Expand frequency function.
D14,15	Switching	Expand frequency function.
D17–19	Switching	Expand frequency function.
D20	Reset diode	Reset circuit time constant capacitor discharge.

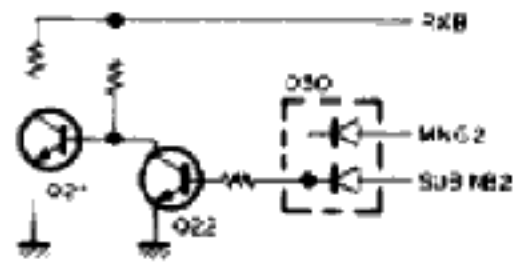
IF UNIT (X48-3060-00)

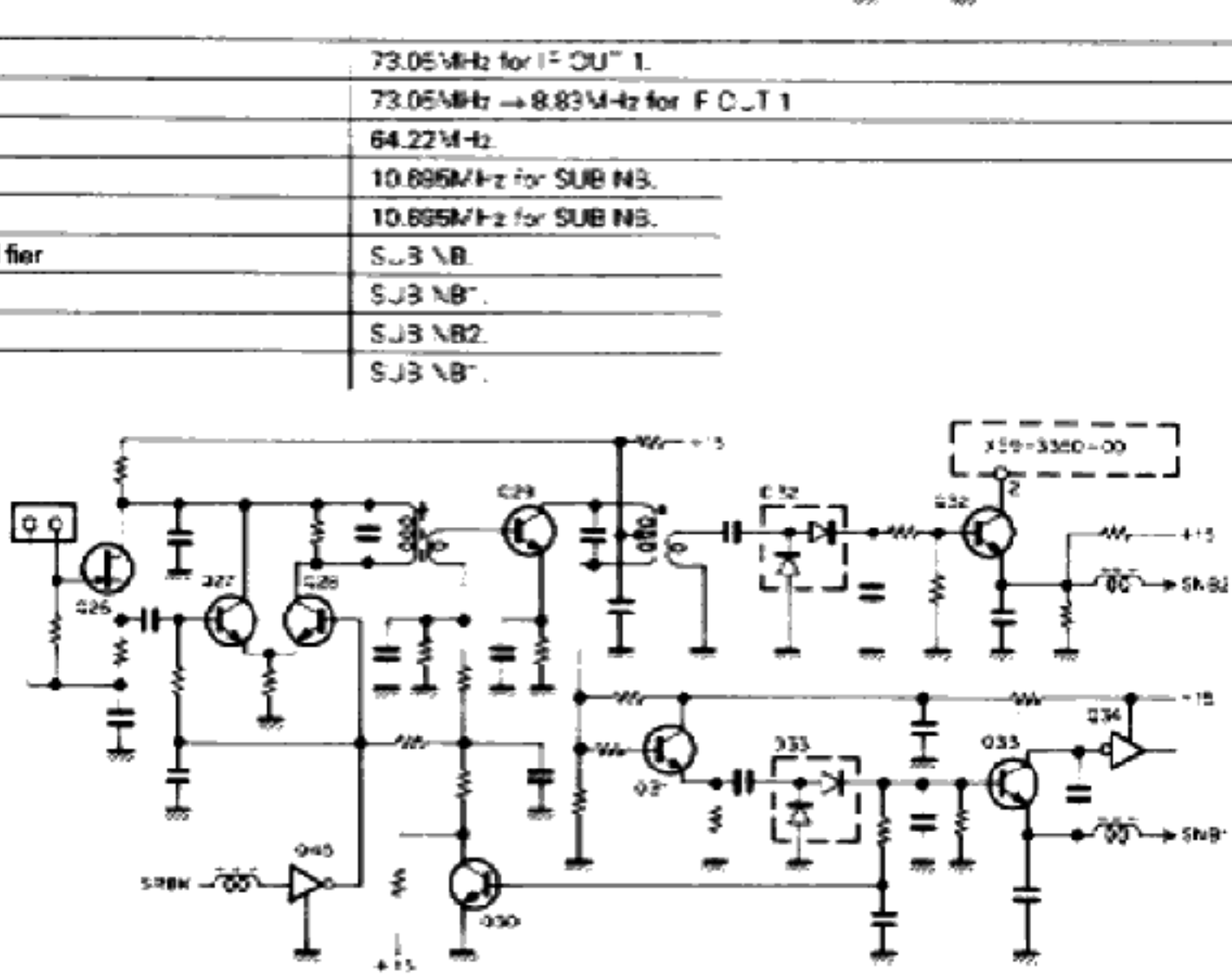
Components	Use/Function	Operation/Condition/Compatibility
IC1	SJB receive detection	Convert IF 10.695MHz into AF level. 
Q1	SJB IF amplifier	40.055MHz.
Q2,3	SJB 2nd mixer	40.055MHz → 10.695MHz
Q4	Switching	On in transmit mode. 

DESCRIPTION OF COMPONENTS

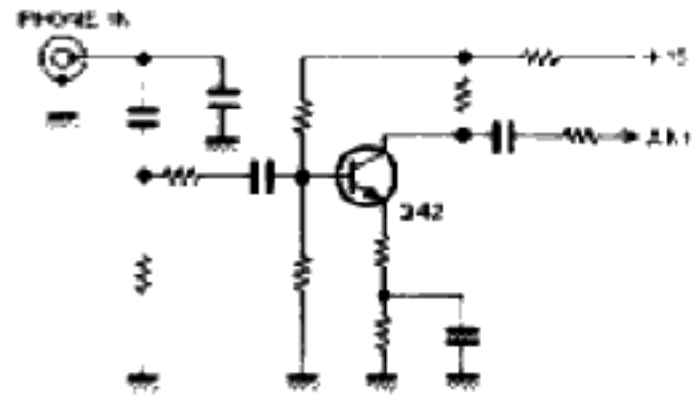
Components	Use/Function	Operation/Condition/Compatibility
Q5	SUB IF amplifier, NB gate	10.695MHz.
Q6	Switching	Turned off when MAIN and SUB NB1, NB2, and SRBK pulse occur.
Q7	Switching	Turned on when SRBK pulse occur.
Q8	Switching	Turned on when MAIN and SUB NB1, NB2 pulse occur.
Q9,10	SUB IF amplifier	10.695MHz.
Q11	Buffer	10.695MHz AGC
Q12	SUB AGC amplifier	
Q13	SUB 2nd local amplifier	60.75MHz.
Q14	MAIN IF amplifier	73.05MHz.
Q15,16	MAIN 2nd mixer	73.05MHz → 8.83MHz.
Q17,18	Switching	Turned on when MRBK pulse occur.
Q19,20	MAIN 3rd mixer	8.83MHz → 455kHz.
Q21	Switching	Turned off when MNG2 and SUB NB2 pulse occur.
Q22	Switching	Turned on when MNG2 and SUB NB2 pulse occur.
Q23	Buffer	73.05MHz for IF OUT 1.
Q24	Mixer	73.05MHz → 8.83MHz for IF OUT 1
Q25	Amplifier	64.22MHz.
Q26	Buffer	10.695MHz for SUB NB.
Q27–29	Amplifier	10.695MHz for SUB NB.
Q30	AGC amplifier	SUB NB.
Q31	Buffer	SUB NB.
Q32	Switching	SUB NB2.
Q33,34	Switching	SUB NB.







DESCRIPTION OF COMPONENTS

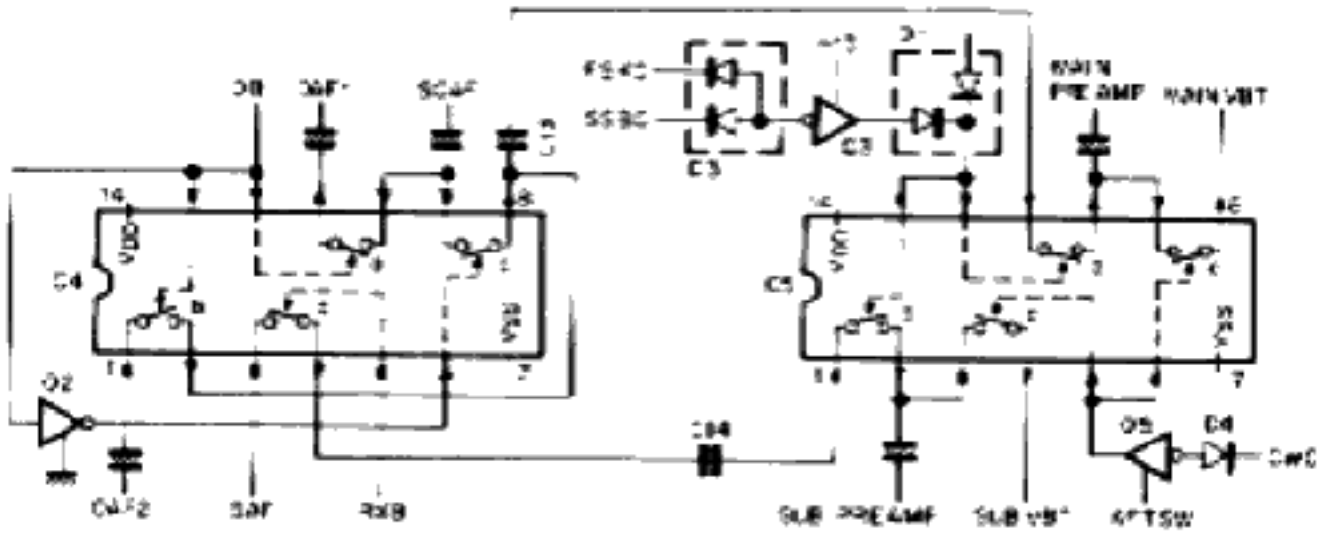
Components	Use/Function	Operation/Condition/Compatibility
Q35	Switching	SUB \32.
Q36,37	TIF 2nd mixer	8.83MHz → 73.05MHz.
Q38	IF amplifier	8.83MHz A_C
Q39	Local amplifier	9.255MHz.
Q40	IF amplifier	8.83MHz.
Q41	TIF 1st mixer	455kHz → 8.83MHz
Q42	AF amplifier	Phone patch. 
Q44	Buffer	73.05MHz.
Q45	Switching	Turned on when SRBK pulse occur.
D1,2	Switching	SUB NB.
D3	SUB AGC detection	
D4	Reverse current prevention	MAIN AGC.
D5–8	NB gate	
D9	Voltage regulator	NB gate.
D10	Reverse current prevention	NB gate.
D11	Reverse current prevention	MAIN NB and SUB NB pulse synthesis.
D12	Switching	On in receive mode.
D13–17	Switching	Filter select.
D18	Switching	On in transmit mode.
D19–27	Switching	Filter select.
D28,29	Switching	On in receive mode.
D30	Reverse current prevention	NB2.
D31	Switching	On in transmit mode.
D32	Noise blanker detection	SUB NB2.
D33	Noise blanker detection	SUB NB1.
D34	Reverse current prevention	CKY.
D35	Voltage regulator	CKY.
D36	Voltage shift	CKY.
D37,38	Switching	On in transmit mode.
D39	Switching	On in receive mode.
D40	Relay surge absorption	Linear amplifier relay.
D41,42	Voltage shift	Linear amplifier relay.
D43	Reverse current prevention	PSQ.

AF UNIT (X49-3020-00)

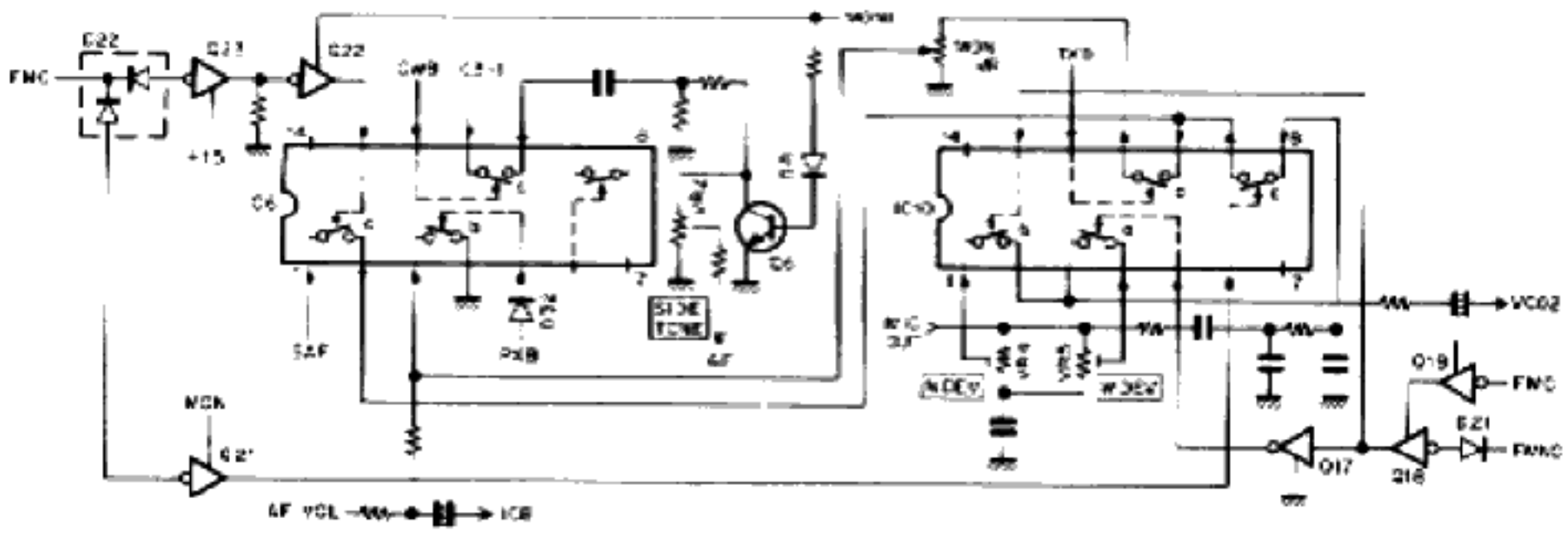
Components	Use/Funetion	Operation/Condition/Compatibility
IC1	Divider (2 x 1/10)	AF VBT clock and sidetone frequency occur.
IC2	Switched capacitor filter x 2	MAIN and SUB AF VBT.
IC3	Switched capacitor filter x 1	Sidetone filter.
IC4 (a/4)	AF select switch	On in DSP mounted (MAIN SSB and CW).
IC4 (b/4)	AF select switch	On in DSP mounted (MAIN SSB and CW).
IC4 (c/4)	AF select switch	On in DSP re-mounted (MAIN SSB and CW).
IC4 (d/4)	AF select switch	On in receive mode (SUB AF)
IC5 (a/4)	AF select switch	On in CW AF VBT operation (When MAIN are not using to AF VBT).
IC5 (b/4)	AF select switch	On in CW AF VBT operation (When SUB are not using to AF VBT).

DESCRIPTION OF COMPONENTS

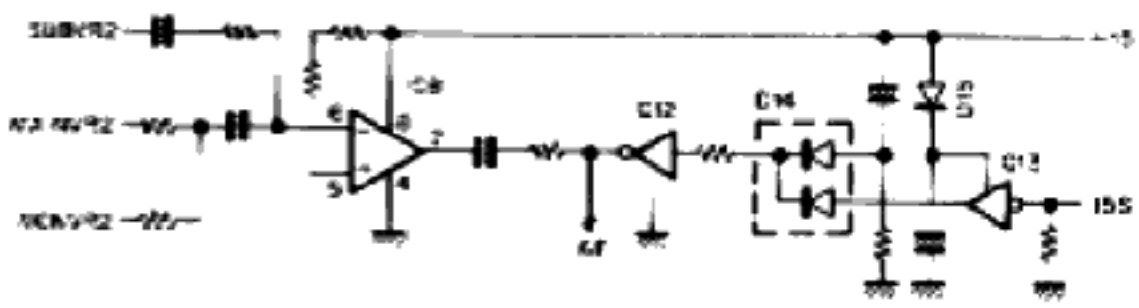
Components	Use/Function	Operation/Condition/Compatibility
IC5 (c/4)	AF select switch	On in CW AF VBT operation (When MAIN are using to AF VBT).
IC5 (d/4)	AF select switch	On in CW AF VBT operation (When SUB are using to AF VBT).



IC6 (a/4)	Sidetone ON and OFF switch	On in CW mode.
IC6 (b/4)	Monitor AF short switch	Receive mode or MONITOR switch is turned off : Short.
IC6 (c/4)	AF select switch	On without FM mode (AF for monitor without FM mode).
IC6 (d/4)		Unused.



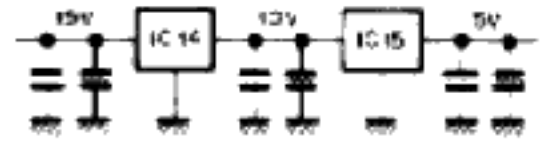
IC7 (a/2)	AF amplifier	MAIN AF.
IC7 (b/2)	AF amplifier	SUB AF.
IC8 (a/2)	AF amplifier	MAIN, SUB, and MONITOR mixing
IC8 (b/2)		Unused.



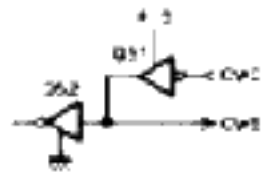
IC9	One shot multi vibrator	Make a vox delay time. 3 : CD (Input) 4 : A (Input) ; GND 5 : B (Input) 6 : Q (Output)
IC10 (a/4)	FM MIC amplifier output select switch	On in FM WIDE mode
IC10 (b/4)	FM MIC amplifier output select switch	On in FM NARROW mode
IC10 (c/4)	AF select switch	On in FM MONITOR mode (AF for FM monitor).
IC10 (d/4)	AF select switch	On in transmit mode (AF monitor).
IC11	PLL1 (MAIN LO1) (500kHz step 30MHz coverage)	2,3,4 : Divided ratio setting input. 5 : 10MHz input. 7 : LOCK voltage output. 8 : UNLOCK output, when unlocked "H". "1 : 38~68MHz input.
IC12	Mixer (MIX1)	5 : 73.05~103.05MHz input. 11 : 35.05~35.55MHz input. 13 : 38~68MHz output.

DESCRIPTION OF COMPONENTS

Components	Use/Function	Operation/Condition/Compatibility
IC13	PLL0 (MAIN LO2)	2,3,4 : Divided ratio setting input. 5 : 10MHz input. 7 : LOCK voltage output. 8 : UNLOCK output, when unlocked "H". *2 : 64.22MHz input.
IC14	AVR	10V in the AF unit.
IC15	AVR	5V in the AF unit.



Q1	AFT amplifier	80kHz ± 50kHz
Q2	Switching	On when DSP installed.
Q3	Switching	On in FSK or SSB mode.
Q4	Switching	On in AF VBT operation.
Q5	Switching	On in CW mode.
Q6	Muting	On when no sidetone output.
Q7	Muting	On when insert a key plug into jack.
Q8	Muting	On in transmit, MABK and SQ mode (MAIN mute).
Q9	Muting	On in transmit, SABK and SQ mode (SUB mute).
Q10	AF amplifier	MAIN REC OUT.
Q11	AF amplifier	SUB REC OUT.
Q12	Muting	When power switch is turned on or off, mute in TX/RX.
Q13	Switching	On for instant when power switch is turned on.
Q14	Switching	On in CW and FSK mode.
Q15	AF amplifier	For sub-tone.
Q16	Muting	On in receive mode (Muted to FM MIC line when receive mode).
Q17,18	Switching	On in FM NARROW mode.
Q19	Switching	On in FM mode.
Q20	AF amplifier	FM MIC signal.
Q21	Switching	On in FM mode.
Q22	Switching	On in FM mode.
Q23	Switching	On in FM mode.
Q24	Switching	VCO select (10kHz~7.5MHz : on).
Q25	Switching	VCO select (7.5MHz~14.5MHz : on).
Q26	Switching	VCO select (14.5MHz~21.5MHz : on).
Q27	Switching	VCO select (21.5MHz~30MHz : on).
Q28	Switching	UNLOCK detector (PLL0, 1).
Q29~31	PLL1 low-pass filter	Active filter (Reference frequency 500kHz).
Q32	VCO1 output amplifier	73.36MHz~103.05MHz.
Q33	MIX1 input buffer	73.36~103.05MHz.
Q34,35	MIX1 output buffer	38MHz~68MHz.
Q36	MIX1 input buffer	35.05MHz~35.55MHz (MAIN LO1).
Q37	MAIN LO1 output buffer	73.06MHz~103.05MHz.
Q38	REF buffer	10MHz (Reference of PLL IC).
Q39	MAIN LO2 output buffer	64.22MHz.
Q40	Buffer	5.63MHz for MAIN IF.
Q41,42	Amplifier	5.63MHz for MAIN IF.
Q43	AGC amplifier	5.63MHz for MAIN IF.
Q44	Amplifier	5.63MHz for MAIN IF.
Q45	Buffer	MAIN NB1.
Q46	Switching	MAIN NB2.
Q47,48	Switching	MAIN NB1.
Q49	Switching	MAIN NB2.
Q50	Switching	On in MONITOR operation.
Q51	Switching	On in CW mode (CW-B).
Q52	Switching	On in CW mode.



DESCRIPTION OF COMPONENTS

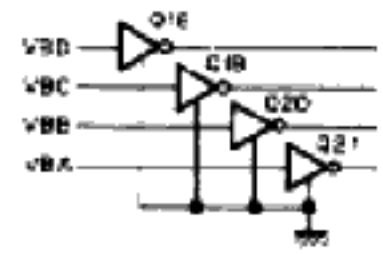
Components	Use/Function	Operation/Condition/Compatibility
D1,2	Reverse current prevention	
D3	Reverse current prevention	FSKC, SSBC.
D4	Reverse current prevention	CWC.
D5~8	Reverse current prevention	
D9	Reverse current prevention	KEY
D10	Reverse current prevention	
D11	Reverse current prevention	RBC,SABK.
D12	Reverse current prevention	RBC, SC.
D13	Reverse current prevention	MABK.
D14,15	Reverse current prevention	
D16	Reverse current prevention	VOXC.
D17	Reverse current prevention	
D19	Reverse current prevention	FSKC,CWC.
D21	Reverse current prevention	FMNC.
D22	Reverse current prevention	
D23	Reverse current prevention	VBC, VBD.
D24	Voltage regulator	VCO.
D25,26	Reverse current prevention	UNLOCK signal.
D27	Voltage regulator	VCO.
D28,29	NB detection	NB2.
D30	NB detection	NB1.
D31	Reverse current prevention	MONITOR.
D32	Reverse current prevention	RXB.
D33	Reverse current prevention	

PLL UNIT (X50-3100-00)

Components	Use/Function	Operation/Condition/Compatibility
IC1	AVR	8V (PLL and CAR unit).
IC2	PLL3 (MAIN LO1) (10Hz step with 10kHz coverage)	2,3,4 : Divided ratio setting input. 5 : 10MHz input. 7 : LOCK voltage output. 8 : UNLOCK output, when unlocked "H". 11 : 58~56MHz input.
IC3	Divider (1/20)	4 : 58~56MHz input. 8 : 2.9~2.8MHz output.
IC4	Mixer (MIX4)	1 : 12.9~12.8MHz output. 2 : 2.9~2.8MHz input. 5 : 10MHz input.
IC5	Mixer (MIX3)	1 : 36.6~31.7MHz output. 2 : 12.9~12.8MHz input. 5 : 49.6~44.5MHz input.
IC6	PLL2 (MAIN LO1) (10kHz step with 500kHz coverage)	2,3,4 : Divided ratio setting input. 5 : 10MHz input. 7 : LOCK voltage output. 8 : UNLOCK output, when unlocked "H". 11 : 36.6~31.7MHz input.
IC7	Divider (1/10)	1 : 49.5~44.5MHz input. 4 : 4.95~4.45MHz output.
IC8	Mixer (MIX2)	1 : 35.05~35.55MHz output. 2 : 4.95~4.45MHz input. 5 : 40MHz input.
IC9 (1/2)	Divider (1/2)	5 : 20MHz input. 9 : 10MHz output.
IC10	PLL8 (SUB LO1)	2,3,4 : Divided ratio setting input. 5 : 10MHz input. 7 : LOCK voltage output. 8 : UNLOCK output, when unlocked "H". 11 : 109~107MHz input.
IC11	Divider (1/20)	4 : 109~107MHz input. 8 : 5.45~5.35MHz output.
IC12	Mixer (MIX12)	1 : 25.45~25.35MHz output. 2 : 5.45~5.35MHz input. 5 : 20MHz input.
IC13	Divider (1/10)	1 : 25.45~25.35MHz input. 4 : 2.545~2.535MHz output.
IC14	Mixer (MIX11)	1 : 12.545~12.535MHz output. 2 : 2.545~2.535MHz input. 5 : 10MHz input.
IC15	Mixer (MIX10)	1 : 38.205~38.215MHz output. 2 : 12.545~12.535MHz input. 5 : 50.75MHz input.
IC16	Mixer (MIX9)	1 : 31.96~31.85MHz output. 2 : 38.205~38.215MHz input. 5 : 70.065~70.055MHz input.
IC17	PLL7 (SUB LO1) (10kHz step)	2,3,4 : Divided ratio setting input. 5 : 10MHz input. 7 : LOCK voltage output. 8 : UNLOCK output, when unlocked "H". 11 : 1.85~31.85MHz input.
IC18 (1/2)	PLL7 LPF	10kHz~7.5MHz active filter (Reference frequency 10kHz).
IC18 (2/2)	PLL7 LPF	7.5MHz~30MHz active filter (Reference frequency 10kHz).
Q1	MIX4 input buffer	10MHz.

DESCRIPTION OF COMPONENTS

Components	Use/Function	Operation/Condition/Compatibility
Q2	MIX3 input buffer	49.5~44.5MHz.
Q3	PLL2 IC input amplifier	36.6~31.7MHz.
Q4	Doubler	40MHz.
Q5	MAIN local output buffer	35.05~35.55MHz (PLL1 loop).
Q6	TTL input amplifier	20MHz.
Q7	MIX12 input buffer	20MHz.
Q8	MIX11 input buffer	10MHz.
Q9	MIX10 input buffer	50.75MHz.
Q10	MIX9 input buffer	40.065~70.055MHz.
Q11,12	PLL7 IC input buffer	1.86~31.85MHz.
Q13	VCO7 output amplifier	40.065~70.055MHz.
Q14	SUB LO1 output buffer	40.065~70.055MHz.
Q15	OSC2	50.75MHz (SUB LO2).
Q16	OSC2 buffer	
Q17	SUB LO2 output buffer	50.75MHz.
Q18	Switching	VCO select (21.5~30MHz : on).
Q19	Switching	VCO select (14.5~21.5MHz : on).
Q20	Switching	VCO select (7.5~14.5MHz : on).
Q21	Switching	VCO select (1.3kHz~7.5MHz : on).
Q22	Switching	UNLOCK detection (PLL2,3,4,5,6,9).
Q23	Switching	UNLOCK detection (PLL7,8).
D1	Reverse current prevention	UNLOCK signal.
D2	VCO3 frequency adjustable	
D6	Reverse current prevention	UNLOCK signal.
D4	VCO2 frequency adjustable	
D5	Reverse current prevention	UNLOCK signal.
D8	VCO7 frequency adjustable	
D7	Voltage regulator	VCO7.
D9	Reverse current prevention	UNLOCK signal.
D9	Voltage regulator	OSC2



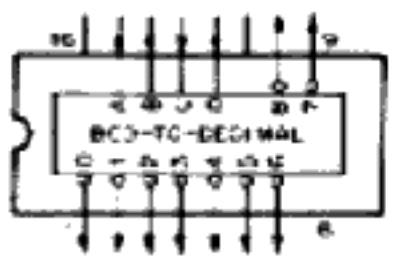
CAR UNIT (X50-3110-XX) -00 : S -01 : SD

Components	Use/Function	Operation/Condition/Compatibility
IC1	PLL5 (MAIN LO4)	2,3,4 : Divided ratio setting input. 5 : 10MHz input. 7 : LOCK voltage output. 8 : UNLOCK output, when unlocked "H". 11 : 35.5MHz input.
IC2	Divider (1/100)	4 : 35.5MHz input. 8 : 355kHz output.
IC3	PLL6 (MAIN LO3)	2,3,4 : Divided ratio setting input. 5 : 10MHz input. 7 : LOCK voltage output. 8 : UNLOCK output, when unlocked "H". 11 : 71.5MHz input.
IC4	Divider (1/100)	4 : 71.5MHz input. 8 : 715kHz output.
IC5	Mixer (MIX7)	1 : 9.285MHz output. 2 : 715kHz input. 5 : 10MHz input.
IC6	PLL4 (MAIN and SUB CAR)	2,3,4 : Divided ratio setting input. 5 : 10MHz input. 7 : LOCK voltage output. 8 : UNLOCK output, when unlocked "H". 11 : 69.5MHz input.
IC7	Divider (1/100)	4 : 69.5MHz input. 8 : 695kHz output.
IC8	Mixer (MIX13)	1 : 10.695MHz output. 2 : 695kHz input. 5 : 10MHz input.
IC9	PLL9 (MAIN CAR)	2,3,4 : Divided ratio setting input. 5 : 10MHz input. 7 : LOCK voltage output. 8 : UNLOCK output, when unlocked "H". 11 : 59.5MHz input.
IC10	Mixer (MIX5)	1 : 10MHz output. 2 : 59.5MHz input. 5 : 69.5MHz input.
IC11	Mixer (MIX8)	When CW PITC= 800Hz 1 : 80kHz output. 2 : 9.92MHz input. 5 : 10MHz input.
IC12	Divider (1/100)	4 : 10MHz input. 8 : 100kHz output.
IC13	PLL (EXT STD)	9 : 1MHz input. 13 : LOCK voltage output. 14 : 10kHz input.

DESCRIPTION OF COMPONENTS

Components	Use/Function	Operation/Condition/Compatibility
IC14	Divider (1/2, 1/5)	1 : 10MHz output 11 : 2MHz output. 12 : 10MHz input. 14 : 20MHz input.
IC15 (1/2)	Divider (1/2)	1 : 1MHz output. 3 : 2MHz input.
IC15 (2/2)	Divider (1/2)	11 : 4.26kHz input. 13 : 2.128kHz output.
IC16	Divider (Programable)	1 : 4.26kHz output. 3–6,11–14 Divided ratio setting input. 7 : Enable FSK "H". 9 : 1MHz input.
IC17 (1/2)	2 line-4 line decoder	1 : Enable "H" : on. 2,3 : AFSK space frequency setting input. 4–7 : Divided ratio setting output (space)
IC17 (2/2)	2 line-4 line decoder	9,12 : Divided ratio setting output (mark). 10,11 : Mark, space select output. 13 : Key pole output. 14 : Shift (FWD, REF) select input.
Q1	MAIN LO4 output buffer	355kHz
Q2	MIX7 input buffer	10MHz
Q3	MAIN LO3 output amplifier	9.285MHz
Q4	MIX13 input buffer	10MHz
Q5	SUB CAR output amplifier	10.665MHz
Q6	MIX5 input buffer	59.5MHz
Q7	MIX5 input buffer	69.5MHz
Q8	MIX8 input buffer	9.92MHz when CW PITCH 800Hz.
Q9	MIX8 input buffer	10MHz
Q10	AFT output buffer	30–150kHz in CW mode
Q11	MAIN CAR output buffer	100kHz.
Q12	EXT STD buffer	10MHz
Q13	OSC1	20MHz (STD).
Q14	OSC2 buffer	SO-2 buffer when SO2 operates.
Q15	TTL input amplifier	20MHz.
Q16	REF output amplifier	20MHz (PLL unit).
Q17	REF output amplifier	10MHz (AF unit).
Q18	REF output amplifier	10MHz (DSP unit).
Q19	AFSK output buffer	2.125kHz (Active low-pass filter).
D1	Reverse current prevention	UNLOCK signal.
D2	VCO5 frequency adjustable	
D3	Reverse current prevention	UNLOCK signal.
D4	VCO6 frequency adjustable	
D5	Reverse current prevention	UNLOCK signal.
D6	VCO4 frequency adjustable	
D7	Reverse current prevention	UNLOCK signal.
D8	VCO9 frequency adjustable	
D9	VCXO frequency adjustable	OSC1.
D10	Voltage regulator	OSC1.
D11–13	Reverse current prevention	AFSK divided setting matrix and mark, space select.
D14	Reverse current prevention	

FILTER UNIT (X51-3060-XX) -00 : TS-950SD (K,M,W,X,P) -01 : TS-950S (K,M,W,X,P) -61 : TS-950S (W2) -62 : TS-950SD (W2)

Components	Use/Function	Operation/Condition/Compatibility
IC1	Band data decoder	
IC2	Relay driver	
IC3	AVR	+5V.
Q1	Relay driver	10F relay.
D1	Relay surge absorption	1.6–2.5MHz LPF relay

DESCRIPTION OF COMPONENTS

Components	Use/Function	Operation/Condition/Compatibility
D2	Relay surge absorption	2.5–4.0MHz LPF relay.
D3	Relay surge absorption	4.0–7.5MHz LPF relay.
D4	Relay surge absorption	7.5–10.5MHz LPF relay.
D5	Relay surge absorption	10.5–14.5MHz LPF relay.
D6	Relay surge absorption	14.5–21.5MHz LPF relay.
D7	Relay surge absorption	21.5–30MHz LPF relay.
D8	RF rectifier	REF rectifier.
D9	RF rectifier	FWD rectifier.
D10	Relay surge absorption	Transmit/receive select relay.
D11	LPF select	18. 21MHz.
D12	LPF select	25. 28MHz.
D13,14	Level shift	12V relay drive.
D15	Lightning surge protection	BAT terminal surge absorber.

CONTROL UNIT (X53-3230-00)

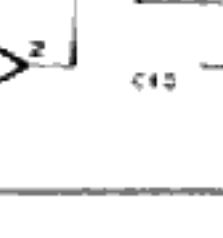
Components	Use/Function	Operation/Condition/Compatibility
IC1	Inverter	1-2, 3-4, 5-6, 12-13 : FULL, VOX. 2-9, 10-11 : Pulse delay
IC2	NAND gate	1-2-3 : CKY. 11-12-13 : VOX, FULL.
IC3	Analog switch	VOX, FULL.
IC4	Analog switch	1-2-13, 3-4-5 : CKY.
IC5	Inverter	8-9, 10-11, 12-13 : CKY
IC6	NAND gate	1-2-3 : CKY. 4-5-6 : RSC
IC7	Audio amplifier	
IC8	Operational amplifier	ALC and S meter
IC9	Analog switch	Meter select.
IC10	One shot multi vibrator	2-3-4-5-7 : CKY timing 10-11-12-13-14-15 : Semi-breakin timing.
IC11	Operational amplifier	1-2-3 : Power meter.
IC12	3-terminal AVR	Input : 13V Output : 8V
IC13	Inverter	1-2, 3-4 : Pulse delay.
IC14	Electronic key controlled CPU	
IC15	NAND gate	Electronic key speed oscillator.
Q1	ALC amplifier	
Q2	Amplifier	SWR protection amplifier.
Q3	Amplifier	PC protection amplifier.
Q4	Voltage shift	ALC meter voltage occur.
Q5	Buffer	ALC voltage control
Q6	Switching	Meter select (ALC/PO)
Q7	Switching	Stand-by control.
Q8	switching	VOX.
Q9	Switching	Discharge
Q10,11	Differential amplifier	ALC amplifier.
Q12	Switching	RF output drop.
Q13–16	Switching	AT tune.
Q17	Switching	KEY.
Q18	Switching	FULL.
Q19	Switching	Reset.
D1	Reference voltage	7.8V.
D2,3	Voltage shift	EXT. ALC.
D4	Temperature compensation	PC protection.
D6	Voltage shift	4.7V.
D6	Voltage shift	ALC
D7	Reverse current prevention	ALC.
D8	Reference voltage	4.7V

DESCRIPTION OF COMPONENTS

Components	Use/Function	Operation/Condition/Compatibility
D9	Discharge	
D10	Switching	Transmission and automatic antenna tuner.
D11	Switching	AT and keying.
D12	Over load prevention	
D13	Reverse current prevention	
D14	Surge voltage absorption	
D15,16	Switching	Transmit signal.
D17	Switching	CKY
D18	Reverse current prevention	
D19	Surge voltage absorption	
D20	Switching	CWB.
D21	Switching	KEY.
D22	Switching	Transmit.
D23	Switching	ATS and KEY
D24	Switching	Transmit.
D25	Switching	KEY.
D26	Switching	Transmit.
D27	Switching	CW semi-break in and delay.
D28	Switching	Temperature RF output drop.
D29	Switching	28MHz RF output drop.
D30	Switching	AT.
D31	Reverse current prevention	Keying dot.
D32	Reverse current prevention	Keying dash.

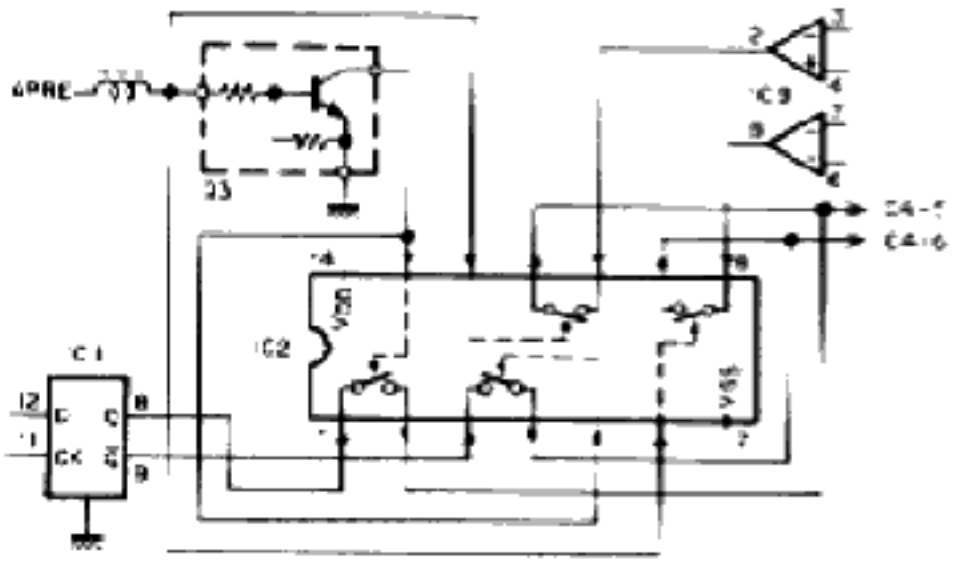
AT UNIT (X53-3240-00)

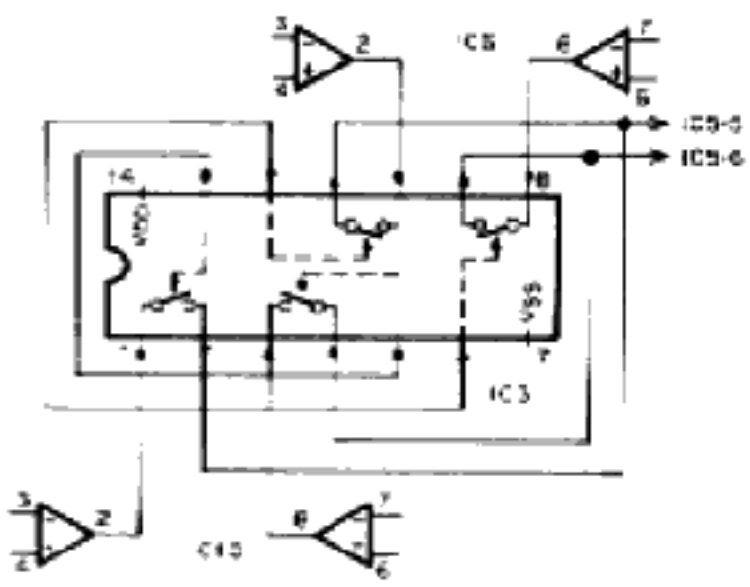
Components	Use/Function	Operation/Condition/Compatibility
C1	D flip-flop	Differential phase detection.
C2	Analog switch	Control select motor 1
C3	Analog switch	Control select motor 2



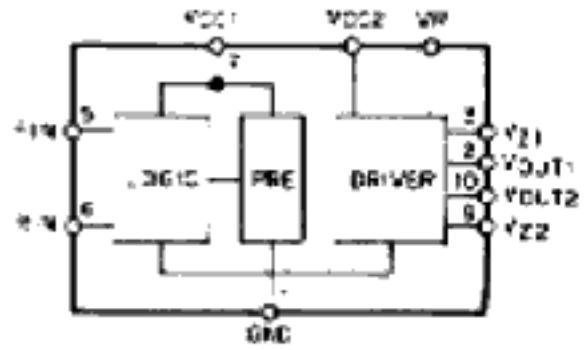
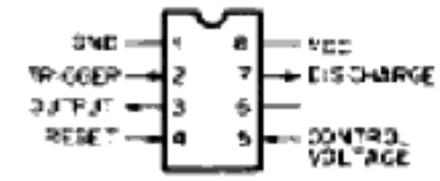
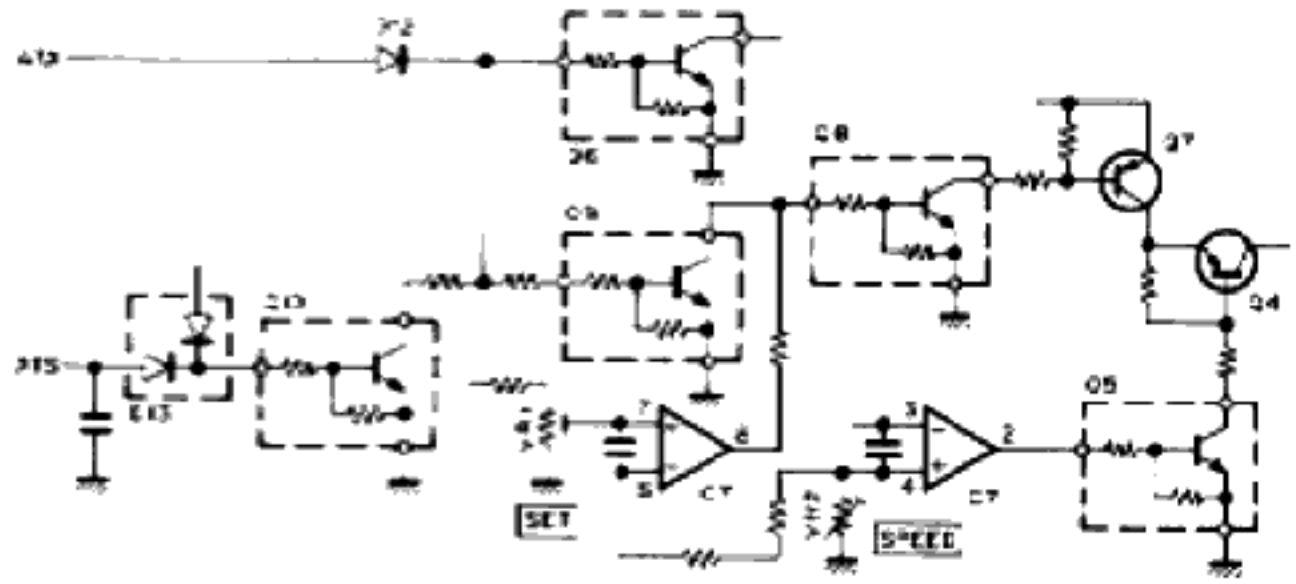
Function table

INPUTS		OUTPUTS	
CLOCK	D	Q	$\overline{Q}$
↑	L	L	H
↑	H	H	L
L	X	Qo	$\overline{Q_o}$





DESCRIPTION OF COMPONENTS

Components	Use/Function	Operation/Condition/Compatibility
IC4 IC5	Motor drive Motor drive	Motor 1. Motor 2. 
IC6	Comparator	Differential modulation detection
IC7	Operational amplifier	Motor control
IC8	Timer	Sawtooth wave generated. 
Q1,2	Amplifier	Wave shaping.
Q3	Switching	Control select.
Q4,5	Switching	Motor speed control.
Q6	Switching	Squ-wave oscillator on or off
Q7,8	Switching	Motor drive.
Q9,10	Switching	Tuning start. 
D1,2	Detection	Modulation detection voltage and current.
D3~8	Switching	Clipper.
D6	Switching	Voltage drop.
D10	Switching	Spike prevention.
D11	Switching	Voltage drop.
D12	Switching	AT control
D13	Switching	Tuning start.

DSP UNIT (X53-3260-00) : TS-950SD

Components	Use/Function	Operation/Condition/Compatibility
IC1,2	HPF	MIC input HPF resistor select.
IC3	Signal select	X : A/D converter output mode. Y : A/D converter output select MIC or AF1. Z : AF2 output select AF1 or output of D/A converter.
IC4	Amplifier, filter	1 : MIC input amplifier (Gain 6dB) 2 : MIC HPF
IC5	Amplifier, filter	1 : AF input amplifier (Gain 6dB). 2 : MIC HPF
IC6	Limitter	Clipper of the IC7 output.

DESCRIPTION OF COMPONENTS

Components	Use/Function	Operation/Condition/Compatibility
IC7	Limiting amplifier, filter	1 : Clipper amplifier to ±3Vp-p (Gain 20dB) 2 : 1st stage of 5th LPF.
IC8	Filter	2nd stage of 5th LPF
IC9	Filter	3rd stage of 5th LPF.
IC10	Sample/hold amplifier	Buffer
IC11	Sample/hold amplifier, amplifier	1 : Buffer 2 : Amplifier (Gain 6dB)
IC12	A/D converter	16 bit A/D converter
IC13,14	A/D converter and gate array interface	Timing and logic interface of between A/D converter and gate array.
IC15	−5V	
IC16	−5V	
IC17	D/A converter	16bit D/A converter.
IC18	D/A converter output duty adjust	
IC19	Buffer	
IC20	LPF	3rd LPF (Gain −21.5dB).
IC21	Mixer	36.892kHz → 455kHz.
IC31	DSP	Modulation, AF SLOPE.
IC32	Gate array	Interface (See to circuit description).
IC33	Reset	Reset pulse when drop DC voltage supply
IC34	PLL	2,3,4 : PLL data setting input. 5 : 10MHz input. 7 : VCO locked voltage output. 1 : 39.325MHz (VCO) input.
IC35	+8V	
IC36	Timing creation	Writing signal creation for gate array.
Q1	Sample/hold amplifier	Switching.
Q2	Amplifier	Amplified to fixed level from output of the filter.
Q3	ATT	Switching for ATT. On in AM, CW mode.
Q4	455kHz output buffer	
Q5	mixer	Input buffer
Q6	mixer	Output buffer
Q11	Level converter	Level converted to CMOS level from TXB (0 ↔ 5).
Q12	10MHz input amplifier	Amplified 10MHz output to PLL IC.
Q13	VCO	Oscillator
Q14	VCO buffer	
Q15	VCO buffer	Output buffer to digital section.
Q16	CLK amplifier	Amplified supply level of gate array from PLL output (39.352MHz).
Q17–19	PLL LPF	
D1	Level shift	Level shift for sample/hold amplifier (FET).
D2	Limitter	
D3	Reverse current prevention	
D4	VCO var-cap diode	Frequency adjust.

DISPLAY UNIT (X54-3080-00)

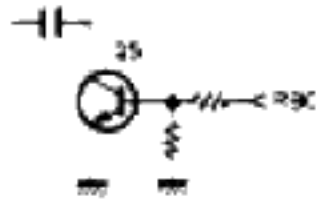
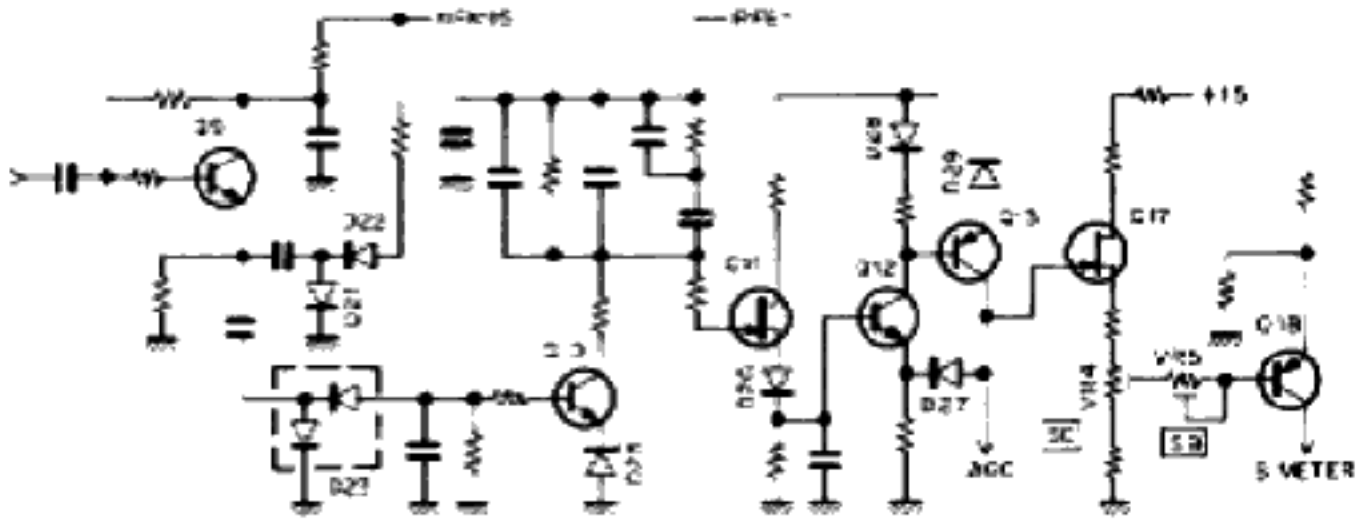
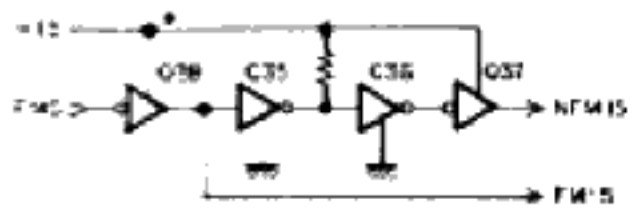
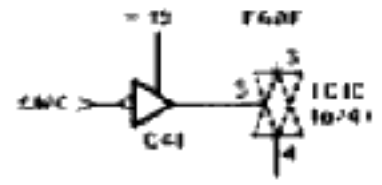
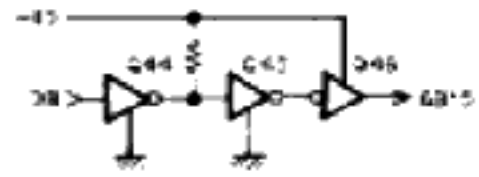
Components	Use/Function	Operation/Condition/Compatibility
IC1	Display SUB CPU	FL tube, LED, sub-tone and BZ mixer
IC2,3	Display gate array	FL tube control port output
IC4	Address decoder	Each IC chip select.
IC5	Function LED latch	
IC6	Sub-tone output latch	Sub-tone D/A converter output
IC7	Inverter	Logic inverter
IC8	Sub-tone control, reset contro	
IC9	Output latch	BZ and option VS-2 data output.
IC10	Oscillator gate	BZ and 1750Hz tone oscillator
Q1 ~137	FL tube starter driver	FL tube starter voltage driver from TTL level.
D1	FL tube heater bias voltage	Between F and F : Approx. AC 9.6V. Between FG and G : Approx. DC −28V

DESCRIPTION OF COMPONENTS

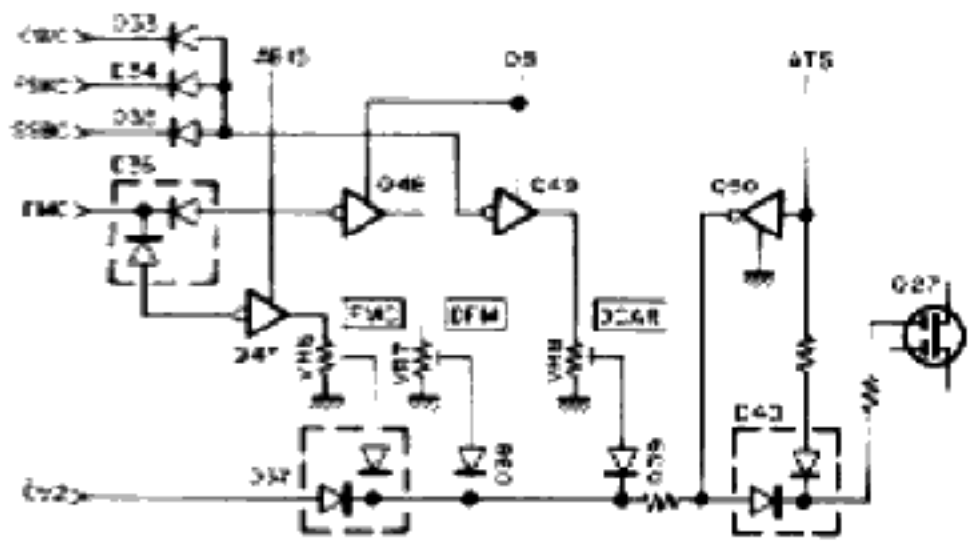
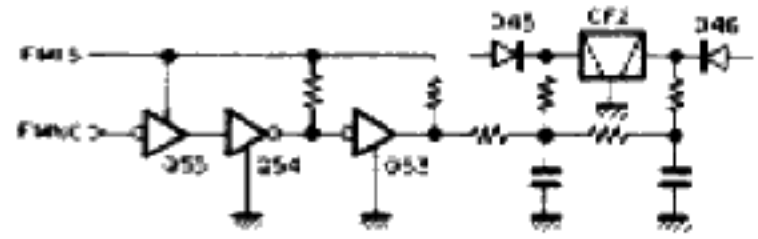
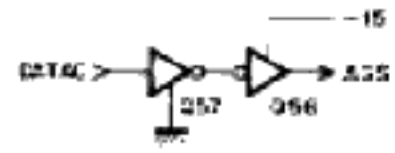
SIGNAL UNIT (X57-3380-00)

Components	Use/Function	Operation/Condition/Compatibility
IC1 (a/4)	AGC select switch	SSB, CW and AM mode select.
IC1 (b/4)	AGC select switch	AGC time constant (MID).
IC1 (c/4)	AGC select switch	AGC time constant (SLOW).
IC1 (d/4)		Unused.
C2 (a/2)	CAR squelch amplifier	
C2 (b/2)	FM squelch amplifier	
C3	FM pre-amplifier	
C4 (a/4)	DSP-1C select switch	DSP-1C select.
C4 (b/4)	DSP-1C select switch	DSP-1C select.
C4 (c/4)	DSP-1C select switch	SSB, CW (AM) or FSK select.
C4 (d/4)	DSP-1C select switch	Or in FSK operates.
IC5	Transmitter IF amplifier	455kHz.
IC6,7	Receive FM IF amplifier	2 : Input 5 : Output
IC8	I/O interface	2~11 : I/O 12 : SO input 13 : SI input 14 : CK input.
IC9	Transmitter amplifier	1 : Input 5 : Output
IC10 (a/4)	Select switch	AGC select of AM/SSB, CW.
IC10 (b/4)	Select switch	AF output select of AM/FM.
IC10 (c/4)	Select switch	Meter select of SSB/FM.
IC10 (c/4)	Select switch	Meter select of SSB/FM.
Q1,2	Receive IF amplifier	455kHz.
Q3	Receive 4th mixer	455kHz → 30kHz.
Q4	IF amplifier	100kHz.

DESCRIPTION OF COMPONENTS

Components	Use/Function	Operation/Condition/Compatibility
Q5	Switching	R3C signal. 
Q6	Buffer	AF.
Q7	Local frequency amplifier	355kHz.
Q8	CAR buffer	100kHz.
Q9	AGC buffer	
Q10–13	AGC amplifier	
Q14	Transmitter CAR mixer	355kHz + 100kHz = 455kHz.
Q15	Transmitter CAR buffer	455kHz.
Q16	Transmitter CAR amplifier	455kHz.
Q17,18	S-meter amplifier	
Q19,20	FM noise amplifier	
Q21	Transmitter IF amplifier	455kHz.
Q22	CAR squelch amplifier	
Q25~27	Transmitter IF buffer	455kHz.
Q28	Receive FM IF amplifier	455kHz.
Q29	FM AF AGC amplifier	
Q30	Processor amplifier	455kHz.
Q33	Processor amplifier	455kHz.
Q34	FM S-meter amplifier	455kHz.
Q35,36	Switching	
Q37	Switching	NFM/15.
Q38	Switching	FM/15. 
Q39,40	Switching	
Q41	Switching	AM/15. 
Q42,43	Switching	
Q44,45	Switching	
Q46	Switching	AB15. 

DESCRIPTION OF COMPONENTS

Components	Use/Function	Operation/Condition/Compatibility
Q47	Switching	FMC.
Q48	Switching	DFM.
Q49	Switching	DCAR.
Q50	Switching	
Q51,52	Switching	
Q53-55	Switching	FM mode. 
Q56	Switching	AGS. 
Q57	Switching	
Q58,59	Switching	D15.
Q60	Switching	SSB.
Q61,62	Switching	CW.
Q63-65	Switching	
Q66	Switching	SC.
Q67	Switching	
D1	Switching	Transmitter 455kHz signal.
D2,3	Switching	Receive 455kHz signal.
D4,5	Switching	CW\ filter.
D6,7	Switching	CW filter.
D8,9	Switching	SSB filter.
D10,11	Switching	AM filter.
D12,13	Switching	Transmitter 455kHz signal.
D14	Switching	Receive 455kHz signal.
D15	Tuning	NOTCH frequency.
D16-19	Ring detection	SSB, CW.
D20	Voltage regulator	5V.
D21,22	Detection	AM.
D23	Detection	AGC.
D24	Reverse current prevention	AGC + FM S.
D25	Voltage shift	3.6V.
D26	Temperature compensation	AGC.
D27	Reverse current prevention	
D28	Temperature compensation	AGC.
D29	Reverse current prevention	AGC.
D31	Detection	FM squelch.
D32	Reverse current prevention	
D33	Reverse current prevention	CWC.
D34	Reverse current prevention	FSKC.
D35	Reverse current prevention	SSBC.

DESCRIPTION OF COMPONENTS

Components	Use/Function	Operation/Condition/Compatibility
D36	Reverse current prevention	
D37	Reverse current prevention	FMC + CV2.
D38	Reverse current prevention	DFM.
D39	Reverse current prevention	DCAR.
D40	Reverse current prevention	
D41	Ring modulation	SSB.
D42	Detection	CAR squelch.
D43	Protection	Comparator input.
D44	Reverse current prevention	
D45,46	Switching	FM 7.2kHz filter.
D47,48	Switching	FM 6kHz filter.
D49,50	Detection	FM
D51	Rectifier	FM AGC.
D52	Reverse current prevention	SSBC
D53	Reverse current prevention	
D54	Reverse current prevention	SSBC
D55	Reverse current prevention	AMC.
D56	Reverse current prevention	
D57	Voltage regulator	12V
D59	Reverse current prevention	
D60	Switching	Processor.
D61–64	Switching	455kHz.
D65	Limitter	Compression meter.
D66	Rectifier	Compression meter.
D67	Rectifier	FM S-meter
D68,69	Reverse current prevention	
D70	Reverse current prevention	ATS.
D71	Voltage regulator	9V.

VCO2 (X58-3390-03) : AF UNIT

Components	Use/Function	Operation/Condition/Compatibility
Q1	VCO2 (PLL2)	64.22MHz
Q2	VCO2 buffer	
D1	VCO2 frequency viable	

VCO (X58-3630-00) : AF UNIT

Components	Use/Function	Operation/Condition/Compatibility
Q1	VCO1-A (PLL1)	73.05–80.55MHz.
Q2	VCO1-B (PLL1)	80.55–87.55MHz.
Q3	VCO1-C (PLL1)	87.55–94.55MHz.
Q4	VCO1-D (PLL1)	94.55–103.05MHz.
D1	VCO1-A frequency viable	
D2	VCO1 switching	On when VAC is "L".
D3	VCO1-B frequency viable	
D4	VCO1 switching	On when VBC is "L".
D5	VCO1-C frequency viable	
D6	VCO1 switching	On when VCC is "L".
D7	VCO1-D frequency viable	
D8	VCO1 switching	On when VDC is "L".

DESCRIPTION OF COMPONENTS

VCO (X58-3630-01) : PLL UNIT

Components	Use/Function	Operation/Condition/Compatibility
C1	VCO7-D (PLL7)	81.666–70.055MHz.
C2	VCO7-C (PLL7)	54.555–61.555MHz.
C3	VCO7-B (PLL7)	47.555–54.555MHz.
C4	VCO7-A (PLL7)	40.055–47.555MHz.
D1	VCO7-D frequency viable	
D2	VCO7 switching	On when VAC is "L".
D3	VCO7-C frequency viable	
D4	VCO7 switching	On when VBC is "L".
D5	VCO7-B frequency viable	
D6	VCO7 switching	On when VCC is "L".
D7	VCO7-A frequency viable	
D8	VCO7 switching	On when VCC is "L".

AVR UNIT (X43-3070-01) (F/6)

Components	Use/Function	Operation/Condition/Compatibility
Q101,102	Switching	On when over-voltage.
D101	Reverse current prevention	
D102	Reference voltage	13V
D103	Protection	On when over-voltage.

VOX (X59-1080-01) : AF UNIT

Components	Use/Function	Operation/Condition/Compatibility
IC1 (1/2)	VOX level comperator	
IC1 (2/2)	ANTI VOX level comperator	
IC2	NOR circuit	
Q1	Switching	Turn on when 11 pi of IC2 is "H".
D1,2	Reverse current prevention	

RM MIC AMP (X59-3000-03) : AF UNIT

Components	Use/Function	Operation/Condition/Compatibility
IC1 (1/2)	Low-pass filter	1,2 : Output
IC1 (2/2)	Limitting amplifier	5 : Input 7 : Output

NB2 (X59-3350-00) : IF, AF UNIT

Components	Use/Function	Operation/Condition/Compatibility
IC1	One shot multi-vibrator	Synchronized with pulse 5ms or 40ms.
Q1,2	Switching	Q1 turned on with 5ms when pulse occurs and Q2 turned off with 40ms.

VCO1 (X59-3440-00) PLL, CAR UNIT

Components	Use/Function	Operation/Condition/Compatibility
Q1	VCO	30–110MHz
Q2	VCO buffer	

LPF (X59-3450-XX) -00 : AF UNIT -01 : PLL, CAR UNIT

Components	Use/Function	Operation/Condition/Compatibility
Q1–3	PLL low-pass filter	Active filter.

DESCRIPTION OF COMPONENTS

MKR (X59-3640-00) : CAR UNIT

Components	Use/Function	Operation/Condition/Compatibility
IC1 (1/2)	Divider (1/2)	
IC1 (2/2)	Divider (1/2)	
D1	Switching	
D2	Reverse current prevention	On when CALS is "L".

SFT (X59-3650-00) : CAR UNIT

Components	Use/Function	Operation/Condition/Compatibility
D1-9	Reverse current prevention	AFSK divider matrix.

CWT (X59-3660-00) : CONTROL UNIT

Components	Use/Function	Operation/Condition/Compatibility
Q201	Switching	Keying signal.
Q202	Switching	Transmitter voltage supply.
Q203-205	Switching	Transmitter stop signal.
Q206-208	Switching	Keying switch.
D201,202	Reverse current prevention	
D203	Reference voltage	3.6V.
D204	Reference voltage	4.7V.

MAP (X59-3670-00) : CONTROL UNIT

Components	Use/Function	Operation/Condition/Compatibility
IC301	Meter amplifier	1-2-3 : SWR meter. 5-6-7 : Processor meter.

TRX (X59-3680-00) : CONTROL UNIT

Components	Use/Function	Operation/Condition/Compatibility
Q151	Switching	Receive voltage supply.
Q152	Switching	Transmitter voltage supply.
Q153	Switching	Transmitter.
Q154,155	Switching	Receive.

ALC (X59-3700-00) : CONTROL UNIT

Components	Use/Function	Operation/Condition/Compatibility
Q251	Switching	CKY and DSP.
Q252,253	Switching	Stand-by switch control.
Q254	Switching	"A" switch.
Q255	Switching	Personal computer interface.
D251	Reverse current prevention	
D252	Reference voltage	12V.

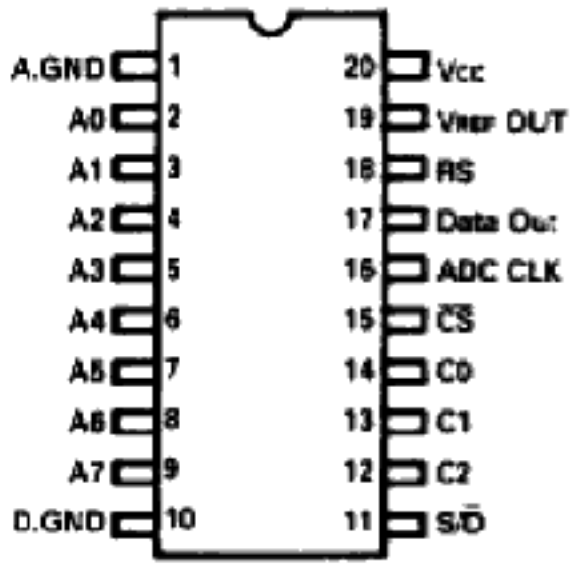
MIC AMP (X59-3710-00) : SWITCH UNIT (A)

Components	Use/Function	Operation/Condition/Compatibility
Q251	MIC amplifier	Amplified input signal from MIC.
Q252	Packet communication switch	Muted to MIC amplifier when using a packet communication.
Q253	Data switch	Muted to MIC amplifier when using a data communication.
Q254	MIC amplifier switch	Muted to MIC amplifier.
Q255	Packet communication stand-by switch	Transmitter signal to supply when using a packet communication.
D251	Reverse current prevention	

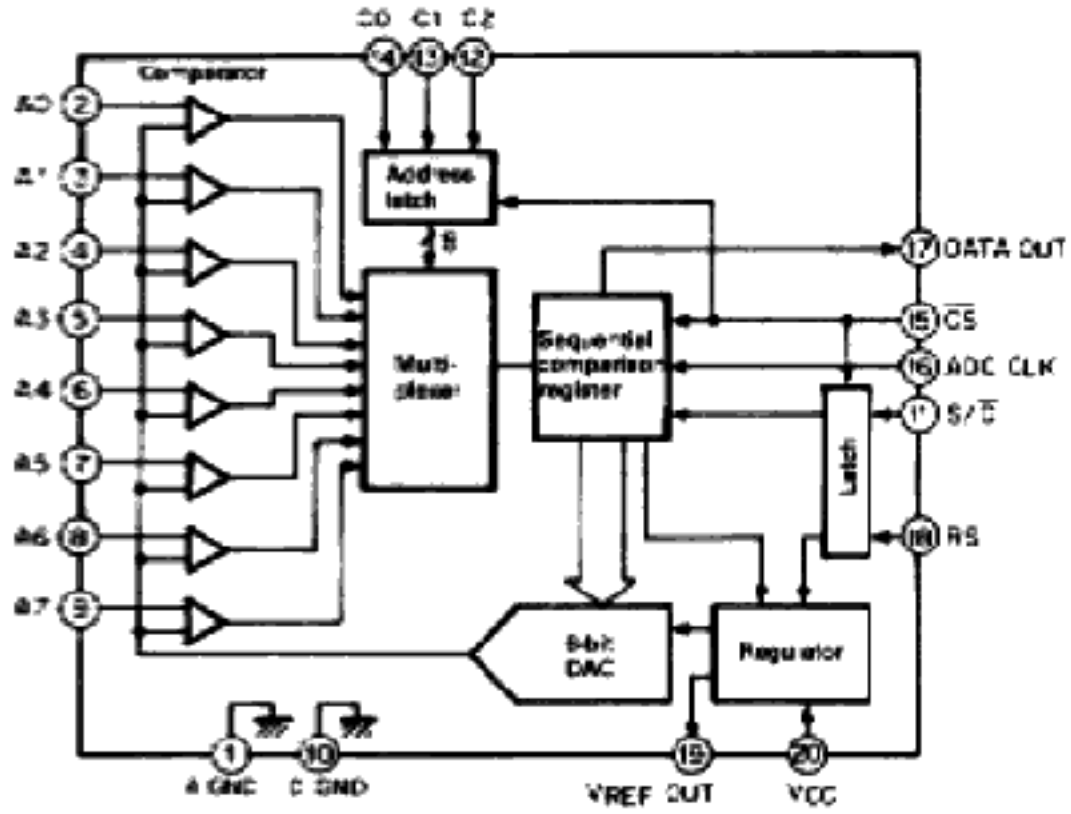
SEMICONDUCTOR DATA

A/D converter : MB4056 (Digital unit IC13)

- **Terminal connection**



- **Block diagram**



- **Terminal function**

Pin No.	Pin name	Name	Function
2–9	A0–A7	Analog input	Eight channel analog input terminals. One channel is selected using channel assignment input terminals C0 through C2.
11	S/D	Conversion mode select input	Selects the A/D conversion mode. When 0, the high and low ranges are converted. When 1, either the high or the low range is converted. This signal is latched on the trailing edge of the CS signal.
12–14	C2–C0	Channel assignment input	Assigns an analog input channel for analog-to-digital conversion. These signals are latched on the trailing edge of the CS signal.
15	CS	Chip select input	Chip select input terminal. When the CS signal is set to 1 then 0, analog-to-digital conversion starts and the data output enters the enable state. When analog-to-digital conversion is completed or interrupted, the CS signal is set to 1.
16	ADC CLK	A/D conversion clock input	A/D conversion clock input terminal. The conversion speed is determined by the clock frequency. The clock frequency need not be constant.
17	Data Out	Data output	This is a terminal (open collector) to output the results of analog-to-digital conversion. Output data is synchronized with the ADC CLK signal in the order of start bit, MSB, 2SB through LSB, and stop bit.
18	RS	Range select input	Selects the analog input voltage range. When 0, the Vrs = 1.25V range is selected. When 1, the Vrs = 5V range is selected. This signal is latched on the trailing edge of the CS signal.
19	VREF OUT	Reference voltage output	This is a terminal (regulator output) to output a reference voltage. When the power supply is used at a voltage of 8 to 18V, a regulated 5V voltage is output to the VREF OUT terminal. A maximum of 10mA current can be supplied by this terminal.
1	A.Gnd	Analog ground	Ground terminal.
10	D.Gnd	Digital ground	
20	Vcc	Power terminal	

- **Range selection**

S/D	RS	1st conversion	2nd conversion
0	0	L	H
0	1	H	L
1	0	L	–
1	1	H	–

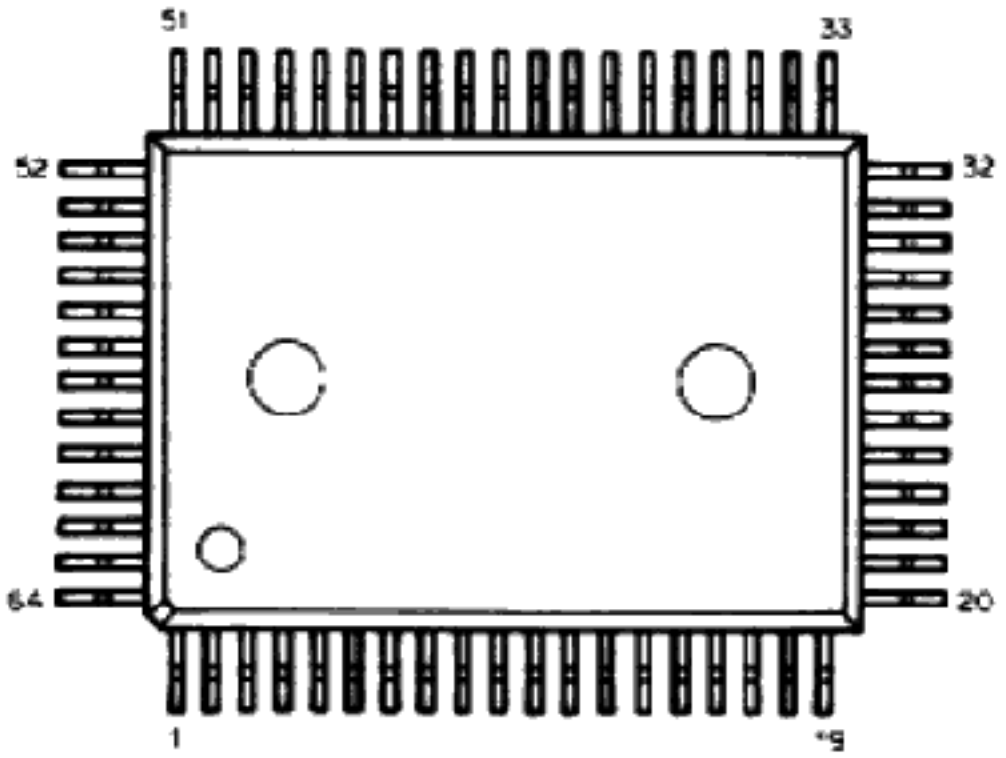
- **Channel selection**

C2	C1	C0	Channel selected
0	0	0	A0
0	0	1	A1
0	1	0	A2
0	1	1	A3
1	0	0	A4
1	0	1	A5
1	1	0	A6
1	1	1	A7

SEMICONDUCTOR DATA

I/O port : CXD1095Q (Digital unit IC6, 8)

- **Terminal connection**



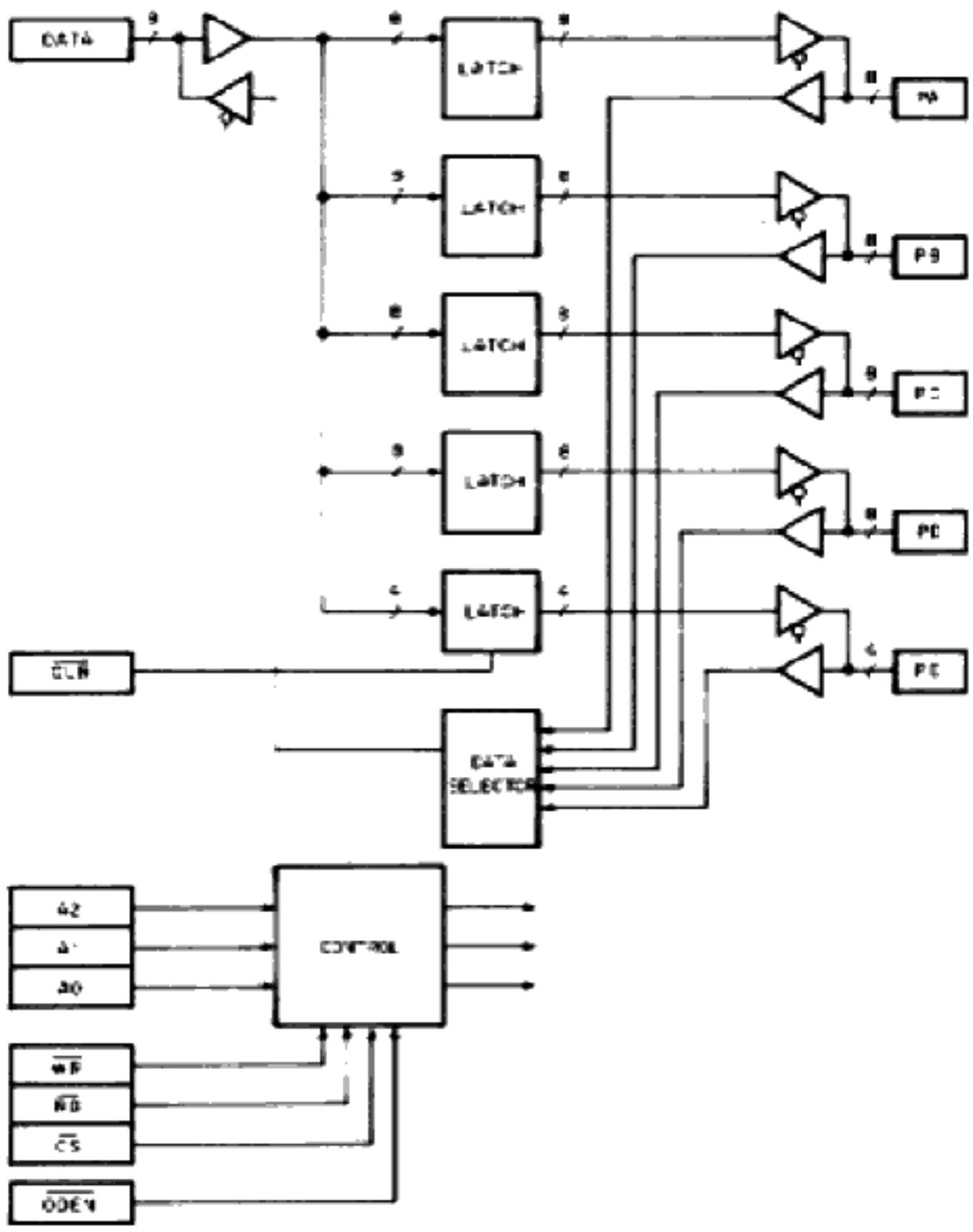
- **Terminal function**

Pin No.	Pin name	I/O	Function
1, 2	NC	–	Not connected.
3–9	PB1–PB7	I/O	Port B input/output terminals.
10	Vss	–	Connected to ground.
11–18	PC0–PC7	I/O	Port C input/output terminals.
19	NC	–	Not connected.
20–24	PD0–PD4	I/O	Port D input/output terminals.
25	Vss	–	Connected to ground.
26	VDD	–	Connected to +5V.
27–29	PD5–PD7	I/O	Port D input/output terminals.
30–32	D0–D2	I/O	Eight bit, tristate, bidirectional data bus. Data can be sent by connecting these terminals to the data bus of a microcomputer system. Goes active when $\overline{CS}$ = 0 and $\overline{RD}$ = 0 or $\overline{WR}$ = 0.
33, 34	NC	–	Not connected.
35–39	D3–D7	I/O	Eight bit, tristate, bidirectional data bus. Data can be sent by connecting these terminals to the data bus of a microcomputer system. Goes active when $\overline{CS}$ = 0 and $\overline{RD}$ = 0 or $\overline{WR}$ = 0.
40	$\overline{CLR}$	I	The register output of port E (4-bit port) is cleared (becomes zero) when $\overline{CLR}$ = 0.
41	$\overline{ODEN}$	I	All ports enter the input state (high-impedance state) when $\overline{ODEN}$ = 0. No output data register or control register is set.
42	Vss	–	Connected to ground.
43	$\overline{WR}$	I	Data is written into CXD1095Q when $\overline{WR}$ = 0. Data bus information is written on the leading edge of the $\overline{WR}$ signal (0 to 1).
44	$\overline{RD}$	I	Data is read from CXD1095Q when $\overline{RD}$ = 0.
45	$\overline{CS}$	I	CXD1095Q is selected when $\overline{CS}$ = 0 and enters the non-selection mode when $\overline{CS}$ = 1. Data lines D7 through D0 enter the high-impedance state.
46–48	A0–A2	I	Five ports and control registers are selected by addressing.
49, 50	PE0, PE1	I/O	Port E input/output terminals.
51	NC	–	Not connected.
52, 53	PE2, PE3	I/O	Port E input/output terminals.
54–56	PA0–PA2	I/O	Port A input/output terminals.
57	Vss	–	Connected to ground.
58	VDD	–	Connected to –5V.
59–63	PA3–PA7	I/O	Port A input/output terminals.
64	PB0	I/O	Port B input/output terminals.

Note : The $\overline{CS}$, $\overline{RD}$, $\overline{WR}$, $\overline{ODEN}$, and $\overline{CLR}$ signals are pulled up to Vcc in the C

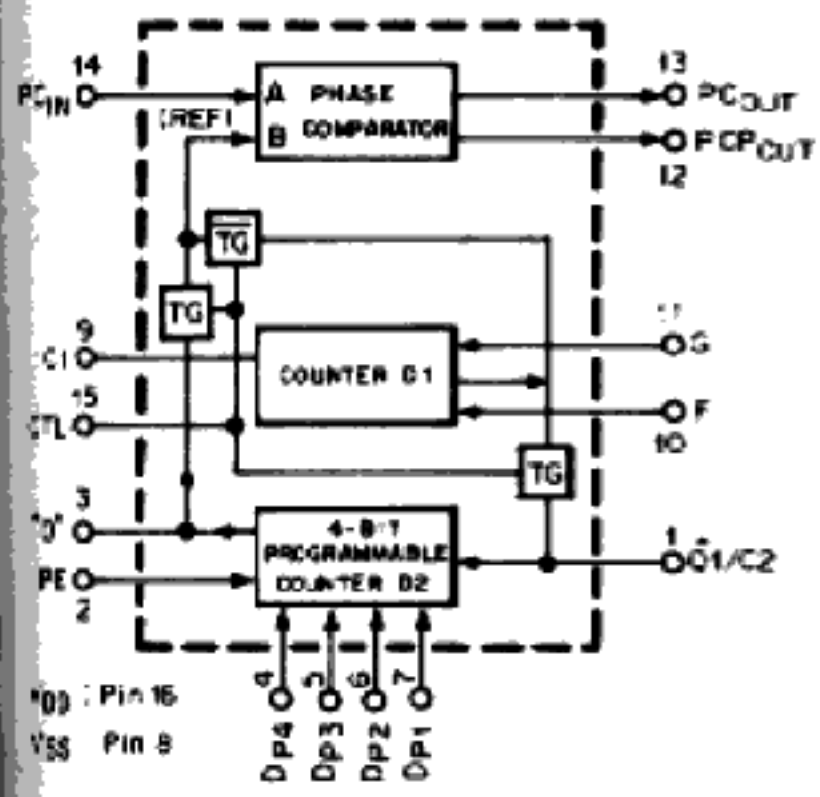
SEMICONDUCTOR DATA

- **Block diagram**

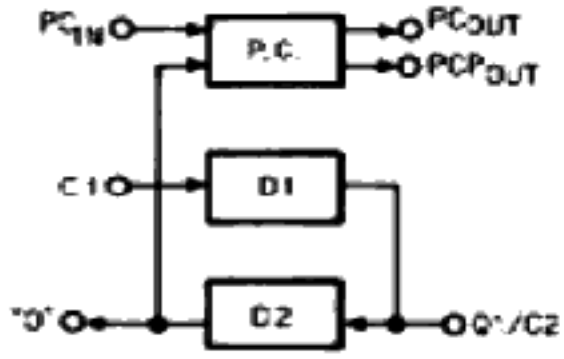


PLL : MC14568BCP (CAR unit IC13)

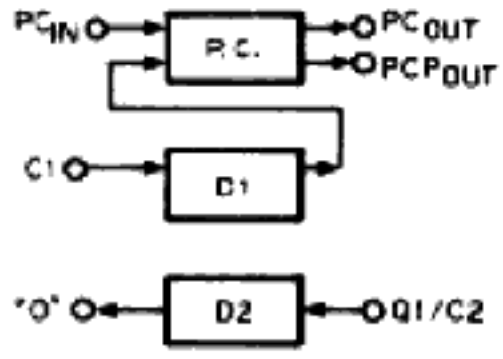
- **Block diagram**



CTL HIGH



CTL LOW

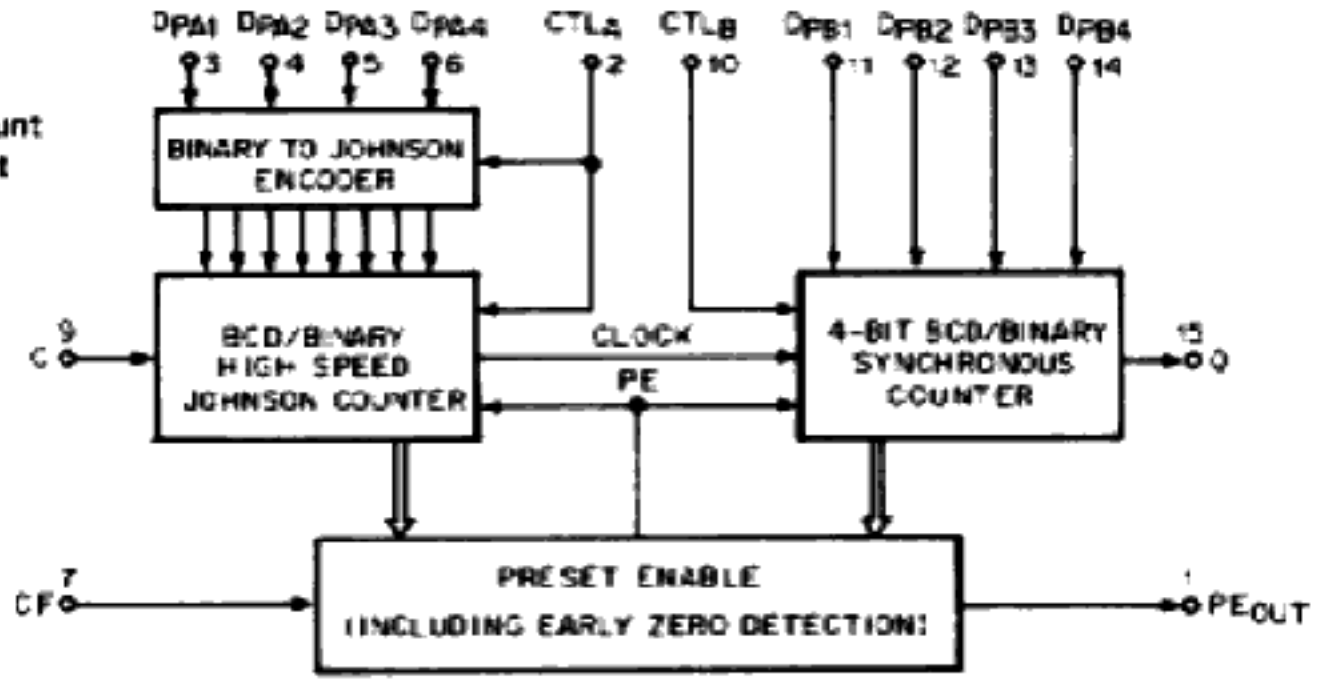


SEMICONDUCTOR DATA

Programmable frequency divider : MC14569BCP (CAR unit IC16)

- **Block diagram**

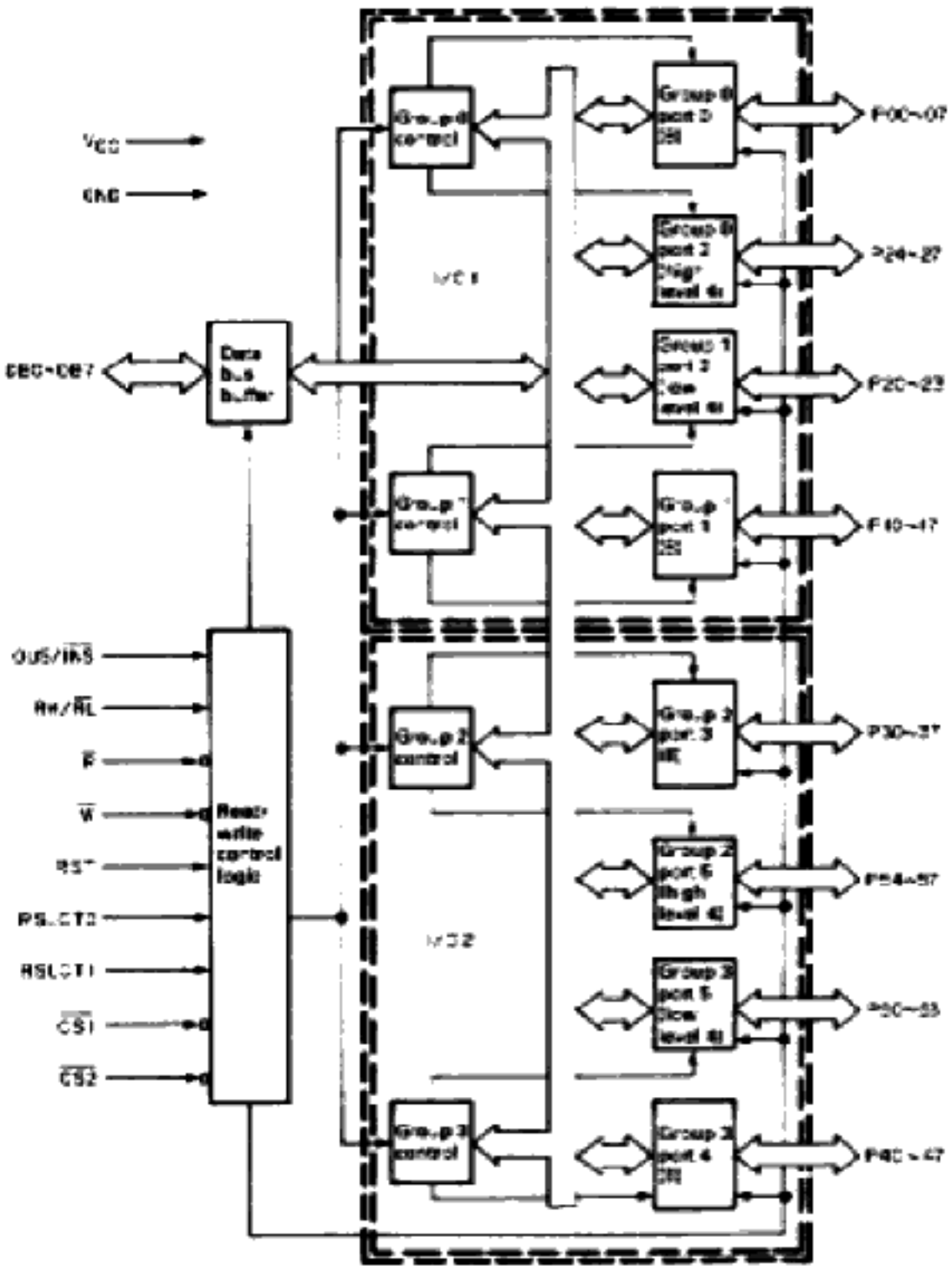
CTL = "0" for Binary Count
CTL = "1" for BCD Count



V_{DD} : Pin 16
V_{SS} : Pin 8

I/O port : MB89363B (Digital unit IC7)

- **Block diagram**



SEMICONDUCTOR DATA

• Terminal function

Pin No.	Pin name	Name	I/O	Function
1~4 77~80	P30~P37	Port 3 all bits	I/O	Eight-bit genera-purpose input/output port. These terminals are included in group 2. Three operation modes can be selected by setting the control parameter by software.
5	$\overline{W}$	Write	I	The control parameter and port output data item can be written using a low-level signal. The parameter and port data can be distinguished and selected using the $\overline{CS1}$, $\overline{CS2}$, RSLCT0, and RSLCT1 signals.
6	RST	Initial setting reset	I	Input terminal. The M5M80963B is set to the initial mode using a reset signal, and initial value 9B (hexadecimal) is automatically set for two control parameters. The initial mode indicates that all ports are in the input state of mode 0. All port terminals stay high in the initial mode. The active signal level is selected using an RH/$\overline{RL}$ signal. RH/$\overline{RL}$ = 0 : $\overline{RST}$ (active low) RH/$\overline{RL}$ = 1 : RST (active high)
9	RH/$\overline{RL}$	Reset active level selection	I	The RST terminal is set to active high or active low. RH/$\overline{RL}$ = 0 : $\overline{RST}$ (active low) RH/$\overline{RL}$ = 1 : RST (active high) The RH/$\overline{RL}$ terminal is fixed at either Vcc or GND at all times.
11	OUS/$\overline{INS}$	Port 0 and 3 read value selection	I	This terminal indicates the output state of ports 0 and 3. It also selects whether the external terminal value of ports 0 and 3 is read directly or whether the output latch value of ports 0 and 3 is read directly when reading the value of ports 0 and 3. OUS/$\overline{INS}$ = 0 : The output latch value of ports 0 and 3 is read. OUS/$\overline{INS}$ = 1 : The external terminal value of ports 0 and 3 is read.
12~19	DB0~DB7	Bi-directional data bus	I/O	Eight-bit, bidirectional data bus. These terminals are used for data communication with the MPU. The bus signal making and breaking and data direction are controlled using the $\overline{CS1}$, $\overline{CS2}$, $\overline{R}$ and $\overline{W}$ signals.
20~23 25~28	P00~P07	Port 0 all bits	I/O	Eight-bit, general-purpose input/output port. These terminals are included in group 0. Three operation modes can be selected by setting the control parameter by software.
29 35	$\overline{CS1}$ $\overline{CS2}$	Device selection	I	When a low-level signal is input to this terminal, signals DB0 through DB7 are released and data communication with the MPU takes place. At that time, the control parameter is written, and data is written into or read from each port. $\overline{CS1}$ = 0 : I/O1 $\overline{CS2}$ = 0 : I/O2 Simultaneous selection of $\overline{CS1}$ = 0 and $\overline{CS2}$ = 0 is inhibited.
30, 74	GND	Ground terminal	I	0V.
31 32	RSLCT0 RSLCT1	Access selection	I	When data is sent to the MPU, the parameter and port are distinguished and selected using the $\overline{CS1}$, $\overline{CS2}$, RSLCT0, and RSLCT1 signals.
34~40 43	P20~P27	Port 2 all bits	I/O	These terminals are used as a general-purpose input/output port, handshaking control terminals, and status data bit input/output terminals in accordance with the operation functions and modes of groups 0 and 1.
44~51	P10~P17	Port 1 all bits	I/O	Eight-bit, general-purpose input/output port. These terminals are included in group 1. Two operation modes can be selected by setting the control parameter by software.
53	Vcc			+5V power.
54~61	P40~P47	Port 4 all bits	I/O	Eight-bit, general-purpose input/output port. These terminals are included in group 3. Two operation modes can be selected by setting the control parameter by software.
62 65~71	P50~P57	Port 5 all bits	I/O	These terminals are used as a general-purpose input/output port, handshaking control terminals, and status data bit input/output terminals.
76	$\overline{R}$	Read		Data from each port is read using a low-level signal. The port type is selected using the $\overline{CS1}$, $\overline{CS2}$, RSLCT0, and RSLCT1 signals.
7,8,13,24 33,41,42 52,63,64 72,73	NC	–	–	Connection to the NC terminal is inhibited.

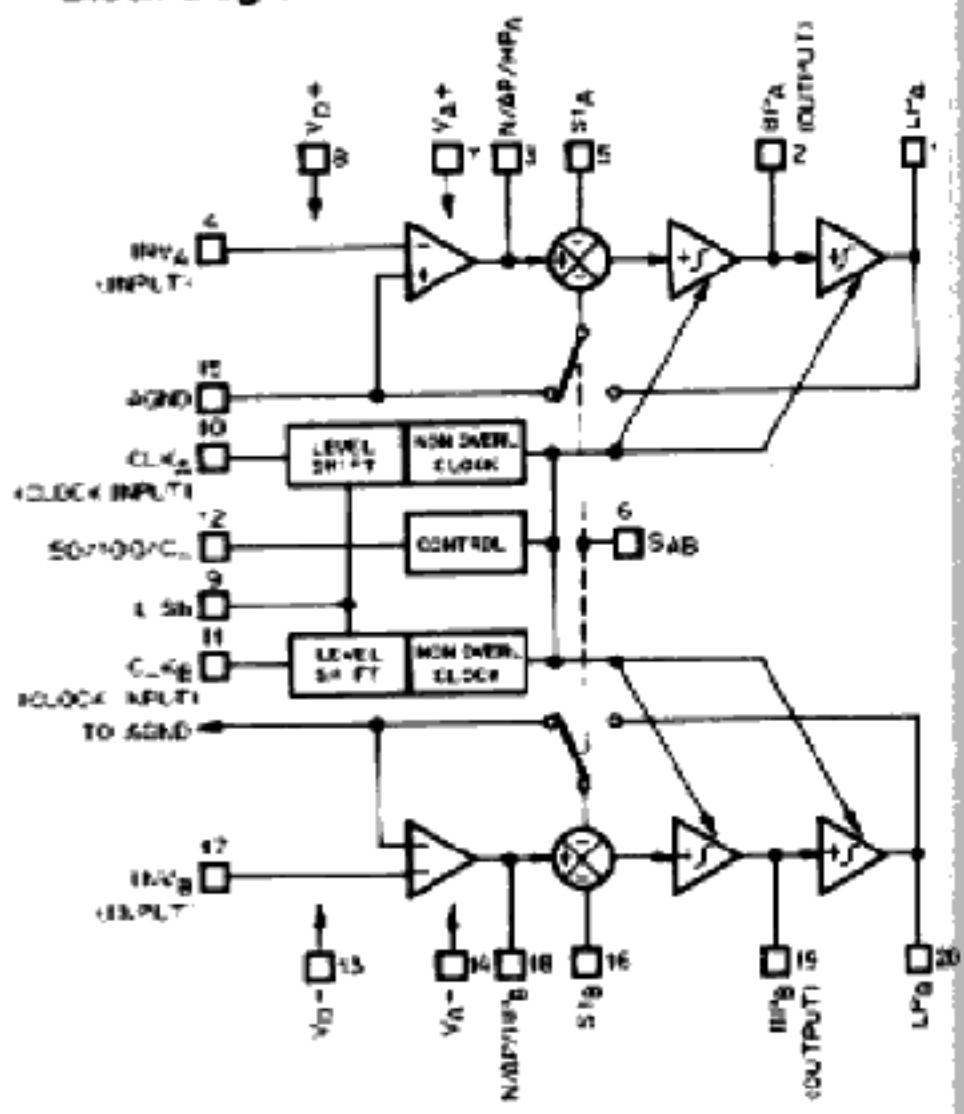
SEMICONDUCTOR DATA

Switched capacitor filter : MF10CCWM (AF unit IC2)

- **Features**

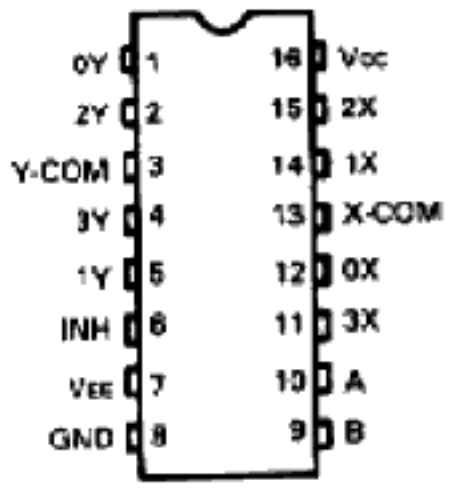
- The cut-off frequency stability varies depending on the external clock.
- The cut-off and center frequencies of a filter can be set and altered using the external clock frequency.
- 20-pin DIP package.
- SO package is provided for surface installation.
- Clock and center frequencies have a high precision ratio (fCLK/fO). (±0.6% : MF10AC, ±1.5% : MF10C)
- Three independent low-pass, bandpass, and high-pass (or notch or all-pass) outputs.
- The product of center frequency fo and Q (fc x Q) is 200kHz.
- Input frequency is 20kHz (representative value is 30kHz).

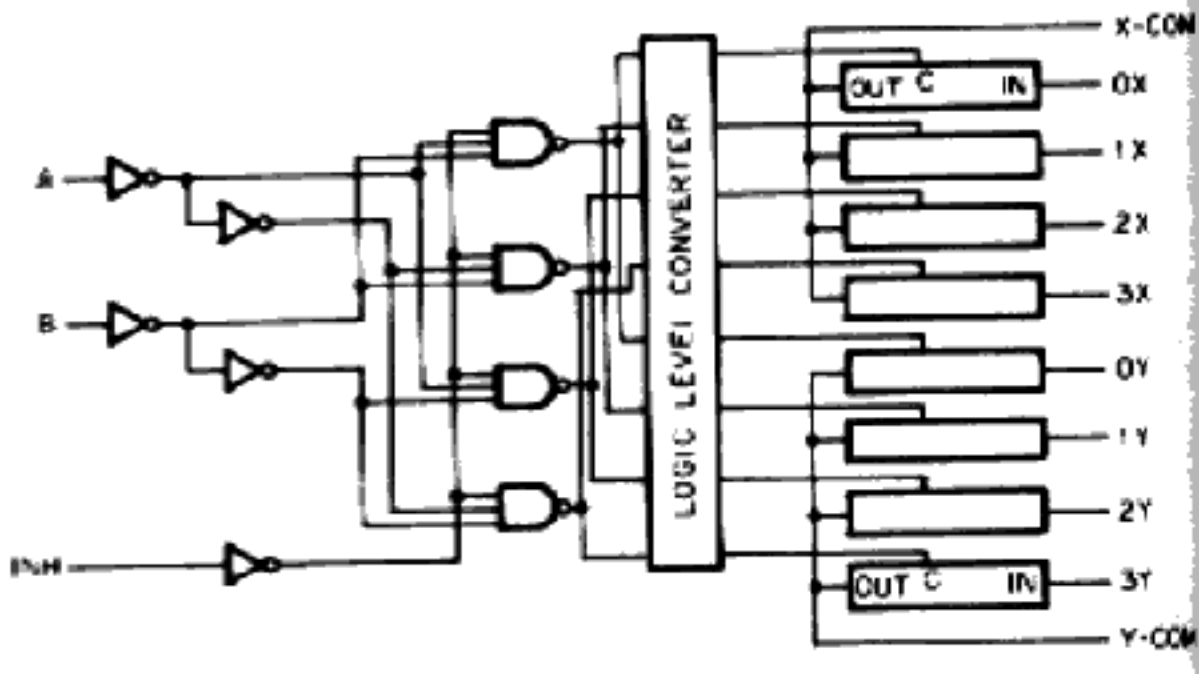
- **Block diagram**



HPF : MC74HC4052F (DSP unit IC1, 2)

- **Terminal connection**
- **Logic circuit diagram**





- **Truth table**

CONTROL INPUTS			"ON" CHANNEL
"INHIBIT"	B	A	
L	L	L	0X,0Y
L	L	H	1X,1Y
L	H	L	2X,2Y
L	H	H	3X,3Y
L	L	L	–
L	L	H	–
L	H	L	–
L	H	H	–
H	X	X	NONE

X : Do not care

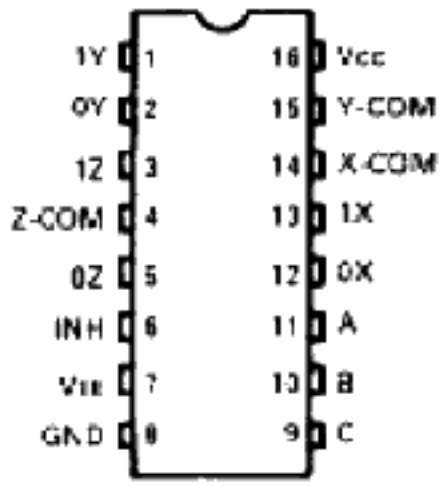
SEMICONDUCTOR DATA

Analog switch : MC74HC4053F (DSP unit IC3)

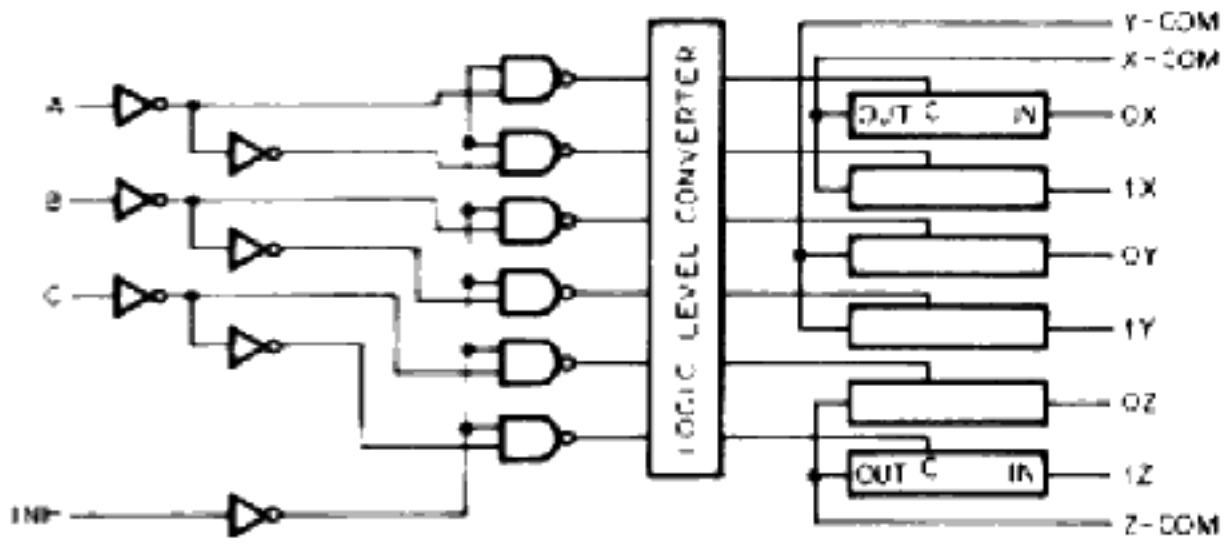
D/A output duty variable : MC74HC4053F (DSP unit IC18)

Mixer : MC74HC4053F (DSP unit IC21)

- **Terminal connection**



- **Logic circuit diagram**



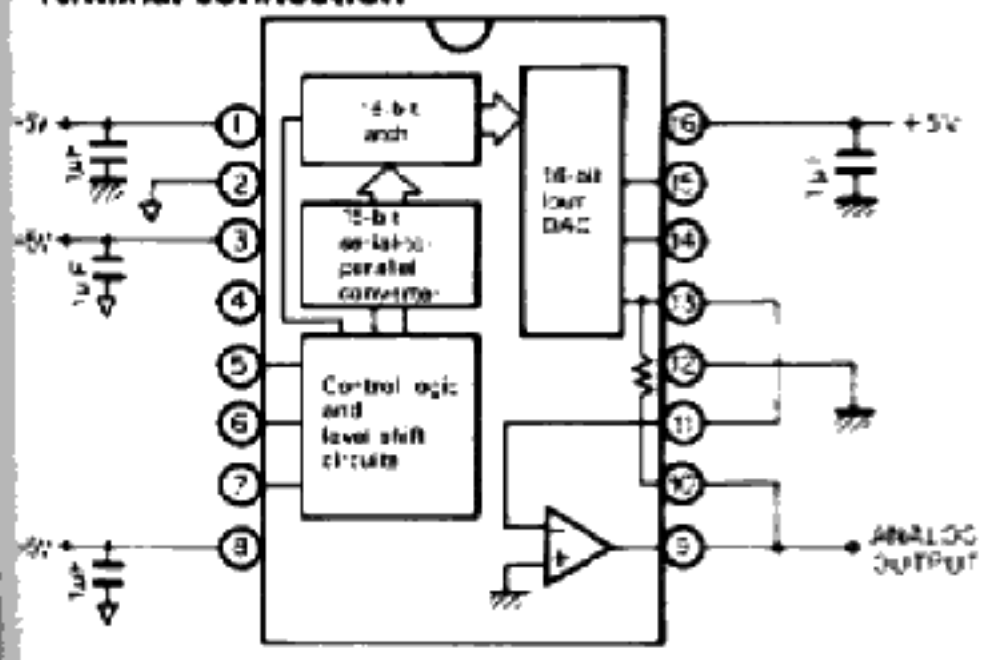
- **Truth table**

CONTROL INPUTS				"ON" CHANNEL
INHIBIT	C	B	A	
L	L	L	L	0X,0Y,0Z
L	L	L	H	1X,0Y,0Z
L	L	H	L	0X,1Y,0Z
L	L	H	H	1X,1Y,0Z
L	H	L	L	0X,0Y,1Z
L	H	L	H	1X,0Y,1Z
L	H	H	L	0X,1Y,1Z
L	H	H	H	1X,1Y,1Z
H	X	X	X	NONE

X : Do not care

D/A converter : PCM56P (DSP unit IC17)

- **Terminal connection**



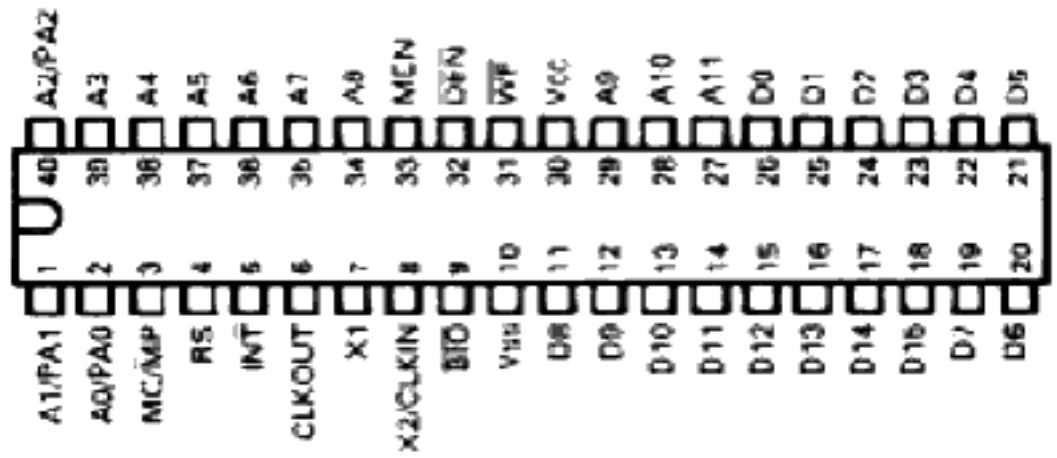
- **Terminal function**

Pin No.	Pin name	Function
1	–Vs	Analog negative power supply
2	LOG COM	Logic common
3	+VL	Logic positive power supply
4	NC	Not connected
5	CLK	Clock input
6	LE	Latch enable input
7	DATA	Serial data input
8	–VL	Logic negative power supply
9	Vout	Voltage output
10	RF	Feedback resistor
11	SJ	Summing junction
12	ANA COM	Analog common
13	Iout	Current output
14	MSB ADJ	MSB adjustment terminal
15	TRIM	MSB trim potentiometer terminal
16	+Vs	Analog positive power supply

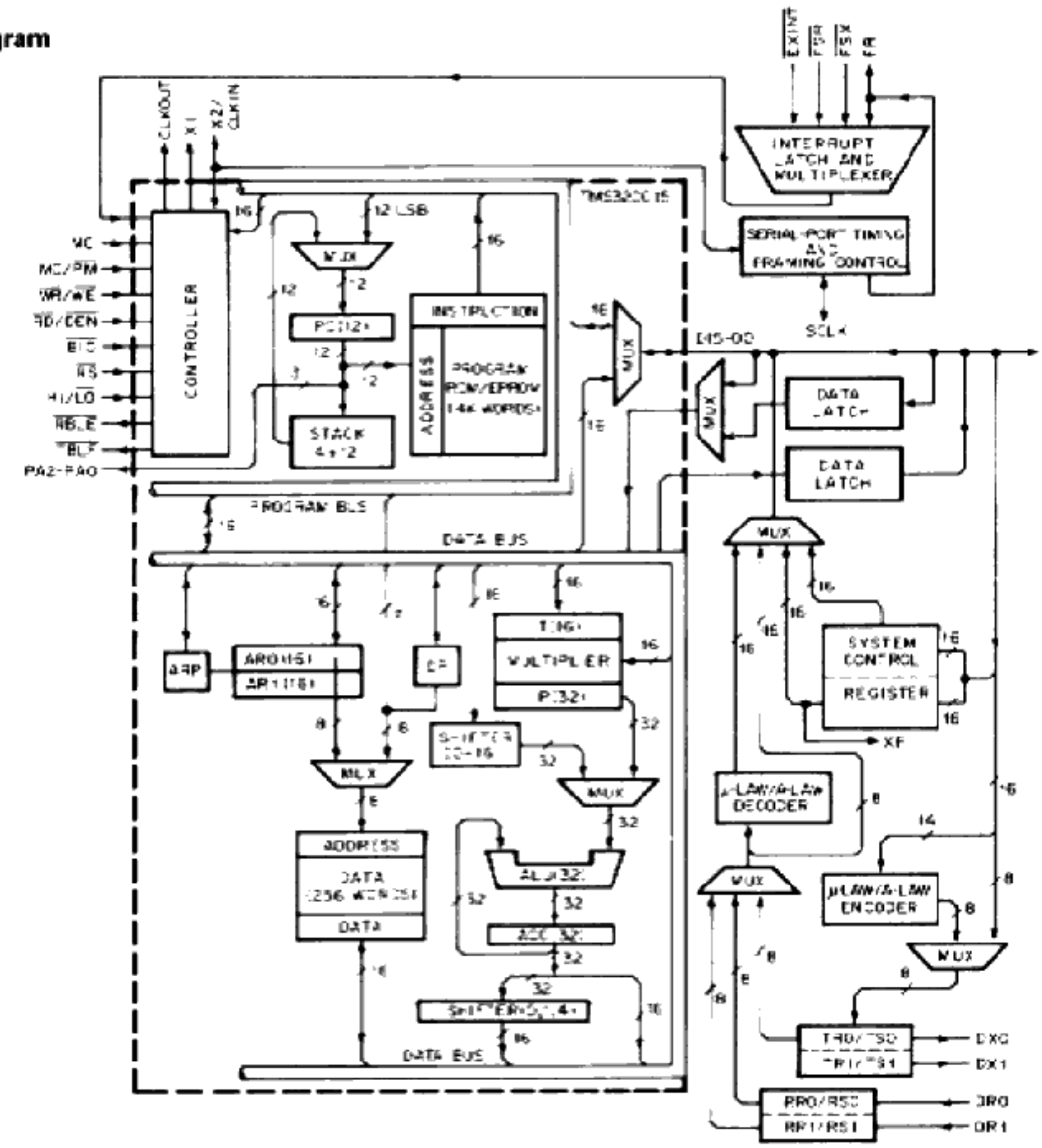
SEMICONDUCTOR DATA

DSP : TMS320E15JJBC1 (DSP unit IC31)

- **Terminal connection**



- **Block diagram**



ACC = ACCUMULATOR
ARP = AUXILIARY REGISTER POINTER
AR0 = AUXILIARY REGISTER 0
AR1 = AUXILIARY REGISTER 1
DP = DATA PAGE POINTER
PC = PROGRAM COUNTER
P = P REGISTER
T = T REGISTER
TR = TRANSMIT REGISTER
RR = RECEIVE REGISTER

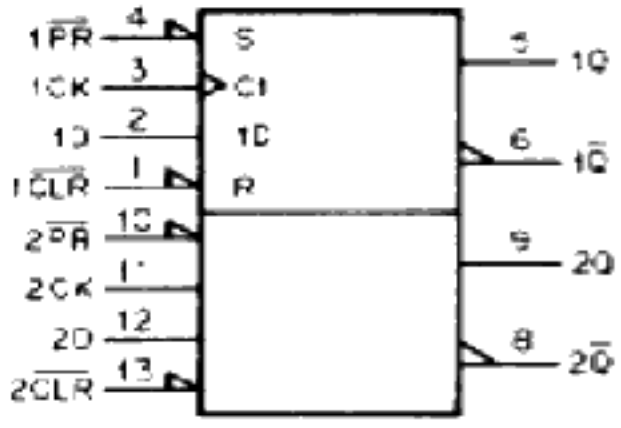
SEMICONDUCTOR DATA

• Terminal function

Pin name	Pin No.	I/O	Function
			Power supply
Vcc	30	-	Supply voltage (+5V ±0M)
Vss	10	-	Ground
			Clock
X2/CLKIN	8		Internal clock crystal input pin (X2). This terminal is also used as an external clock input pin (CLKIN).
X1	7	O	Internal clock crystal output pin.
CLKOUT	6	O	Clock output signal. The CLKOUT signal frequency is 1/4 of the external clock input or internal clock crystal frequency. The duty ratio is 50%.
			Control
$\overline{WE}$	31	O	TMS32010 indicates that data on the data bus is valid during active low. Goes active in the first cycle only of an OUT command and the second cycle of a TBLW command. When the WE signal is active, the MEN and DEN signals are high at all times.
$\overline{DEN}$	32	O	TMS32010 indicates that data is received from the data bus during active low. Goes active in the first cycle only of an IN command. The $\overline{MEN}$ and $\overline{WE}$ signals are high at all times.
$\overline{MEN}$	33	O	Goes active except when the $\overline{WE}$ and $\overline{DEN}$ signals are active during active low. This is a control signal used to fetch commands from on-chip and off-chip program memory.
			Interrupt
$\overline{RS}$	4	I	Reset. When the $\overline{RS}$ pin is made low for five clock cycles (minimum) during active low, the $\overline{DEN}$, $\overline{WE}$, and $\overline{MEN}$ signals go high and data lines D15 through D0 take on a high impedance. The PC and address lines A11 through A0 are simultaneously cleared on clock cycle after the trailing edge of the $\overline{RS}$ signal, and all address lines go low. The interrupt mask and interrupt flag register are cleared, but the overflow mode register, data pointer, and auxiliary register pointer are not altered. The device is in reset mode until this signal goes high.
$\overline{INT}$	5	I	Interrupt. An interrupt signal is generated on the trailing edge of the $\overline{INT}$ signal. This edge is used to alter the interrupt flag register (INTF) until a device interrupt occurs. The interrupt is also possible when low.
$\overline{BIO}$	9	I	Input/output branch control. This branches to the address designated using commands when the BIO signal is active (low) during BIOZ command execution.
			Program memory control
MC/$\overline{MP}$	3	I	Microcomputer/microprocessor mode. When MC/$\overline{MP}$ = 1, the microcomputer mode is in effect and there is a 1524-word on-chip program memory. Address 1523 through 1535 are used for testing. A 2560-word program memory can be installed externally in this mode. When MC/$\overline{MP}$ = 0, microprocessor mode is in effect and all program memory is installed externally.
			Bidirectional data bus
D15–D8	18–17	I/O	Data lines D15 (MSB) through D8 (LSB) always take on a high impedance except when the $\overline{WE}$ signal is active (low).
D7–D0	19–26	I/O	
			Program memory address bus and port address bus
A11–A3	27–29	O	Program memory address lines A11 (MSB) through A0 (LSB) and port address lines PA2 (MSB) through
A2–A3	34–39	O	PA0 (LSB). Lines A11 through A3 do not take on a high impedance. Lines A2 through A0 indicate port
A2/PA2	40	O	address PA2 through PA0 during INOUT command execution.
A1/PA1		O	
A0/PA0	2	O	

A/D gate array interface : TC74HC74AF (DSP unit IC14)

• Logic circuit diagram



• Truth table

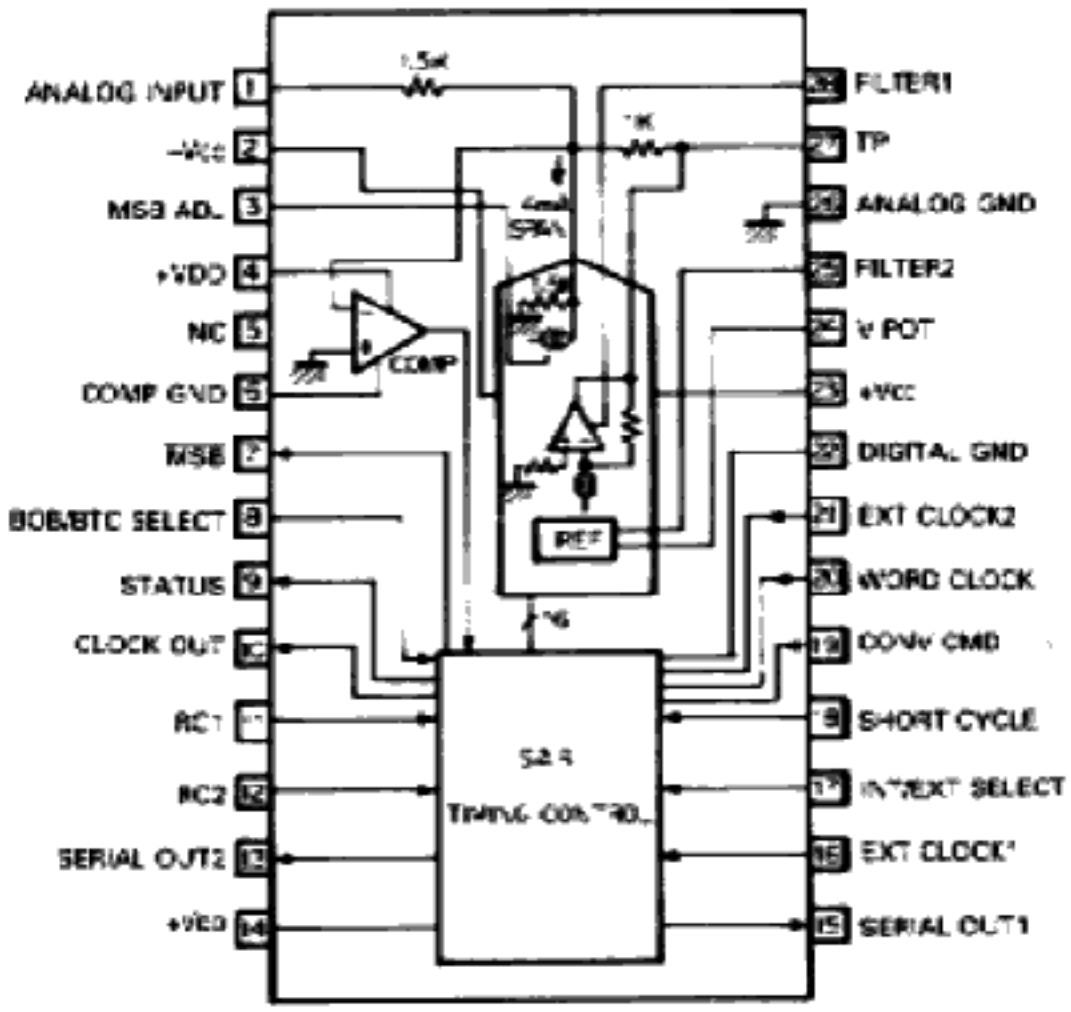
INPUTS				OUTPUTS		FUNCTION
$\overline{CLR}$	$\overline{PR}$	D	CK	Q	$\overline{Q}$	
L	H	X	X	L	H	CLEAR
H	L	X	X	H	L	PRESET
L	L	X	X	H	H	–
H	H	↑	↑	L	H	–
H	H	H	↓	H	L	–
H	H	X	↓	Q^n	$\overline{Q^n}$	NO CHANGE

X : Do not care

SEMICONDUCTOR DATA

A/D converter : PCM78AP (DSP unit IC12)

- **Block diagram**



- **Terminal function**

Pin No.	Pin name	I/O	Function
1	ANALOG INPUT	I	A/D converter analog input. Input impedance 1.5kΩ (TYP.)
2	-Vcc	–	Analog -Vcc.
3	MSB ADJ.	I	MSB adjustment (MSB DLE compensation) input terminal.
4	+VDD	–	Comparator +VDD.
5	NC	–	
6	COMP GND	–	Comparator ground. Usually connected to digital common.
7	$\overline{\text{MSB}}$	O	$\overline{\text{MSB}}$ output terminal.
8	BOB/BTC SELECT	I	Output digital code selection terminal. "L" : BOB, "H" : BTC
9	STATUS	O	Status signal output terminal.
10	CLOCK OUT	O	Main clock output terminal for SAR operation.
11	RC1	–	Internal clock oscillation frequency setting terminal. Pulled up to +Vcc by 10kΩ when an external clock is used.
12	RC2	–	Internal clock oscillation frequency setting terminal. Pulled up to +Vcc by 10kΩ when an external clock is used.
13	SERIAL OUT2	O	Serial data output synchronized with EXT CLOCK2 signal.
14	+Vdd	–	Digital +Vcc.
15	SERIAL OUT1	O	Serial data output synchronized with internal clock or EXT CLOCK1.
16	EXT CLOCK1	I	External clock (EXT CLOCK1) input. Opened or pulled up when not used.
17	INT/EXT SELECT	I	Internal/external clock selection terminal. "L" : INT, "H" : EXT
18	SHORT CYCLE	I	Short cycle timing input terminal.
19	CONV CMD	I	Conversion command signal input terminal. Set low when not used.
20	WORD CLOCK	I	WORD CLOCK input terminal. Opened or pulled up when not used.
21	EXT CLOCK2	I	External clock (EXT CLOCK2) input terminal. Opened or pulled up when not used.
22	DIGITAL GND	–	Digital ground.
23	+Vcc	–	Analog +Vcc.
24	V POT	O	MSB adjustment reference voltage output terminal.
25	FILTER2	–	Internal reference filter. A 3.3μF capacitor is connected to -Vcc.
26	ANALOG GND	–	Analog ground. A 2.2μF capacitor is connected to ANA GND.
27	TP	–	Test point for operation check.
28	FILTER1	–	Internal reference filter. A 3.3μF capacitor is connected to ANA GND.

PARTS LIST

PRECAUTIONS ABOUT PARTS LIST

● On general purpose chip parts

From a part number, the resistance value and capacity value are omitted, and "XXX" is used instead. (Ex.: RD41DB2BXXXJ)
In this case, from the circuit diagram, the reference number and resistance value and capacitance value are read, and they are changed into a part number making use of the following table.

In addition, it should be noted that of those parts represented by serial reference numbers, some numbers may be unused.
The unused numbers are listed on the circuit diagram.

● On resistance RD14BB

Of resistance RD14BB, any part number of less than 1/4W is omitted from the parts list.

● On symbols occurring on parts list

★ : Indicates new parts
⚠ : Indicates safety critical components

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Resistor value	Capacitor value
22Ω = 2 2 0 (Multiplier / 2nd number / 1st number)	22pF = 2 2 0 (Multiplier / 2nd number / 1st number)
0.5Ω = 0R5	0.5pF = 0R5
1Ω = 010	1pF = 010
10Ω = 100	10pF = 100
100Ω = 101	100pF = 101
1000Ω = 1KΩ = 102	1000pF = 0.001μF = 102
10KΩ = 103	0.01μF = 103
100KΩ = 104	
1000KΩ = 1MΩ = 105	

Letter "R" is used for the decimal point. In this case, all become significant figures.

TS-950S/SD

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Ref. No. 参照番号	Address 位置	New Parts 新部品	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
			TS-950S/SD			
1	1A	*	A01-1073-.1	METALLIC CABINET(T9P)	KP	S
-	1A	*	A01-1081-1.	METALLIC CABINET(TSP)	MnW2X	S
-	1A	*	A01-1082-.1	METALLIC CABINET(T9P)	KP	D
-	1A	*	A01-1083-1.	METALLIC CABINET(TSP)	MnW2X	D
2	3A	*	A01-1074-.1	METALLIC CABINET(B9TTGM)	KYUW2	
2	3A	*	A01-1074-1.	METALLIC CABINET(B&TTGM)	X	
2	3A	*	A01-1093-01	METALLIC CABINET(B9TTGM)	P	
3	2D	*	A20-7024-12	PANEL		S
3	2D	*	A20-7026-02	PANEL		D
4	2D	*	A20-7028-12	PANEL ASSY		S
4	2D	*	A20-7027-02	PANEL ASSY		D
5	2G	*	A23-1[illegible]8-12	REAR PANEL		S
6	1K	*	A40-0624-03	BOTTOM PLATE		
8	1K	*	B04-0412-04	MESH PLATE		
-		*	B04-0413-03	MESH PLATE	P	
10	2D	*	B10-1119-13	FRONT GLASS		
11	2C	*	B11-0466-04	FILTER		
-		*	B40-3951-04	MODEL NAME PLATE	KP	
-		*	B40-3966-04	MODEL NAME PLATE	M	
-		*	B40-3967-04	MODEL NAME PLATE	MW2	
-		*	B40-7608-04	MODEL NAME PLATE	X	
-			B41-0336-04	CAUTION LABEL(LIGHTING MARKING	KP	
-			B41-0525-04	CAUTION LABEL(FUSE REPLACEMENT	KP	
-			B42-3343-04	LABEL(S/N)		
-		*	B42-3365-04	LABEL(PRE SET)		
-		*	B42-3371-04	LABEL ACSY(REAR PANEL VIEW)		
-		*	B42-3374-04	LABEL(AC 120/220V)	M	
-		*	B42-3375-04	LABEL(AC 220/220V)	MW2	
-		*	B42-3376-04	LABEL(AC 120/240V)	X	
-		*	B42-3395-04	LABEL	K	D
18	2C	*	B43-1098-04	BADGE		
-			B44-2163-04	LABEL(LPC CORD)		
-		*	B46-0425-00	WARRANTY CARD	K	
-			B46-0419-00	WARRANTY CARD	MW2	
-			B46-0422-00	WARRANTY CARD	P	
-		*	B50-8299-10	INSTRUCTION MANUAL		
-		*	B50-8351-00	INSTRUCTION MANUAL(COMMAND EXP		
20	2K		E04-0167-05	RF COAXIAL CABLE RECEPTACLE		
-			E07-0751-05	7P DIN PLUG ASSY		
-			E07-1351-05	13P ROUND PLUG ASSY		
22	3K		E13-0101-05	PIN JACK		
-			E29-0114-05	CAP	MW2X	
-			E30-0974-05	AC POWER CORD	KM	
-			E30-2125-05	AC POWER CORD	P	
-		*	E30-2153-15	AC POWER CORD	MW2	
-		*	E30-2159-15	AC POWER CORD	X	
-		*	E30-2176-05	CORD WITH PINPLUG		
-			E31-2048-05	CONNECTING WIRE(AT)		
-		*	E31-3111-15	CONNECTING WIRE(AT)		
-			E31-3221-25	CONNECTING WIRE(VIF)		
-		*	E31-6067-05	CONNECTING WIRE(SIG-CONT)14P		
-		*	E31-6068-05	CONNECTING WIRE(SIG-4P) 14P		

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-		*	E31-6069-05	CONNECTING WIRE(SIG-DIG,AF-DIG		
-		*	E31-6070-05	CONNECTING WIRE(DIS-SW4) 18P		
-		*	E31-6071-05	CONNECTING WIRE(DIG-DIG) 10P		
-		*	E31-6072-05	CONNECTING WIRE(PLL-DIG) 24P		
-		*	E31-6073-05	CONNECTING WIRE(CONT-DIG) 16P		
-		*	E31-6074-05	CONNECTING WIRE(SW4-DIG) 20P		
35	2I	*	FC1-0968-13	HEAT SINK		
36	1I		F05-3121-05	FUSE(SEMKO 3.15A)	WW2X	
36	1I		F05-3523-05	FUSE(3.5A)	M	
-			F05-6021-05	FUSE ACSY(6A)	M	
36	1I		F05-6027-05	FUSE(UL 6A)	KP	
37	1A	*	F07-0886-04	COVER(PCB TOP CABINET)		
38	1G	*	F07-0887-04	COVER(REAR PANEL FAN SIDE)		
39	2G,2H	*	F09-0423-05	FAN		
40	1K	*	F11-1139-23	SHIELDING COVER(FINAL)		
41	3C	*	F11-2153-03	SHIELDING COVER(RF)		
42	1E	*	F20-1022-03	INSULATING BOARD(SW)		
-		*	F20-1041-04	INSULATING BOARD(RF SHIELD)		
-		*	F20-1036-04	INSULATING BOARD(AVR)		
-		*	F20-1043-04	INSULATING BOARD(CHASSIS)		
-			G02-0505-05	LEAF SPRING		
48	1I		G02-0574-04	FLAT SPRING		
49	1I		G02-0576-04	FLAT SPRING		
50	1A		G10-0656-04	NON-WOVEN FABRIC(SP)		
-			G10-0662-04	NEW-WOVEN FABRIC		
52	1E	*	G10-0697-14	NON-WOVEN FABRIC(FILTER)		
-			G11-0609-04	CUSHION(MIC)		
-			G13-0855-04	FORMED PLATE(MIC)		
53	2C	*	G13-0917-04	CUSHION(KNOB)		
54	2C	*	G13-0918-04	CUSHION(KNOB)		
55	1A	*	G13-0919-04	CUSHION(SP)		
56	3H	*	G13-0927-04	CUSHION(ELECTRO CAP)		
-		*	G13-0943-14	CUSHION(TRANSFORMER)		
58	2H	*	G16-0520-04	SHEET(SP)		
-		*	H01-0263-04	ITEM CARTON BOX		S
-		*	H01-0604-04	ITEM CARTON BOX		O
-		*	H03-2763-04	OUTER PACKING CASE		S
-		*	H03-2784-04	OUTER PACKING CASE		D
-		*	H10-2656-01	POLYSTYRENE FOAMED FIXTURE		
-		*	H10-2657-01	POLYSTYRENE FOAMED FIXTURE		
-		*	H12-1419-04	PACKING FIXTURE		
-		*	H20-1434-03	PROTECTION COVER		
-			H25-0107-04	PROTECTION BAG(ACSY)		
-			H25-0108-04	PROTECTION BAG(MIC)		
60	3B		J02-0049-14	FOOT(REAR)		
61	3A		J02-0423-04	FOOT(FRONT)		
62	3A		J02-0424-04	FOOT(FRONT)		
63	1A,3A		J02-0426-03	FOOT(SIDE)		
64	2H		J19-1382-05	LEAD HOLDER		
65	2F		J21-2664-14	MOUNTING HARDWARE(CONT B/3)		
66	2J	*	J21-4272-03	MOUNTING HARDWARE(HEAT SINK)		
67	2H	*	J21-4273-04	MOUNTING HARDWARE(FAN)		
68	2H	*	J21-4274-04	MOUNTING HARDWARE(SP)		
69	2I	*	J21-4275-04	MOUNTING HARDWARE(ELECTRO CAP)		

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70	1I	×	J21-4275-04	MOUNTING HARDWARE(AVR)		
71	2K	×	J21-4277-04	MOUNTING HARDWARE(REAR PANEL)		
72	3I	×	J21-4278-04	MOUNTING HARDWARE(AT)		
73	1D		J31-0141-04	CABLAR(MIC)		
74	2I	×	J32-0909-04	STUD(AVR)		
75	2I	×	J32-0910-04	STUD(AVR)		
-			J42-0083-05	BUSHING(AC)	KY	
-			J42-0085-05	BUSHING(AC)	Mm2K	
77	2G		J50-0401-05	HINGE		
78	1A		J59-0021-05	GROMMET		
79	1A		J59-0002-05	GROMMET		
-			J61-0033-05	WIRE BAND(SUB TRANSFORMER)		
-			J61-0039-05	WIRE BAND(P.L)		
-			J61-0307-05	WIRE BAND		
80	1B		K01-0407-05	HANDLE		
81	2C	×	K21-0789-12	KNOB(MAIN TUNING)		
82	2C	×	K23-0793-04	KNOB(SWITCH)		
83	2C	×	K23-0794-04	KNOB(ATT,ACC)		
84	2C		K29-0761-04	KNOB RING		
85	2I	×	K29-3172-04	KNOB(M.C-)		
86	2I	×	K29-3173-04	KNOB(METER)		
87	2I	×	K29-3174-03	KNOB(0)		
88	2I	×	K29-3175-03	KNOB(1)		
89	2I	×	K29-3176-03	KNOB(2)		
90	2I	×	K29-3177-03	KNOB(3)		
91	2I	×	K29-3178-03	KNOB(4)		
92	2I	×	K29-3179-03	KNOB(5)		
93	2I	×	K29-3180-03	KNOB(6)		
94	2I	×	K29-3181-03	KNOB(7)		
95	2I	×	K29-3182-03	KNOB(8)		
96	2I	×	K29-3183-03	KNOB(9)		
97	2I	×	K29-3184-03	KNOB(CLR)		
98	2I	×	K29-3185-03	KNOB(ENT)		
99	2I	×	K29-3186-03	KNOB(TF-W)		
100	2I	×	K29-3187-03	KNOB(SUB)		
101	2I	×	K29-3188-03	KNOB(STEP)		
102	2I	×	K29-3189-03	KNOB(TF-SET)		
103	2I	×	K29-3190-03	KNOB(TONE)		
104	2I	×	K29-3191-03	KNOB(MODE)		
105	2I	×	K29-3192-03	KNOB(9.83)		
106	2I	×	K29-3193-03	KNOB(455)		
107	2I	×	K29-3194-03	KNOB(LSB)		
108	2I	×	K29-3195-03	KNOB(USB)		
109	2I	×	K29-3196-03	KNOB(CW)		
110	2I	×	K29-3197-03	KNOB(FSK)		
111	2I	×	K29-3198-03	KNOB(AM)		
112	2I	×	K29-3199-03	KNOB(FM)		
113	2I	×	K29-3200-03	KNOB(GRND MARK)		
114	2I	×	K29-4501-03	KNOB(F.LOCK)		
115	2I	×	K29-4502-03	KNOB(A=B)		
116	2I	×	K29-4503-03	KNOB(RX-SUB)		
117	2I	×	K29-4504-03	KNOB(DATA)		
118	2I	×	K29-4505-04	KNOB(MIN)		
119	2I	×	K29-4506-04	KNOB(M-VFO)		

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120	2I	*	K29-4507-04	KNOB(SCAN)		
121	2I	*	K29-4508-04	KNOB(DOWN)		
122	2D	*	K29-4509-04	KNOB(UP)		
123	2D	*	K29-4510-04	KNOB(VOX)		
124	1D	*	K29-4511-04	KNOB(POWER)		
125	1D	*	K29-4512-04	KNOB(VOX,PULL)		
126	1D	*	K29-4513-04	KNOB(PROC)		
127	2C	*	K29-4514-04	KNOB(SGL)		
128	2C	*	K29-4515-04	KNOB(MAIN,MIC)		
129	2C	*	K29-4516-04	KNOB(S.B,PWR)		
130	1D,1E	*	K29-4518-04	KNOB(SEND,RIT)		
133	2I	*	L01-8421-15	POWER TRANSFORMER(MAIN 120V)	KP	
133	2I	*	L01-8426-15	POWER TRANSFORMER(MAIN 120-100	MW#2X	
134	3H	*	L01-8431-05	POWER TRANSFORMER(SUB 120V)	KP	
134	3H	*	L01-8436-05	POWER TRANSFORMER(SUB 120-100	MW#2X	
-	3H		L79-0847-05	FILTER ASSY(YK-88C-1)		D
A	2K		N09-0602-04	HEX BOLT		
		*	N09-2051-05	SCREW	X	
136	2K		N14-0615-05	NUT		
137	2K		N14-0509-05	NUT		
138	2K		N18-1040-46	FLAT WASHER		
139	2C		N19-0637-04	FLAT WASHER(PANEL)		
B	1B,2F		N32-2606-46	FLAT HEAD MACHINE SCREW		
C	1D,1H		N32-3006-46	FLAT HEAD MACHINE SCREW		
-			N33-3006-41	OVAL HEAD MACHINE SCREW	P	
D	1B,3B		N33-4008-41	OVAL HEAD MACHINE SCREW		
E	1B		N35-2604-46	BINDING HEAD MACHINE SCREW		
-			N35-2606-46	BINDING HEAD MACHINE SCREW	MW#2X	
F	1I	*	N35-2608-46	BINDING HEAD MACHINE SCREW		
G	1I		N35-3005-46	BINDING HEAD MACHINE SCREW		
H	2I		N35-3010-46	BINDING HEAD MACHINE SCREW		
I	1I	*	N35-4018-46	BINDING HEAD MACHINE SCREW		
J	3F		N87-2605-46	BRAZIER HEAD TAPTITE SCREW		
K	1G,1K		N87-3006-46	BRAZIER HEAD TAPTITE SCREW		
-	3K		N87-3012-46	BRAZIER HEAD TAPTITE SCREW		
M	2I		N87-3014-46	BRAZIER HEAD TAPTITE SCREW		
N	3A		N87-4010-46	BRAZIER HEAD TAPTITE SCREW		
O	2G		N88-3006-46	FLAT HEAD TAPTITE SCREW		
P	2K		N89-3006-46	BINDING HEAD TAPTITE SCREW		
Q	2G		N89-3008-46	BINDING HEAD TAPTITE SCREW		
R	3H,2I	*	N90-4004-46	TP HEAD MACHINE SCREW(TRANS)		
S	2C		N90-3008-46	TP HEAD MACHINE SCREW		
-		*	S31-2418-05	SLIDE SWITCH	MW#2X	
141	1J	*	S40-2460-05	PUSH SWITCH		
-			S50-1406-05	SENSITIVE SWITCH(MIC)		
142	1K		T07-0221-05	LOUDSPEAKER(FULLRANGE)		
-			T91-0352-15	MICROPHONE		
-		*	05A201L4	SURGE ABSORBER		
144	1E	*	W02-0855-05	ENCODER(MAIN)		
145	1E	*	W02-0857-15	ENCODER(SUB)		
150	1C,1J	*	X41-3080-00	SWITCH(A) UNIT		

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151	1D,1E	*	X41-3090-00	SWITCH(B) UNIT		
152	2H,2I	*	X42-3070-01	4VR UNIT		
153	3G	*	X44-3100-00	RF UNIT		
154	2K	*	X45-3330-00	FINAL UNIT		
155	3F	*	X46-3050-11	DIGITAL UNIT	XP	
155	3F	*	X46-3050-21	DIGITAL UNIT	M	
155	3F	*	X46-3050-61	DIGITAL UNIT	W	
155	3F	*	X46-3050-62	DIGITAL UNIT	W2	
155	3F	*	X46-3050-71	DIGITAL UNIT	X	
156	2G	*	X48-3060-00	IF UNIT		
157	3F	*	X49-3020-00	AF UNIT		
158	1F	*	X50-3100-00	PLL UNIT		
159	1G	*	X50-3110-20	CAR UNIT		S
159	1G	*	X50-3110-01	CAR UNIT		D
-			X51-3050-20	FILTER UNIT(YG-455C-1)		D
161	2K	*	X51-3060-01	FILTER UNIT	KMWXP	S
161	2K	*	X51-3060-11	FILTER UNIT	KMWXP	D
161	2K	*	X51-3060-61	FILTER UNIT	W2	S
161	2K	*	X51-3060-62	FILTER UNIT	W2	D
-		*	X51-3070-00	FILTER UNIT(YG-455S-1)		D
-		*	X51-3080-20	FILTER UNIT(YG-455CN-1)		D
162	2F	*	X53-3230-00	CONTROL UNIT		
164	1L	*	X53-3240-20	AT UNIT		
165	2B	*	X53-3260-00	DSP UNIT		D
166	1E	*	X54-3080-00	DISPLAY UNIT		
167	3F	*	X57-3380-00	SIGNAL UNIT		

SWITCH UNIT (A) (X41-3080-00)

C1 -4		CK73FB1H102K	CHIP C	1000PF	K
C5		CE04EW1C470*	ELECTRO	47UF	16WV
C6		CE04EW1H010M	ELECTRO	1.0UF	50WV
C7		CE04EW1C330*	ELECTRO	33UF	16WV
C8 -10		CK73FB1H102K	CHIP C	1000PF	K
C11		CE04EW1H100*	ELECTRO	10UF	50WV
C12 -15		CK73FB1H103K	CHIP C	0.01UF	K
C16		CE04EW1C220*	ELECTRO	22UF	16WV
C17 -20		CK73FB1H103K	CHIP C	0.01UF	K
C21		CE04EW1C220*	ELECTRO	22UF	16WV
C22 -25		CC73FSL1HXXXJ	CHIP C		
C26 -28		CK73FB1HXXXK	CHIP C		
C29		CK73EF1C105Z	CHIP C	1.0UF	Z
C30		CK73FF1E104K	CHIP C	0.1UF	K
C31		CK73FB1H103K	CHIP C	0.01UF	K
C32 -34		CC73FSL1H101J	CHIP C	100PF	J
C35 ,36		CK73FB1H103K	CHIP C	0.01UF	K
	*	E23-0623-04	TERMINAL		
CN1		E40-3239-05	PIN CONNECTOR(4P)		
CN2	*	E40-5136-05	PIN CONNECTOR(20P)		
CN3		E40-3238-05	PIN CONNECTOR(3P)		
CN4		E40-3240-05	PIN CONNECTOR(5P)		
CN5		E40-3237-05	PIN CONNECTOR(2P)		
CN6		E40-5133-05	PIN CONNECTOR(18P)		
CN7		E40-3238-05	PIN CONNECTOR(3P)		
CN8		E23-0401-05	TERMINAL		
CN9		E40-3237-05	PIN CONNECTOR(2P)		

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CN1			E40-3239-05	PIN CONNECTOR(4P)		
CN1			E40-3238-05	PIN CONNECTOR(3P)		
CN12			E40-3293-05	PIN CONNECTOR(2P)		
CN13			E23-0401-05	TERMINAL		
CN14		*	E40-3305-05	PIN CONNECTOR(9P)		
CN15			E40-3302-05	PIN CONNECTOR(5P)		
CN16			E40-3304-05	PIN CONNECTOR(7P)		
CN17			E40-3301-05	PIN CONNECTOR(4P)		
CN18			E40-3304-05	PIN CONNECTOR(7P)		
CN19			E40-3299-05	PIN CONNECTOR(2P)		
CN20			E40-3303-05	PIN CONNECTOR(6P)		
CN21			E23-0401-05	TERMINAL		
CN22			E40-3239-05	PIN CONNECTOR(4P)		
CN23			E40-3238-05	PIN CONNECTOR(3P)		
CN24			E23-0401-05	TERMINAL		
CN25			E40-3243-05	PIN CONNECTOR(8P)		
CN26			E40-3239-05	PIN CONNECTOR(4P)		
CN27			E40-3241-05	PIN CONNECTOR(6P)		
CN28			E40-3237-05	PIN CONNECTOR(2P)		
CN29			E40-3242-05	PIN CONNECTOR(3P)		
CN30			E40-3235-05	PIN CONNECTOR(4P)		
CN31			E40-3237-05	PIN CONNECTOR(2P)		
CN32			E40-3240-05	PIN CONNECTOR(5P)		
CN33,34			E23-0401-05	TERMINAL		
J1			E06-0858-15	3P METAL RECEPTACLE(MIC)		
L1 -5			L40-1011-13	SMALL FIXED INDUCTOR(10UH)		
L6			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
R1 -44			RK73FB2AXXXJ	CHIP R		
VR1			R19-3423-05	POTENTIOMETER 10K(PROCESSOR)		
VR2		*	R24-3406-05	POTENTIOMETER 10K(POWER)		
VR3		*	R25-5402-05	POTENTIOMETER 10CK(KEY SPEED)		
VR4		*	R05-3449-05	POTENTIOMETER 10K(MONITOR)		
VR5		*	R10-6401-05	POTENTIOMETER 25CK(VOX DELAY)		
VR6		*	R05-3403-05	POTENTIOMETER 50D(ANTIVOX)		
VR7		*	R25-3445-05	POTENTIOMETER 10K(VOX GAIN)		
VR8 ,9		*	R05-3451-05	POTENTIOMETER 10K(R.F-TUNE)		
VR10		*	R25-4425-05	POTENTIOMETER 50K(DIMMER)		
VR11		*	R05-3451-05	POTENTIOMETER 10K(CAR LEVEL)		
VR12		*	R24-1401-05	POTENTIOMETER 1K(MB LEVEL)		
S1 -4			S50-1412-05	SENSITIVE SWITCH(SWR,COMP,IC		
S5 ,6		*	S40-1428-05	PUSH SWITCH(VOICE,B.B)		
S7 ,8		*	S40-1429-05	PUSH SWITCH(LSB,CW)		
S9		*	S40-1430-05	PUSH SWITCH(AM)		
S10 ,11		*	S40-1426-05	PUSH SWITCH(DATA,455)		
S12 ,13		*	S40-1425-05	PUSH SWITCH(LSB,FSK)		
S14		*	S40-1430-05	PUSH SWITCH(FM)		
S15 ,16		*	S40-1425-05	PUSH SWITCH(F-LOCK,TF-S)		
S17 -19		*	S40-1429-05	PUSH SWITCH(RXA,RXB,RXM)		
S20 -22		*	S40-1425-05	PUSH SWITCH(A=B,DOWN,TONE)		
S23 -25		*	S40-1429-05	PUSH SWITCH(TXA,TXB,TXM)		
S26 -28		*	S40-1425-05	PUSH SWITCH(RX>S,UP,TF-W)		
S29 -31		*	S40-1429-05	PUSH SWITCH(1,4,7)		
S32 -34		*	S40-1425-05	PUSH SWITCH(CLR,0IN,SUB)		
S35 -38		*	S40-1429-05	PUSH SWITCH(2,5,8,0)		

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S39 ,40		×	S40-1428-05	PUSH SWITCH(M>V,STEP)		
S41 -43		×	S40-1425-05	PUSH SWITCH(3,6,9)		
S44 ,45		×	S40-1428-05	PUSH SWITCH(ENT,SCAN)		
S46 -52			S40-2440-15	PUSH SWITCH(MAN./AUX ETC)		
S53 -55			S40-2441-15	PUSH SWITCH(RIT,XIT,ETC)		
S56 ,57			S40-2440-15	PUSH SWITCH(NOTCH,AF MBT)		
S58			S40-2441-15	PUSH SWITCH(AIP)		
S59 -61			S40-2440-15	PUSH SWITCH(PROC,NB1,NB2)		
S62 ,63		×	S31-2416-05	SLIDE SWITCH(MANUAL/AUTO,CAL)		
D1 -7			RLS73	CHIP DIODE		
D8 ,9			LN1301C(G)	LED(AIP,NOTCH)		
D10			LN1401C	LED(AT TUNE)		
D11			LN1201C	LED(ON AIR)		
D12			RLS73	CHIP DIODE		
D13		×	RLZJ10B	CHIP ZENER DIODE		
D14			RLS73	CHIP DIODE		
IC1			TC4066BF	IC(ANALOG/DIGITAL SW)		
IC2			NE555P	IC		
Q1 -15			DTC143EK	DIGITAL TRANSISTOR		
Q16			DTC143TK	DIGITAL TRANSISTOR		
Q17			2SC1324(G)	CHIP TRANSISTOR		
		×	X59-3710-10	MODULE UNIT(MIC AMP)		
SWITCH UNIT (B) (X41-3090-00)						
C1 ,2			CK45B1H102K	CERAMIC 1000PF K		
CN1			E40-3304-05	PIN CONNECTOR(7P)		
CN2			E40-3301-05	PIN CONNECTOR(4P)		
CN3			E40-3302-05	PIN CONNECTOR(3P)		
CN4			E40-3238-05	PIN CONNECTOR(3P)		
CN5			E40-3301-05	PIN CONNECTOR(4P)		
CN6			E40-3300-05	PIN CONNECTOR(3P)		
CN7			E40-3301-05	PIN CONNECTOR(4P)		
CN8			E40-3299-05	PIN CONNECTOR(2P)		
CN9			E40-3241-05	PIN CONNECTOR(6P)		
CN10			E40-3300-05	PIN CONNECTOR(3P)		
CN11			E40-3303-05	PIN CONNECTOR(6P)		
CN12			E40-3302-05	PIN CONNECTOR(5P)		
CN13			E40-3299-05	PIN CONNECTOR(2P)		
J1		×	E11-0437-05	PHONE JACK		
W1 ,2		×	E31-6055-15	CONNECTING WIRE		
R1			RD14BB2C102J	RD 1.0K J 1/6W		
R2			RD14BB2C683J	RD 68K J 1/6W		
R3			RD14BB2C332J	RD 3.3K J 1/6W		
R4			RD14BB2C103J	RD 10K J 1/6W		
R5 ,6			RD14BB2C472J	RD 4.7K J 1/6W		
R7 ,8			RD14CB2E101J	RD 100 J 1/4W		
R9			RD14BB2C471J	RD 470 J 1/6W		
R10			RD14BB2C223J	RD 22K J 1/6W		
VR1		×	R24-3405-05	POTENTIOMETER 10K(NOTCH/SQ)		
VR2		×	R19-3426-05	POTENTIOMETER 10K(SUB AF/PITCH		
VR3		×	R19-3427-05	POTENTIOMETER 10K(AF/RF GAIN)		
VR4		×	R19-9413-05	POTENTIOMETER 10K/50K(IF,AF,MB		
VR5			R12-1085-05	TRIMMING POT. 2.2K(IF MBT)		
VR6		×	R19-3429-05	POTENTIOMETER 10K(SLOPE TUNE)		

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VR7 -9			R12-1085-05	TRIMMING POT. 2.2K(SLOPE TUNE)			
S1		*	S29-1441-05	ROTARY SWITCH(ANT)			
S2		*	S29-1442-05	ROTARY SWITCH(AGC)			
S3		*	S02-0858-05	ENCODER(RIT/XIT)			
S4		*	MC2-0859-05	ENCODER(M.CH/VFO CH)			
AVR UNIT (X43-3070-01)							
C1		*	CK73EF1H224Z	CHIP C	0.22UF	Z	
C2			CK73FF1E4732	CHIP C	0.047UF	Z	
C3 ,4		*	C92-2110-05	ELECTR9	330UF	35WV	
C5		*	CK73EF1H104Z	CHIP C	0.10UF	Z	
C6			CK73FF1E473Z	CHIP C	0.047UF	Z	
C7 ,8			CK73FF1H103Z	CHIP C	0.010UF	Z	
C9			CK73FB1H102K	CHIP C	1000PF	K	
C10		*	C92-2109-05	ELECTR9	470UF	25WV	
C11			CK73FF1E473Z	CHIP C	0.047UF	Z	
C12			CE04EW1E471M	ELECTR6	470UF	25WV	
C13			CK73FF1H103Z	CHIP C	0.010UF	Z	
C14 -16			CE04EW1E101M	ELECTR6	100UF	25WV	
C17 -22			CK73FF1E104Z	CHIP C	0.10UF	Z	
C23 -25			CE04EW1E101M	ELECTR6	100UF	25WV	
C26 -29			CK45E2H103P	CERAMIC	0.010UF	P	
C30		*	C90-2111-05	ELECTR9	1000UF	80WV	
C31			CK45E2H103P	CERAMIC	0.010UF	P	
C32 ,33			CK73FF1H103Z	CHIP C	0.010UF	Z	
C34		*	CE04EW1J101M	ELECTR6	100UF	63WV	
C35 -38		*	CK73EF1H224Z	CHIP C	0.22UF	Z	
C39			CE04EW1E102M	ELECTR6	1000UF	25WV	
C40			CK73FF1E104Z	CHIP C	0.10UF	Z	
C41			CK73FB1H222K	CHIP C	2200PF	K	
C42			CK73EF1E474Z	CHIP C	0.47UF	Z	
C43			CE04EW1C471M	ELECTR6	470UF	16WV	
C44			C91-0547-05	CERAMIC	0.01UF	P	
C45 ,46			C91-1075-05	CERAMIC	470PF	K	
C47 -54			CK45E2H103P	CERAMIC	0.010UF	P	
C55 -62		*	CK73EF1H224Z	CHIP C	0.22UF	Z	
C63 -65			CK73FF1H103Z	CHIP C	0.010UF	Z	
C66		*	C90-2113-05	ELECTR6	2200UF	80WV	
C67			CK45E2H103P	CERAMIC	0.010UF	P	
C68		*	C90-2112-05	ELECTR6	2200UF	35WV	
C69 ,70			CK73FF1H103Z	CHIP C	0.010UF	Z	
C71			CE04EW1H100M	ELECTR6	10UF	50WV	
C72			CK73FB1H103K	CHIP C	0.010UF	K	
			E23-0169-05	TERMINAL			
			E23-0168-05	TERMINAL			
			E23-0401-05	TERMINAL			
CN1			E40-0370-05	PIN CONNECTOR(3P)			
CN2 ,3			E40-3237-05	PIN CONNECTOR(2P)			
CN4			E40-3238-05	PIN CONNECTOR(3P)			
CN5			E40-3240-05	PIN CONNECTOR(5P)			
CN6			E40-3243-05	PIN CONNECTOR(6P)			
CN7			E40-0342-05	PIN CONNECTOR(3P)			
CN8			E40-3241-05	PIN CONNECTOR(6P)			

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CN9 ,10			E40-0470-05	PIN CONNECTOR(4P)		
CN11			E40-3239-05	PIN CONNECTOR(3P)		
CN12			E40-3237-05	PIN CONNECTOR(2P)		
CN13			E40-0442-05	PIN CONNECTOR(4P)		
CN14			E40-3238-05	PIN CONNECTOR(3P)		
CN101			E23-0401-05	TERMINAL		
TP1			323-0467-05	TERMINAL		
F1			FC5-7521-05	FUSE(7.5A)		
		*	G13-0934-04	CUSHION		
			J13-0855-05	FUSE HOLDER(TRANS 1ST STAGE)		
			J13-0410-05	FUSE HOLDER(TRANS 2ND STAGE)		
R1			RS14KB3A2R2J	FL-PRG9F RS 2.2 J 1W		
R2 -3			RK73FB2AXXXJ	CHIP R		
R4		*	RS14KB3F151J	FL-PRG9F RS 150 J 3W		
R5 ,6			RK73FB2A392J	CHIP R 3.9K J 1/10W		
R7		*	RS14KB3F181J	FL-PRG9F RS 180 J 3W		
R8 -10			RK73FB2AXXXJ	CHIP R		
R11			RS14KB3A820J	FL-PRG9F RS 82 J 1W		
R12			RD14BB2B68J	RD 680 J 1/4W		
R13			RS14KB3A2R2J	FL-PRG9F RS 2.2 J 1W		
R14			RK73EB2B223J	CHIP R 22K J 1/8W		
R15		*	RS14KB3F103J	FL-PRG9F RS 10K J 3W		
R16			RS14KB3A82OJ	FL-PRG9F RS 82 J 1W		
R17			RS14KB3D100J	FL-PRG9F RS 10 J 2W		
R19 -23		*	RK73EB2BXXXJ	CHIP R		
R24 -102			RK73FB2AXXXJ	CHIP R		
R104			RS14KB3F15OJ	RS 15 J 3W		
R105			RS14KB3F18OJ	RS 18 J 3W		
VR1		*	R12-0105-05	TRIMMING POT.22O OHM		
S1		*	S59-1412-05	THERMAL SWITCH(80°C)		
S2		*	S59-1411-05	THERMAL SWITCH(50°C)		
D1		*	1B2C1(LC1)	DIODE		
D2			RLS73	CHIP DIODE		
D3		*	RLZ7.5B	CHIP ZENER DIODE(7.5V)		
D4		*	UZP6.2B	ZENER DIODE(6.2V)		
D5 ,6			S1WB10	DIODE		
D7 ,8		*	RLZ20C	CHIP ZENER DIODE(20V)		
D9			S15VB20	DIODE		
D10			S15VB10	DIODE		
D101			RLS73	CHIP DIODE		
D102			RLZ5.6B	CHIP DIODE		
D103		*	SPB6Z47	THYRISTOR		
IC1 -3			UPC7805H	IC(VOLTAGE REGULATOR/ -5V)		
IC4			UPC7912HP	IC(VOLTAGE REGULATOR/ -12V)		
Q1		*	2SB941(Q)	TRANSISTOR		
Q2		*	2SC3907(9)	TRANSISTOR		
Q3			2SD1624S	TRANSISTOR		
Q4			2SC2712(Y)	TRANSISTOR		
Q5			2SA1358(Y)	TRANSISTOR		
Q101			DTC114EK	DIGITAL TRANSISTOR		
Q102			2SA1358(Y)	TRANSISTOR		

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RF UNIT (X44-3100-00)							
C1 -3			CK73FB1E103K	CHIP C	0.01UF	K	
C4			CK73FB1H102K	CHIP C	1000PF	K	
C5			CK73FF1E104Z	CHIP C	0.10UF	Z	
C6 -7			CC73FCH1HXXXJ	CHIP C			
C8			CC73FSL1H[illegible]J	CHIP C	.5PF	J	
C9 -10			CC73FC[illegible]XXXJ	CHIP C			
C11 ,12			CK73FF1E104Z	CHIP C	0.10UF	Z	
C13			CE04EW1C220M	ELECTRO	22UF	16WV	
C14 -17			CK73FB1H102K	CHIP C	1000PF	K	
C18 -20			CK73FF1E104Z	CHIP C	0.10UF	Z	
C21			CE04EW1C220M	ELECTRO	22UF	16WV	
C22 -25			CK73FB1HXXXK	CHIP C			
C26			CE04EW1C220M	ELECTRO	22UF	16WV	
C27			CK73FF1E104Z	CHIP C	0.10UF	Z	
C28 -30			CC73FSL1HXXXJ	CHIP C			
C31 -32			CK73FB1[illegible]XXXK	CHIP C			
C33			CK73FB1H682K	CHIP C	6800PF	K	
C34 -36			CC73FSL1HXXXJ	CHIP C			
C37			CK73FF1E104Z	CHIP C	0.10UF	Z	
C38			CE04EW1C220M	ELECTRO	22UF	16WV	
C39			CK73FF1E104Z	CHIP C	0.10UF	Z	
C40 -42			CC73FSL1HXXXJ	CHIP C			
C43			CK73FF1E104Z	CHIP C	0.10UF	Z	
C44			CE04EW1C220M	ELECTRO	22UF	16WV	
C45			CK73FF1E104Z	CHIP C	0.10UF	Z	
C46 -48			CC73FSL1HXXXJ	CHIP C			
C49			CK73FF1E104Z	CHIP C	0.10UF	Z	
C50			CE04EW1C220M	ELECTRO	22UF	16WV	
C51			CK73FF1E104Z	CHIP C	0.10UF	Z	
C52			CC73FSL1H561J	CHIP C	560PF	J	
C53			CC73FCH1H270J	CHIP C	27PF	J	
C54			CC73FSL1H471J	CHIP C	470PF	J	
C55			CK73FF1E104Z	CHIP C	0.10UF	Z	
C56			CE04EW1C220M	ELECTRO	22UF	16WV	
C57			CK73FF1E104Z	CHIP C	0.10UF	Z	
C58			CC73FSL1H221J	CHIP C	220PF	J	
C59			CC73FCH1H470J	CHIP C	47PF	J	
C60			CC73FSL1H121J	CHIP C	120PF	J	
C61			CK73FF1E104Z	CHIP C	0.10UF	Z	
C62			CE04EW1C220M	ELECTRO	22UF	16WV	
C63			CK73FF1E104Z	CHIP C	0.10UF	Z	
C64			CC73FSL1H[illegible]J	CHIP C	470PF	J	
C65			CC73FCH1H180J	CHIP C	18PF	J	
C66			CC73FSL1H331J	CHIP C	330PF	J	
C67			CK73FF1E104Z	CHIP C	0.10UF	Z	
C68			CE04EW1C220M	ELECTRO	22UF	16WV	
C69			CK73FF1E104Z	CHIP C	0.10UF	Z	
C70			CC73FSL1H181J	CHIP C	180PF	J	
C71			CC73FCH1H330J	CHIP C	33PF	J	
C72			CK73FF1E104Z	CHIP C	0.10UF	Z	
C73			CE04EW1C220M	ELECTRO	22UF	16WV	
C74			CK73FF1E104Z	CHIP C	0.10UF	Z	
C75 -77			CC73FSL1HXXXJ	CHIP C			

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C76			CK73FF1E104Z	CHIP C	0.10UF Z		
C79			CE04EW1C220M	ELECTR9	22UF 16WV		
C80			CK73FF1E104Z	CHIP C	0.10UF Z		
C81			CC73FSL1H221J	CHIP C	220PF J		
C82 ,83			CC73FCH1H180J	CHIP C	18PF J		
C84			CK73FF1E104Z	CHIP C	0.10UF Z		
C85			CE04EW1C220M	ELECTR9	22UF 16WV		
C86			CK73FF1E104Z	CHIP C	0.10UF Z		
C87			CC73FSL1H221J	CHIP C	220PF J		
C89			CC73FCH1H680J	CHIP C	68PF J		
C90			CK73FF1E104Z	CHIP C	0.10UF Z		
C91			CE04EW1C220M	ELECTR9	22UF 16WV		
C92			CK73FF1E104Z	CHIP C	0.10UF Z		
C93			CC73FSL1H221J	CHIP C	220PF J		
C94			CC73FCH1H080D	CHIP C	8.0PF D		
C96			CK73FF1E104Z	CHIP C	0.10UF Z		
C97			CE04EW1C220M	ELECTR9	22UF 16WV		
C98			CK73FF1E104Z	CHIP C	0.10UF Z		
C99			CC73FSL1H151J	CHIP C	150PF J		
C100			CC73FCH1H080D	CHIP C	8.0PF D		
C101			CK73FF1E104Z	CHIP C	0.10UF Z		
C102			CE04EW1C220M	ELECTR9	22UF 16WV		
C103			CK73FF1E104Z	CHIP C	0.10UF Z		
C104-106			CC73FCH1H150J	CHIP C	15PF J		
C107			CK73FF1E104Z	CHIP C	0.10UF Z		
C108			CE04EW1C220M	ELECTR9	22UF 16WV		
C109-115			CK73FF1E104Z	CHIP C	0.10UF Z		
C117,118			CE04EW1HC10M	ELECTR9	1.0UF 50WV		
C119			CE04EW1E4R7X	ELECTR9	4.7UF 25WV		
C121			CC73FCH1H101J	CHIP C	100PF J		
C122			CK73FF1E104Z	CHIP C	0.10UF Z		
C123			CE04EW1C220M	ELECTR9	22UF 16WV		
C124,125			CK73FF1E104Z	CHIP C	0.10UF Z		
C126			CE04EW1C470M	ELECTR9	47UF 16WV		
C127			CK73FF1E104Z	CHIP C	0.10UF Z		
C128			CE04EW1C220M	ELECTR9	22UF 16WV		
C129-131			CK73FF1E104Z	CHIP C	0.10UF Z		
C132			CE04EW1C220M	ELECTR9	22UF 16WV		
C133-135			CK73FF1E104Z	CHIP C	0.10UF Z		
C136-138			CC73FCH1HXXXC	CHIP C			
C139-141			CK73FF1E104Z	CHIP C	0.10UF Z		
C142-143			CC73FCH1HXXXC	CHIP C			
C144			CC73FSL1H151J	CHIP C	150PF J		
C145-146			CC73FCH1HXXXC	CHIP C			
C147-149			CK73FF1E104Z	CHIP C	0.10UF Z		
C150			CE04EW1C220M	ELECTR9	22UF 16WV		
C151-153			CK73FF1E104Z	CHIP C	0.10UF Z		
C154			CK73F31E103K	CHIP C	0.010UF K		
C156			CK73FF1E104Z	CHIP C	0.10UF Z		
C159-161			CC73FCH1HXXXD	CHIP C			
C162-165			CK73FB1E103K	CHIP C	0.010UF K		
C166-168			CK73FF1E104Z	CHIP C	0.10UF Z		
C169-170			CC73FCH1HXXXJ	CHIP C			
C171			CC73FSL1H151J	CHIP C	150PF J		
C172-173			CC73FCH1HXXXJ	CHIP C			

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C174			CE04EW1C220Y	ELECTRO 22UF .6WV		
C175-177			CK73FF1E104Z	CHIP C 0.10UF Z		
C179-185			CK73FB1HXXXX	CHIP C		
C186-187			CC73FCH1HXXXC	CHIP C		
C188,189			CK73FF1E104Z	CHIP C 0.10UF Z		
C190			CK73FB1H102K	CHIP C 1000PF K		
C191			CK73FF1E104Z	CHIP C 0.10UF Z		
C192			CK73FB1H102K	CHIP C 1000PF K		
C193			CE04EW1V010M	ELECTRO 10UF 35WV		
C194-196			CK73FF1E104Z	CHIP C 0.10UF Z		
C197,198			CK73FB1H102K	CHIP C 1000PF K		
C199			CK73FB1E103K	CHIP C 0.010UF K		
C200			CK73FF1E104Z	CHIP C 0.10UF Z		
C201			CK73FB1E103K	CHIP C 0.010UF K		
C203			CC73FCH1H330J	CHIP C 33PF J		
C204-205			CC73FSL1HXXXJ	CHIP C		
C206,207			CK73FB1E103K	CHIP C 0.010UF K		
C208-209			CC73FSL1HXXXJ	CHIP C		
C210			CK73FF1E104Z	CHIP C 0.10UF Z		
C211			CC73FCH1H680J	CHIP C 68PF J		
C212,213			CK73FB1E103K	CHIP C 0.010UF K		
C214-216			CC73FCH1HXXXJ	CHIP C		
C219,220			CK73FB1E103K	CHIP C 0.010UF K		
C221-225			CK73FF1E104Z	CHIP C 0.10UF Z		
C222			CK73FB1E103K	CHIP C 0.010UF K		
C226,227			CK73FF1E104Z	CHIP C 0.10UF Z		
C228-230			CC73FCH1HXXXJ	CHIP C		
C232-234			CK73FF1EXXXZ	CHIP C		
C235,236			CC73FCH1H680J	CHIP C 68PF J		
C237			CK73FB1E103K	CHIP C 0.01CUF K		
C238			CK73FF1E104Z	CHIP C 0.1CUF Z		
C239			CK73FB1E103K	CHIP C 0.010UF K		
C240			CK73FF1E104Z	CHIP C 0.1CUF Z		
C241			CK73FB1E103K	CHIP C 0.01CUF K		
C242			CC45CH1H220J	CERAMIC C 22PF J		
TC1			C05-0315-05	TRIMMING CAP 60PF		
CN1			E04-0157-05	RF COAXIAL JACK(TIP)		
CN2			E40-3237-05	PIN CONNECTOR(2P)		
CN3 ,4			E04-0157-05	RF COAXIAL JACK(M,S VCO)		
CN5			E40-3239-05	PIN CONNECTOR(4P)		
CN6			E40-3241-05	PIN CONNECTOR(6P)		
CN7			E04-0157-05	RF COAXIAL JACK(XIF)		
CN8		*	E13-0261-05	PHONE JACK(RX ANT,DRV)		
CN9			E40-3239-05	PIN CONNECTOR(4P)		
CN10			E04-0157-05	RF COAXIAL JACK(SIF)		
TP1 -4			E23-0512-05	TERMINAL		
A1 ,2		*	F11-0970-14	SHIELDING COVER		
L1			L40-2282-13	SMALL FIXED INDUCTOR(0.22UH)		
L2		*	L40-2782-13	SMALL FIXED INDUCTOR(0.27UH)		
L3			L19-0324-05	BALUN TRANSFORMER		
L4			L40-1021-14	SMALL FIXED INDUCTOR(1UH)		
L5 -9			L40-1001-19	SMALL FIXED INDUCTOR(10UH)		
L10			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		

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L11 ,12			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L13		*	L40-8201-14	SMALL FIXED INDUCTOR(82UH)		
L14			L40-4701-14	SMALL FIXED INDUCTOR(47UH)		
L15			L40-5601-14	SMALL FIXED INDUCTOR(56UH)		
L16			L40-8291-14	SMALL FIXED INDUCTOR(8.2UH)		
L17			L40-1501-14	SMALL FIXED INDUCTOR(15UH)		
L18			L40-8291-14	SMALL FIXED INDUCTOR(8.2UH)		
L19		*	L34-4164-05	COIL(B.P.F 3-4MHZ) 4.7UH		
L20		*	L34-4176-05	COIL(B.P.F 3-4MHZ) 15UH		
L21		*	L34-4164-05	COIL(B.P.F 3-4MHZ) 4.7UH		
L22			L40-3391-14	SMALL FIXED INDUCTOR(3.3UH)		
L23			L40-6891-14	SMALL FIXED INDUCTOR(6.8UH)		
L24			L40-3391-14	SMALL FIXED INDUCTOR(3.3UH)		
L25		*	L34-4146-05	COIL(B.P.F 7-7.5MHZ) 2.82UH		
L26		*	L34-4178-05	COIL(B.P.F 7-7.5MHZ) 18UH		
L27		*	L34-4146-05	COIL(B.P.F 7-7.5MHZ) 2.82UH		
L28			L40-1292-14	SMALL FIXED INDUCTOR(1.2UH)		
L29			L40-6891-14	SMALL FIXED INDUCTOR(6.8UH)		
L30			L40-1292-14	SMALL FIXED INDUCTOR(1.2UH)		
L31		*	L34-4140-05	COIL(B.P.F 10-10.5MHZ)0.47UH		
L32		*	L34-4135-05	COIL(B.P.F 10-10.5MHZ)13UH		
L33		*	L34-4140-05	COIL(B.P.F 10-10.5MHZ)0.47UH		
L34			L40-8282-14	SMALL FIXED INDUCTOR(0.82UH)		
L35			L40-5691-14	SMALL FIXED INDUCTOR(5.6UH)		
L36			L40-8282-14	SMALL FIXED INDUCTOR(0.82UH)		
L37		*	L34-4136-05	COIL(B.P.F 14-14.5MHZ)2.33UH		
L38		*	L34-4172-05	COIL(B.P.F 14-14.5MHZ)10UH		
L39		*	L34-4136-05	COIL(B.P.F 14-14.5MHZ)2.33UH		
L40			L40-4782-14	SMALL FIXED INDUCTOR(0.47UH)		
L41			L40-5691-14	SMALL FIXED INDUCTOR(5.6UH)		
L42			L40-3982-14	SMALL FIXED INDUCTOR(3.9UH)		
L43			L40-3382-14	SMALL FIXED INDUCTOR(0.33UH)		
L44			L40-5691-14	SMALL FIXED INDUCTOR(5.6UH)		
L45			L40-2782-14	SMALL FIXED INDUCTOR(0.27UH)		
L46		*	L34-4132-05	COIL(B.P.F 21-21.5MHZ)0.22UH		
L47		*	L34-4166-05	COIL(B.P.F 21-21.5MHZ)4.7UH		
L48		*	L34-4132-05	COIL(B.P.F 21-21.5MHZ)0.22UH		
L49			L40-2782-14	SMALL FIXED INDUCTOR(0.27UH)		
L50			L40-5691-14	SMALL FIXED INDUCTOR(5.6UH)		
L51			L40-2282-14	SMALL FIXED INDUCTOR(0.22UH)		
L52		*	L34-4192-05	COIL(B.P.F 24.5-30MHZ)		
L53		*	L34-4193-05	COIL(B.P.F 24.5-30MHZ)		
L54		*	L34-4194-05	COIL(B.P.F 24.5-30MHZ)		
L55 ,56			L40-4711-14	SMALL FIXED INDUCTOR(470UH)		
L57 -59			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		
L60 ,61			L19-0324-05	BALUN TRANSFORMER		
L62			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		
L63			L19-0324-05	BALUN TRANSFORMER		
L64			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		
L65			L19-0324-05	BALUN TRANSFORMER		
L66			L40-4782-14	SMALL FIXED INDUCTOR(0.47UH)		
L67			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		
L68			L34-4046-15	COIL		
L69			L34-0895-05	COIL		
L70			L19-0344-05	BALUN TRANSFORMER		

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L71			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		
L72			L40-2792-14	SMALL FIXED INDUCTOR(0.27UH)		
L73			L40-2282-14	SMALL FIXED INDUCTOR(0.22UH)		
L74			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		
L75			L19-0324-05	BALUN TRANSFORMER		
L76			L40-1001-14	SMALL FIXED INDUCTOR(100UH)		
L77			L34-2267-05	COIL(SUB IFT)		
L78			L34-4047-05	COIL(SUB IFT)		
L79			L34-4048-05	COIL(SUB IFT)		
L80			L34-4047-05	COIL(SUB IFT)		
L81		*	L39-0454-05	TROIDAL COIL		
L82 ,83			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		
L84			L40-2792-14	SMALL FIXED INDUCTOR(0.27UH)		
L85			L40-2282-14	SMALL FIXED INDUCTOR(0.22UH)		
L86			L19-0324-05	BALUN TRANSFORMER		
L87		*	L34-4222-05	COIL(MAIN IFT)		
L88			L40-4791-14	SMALL FIXED INDUCTOR(4.7UH)		
L89		*	L39-0454-05	TROIDAL COIL		
L90		*	L39-0455-05	TROIDAL COIL		
L91 ,92		*	L39-0454-05	TROIDAL COIL		
L93		*	L34-4211-05	COIL(FIF)		
L94 ,95		*	L34-4190-05	COIL(FIF)		
L96			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		
L97			L40-2292-17	SMALL FIXED INDUCTOR(2.2UH)		
L98			L40-3391-17	SMALL FIXED INDUCTOR(3.3UH)		
L99			L40-1592-17	SMALL FIXED INDUCTOR(1.5UH)		
L100			L40-1892-17	SMALL FIXED INDUCTOR(1.8UH)		
L101			L40-1592-17	SMALL FIXED INDUCTOR(1.5UH)		
L102-104			L40-6882-17	SMALL FIXED INDUCTOR(0.68UH)		
L105			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		
L106			L40-6882-17	SMALL FIXED INDUCTOR(0.68UH)		
L107			L40-4782-17	SMALL FIXED INDUCTOR(0.47UH)		
L108			L39-0432-05	TROIDAL COIL		
L109			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L110			L39-0454-05	TROIDAL COIL		
L111			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		
L112-114			L40-2292-14	SMALL FIXED INDUCTOR(2.2UH)		
XF1			L71-0275-05	CRYSTAL FILTER(40.055MHZ)		
R1 -84			RK73FB2AXXXJ	CHIP R		
R85			RD14BB2C560J	RD 56 J 1/6W		
R86 -187			RK73FB2AXXXJ	CHIP R		
R188			RD14BB2C682J	RD 6.8K J 1/6W		
VR1 ,2			R12-1089-05	TRIMMING POT. 4.7K		
VR3			R12-0108-05	TRIMMING POT. 47K		
VR4 -6			R12-1033-05	TRIMMING POT. 47K		
W1			R92-1061-05	JUMPER REST 0 OHM		
K1 ,2			S51-1436-05	RELAY		
D1 ,2			RLS73	CHIP DIODE		
D3		*	RLZJ5.1B	CHIP ZENER DIODE(5.1V)		
D4 ,5			1S1060	CHIP DIODE		
D6 -36			RLS135	CHIP DIODE		
D37 ,38			MI204	DIODE		
D39			RLS135	CHIP DIODE		

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D40 ,41			LTS02LP	LED				
D42 -45			RLS135	CHIP DIODE				
D46 ,47			RLS73	CHIP DIODE				
D48 -57			RLS135	CHIP DIODE				
D58 -60			RLS73	CHIP DIODE				
D61 ,62			DAN202K(K)	CHIP DIODE				
D63			DSP-301N	DIODE				
D64			RLS135	CHIP DIODE				
D65			1SS133	DIODE				
IC1 ,2			SN74LS145N	IC(D,A, BCD MALTI)				
Q1 ,2			2SA1162(Y)	CHIP TRANSISTOR				
Q3			2SC2712(Y)	CHIP TRANSISTOR				
Q4 ,5			2SK125-5	FET				
Q6		×	2SK520(K43)	CHIP FET				
Q7 -16		×	2SK520(K44)	CHIP FET				
Q17 -19			2SC2954(GR)	CHIP TRANSISTOR				
Q20 -22			3SK131(Y)	CHIP FET				
Q23			DTC114EK	DIGITAL TRANSISTOR				
Q24 -28			DTC124EK	DIGITAL TRANSISTOR				
Q29 ,30			DTA114EK	DIGITAL TRANSISTOR				
Q31 -35			DTA124EK	DIGITAL TRANSISTOR				
Q37			2SC2712(Y)	CHIP TRANSISTOR				
TH1			112-302-2	THERMISTOR 3K				
FINAL UNIT (X45-3330-00)								
C1			CK45B1HS61K	CERAMIC	560PF	K		
C2			CK45B1H102K	CERAMIC	1000PF	K		
C3			C91-0119-05	CERAMIC	0.047UF	K		
C4			CK45F1H103Z	CERAMIC	0.010UF	Z		
C5 ,6			CK45F1H223Z	CERAMIC	0.022UF	Z		
C7			CE04EW1H100Y	ELECTRO	10UF	50WV		
C8		*	CE04EW1H470M	ELECTRO	47UF	50WV		
C9 ,10			CK45F1H223Z	CERAMIC	0.022UF	Z		
C11			C91-0119-05	CERAMIC	0.047UF	K		
C12			CE04EW1H100Y	ELECTRO	10UF	50WV		
C13 ,14		*	CE04EW1H101M	ELECTRO	100UF	50WV		
C15			CK45F1H223Z	CERAMIC	0.022UF	Z		
C16			CC45SL2H121J	CERAMIC	120PF	J		
C18			CK45B1H102K	CERAMIC	1000PF	K		
C19			CK45F1H223Z	CERAMIC	0.022UF	Z		
C20			CE04EW1H100Y	ELECTRO	10UF	50WV		
C21			CM93D2H102J	MICA	1000PF	J		
C22			C91-0119-05	CERAMIC	0.047UF	K		
C23 ,24			CC45SL2H221J	CERAMIC	220PF	J		
C25 -30		*	CK45B2H103K	CERAMIC	0.010UF	K		
C31			CK45B1H102K	CERAMIC	1000PF	K		
C33			CK45B1H222K	CERAMIC	2200PF	K		
C34		×	CK4532H103K	CERAMIC	0.010UF	K		
C35		*	C90-2121-05	ELECTRO	2200UF	80WV		
C36			CE04EW1E471M	ELECTRO	470UF	25WV		
C37			CK45F1H223Z	CERAMIC	0.022UF	Z		
C38 ,39			C91-1004-05	CHIP C	0.056UF	J		
CN1			E40-0470-05	PIN CONNECTOR(4P)				
CN2			E40-0370-05	PIN CONNECTOR(3P)				
CN3			E40-3239-05	PIN CONNECTOR(4P)				

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CN4			E40-3238-05	PIN CONNECTOR(3P)				
CN5			E40-3237-05	PIN CONNECTOR(2P)				
CN6			E04-0054-05	RF COAXIAL JACK				
JF1 ,2			E40-0211-05	PIN CONNECTOR				
MI		*	E31-4038-05	CONNECTING WIRE				
Q31	3K		P01-0969-21	HEAT SINK				
Q32	2J		P29-3014-05	INSULATOR				
F1	1J		P05-1021-05	FUSE(10A)				
Q33	1J,2J		G02-0571-04	FLAT SPRING				
			J13-0055-05	FUSE HOLDER				
L1			L40-1001-14	SMALL FIXED INDUCTOR(10uH)				
L2			L19-0315-25	BALUN TRANSFORMER				
L3		*	L39-0476-05	TROIDAL COIL				
L4		*	L39-0477-25	TROIDAL COIL				
L5		*	L39-0456-15	TROIDAL COIL				
L6 -8			L33-0617-05	RFC				
L9			L33-0699-05	CHOKE COIL				
L10			L40-3351-14	SMALL FIXED INDUCTOR(3.3uH)				
L11			L33-0699-05	CHOKE COIL				
L12 ,13		*	L33-0726-05	CHOKE COIL				
L14			L33-0699-05	CHOKE COIL				
L15 -17			L33-0699-05	CHOKE COIL				
L18 -21			L40-1021-14	SMALL FIXED INDUCTOR(100uH)				
L22 ,23			L33-0651-05	CHOKE COIL				
Q35	2K		N15-1040-46	FLAT WASHER				
T	2J,2K		N30-3008-46	PAN HEAD MACHINE SCREW				
U	2J		N30-3010-46	PAN HEAD MACHINE SCREW				
V	2J		N35-3012-46	BINDING HEAD MACHINE SCREW				
W	2J,2K		N87-3008-46	BRAZIER HEAD TAPTITE SCREW				
R2			RD14BB2C563J	RD	56	J	1/6W	
R3			RD14BB2C681J	RD	680	J	1/6W	
R4			RD14BB2C221J	RD	220	J	1/6W	
R5			RC05GF2H3R9J	RC	3.9	J	1/2W	
R6			RD14CB2C331J	RD	330	J	1/6W	
R8 ,9			RD14CB2E150J	RD	15	J	1/4W	
R10 ,11			RC05GF2H181J	RC	180	J	1/2W	
R13 -16			RC05GF2H2R2J	RC	2.2	J	1/2W	
R17 ,18		*	RC05GF2H270J	RC	27	J	1/2W	
R19 ,20			RC05GF2H5R6J	RC	5.6	J	1/2W	
R21			RD14BB2C681J	RD	680	J	1/6W	
R22			RD14BB2C561J	RD	560	J	1/6W	
R23		*	RS14DB3A390J	FL-PRGF RS	39	J	1W	
R24			RD14BB2C273J	RD	27K	J	1/6W	
R25			RD14BB2C103J	RD	10CK	J	1/6W	
R26 ,27			RS14DB3D120J	FL-PRGF RS	120	J	2W	
R28			RD14BB2C473J	RD	47K	J	1/6W	
R29			RD14BB2C474J	RD	470K	J	1/6W	
R30 ,31			RD14BB2C473J	RD	47K	J	1/6W	
R32			RD14BB2C223J	RD	22K	J	1/6W	
R33			RS14DB3A562J	FL-PRGF RS	5.6K	J	1W	
R34			RD14BB2C152J	RD	1.5K	J	1/6W	
R35			RD14BB2C122J	RD	1.2K	J	1/6W	
R36			RS14DB3A56DJ	FL-PRGF RS	56	J	1W	

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Ref. No. 参照番号	Address 位置	New Parts 新旧	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
R27		×	R92-1251-05	FIXED RESISTOR 0.1 OHM		
R30		×	R92-1247-05	FIXED RESISTOR 0.1 OHM		
VR1 -3			R12-1033-05	TRIMMING POT. 1K		
W2			R92-0150-05	JUMPER REST 0 OHM		
S1		×	S59-1413-05	THERMAL SWITCH(50°C)		
S2		×	S59-1414-05	THERMAL SWITCH(70°C)		
S3		×	S59-1415-05	THERMAL SWITCH(90°C)		
T1 -3			L92-0102-05	TOROIDAL CORE(KT-41)		
D1			MV-5T	DIODE		
D2 ,3			SV02YS	DIODE		
D4			MTZ4.7JC	ZENER DIODE(4.7V)		
D5 ,6			1S1555	DIODE		
D7			MC921	DIODE		
D8			MTZ8.2JC	ZENER DIODE(8.2V)		
D9			1S1555	DIODE		
D10		×	UZP4.7B	ZENER DIODE(4.7V)		
Q1			2SC1971	TRANSISTOR		
Q2 ,3		×	2SC3133	TRANSISTOR		
Q4		×	MRF429MP	TRANSISTOR		
Q6 ,7			2SD1406(Y)	TRANSISTOR		
Q8		×	2SC2922	TRANSISTOR		
Q9			2SB661(C)	TRANSISTOR		
Q10			2SC2459(BL)	TRANSISTOR		
Q11			DTC124ES	DIGITAL TRANSISTOR		
Q12			DTC143TS	DIGITAL TRANSISTOR		
Q13			2SA562(Y)	TRANSISTOR		
Q14			DTC124ES	DIGITAL TRANSISTOR		
Q15			DTA124ES	DIGITAL TRANSISTOR		
DIGITAL UNIT (X46-3050-XX) -11 : K,P -21 : M -61 : W -62 : W2 -71 : X						
C1 ,2			CK73FB1H102K	CHIP C 1000PF K		
C3			CK73FB1E103K	CHIP C 0.010UF K		
C4 ,5			CK73FB1H102K	CHIP C 1000PF K		
C6			CK73FB1E103K	CHIP C 0.010UF K		
C7 -10			CK73FB1H102K	CHIP C 1000PF K		
C11 ,12			CK73FB1E103K	CHIP C 0.01UF K		
C13			CE04EW1C470M	ELECTRO 47UF 16WV		
C14 -16			CK73FB1E103K	CHIP C 0.01UF K		
C17			CE04EW1C470M	ELECTRO 47UF 16WV		
C18			CE04EW1H3R3Y	ELECTRO 3.3UF 50WV		
C19 -25			CK73FB1E103K	CHIP C 0.01UF K		
C26			CE04EW1C470Y	ELECTRO 47UF 16WV		
C27 ,28			CK73FB1H471K	CHIP C 470PF K		
C29			CE04EW1C470Y	ELECTRO 47UF 16WV		
C30 -41			CK73FB1E103K	CHIP C 0.01UF K		
C42 -44			CK73FB1H102K	CHIP C 1000PF K		
C45 -51			CK73FB1E103K	CHIP C 0.01UF K		
C52			CK73FF1E104Z	CHIP C 0.1UF Z		
C53 ,54			CC73FCH1H100D	CHIP C 10PF D		
C55 -72			CK73FB1E103K	CHIP C 0.010UF K		
C73			CE04EW1C470Y	ELECTRO 47UF 16WV		
C74			CK73FF1E104Z	CHIP C 0.10UF Z		
C75			CE04EW1C101Y	ELECTRO 100UF 16WV		
C76			CK73FF1E104Z	CHIP C 0.10UF Z		
C77			CK73FB1E103K	CHIP C 0.010UF K		

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C76			CE04EW1C470M	ELECTRO	47UF 16WV		
C79			CK73FB1E103K	CHIP C	0.010UF K		
C80			CK73FF1E104Z	CHIP C	0.10UF Z		
C81			CE04EW1C470M	ELECTRO	47UF 16WV		
C82			C90-2041-05	ELECTRO	1CUF 10WV		
C83			CK73FF1E104Z	CHIP C	0.10UF Z		
C84 -99			CK73FB1E103K	CHIP C	0.010UF K		
C100			CE04EW1C470M	ELECTRO	47UF 16WV		
C101			CK73FF1E104Z	CHIP C	0.10UF Z		
C102			CK73FB1E103K	CHIP C	0.010UF K		
C103			CK73FF1E104Z	CHIP C	0.10UF Z		
C104-106			CK73FB1E103K	CHIP C	0.010UF K		
C107-120			CK73FB1H102K	CHIP C	1000PF K		
C121-142			CK73FB1E103K	CHIP C	0.010UF K		
C143,144			CE04EW1E220M	ELECTRO	22UF 25WV		
C145-170			CK73FB1EXXXK	CHIP C			
C171			CK73FF1E104Z	CHIP C	0.10UF Z		
C172-182			CK73FB1E103K	CHIP C	0.010UF K		
C183-186			CK73FB1H220J	CHIP C	22PF J		
C189			CK73FF1E104Z	CHIP C	0.10UF Z		
C190			CK73FB1E223K	CHIP C	0.022UF K		
C191-205			CK73FB1H471K	CHIP C	470PF K		
C206,207			CK73FB1E103K	CHIP C	0.010UF K		
C208-216			CK73FB1H471K	CHIP C	470PF K		
C217			C91-0119-05	SR	0.047UF		
CN1			E40-5131-05	FPC CONNECTOR(16P)			
CN2		*	E40-5334-05	FPC CONNECTOR(24P)			
CN3		*	E40-5333-05	FPC CONNECTOR(14P)			
CN4			E40-5135-05	FPC CONNECTOR(20P)			
CN5			E40-5234-05	PIN CONNECTOR(10P)			
CN6		*	E40-5333-05	FPC CONNECTOR(14P)			
CN7			E40-3239-05	PIN CONNECTOR(4P)			
CN8			E40-3241-05	PIN CONNECTOR(6P)			
CN9			E40-3242-05	PIN CONNECTOR(7P)			
CN10			E40-3240-05	PIN CONNECTOR(5P)			
CN11			E40-3243-05	PIN CONNECTOR(8P)			
CN12			E40-3238-05	PIN CONNECTOR(3P)			
CN13			E40-3240-05	PIN CONNECTOR(5P)			
CN14			E40-3241-05	PIN CONNECTOR(6P)			
CN15			E40-3239-05	PIN CONNECTOR(4P)			
CN16			E40-3237-05	PIN CONNECTOR(2P)			
CN17			E40-3241-05	PIN CONNECTOR(6P)			
CN18			E40-3240-05	PIN CONNECTOR(5P)			
CN19			E40-3239-05	PIN CONNECTOR(4P)			
CN20			E40-3237-05	PIN CONNECTOR(2P)			
CN21			E40-3238-05	PIN CONNECTOR(3P)			
CN22			E40-3239-05	PIN CONNECTOR(4P)			
CN23			E40-3242-05	PIN CONNECTOR(7P)			
CN24		*	E02-2009-05	IC SOCKET(28P)			
L1 ,2			L40-1011-13	SMALL FIXED INDUCTOR(10UH)			
L3 ,4			L40-4711-13	SMALL FIXED INDUCTOR(470UH)			
L5			L40-1011-17	SMALL FIXED INDUCTOR(100UH)			
L6 -10			L40-1011-13	SMALL FIXED INDUCTOR(10UH)			
L11 ,12			L40-2211-17	SMALL FIXED INDUCTOR(220UH)			

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L13 ,14			L40-1011-13	SMALL FIXED INDUCTOR(100UH)		
L15 -16			L40-1011-17	SMALL FIXED INDUCTOR(100_H)		
X1			L77-1380-05	CRYSTAL RESONATOR(11.0592MHZ)		
CP1			R90-0455-05	MULTI-CHMP 4.7PKB J 1/4W		
CP2 -5			R90-0598-05	MULTI-CHIP 12K/22K		
CP6 -9		*	R90-0712-05	MULTI-CHMP 330P X6		
R1 -169			RK73EB2AXXXJ	CHIP R		
VR1			R12-1084-05	TRIMMING POT. 1K		
VR2 -5			R12-1090-05	TRIMMING POT. 4.7K		
SW1 -3			R92-0150-05	JUMPER REST 0 OHM		
S1		*	S59-6403-05	SWITCH(FILTER SELECT)		
D1 -5			RLS73	CHIP DIODE		
D6 ,7			1SV10	CHIP DIODE		
D8 -11		*	02CZ5.1	CHIP ZENER DIODE(5.1V)		
D12			1SS133	DIODE	MX	
D14			1SS133	DIODE	W2	
D15			1SS133	DIODE	W	
D17			1SS133	DIODE	KMWW2	
D18 ,19			1SS133	DIODE		
D20			RLS73	CHIP DIODE		
D21			RLS73	CHIP DIODE	X	
IC1			UPD78C10G-36	IC(MICROPROCESSOR)		
IC2		*	27C256A-25(AM)	IC(ROM)		
IC3			TC5564APL-15	IC(8KX8 RAM)		
IC4		*	TC74HC573AF	IC(LATCH)		
IC5		*	TC74HC138AF	IC(DECODER)		
IC6		*	CXD1095Q	IC(I/O)		
IC7			YB893638	IC(MICROPROCESSOR)		
IC8		*	CXD1095Q	IC(I/O)		
IC9 ,10			L292(3)	IC(COUNTER)		
IC11			NJM4558M	IC(OP AMP X2)		
IC12		*	TC4584BF	IC(INVERTER)		
IC13		*	YB4056	IC(A/D CONV.)		
IC14			M51951BML	IC(SYSTEM RESET)		
IC15			SN7404N	IC(6-CIRCUIT INVERTER)		
IC16		*	NJM2902M	IC(OP AMP X4)		
IC17,18			TC4S069F	IC(INVERTER GATE)		
IC19-21			TC4S81F	IC(AND GATE)		
Q1 -11		*	PMC1	DIGITAL TRANSISTOR		
BA1			MC9-0514-05	LITHIUM BATTERY		
IF UNIT (X48-3060-00)						
C1			CK73FB1H222K	CHIP C 2200PF K		
C2			CK73FB1E104Z	CHIP C 0.10UF Z		
C3 -5			CK73FB1HXXXK	CHIP C		
C6 -11			CK73FB1EXXXK	CHIP C		
C12			CK73FB1H222K	CHIP C 2200PF K		
C13			CK73FB1E103K	CHIP C 0.010UF K		
C14			CC73FCH1H100D	CHIP C 10PF D		
C15 -19			CK73FB1E103K	CHIP C 0.010UF K		
C20			CC73FCH1H101J	CHIP C 100PF J		
C21 -23			CK73FB1E103K	CHIP C 0.010UF K		
C24			CK73FB1E104Z	CHIP C 0.10UF Z		

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C25			CE04EW1C470M	ELECTRO	47UF 16WV		
C26			CK73FB1E223K	CHIP C	0.022UF K		
C27			CK73EF1E474Z	CHIP C	0.47UF Z		
C28			CE04EW1C100M	ELECTRO	10UF 16WV		
C29			CK73FB1H102K	CHIP C	1000PF K		
C30			CC73FSL1H220J	CHIP C	22PF J		
C31			CK73FB1E223K	CHIP C	0.022UF K		
C32			CE04EW1C100M	ELECTRO	10UF 16WV		
C33			CE04EW1H3R3M	ELECTRO	3.3UF 50WV		
C34 -39			CK73FB1HXXXX	CHIP C			
C40 -43			CC73FCH1HXXXC	CHIP C			
C44			CK73FB1H102K	CHIP C	1000PF K		
C45			CK73FF1E104Z	CHIP C	0.10UF Z		
C46 -48			CK73FB1H102K	CHIP C	1000PF K		
C49 ,50			CK73FB1E103K	CHIP C	0.010UF K		
C51			CK73FB1H102K	CHIP C	1000PF K		
C52			CK73FB1E103K	CHIP C	0.010UF K		
C53 ,54			CC73FCH1H220J	CHIP C	22PF J		
C55			CK73FB1E103K	CHIP C	0.010UF K		
C56			CC73FCH1H101J	CHIP C	100PF J		
C57 ,58			CK73FB1E103K	CHIP C	0.010UF K		
C59			CC73FCH1H470J	CHIP C	47PF J		
C60			CK73FB1E223K	CHIP C	0.022UF K		
C61			CC73FSL1H221J	CHIP C	220PF J		
C62			CC73FCH1H470J	CHIP C	47PF J		
C63 ,64			CK73FB1E223K	CHIP C	0.022UF K		
C65 -66			CC73FCH1HXXXC	CHIP C			
C67 -71			CK73FB1H102K	CHIP C	1000PF K		
C72			CC73FCH1H470J	CHIP C	47PF J		
C73			CK73FB1E103K	CHIP C	0.010UF K		
C74			CK73FB1H102K	CHIP C	1000PF K		
C75			CK73FF1E473Z	CHIP C	0.047UF Z		
C76			CK73FB1E103K	CHIP C	0.010UF K		
C77			CE04EW1H010M	ELECTRO	1.0UF 50WV		
C78 -82			CK73FB1E103K	CHIP C	0.010UF K		
C83			CK73FB1H102K	CHIP C	1000PF K		
C84 ,85			CK73FF1E104Z	CHIP C	0.10UF Z		
C86 ,87			CK73FB1E103K	CHIP C	0.010UF K		
C88 -90			CK73FB1H102K	CHIP C	1000PF K		
C91			CK73FF1E104Z	CHIP C	0.10UF Z		
C92 -99			CK73FB1E103K	CHIP C	0.010UF K		
C100			CC73FCH1H020C	CHIP C	2.0PF C		
C101-104			CK73FB1EXXXX	CHIP C			
C105			CK73FB1H102K	CHIP C	1000PF K		
C106-110			CK73FF1E104Z	CHIP C	0.10UF Z		
C111			CC73FCH1H330J	CHIP C	33PF J		
C112			CK73EF1E474Z	CHIP C	0.47UF Z		
C113-130			CK73FB1E103K	CHIP C	0.010UF K		
C131,132			CK73FF1E473Z	CHIP C	0.047UF Z		
C133			CC73FCH1H101J	CHIP C	100PF J		
C134			CK73FF1E473Z	CHIP C	0.047UF Z		
C135-141			CK73FB1E103K	CHIP C	0.010UF K		
C142			CC73FCH1H101J	CHIP C	100PF J		
C143-147			CK73FB1H102K	CHIP C	1000PF K		
C148			CK73FB1E103K	CHIP C	0.010UF K		

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C149			CK45E2H222P	CERAMIC 2200PF P		
C150-152			CK73FB1H102K	CHIP C 1000PF K		
C153			CC73FCH1H101J	CHIP C 100PF J		
C154,155			CK73F1E104Z	CHIP C 0.10UF Z		
C156			CC73FCH1H101J	CHIP C 100PF J		
C157			CEC4EV1A101M	ELECTRO 100Uh 10WV		
C158			CK73F1E104Z	CHIP C 0.10UF Z		
C159			CEC4EV1C10CM	ELECTRO 10UF 16WV		
C161			CK73F1C105Z	CHIP C 1.0UF Z		
C162			CK73FB1E103K	CHIP C 0.010UF K		
C163-165			CK73FB1H102K	CHIP C 1000PF K		
C166			CC73FCH1H220J	CHIP C 22PF J		
C167-175			CK73FB1HXXXZ	CHIP C		
C176,177			CC73FCH1H220J	CHIP C 22PF J		
C178			CC73FSL1H221J	CHIP C 220PF J		
CN1			E40-5067-05	PIN CONNECTOR(10P)		
CN2			E40-3237-05	PIN CONNECTOR(2P)		
CN3			E40-3238-05	PIN CONNECTOR(3P)		
CN4 -7			E04-0157-05	RF COAXIAL JACK		
CN8			E40-3237-05	PIN CONNECTOR(2P)		
CN9			E04-0154-05	RF COAXIAL JACK		
CN10			E40-3237-05	PIN CONNECTOR(2P)		
CN11			E40-3239-05	PIN CONNECTOR(4P)		
CN12			E23-0401-05	TERMINAL(1P)		
CN13			E40-3237-05	PIN CONNECTOR(2P)		
CN14			E40-5066-05	PIN CONNECTOR(9P)		
CN15			E40-3243-05	PIN CONNECTOR(6P)		
CN16			E40-3238-05	PIN CONNECTOR(3P)		
CN17			E40-3237-05	PIN CONNECTOR(2P)		
CN18			E40-3238-05	PIN CONNECTOR(3P)		
CN19-24			E40-5059-05	PIN CONNECTOR(XTAL FILTER)		
J1		*	E11-0438-05	PHONE JACK(KEY)		
J2			E11-0414-05	PHONE JACK(EXT.SP)		
J3			E06-0352-05	DIN SOCKET(ACC2)		
J4			E13-0462-05	PHONO JACK(RCA 4P)		
J5			E04-0752-05	DIN CONNECTOR(REMOTE 7P)		
TP1 -3			E23-0512-05	TERMINAL		
			J32-0761-04	STUD		
CF1			L72-0351-05	CERAMIC FILTER(8.83MHZ)		
L1			L34-2267-05	TUNING COIL		
L2		*	L34-4205-05	TUNING COIL		
L3			L34-4025-05	TUNING COIL		
L4 -7			L30-0281-15	IFT		
L8		*	L34-4206-05	TUNING COIL		
L9 -11			L34-4006-05	TUNING COIL		
L12		*	L34-4209-05	TUNING COIL		
L13			L34-0943-05	TUNING COIL		
L14 ,15			L34-0942-05	TUNING COIL		
L16			L34-0943-05	TUNING COIL		
L17			L34-2124-05	TUNING COIL		
L18			L34-0536-05	TUNING COIL		
L19			L34-0781-05	TUNING COIL		
L20		*	L34-4210-05	TUNING COIL		

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L21 ,22			L30-0281-15	???		
L23		*	L34-4192-05	TUNING COIL		
L24		*	L34-4207-05	TUNING COIL		
L25			L34-0943-05	TUNING COIL		
L26			L34-0756-05	TUNING COIL		
L27 -29			L34-0536-05	TUNING COIL		
L30			L34-0791-05	TUNING COIL		
L31			L34-0536-05	TUNING COIL		
L32 -35			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L36			L40-2292-14	SMALL FIXED INDUCTOR(2.2UH)		
L37 -39			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L41			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L42			L40-1801-14	SMALL FIXED INDUCTOR(1UH)		
L43			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		
XF1			L71-0249-05	CRYSTAL FILTER(10.695MHZ)		
XF2		*	L71-0411-05	MCF(23.05MHZ)		
XF3			L71-0222-05	CRYSTAL FILTER(8.83MHZ)		
U	3F		X30-3010-46	PAN HEAD MACHINE SCREW		
R114			RK73FB2AXXXJ	CHIP R		
R115			RD14BB2C103J	RD 10K J 1/8W		
R116-234			RK73FB2AXXXJ	CHIP R		
R235			RD14BB2C103J	RD R 10K J 1/10W		
VR1			R12-0104-05	TRIMMING POT. 220		
VR2 ,3			R12-3125-05	TRIMMING POT. 10K		
VR4			R12-0108-05	TRIMMING POT. 470		
VR5			R12-3126-05	TRIMMING POT. 10K		
X1			S51-1420-05	RELAY		
SW1 ,2		*	S31-2419-05	SLIDE SWITCH		
D1 ,2			DAN222(K)	CHIP DIODE		
D3			HSM88AS	CHIP DIODE		
D4			DLS1585	CHIP DIODE		
D5 -6			RLS135	CHIP DIODE		
D9		*	RLZ6.2A	CHIP ZENER DIODE(6.2V)		
D10			RLS135	CHIP DIODE		
D11			DAN202(K)	CHIP DIODE		
D12 -29			RLS135	CHIP DIODE		
D30			DAN202(K)	CHIP DIODE		
D31			RLS135	CHIP DIODE		
D32 ,33			HSM88AS	CHIP DIODE		
D34			DLS1585	CHIP DIODE		
D35			LT8001P	LED		
D36			DLS1585	CHIP DIODE		
D37 -39			RLS135	CHIP DIODE		
D40			DLS1585	DIODE		
D41 ,42			1S1555	DIODE		
D43			DLS1585	CHIP DIODE		
IC1			AN612	IC(BALANCE MODULATOR)		
Q1			3SK131(M)	CHIP FET		
Q2 ,3		*	2SK520(K44)	CHIP FET		
Q4			DTC124EK	DIGITAL TRANSISTOR		
Q5			3SK131(M)	CHIP FET		
Q6 -8			2SC2712(Y)	CHIP TRANSISTOR		
Q9 ,10			3SK131(M)	CHIP FET		

E: Scandinavia & Europe K: USA P: Canada W: Europe
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PARTS LIST

× New Parts

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Teile ohne Parts No werden nicht geliefert.

Ref. No. 参用番号	Address 位置	New Parts 新番	Parts No 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
Q11			2SC2714(Y)	CHIP TRANSISTOR		
Q12			2SC2712(Y)	CHIP TRANSISTOR		
Q13			2SC2714(Y)	CHIP TRANSISTOR		
Q14			3SK131(M)	CHIP FET		
Q15 ,16			2SK520(K44)	CHIP FET		
Q17			2SC2712(Y)	CHIP TRANSISTOR		
Q18			2SA1162(Y)	CHIP TRANSISTOR		
Q19 ,20			3SK131(M)	CHIP FET		
Q21 ,22			2SC2712(Y)	CHIP TRANSISTOR		
Q23			2SC2714(Y)	CHIP TRANSISTOR		
Q24			3SK131(M)	CHIP FET		
Q25			2SC2714(Y)	CHIP TRANSISTOR		
Q26			2SK210(GR)	CHIP FET		
Q27 -29			2SC2714(Y)	CHIP TRANSISTOR		
Q30			2SC2712(Y)	CHIP TRANSISTOR		
Q31			2SC2714(Y)	CHIP TRANSISTOR		
Q32 ,33			2SC2712(Y)	CHIP TRANSISTOR		
Q34			DTA124EK	DIGITAL TRANSISTOR		
Q35			2SA1162(Y)	CHIP TRANSISTOR		
Q36 -38			3SK131(M)	CHIP FET		
Q39			2SC2714(Y)	CHIP TRANSISTOR		
Q40			2SC2712(Y)	CHIP TRANSISTOR		
Q41			3SK131(M)	CHIP FET		
Q42			2SC3324(C)	CHIP TRANSISTOR		
Q44		×	2SK520(K44)	CHIP FET		
Q45			DTC124EK	DIGITAL TRANSISTOR		
TH1 ,2			112-502-2	THERMISTOR 5K		
TH3			112-501-2	THERMISTOR 50Ω		
			X59-3350-00	MODULE UNIT(NB2)		
AF UNIT (X49-3020-00)						
C1			CK73FB1H472K	CHIP C 4700PF K		
C2 ,3			CK73FF1E104Z	CHIP C 0.10UF Z		
C4			CK73FB1E103K	CHIP C 0.010UF K		
C5 -10			CK73FF1E104Z	CHIP C 0.10UF Z		
C11			CE04EW1C470M	ELECTR9 47UF 16WV		
C12			CE04EW1H010M	ELECTR6 1.0UF 50WV		
C13			CE04EW1C470M	ELECTR9 47UF 16WV		
C14			CE04EW1H010M	ELECTR6 1.0UF 50WV		
C15 ,16			CK73EF1C105Z	CHIP C 1.0UF Z		
C17			CK73FB1H473K	CHIP C 0.047UF K		
C18			CK73FF1E104Z	CHIP C 0.1UF Z		
C19			CK73EF1C105Z	CHIP C 1.0UF Z		
C20			CE04EW1H010M	ELECTR9 1.0UF 50WV		
C21			CE04EW1C470M	ELECTR6 47UF 16WV		
C22			CE04EW1H010M	ELECTR9 1.0UF 50WV		
C23 ,24			CE04EW1C470M	ELECTR6 47UF 16WV		
C25			CE04EW1H010M	ELECTR9 1.0UF 50WV		
C26			CE04EW1E4R7M	ELECTR6 4.7UF 25WV		
C27			CK73EF1C105Z	CHIP C 1.0UF Z		
C28			CE04EW1E4R7M	ELECTR6 4.7UF 25WV		
C29			CK73EF1C105Z	CHIP C 1.0UF Z		
C30			CK73FB1H102K	CHIP C 1000PF K		
C31			CE04EW1C470M	ELECTR9 47UF 16WV		
C32 -34			CE04EW1C100M	ELECTR6 10UF 16WV		

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C35			CK73FB1E103K	CHIP C	0.01UF K		
C36			CE04EW1C100M	ELECTRO	10UF 16WV		
C37			CE04EW1C470M	ELECTRO	47UF 16WV		
C38 ,39			CE04EW1C100M	ELECTRO	10UF 16WV		
C40			CK73FB1E103K	CHIP C	0.01UF K		
C41 ,42			CE04EW1H0R1M	ELECTRO	0.1UF 50WV		
C43			CE04EW1C470M	ELECTRO	47UF 16WV		
C44			CK73FB1E103K	CHIP C	0.01UF K		
C45			CE04EW1E4R7M	ELECTRO	4.7UF 25WV		
C46			CE04EW1H1R0M	ELECTRO	1.0UF 50WV		
C47			CK73FF1E104Z	CHIP C	0.1UF Z		
C48			CK73FB1H471K	CHIP C	470PF K		
C49			CE04EW1E4R7M	ELECTRO	4.7UF 25WV		
C50			CE04EW1C470M	ELECTRO	47UF 16WV		
C51 ,52			CE04EW1C100M	ELECTRO	10UF 16WV		
C53			CK73FF1E104Z	CHIP C	0.1UF Z		
C54			CE04EW1C470M	ELECTRO	47UF 16WV		
C55			CE04EW1C100M	ELECTRO	10UF 16WV		
C56			CK73FB1H102K	CHIP C	1000PF K		
C57			CE04EW1C470M	ELECTRO	47UF 16WV		
C58 -60			CK73FB1HXXXK	CHIP C			
C61 ,62			CE04EW1C470M	ELECTRO	47UF 16WV		
C63			CE04EW1C100M	ELECTRO	10UF 16WV		
C64 ,65			CE04EW1C470M	ELECTRO	47UF 16WV		
C66			CK73FB1H102K	CHIP C	1000PF K		
C67 ,68			CK73FF1C105Z	CHIP C	1.0UF Z		
C69			CK73FB1E123K	CHIP C	0.012UF K		
C70			CK73FF1E104Z	CHIP C	0.1UF Z		
C71 ,72			CK73FB1E103K	CHIP C	0.010UF K		
C73 ,74			CK73FF1E104Z	CHIP C	0.1UF Z		
C77 -80			CC73FSL1H101J	CHIP C	100PF J		
C81			CK73FB1H102K	CHIP C	1000PF K		
C82			CK73FF1E104Z	CHIP C	0.10UF Z		
C83			CE04EW1C221M	ELECTRO	220UF 16WV		
C84			CE04EW1C471M	ELECTRO	470UF 16WV		
C85 -88			CK73FB1H102K	CHIP C	1000PF K		
C89			CQ92V1H103K	MYLAR	0.010UF K		
C90			C91-1053-05	FILM	0.47UF 63WV		
C91			CK73FF1E104Z	CHIP C	0.1UF Z		
C92			CE04EW1C101M	ELECTRO	100UF 16WV		
C93 -97			CK73FB1E103K	CHIP C	0.010UF K		
C98 -100			CK73FB1H102K	CHIP C	1000PF K		
C101-103			CC73FCH1HXXXC	CHIP C			
C104-106			CK73FB1H102K	CHIP C	1000PF K		
C107,108			CK73FB1E103K	CHIP C	0.010UF K		
C109			CK73FB1H102K	CHIP C	1000PF K		
C110			CK73FB1E103K	CHIP C	0.01UF K		
C111			CE04EW1C470M	ELECTRO	47UF 16WV		
C112-117			CK73FB1E103K	CHIP C	0.01UF K		
C118-127			CC73FCH1HXXXJ	CHIP C			
C128-130			CK73FB1E103K	CHIP C	0.010UF K		
C131-133			CK73FB1H102K	CHIP C	1000PF K		
C134			CK73FF1E104Z	CHIP C	0.1UF Z		
C135			CE04EW1C470M	ELECTRO	47UF 16WV		
C136			CK73FB1E103K	CHIP C	0.010UF K		

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Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格		Destination 仕向	Remarks 備考
C137			CK73FB1H102K	CHIP C	1000PF	K	
C138			CK72FB1E105K	CHIP C	1.0UF	K	
C139			CK73FB1H102K	CHIP C	1000PF	K	
C140			CK72FB1E105K	CHIP C	1.0UF	K	
C141			CE04BW1C470M	ELECTRO	47UF	16WV	
C142,143			CK72FB1E105K	CHIP C	1.0UF	K	
C144			CQ92M1H333K	MYLAR	0.033UF	K	
C145			CE04EW1C470M	ELECTRO	47UF	16WV	
C146			CQ91-1[illegible]-05	FILM	0.22UF	63WV	
C147			CS13B1VR47M	TANTAL	0.47UF	35WV	
C148			CK45B1H102K	CHIP C	1000PF	K	
C149			CK73FF1E104Z	CHIP C	0.10UF	Z	
C150			CE04EW1C101M	ELECTRO	100UF	16WV	
C151-153			CK73FB1H102K	CHIP C	1000PF	K	
C154-156			CC73FCH1HXXXJ	CHIP C			
C157			CK73FB1H102K	CHIP C	1000PF	K	
C158			CK73FF1E104Z	CHIP C	0.10UF	Z	
C159			CE04EW1C470M	ELECTRO	47UF	16WV	
C160			CK73FF1E104Z	CHIP C	0.10UF	Z	
C161			CE04BW1C470M	ELECTRO	47UF	16WV	
C162			CK73FF1E104Z	CHIP C	0.10UF	Z	
C163			CE04BW1C470M	ELECTRO	47UF	16WV	
C164			CC73FCH1H470J	CHIP C	47PF	J	
C165,166			CK73FF1E473Z	CHIP C	0.047UF	Z	
C167			CE04EW1C470M	ELECTRO	47UF	16WV	
C168			CK73FB1H102K	CHIP C	1000PF	K	
C169			CE04BW1HR47M	ELECTRO	0.47UF	50WV	
C170			CE04BW1H[illegible]M	ELECTRO	1.0UF	50WV	
C171,172			CK73FF1E104Z	CHIP C	0.10UF	Z	
C173			CK73FB1E103K	CHIP C	0.010UF	K	
C174			CK73FF1E473Z	CHIP C	0.047UF	Z	
C175			CK73FB1E103K	CHIP C	0.010UF	K	
C176			CK73FB1H102K	CHIP C	1000PF	K	
C177			CK73FF1E104Z	CHIP C	0.10UF	Z	
C178			CK73FB1H102K	CHIP C	1000PF	K	
C179			CC73FSL1H330J	CHIP C	33PF	J	
C180			CK73FB1H102K	CHIP C	1000PF	K	
C181			CC73FSL1H330J	CHIP C	33PF	J	
C182			CK73FF1E104Z	CHIP C	0.10UF	Z	
C183			CK73FB1H102K	CHIP C	1000PF	K	
C184,185			CK73FF1E104Z	CHIP C	0.10UF	Z	
C186,187			CK73FB1H102K	CHIP C	1000PF	K	
C188			CC73FSL1H151J	CHIP C	150PF	J	
C189			CE04EW1E4R7M	ELECTRO	4.7UF	25WV	
CN1			E40-5038-05	PPC CONNECTOR(14P)			
CN2			E40-3237-05	PIN CONNECTOR(2P)			
CN3			E40-3241-05	PIN CONNECTOR(6P)			
CN4 ,5			E40-3239-05	PIN CONNECTOR(4P)			
CN6			E40-3235-05	PIN CONNECTOR(2P)			
CN7			E40-3240-05	PIN CONNECTOR(5P)			
CN8			E40-3243-05	PIN CONNECTOR(8P)			
CN9			E40-3237-05	PIN CONNECTOR(2P)			
CN10			E40-3239-05	PIN CONNECTOR(4P)			
CN11			E40-3236-05	PIN CONNECTOR(3P)			

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CN12			E40-3240-05	PIN CONNECTOR(5P)		
CN13,14			E40-3239-05	PIN CONNECTOR(4P)		
CN15			E42-3237-05	PIN CONNECTOR(2P)		
CN16			E40-3038-05	FPC CONNECTOR(14P)		
CN17			E40-3240-05	PIN CONNECTOR(5P)		
CN18			E40-3237-05	PIN CONNECTOR(2P)		
CN19,20			E04-0154-05	RF COAXIAL JACK		
CN21			E23-0401-05	TERMINAL		
TP1 ,2			E23-0464-05	TERMINAL		
L1 ,2			L40-1011-14	SMALL FIXED INDUCTOR(10UH)		
L3			L40-3982-17	SMALL FIXED INDUCTOR(0.39UH)		
L4			L40-1292-17	SMALL FIXED INDUCTOR(1.2UH)		
L5			L40-3982-17	SMALL FIXED INDUCTOR(0.39UH)		
L6			L40-1011-14	SMALL FIXED INDUCTOR(10UH)		
L7			L40-1092-17	SMALL FIXED INDUCTOR(1UH)		
L8			L40-1592-17	SMALL FIXED INDUCTOR(1.5UH)		
L9		*	L40-0282-17	SMALL FIXED INDUCTOR(0.82UH)		
L10			L40-3982-17	SMALL FIXED INDUCTOR(0.39UH)		
L11			L40-1011-14	SMALL FIXED INDUCTOR(10UH)		
L12			L34-1124-05	COIL (50.7T)		
L13			L34-0535-05	TUNING COIL		
L14			L34-0536-05	TUNING COIL		
R1 -207			RK73B2AXXXJ	CHIP R		
VR1			R12-3126-05	TRIMMING POT. 10K		
VR2			R12-3128-05	TRIMMING POT. 22K		
VR3 -5			R12-3126-05	TRIMMING POT. 10K		
VR6			R12-3128-05	TRIMMING POT. 22K		
W3 ,4			R92-0150-05	JUMPER REST 0 OHM		
D1			DAN202(K)	CHIP DIODE		
D2			RLS73	CHIP DIODE		
D3			DAP202(K)	CHIP DIODE		
D4			RLS73	CHIP DIODE		
D5			DAP202(K)	CHIP DIODE		
D6			DAN202(K)	CHIP DIODE		
D7 -9			RLS73	CHIP DIODE		
D10			DAP202(K)	CHIP DIODE		
D11 ,12			DAN202(K)	CHIP DIODE		
D13			RLS73	CHIP DIODE		
D14			DAN202(K)	CHIP DIODE		
D15 -17			RLS73	CHIP DIODE		
D19			DAP202(K)	CHIP DIODE		
D21			RLS73	CHIP DIODE		
D22 ,23			DAN202(K)	CHIP DIODE		
D24		*	RLZJ12B	CHIP ZENER DIODE(12V)		
D25 ,26			RLS73	CHIP DIODE		
D27		*	RLZJ9.1B	CHIP ZENER DIODE(9.1V)		
D28 -30			HSM88AS	CHIP DIODE		
D31 -33			RLS73	CHIP DIODE		
D34			1SS133	DIODE		
IC1		*	SN74LS390NS	IC(DIV 1/100)		
IC2		*	MP10CDWM	IC(SWITCHED CAPACITOR)		
IC3		*	MF5CWM	IC(SWITCHED CAPACITOR)		
IC4 -6			TC4066BF	IC(BILATERAL SWITCH X4)		

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IC7 ,8			NJM4558?	IC(DP A?P X2)		
IC9		*	TC4538BF	IC(DUE S-ST MULTI)		
IC10			TC4066B?	IC(BILATERAL SWITCH X4)		
IC11		*	CXD1225M	IC(P_L)		
IC12			SN76514\	IC(DIV 1/10)		
IC13		*	CXD1225M	IC(P_L)		
IC14		*	AN75N10	IC(10V 4V?)		
IC15			AN78N05	IC(5V 4V?)		
Q1			2SC2712(Y)	CHIP TRANSISTOR		
Q2			DTC124EK	DIGITAL TRANSISTOR		
Q3			DTA124E(	DIGITAL TRANSISTOR		
Q4			DTC124EK	DIGITAL TRANSISTOR		
Q5			DTA124E(	DIGITAL TRANSISTOR		
Q6			2SD1757(K)	CHIP TRANSISTOR		
Q7			2SC2712(Y)	CHIP TRANSISTOR		
Q8 ,9			2SD1757(K)	CHIP TRANSISTOR		
Q10 ,11			2SC2712(Y)	CHIP TRANSISTOR		
Q12			2SD1757(K)	CHIP TRANSISTOR		
Q13 ,14			DTA124E(	DIGITAL TRANSISTOR		
Q15			2SC2712(Y)	CHIP TRANSISTOR		
Q16			DTC144W(	DIGITAL TRANSISTOR		
Q17			DTC124EK	DIGITAL TRANSISTOR		
Q18 ,19			DTA124E(	DIGITAL TRANSISTOR		
Q20			2SC2712(Y)	CHIP TRANSISTOR		
Q21 -23			DTA124EK	DIGITAL TRANSISTOR		
Q24 -27			DTC114EK	DIGITAL TRANSISTOR		
Q28			DTC143TK	DIGITAL TRANSISTOR		
Q29 -31			2SC3324(G)	CHIP TRANSISTOR		
Q32 -36			2SC2714(Y)	CHIP TRANSISTOR		
Q37			2SC2996(Y)	CHIP TRANSISTOR		
Q38			2SC2712(Y)	CHIP TRANSISTOR		
Q39			2SC2714(Y)	CHIP TRANSISTOR		
Q40			2SK210(GR)	CHIP FET		
Q41 -47			2SC2712(Y)	CHIP TRANSISTOR		
Q48			DTA124EK	DIGITAL TRANSISTOR		
Q49			2SA1162(Y)	CHIP TRANSISTOR		
Q50			DTC114EK	DIGITAL TRANSISTOR		
Q51			DTA124E(	DIGITAL TRANSISTOR		
Q52			DTC124EK	DIGITAL TRANSISTOR		
		*	X58-3190-03	SUB UNIT(VC92)		
		*	X58-3430-00	SUB UNIT(VC9)		
		*	X59-1080-01	MODULE UNIT(VOX)		
		*	X59-3000-03	MODULE UNIT(FM VCO)		
			X59-3350-20	MODULE UNIT(NB2)		
			X59-3450-00	MODULE UNIT(LPF)		
PLL UNIT (X50-3100-00)						
C1			CE04EW1E470M	ELECTRO	47UF 25WV	
C2			CK73F?1H?104Z	CHIP C	0.1UF Z	
C3			CE04EW1C470M	ELECTRO	47UF 16WV	
C4			CK73F?1H?104Z	CHIP C	0.1UF Z	
C5			CE04EW1A470M	ELECTRO	47UF 10WV	
C6			CK73F?1H?104Z	CHIP C	0.1UF Z	
C7			CE04EW1C470M	ELECTRO	47UF 16WV	
C8			CK73F3?1H?334	CHIP C	0.33UF K	

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C9			CE04EW1A47OM	ELECTRO	47UF 10WV		
C10			CK73FB1H102K	CHIP C	1000PF K		
C11			CK73FB1E103K	CHIP C	0.010UF K		
C12			CK73FB1H102K	CHIP C	1000PF K		
C13			CE04EW1C47OM	ELECTRO	47UF 16WV		
C14			CQ92M1H472K	MYLAR	4700PF K		
C15			CQ92M1H223K	MYLAR	0.022UF K		
C16			C91-0105-05	CHIP C	0.0047UF K		
C17			CK73FB1H103K	CHIP C	0.010UF K		
C18			CE04EW1C470M	ELECTRO	47UF 16WV		
C19			CC73FCH1H270J	CHIP C	27PF J		
C20 ,21			CC73FCH1H330J	CHIP C	33PF J		
C22 -24			CK73FB1E103K	CHIP C	0.010UF K		
C25			CE04EW1A470M	ELECTRO	47UF 10WV		
C26			CK73FB1E103K	CHIP C	0.010UF K		
C27			CK73FF1E473Z	CHIP C	0.047UF Z		
C28			CC73FCH1H680J	CHIP C	68PF J		
C29			CC73FSL1H151J	CHIP C	150PF J		
C30			CC73FCH1H680J	CHIP C	68PF J		
C31 -35			CK73FF1E473Z	CHIP C	0.047UF Z		
C36 -52			CK73FB1XXXXK	CHIP C			
C53			CE04EW1A470M	ELECTRO	47UF 10WV		
C54			CK73FB1H102K	CHIP C	1000PF K		
C55			CK73FB1C103K	CHIP C	0.010UF K		
C56			CK73FB1H102K	CHIP C	1000PF K		
C57			CE04EW1C47OM	ELECTRO	47UF 16WV		
C58			CQ92M1H103K	MYLAR	0.010UF K		
C59			CQ92M1H473K	MYLAR	0.047UF K		
C60			CK45B1H102K	CERAMIC	1000PF K		
C61			CK73FB1E103K	CHIP C	0.010UF K		
C62			CE04EW1C470M	ELECTRO	47UF 16WV		
C63			CC73FCH1H470J	CHIP C	47PF J		
C64 ,65			CC73FCH1H330J	CHIP C	33PF J		
C66 -68			CK73FB1E103K	CHIP C	0.010UF K		
C69			CK73FF1E473Z	CHIP C	0.047UF Z		
C70 -72			CC73FCH1HXXXJ	CHIP C			
C73 -77			CK73FF1E473Z	CHIP C	0.047UF Z		
C78			CC73FCH1H150J	CHIP C	15PF J		
C79 ,80			CK73FB1E103K	CHIP C	0.010UF K		
C81			CC73FCH1H010C	CHIP C	1.0PF C		
C82 -86			CK73FB1E103K	CHIP C	0.010UF K		
C87			CC73FCH1H470J	CHIP C	47PF J		
C88 ,89			CK73FB1E103K	CHIP C	0.010UF K		
C90			CC73FCH1H470J	CHIP C	47PF J		
C91			CC73FSL1H101J	CHIP C	100PF J		
C92			CC73FCH1H470J	CHIP C	47PF J		
C93			CK73FB1E103K	CHIP C	0.010UF K		
C94 -96			CC73FCH1HXXXJ	CHIP C			
C97			CK73FB1E103K	CHIP C	0.010UF K		
C98			CE04EW1A470M	ELECTRO	47UF 10WV		
C99			CK73FB1H102K	CHIP C	1000PF K		
C100			CK73FB1E103K	CHIP C	0.010UF K		
C101			CK73FB1H102K	CHIP C	1000PF K		
C102			CE04EW1C470M	ELECTRO	47UF 16WV		
C103			CQ92M1H472K	MYLAR	4700PF K		

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Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格		Destination 仕向	Remarks 備考
C104			C092M1H223K	MYLAR	0.022UF K		
C105			C91-0105-05	CERAMIC	0.0047UF K		
C106			CK73FB1H102K	CHIP C	1000PF K		
C107			CEC4EW1C470M	ELECTR6	47UF 16WV		
C108			CC73CPH1H150C	CHIP C	15PF C		
C110			CC73FCH1H220J	CHIP C	22PF J		
C111,112			CK73FB1H102K	CHIP C	1000PF K		
C113			CK73FB1E103K	CHIP C	0.010UF K		
C114			CEC4EW1A470M	ELECTR9	47UF 10WV		
C115			CK73FB1H102K	CHIP C	1000PF K		
C116			CK73FF1E473Z	CHIP C	0.047UF Z		
C117-119			CC73FCH1HXXXJ	CHIP C			
C120-124			CK73FF1E473Z	CHIP C	0.047UF Z		
C125-131			CK73FB1E103K	CHIP C	0.010UF K		
C132			CK73FF1E473Z	CHIP C	0.047UF Z		
C133			CC73FCH1H680J	CHIP C	68PF J		
C134			CC73FSL1H151J	CHIP C	150PF J		
C135			CC73FCH1H680J	CHIP C	68PF J		
C136-140			CK73FF1E473Z	CHIP C	0.047UF Z		
C141-162			CK73FB1EXXXK	CHIP C			
C163			CE04EW1C221M	ELECTR6	220UF 16WV		
C164			CE04EW1C331M	ELECTR6	330UF 16WV		
C165			CK73FB1E103K	CHIP C	0.010UF K		
C166-172			CC73FCH1HXXXD	CHIP C			
C173			CK73FB1E103K	CHIP C	0.010UF K		
C174,175			CK73FF1E473Z	CHIP C	0.047UF Z		
C176,177			CK73FB1E103K	CHIP C	0.010UF K		
C178			CE04EW1A470M	ELECTR6	47UF 10WV		
C179			CK73FB1H102K	CHIP C	1000PF K		
C180			CK73FB1E103K	CHIP C	0.010UF K		
C181			CK73FB1H102K	CHIP C	1000PF K		
C182			CK73FB1E103K	CHIP C	0.010UF K		
C183			CE04EW1C470M	ELECTR9	47UF 16WV		
C184			CE04EW1H010M	ELECTR6	1.0UF 50WV		
C185			CK73FB1E103K	CHIP C	0.010UF K		
C186			C092M1H223K	MYLAR	0.022UF K		
C187			C91-1083-05	FILM	0.47UF 63WV		
C188			C092M1H223K	MYLAR	0.022UF K		
C189			C91-1083-05	FILM	0.47UF 63WV		
C190-192			CK73FB1E103K	CHIP C	0.010UF K		
C193-195			CC73FCH1HXXXD	CHIP C			
C196-200			CK73FB1E103K	CHIP C	0.010UF K		
C201			CEC4EW1C470M	ELECTR9	47UF 16WV		
C202			CK73FB1E103K	CHIP C	0.010UF K		
C203-204			CC73FCH1HXXXJ	CHIP C			
C205			CK73FB1H102K	CHIP C	1000PF K		
C206-207			CC73FCH1HXXXJ	CHIP C			
C208,209			CK73FB1E103K	CHIP C	0.010UF K		
C210-212			CC73FCH1HXXXJ	CHIP C			
C213-219			CK73FB1E103K	CHIP C	0.010UF K		
C220,221			CK73FB1H102K	CHIP C	1000PF K		
C222-225			CK73FB1E103K	CHIP C	0.010UF K		
C226-239			CC73FSL1H101J	CHIP C	100PF J		
C240			CK73FF1E104Z	CHIP C	0.10UF Z		
C241			CC73FCH1H100D	CHIP C	10PF D		

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Ref. No. 参照番号	Address 位置	New Parts 新	Parts No. 部品番号	Description 部品名／規格	Destination 仕向	Remarks 備考
VC1			C05-0309-05	TRIMMING CAP 40PF		
CN1			E40-5139-05	FPC CONNECTOR(24P)		
CN2			E40-3240-05	PIN CONNECTOR(5P)		
CN3			E40-3242-05	PIN CONNECTOR(7P)		
CN4			E40-3240-05	PIN CONNECTOR(5P)		
CN5			E40-3239-05	PIN CONNECTOR(3P)		
CN6			E40-3239-05	PIN CONNECTOR(4P)		
CN7 -9			E04-0157-05	RF COAXIAL JACK		
TP1			B23-0512-05	TERMINAL		
TP2			B23-0464-05	TERMINAL		
TP3 ,4			B23-0512-05	TERMINAL		
TP5			B23-0464-05	TERMINAL		
TP6 ,7			B23-0512-05	TERMINAL		
TP8			B23-0464-05	TERMINAL		
TP9 -12			B23-0512-05	TERMINAL		
TP13,14			B23-0464-05	TERMINAL		
A1 -3			F11-0817-04	SHIELDING CASE		
A4 ,5			F11-0818-04	SHIELDING COVER		
L1 ,2			L40-1011-14	SMALL FIXED INDUCTOR(1.0UH)		
L3			L32-0649-05	OSCILLATING COIL (VCO)		
L4			L40-1011-14	SMALL FIXED INDUCTOR(1.0UH)		
L5 ,6			L40-4701-17	SMALL FIXED INDUCTOR(47UH)		
L7		*	L34-4196-05	B.P.F 12.6-12.8MHZ		
L8		*	L34-4197-05	B.P.F 12.6-12.8MHZ		
L9		*	L34-4196-05	B.P.F 12.6-12.8MHZ		
L10		*	L34-4198-05	B.P.F 9.265MHZ		
L11		*	L34-4199-05	B.P.F 9.265MHZ		
L12		*	L34-4198-05	B.P.F 9.265MHZ		
L13 ,14			L40-1011-14	SMALL FIXED INDUCTOR(1.0UH)		
L15			L32-0198-05	OSCILLATING COIL(VCO)		
L16			L40-1011-14	SMALL FIXED INDUCTOR(1.0UH)		
L17 ,18			L40-3301-17	SMALL FIXED INDUCTOR(33UH)		
L19 ,20			L34-2062-15	TUNING COIL 40MHZ		
L21		*	L34-4200-05	B.P.F 35.05-35.55MHZ		
L22		*	L34-4201-05	B.P.F 35.05-35.55MHZ		
L23		*	L34-4200-05	B.P.F 35.05-35.55MHZ		
L24			L40-1011-14	SMALL FIXED INDUCTOR(1.0UH)		
L25 ,26			L40-6891-17	SMALL FIXED INDUCTOR(6.8UH)		
L27 ,28		*	L40-1201-17	SMALL FIXED INDUCTOR(12UH)		
L29 ,30			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L31			L32-0666-15	OSCILLATING COIL (VCO)		
L32			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L33 ,34		*	L40-2701-17	SMALL FIXED INDUCTOR(27UH)		
L35		*	L34-4202-05	B.P.F 25.45-25.35MHZ		
L36		*	L34-4203-05	B.P.F 25.45-25.35MHZ		
L37		*	L34-4202-05	B.P.F 25.45-25.35MHZ		
L38			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L39 ,40		*	L40-5501-17	SMALL FIXED INDUCTOR(56UH)		
L41		*	L34-4196-05	B.P.F 12.545-12.535MHZ		
L42		*	L34-4197-05	B.P.F 12.545-12.535MHZ		
L43		*	L34-4196-05	B.P.F 12.545-12.535MHZ		
L44		*	L34-4200-05	B.P.F 38.225-38.215MHZ		
L45		*	L34-4201-05	B.P.F 38.225-38.215MHZ		

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L46		×	L34-4200-05	S.P.F 30.225-38.275MHX		
L47			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L48			L40-8282-17	SMALL FIXED INDUCTOR(0.82UH)		
L49			L40-1592-17	SMALL FIXED INDUCTOR(1.5UH)		
L50			L40-1892-17	SMALL FIXED INDUCTOR(1.8UH)		
L51 ,52			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L53			L40-1092-17	SMALL FIXED INDUCTOR(1UH)		
L54			L40-1592-17	SMALL FIXED INDUCTOR(1.5UH)		
L55			L40-1092-17	SMALL FIXED INDUCTOR(1UH)		
L56			L33-0663-05	C-TYPE COIL 1UH		
L57		×	L34-4195-05	TUNING COIL 52.35YH2		
L58			L34-1124-05	COIL		
X1		×	L77-1423-05	CRYSTAL RESONATOR(50.75M-Z)		
R1			RS14DB2A222J	FL-PROOF RS 22 J 1W		
R2 -148			RK73EB2AXXXJ	CHIP R		
IC1			4N78Y08	IC(VOLTAGE REGULATOR/ +8V)		
IC2		*	UPC78Y08	IC(VOLTAGE REGULATOR/ +8V)		
D1			RLS73	CHIP DIODE		
D2			1SV166	CHIP DIODE		
D3			RLS73	CHIP DIODE		
D4			1SV166	CHIP DIODE		
D5			RLS73	CHIP DIODE		
D6			1SV166	CHIP DIODE		
D7		×	RLZJ12B	CHIP ZENER DIODE(12V)		
D8			RLS73	CHIP DIODE		
D9		*	RLZJ9.1B	CHIP ZENER DIODE(9.1V)		
IC2			CX-7925B	IC(DIGITAL SELECT PLL)		
IC3			M54459L	IC(PRE SCALER)		
IC4 ,5			SN16913P	IC(DUBLE BALANCED MIXERS)		
IC6			CX-7925B	IC(DIGITAL SELECT PLL)		
IC7		*	MB467	IC(DIV 1/10)		
IC8			SN16913P	IC(DUBLE BALANCED MIXERS)		
IC9			SN74LS73AN	IC(J-K FLIP FLOP)		
IC10			CX-7925B	IC(DIGITAL SELECT PLL)		
IC11			M54459L	IC(PRE SCALER)		
IC12			SN16913P	IC(DUBLE BALANCED MIXERS)		
IC13		×	MB467	IC(DIV 1/10)		
IC14-16			SN16913P	IC(DUBLE BALANCED MIXERS)		
IC17			CX-7925B	IC(DIGITAL SELECT PLL)		
IC18			NJM4558SD	IC(OP AMP X2)		
Q1			2SC2712(Y)	CHIP TRANSISTOR		
Q2 -6			2SC2714(Y)	CHIP TRANSISTOR		
Q7 ,8			2SC2712(Y)	CHIP TRANSISTOR		
Q9 ,10			2SC2714(Y)	CHIP TRANSISTOR		
Q11 ,12			2SC2712(Y)	CHIP TRANSISTOR		
Q13			2SC2714(Y)	CHIP TRANSISTOR		
Q14		×	2SC2995(Y)	CHIP TRANSISTOR		
Q15 -17			2SC2714(Y)	CHIP TRANSISTOR		
Q18 -21			DTC114EK	DIGITAL TRANSISTOR		
Q22 ,23			DTC114TK	DIGITAL TRANSISTOR		
		×	X58-3630-01	SUB UNIT(VC6)		
			X59-3440-00	MODULE UNIT(VCO)		
			X59-3450-01	MODULE UNIT(LPF)		

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CAR UNIT (X50-3110-XX) -00 : TS-950S -01 : TS-950SD							
C1			CK73FB1E103K	CHIP C	0.010UF K		
C2			CE04EW1A470M	ELECTRS	47UF 10WV		
C3			CK73FB1H101K	CHIP C	100PF K		
C4			CK73FB1E103K	CHIP C	0.010UF K		
C5			CK73FB1H102K	CHIP C	1000PF K		
C6			CE04EW1C470Y	ELECTRS	47UF 16WV		
C7			CQ92M1H472K	MYLAR	4700PF K		
C8			CQ92M1H223K	MYLAR	0.022UF K		
C9			C91-0105-05	CERAMIC	0.0047UF K		
C10			CK73FB1E103K	CHIP C	0.010UF K		
C11			CE04EW1C470Y	ELECTRS	47UF 16WV		
C12			CC73FCH1H470J	CHIP C	47PF J		
C13 -14			CC73FCH1HXXXJ	CHIP C			
C15 -17			CK73FB1E103K	CHIP C	0.010UF K		
C18			CE04EW1A470M	ELECTRS	47UF 10WV		
C19			CK73FB1E103K	CHIP C	0.010UF K		
C20			CK73FF1E104Z	CHIP C	0.10UF Z		
C21 -23			CK73FB1HXXXK	CHIP C			
C24 ,25			CK73FF1E104Z	CHIP C	0.10UF Z		
C26			CE04EW1E470Y	ELECTRS	47UF 25WV		
C27			CK73FF1E104Z	CHIP C	0.10UF Z		
C28			CK73FB1E103K	CHIP C	0.010UF K		
C29			CE04EW1A470M	ELECTRS	47UF 10WV		
C30			CK73FB1H102K	CHIP C	1000PF K		
C31			CK73FB1E103K	CHIP C	0.010UF K		
C32			CK73FB1H102K	CHIP C	1000PF K		
C33			CE04EW1C470M	ELECTRS	47UF 16WV		
C34			CQ92M1H472K	MYLAR	4700PF K		
C35			CQ92M1H223K	MYLAR	0.022UF K		
C36			C91-0105-05	CERAMIC	0.0047UF K		
C37			CK73FB1H102K	CHIP C	1000PF K		
C38			CE04EW1C470M	ELECTRS	47UF 16WV		
C39			CC73FCH1H220J	CHIP C	22PF J		
C40 -41			CC73FCH1HXXXJ	CHIP C			
C42 ,43			CK73FB1H102K	CHIP C	1000PF K		
C44			CK73FB1E103K	CHIP C	0.010UF K		
C45			CE04EW1A470M	ELECTRS	47UF 10WV		
C46			CK73FB1H102K	CHIP C	1000PF K		
C47			CK73FF1E104Z	CHIP C	0.10UF Z		
C48 -50			CK73FB1HXXXK	CHIP C			
C51 -55			CK73FF1E104Z	CHIP C	0.10UF Z		
C56 -62			CK73FB1E103K	CHIP C	0.010UF K		
C63			CE04EW1A470M	ELECTRS	47UF 10WV		
C64			CK73FB1H102K	CHIP C	1000PF K		
C65			CK73FB1E103K	CHIP C	0.010UF K		
C66			CK73FB1H102K	CHIP C	1000PF K		
C67			CE04EW1C470M	ELECTRS	47UF 16WV		
C68			CQ92M1H472K	MYLAR	4700PF K		
C69			CQ92M1H223K	MYLAR	0.022UF K		
C70			C91-0105-05	CERAMIC	0.0047UF K		
C71			CK73FB1H102K	CHIP C	1000PF K		
C72			CE04EW1C470M	ELECTRS	47UF 16WV		
C73			CC73FCH1H220J	CHIP C	22PF J		

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C74 -75			CC73FCH1HXXXJ	CHIP C			
C76 ,77			CK73FB1H102K	CHIP C	1000PF	K	
C78			CK73FB1E103K	CHIP C	0.010UF	K	
C79			CE04EW1A470M	ELECTRO	47UF	10WV	
C80			CK73FB1H102K	CHIP C	1000PF	K	
C81			CK73FF1E104Z	CHIP C	0.10UF	Z	
C82 -84			CK73FB1HXXXK	CHIP C			
C85 -89			CK73FF1E104Z	CHIP C	0.10UF	Z	
C90 -96			CK73FB1E103K	CHIP C	0.010UF	K	
C97			CE04EW1A470*	ELECTRO	47UF	10WV	
C98			CK73FB1H102K	CHIP C	1000PF	K	
C99			CK73FB1E103K	CHIP C	0.010UF	K	
C100			CK73FB1H102K	CHIP C	1000PF	K	
C101			CE04EW1C470*	ELECTRO	47UF	16WV	
C102			CQ92M1H472K	MYLAR	4700PF	K	
C103			CQ92M1H223K	MYLAR	0.022UF	K	
C104			CC81-0105-05	CERAMIC	0.0047UF	K	
C105			CK73FB1E103K	CHIP C	0.010UF	K	
C106			CE04EW1C470M	ELECTRO	47UF	16WV	
C107			CC73FCH1H220J	CHIP C	22PF	J	
C108-109			CC73FCH1HXXXJ	CHIP C			
C110			CK73FB1E103K	CHIP C	0.010UF	K	
C111-112			CC73FCH1HXXXJ	CHIP C			
C113-118			CK73FB1E103K	CHIP C	0.010UF	K	
C119-120			CC73FCH1HXXXJ	CHIP C			
C121,122			CK73FB1H102K	CHIP C	1000PF	K	
C123			CK73FB1E103K	CHIP C	0.010UF	K	
C124-126			CC73FCH1HXXXJ	CHIP C			
C127-129			CK73FB1E103K	CHIP C	0.010UF	K	
C130-133			CK73FF1E104Z	CHIP C	0.10UF	Z	
C134-136			CK73FB1E103K	CHIP C	0.010UF	K	
C137			CK73FF1E104Z	CHIP C	0.10UF	Z	
C138-140			CK73FB1HXXXK	CHIP C			
C141,142			CK73FF1E104Z	CHIP C	0.10UF	Z	
C143			CE04EW1E470M	ELECTRO	47UF	25WV	
C144			CK73FF1E104Z	CHIP C	0.10UF	Z	
C145,146			CK73FB1E103K	CHIP C	0.010UF	K	
C147			CE04EW1A470M	ELECTRO	47UF	10WV	
C148			CK73FB1E103K	CHIP C	0.010UF	K	
C149			CK73FF1E104Z	CHIP C	0.10UF	Z	
C150-152			CK73FB1HXXXK	CHIP C			
C153,154			CK73FF1E104Z	CHIP C	0.10UF	Z	
C155			CE04EW1E470M	ELECTRO	47UF	25WV	
C156-161			CK73FF1E104Z	CHIP C	0.10UF	Z	
C162			CE04EW1A470M	ELECTRO	47UF	10WV	
C163			CQ92M1H472K	MYLAR	4700PF	K	
C164			CE15E1VOR1M	TANTAL	0.1UF	35WV	
C165			CC81-0117-05	CERAMIC	0.01UF	K	
C166			CK73FB1E103K	CHIP C	0.010UF	K	
C167-170			CC73FCH1HXXXJ	CHIP C			
C171			CK73FB1E103K	CHIP C	0.010UF	K	
C172			CE04EW1C470M	ELECTRO	47UF	16WV	
C173-175			CK73FB1E103K	CHIP C	0.010UF	K	
C176			CE04EW1A470M	ELECTRO	47UF	10WV	
C177			CC73FCH1H5R0C	CHIP C	5.0PF	C	

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C178			CK73FB1E103K	CHIP C	0.010UF K		
C179,180			CC73FCH1H121J	CHIP C	120PF J		
C181			CK73FB1E103K	CHIP C	0.010UF K		
C182			CC73FCH1H470J	CHIP C	47PF J		
C183-185			CK73FB1E103K	CHIP C	0.010UF K		
C187			CE04EW1A470M	ELECTRO	47UF 10WV		
C188			CK73FB1E103K	CHIP C	0.010UF K		
C189-191			CC73FCH1HKXXJ	CHIP C			
C192-194			CK73FB1E103K	CHIP C	0.010UF K		
C195,196			CC73FCH1H050C	CHIP C	5.0PF C		
C197-199			CK73FB1E103K	CHIP C	0.010UF K		
C200-202			CC73FCH1HXXXJ	CHIP C			
C203			CK73FB1E104Z	CHIP C	0.10UF Z		
C204			CE04EW1A470M	ELECTRO	47UF 10WV		
C205-207			CK73FB1HXXXK	CHIP C			
C208-211			CK73FB1E104Z	CHIP C	0.10UF Z		
C212			CK73FB1E103K	CHIP C	0.010UF K		
C213			CE04EW1A470M	ELECTRO	47UF 10WV		
C214			CK73FB1E103K	CHIP C	0.010UF K		
C215-221			CK73FB1HXXXK	CHIP C			
C222-226			CK73FB1E103K	CHIP C	0.010UF K		
TC1			C05-0044-05	TRIMMING CAP(30PF)			
TC2			C05-0355-05	TRIMMING CAP(30PF)			
CN1			E40-3239-05	PIN CONNECTOR(4P)			
CN2			E40-3237-05	PIN CONNECTOR(2P)			
CN3			E40-3239-05	PIN CONNECTOR(4P)			
CN4			E40-3238-05	PIN CONNECTOR(3P)			
CN5			E40-3237-05	PIN CONNECTOR(2P)			
CN6			E40-3239-05	PIN CONNECTOR(4P)			
CN7			E40-3238-05	PIN CONNECTOR(3P)			
CN8 ,9			E40-3237-05	PIN CONNECTOR(2P)			
CN10			E04-0154-05	RF COAXIAL JACK			
CN11			E40-3237-05	PIN CONNECTOR(2P)			
CN12			E40-3241-05	PIN CONNECTOR(6P)			
CN13			E40-3242-05	PIN CONNECTOR(7P)			
J1 ,2			E13-0166-05	PIN JACK(EXT.SP)			
J3			E06-0859-05	DIN SOCKET(SCOPE DIN 8P)			
J4			E06-0658-05	DIN SOCKET(ACC1 DIN 6P)			
TP1 -4			B22-0454-05	TERMINAL			
TP5 ,6			B23-0512-05	TERMINAL			
A1 -4			F10-0817-04	SHIELDING COVER			
CF1			L72-0350-05	CERAMIC FILTER(9.295MHZ)			
CF2			L72-0369-05	CERAMIC FILTER(10.695MHZ)			
L1 ,2			L40-1011-14	SMALL FIXED INDUCTOR(100UH)			
L3			L32-0197-05	OSCILLATING COIL (VCO)			
L4			L40-1011-14	SMALL FIXED INDUCTOR(100UH)			
L5		×	L40-6801-17	SMALL FIXED INDUCTOR(68UH)			
L6			L40-4711-14	SMALL FIXED INDUCTOR(470UH)			
L7		×	L40-6801-17	SMALL FIXED INDUCTOR(68UH)			
L8 ,9			L40-1011-14	SMALL FIXED INDUCTOR(100UH)			
L10			L32-0639-05	OSCILLATING COIL (VCO)			
L11			L40-1011-14	SMALL FIXED INDUCTOR(100UH)			
L12 ,13			L40-2211-17	SMALL FIXED INDUCTOR(220UH)			

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L14		*	L34-4204-15	TUNING COIL		
L15 ,16			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L17			L32-0639-05	OSCILLATING COIL (VCO)		
L18			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L19 ,20			L40-2211-17	SMALL FIXED INDUCTOR(220UH)		
L21		*	L34-4204-15	TUNING COIL		
L22 ,23			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L24			L32-0645-05	OSCILLATING COIL (VCO)		
L25 ,26		*	L40-1201-17	SMALL FIXED INDUCTOR(12UH)		
L27 ,28		*	L40-6811-14	SMALL FIXED INDUCTOR(680UH)		
L29			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L30 ,31			L40-1021-14	SMALL FIXED INDUCTOR(1MH)		
L32			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L33			L40-4701-17	SMALL FIXED INDUCTOR(47UH)		
L35			L40-6882-17	SMALL FIXED INDUCTOR(6.8UH)		
L36			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
L37 ,38		*	L40-1201-17	SMALL FIXED INDUCTOR(12UH)		
L39 ,40			L40-6891-17	SMALL FIXED INDUCTOR(6.8UH)		
L41 ,42			L40-1011-14	SMALL FIXED INDUCTOR(100UH)		
X1			L77-0963-05	CRYSTAL RESONATOR(20MHZ)		
X2			L77-1394-15	TCXO 20MHZ	D	
R1 -144			RK73FB2AXXXJ	CHIP R		
W3			R92-0670-05	CHIP REST 0 OHM		
S1			S31-1411-05	SLIDE SWITCH		
S2		*	S31-2420-05	SLIDE SWITCH		
D1			RLS73	CHIP DIODE		
D2			1SV166	CHIP DIODE		
D3			RLS73	CHIP DIODE		
D4			1SV166	CHIP DIODE		
D5			RLS73	CHIP DIODE		
D6			1SV166	CHIP DIODE		
D7			RLS73	CHIP DIODE		
D8 ,9			1SV166	CHIP DIODE		
D10		*	RLZ12B	CHIP ZENER DIODE(12V)		
D11 -13			DAP202(K)	CHIP DIODE		
D14			RLS73	DIODE		
D15			RLZJ6.8B	CHIP ZENER DIODE(6.8V)		
IC1			CX-79258	IC(DIGITAL SELECT PLL)		
IC2			M54459L	IC(DIV 1/100)		
IC3			CX-79258	IC(DIGITAL SELECT PLL)		
IC4			M54459L	IC(DIV 1/100)		
IC5			SN16913P	IC(DUBLE BALANCED MIXERS)		
IC6			CX-79258	IC(DIGITAL SELECT PLL)		
IC7			M54459L	IC(DIV 1/100)		
IC8			SN16913P	IC(DUBLE BALANCED MIXERS)		
IC9			CX-79259	IC(DIGITAL SELECT PLL)		
IC10,11			SN16913P	IC(DUBLE BALANCED MIXERS)		
IC12			M54459L	IC(DIV 1/100)		
IC13		*	MC145680CP	IC(PLL)		
IC14		*	M74LS90P	IC(DIV)		
IC14			SN74LS90N	IC(DIV)		
IC15			TC4013BP	IC(D FLIP-FLOP X2)		
IC16			MC145698CP	IC		

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IC17		*	TC45568P	IC		
Q1 ,2			2SC2712(Y)	CHIP TRANSISTOR		
Q3			2SC2714(Y)	CHIP TRANSISTOR		
Q4			2SC2712(Y)	CHIP TRANSISTOR		
Q5 -7			2SC2714(Y)	CHIP TRANSISTOR		
Q8 -12			2SC2712(Y)	CHIP TRANSISTOR		
Q13 -15			2SC2714(Y)	CHIP TRANSISTOR		
Q16			2SC2712(Y)	CHIP TRANSISTOR		
Q17 ,18			2SC2712(Y)	CHIP TRANSISTOR		
Q19			2SA1162(Y)	CHIP TRANSISTOR		
			X59-3440-00	MODULE UNIT(VCO)		
			X59-3450-01	MODULE UNIT(LPF)		
		*	X59-3640-00	MODULE UNIT(MIX)		
		*	X59-3650-00	MODULE UNIT(SFT)		
FILTER UNIT (X51-3060-XX) -01 : TS-950S (K,M,W,X,P) -11 : TS-950SD (K,M,W,X,P) -61 : TS-950S (W2) -62 : TS-950SD (W2)						
C1 -13			CK45F1H103Z	CERAMIC	0.010UF Z	
C14 ,15			CE04E1V1E100M	ELECTRO	100UF 25WV	
C16			C91-0119-05	CERAMIC	0.047UF K	
C17			CC45CH2H030C	CERAMIC	3.0PF C	
C18			CC45CH1H560J	CERAMIC	56PF J	
C19			CC45CH1H101J	CERAMIC	100PF J	
C20 ,21			C91-0119-05	CERAMIC	0.047UF K	
C22			CC45SL1H150J	CERAMIC	15PF J	
C23			CK45F1H103Z	CERAMIC	0.010UF Z	
C101			CM93D2H102J	MICA	1000PF J	
C102			CC45SL2H431J	CERAMIC	430PF J	
C103			CM93E2H222J	MICA	2200PF J	
C104			CC45SL2H221J	CERAMIC	220PF J	
C105			CM93D2H121J	MICA	120PF J	
C106,107			CC45SL2H330J	CERAMIC	33PF J	
C108			CC45SL2H241J	CERAMIC	240PF J	
C109			CM93D2H121J	MICA	120PF J	
C110			CC45SL2H470J	CERAMIC	47PF J	
C111			CC45SL2H560J	CERAMIC	56PF J	
C112			CC45SL2H391J	CERAMIC	390PF J	
C113			CC45SL2H221J	CERAMIC	220PF J	
C114			CC45SL2H241J	CERAMIC	240PF J	
C115			CC45SL2H121J	CERAMIC	120PF J	
C116			CC45SL2H201J	CERAMIC	200PF J	
C117			CC45SL2H331J	CERAMIC	330PF J	
C118			CC45SL2H560J	CERAMIC	56PF J	
C119			CC45SL2H331J	CERAMIC	330PF J	
C120			CC45SL2H151J	CERAMIC	150PF J	
C121			CC45SL2H101J	CERAMIC	100PF J	
C122			CC45SL2H391J	CERAMIC	390PF J	
C123		*	CC45SL2H360J	CERAMIC	36PF J	
C124			CC45SL2H241J	CERAMIC	240PF J	
C125		*	CC45SL2H121J	CERAMIC	120PF J	
C126			CC45SL2H470J	CERAMIC	47PF J	
C127			CC45SL2H301J	CERAMIC	300PF J	
C128		*	CC45SL2H240J	CERAMIC	24PF J	
C129		*	CC45SL2H201J	CERAMIC	200PF J	
C130			CC45SL2H101J	CERAMIC	100PF J	
C131			CC45SL2H330J	CERAMIC	33PF J	
C132			CC45SL2H221J	CERAMIC	220PF J	

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C133			CC45SL2H100D	CERAMIC	10PF	D		
C134			CC45SL2H121J	CERAMIC	120PF	J		
C135			CC45SL2H820J	CERAMIC	82PF	J		
C136		*	CC45SL2H300J	CERAMIC	30PF	J		
C137			CC45SL2H151J	CERAMIC	150PF	J		
C138			CC45SL2H100D	CERAMIC	10PF	D		
C139			CC45SL2H820J	CERAMIC	82PF	J		
C140			CC45SL2H151J	CERAMIC	150PF	J		
C141,142			CC45SL2H470J	CERAMIC	47PF	J		
C143			CC45SL2H390J	CERAMIC	39PF	J		
C144			CC45SL2H470J	CERAMIC	47PF	J		
TC1			CD5-2030-15	TRIMMING CAP(20PF)				
CN1 ,2			E04-0157-05	RF COAXIAL JACK				
CN3			E40-3237-05	PIN CONNECTOR(2P)				
CN4			E04-0157-05	RF COAXIAL JACK				
CN5			E40-3238-05	PIN CONNECTOR(3P)				
CN6			E40-3242-05	PIN CONNECTOR(5P)				
CN7			E40-5067-05	PIN CONNECTOR(10P)				
CN8			E40-3242-05	PIN CONNECTOR(5P)				
CN10,11			E40-0517-05	PIN CONNECTOR			S	
CN12,13			E40-0517-05	PIN CONNECTOR				
W23		*	E31-6080-05	WIRE WITH CONNECTOR				
CF1			L72-0333-05	CERAMIC FILTER(CFJ455K12)			S	
L1			L39-0405-05	TROIDAL COIL				
L2 -8			L40-1011-14	SMALL FIXED INDUCTOR(10UH)				
L9 ,10			L40-1021-14	SMALL FIXED INDUCTOR(1MH)				
L11			L40-1011-14	SMALL FIXED INDUCTOR(10UH)				
L12 ,13			L34-0941-05	TUNING COIL				
L101		*	L39-0456-05	TROIDAL COIL (3.6UH)				
L102		*	L39-0457-05	TROIDAL COIL (4.5UH)				
L103		*	L39-0458-05	TROIDAL COIL (1.9UH)				
L104		*	L39-0459-05	TROIDAL COIL (2.4UH)				
L105		*	L39-0460-05	TROIDAL COIL (1.0UH)				
L106		*	L39-0461-05	TROIDAL COIL (1.2UH)				
L107		*	L39-0462-05	TROIDAL COIL (0.7UH)				
L108		*	L39-0463-05	TROIDAL COIL (0.9UH)				
L109		*	L34-1278-05	COIL	9.7Φ 8.5T			
L110		*	L34-1277-05	COIL	9.7Φ 9.5T			
L111		*	L34-1280-05	COIL	9.7Φ 6.5T			
L112		*	L34-1279-05	COIL	9.7Φ 7.5T			
L113		*	L34-1282-05	COIL	9.7Φ 4.5T			
L114		*	L34-1281-05	COIL	9.7Φ 5.5T			
T1			L92-0102-05	TROIDAL CORE				
T2 -6			L92-0104-05	TROIDAL	T50-2			
T7 -9			L92-0105-05	TROIDAL	T68-6			
XF1			L71-0256-05	MCF(8.83MHZ)				
CP1			R90-0286-05	MULTI-COMP	4.7KX4			
CP2			R90-0455-05	MULTI-COMP	4.7KX8	J	1/4W	
CP3		*	R90-0713-05	MULTI-COMP	0.1UFX9			
R1			RD14CB2E270J	RD	27	J	1/4W	
R2			RD14CB2E330J	RD	33	J	1/4W	
R3			RD14BB2C100J	RD	10	J	1/6W	
R4			RD14BB2C103J	RD	10K	J	1/6W	
R5			RD14BB2C472J	RD	4.7K	J	1/6W	

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VR1			R12-0104-05	TRIMMING POT. 220			
W1 ,2			R92-0150-05	JUMPER REST 0 OHM			
W22			R92-0150-05	JUMPER REST 0 OHM			
W24			R92-0150-05	JUMPER REST 0 OHM			
K1 -14			SSL-1420-05	RELAY			
K15			SSL-1429-05	RELAY			
D1 -7			1S1555	DIODE			
D8 ,9			1SS101	DIODE			
D10			1S1555	DIODE			
D11 ,12			MC921	DIODE			
D13 ,14			1S1555	DIODE			
D15			DSP-201N	DIODE			
IC1		*	M74LS145N	IC(BCD-DECIMAL)			
IC1			M74LS145P	IC(BCD-DECIMAL)			
IC2			M54581P	IC(INVERTER)			
IC3			4N78S05	IC(5V AVR)			
Q1			2SA562(Y)	TRANSISTOR			
CONTROL UNIT (X53-3230-00)							
C1			CE04EW1C100M	ELECTRO	10UF	16WV	
C2			CE04EW1C220M	ELECTRO	22UF	16WV	
C3			CE04EW1C102M	ELECTRO	1000UF	16WV	
C4			CE04EW1H010M	ELECTRO	1.0UF	50WV	
C5			CE04EW1H100M	ELECTRO	10UF	50WV	
C6			CC73FCH1H101J	CHIP C	100PF	J	
C7			CE04EW1A221M	ELECTRO	220UF	10WV	
C8			CE04EW1C101M	ELECTRO	100UF	16WV	
C9			CE04EW1H010M	ELECTRO	1UF	50WV	
C10 ,11			CE04EW1C100M	ELECTRO	10UF	16WV	
C12			CK73EF1C105Z	CHIP C	1.0UF	Z	
C13 ,14			CE04EW1C221M	ELECTRO	220UF	16WV	
C15			CE04EW1H4R7M	ELECTRO	4.7UF	50WV	
C16			CE04EW1A470M	ELECTRO	47UF	10WV	
C17			CE04EW1C100M	ELECTRO	10UF	16WV	
C18			CE04EW1A470M	ELECTRO	47UF	10WV	
C19			CK73EF1C105Z	CHIP C	1.0UF	Z	
C20 -23			CK73FB1H103K	CHIP C	0.01UF	K	
C24			CC73FCH1H101J	CHIP C	100PF	J	
C25 -26			CK73FB1HXXXK	CHIP C			
C27			CK73EF1E104Z	CHIP C	0.1UF	Z	
C28			CK73EF1E474Z	CHIP C	0.47UF	Z	
C29 -33			CK73FB1HXXXK	CHIP C			
C34			CK73EF1E104Z	CHIP C	0.1UF	Z	
C35 -39			CK73FB1HXXXK	CHIP C			
C40 -43			CK73EF1E104Z	CHIP C	0.1UF	Z	
C44 -49			CK73FB1HXXXK	CHIP C			
C50 ,51			CC73FCH1H101J	CHIP C	100PF	J	
C52			CK73FB1H103K	CHIP C	0.01UF	K	
C53			CQ92M1H563K	MYLAR	0.056UF	K	
C54 -58			CK73FB1HXXXK	CHIP C			
C59			CE04EW1C470M	ELECTRO	47UF	16WV	
C60			CK73EF1E104Z	CHIP C	0.1UF	Z	
C61			CK45E1H103K	CERAMIC	0.01UF	K	
CN1			E40-3236-05	PIN CONNECTOR(3P)			

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CN2 ,3			E40-3231-05	PIN CONNECTOR(2P)		
CN4			E40-3238-05	PIN CONNECTOR(3P)		
CN5 ,6			E40-3231-05	PIN CONNECTOR(2P)		
CN7			E40-3240-05	PIN CONNECTOR(5P)		
CN8			E40-3242-05	PIN CONNECTOR(7P)		
CN9			E40-3238-05	PIN CONNECTOR(3P)		
CN10			E40-3242-05	PIN CONNECTOR(5P)		
CN11			E40-3238-05	PIN CONNECTOR(3P)		
CN12			E40-3239-05	PIN CONNECTOR(4P)		
CN13			E40-3238-05	PIN CONNECTOR(3P)		
CN14 ,15			E40-3239-05	PIN CONNECTOR(4P)		
CN16			E40-3240-05	PIN CONNECTOR(5P)		
CN17			E40-3231-05	PIN CONNECTOR(2P)		
CN18			E40-3241-05	PIN CONNECTOR(6P)		
CN19			E40-5131-05	FPC CONNECTOR(16P)		
CN20		*	E40-5333-05	FPC CONNECTOR(14P)		
CN21			E40-3239-05	PIN CONNECTOR(4P)		
CN22			E40-3241-05	PIN CONNECTOR(6P)		
CN23			E40-3231-05	PIN CONNECTOR(2P)		
CN24			E40-3238-05	PIN CONNECTOR(3P)		
CN25			E40-3242-05	PIN CONNECTOR(5P)		
CN26			E40-3238-05	PIN CONNECTOR(3P)		
CN27		*	E40-0517-05	PIN CONNECTOR(6P)		
CN28		*	E40-5336-05	PIN CONNECTOR(6P)		
CN29		*	E40-5335-05	PIN CONNECTOR(3P)		
CN30			E40-0317-05	PIN CONNECTOR(2P)		
CN31			E40-3242-05	PIN CONNECTOR(5P)		
CN32,33			E23-0512-05	TERMINAL		
		*	F02-0438-04	HEAT SINK(CAP/ADDITION TYPE)		
			G02-0574-04	FLAT SPRING		
L1			L40-1011-14	SMALL FIXED INDUCTOR(10UH)		
L2			L40-3391-13	SMALL FIXED INDUCTOR(3.3UH)		
L3 ,4			L40-1021-14	SMALL FIXED INDUCTOR(100UH)		
X1		*	L78-0057-05	RESONATOR(20MHZ)		
R1 -14			RK73FB2AXXXJ	CHIP R		
R15			R92-0670-05	CHIP R 0 OHM		
R16 -74			RK73FB2AXXXJ	CHIP R		
R75			R92-0670-05	CHIP R 0 OHM		
R76 -103			RK73FB2AXXXJ	CHIP R		
R104			RD14BB2C222J	RD 2.2K J 1/6W		
R105			RK73FB2A562J	CHIP R 5.6K J 1/10W		
R106			RD14BB2C223J	RD 22K J 1/6W		
R107			RD14BB2C103J	RD 10K J 1/6W		
VR1		*	R12-3103-05	TRIMMING POT. 47K		
VR2		*	R12-1070-05	TRIMMING POT. 1K		
VR3 -5		*	R12-3100-05	TRIMMING POT. 10K		
VR6 ,7		*	R12-3103-05	TRIMMING POT. 47K		
VR8 ,9		*	R12-3100-05	TRIMMING POT. 10K		
VR10		*	R12-1077-05	TRIMMING POT. 4.7K		
VR11		*	R12-3100-05	TRIMMING POT. 10K		
VR12		*	R12-3103-05	TRIMMING POT. 47K		
VR13		*	R12-3102-05	TRIMMING POT. 33K		
W2			R92-0150-05	JUMPER REST 0 OHM		

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W6			R92-1061-05	JUMPER REST 0 OHM		
S1			S31-1411-05	SLIDE SWITCH		
S2		*	S59-4402-05	DIP SWITCH		
D1			LT8201P	DIODE		
D2		*	RLZ12B	CHIP ZENER DIODE(12V)		
D3			RLS73	CHIP DIODE		
D5		*	RLZ4.7B	CHIP ZENER DIODE(4.7V)		
D6			RLS73	CHIP DIODE		
D7			HSM88AS	CHIP DIODE		
D8		*	RLZ4.7B	CHIP ZENER DIODE(4.7V)		
D9			RLS73	CHIP DIODE		
D10 ,11			DAN202(K)	CHIP DIODE		
D12		*	RLZ15B	CHIP ZENER DIODE(15V)		
D13 -16			RLS73	CHIP DIODE		
D17			DAN202(K)	CHIP DIODE		
D18 -28			RLS73	CHIP DIODE		
D29			DAN202(K)	CHIP DIODE		
D30 -33			RLS73	CHIP DIODE		
IC1			TC4069UBF	IC(INVERTER X6)		
IC2			TC4011BF	IC(NAND X4)		
IC3 ,4			TC4066BF	IC(BILATERAL SWITCH X4)		
IC5			TC4069UBF	IC(INVERTER X6)		
IC6			TC4011BF	IC(NAND X4)		
IC7			UPC2002V	IC(OP AMP X2)		
IC8			NJM4558M	IC(OP AMP X2)		
IC9			TC40663P	IC(BILATERAL SWITCH X4)		
IC10		*	TC4538BF	IC(ONE SHOT MULTI)		
IC11			NJM4558M	IC(OP AMP X2)		
IC12			AN78N08	IC(VOLTAGE REGULATOR/ +8V)		
IC13			TC4069UBF	IC(INVERTER X6)		
IC14		*	UPD7564CS-114	IC(MICROPROCESSOR)		
IC15			TC4011BF	IC(NAND X4)		
IC16			M51951BML	IC(SYSTEM RESET)		
Q1 -3			2SC2712(Y)	CHIP TRANSISTOR		
Q4			2SK208(GR)	CHIP FET		
Q5			2SC2712(Y)	CHIP TRANSISTOR		
Q6			DTC144EK	DIGITAL TRANSISTOR		
Q7			DTC124EK	DIGITAL TRANSISTOR		
Q8			DTC144EK	DIGITAL TRANSISTOR		
Q9			DTA124EK	DIGITAL TRANSISTOR		
Q10 ,11			2SC2712(Y)	CHIP TRANSISTOR		
Q12 -17			DTC124EK	DIGITAL TRANSISTOR		
Q18			DTC144VK	DIGITAL TRANSISTOR		
Q19			DTC114TK	DIGITAL TRANSISTOR		
		*	X59-3660-00	MODULE UNIT(CNT)		
		*	X59-3670-00	MODULE UNIT(MAP)		
		*	X59-3680-00	MODULE UNIT(TRX)		
		*	X59-3720-00	MODULE UNIT(A.C)		
AT UNIT (X53-3240-00)						
C1			CC45SL2H330J	CERAMIC	33PF J	
C2 -8			CK73FB1E103K	CHIP C	0.01UF K	
C9 -11			CK73FB.EXXXK	CHIP C		
C12			CE04EW1C470M	ELECTRO	47UF 16WV	

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C13 -19			CK73FB1E103K	CHIP C	0.010UF	K		
C20			CE04EW1C470M	ELECTRO	47UF	16WV		
C21 -25			CK73FB1E103K	CHIP C	0.010UF	K		
C26			CE04EW1C470M	ELECTRO	47UF	16WV		
C27			CK73FB1E103K	CHIP C	0.010UF	K		
C28 ,29			CK73FB1H102K	CHIP C	1000PF	K		
C31 -33			CK73FB1EXXXK	CHIP C				
C35			CE04EW1C470M	ELECTRO	47UF	16WV		
C36 -39			CK73FB1EXXXK	CHIP C				
C40			CK73FB1H472K	CHIP C	4700PF	K		
C41 ,42			CK73FB1E103K	CHIP C	0.010UF	K		
C43			CK73FB1H223K	CHIP C	0.022UF	K		
C44 -46			CK73FB1E103K	CHIP C	0.010UF	K		
C101-109			CK73FB1H223K	CHIP C	0.022UF	K		
TC1			C05-003X-05	TRIMMING CAP(10PF)				
VC1 ,2			C02-0029-05	VARIABLE CAPACITOR				
A5		*	D40-0633-05	GEAR ASSY				
CN1 ,2			E04-0157-05	RF COAXIAL JACK				
CN3			E40-3239-05	PIN CONNECTOR(4P)				
CN4			E40-3240-05	PIN CONNECTOR(5P)				
CN5			E40-3238-05	PIN CONNECTOR(3P)				
CN101			E40-5066-05	PIN CONNECTOR(9P)				
A2	1M	*	F10-1401-13	SHIELDING PLATE				
A1	1N	*	F11-1142-12	SHIELDING COVER				
A3	1M	*	F11-1143-14	SHIELDING COVER A				
A4	2N	*	F11-1144-04	SHIELDING COVER B				
L1			L39-0416-05	TRIDAL COIL				
L2			L39-0415-15	TRIDAL COIL				
L3 -6			L40-1011-13	SMALL FIXED INDUCTOR(10UH)				
L7 -13			L40-1011-14	SMALL FIXED INDUCTOR(100UH)				
L14 -17			L40-1011-13	SMALL FIXED INDUCTOR(10UH)				
L101-108			L40-1011-14	SMALL FIXED INDUCTOR(100UH)				
L109		*	L34-1276-05	COIL(20TH)				
L110		*	L39-0479-05	TRIDAL COIL	7MHZ			
L111			L34-2251-05	TRIDAL COIL	3.5MHZ			
L112		*	L39-0479-05	TRIDAL COIL	1.9MHZ			
T1 ,2			L92-0103-05	TRIDAL CORE				
T110-112			L92-0117-05	TRIDAL CORE				
S	1M, 1N		N87-3006-46	BRAZIER HEAD TAPTITE SCREW				
S	1M, 2N		N86-3006-46	FLAT HEAD TAPTITE SCREW				
			R12-3447-05	TRIMMING POT.				
R1 ,2			RD14BB2E101J	RD	100	J 1/4W		
R3			RK73FB2A102J	CHIP R	1.0K	J 1/10W		
R4			RD14BB2E470J	RD	47	J 1/4W		
R5 -23			RK73FB2AXXXJ	CHIP R				
R24 ,25			RD14BB2E100J	RD	10	J 1/4W		
R26 -28			RK73FB2AXXXJ	CHIP R				
R29			RD14BB2C471J	RD	470	J 1/6W		
R30 -37			RK73FB2AXXXJ	CHIP R				
R38			RD14BB2C472J	RD	4.7K	J 1/6W		
R39 -50			RK73FB2AXXXJ	CHIP R				
VR1			R12-3126-05	TRIMMING POT.10K				

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VR2			R12-3128-05	TRIMMING POT.22K			
VR101,102		*	RK1-3435-05	POTENTIOMETER 10K			
R23 -28			R92-0629-05	CHIP R	0 OHM		
R29 -47			R92-0570-05	CHIP R	0 OHM		
R48			R92-0150-05	JUMPER REST	0 OHM		
K1			S51-2407-05	RELAY			
K101-108		*	S51-1442-05	RELAY			
M1 ,2	2L		T42-0453-05	DC MOTOR ASSY			
D1 ,2			1N60	DIODE			
D3 -8			1SS226	CHIP DIODE			
D9 -12			1S1555	CHIP DIODE			
D13			DAN202(K)	DIODE			
D101-108			1S1555	DIODE			
IC1			SN74S74N	IC			
IC2 ,3			TC4C66BP	IC(ANALOG/ DIGITAL SW)			
IC4 ,5			BA6109U2	IC(METER DRIVER)			
IC6			NJM2903S	IC(DUAL COMPALATOR)			
IC7			NJM2904S	IC(OP AMP X2)			
IC8			XEE5EP	IC			
IC9 ,10			NJM2903S	IC(DUAL COMPALATOR)			
Q1 ,2			2SC2714(Y)	CHIP TRANSISTOR			
Q3			DTC114EK	DIGITAL TRANSISTOR			
Q4			2SA1204(Y)	CHIP TRANSISTOR			
Q5 ,6			DTC114EK	DIGITAL TRANSISTOR			
Q7			2SA1204(Y)	CHIP TRANSISTOR			
Q8 -10			DTC114EK	DIGITAL TRANSISTOR			

DISPLAY UNIT (X54-3080-00)

C1			CE04EW1E470Y	ELECTRO	47UF	25WV
C2 ,3			CE04EW1H470M	ELECTRO	47UF	50WV
C4 ,5			CE04EW1A471M	ELECTRO	470UF	10WV
C6			CK73FB1E103K	CHIP C	0.010UF	K
C7 ,8			CK73FB1H103K	CHIP C	0.010UF	K
C9			CK73FB1E103K	CHIP C	0.010UF	K
C10 ,11			CK73FB1H471K	CHIP C	470PF	K
C12			CK73FB1E103K	CHIP C	0.010UF	K
C13 -17			CK73FB1H471K	CHIP C	470PF	K
C18 -33			CK73FB1E103K	CHIP C	0.010UF	K
C34 -37			CK73FB1H102K	CHIP C	1000PF	K
C38			CK73FF1E104Z	CHIP C	0.10UF	Z
C39 ,40			CC73FCH1H100D	CHIP C	10PF	D
C42 ,43			CK73FB1E103K	CHIP C	0.010UF	K
C44			CK73FB1H102K	CHIP C	1000PF	K
C45 -47			CK73FB1E103K	CHIP C	0.010UF	K
C48			CK73FF1E104Z	CHIP C	0.10UF	Z
C49			CK73FB1E103K	CHIP C	0.010UF	K
C50			CK73FF1E104Z	CHIP C	0.10UF	Z
C51			CK73FB1E103K	CHIP C	0.010UF	K
C52			CK73FF1E104Z	CHIP C	0.10UF	Z
C53			CK73FB1E103K	CHIP C	0.010UF	K
C54			CK73FF1E104Z	CHIP C	0.10UF	Z
C55 ,56			CK73FB1E103K	CHIP C	0.010UF	K
C57			CK73FF1E104Z	CHIP C	0.10UF	Z
C58			CK73FB1E103K	CHIP C	0.010UF	K

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C59 -60			CK73FB1HXXXK	CHIP C				
C61			CS1 -0&3?-05	MYLAR	39C0?F	J		
C62 ,63			CK73FB1H472K	CHIP C	4?0C??	K		
C64 ,65			CK73FB1E?C3K	CHIP C	?.?C2U?	K		
C66			CE04EW1A471M	ELECTRO	470UF	10WV		
CN1			E40-5133-05	PC CONNECTOR(15P)				
CN2 -4			E40-3237-05	PIN CONNECTOR(2P)				
CN5			E40-5034-05	PIN CONNECTOR(10P)				
CN6			E40-3243-05	PIN CONNECTOR(8P)				
CN7			E40-3241-05	PIN CONNECTOR(6P)				
		*	J19-1435-03	HOLDER				
L1			L40-1011-13	SMALL FIXED INDUCTOR(10UH)				
L2			L40-1011-14	SMALL FIXED INDUCTOR(100UH)				
L3			L40-1011-13	SMALL FIXED INDUCTOR(10UH)				
X1			L77-1382-05	CRYSTAL RESONATOR(21.0592MHZ)				
CP1			R90-0598-05	MULTI-COMP				
R1 ,2			RD14BB2C2R2J	RD	2.2	J 1/6W		
R3 -460			RK73FB2AXXXJ	CHIP R				
VR1			R12-3128-05	TRIMMING POT.22K				
W1 -3			R92-0153-05	JUMPER REST 0 OHM				
W4 ,5			R92-0579-05	CHIP R	0	OHM		
W6 -9			R92-0670-05	CHIP R	0	OHM		
W10			R92-1061-05	JUMPER REST 0 OHM				
D1			RLZJ11B	CHIP ZENER DIODE(11V)				
IC1		*	647180XCFS6JBE1	IC(SUB CPU)				
IC2 ,3		*	MB62218DPF	IC(GATE ARRAY)				
IC4		*	TC74HC138AF	IC(CHIP SELECT)				
IC5 ,6		*	TC74HC574AF	IC(LATCH)				
IC7		*	TC74HC04AF	IC(INVERTER)				
IC8		*	TC74HC00AF	IC(NAND)				
IC9		*	TC74HC175AF	IC(LATCH)				
IC10			TC4011BF	IC(NAND X4)				
Q1 -20		*	2SA1163(GR)	CHIP TRANSISTOR				
Q21		*	2SA1201(6)	CHIP TRANSISTOR				
Q22 -25		*	2SA1163(GR)	CHIP TRANSISTOR				
Q26		*	2SA1201(6,Y)	CHIP TRANSISTOR				
Q27 -42		*	2SA1163(GR)	CHIP TRANSISTOR				
Q43 -62		*	2SA1163(GR)	CHIP TRANSISTOR				
Q63 -76		*	2SA1163(GR)	CHIP TRANSISTOR				
Q77 -84			FMG1	DIGITAL TRANSISTOR				
Q85 -90		*	2SA1163(GR)	CHIP TRANSISTOR				
Q91 -93		*	2SA1163(GR)	CHIP TRANSISTOR				
Q94			FMG1	DIGITAL TRANSISTOR				
Q95 -103		*	2SA1163(GR)	CHIP TRANSISTOR				
Q104			FMG1	DIGITAL TRANSISTOR				
Q105-112		*	2SA1163(GR)	CHIP TRANSISTOR				
Q113-116		*	2SA1163(GR)	CHIP TRANSISTOR				
Q117		*	2SA1201(6)	CHIP TRANSISTOR				
Q118-133		*	2SA1163(GR)	CHIP TRANSISTOR				
Q134-137		*	2SA1163(GR)	CHIP TRANSISTOR				
V1		*	FIP25AM#2	VACUUM TUBE				
SIGNAL UNIT (X57-3380-00)								
C1 -4			CK73FB1E104Z	CHIP C	0.10UF	Z		

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C5			CK73FB1E223K	CHIP C	0.022UF	K		
C6 -29			CK73FB1EXXXZ	CHIP C				
C30			CK73EF1E474Z	CHIP C	0.47UF	Z		
C31 ,32			CK73FF1E104Z	CHIP C	0.10UF	Z		
C33 ,34			C91-1076-05	MYLAR	180PF	J		
C35			CK73FB1E103K	CHIP C	0.010UF	K		
C36			CK73FF1E104Z	CHIP C	0.10UF	Z		
C37			CC73FSL1H151J	CHIP C	150PF	J		
C38			CK73EF1E224Z	CHIP C	0.22UF	Z		
C39			CK73FF1E104Z	CHIP C	0.10UF	Z		
C40			CK73EF1E474Z	CHIP C	0.47UF	Z		
C41 ,42			CK73FF1E104Z	CHIP C	0.10UF	Z		
C43 ,44			CC73FSL1H221J	CHIP C	220PF	J		
C45 -45			CK73FB1EXXXK	CHIP C				
C47			CK73EF1E474Z	CHIP C	0.47UF	Z		
C48			CE04EW1C101Y	ELECTRO	100UF	16WV		
C49			CK73EF1C105Z	CHIP C	1.0UF	Z		
C50 -52			CK73FB1H102K	CHIP C	1000PF	K		
C53 ,54			CK73FF1E104Z	CHIP C	0.10UF	Z		
C55 ,56			CK73FB1E103K	CHIP C	0.010UF	K		
C57 -59			CK73FF1E104Z	CHIP C	0.10UF	Z		
C60			CK73EF1E474Z	CHIP C	0.47UF	Z		
C61			CK73FB1E103K	CHIP C	0.010UF	K		
C62 -64			CC73FSL1HXXXJ	CHIP C				
C65			CK73FB1E103K	CHIP C	0.010UF	K		
C66			CE04EW1H3R3M	ELECTRO	3.3UF	50WV		
C67			CK73FB1E223K	CHIP C	0.022UF	K		
C68			CE04EW1H1R0M	ELECTRO	1.0UF	50WV		
C69			CE04EW1C100M	ELECTRO	10UF	16WV		
C71			CE04EW1H2R2M	ELECTRO	2.2UF	50WV		
C72 ,73			CK73FB1E103K	CHIP C	0.010UF	K		
C74			CE04EW1C100M	ELECTRO	10UF	16WV		
C75			CK73FF1E104Z	CHIP C	0.10UF	Z		
C76			CE04EW1C100M	ELECTRO	10UF	16WV		
C77			CC73FSL1H100J	CHIP C	10PF	J		
C78			CK73FB1E223K	CHIP C	0.022UF	K		
C79			CE04EW1HR47M	ELECTRO	0.47UF	50WV		
C80 ,81			CK73FB1E223K	CHIP C	0.022UF	K		
C82 -87			CK73FF1E104Z	CHIP C	0.10UF	Z		
C88 -89			CC73FSL1HXXXJ	CHIP C				
C90 -96			CK73FF1EXXXZ	CHIP C				
C96			CK73FB1E153K	CHIP C	0.015UF	K		
C99			CK73FB1H182K	CHIP C	1800PF	K		
C100			CC73FCH1H330J	CHIP C	33PF	J		
C101			CK73FB1H222K	CHIP C	2200PF	K		
C102			CC73FSL1H470J	CHIP C	47PF	J		
C103			CK73FB1H561K	CHIP C	560PF	K		
C104,105			CE04EW1C100M	ELECTRO	10UF	16WV		
C106			CK73FF1E104Z	CHIP C	0.10UF	Z		
C107			CK73FB1H102K	CHIP C	1000PF	K		
C108			CE04EW1C330M	ELECTRO	33UF	16WV		
C109			CE04EW1H2R2M	ELECTRO	2.2UF	50WV		
C110-111			CC73FSL1HXXXJ	CHIP C				
C112			CE04EW1C330M	ELECTRO	33UF	16WV		
C113			CE04EW1H1R0M	ELECTRO	1.0UF	50WV		

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C114			CK73FB1E104Z	CHIP C	0.10UF Z		
C115-116			CC73FSL1HXXXJ	CHIP C			
C117-120			CK73FB1E104Z	CHIP C	0.10UF Z		
C121			CK73FB1E334K	CHIP C	0.33UF K		
C122-124			CK73FB1E104Z	CHIP C	0.10UF Z		
C125			CE04EW1C100*	ELECTR6	10UF 16WV		
C126			CE04EW1E4R7M	ELECTR9	4.7UF 25WV		
C127			CK73FB1H102K	CHIP C	1000PF K		
C128			CE04EW1H2R2M	ELECTR9	2.2UF 50WV		
C129			CC73FSL1H101J	CHIP C	100PF J		
C130-137			CK73FF1E104Z	CHIP C	0.10UF Z		
C138			CC73FCH1H330J	CHIP C	33PF J		
C139-140			CK73FB1HXXXK	CHIP C			
C141			CE04EW1C100M	ELECTR6	10UF 16WV		
C142.143			CK73FF1E104Z	CHIP C	0.10UF Z		
C144			CC73FSL1H100J	CHIP C	10CPF J		
C145			CE04EW1C100M	ELECTR9	10UF 16WV		
C146			CE04EW1H1R0M	ELECTR9	1.0UF 50WV		
C147			CE04EW1E4R7*	ELECTR6	4.7UF 25WV		
C148			CE04EW1C100M	ELECTR9	10UF 16WV		
C149			CC73FSL1H101J	CHIP C	100PF J		
C150			CK73FB1E223K	CHIP C	0.022UF K		
C151			CE04EW1C220*	ELECTR6	22UF 16WV		
C152.153			CE04EW1H1R0M	ELECTR9	1.0UF 50WV		
C154-155			CK73FB1HXXXK	CHIP C			
C156			CE04EW1C470M	ELECTR9	47UF 16WV		
C157			CE04EW1E4R7*	ELECTR6	4.7UF 25WV		
C158			CK73FB1E103K	CHIP C	0.010UF K		
C159			CE04EW1C100M	ELECTR6	10UF 16WV		
C160			CK73FB1H102K	CHIP C	1000PF K		
C161			CK73FF1E104Z	CHIP C	0.10UF Z		
C162			CC73FSL1H151J	CHIP C	150PF J		
C163			CK73FB1E103K	CHIP C	0.010UF K		
C164			CC73FSL1H151J	CHIP C	150PF J		
C165			CK73FF1E104Z	CHIP C	0.10UF Z		
C166			CK73FB1E103K	CHIP C	0.010UF K		
C167-174			CK73FF1EXXXZ	CHIP C			
C175			CK73FB2E103K	CHIP C	0.010UF K		
C176-177			CK73FB1HXXXK	CHIP C			
C178-181			CK73FF1E104Z	CHIP C	0.10UF Z		
C182			CC73FSL1H330J	CHIP C	33CPF J		
C183			CK73FF1E104Z	CHIP C	0.10UF Z		
C184			CK73FB1E103K	CHIP C	0.010UF K		
C185			CC73FSL1H151J	CHIP C	150PF J		
C186-191			CK73FF1E104Z	CHIP C	0.10UF Z		
C192			CC73FCH1H150J	CHIP C	15PF J		
C193			CC73FSL1H561J	CHIP C	560PF J		
C194-198			CK73FF1E104Z	CHIP C	0.10UF Z		
C199-201			CK73FB1HXXXK	CHIP C			
C202-204			CK73FF1E104Z	CHIP C	0.10UF Z		
C205			CE04EW1H010*	ELECTR9	1.0UF 50WV		
C206			CK73FB1H102K	CHIP C	1000PF K		
C207			CK73FF1E104Z	CHIP C	0.10UF Z		
C208			CK73FB1H392K	CHIP C	3900PF K		
C209			CC73FSL1H121J	CHIP C	120PF J		

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C210			CK73FF1E104Z	CHIP C	0.1UF	Z		
C211			CE04EW1C220*	ELECTRO	22UF	16WV		
C212			CE04EW1C330*	ELECTRO	33UF	16WV		
C213			CE04EW1H2R2M	ELECTRO	2.2UF	50WV		
C214			CE04EW1H010M	ELECTRO	1.0UF	50WV		
C215-216			CK73FF1EXXX2	CHIP C				
C217			CK45B2H102K	CERAMIC	1000PF	K		
C218			CE04WW1C100M	ELECTRO	10UF	16WV		
C219			CK45B1H472K	CERAMIC	4700PF	K		
VC1			C05-2315-05	TRIMMING C4P 6CPF				
CN1 ,2			E40-5239-05	FPC CONNECTOR(14P)				
CN3			E40-3239-05	PIN CONNECTOR(4P)				
CN4 ,5			E40-3237-05	PIN CONNECTOR(2P)				
CN6			E40-3239-05	PIN CONNECTOR(4P)				
CN7			E40-3240-05	PIN CONNECTOR(5P)				
CN8			E40-3238-05	PIN CONNECTOR(3P)				
CN9			E40-5038-05	FPC CONNECTOR(14P)				
CN10			E40-5057-05	PIN CONNECTOR(10P)				
CN11			E40-3237-05	PIN CONNECTOR(2P)				
CN12			E40-3242-05	PIN CONNECTOR(7P)				
CN13			E40-3243-05	PIN CONNECTOR(8P)				
CN14			E40-5066-05	PIN CONNECTOR(5P)				
CN15			E40-3237-05	PIN CONNECTOR(2P)				
CN16			E40-3239-05	PIN CONNECTOR(4P)				
CN17			E40-3237-05	PIN CONNECTOR(2P)				
CN18			E40-3238-05	PIN CONNECTOR(3P)				
CN19-24			E40-5059-05	PIN CONNECTOR(5P)				
TP1			E23-0464-05	TERMINAL				
W1		*	E31-6079-05	CONNECTING WIRE				
			E32-0761-04	SOLD				
CF1			L72-0319-05	CERAMIC FILTER(AM)				
CF2			L72-0315-05	CERAMIC FILTER(12K)				
CF3			L72-0319-05	CERAMIC FILTER(AM)				
CF4			L79-0446-05	CERAMIC DISCRI				
CF5			L72-0319-05	CERAMIC FILTER(AM)				
L1			L40-1021-14	SMALL FIXED INDUCTOR(1MH)				
L2			L34-2121-05	TUNING COIL				
L3			L40-1021-14	SMALL FIXED INDUCTOR(1MH)				
L4			L34-2124-05	TUNING COIL				
L5			L32-0650-15	OSCILLATING COIL				
L6			L34-2122-05	TUNING COIL				
L7			L34-2128-15	TUNING COIL				
L8			L40-2211-14	SMALL FIXED INDUCTOR(220UH)				
L9			L40-1021-14	SMALL FIXED INDUCTOR(1MH)				
L10 -12			L34-2124-05	TUNING COIL				
L13 -15			L40-1021-14	SMALL FIXED INDUCTOR(1MH)				
L16			L34-2124-05	TUNING COIL				
L17			L40-1021-14	SMALL FIXED INDUCTOR(1MH)				
L18			L34-2124-05	TUNING COIL				
L19			L40-1021-14	SMALL FIXED INDUCTOR(1MH)				
L20			L40-3325-04	SMALL FIXED INDUCTOR(3.3YH)				
L21			L40-1021-14	SMALL FIXED INDUCTOR(1MH)				
L22			L34-2124-05	TUNING COIL				
L23			L40-1021-14	SMALL FIXED INDUCTOR(1YH)				

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L24 ,25			L34-2,24-05	TUNING COIL		
L26			L30-0199-05	JPT		
L27			L40-2215-25	SMALL FIXED INDUCTOR(220uH)		
L28			L30-0503-05	JPT		
R1 -252			RK73FB2AX3XJ	CHIP R		
R283			RK73GB2B682J	CHIP R 6.8K J 1/8W		
VR1			R12-3126-05	TRIMMING POT.10K		
VR2			R12-3132-05	TRIMMING POT.47K		
VR3			R12-3126-05	TRIMMING POT.22K		
VR4			R12-3126-05	TRIMMING POT.10K		
VR5		*	R12-6218-05	TRIMMING POT.470K		
VR6 -8			R12-3132-05	TRIMMING POT.47K		
VR9			R12-0104-05	TRIMMING POT.22K		
VR10			R12-3130-05	TRIMMING POT.33K		
VR11			R12-3128-05	TRIMMING POT.22K		
W2			R92-0670-05	CHIP R 0 OHM		
W3			R92-0679-05	CHIP R 0 OHM		
W4			R92-1261-25	JUMPER WIRE 0 OHM		
W5			R92-0679-05	CHIP R 0 OHM		
D1 -14			RLS135	CHIP DIODE		
D15			1SV149A	DIODE		
D16 -19			1N60	DIODE		
D20		*	RLZ5.1A	CHIP ZENER DIODE(5.1V)		
D21 ,22			RLS73	CHIP DIODE		
D23			HSM88AS	CHIP DIODE		
D24			DAN222(K)	CHIP DIODE		
D25			RLZJ3.6B	CHIP ZENER DIODE(3.6V)		
D26 -30			RLS73	CHIP DIODE		
D31			HSM88AS	CHIP DIODE		
D32 -35			RLS73	CHIP DIODE		
D36 ,37			DAN202(K)	CHIP DIODE		
D38 ,39			RLS73	CHIP DIODE		
D40			DAN202(K)	CHIP DIODE		
D41			MD4979,-34	DIODE		
D42			HSM88AS	CHIP DIODE		
D43 ,44			RLS73	CHIP DIODE		
D45 -48			RLS135	CHIP DIODE		
D49 -51			1N60	CHIP DIODE		
D52			RLS73	CHIP DIODE		
D53			DAN202(K)	CHIP DIODE		
D54 ,55			RLS73	CHIP DIODE		
D56			DAN202(K)	CHIP DIODE		
D57			RLZJ12B	ZENER DIODE(12V)		
D59			DAN222(K)	CHIP DIODE		
D60 -64			RLS135	CHIP DIODE		
D65			RLS73	CHIP DIODE		
D66 ,67			HSM88AS	CHIP DIODE		
D68 -70		*	RLS73	CHIP DIODE		
D71			RLZJ9.1C	CHIP ZENER DIODE(9.1V)		
D72 ,73			RLS73	CHIP DIODE		
D74			1SS133	DIODE		
IC1			TC4066BF	IC(BILATERAL SWITCH X4)		
IC2			NJM2903V	IC(COMPARATOR X2)		
IC3			UPC1158-2	IC(AUDIO AMP)		

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IC4			TC4056BF	IC(BILATERAL SWITCH X4)		
IC5			TA31227F	IC(FM IF)		
IC6 ,7			UPC577H	IC(FM IF AMP)		
IC8			TC9174P	IC(CMOS I/O)		
IC9			TA7142P	IC(RF AMP)		
IC10			TC4066BF	IC(BILATERAL SWITCH X4)		
Q1 -4			3SK131(M)	CHIP FET		
Q5 -10			2SC2712(Y)	CHIP TRANSISTOR		
Q11		*	2SK210(Y)	CHIP FET		
Q12			2SC2712(Y)	CHIP TRANSISTOR		
Q13			2SA1162(Y)	CHIP TRANSISTOR		
Q14			3SK131(M)	CHIP FET		
Q15 ,16			2SC2712(Y)	CHIP TRANSISTOR		
Q17			2SK210(GR)	CHIP FET		
Q18			2SA1162(Y)	CHIP TRANSISTOR		
Q19 ,20			2SC2712(Y)	CHIP TRANSISTOR		
Q21			3SK131(M)	CHIP FET		
Q22			2SC2712(Y)	CHIP TRANSISTOR		
Q25 ,26			2SC2712(Y)	CHIP TRANSISTOR		
Q27			3SK131(M)	CHIP FET		
Q28 ,29			2SC2712(Y)	CHIP TRANSISTOR		
Q30			3SK131(M)	CHIP FET		
Q33 ,34			2SC2712(Y)	CHIP TRANSISTOR		
Q35 ,36			DTC124EK	DIGITAL TRANSISTOR		
Q37			DTA124EK	DIGITAL TRANSISTOR		
Q38			DTA114EK	DIGITAL TRANSISTOR		
Q39 ,40			DTC124EK	DIGITAL TRANSISTOR		
Q41 ,42			DTA124EK	DIGITAL TRANSISTOR		
Q43 -45			DTC124EK	DIGITAL TRANSISTOR		
Q46 -49			DTA124EK	DIGITAL TRANSISTOR		
Q50 ,51			DTC124EK	DIGITAL TRANSISTOR		
Q52			DTA124EK	DIGITAL TRANSISTOR		
Q53 ,54			DTC124EK	DIGITAL TRANSISTOR		
Q55 ,56			DTA124EK	DIGITAL TRANSISTOR		
Q57			DTC124EK	DIGITAL TRANSISTOR		
Q58			DTA124EK	DIGITAL TRANSISTOR		
Q59			DTC124EK	DIGITAL TRANSISTOR		
Q60 -63			DTA124EK	DIGITAL TRANSISTOR		
Q64			DTC124EK	DIGITAL TRANSISTOR		
Q65			DTA124EK	DIGITAL TRANSISTOR		
Q66 ,67			DTC124EK	DIGITAL TRANSISTOR		
TH1 ,2			1E2-502-2	THERMISTOR 5K		
TH3			1E2-503-2	THERMISTOR 50K		
TH4			1E2-101-2	THERMISTOR 100		
TH5			1E2-103-2	THERMISTOR 10K		
TH6			1E2-302-2	THERMISTOR 3K		

VCO2 (X58-3390-03)

C1			CK73FB1H102K	CHIP C	1000PF	K
C2			CC73FSL1H101J	CHIP C	100PF	J
C3 -7			CC73FCH1HXXXD	CHIP C		
C8 ,9			CK73FB1H102K	CHIP C	1000PF	K
C10			CC73FCH1H010C	CHIP C	1PF	C
C11			CK73FB1H102K	CHIP C	1000PF	K
*C1			CDS-2349-05	TRIMMING CAP	10PF	

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			B42-2437-04	LABEL		
Q1			2SK508NV(K52)	CHIP FET		
Q2			2SC2714(Y)	CHIP TRANSISTOR		
L1			L34-0690-05	CHOKE COIL(3.3U-)		
L2			L34-2353-05	COIL		
D1			1SV164	VARI-CAP DIODE		
VCO (X58-3630-XX)						
C1			CK73FS1H102K	CHIP C 1000PF K	AF	
C1			CK73FB1E103K	CHIP C 0.010UF K	PLL	
C2 -6			CC73FCH1HXXXJ	CHIP C		
C7 ,8			CK73FB1H102K	CHIP C 1000PF K	AF	
C7 ,8			CK73FB1E103K	CHIP C 0.01UF K	PLL	
C9 -13			CC73FCH1HXXXJ	CHIP C		
C14 ,15			CK73FS1H102K	CHIP C 1000PF K	AF	
C14 ,15			CK73FB1E103K	CHIP C 0.01UF K	PLL	
C16 -20			CC73FCH1HXXXJ	CHIP C		
C21 ,22			CK73FS1H102K	CHIP C 1000PF K	AF	
C21 ,22			CK73FB1E103K	CHIP C 0.01UF K	PLL	
C23 -27			CC73FCH1HXXXJ	CHIP C		
C28			CK73FB1H102K	CHIP C 1000PF K	AF	
C28			CK73FB1E103K	CHIP C 0.01UF K	PLL	
C29 ,30			C91-0119-05	CERAMIC 0.047UF K		
TC1 ,2			C05-0349-05	TRIMMING CAP 10PF		
TC3 ,4			C05-0348-05	TRIMMING CAP 6PF	AF	
TC3 ,4		*	C05-0439-05	TRIMMING CAP 10PF	PLL	
W1			E40-5158-05	PIN CONNECTOR 4P		
W2			E40-5159-05	PIN CONNECTOR 7P		
A1		×	F11-1140-04	SHIELDING COVER		
A2		×	F11-1141-04	SHIELDING COVER		
L1			L33-0664-05	CHOKE COIL 2.7UH		
L2		*	L34-2354-05	COIL (VCO)	AF	
L2		×	L34-2355-05	COIL (VCO)	PLL	
L3			L40-4791-19	SMALL FIXED INDUCTOR 4.7UH		
L4			L33-0664-05	CHOKE COIL 2.7UH		
L5		*	L34-2354-05	COIL (VCO)	AF	
L5		×	L34-2355-05	COIL (VCO)	PLL	
L6			L40-4791-19	SMALL FIXED INDUCTOR 4.7UH		
L7			L33-0664-05	CHOKE COIL 2.7UH		
L8		×	L34-2354-05	COIL (VCO)	AF	
L8		*	L34-2356-05	COIL (VCO)	PLL	
L9			L40-4791-19	SMALL FIXED INDUCTOR 4.7UH		
L10			L33-0664-05	CHOKE COIL 2.7UH		
L11		×	L34-2354-05	COIL (VCO)	AF	
L11		×	L34-2357-05	COIL (VCO)	PLL	
L12			L40-4791-19	SMALL FIXED INDUCTOR 4.7UH		
			X30-2604-41	PAN HEAD MACHINE SCREW		
R1 -20			RK73FB2AXXXJ	CHIP R		
W3 ,4			R92-0670-05	CHIP R 0 OHM		
D1			1SV164	CHIP DIODE		

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D2			RLS13E	CHIP DIODE				
D3			1SV166	CHIP DIODE				
D4			RLS13E	CHIP DIODE				
D5			1SV166	CHIP DIODE				
D6			RLS135	CHIP DIODE				
D7			1SV166	CHIP DIODE				
D8			RLS135	CHIP DIODE				
Q1 -4			2SK210(GR)	CHIP FET				
VOX (X59-1080-01)								
C2			CK73FB1H223K	CHIP C	0.022UF	K		
C1			CK73FB1H102K	CHIP C	1000PF	K		
			E23-047[-05	TERMINAL				
R2 -3			RK73FB2AXXXJ	CHIP R				
R1 -3			R92-0670-05	CHIP R	0 OHM			
D1 ,2			DAP222(K)	CHIP DIODE				
IC1			NJM2904V	IC(OP AMP X2)				
IC2			TC40C18F	IC(NOR X5)				
Q1			2SC2712(Y)	CHIP TRANSISTOR				
FM MIC AMP (X59-3000-03)								
C1 -3			CC73FCH1HXXXJ	CHIP C				
C4			CK73FB1H102K	CHIP C	1000PF	K		
C5			CK73FB1E223K	CHIP C	0.022UF	K		
C2			CK73FB1H561K	CHIP C	560PF	K		
			E23-047[-05	TERMINAL				
R1 -2			RK73FB2AXXXJ	CHIP R				
J1			R92-0670-05	CHIP R	0 OHM			
IC1			NJM4558M	IC(OP AMP X2)				
Q1			2SC2712(Y)	CHIP TRANSISTOR				
NB2 (X59-3350-00)								
C3			CK73EF1E474Z	CHIP C	0.47UF	Z		
C2 -1			CK73FB1HXXXK	CHIP C				
			E23-047[-05	TERMINAL				
1 -3			RK73FB2AXXXJ	CHIP R				
M1 -3			R92-0670-05	CHIP R	0 OHM			
Q1			DTC114EK	DIGITAL TRANSISTOR				
IC1			TC40U18F	IC(XAND X4)				
VCO1 (X59-3440-00)								
C1			CC73FCH1H080D	CHIP C	8.0PF	D		
C2			CK73FB1H102K	CHIP C	1000PF	K		
C3			CC73FCH1H3R0C	CHIP C	3.0PF	C		
C4			CK73FB1H103K	CHIP C	0.010UF	K		
			E23-047[-05	TERMINAL				
L1			L40-1011-46	SMALL FIXED INDUCTOR				
R1 -7			RK73FB2AXXXJ	CHIP R				
Q1			2SK210(GR)	CHIP FET				
Q2			2SC2714(Y)	CHIP TRANSISTOR				

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LPF (X59-3450-XX)							
C1			CK73FB1H103K	CHIP C	0.010UF K		
			E23-0471-05	TERMINAL			
R1 -4			RK73FB2AXXXJ	CHIP R			
Q1 -3		×	2SC3324(G)	CHIP TRANSISTOR			
MKR (X59-3640-00)							
C2			CC73FCH1H100D	CHIP C	10PF D		
C3 ,4			CK73FF1E104Z	CHIP C	0.10UF Z		
			E23-0471-05	TERMINAL			
R1 -3			RK73FB2AXXXJ	CHIP R			
W1 ,2			RS2-0670-05	CHIP R	0 OHM		
D1			DA204K	CHIP DIODE			
D2			RLS73	CHIP DIODE			
IC1		×	TC40103F	IC(D FLIP-FLOP X2)			
SFT (X59-3650-00)							
			E23-0471-05	TERMINAL			
W1 -3			RS2-0670-05	CHIP R	0 OHM		
D1 -5			DAN202(K)	CHIP DIODE			
D7			DAP202(K)	CHIP DIODE			
D6			RLS73	CHIP DIODE			
D8 ,9			RLS73	CHIP DIODE			
CWT (X59-3660-00)							
C201			CK73FB1E473K	CHIP C	0.047UF K		
C202			CK73FF1E104Z	CHIP C	0.10UF Z		
			E23-0471-05	TERMINAL			
R201-206			RK73FB2AXXXJ	CHIP R			
W201,202			RS2-0670-05	CHIP R	0 OHM		
D201,202			RLS73	CHIP DIODE			
D203		×	RLZJ3.6B	CHIP ZENER DIODE(3.6V)			
D204		×	RLZJ4.7B	CHIP ZENER DIODE(4.7V)			
Q201			2SA1624(Y)	CHIP TRANSISTOR			
Q202			DTA144EK	DIGITAL TRANSISTOR			
Q203,204			DTC144EK	DIGITAL TRANSISTOR			
Q205			DTA144EK	DIGITAL TRANSISTOR			
Q206			DTC144EK	DIGITAL TRANSISTOR			
Q207			DTA144EK	DIGITAL TRANSISTOR			
Q208			DTC114TK	DIGITAL TRANSISTOR			
MAP (X59-3670-00)							
C301			CK73FB1E473K	CHIP C	0.047UF K		
			E23-0471-05	TERMINAL			
R301-310			RK73FB2AXXXJ	CHIP R			
IC301			NJM4558M	IC(DP A/P X2)			
TRX (X59-3680-00)							
			E23-0471-05	TERMINAL			

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Ref. No. 参照番号	Address 位置	New Parts F	Parts No. 部品番号	Description 部品名／規格		Destination 仕向	Remarks 備考
R151-156			RK73FB2AXXXJ	CHIP R			
Q151,152			2SA1204(Y)	CHIP TRANSISTOR			
Q153-155			DTC144E	DIGITAL TRANSISTOR			
ALC (X59-3700-00)							
C251			CK73FB1E473M	CHIP C	0.047UF M		
C252-253			CK73FB1HXXXK	CHIP C			
			E23-0471-05	TERMINAL			
R251-257			RK73FB2AXXXJ	CHIP R			
W251			R92-0670-05	CHIP R	0 OHM		
D251			RLS73	CHIP DIODE			
D252		*	RLZJ12B	CHIP ZENER DIODE(12V)			
Q251			2SC2712(Y)	CHIP TRANSISTOR			
Q252			DTC144EK	DIGITAL TRANSISTOR			
Q253			DTA144EK	DIGITAL TRANSISTOR			
Q254,255			DTC144EK	DIGITAL TRANSISTOR			
MIC AMP (X59-3710-00)							
C251			CK73FB1C103Z	CHIP C	0.010UF Z		
C252			CC73FCH1H101J	CHIP C	100PF J		
C253			CK73EF1C105Z	CHIP C	1.0UF Z		
C254			CC73FCH1H101J	CHIP C	100PF J		
C255			CK73FB1H102K	CHIP C	1000PF K		
			E23-0471-05	TERMINAL			
R251-259			RK73FB2AXXXJ	CHIP R			
R260,261			R92-0671-05	CHIP R	0 OHM		
D251			DAN222(K)	CHIP DIODE			
Q251			2SC3324(G)	CHIP TRANSISTOR			
Q252,253			DTA114EK	DIGITAL TRANSISTOR			
Q254			DTC114TK	DIGITAL TRANSISTOR			
Q255			DTC114EK	DIGITAL TRANSISTOR			
FILTER UNIT (X51-3070-00) : SD							
C1 ,2			CK45F1H103Z	CERAMIC	0.010UF Z		
CN1 ,2			E40-0517-05	PIN CONNECTOR			
XF1			L71-0292-05	CRYSTAL FILTER(YG-455S-1)			
FILTER UNIT (X51-3080-00) : SD							
C1 ,2			CK45F1H103Z	CERAMIC	0.010UF Z		
CN1 ,2			E40-0517-05	PIN CONNECTOR			
XF1			L71-0239-25	CRYSTAL FILTER(YG-456-CN1)			
DSP UNIT (X53-3260-00) : SD							
		*	B42-3377-04	LABEL			
C1 ,2			CE04W1E331M	ERECTR	330UF 25WV		
C3 ,4			CK73FB1H223K	CHIP C	0.022UF K		
C5 ,6			CK73FB1H102K	CHIP C	1000PF K		
C7 ,8			CK73EF1E474Z	CHIP C	0.47UF Z		
C9 -15			CE04W1E221M	ERECTR	220UF 25WV		
C17			C90-2045-05	ERECTR	2.2UF 25WV		
C18 ,19			CE04W1E220M	ERECTR	22UF 25WV		

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C20 -22			CK73FB1E223K	CHIP C	0.022UF K		
C23			CE04EW1E220M	ELECTRO	22UF 25WV		
C24			C92-2045-05	ERECTRO	2.2UF 25WV		
C25			CE04EW1E220M	ELECTRO	22UF 25WV		
C26			C92-2045-05	ERECTRO	2.2UF 25WV		
C27 ,28			CE04EW1E101M	ELECTRO	100UF 25WV		
C29 -31			CK73FB1HXXXK	CHIP C			
C32 ,33			C90-2045-05	ELECTRO	2.2UF 25WV		
C33 -36			CK73FB1E223K	CHIP C	0.022UF K		
C40 ,41			CC73FSL1H101J	CHIP C	100PF J		
C42 -45			CK73EB1E563K	CHIP C	0.056UF K		
C46 -50			CC73FCH1H220J	CHIP C	22PF J		
C51 ,52			CC73FSL1H221J	CHIP C	220PF J		
C53			CC73FCH1H102J	CHIP C	1000PF J		
C54			C92-0004-05	CHIP-TAN	1UF 16WV		
C55			CE04EW1H3R3M	ELECTRO	3.3UF 50WV		
C56			C90-2040-05	ERECTRO	2.2UF 25WV		
C57			CE04EW1H3R3M	ELECTRO	3.3UF 50WV		
C58			C92-0004-05	CHIP-TAN	1UF 16WV		
C59 -62			CC73FSL1HXXXJ	CHIP C			
C64			CK73FB1H153K	CHIP C	0.015UF K		
C65 ,66			CK73FB1E223K	CHIP C	0.022UF K		
C67			CC73FSL1H101J	CHIP C	100PF J		
C68 -73			CK73FB1E223K	CHIP C	0.022UF K		
C74 -75			CC73FSL1HXXXJ	CHIP C			
C76			CC73FCH1H102J	CHIP C	1000PF J		
C77			CK73FB1E223K	CHIP C	0.022UF K		
C78			C92-0004-05	CHIP-TAN	1UF 16WV		
C90 ,91			CK73FB1H102K	CHIP C	1000PF K		
C92			CK73FB1E223K	CHIP C	0.022UF K		
C93 -96			CC73FSL1H101J	CHIP C	100PF J		
C200			CE04EW1A221M	ELECTRO	220UF 10WV		
C201			CK73FB1E223K	CHIP C	0.022UF K		
C202-208			CC73FSL1H101J	CHIP C	100PF J		
C209			CK73FF1E104Z	CHIP C	0.1UF Z		
C210			CK73EB1E563K	CHIP C	0.056UF K		
C211			CK73FB1H102K	CHIP C	1000PF K		
C212,213			CC73FCH1H100D	CHIP C	10PF D		
C214-222			CK73FB1E221K	CHIP C	220PF K		
C224			CK73FF1E104Z	CHIP C	0.1UF Z		
C225-228			CK73FB1E223K	CHIP C	0.022UF K		
C229			CE04EW1C470M	ELECTRO	47UF 16WV		
C230,231			CK73FB1E223K	CHIP C	0.022UF K		
C232-234			CC73FSL1H101J	CHIP C	100PF J		
C235,236			CK73FB1H220K	CHIP C	22PF K		
C237			CK73FB1E223K	CHIP C	0.022UF K		
C238			CK73FF1E104Z	CHIP C	0.1UF Z		
C239			CE04EW1E101M	ELECTRO	100UF M		
C240			CK73EB1E683K	CHIP C	0.068 K		
C241			CK73FB1H153K	CHIP C	0.015UF K		
C242			CE04EW1C470Y	CHIP C	47UF 16WV		
C243			CK73EB1E563K	CHIP C	0.056UF K		
C244			CK73FB1H562K	CHIP C	5600PF K		
C245			CE04EW1C470M	ELECTRO	47UF 16WV		
C246			CK73FB1H220K	CHIP C	22PF K		

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C247-249			CC73FCH1HXXXJ	CHIP C			
C250			CC73FSL1H470J	CHIP C	47PF J		
C251			CC73FCH1H3R0C	CHIP C	3.0PF C		
C252-254			CK73FB1HXXXK	CHIP C			
C255			CE04EW1E101*	ELECTRO	100UF 25WV		
C256			CK73FB1H153K	CHIP C	0.015UF K		
C257			CE04EW1C470*	ELECTRO	47UF 16WV		
C258-263			CK73FB1HXXXK	CHIP C			
C264,265			CC73FSL1H101J	CHIP C	100PF J		
C266			CK73FB1H221K	CHIP C	220PF K		
C267-271			CC73FSL1H101J	CHIP C	100PF J		
		*	E31-6066-05	CONNECTING WIRE			
			E31-6078-05	CONNECTING WIRE			
CN1			E40-3243-05	PIN CONNECTOR(6P)			
CN2			E40-3239-05	PIN CONNECTOR(4P)			
CN3			E40-3237-05	PIN CONNECTOR(2P)			
CN4 ,5			E40-5135-05	PIN CONNECTOR(20P)			
CN6			E40-5066-05	PIN CONNECTOR(9P)			
CN7			E40-3243-05	PIN CONNECTOR(6P)			
CN8			E52-2218-05	IC SOCKET(40P)			
TP1 -3			E23-0464-05	TERMINAL			
TP5			E40-0211-05	PIN CONNECTOR			
TP6			E23-0464-05	TERMINAL			
301	3B		F01-0972-02	HEAT SINK			
302	3B	*	F10-1406-03	SHIELDING PLATE			
303	3B		G02-0574-04	FLAT SPRING			
304	3B		J21-4260-04	MOUNTING HARDWARE			
CF1		*	L72-0335-05	CERAMIC FILTER			
L1 ,2		*	L40-1025-29	SMALL FIXED INDUCTOR(10UH)			
L9		*	L40-1225-29	SMALL FIXED INDUCTOR(120UH)			
L10			L40-1021-48	SMALL FIXED INDUCTOR(10UH)			
L11			L40-1011-48	SMALL FIXED INDUCTOR(100UH)			
L12			L32-0198-05	OSCILLATING COIL(X06)			
L13			L40-1011-48	SMALL FIXED INDUCTOR(100UH)			
X1		*	L77-1408-05	CRYSTAL RESONATOR(25MHZ)			
Y	3B		N30-2606-46	PAN HEAD MACHINE SCREW			
J	3B		N67-2606-46	BRAZIER HEAD TAPTITE SCREW			
R1 -236			RK73FB2AXXXJ	CHIP R			
VR1			R12-3126-05	TRIMMING POTENTIOMETER			
S1 .2		*	S59-0439-05	DIP SWITCH			
S3		*	S59-4401-05	DIP SWITCH			
IC15			UPC78M05HF	IC			
IC16			UPC79M05HF	IC			
IC32			UPD65012GF-3B0	IC			
D1			RD3.9M-B2	CHIP ZENER DIODE(3.9V)			
D2			1SS226	CHIP DIODE			

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C3			.BS272	DIODE		
C4			1SV166	DIODE		
IC1 ,2		×	MC74HC4052F	IC		
IC3		×	YC74HC4053F	IC		
IC4 ,5			NJM4558Y	IC(DP AYP X2)		
IC6			XIY456CM	IC(SP 4MP X2)		
IC7 -9			NJM4558Y	IC(DP AYP X2)		
IC10 ,11		×	XIY072BM	IC		
IC12		×	PCM384P	IC		
IC13		×	YM74HCT30Y	IC		
IC14			TC74HC74AF	IC		
IC17		×	PCM56P	IC(D4 CONVERTER)		
IC18		×	MC74HC4053F	IC		
IC19		×	LM6361M	IC		
IC20			NJM4558Y	IC(DP AYP X2)		
IC21		×	YC74HC4053F	IC		
IC31		×	TYS12CB1SJJBC1	IC		
IC33			S-8054ALR-L1	IC(VOLTAGE DETECTOR)		
IC34			CX-7925B	IC(DIGITAL SELECT PLL)		
IC35			NJM78L08UA	IC(VOLTAGE REGULATOR/+8V)		
IC36		×	MY74HCT20Y	IC		
Q1			2SK508(K52)	CHIP FET		
Q2 -6			2SC2412K(R)	CHIP TRANSISTOR		
Q11			DTC144WK	DIGITAL TRANSISTOR		
Q12			2SC2714(Y)	CHIP TRANSISTOR		
Q13			2SK210(GR)	CHIP FET		
Q14 -16			2SC2714	CHIP TRANSISTOR		
Q17 -19			2SC3324(G)	CHIP TRANSISTOR		

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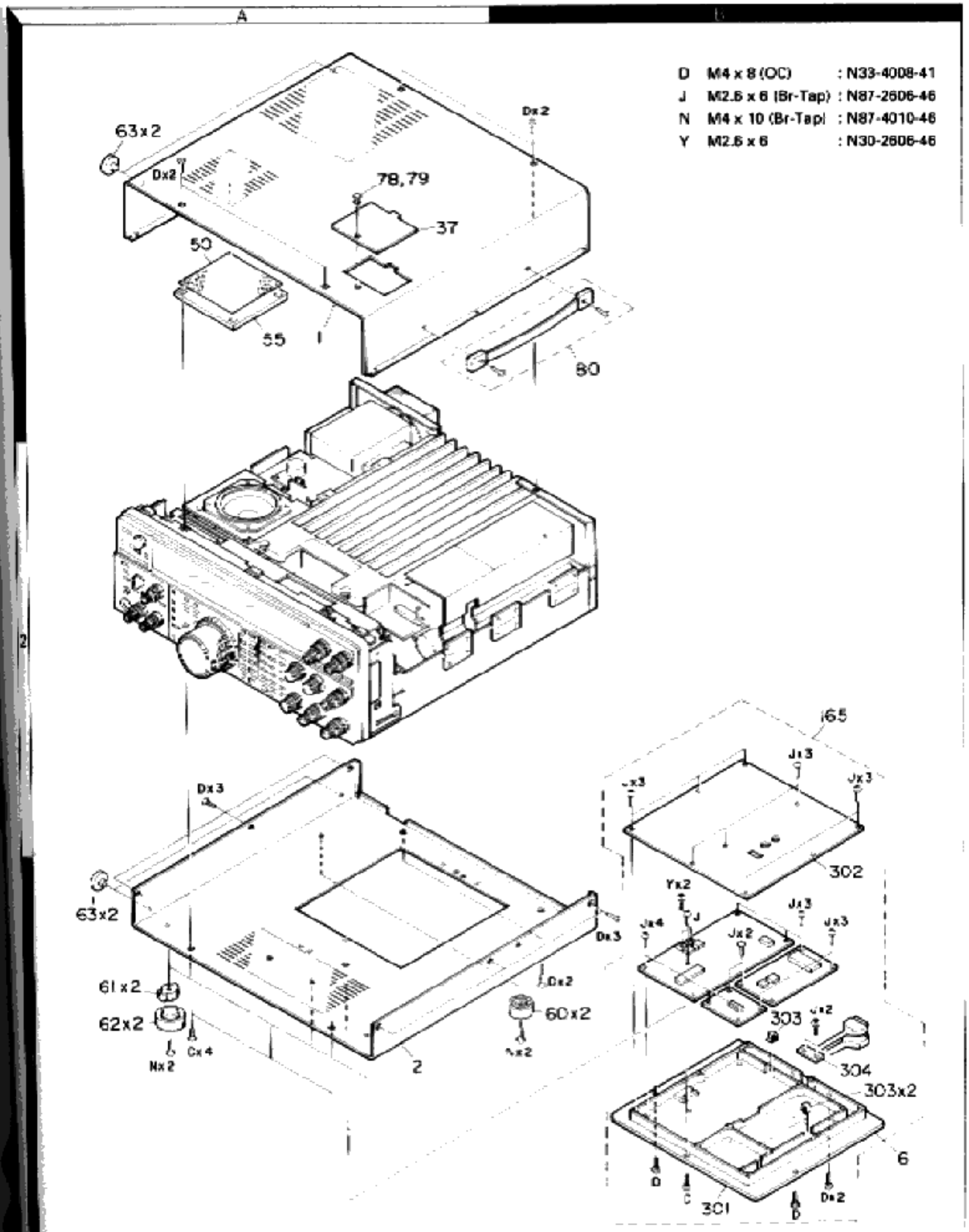
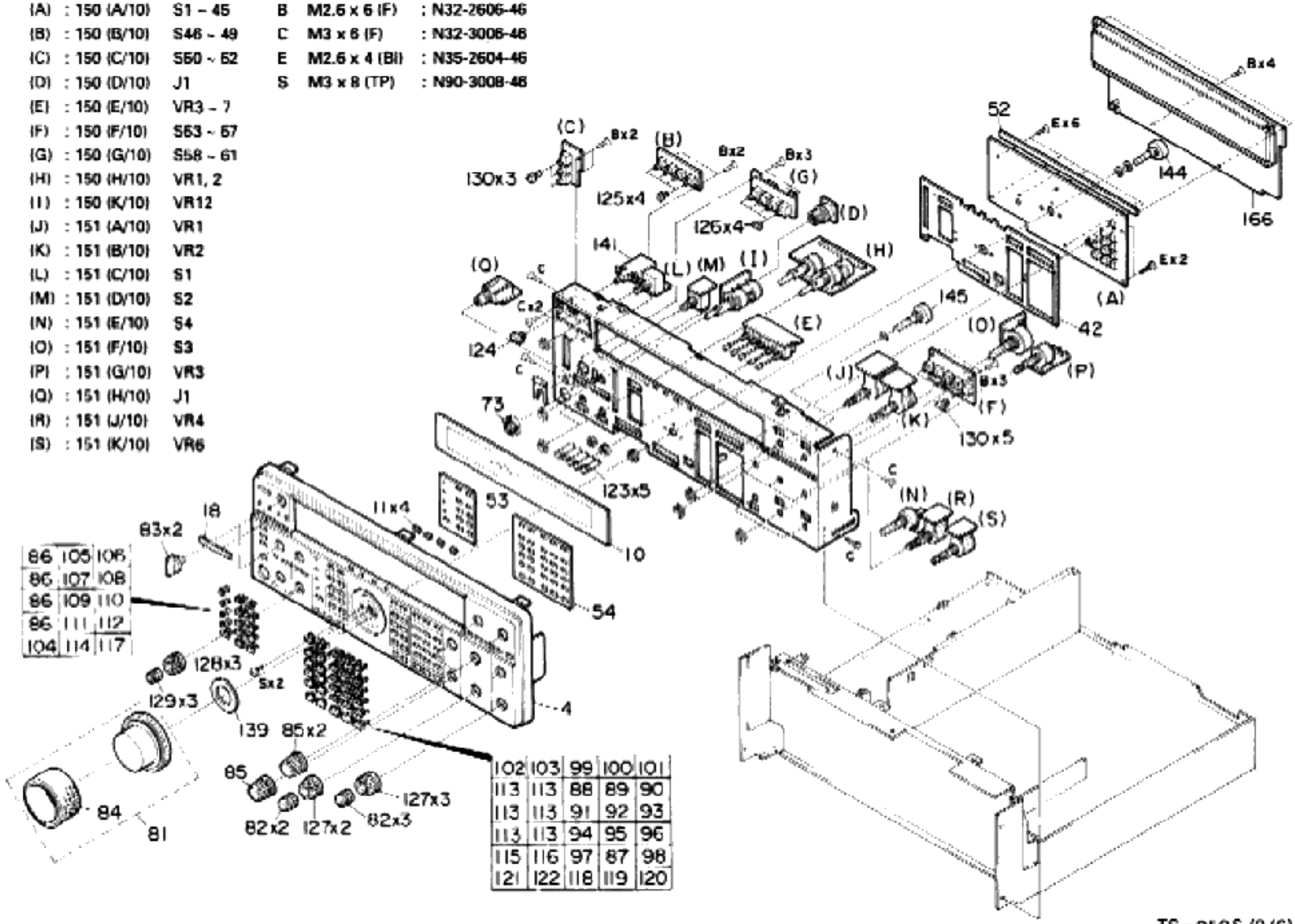
DISASSEMBLY



TS-950S (1/6)

(A) : 150 (A/10) S1 – 45
(B) : 150 (B/10) S46 ~ 49
(C) : 150 (C/10) S50 ~ 52
(D) : 150 (D/10) J1
(E) : 150 (E/10) VR3 – 7
(F) : 150 (F/10) S53 ~ 57
(G) : 150 (G/10) S58 ~ 61
(H) : 150 (H/10) VR1, 2
(I) : 150 (K/10) VR12
(J) : 151 (A/10) VR1
(K) : 151 (B/10) VR2
(L) : 151 (C/10) S1
(M) : 151 (D/10) S2
(N) : 151 (E/10) S4
(O) : 151 (F/10) S3
(P) : 151 (G/10) VR3
(Q) : 151 (H/10) J1
(R) : 151 (J/10) VR4
(S) : 151 (K/10) VR6

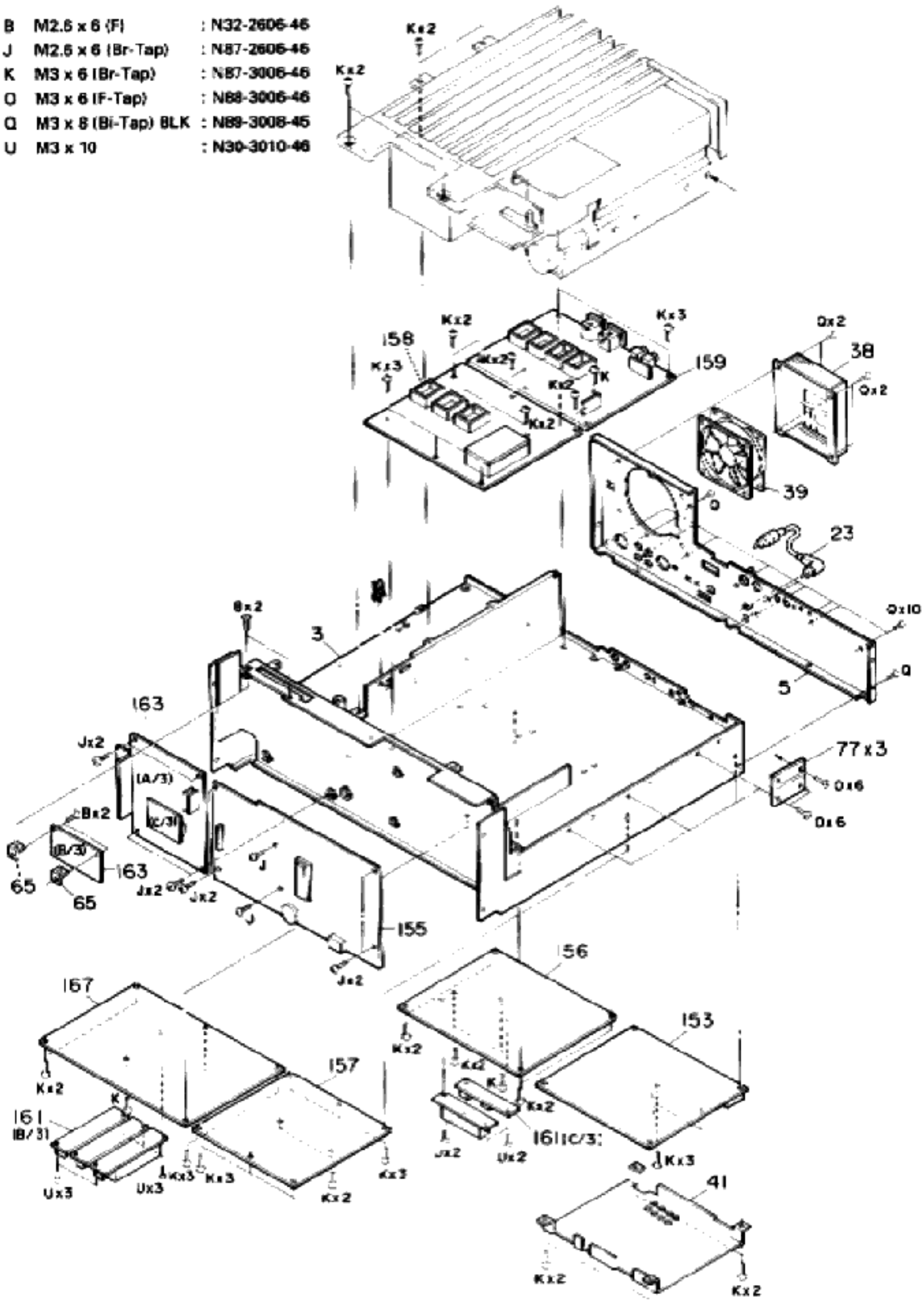
B M2.6 x 6 (F) : N32-2606-46
C M3 x 6 (F) : N32-3006-46
E M2.6 x 4 (Bl) : N35-2604-46
S M3 x 8 (TP) : N90-3008-46



TS-950S (2/6)

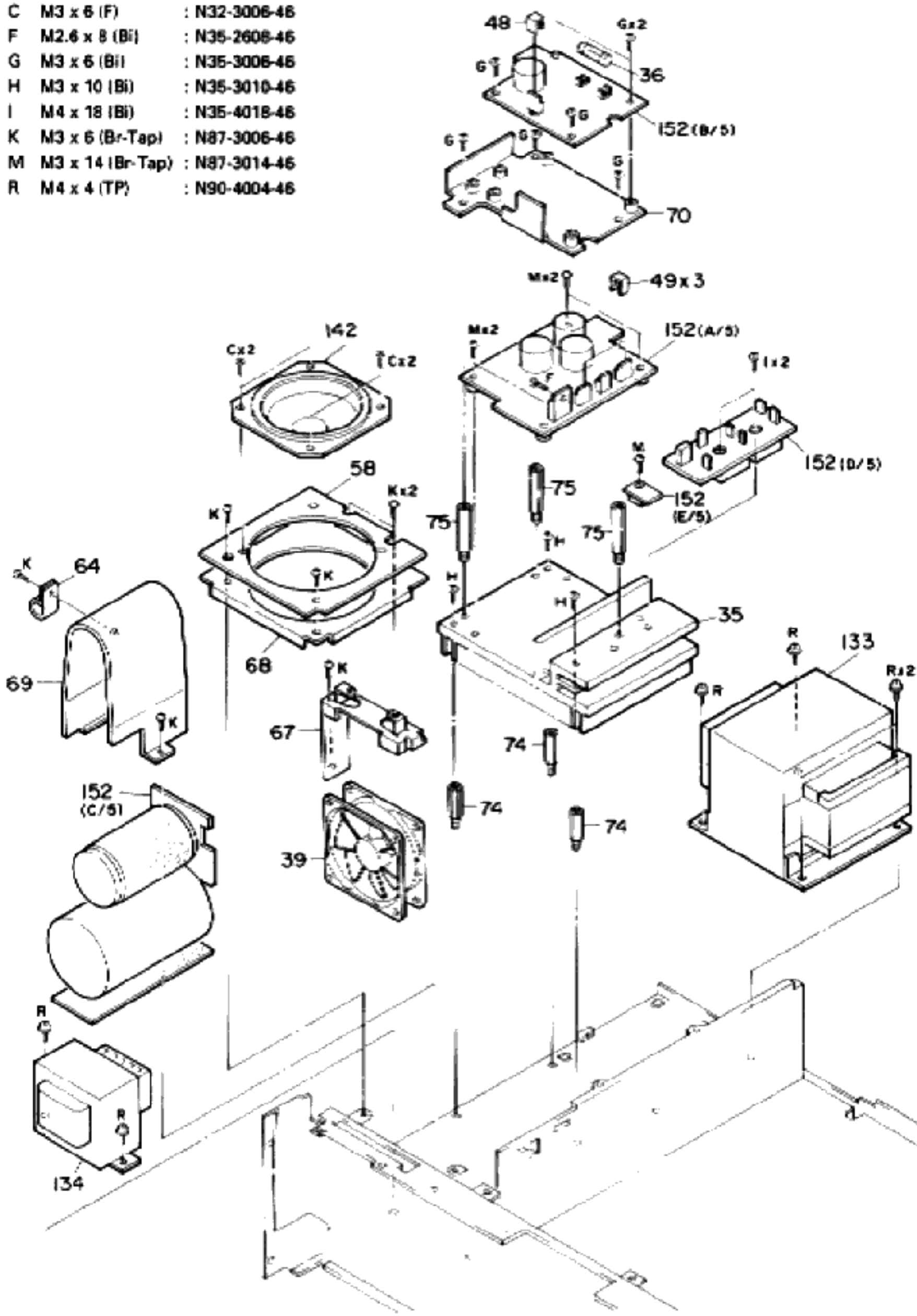
DISASSEMBLY

B	M2.6 x 6 (F)	: N32-2606-46
J	M2.6 x 6 (Br-Tap)	: N87-2606-46
K	M3 x 6 (Br-Tap)	: N87-3006-46
O	M3 x 6 (F-Tap)	: N88-3006-46
Q	M3 x 8 (Bi-Tap) BLK	: N89-3008-45
U	M3 x 10	: N30-3010-46



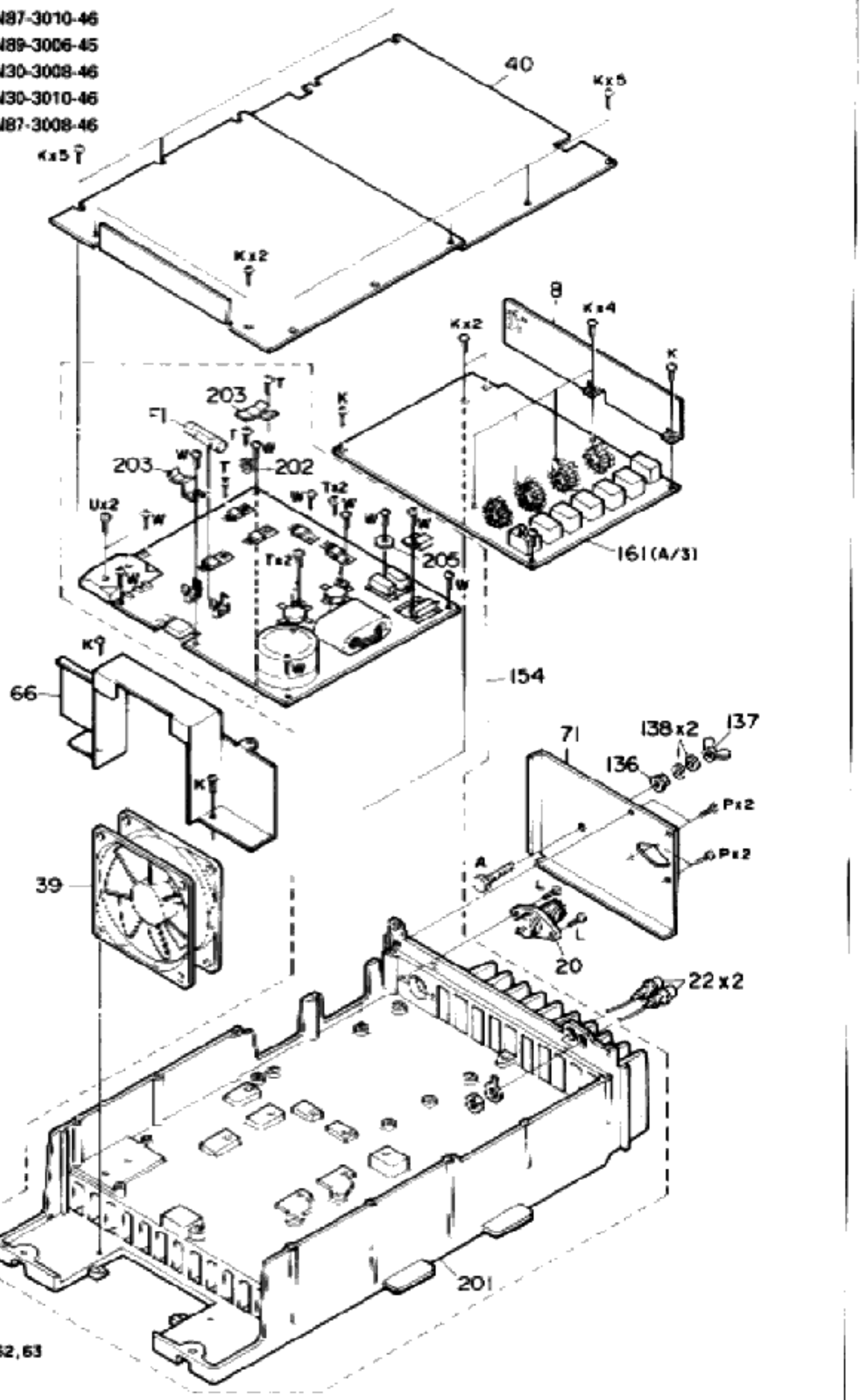
DISASSEMBLY

C	M3 x 6 (F)	: N32-3006-46
F	M2.6 x 8 (Bi)	: N35-2608-46
G	M3 x 6 (Bi)	: N35-3006-46
H	M3 x 10 (Bi)	: N35-3010-46
I	M4 x 18 (Bi)	: N35-4018-46
K	M3 x 6 (Br-Tap)	: N87-3006-46
M	M3 x 14 (Br-Tap)	: N87-3014-46
R	M4 x 4 (TP)	: N90-4004-46



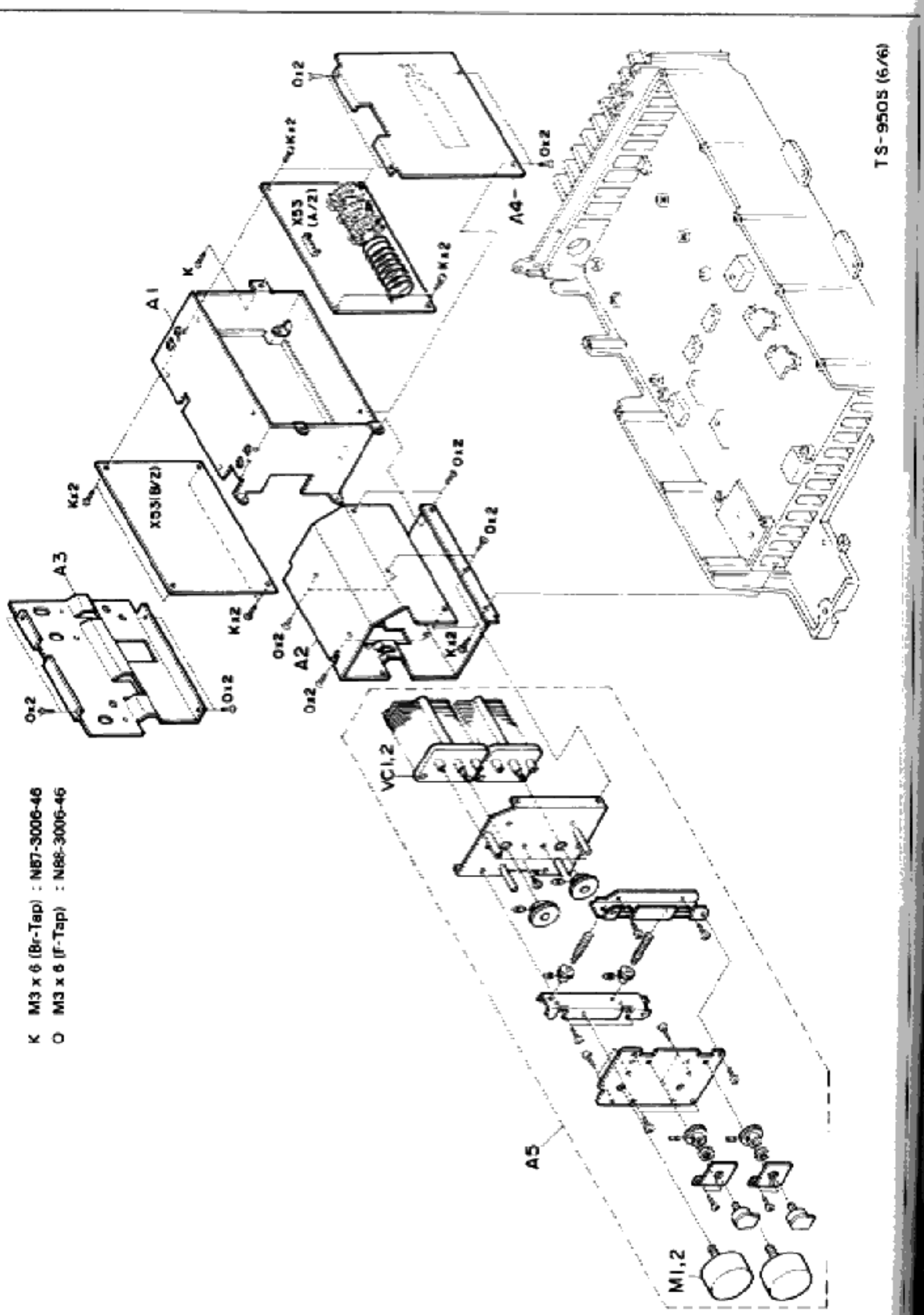
DISASSEMBLY

A	M4 x 16	: N09-0682-04
K	M3 x 6 (Br-Tap)	: N87-3006-46
L	M3 x 10 (Br-Tap)	: N87-3010-46
P	M3 x 6 (Bi-Tap) BLK	: N89-3006-45
T	M3 x 8	: N30-3008-46
U	M3 x 10	: N30-3010-46
W	M3 x 8 (Br-Tap)	: N87-3008-46

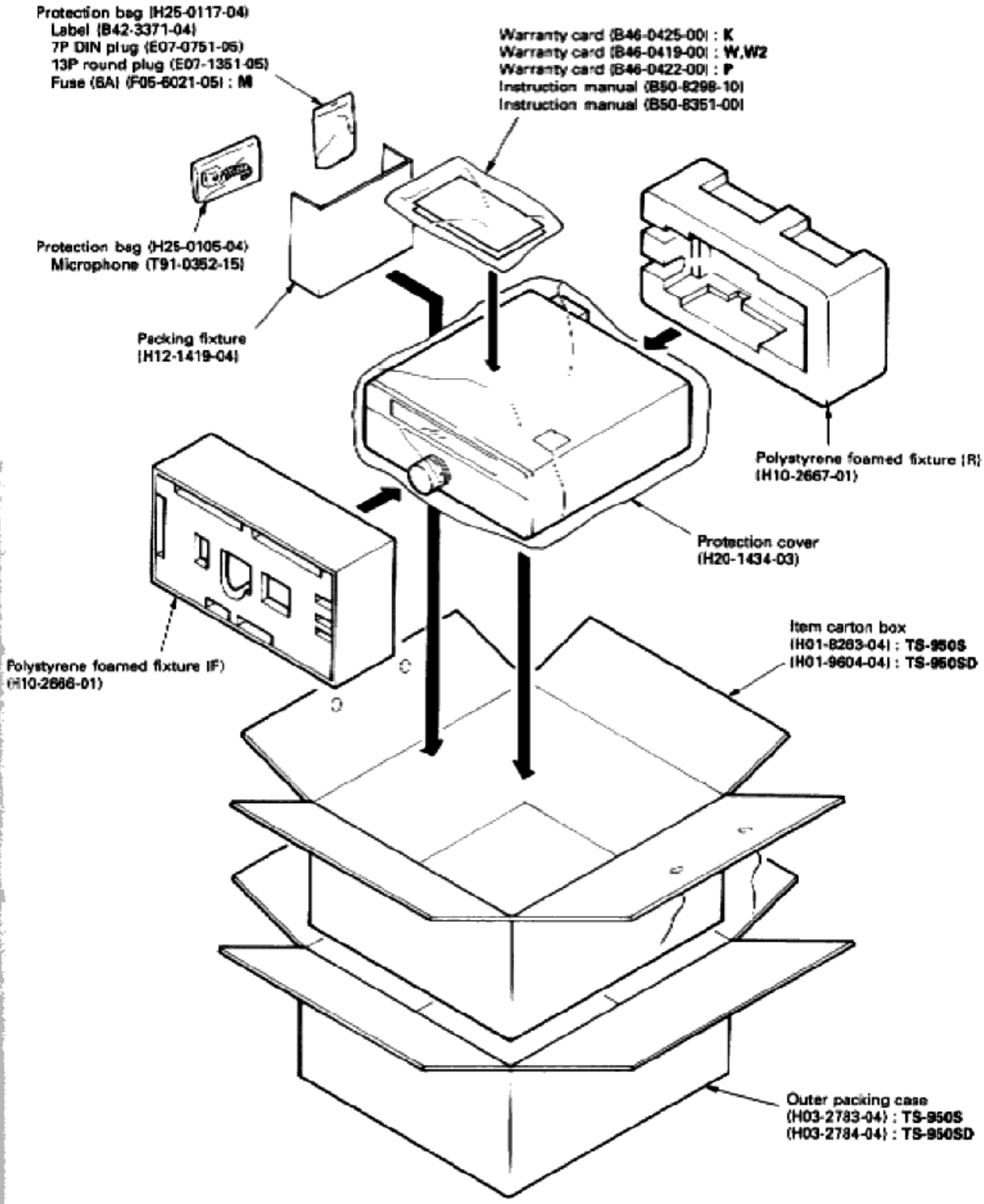


TS-950S(5/6)

DISASSEMBLY



PACKING


Protection bag (H25-0117-04)
Label (B42-3371-04)
7P DIN plug (E07-0751-05)
13P round plug (E07-1351-05)
Fuse (6A) (F05-6021-05) : M
Warranty card (B46-0425-00) : K
Warranty card (B46-0419-00) : W,W2
Warranty card (B46-0422-00) : P
Instruction manual (B50-8298-10)
Instruction manual (B50-8351-00)
Protection bag (H25-0105-04)
Microphone (T91-0352-15)
Packing fixture (H12-1419-04)
Polystyrene foamed fixture (R) (H10-2667-01)
Protection cover (H20-1434-03)
Item carton box (H01-8283-04) : TS-950S (H01-9604-04) : TS-950SD
Polystyrene foamed fixture (F) (H10-2666-01)
Outer packing case (H03-2783-04) : TS-950S (H03-2784-04) : TS-950SD

ADJUSTMENT

Required Test Equipment

1. DC Voltmeter (DC V.M)
1) Input resistance : More than 1MΩ
2) Voltage range : 1.5 to 1000V 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 : 100mA, 1.5A, 15A, High-precision ammeter may be used.

3. RF VTVM (RF V.M)
1) Input impedance : 1MΩ and less than 3pF, min.
2) Voltage range : 10mV to 300V
3) Frequency range : 10kHz to 500MHz

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

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

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

7. Oscilloscope
Requires high sensitivity, and external synchronization capability (150MHz or greater).

8. Sweep Generator
1) Center frequency : 50kHz to 90MHz
2) Frequency deviation : Maximum ±35MHz
3) Output voltage : 0.1V or greater
4) Sweep rate : At least 0.5 sec/cm

9. Standard Signal Generator (SSG)
1) Frequency range : 50kHz to 50MHz
2) Output : –20dB/0.1μV to 120dB/1V
3) Output impedance : 50Ω
4) AM and FM modulation can be possible.
Note : Generator must be frequency stable.

10. Frequency Counter (f. counter)
1) Minimum input voltage : 50mV
2) Frequency range : 150MHz or greater

11. Noise Generator
Must generate ignition noise containing harmonics beyond 30MHz

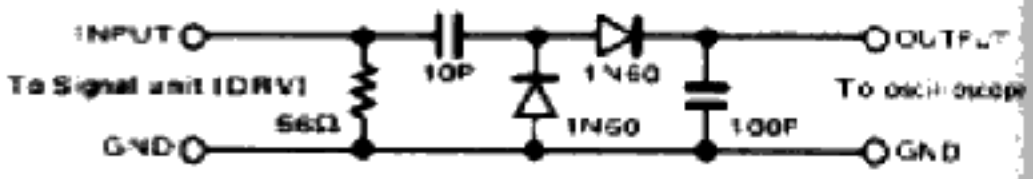
12. RF Dummy Load
1) Impedance : 150Ω and 50Ω
2) Dissipation : 150W or greater

13. Linear Detector
1) Frecuency range : 30MHz

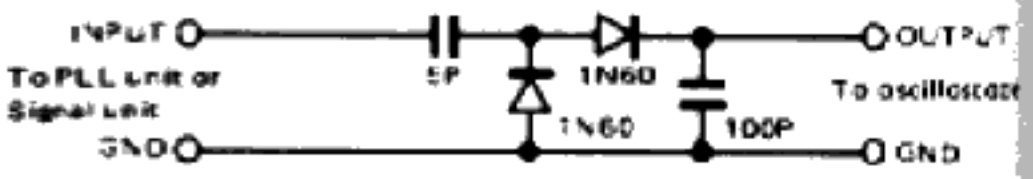
14. Power Meter
1) Impedance : 50Ω
2) Dissipation : 300W continuous or greater
3) Frequency limits : 60MHz or greater

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

16. Detector
1) For adjustment of TX BPF



2) For adjustment of PLL/VCO BPF



17. Directional Coupler

18. Monitor Receiver
R-1000 class

19. Microphone
MC-43S or MC-60/60S8

20. Tracking Generator

ADJUSTMENT

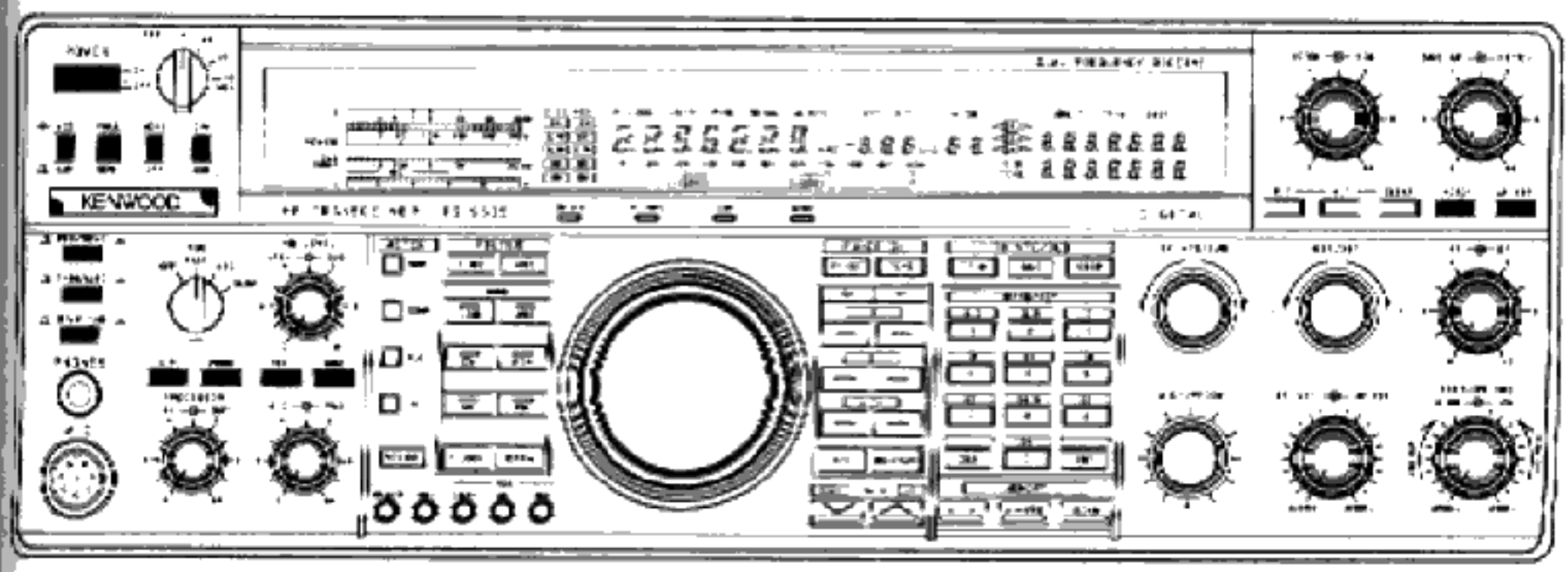
Preparation

Unless otherwise specified, set the controls as follows:

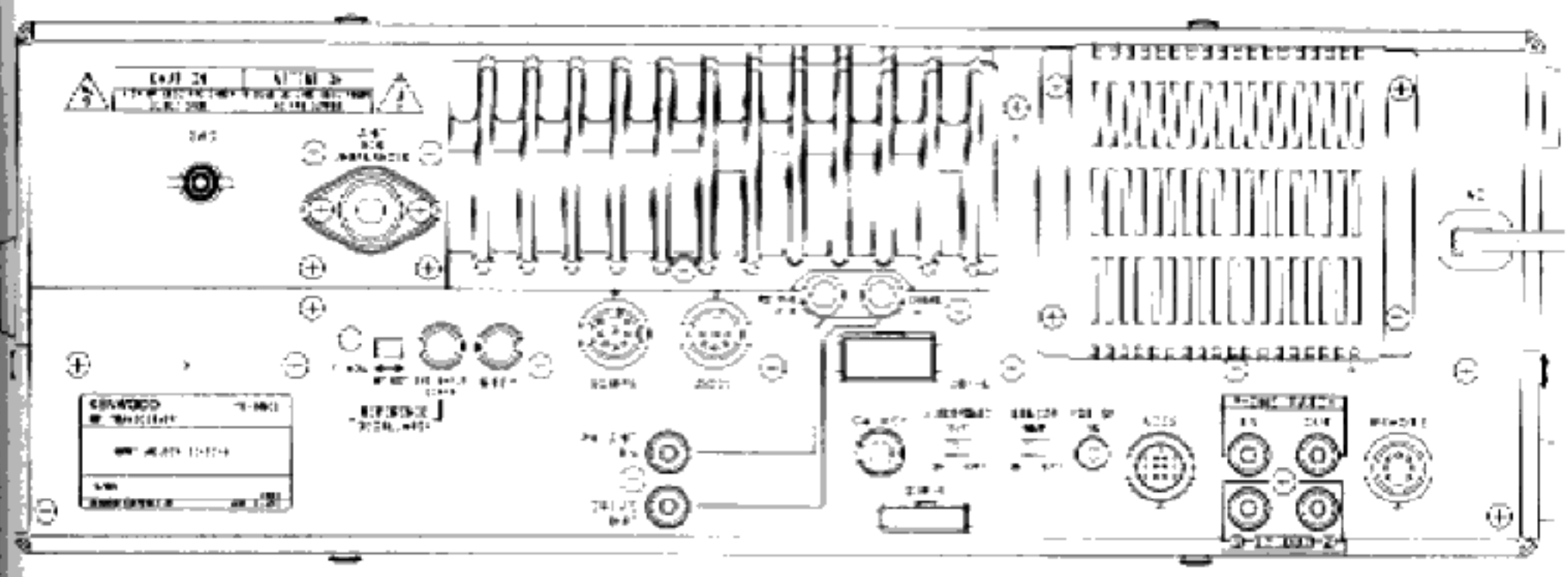
1. Power ON, holding A=B SW, keep □ condition from □ or ▭ SW's which marked ■.
   (other push SW's are nonlock type or tact SW.)

2. POWER ..... ON
   ATT 0
   AGC ..... FAST
   METER ..... POWER
   NB LEVEL 0
   PROCESSOR IN 0
   PROCESSOR OUT 0
   MIC 0
   PWR ..... MAX
   NOTCH ..... Centered
   SQL 0
   PITCH ..... Centered
   AF 0
   RF ..... MAX
   IF VBT ..... NORMAL
   CW VBT ..... NORMAL
   SSB SLOPE TUNE HIGH ..... MAX
   SSB SLOPE TUNE LOW ..... MAX

Front panel



Rear panel



ADJUSTMENT

Voltage check

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
1. Voltage	1) POWER SW : ON STBY : REC MODE : CW	DC V.M	AVR (A/6)	TP1	AVR (A/6)	VR1	15.0V	±0.2V

PLL and CAR section adjustment

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
1. Reference OSC	1) POWER SW : ON STBY : REC MODE : CW	f. counter	PLL	TP1	CAR	TC1	20.000.000Hz	±20Hz
2. SCOPE sub marker	1) Connect the SM-230 (±25kHz span) to SCOPE connector on the rear panel. SUB : ON RX→SUB : ON (MAIN=SUB) MAIN DISP : 10kHz up SUB : OFF	DC V.M	Rear panel	SCOPE 7 pin	DIG	VR1	0V	±0.01V
3. EXT. STD voltage adj.	1) CAR unit S1 : EXT Connect the 10kHz/1Vp-p signal generator to EXT terminal (J1).	DC V.M 10kHz signal generator	CAR Rear panel	TP7 EXT. INPUT	CAR	TC2	2.5V	±0.2V
TS-950SD	2) CAR unit S2 : SO	f. counter	PLL	TP1			Check	20.000.000MHz ± 20Hz
4. VCO adj. 4-1. VCO5 35.5MHz	1) MAIN DISP : 14.000.0MHz MODE : FM STBY : REC	DC V.M	CAR	TP1	CAR	L3	4.0V	±0.2V
4-2. VCO6 71.5MHz				TP2		L10	4.0V	±0.2V
4-3. VCO4 69.5MHz				TP3		L17	4.0V	±0.2V
4-4. VCO9 59.5MHz	2) MODE : USB			TP4		L24	5.0V	±0.2V
5. HET adj. 9.285MHz	1) MAIN DISP : 14.000.0MHz MODE : USB STBY : REC	Oscilloscope (100MHz)	CAR	TP5	CAR	L14	Level MAX	Ref. 0.4Vp-p
6. CAR adj. 10.695MHz	1) MAIN DISP : 14.000.0MHz MODE : USB STBY : REC	Oscilloscope	CAR	TP6	CAR	L21	Level MAX	Ref. 0.4Vp-p
7. 40MHz BPF adj.	1) MAIN DISP : 14.000.0MHz MODE : USB STBY : REC	Oscilloscope	PLL	TP6	PLL	L19,20	Level MAX	Ref. 0.8Vp-p
8. VCO adj. VCO3 58~56MHz	1) MAIN DISP : 14.000.0MHz MODE : FM STBY : REC	DC V.M	PLL	TP2	PLL	L3	5.0V	±0.2V
	2) Turn to main tuning knob MAIN DISP : 13.999.9MHz						Check	3.0~4.0V
9. 12.85MHz BPF adj.	1) MAIN DISP : 14.005.0MHz MODE : FM STBY : REC	Oscilloscope	PLL	TP3	PLL	L7~9	Level MAX	Ref. 0.3Vp-p
10. 34.1MHz BPF adj.	1) MAIN DISP : 14.250.0MHz MODE : FM STBY : REC	Oscilloscope	PLL	TP4	PLL	L10~ L12	Level MAX	Ref. 0.4Vp-p
11. VCO adj. VCO2 49.5~ 44.5MHz	1) MAIN DISP : 14.000.0MHz MODE : FM STBY : REC	DC V.M	PLL	TP5	PLL	L15	6.0V	±0.2V
	2) Turn to main tuning knob MAIN DISP : 13.999.9MHz						Check	2.0~3.0V

ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
12. Local 35.3MHz BPF adj.	1) MAIN DISP : 14.250.0MHz MODE : FM STBY : REC	Oscilloscope	PLL	TP7	PLL	L21~L23	Level MAX	Ref. 0.3Vp-p
13. HET 50.750MHz OSC adj.	1) MAIN DISP : 14.250.0MHz MODE : FM STBY : REC	Oscilloscope	PLL	TP11	PLL	L57	Level MAX	Ref. 0.3Vp-p
		f. counter				TC1	50.750MHz	±50Hz
14. VCO adj. VCO8 109-107MHz	1) SUB DISP : 14.000.0MHz MODE : FSK SUB : ON STBY : REC	DC V.M	PLL	TP8	PLL	L31	5.0V	±0.2V
	2) Turn to sub tuning knob SUB DISP : 13.999.9MHz						Check	3.0-4.0V
15. 25.40MHz BPF adj.	1) SUB DISP : 14.005.0MHz MODE : FSK STBY : REC	Oscilloscope	PLL	TP9	PLL	L35~L37	Level MAX	Ref. 0.3Vp-p Note : Adjust clockwise from surface position (core is inserted)
16. 12.54MHz BPF adj.	1) SUB DISP : 14.005.0MHz MODE : FSK STBY : REC	Oscilloscope	PLL	TP10	PLL	L41~L43	Level MAX	Ref. 0.4Vp-p
17. 38.21MHz BPF adj.	1) SUB DISP : 14.005.0MHz MODE : FSK STBY : REC	Oscilloscope	PLL	TP12	PLL	L44~L46	Level MAX	Ref. 0.3Vp-p
18. VCO adj. 18-1. VCO7-A 40.065~47.555MHz	1) MAIN DISP : 0.010MHz SUB DISP : 0.010MHz MODE : FSK STBY : REC	DC V.M	PLL	TP13	PLL (VCO)	TC4	2.8V	±0.2V
	2) SUB DISP : 7.500MHz MAIN DISP : 7.490MHz						Check	8.0~11.0V
18-2. VCO7-B 47.555~54.555MHz	1) MAIN DISP : 7.500MHz SUB DISP : 7.500MHz			TP14	PLL (VCO)	TC3	2.8V	±0.2V
	2) SUB DISP : 14.500MHz MAIN DISP : 14.490MHz						Check	8.0~11.0V
18-3. VCO7-C 54.555~61.555MHz	1) MAIN DISP : 14.500MHz SUB DISP : 14.490MHz				PLL (VCO)	TC2	2.8V	±0.2V
	2) SUB DISP : 21.500MHz MAIN DISP : 21.490MHz						Check	8.0~11.0V
18-4. VCO7-D 61.555~70.055MHz	1) MAIN DISP : 21.500MHz SUB DISP : 21.500MHz				PLL (VCO)	TC1	2.8V	±0.2V
	2) SUB DISP : 30.000MHz MAIN DISP : 30.000MHz						Check	8.0~11.0V
19. VCO adj. VCO0 64.22MHz	1) STBY : REC	DC V.M	AF	TP2	AF (VCO2)	TC1	5.0V	±0.2V
20. VCO adj. 20-1. VCO1-A 73.06~80.55MHz	1) MAIN DISP : 0.010MHz MODE : FM STBY : REC	DC V.M	AF	TP1	AF (VCO)	TC1	2.8V	±0.2V
	2) MAIN DISP : 7.490MHz						Check	8.0~11.0V
20-2. VCO1-B 80.55~87.55MHz	1) MAIN DISP : 7.500MHz				AF (VCO)	TC2	2.8V	±0.2V
	2) MAIN DISP : 14.490MHz						Check	8.0~11.0V
20-3. VCO1-C 87.55~94.55MHz	1) MAIN DISP : 14.500MHz				AF (VCO)	TC3	2.8V	±0.2V
	2) MAIN DISP : 21.490MHz						Check	8.0~11.0V
20-4. VCO1-D 94.55~103.05MHz	1) MAIN DISP : 21.500MHz				AF (VCO)	TC4	2.8V	±0.2V
	2) MAIN DISP : 30.000MHz						Check	8.0~11.0V

ADJUSTMENT

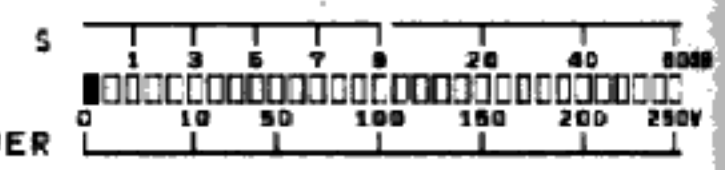
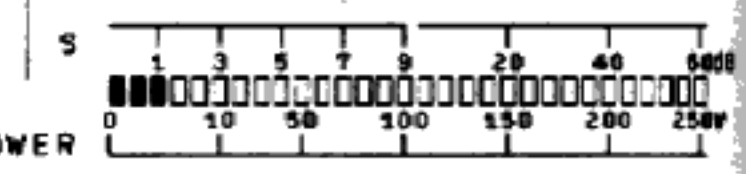
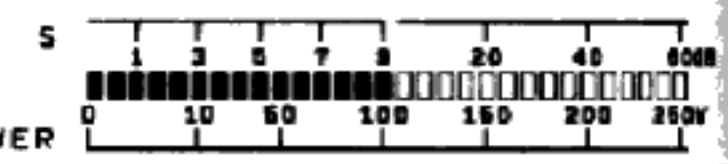
Receiver section adjustment

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
1. IF VBT	1) MAIN DISP : 21.500MHz MODE : AM IF VBT : MAX	f. counter	SIG	CN16-3	SW(B) (J/10)	VR5	355.0kHz	±100Hz
2. Slope tune	1) POWER SW : OFF Push the POWER SW ON, holding the 2 and 8 keys down. SLOPE TUNE HI, LOW : Fully CW position MODE : USB	f. counter	SIG	CN16-3	SW(B) (K/10)	VR8	353.4kHz	±100Hz
	2) MODE : LSB After adjusted. SLOPE TUNE LOW : NORMAL					VR7	355.0kHz	±100Hz
3. PITCH	1) POWER SW : OFF→ON PITCH : Centered (12 o'clock) MODE : CW	f. counter	IF	CN16-1	SW(B) (K/10)	VR9	10.6935MHz	+20Hz, -0Hz
4-1. MAIN AGC	1) MAIN DISP : 14.000MHz MODE : USB RF GAIN : MAX	DC V.M	SIG	TP1	SIG	VR3	2.8V	±0.01V
4-2. SUB AGC	1) SUB : ON IF unit VR2 : MIN After adjusted SUB : OFF IF unit VR2 : Centered		IF	TP2	IF	VR3	2.8V	±0.01V
5-1. MAIN MIX BAL	1) MAIN DISP : 14.000MHz AF VR : MAX After adjusted AF VR : MIN	AF V.M	Rear panel	EXT. SP	RF	VR2	AF noise level MIN	
5-2. SUB MIX BAL	1) SUB : ON SUB DISP : 14.000MHz SUB AF VR : MAX IF unit VR2 : MAX After adjusted SUB AF VR : MIN SUB : OFF					VR1		
6. BPF	1) BAND : 2.5~4.5MHz MAIN DISP : 3.500MHz AIP : OFF AGC : OFF	Spectrum analyzer Tracking generator	RF	TP3	RF	L19~ L21		2.5 4.5MHz
	2) BAND : 6.5~7.5MHz MAIN DISP : 7.000MHz					L25~ L27		6.5 7.5MHz
	3) BAND : 9.5~11.0MHz MAIN DISP : 10.000MHz					L31~ L33		9.5 11.0MHz
	4) BAND : 13.5~15.0MHz MAIN DISP : 14.000MHz					L37~ L39		13.5 15.0MHz
	5) BAND : 20.5~22.0MHz MAIN DISP : 21.000MHz					L46~ L48		20.5 22.0MHz

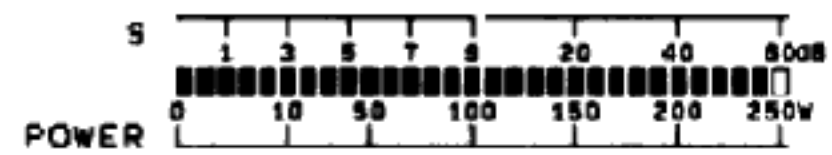
ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
8. BPF	6l BAND : 23.0–30.5MHz MAIN DISP : 28.000MHz	Spectrum analyzer Tracking generator	RF	TP3	RF	L52~L64		23.0 30.5MHz
71. MAIN MCF 73.050MHz	1) MAIN DISP : 14.175MHz Tracking generator output : –30dBm Center frequency : 73.050MHz	Spectrum analyzer Spectrum analyzer	IF	TP3 CN6	IF	L9~11	Crest value : MAX Ripple : MIN Adjust as shown at right.	73.050 73.043 73.057MHz
72. SUB MCF 40.055MHz	1) Center frequency : 40.055MHz	Spectrum analyzer Tracking generator	IF RF	TP1 TP4	IF RF	L1 L77–L80		40.055 40.049 40.061MHz
81. MAIN RX IF AMP	1) MAIN DISP : 14.175MHz MODE : USB AGC : OFF AIP : OFF SUB AF VR : MIN AF VR : 0.63V/8Ω SSG f : 14.176MHz SSG output : 5–0.5μV (–93––113dBm) Note : Use the minimum input as possible.	SSG DM. SP Oscilloscope AF V.M	Rear panel	ANT EXT. SP	RF IF SIG	L87 L12–L17 L20,30 L2,4 L5.7	Repeat for MAX AF output reading.	
	2) Set the indicator of FILTER 8.83 select switch to disappear position. After adjusted Set the FILTER select switch 2.7kHz position.				IF	L28,29	MAX for AF output	
82. SUB RX IF AMP	1) SUB : ON SUB DISP : 14.175MHz MODE : USB AF VR : MIN SUB AF VR : 0.63V/8Ω AF unit VR1 : 12 o'clock IF unit VR2 : 12 o'clock SSG f : 14.176MHz SSG output : 5–0.5μV (–93––113dBm) Note : Use the minimum input as possible. After adjusted SUB : OFF				RF IF	L77 L1~8	Repeat for MAX AF output reading.	
9. IF OUT1	1) SSG output : 50mV (–33dBm) AGC : OFF	SSG Oscilloscope	Rear panel	ANT IF OUT1	IF	L18,19	MAX for 8.83MHz signal output.	

ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test equipment	Unit	Terminal	Unit	Parts	Method	
10. NOTCH	1) MAIN DISP : 14.175MHz MODE : CW NOTCH VR : 12 O'clock PITCH VR : 12 o'clock SUB AF VR : MIN SSG f : 14.176MHz SSG output : 0.5µV (–113dBm)	SSG DM. SP Oscilluscope AF V.M f.counter	Rear panel	ANT EXT. SP	Front panel	AF VR Main encoder	Adjust for 1500Hz/ 0.63V/8Ω AF output.	
	2) NOTCH SW : ON SSG output : 50µV (–73dBm) After adjusted NOTCH SW : OFF				SIG	L6 VR2	Repeat for MIN AF output reading.	
					Front panel	NOTCH VR	Check	Null point must occur between 11 : 00 – 13 : 00. Then AF output is less than 0.63V/8Ω.
11-1. MAIN S-meter and RX GAIN	1) MAIN DISP : 14.175MHz MODE : USB AGC : OFF RF GAIN VR : MAX AIP : OFF SSG RF : OFF	SSG 8Ω dummy SP Oscilloscope AF V.M f. counter	Rear panel	ANT EXT. SP	SIG	VR4	Set the S-meter to 1 dot (just before 2 dots lights).	
	2) AGC : FAST SSG f : 14.176MHz SSG output : 0.9µV (–108dBm)					VR1	Set the S-meter to 3 dots (just before 4 dots lights).	
	3) SSG output : 1.26µV (–105dBm)					VR4 VR1		
	4) SSG output : 1µV (–107dBm)							
	5) SSG output : 12.6µV (–25dBm)					VR5	S9+60dB (Full scale)	
	6) SSG output : 2µV (–81dBm)						Check	Within S9 +4, –8dBµ
								
	7) SSG output : 1µV (–107dBm)						Check	S1 (3 dots) lights, ±3dBµ
	8) Repeat item 1) to 7).							
	9) SSG output : 3.55µV (–36dBm)						Check SSG level of S9+60dB reading.	3.55µV (–36dBm)
11-2. SUB RX GAIN	1) SUB : ON SUB DISP : 14.175MHz MODE : USB SSG f : 14.176MHz SSG output : 1µV (–107dBm) After adjusted SUB : OFF	DC V.M	IF	TP2	IF	VR2	2.75V Adjust for slowly.	±0.03V
12. FM GAIN	1) MAIN DISP : 28.200MHz MODE : FM SIG unit VR10 : 12 o'clock SSG f : 28.200MHz SSG MOD : 1kHz SSG DEV : 3kHz SSG output : 50µV (–73dBm)	SSG 8Ω dummy Oscilloscope SP AF V.M	Rear panel	ANT EXT. SP	SIG	L28	MAX for AF output.	
	2) SSG MOD : 1kHz SSG DEV : 5kHz SSG output : 50µV (–73dBm)				Front panel	AF VR	Set to 0.63V/8Ω by AF GAIN volume.	
	3) SSG DEV : 3kHz				SIG	VR10	Adjust to 0.63V/8Ω AF output.	
							Check AF output	0.45V/8Ω or more.

ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
13. FM S-meter	1) SSG f : 28.200MHz SSG MOD : 1kHz SSG DEV : 3kHz SSG output : 11.2μV (–86dBm)	SSG 8Ω dummy Oscilinscope AF V.M	Rear panel	ANT EXT.SP	SIG	VR11	Just before 60 dots lights. 	
	2) SSG output : 0.5μV (–113dBm)						Check SSG levle of S1 reading.	–5~5dBμ
14-1. MAIN NB	1) MAIN DISP : 21.200MHz MODE : USB SUB AF VR : MIN SUB NB VR : MIN NB1 SW : ON MAIN NB VR : 12 o'clock	Noise generator SP	Rear panel	ANT EXT. SP			Adjust the noise generator output to S-meter 1 to 3 dots lights. Adjust the MAIN NB LEVEL to just before NB operates has insufficient effect.	
					AF	L13,14	MIN noise level	
	2) MAIN NB → SUB check MAIN AF VR : MIN SUB NB VR : MIN MAIN NB VR : 12 o'clock NB1 SW : ON NB2 SW : ON						Adjust the raise noise generator level to S1 and S9 then check.	Noise disappears.
14-2. SUB NB	1) SUB : ON SUB DISP : 21.200MHz MODE : USB MAIN AF VR : MIN MAIN NB VR : MIN NB1 SW : ON SUB NB VR : 12 o'clock						Adjust the noise generator output to S-meter 1 to 3 dots lights. Adjust the SUB NB LEVEL to just before NB operates has insufficient effect.	
					IF	L21,22	MIN noise level	
	2) SUB NB → MAIN check SUB AF VR : MIN MAIN NB VR : MIN SUB NB VR : 12 o'clock NB1 SW : ON NB2 SW : ON After adjusted SUB : OFF NB1, NB2 SW : OFF						Adjust the raise noise generator level to S1 and S9 then check.	Noise disappears.
15. Beep tone	1) AF VR : MIN CW key : 1 push	DM. SP Oscilloscope	Rear panel	EXT. SP (A/3)	CONT	VR1	0.3Vp-p	0.2~0.4Vp-p

ADJUSTMENT

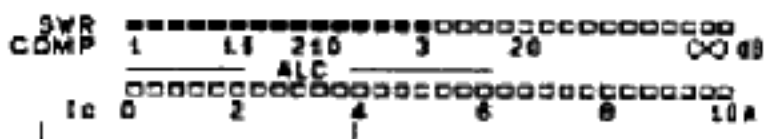
Transmitter section adjustment

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
1. ALC voltage	1) MAIN DISP : 14.200MHz MODE : USB PWR VR : MAX STBY : SEND	Digital voltmeter	IF	CN3-1	CONT (A/3)	VR5	2.7V	±0.05V
2. CAR MIX & AMP	1) MODE : AM MIC VR : MIN STBY : SEND	Oscilloscope	SIG	Center pin of the VR9	SIG	L10~L12	Repeat for MAX	3Vp-p or more
3. TX IF AMP	1) MAIN DISP : 7.050MHz SW unit (A) VR11 (CAR VR) : MAX Disconnect the CN4 on the IF unit and connect the spectrum analyzer. STBY : SEND	Spectrum analyzer	IF	CN4	SIG IF	L16,18 L23~L27 L31	MAX for 73MHz signal output	Approx. 0dBm or more
4. 84.2MHz spurious	1) MAIN DISP : 7.050MHz SW unit (A) VR11 (CAR VR) : MAX Disconnect the CN4 on the IF unit and connect the spectrum analyzer. STBY : SEND After adjusted Connect the CN4	Spectrum analyzer	IF	CN4	IF	VR4	MIN spurious level	
5. 8.83 MCF	1) MAIN DISP : 7.050MHz SW unit (A) VR11 (CAR VR) : MAX MODE : AM STBY : SEND	Tracking generator Spectrum analyzer Istrobel	IF Filter (C/3)	CN17-1 CN12-2	IF (Filter (C/3))	L12,13		8.83MHz ±2.5kHz
6. TX IFT	1) MODE : AM RF unit VR4~6 : Centered STBY : SEND	Spectrum analyzer	Rear panel	DRV OUT	RF	L93~L95	Repeat for MAX	
7. MIX BIAS	1) MAIN DISP : 7.050MHz MODE : AM STBY : SEND	Spectrum analyzer	Rear panel	DRV OUT	RF	VR4	MAX	
	2) MAIN DISP : 14.050MHz					VR5	MAX	
	3) MAIN DISP : 29.000MHz					VR6	MAX	
8. MIX BAL	1) MAIN DISP : 21.000MHz MODE : AM STBY : SEND	Spectrum analyzer	Rear panel	DRV OUT	RF	VR3	MIN 31MHz spurious level	
9-1. FINAL Vcc	1) MAIN DISP : 21.000MHz MODE : CW Final unit VR1, 2 : MIN STBY : SEND	DC V.M	Final	Fuse	Final	VR3	48.0V	±0.5V
9-2. Drive bias	1) MODE : USB STBY : SEND	Ammeter		TP1		VR1	170mV	165~175mV
9-3. Final bias				TP2		VR2	25mV	24.5~25.5mV
10. NULL	1) MAIN DISP : 14.200MHz MODE : AM Control unit VR6 : Centered VR7 : MAX VR12 : MAX SW unit (A) VR11 (CAR VR) : MIN STBY : SEND	Power meter DC V.M	Rear panel Filter	ANT CN6-1	SW(A) (J/10) Filter	VR11 TC1	Approx. 10W MIN DC V.M level	 0V

ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
11. IC meter	1) METER IC : ON SW unit (A) VR11 (CAR VR) : MIN STBY : SEND	DC V.M	Final	TP2	SW(A) (J/10)	VR11	0.4V	
					CONT (A/3)	VR4	IC meter 4 dots lights	Check, IC meter 4 dots will disappeare when adjust the CAR VR to 0.38V or more.
12. IC protection	1) SW unit (A) VR11 (CAR VR) : MIN Control unit VR12 : MAX VR6 : MIN VR7 : MAX Adjust while slowly raising CAR VR, then 200W. Note : Please adjust VR6 and VR12 immediately, because power output will appear over 200W.	Power meter	Rear panel	ANT	CONT (B/3)	VR12	190W	
					CONT (A/3)	VR6	185W	
13. ALC	1) MAIN DISP . 14.200MHz MODE : CW FULL : ON SW unit (A) VR11 (CAR VR) : MIN Control unit VR12 : MIN STBY : SEND	Power meter	Rear panel	ANT	SW(A) (J/10)	VR11	Slowly increase to MAX.	
					CONT (B/3)	VR12	110W	100–120W
14. ALC frequency response	1) MAIN DISP : 24.900MHz STBY : SEND 2) MAIN DISP : 14.200MHz STBY : SEND	Power meter	Rear panel	ANT	Filter	VR1	110W	100–120W
							Check If less than 100W, readjust item 13.	100–120W
15. Power meter	1) MAIN DISP : 14.200MHz MODE : CW STBY : SEND	Power meter	Front panel	Power meter	Front panel	PWR VR	100W	
					CONT (B/3)	VR11	Set the PWR meter of display to "100W" segments.	"100W" segment will disappear when adjust the CAR VR to less than 97W.
16. Carrier suppression	1) MAIN DISP : 14.200MHz MIC VR : MIN SW unit (A) VR11 (CAR VR) : MAX MODE : USB/LSB PWR VR : MAX STBY : SEND Spectrum analyzer conditions SPAN : 10kHz RBW : 300Hz VIDEO FIL. : 300Hz TIME : 500ms	Power meter Directional coupler Spectrum analyzer	Rear panel	ANT	SIG	TC1 VR9	MIN (adjust alternately). Adjust for no difference between USB and LSB	45dB or less
16-1. MAIN SSB mode frequency response	1) POWER SW : OFF Push the POWER SW ON holding the 1 and 7 keys down. PROC : OFF MODE : USB/LSB MIC terminal : 2-tone AG1 : 900Hz/5mV AG2 : 3.5kHz/5mV MIC VR : Set to starting ponit of ALC meter STBY : SEND Set the FILTER select 8.83 to 6kHz when transmit.	Power meter Directional coupler Oscilloscope AG AF V.M	Rear panel Front panel	ANT MIC	DIG	VR4 (USB) VR3 (LSB)	Adjust as shown at right.	OK  NG 

ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
17-1. MAIN SSB mode frequency response	• Receive sound Push the POWER SW ON holding the 3 and 9 keys down.	Power meter Directional coupler	Rear panel	ANT	DIG	VR4 (USB) VR3 (LSB)	Adjust for requirement sound with monitor receiver.	
17-2. SSB mode frequency response	1) MAIN DISP : 14.200MHz MODE : USB/LSB MIC terminal : 2-tone AG1 : 1kHz/5mV AG2 : 3.4kHz/5mV MIC VR : Set to starting point of ALC meter. STBY : SEND Set the FILTER select 6.63 to 2.7kHz when transmit.	Oscilloscope AG AF V.M	Front panel	MIC		VR2	Adjust as shown at right.	OK  NG 
17-3. SUB SSB mode frequency response	1) MAIN DISP : 14.220MHz POWER SW : OFF Push the POWER SW ON holding the 3 and 9 keys down. SUB : ON AF VR : MIN SUB AF VR : MAX MODE : USB/LSB STBY : SEND			SP		VR5	Adjust for same noise frequency response.	
18. PROC AMP	1) MAIN DISP : 14.200MHz MODE : USB PROC SW : ON METER COMP : ON PROC OUT VR : MAX MIC terminal : 2-tone AG1 : 1kHz/5mV AG2 : 3.4kHz/5mV STBY : SEND After adjusted POWER SW : OFF → ON PROC SW : OFF	Power meter Directional coupler Oscilloscope AG AF V.M	Rear panel Front panel	ANT MIC	SIG	L24,25	Adjust the PROC IN VR to no indication of COMP and ALC meter. MAX oscilloscope wave reading.	
19. Carrier suppression check	1) MODE : USB/LSB MIC VR : MIN SW unit (A) VR11 (CAR VR) : MAX PWR VR : MAX STBY : SEND	Power meter Directional coupler Spectrum analyzer Oscilloscope	Rear panel	ANT			Check	45dB or less
20. SWR protection	1) MAIN DISP : 14.200MHz MODE : AM Control unit VR7 : MIN ANT : Connect the through line power meter and 150Ω dummy load. STBY : SEND	Through line power meter 150Ω dummy	Rear panel Front panel	ANT Power meter	CONT (A/3)	VR7	10W Note : Please adjust quickly.	±1W
21. SWR meter	1) MAIN DISP : 1.800MHz METER SWR : Push ANT : Connect the 150Ω dummy load. STBY : SEND	150Ω dummy	Rear panel Front panel	ANT SWR meter	CONT (A/3)	VR8	SWR : 3 	
22. MIN power setting	1) MAIN DISP : 14.200MHz PWR VR : MIN STBY : SEND After adjusted PWR VR : MAX	Power meter	Rear panel	ANT	CONT (B/3)	VR10	12W	10~14W

ADJUSTMENT

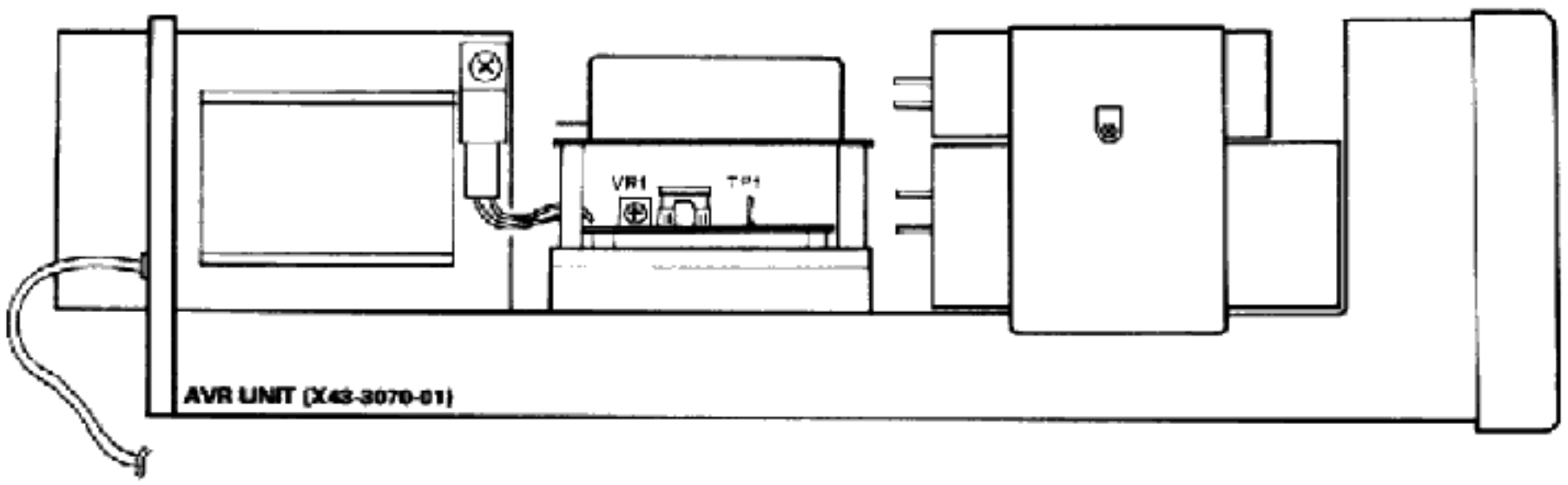
Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
23-1. ALC meter ZERO	1) MAIN DISP : 14.200MHz MODE : USB Control unit (A/3) VR3 : Centered STBY : SEND	DC V.M	CONT (A/3)	VR3	CONT (A/3)	VR2	0.01V	±0.001V
23-2. ALC meter FULL	1) MIC terminal : AG (1kHz/5mV) METER ALC : Push STBY : SEND	Power meter	Rear panel	ANT	Front panel	MIC GAIN	Set the MIC GAIN VR to 1 dot of ALC meter (just before 1 dot lights).	
	2) MIC terminal : AG (1kHz/10mV) STBY : SEND	AG AF V.M	Front panel	MIC ALC meter	CONT (A/3)	VR3	Adjust for MAX ALC zone reading	
24. PROC meter	1) MODE : USB METER COMP : Push PROC SW : ON MIC terminal : AG (1kHz/1mV) STBY : SEND	Power meter	Rear panel	ANT	Front panel	PROC IN VR	Set the PROC IN VR to 1 dot of COMP meter (just before 1 dot lights).	
	2) MIC terminal : AG (1kHz/10mV) STBY : SEND After adjusted PROC SW : OFF	AG AF V.M	Front panel	MIC COMP meter	CONT (A/3)	VR9	Adjust for 20dB COMP meter	
25-1. FM MIC DEV	1) MAIN DISP : 29.050MHz MODE : FM FILTER 455 : 12kHz MIC terminal : AG (1kHz/30mV) STBY : SEND	Power meter Directional coupler Linear detector Oscilloscope	Rear panel	ANT	AF	VR5	DEV ±4.6kHz	
25-2. MIC GAIN	1) MIC terminal : AG (1kHz/3mV) **W,W2,X** : AG (1kHz/5mV) **K,M,P** STBY : SEND					VR6	DEV ±3.0kHz	±0.1kHz
25-3. MIC GAIN (FM narrow)	1) FILTER 455 : 6kHz MIC terminal : AG (1kHz/30mV) STBY : SEND	AG AF V.M	Front panel	MIC		VR4	DEV ±2.3kHz	±0.1kHz
	2) MIC terminal : AG (1kHz/3mV) **W,W2,X** : AG (1kHz/5mV) **K,M,P** STBY : SEND						Check	DEV ±1.4–1.6kHz
26. SUB TONE	1) MAIN DISP : 29.700MHz MODE : FM FUNCTION TX VFO : B A=B key : 1 push TONE : ON MIC terminal : Open STBY : SEND After adjusted TONE : OFF TX VFO : A	Power meter Directional coupler Linear detector Oscilloscope AF V.M	Rear panel	ANT			Check that SUB TONE indication will appeare to 88.5c	Please press the TONE key if disappeared.
					AF	VR3	DEV ±600Hz	±60Hz
27. FM carrier	1) MAIN DISP : 29.700MHz MODE : FM METER ALC : ON MIC terminal : Open STBY : SEND	Power meter Directional coupler	Rear panel	ANT	SIG	VR6	Adjust for MAX ALC zone reading.	
28-1. DSP TS-950SD	1) DSP unit S1 : 1 S2 : 1 S3-1 : OFF S3-2 : OFF S3-3 : OFF S3-4 : ON TP6 : Short (ON)	Power meter	Rear panel	ANT	IF	VR5	Set to mechanical centered point.	

ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
28-2. GAIN 1	2) MAIN DISP : 14.200MHz MODE : AM METER ALC : ON STBY : SEND	Power meter	Rear panel	ANT	SIG	L22	Power MAX	Set the SW unit (A) VR11 (CAR VR) to 10W. Also discrease the CAR VR to no ALC reading when adjust item 28-2.
28-3. GAIN 2	3) MODE : USB STBY : SEND					VR8	Adjust for full scale of ALC meter.	
28-4. FM GAIN	4) MAIN DISP : 29.700MHz MODE : FM METER ALC : ON STBY : SEND					VR7	Adjust for MAX ALC zone reading.	
29. DSP MIC GAIN TS-950SD	1) MIC terminal : AG (1kHz/5mV) STBY : SEND	Power meter	Rear panel	ANT	Front panel	MIC GAIN VR	Set the MIC GAIN VR to 1 dot of ALC meter (just before 1 dot lights).	
	2) MIC terminal : AG (1kHz/10mV) STBY : SEND				DSP	VR1	Adjust for MAX ALC zone reading.	
30. DSP unit VCO TS-950SD	1) Connect the two DSP connector to the rear panel. MAIN DISP : Any frequency STBY : SEND	DC V.M	DSP	TP6	DSP	L12	4V	±0.2V
31. Monitor level	1) MAIN DISP : 21.050MHz MODE : USB MONI SW : ON MONI VR : 12 o'clock ALC SW : ON MIC terminal : AG (1kHz/10mV) STBY : SEND MIC VR : ALC zone MAX	Power meter DM, SP Oscilloscope AF V.M	Rear panel	ANT EXT. SP	IF	VR1	Set to mechanical centered point.	
							Check	0.3–1.0V/8Ω
32. CW sidetone	1) MAIN DISP : 21.050MHz MODE : CW MONI SW : OFF PITCH VR : 12 o'clock VOX SW : ON FUNCTION TX : A FUNCTION RX : A Rear panel ELECTRONIC KEY : OFF LINEAR AMP : ON	Power meter f. counter AF V M	Rear panel	ANT EXT. SP	AF	VR2	Adjust to 0.2V/8Ω with key down.	±0.02V
33. Auto antenna tuner	1) MAIN DISP : 1.900MHz MODE : CW AUTO/THRU : AUTO AT TUNE : ON	Oscilloscope 50Ω dummy SWR meter (Front panel) 150Ω dummy	Rear panel	ANT	AT (A/2)	VR1	Adjust VR1 to fully CCW position. Adjust VR1 is slowly increase. 2 dots of SWR meter just goes off.	
						VR2 TC1	Set to mechanical centered point.	Do not hang-up when tuning in 28MHz bands.
							Check	Motor stop until all band.

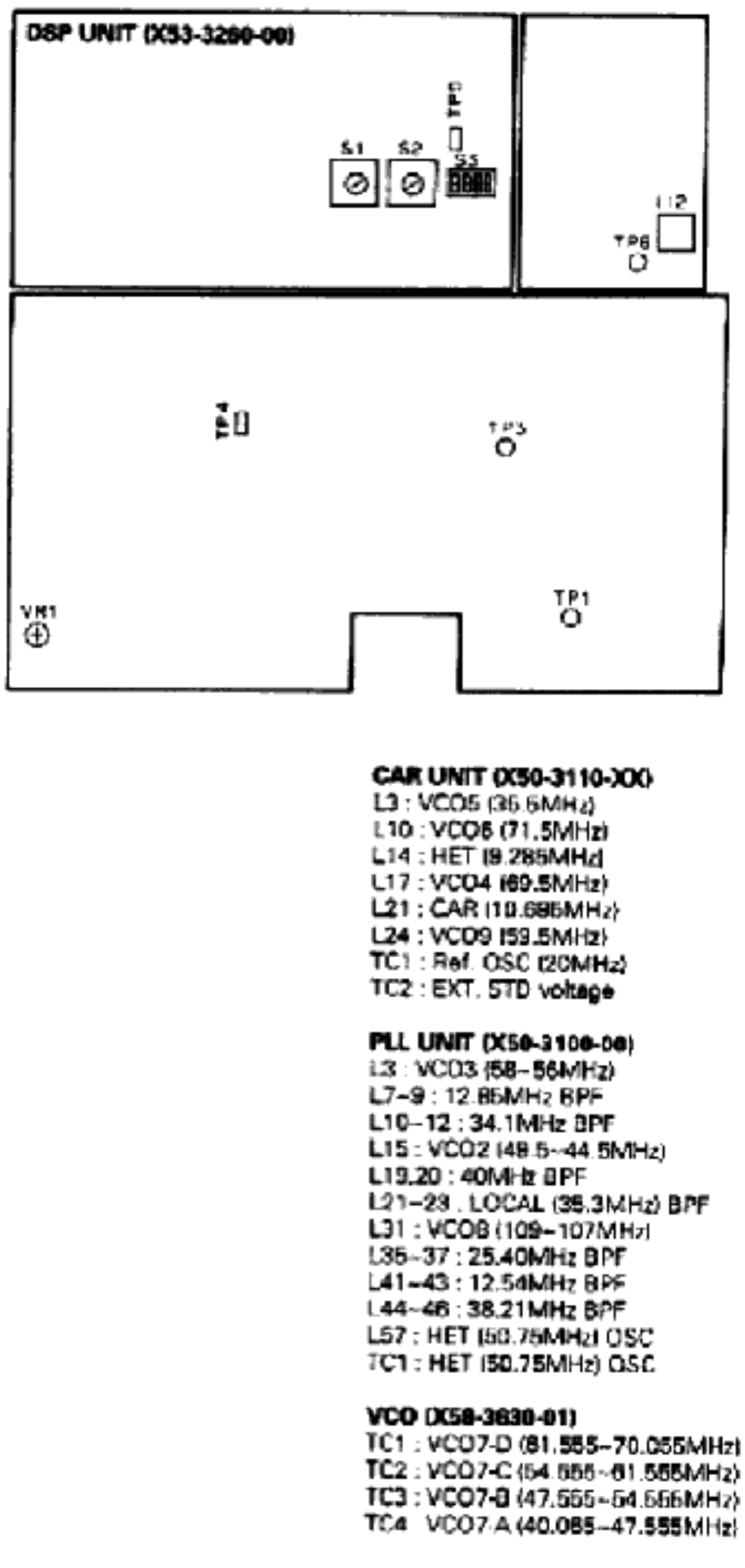
ADJUSTMENT

Adjustment points (AVR unit)



AVR UNIT (X43-3070-01)
VR1 : 15V adj.

Adjustment points (DSP unit)



DSP UNIT (X53-3260-00) : TS-950SD
L12 : VCO
VR1 : MIC GAIN

CAR UNIT (X50-3110-XX)
L3 : VCO5 (35.6MHz)
L10 : VCO6 (71.5MHz)
L14 : HET (9.285MHz)
L17 : VCO4 (69.5MHz)
L21 : CAR (10.695MHz)
L24 : VCO9 (59.5MHz)
TC1 : Ref. OSC (20MHz)
TC2 : EXT. STD voltage

PLL UNIT (X59-3100-00)
L3 : VCO3 (58–56MHz)
L7–9 : 12.85MHz BPF
L10–12 : 34.1MHz BPF
L15 : VCO2 (48.5–44.5MHz)
L19,20 : 40MHz BPF
L21–23 : LOCAL (35.3MHz) BPF
L31 : VCO8 (109–107MHz)
L35–37 : 25.40MHz BPF
L41–43 : 12.54MHz BPF
L44–46 : 38.21MHz BPF
L57 : HET (50.75MHz) OSC
TC1 : HET (50.75MHz) OSC

VCO (X58-3630-01)
TC1 : VCO7-D (81.555–70.055MHz)
TC2 : VCO7-C (54.555–61.555MHz)
TC3 : VCO7-B (47.555–54.555MHz)
TC4 : VCO7-A (40.055–47.555MHz)

RF UNIT (X44-3100-00)
L19–21 : 2.5–4.5MHz BPF
L25–27 : 6.5–7.5MHz BPF
L31–33 : 9.5–11.0MHz BPF
L37–39 : 13.5–15.0MHz BPF
L46–48 : 20.5–22.0MHz BPF
L52–54 : 23–30.5MHz BPF
L77–80 : SUB MCF (40.055MHz)
L87 : MAIN RX IF AMP
L93–95 : TX IFT
TC1 : 73.05MHz trap
VR1 : RX SUB MIX balance
VR2 : RX MAIN MIX balance
VR3 : TX MIX balance
VR4 : TX MIX bias (7MHz)
VR5 : TX MIX bias (14MHz)
VR6 : TX MIX bias (29MHz)

AF UNIT (X49-3020-00)
L13,14 : MAIN NB GAIN
VR1 : VBT (Centered)
VR2 : CW sidetone
VR3 : SUB TONE DEV.
VR4 : Narrow FM MIC GAIN
VR5 : FM MIC DEV.
VR6 : MIC GAIN

VCO2 (X58-3380-03)
TC1 : VCO3 (64.22MHz)

VCO (X58-3630-00)
TC1 : VCO1-A (73.05–80.55MHz)
TC2 : VCO1-B (80.55–87.55MHz)
TC3 : VCO1-C (87.55–94.55MHz)
TC4 : VCO1-D (94.55–103.05MHz)

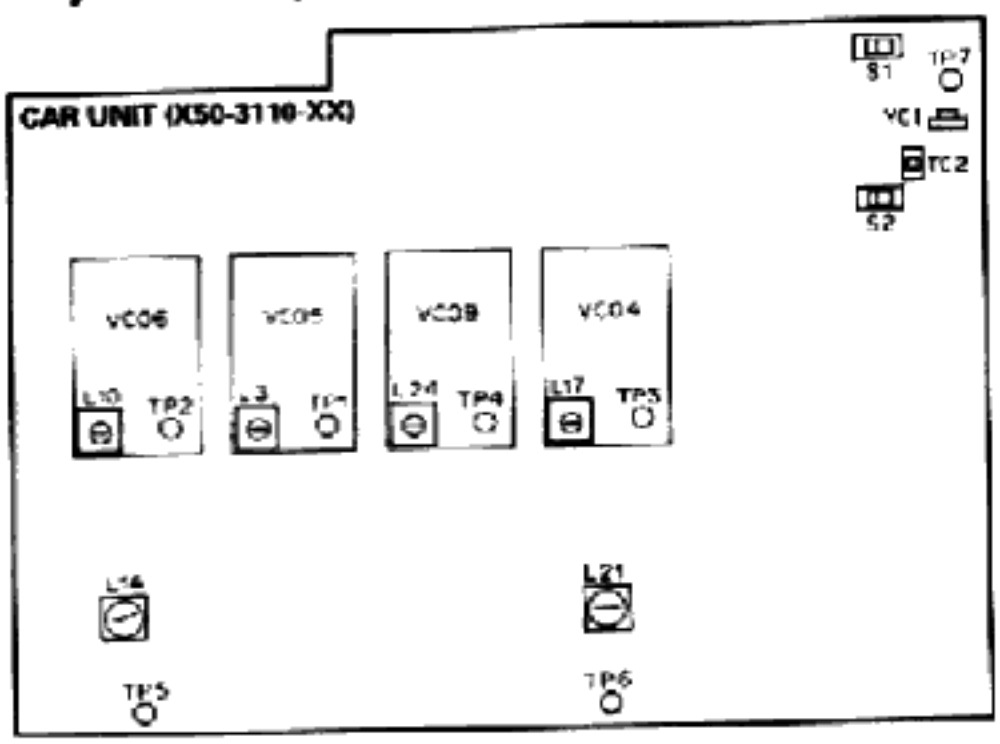
IF UNIT (X48-3060-00)
L1–8 : RX SUB IF AMP
L9–11 : RX MAIN MCF
L12–17 : RX MAIN IF AMP
L18,19 : IF OUT1
L20 : RX MAIN IF AMP
L21,22 : SUB NB GAIN
L23–27 : TX IF AMP
L28–30 : RX MAIN IF AMP
L31 : TX IF AMP
VR1 : MONI level
VR2 : SUB RX GAIN
VR3 : SUB AGC
VR4 : 64.2MHz TX spurious
VR5 : DSP (TS-950SD)

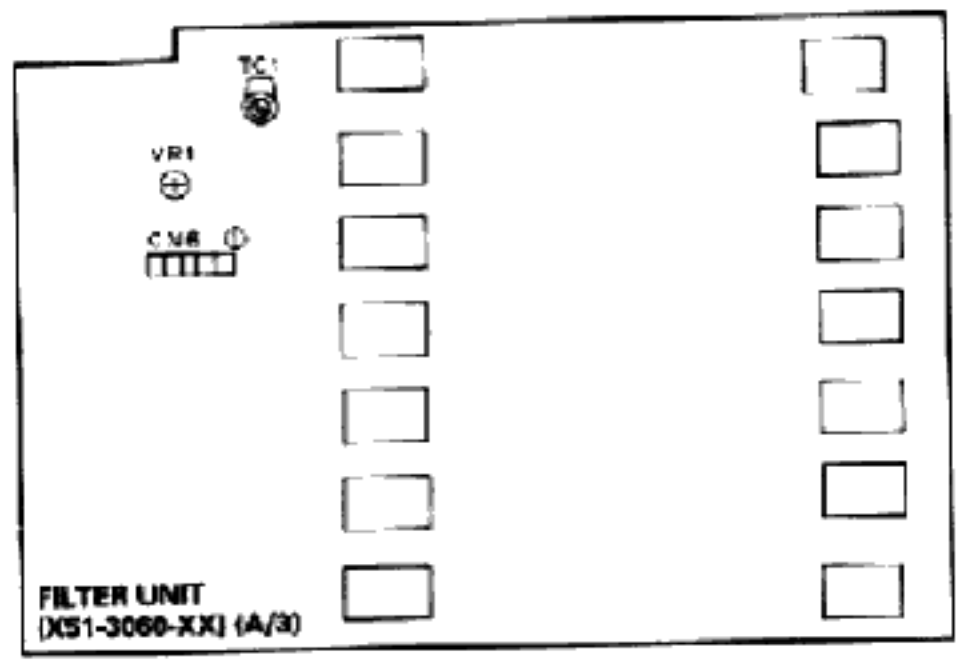
FILTER UNIT (X51-3060-XX) (C/3)
L12,13 : 8.83MHz MCF

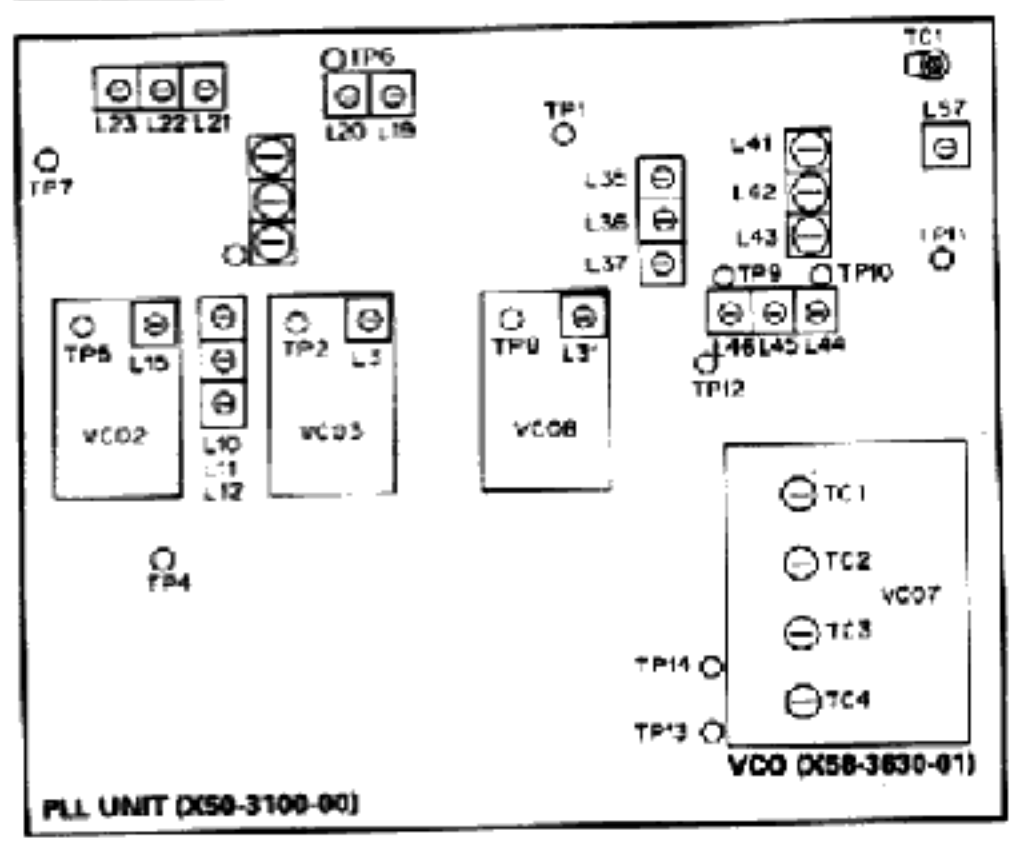
SIGNAL UNIT (X57-3380-00)
L2,4,5,7 : RX MAIN IF AMP
L6 : NOTCH
L10–12 : TX CAR MIX & AMP
L16,18 : TX IF AMP
L22 : DSP GAIN (AM)
L24,25 : PROC AMP
L26 : RX FM GAIN
TC1 : CAR suppression
VR1 : MAIN SSB S-1
VR2 : NOTCH
VR3 : MAIN AGC
VR4 : MAIN RX GAIN
VR5 : MAIN SSB S-9
VR6 : TX FM CAR level
VR7 : DSP GAIN (FM)
VR8 : DSP GAIN (SSB)
VR9 : CAR suppression
VR10 : RX FM GAIN
VR11 : RX FM S-meter

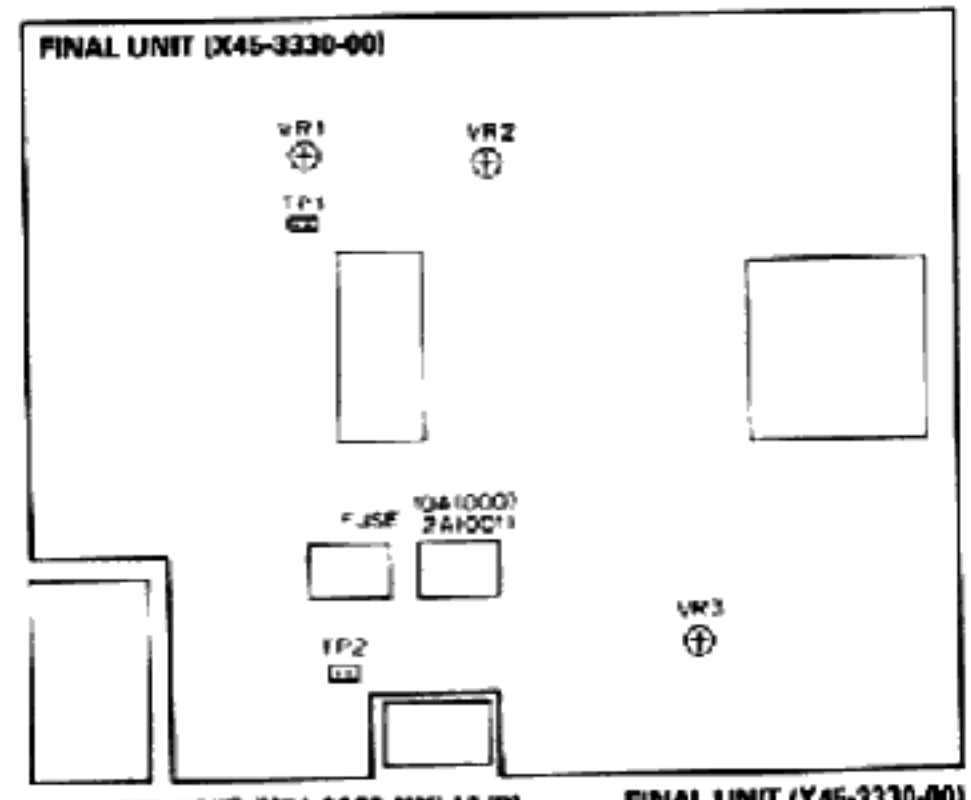
ADJUSTMENT

Adjustment points (Upper side)









FILTER UNIT (X51-3060-XX) (A/3)
VR1 : ALC frequency response
TC1 : NULL

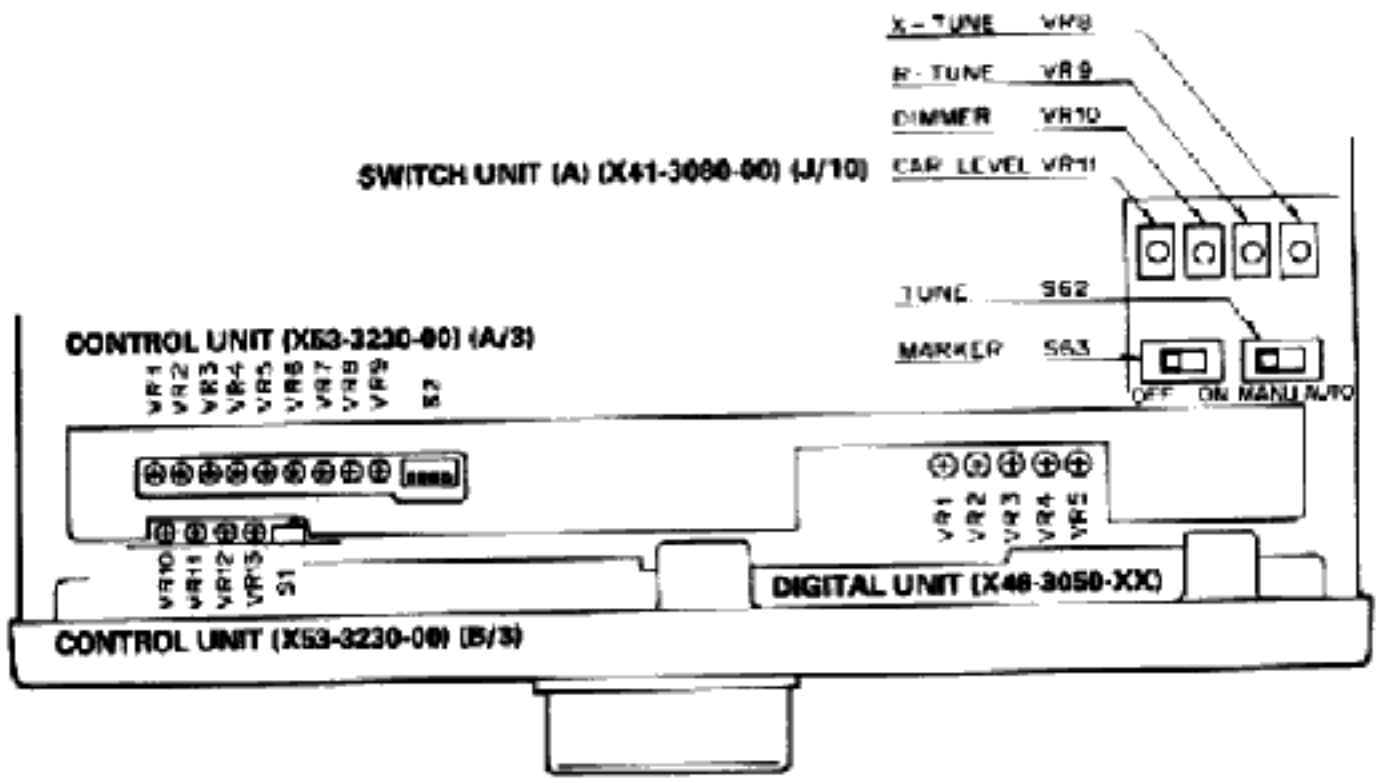
FINAL UNIT (X45-3330-00)
VR1 : Drive bias
VR2 : Final bias
VR3 : Final Vcc

CONTROL UNIT (X53-3230-00) (A/3)
VR1 : Beep tone
VR2 : ALC meter-e
VR3 : ALC meter full
VR4 : IC meter
VR5 : ALC voltage
VR6 : IC protection
VR7 : SWR protection
VR8 : SWR meter
VR9 : PROC meter

CONTROL UNIT (X53-3230-00) (B/3)
VR10 : TX MIN power setting
VR11 : Power meter
VR12 : RF power
VR13 : Not used

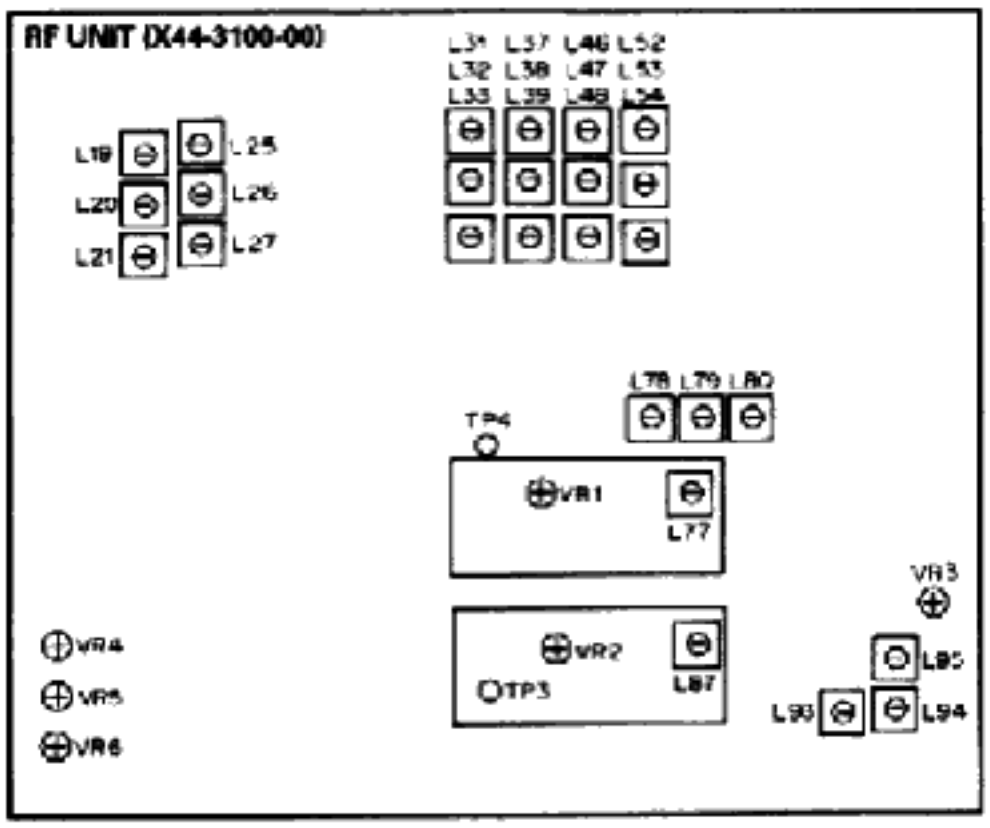
SWITCH UNIT (A) (X41-3060-00) (J/10)
VR8 : MANUAL TONE VR (Centered)
VR9 : MANUAL TONE VR (Centered)
VR10 : DIMMER (Centered)
VR11 : CAR level

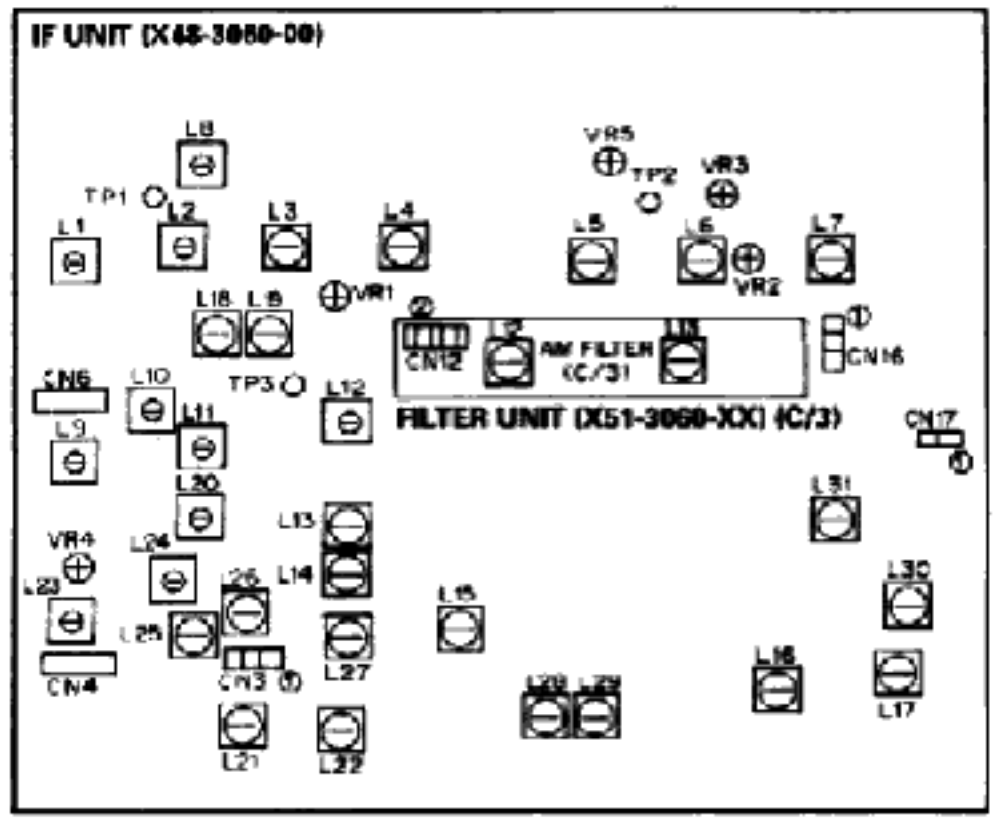
DIGITAL UNIT (X46-3050-XX)
VR1 : SCOPE SUB MARKER
VR2 : CAR point (LSB/USB)
VR3 : CAR point (LSB)
VR4 : CAR point (USB)
VR5 : CAR point

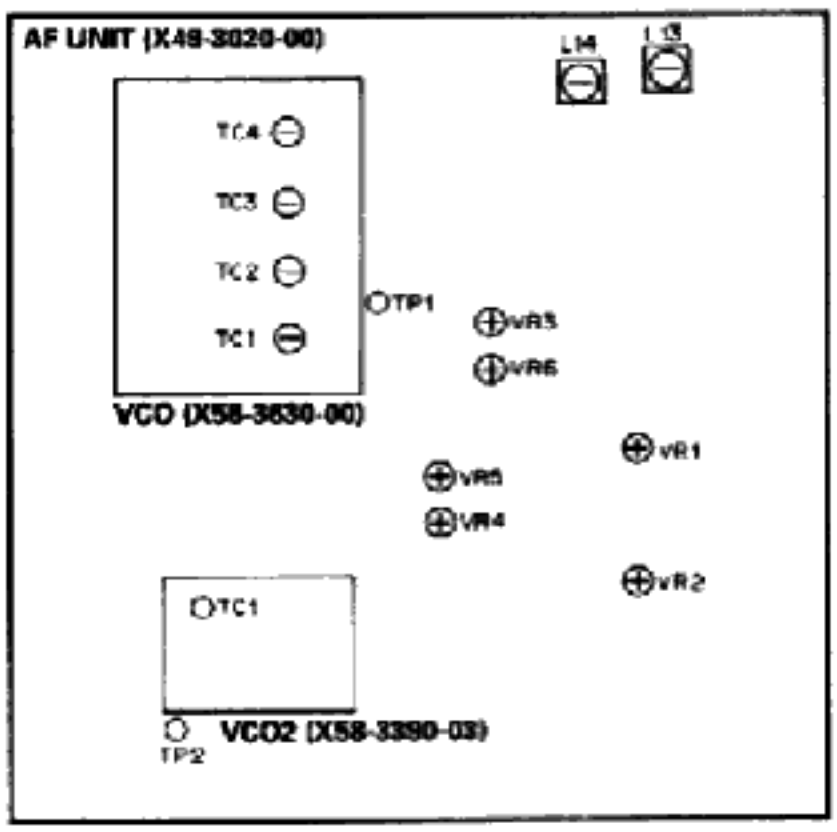


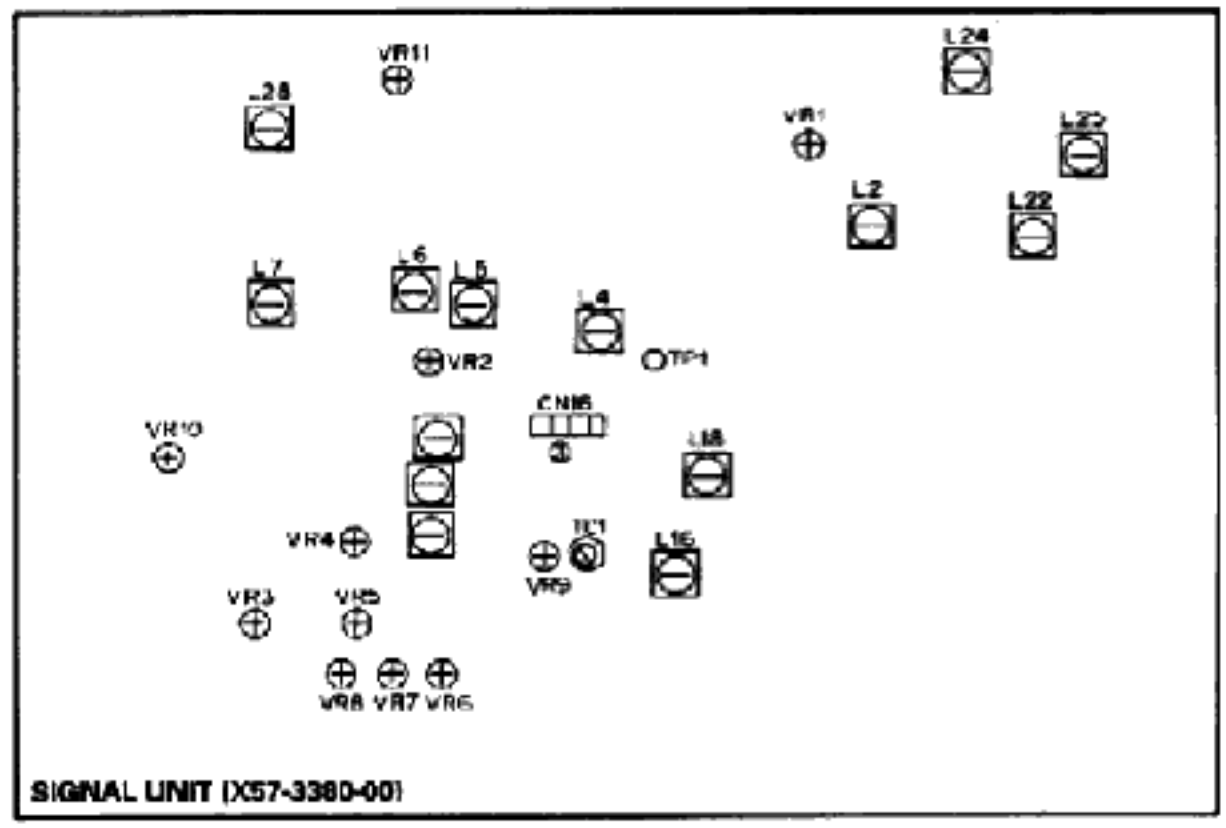
ADJUSTMENT

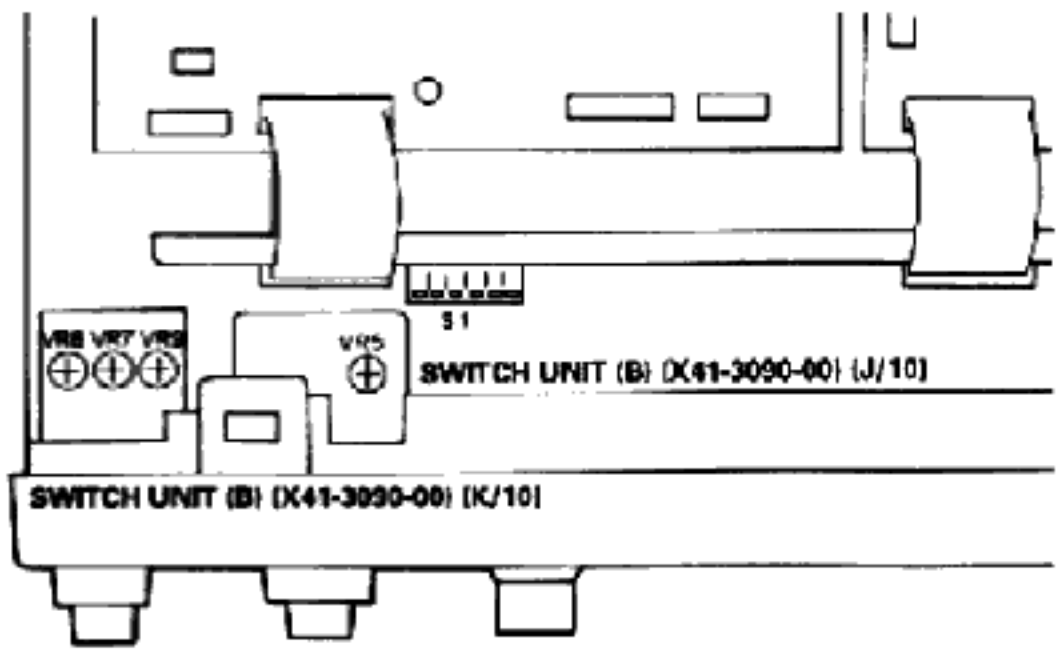
Adjustment points (Lower side)











SWITCH UNIT (B) (X41-3090-00) (K/10)
VR7 : Slope tune LSB
VR8 : Slope tune USB
VR9 : PITCH CW

SWITCH UNIT (B) (X41-3090-00) (J/10)
VR5 : IF VBT (455.0kHz)

TERMINAL FUNCTION

Connector No.	Terminal No.	Terminal Name	Terminal function
SWITCH UNIT (A) (X41-3080-00)			
CN1 (A/10)	1	LTXB	Transmitter LED signal. Active "H"
	2	LMTA	AT-TUNE LED signal. Active "H"
	3	LNOT	NOTCH LED signal. Active "H"
	4	HIPC	AIP LED signal. Active "L"
CN2 (A/10)	1	GND	GND
	2	MD	MIC down signal.
	3	MU	MIC up signal.
	4	K0	Key output 0. SW ON : "L"
	5	K1	Key output 1. SW ON : "L"
	6	K2	Key output 2. SW ON : "L"
	7	K3	Key output 3. SW ON : "L"
	8	K4	Key output 4. SW ON : "L"
	9	K5	Key output 5. SW ON : "L"
	10	K6	Key output 6 SW ON : "L"
	11	K7	Key output 7. SW ON : "L"
	12	S0	Key matrix select signal 0. "L" : Select
	13	S1	Key matrix select signal 1. "L" : Select
	14	S2	Key matrix select signal 2. "L" : Select
	15	S3	Key matrix select signal 3. "L" : Select
	16	S4	Key matrix select signal 4. "L" : Select
	17	S5	Key matrix select signal 5. "L" : Select
	18	S6	Key matrix select signal 6. "L" : Select
	19	NC	Not used.
	20	GND	GND
CN3 (A/10)	1	MD	MIC down signal.
	2	MU	MIC up signal.
	3	NC	Not used.
CN4 (A/10)	1	S6	Key matrix select signal 6.
	2	K7	Key output 7.
	3	K6	Key output 6.
	4	K5	Key output 5.
	5	NC	Not used.
CN5 (A/10)	1	K0	Key output 0.
	2	S5	Key matrix select signal 5.
CN6 (A/10)	1	GND	GND
	2	LRB	Function RX-B LED signal input. Active "H"
	3	LTB	Function TX-B LED signal input. Active "H"
	4	LTM	Function TX-M LED signal input. Active "H"
	5	LRA	Function RX-A LED signal input. Active "H"
	6	LRM	Function RX-M LED signal input. Active "H"
	7	LK1	Key top LED signal input. Active "H"
	8	LTA	Function TX-A LED signal input. Active "H"
	9	LFSK	FSK LED signal input. Active "H"
	10	LLSB	LSB LED signal input. Active "H"
	11	LUSB	USB LED signal input. Active "H"
	12	LCW	CW LED signal input. Active "H"
	13	LAM	AM LED signal input. Active "H"
	14	NC	Not used.
	15	NC	Not used.
	16	LFM	FM LED signal input. Active "H"
	17	TR	TX/RX identity signal output.
	18	5DIG	+5V.
CN7 (B/10)	1	+15	+15V.
	2	VOX	VOX signal.
	3	FULL	Full break-in signal.
CN8 (B/10)	1	MONI	Monitor. ON : "H"
CN9 (B/10)	1	DIM2	Dimmer signal input
	2	DIM1	Dimmer signal output.

Connector No.	Terminal No.	Terminal Name	Terminal function
CN10 (C/10)	1	SS	Standby signal. "L" : TX
	2	ATA	AT AUTO switch. "L" : AUTO
	3	ATS	AT start switch. Active "H"
	4	GND	GND
CN11 (C/10)	1	ATS	AT switch. Active "H"
	2	+15	+15V input.
	3	MONI	Monitor ON/OFF controlled output. ON : "H"
CN12 (H/10)	1	ANI	Audio signal (TX : Mic amplifier output).
	2	GND	GND
CN13 (H/10)	1	PCV	Gain variable voltage for power control.
CN14 (H/10)	1	PKSS	Packet stand-by input. Active "L"
	2	GND	GND
	3	PRCVR2	Processor IN signal output.
	4	GND	GND
	5	MICVR2	Mic volume output signal output.
	6	MICAO	Mic amplifier output signal output.
	7	GND	GND
	8	GND	GND
	9	PRL2	Processor OUT controlled voltage output.
CN15 (H/10)	1	8M	Microphone terminal +8V.
	2	GND	GND
	3	SS	Standby signal "L" : TX
	4	MG	MIC GND
	5	MIC	MIC signal.
CN16 (H/10)	1	DATC	DATA mode signal input. "L" : DATA mode
	2	POV3	Power volume GND.
	3	POV2	Power volume output.
	4	POV1	Power volume input.
	5	SS	Standby signal "L" : TX
	6	GND	GND
	7	+8	+8V.
CN17 (E/10)	1	CWD	CW delay controlled voltage output.
	2	+15	+15V.
	3	KSP2	Electric keyer speed controlled voltage input.
	4	KSP1	Electric keyer speed controlled voltage output.
CN18 (E/10)	1	GND	GND
	2	VOXVR2	VOX gain controlled voltage output.
	3	GND	GND
	4	AVR2	ANTI VOX controlled voltage output.
	5	VOXDL	VOX delay controlled voltage output.
	6	GND	GND
	7	MONVR2	Monitor signal output
CN19 (E/10)	1	GND	GND
	2	MICAO	Mic amplifier output signal.
CN20 (E/10)	1	GND	GND
	2	SP2	AF signal (PHONE use : OFF).
	3	GND	GND
	4	MICAO	Mic amplifier signal input.
	5	GND	GND
	6	MONVR2	Monitor signal input.
CN21 (F/10)	1	GND	GND
CN22 (F/10)	1	K7	Key output 7 input.
	2	K6	Key output 6 input.
	3	K5	Key output 5 input.
	4	S6	Key matrix select signal 6 input.
CN23 (F/10)	1	AFTS	AF VBT switch "H" : ON
	2	NOTS	NOTCH switch. "H" : ON
	3	NFM15	+15V (Except FM mode).

Connect No.	
CN24 (G/10)	
CN25 (G/10)	
CN26 (G/10)	
CN27 (G/10)	
CN28 (G/10)	
CN29 (J/10)	
CN30 (J/10)	
CN31 (J/10)	
CN32 (J/10)	
CN33 (C/10)	
W1 (B/10)	
W2 (D/10)	
W3 (G/10)	
W4 (K/10)	

TERMINAL FUNCTION

Connector No.	Terminal No.	Terminal Name	Terminal function
CN24 (G/10)	1	+15	+15V.
CN25 (G/10)	1	SSBB	SSB voltage supply (+15V).
	2	PRCSW	Processor switch. "H" : ON
	3	GND	GND
	4	MPV	Mic volume signal/Processor IN signal. Processor switch ON : Processor IN
	5	NB2	Noise blanker 2 switch.
	6	NB1	Noise blanker 1 switch.
	7	GND	GND
	8	+15	+15V.
CN26 (G/10)	1	GND	GND
	2	PRCVR2	Processor IN signal.
	3	GND	GND
	4	MICVR2	Mic volume output signal.
CN27 (G/10)	1	NBV2	Main NB2 controlled voltage.
	2	SNBV2	Sub NB2 controlled voltage.
	3	SNBV1	Sub NB1 controlled voltage.
	4	NBV1	Main NB1 controlled voltage.
	5	GND	GND
	6	+15	+15V.
CN28 (G/10)	1	SNB2	Sub NB2 switch.
	2	SNB1	Sub NB1 switch.
CN29 (J/10)	1	5DG	+5V.
	2	MNS	AT manual/auto switch. "L" : Auto
	3	GND	GND
	4	PR2	AT VC2 preset data.
	5	PR1	AT VC1 preset data.
	6	BI	Dimmer controlled signal.
	7	LH	Dimmer controlled signal.
CN30 (J/10)	1	GND	GND
	2	PRE1	Preset data 1.
	3	PRE2	Preset data 2.
	4	GND	GND
CN31 (J/10)	1	DIM2	Dimmer signal output.
	2	DIM1	Dimmer signal input.
CN32 (J/10)	1	CALS	Marker switch.
	2	GND	GND
	3	NC	Not used.
	4	CV2	CAR level volume.
	5	CV1	CAR level volume.
CN33 (C/10)	1	MONI	Monitor. ON : "H"
W1 (B/10)	1	MONI	Monitor. ON : "H"
W2 (D/10)	1	MG	MIC GND
	2	MIC	MIC signal.
	3	SS	Standby signal. "L" : Tx
	4	GND	GND
	5	MD	MIC down signal.
	6	MU	MIC up signal.
	7	8M	MIC +8V.
W3 (G/10)	1	K0	Key output 0. SW ON : "L"
	2	S5	Key matrix select signal 5. "L" : Select
W4 (K/10)	1	SNBV1	Sub NB1 controlled voltage.
	2	NBV2	Main NB2 controlled voltage.
	3	NBV1	Main NB1 controlled voltage.
	4	GND	GND
	5	SNBV2	Sub NB2 controlled voltage
	6	+15	+15V.

Connector No.	Terminal No.	Terminal Name	Terminal function
SWITCH UNIT (B) (X41-3090-00)			
CN1 (A/10)	1	SQ1	Squelch volume input except FM mode.
	2	SQ2	Squelch volume output except FM mode.
	3	FSQ2	Squelch volume input with FM mode.
	4	FSQ1	Squelch volume output with FM mode.
	5	GND	GND
	6	NOV2	Notch volume output.
	7	NOTS	Notch volume input.
CN2 (B/10)	1	SUBVR2	Sub AF volume output.
	2	GND	GND
	3	SUBVR1	Sub AF volume input.
	4	GND	GND
CN3 (B/10)	1	PITVR	Reference voltage (Pitch).
	2	PIT	CW pitch volume.
	3	AGND	Analog GND
CN4 (C/10)	1	+15	+15V.
	2	ATT1	10dB ATT controlled signal.
	3	ATT2	20dB ATT controlled signal.
CN5 (D/10)	1	AGS	AGC select switch.
	2	MID	AGC time constant MID select signal.
	3	SLOW	AGC time constant SLOW select signal.
	4	AGO	AGC OFF.
CN6 (F/10)	1	REN2	RIT encoder output 2.
	2	GND	GND
	3	REN1	RIT encoder output 1.
CN7 (G/10)	1	GND	GND
	2	MAINVR2	Main AF volume output.
	3	GND	GND
	4	MAINVR1	Main AF volume input.
CN8 (G/10)	1	RFB2	RF GAIN volume output.
	2	RFB1	RF GAIN volume input.
CN9 (H/10)	1	SP1	Speeker 1 (AF signal hot side).
	2	GND	GND
	3	SP2	AF signal. (Circuit will opened when PHONE plug is inserted.)
	4	GND	GND
	5	SP2	AF signal. (Circuit will opened when PHONE plug is incerted.)
	6	GND	GND
CN10 (E/10)	1	GND	GND
	2	CEN1	Click encoder output 1.
	3	CEN2	Click encoder output 2.
CN11 (J/10)	1	AFVBT1	AF VBT volume.
	2	AFVBT2	AF VBT volume.
	3	NC	Not used.
	4	AGND	Analog GND
	5	VBT	VBT volume.
	6	VRE3	Reference voltage 3.
CN12 (K/10)	1	SLL	Slope tune low cut volume.
	2	AGND	Analog GND
	3	SLH	Slope tune high cut volume.
	4	VRE1	Reference voltage 1.
	5	VRE2	Reference voltage 2.
CN13 (K/10)	1	REF4	Reference voltage 4.
	2	PITVR	Reference voltage (Pitch).
W1 (K/10)	1	GND	GND

TERMINAL FUNCTION

Connector No.	Terminal No.	Terminal Name	Terminal function
AVR UNIT (X43-3070-01)			
CN1 (A/5)	1	FG2	GND
	2	F15	Final unit +15V output.
	3	F15	Final unit +15V output.
CN2 (A/5)	1	+MT1	Power supply fan (+).
	2	–MT1	Power supply fan (–).
CN3 (A/5)	1	+MT2	Transformer fan (+).
	2	–MT2	Transformer fan (–).
CN4 (A/5)	1	15SG	Signal unit +15V output.
	2	GND	GND
	3	–12SG	Signal unit –12V output.
CN5 (A/6)	1	TPT	Approx. 5V output when decrease a RF output (power down)
	2	GND	GND
	3	15CN	Control unit +15V output.
	4	AF15	Control unit +15V output. (For AF amplifier µPC2002)
	5	–12CN	Control unit –12V output.
CN6 (A/6)	1	5PL	PLL unit +5V output.
	2	15PL	PLL unit +15V output.
	3	GND	GND
	4	5DG	Digital unit +5V output.
	5	GND	GND
	6	5DS	Display unit +5V output.
	7	15DS	Display unit +15V output.
	8	GND	GND
CN7 (D/5)	1	F	Display unit heater voltage input. (FG GND : AC 4.9V)
	2	FG	Display unit heater GND.
	3	F	Display unit heater voltage input. (FG GND : AC 4.9V)
CN8 (A/5)	1	5DM	DSP unit +5V output.
	2	5GND	GND
	3	15DM	DSP unit +15V output.
	4	15GND	GND
	5	–12DM	DSP unit –12V output.
	6	NC	GND
CN9 (C/5)	1	FG1	Final unit GND.
	2	FG1	Final unit GND.
	3	FHV	Final unit +68V output.
	4	FHV	Final unit +68V output.
CN10 (A/5)	1	GND	GND
	2	GND	GND
	3	CO	+15V power supply input.
	4	CO	+15V power supply input.
CN11 (B/5)	1	HV	Display unit –40V output.
	2	HG	GND
	3	NC	GND
CN12 (B/5)	1	GND	GND
	2	–12	Each unit –12V output.
CN13 (B/5)	1	AC40	–40V power supply input.
	2	AC40	–40V power supply input.
	3	AC12	–12V power supply input.
	4	AC12	–12V power supply input.
CN14 (D/5)	1	F	Display unit heater voltage output. (FG GND : AC 4.9V)
	2	FG	Display unit heater GND.
	3	F	Display unit heater voltage output. (FG GND : AC 4.9V)

Connector No.	Terminal No.	Terminal Name	Terminal function
W1 (A/5)	1	GND	GND
	2	–12	Each unit –12V input.
W2 (C/5)		G	GND
		G	GND
		CO	+15V power supply output.
		CO	+15V power supply output.
W3 (A/5)		BB	+15V power supply bias input.
W4 (A/5)	1	S1	Thermal switch + for power supply heat sink.
	2	S2	Thermal switch – for power supply heat sink.
W5 (A/5)	1	SCRA	SCR unit (X58-3730-00) input.
(D/5)		BB	+15V power supply bias output.
(B/5)		AC-L	Ac live (AC hot side).
(B/5)		AC-N	AC neutral (AC GND side).
		PWR-C	Power switch common.
(B/5)		PWR-M	Power switch make.
(B/5)		T-L	Power transformer live.
(B/5)		T-N	Power transformer neutran.
RF UNIT (X44-3100-00)			
CN1		TIF	Transmit IF signal (73.05MHz).
CN2	1	MKR	Marker signal .
	2	GND	Maker signal GND.
CN3		MVCO	Main LO1 input (73.06–103.05MHz).
CN4		SVCO	Sub LO1 input (40.065–70.055MHz).
CN5	1	TF3	Transmit BPF select signal (14.5–30MHz).
	2	TF2	Transmit BPF select signal (7.5–14.5MHz).
	3	TF1	Transmit BPF select signal (0.01–7.5MHz).
	4	GND	GND
CN6	1	HIPC	AIP (advanced intercept Point) controlled signal.
	2	RB0	Receive band information.
	3	RB1	Receive band information.
	4	RB2	Receive band information.
	5	RB3	Receive band information.
	6	NC	Not used.
CN7		MIF	Main IF signal (73.05MHz)
CN8		DRV	Transmit drive output.
		RAT	Receive antenna input.
CN9	1	ATT1	Active "H" 10dB ATT level when receive ATT signal.
	2	ATT2	Active "L" 20dB ATT level when receive ATT signal.
	3	+15	+15V.
	4	PCV	Gain variable voltage for power control.
CN10		SIF	Sub IF signal.
W4	1	GND	GND
	2	MOS	+15V when monitor operates.
	3	ATS	+15V when AT TUNE operetes.
	4	AGC	RF AGC control signal.
	5	TXB	+15V when transmit.
	6	+15	+15V.
	7	RXB	+15V when receive.
FINAL UNIT (X45-3330-00)			
CN1	1	FG1	Final common.
	2	FG1	Final common.
	3	FHV	+68V.
	4	FHV	+68V.
CN2	1	FG2	GND.
	2	F15	+15V.
	3	F15	+15V.

TERMINAL FUNCTION

Connector No.	Terminal No.	Terminal Name	Terminal function
CN3	1	TXI	Transmit stopped.
	2	TXB	+15V when transmit.
	3	IC–	IC meter (–).
	4	IC+	IC meter (+).
CN4	1	NC	Not used.
	2	TXB	+15V when transmit.
	3	F15	+15V.
CN5	1	MOT+	Fan motor (+).
	2	MOT–	Fan motor (–).
CN6		DRV	Drive signal input.
W1		PO	Final output.
DIGITAL UNIT (X46-3050-XX)			
CN1	1	5DG	+5V input.
	2	PRC	
	3	LTXB	Transmit LED signal input.
	4	ESS	Personal computer interface transmission request signal output. Active "H"
	5	TXI	Transmission disable signal output.
	6	CSS	Transmit/receive controlled signal input. "L" : TX, "H" : RX
	7	NC	Not used.
	8	DATC	DATA mode signal output. "L" : DATA mode
	9	NC	Not used.
	10	NC	Not used.
	11	ALMS	MET3 select signal output. "L" : ALC meter, "H" : Ic meter
	12	ATS	AT switch input.
	13	ATA	AT AUTO input.
	14	–12	–12V input.
	15	+15	+15V input.
	16	GND	GND
CN2	1	GND	
	2	PLE4	PLL controlled data enable 4 output.
	3	PLE2	PLL controlled data enable 2 output.
	4	PLE9	PLL controlled data enable 9 output.
	5	PLE3	PLL controlled data enable 3 output.
	6	PLE5	PLL controlled data enable 5 output.
	7	PLE8	PLL controlled data enable 8 output.
	8	PLE6	PLL controlled data enable 6 output.
	9	PLE7	PLL controlled data enable 7 output.
	10	NC	Not used.
	11	PDA	PLL controlled data output.
	12	PCK	PLL controlled data clock output.
	13	MLE	DSP controlled data enable output (PLL).
	14	MEN	DSP controlled data enable output (DSP).
	15	MCK	DSP controlled data clock output (DSP, PLL)
	16	MDA	DSP controlled data output (DSP, PLL).
	17	UL2	Unlock signal input.
	18	UL3	Unlock signal input.
	19	FSKC	FSK mode signal output. "H" : FSK mode
	20	SEL1	FSK controlled signal 1 output (shift width)
	21	SEL2	FSK controlled signal 2 output (shift width)
	22	SEL3	FSK controlled signal 3 output (shift direction)
	23	NC	Not used.
	24	GND	GND
CN3	1	GND	GND
	2	SSBC	SSB mode signal output. "L" : Mode select
	3	FMC	FM mode signal output. "L" : Mode select
	4	CWC	CW mode signal output. "L" : Mode select
	5	AMC	AM mode signal output. "L" : Mode select

Connector No.	Terminal No.	Terminal Name	Terminal function
	6	FSKC	FSK mode signal output. "L" : Mode select
	7	DATC	DATA mode signal output. "L" : Mode select
	8	DB	DSP mounted signal input. "H" : Mounted
	9	LNOT	NOTCH LED signal input.
	10	GND	GND
	11	SD	Serial/parallel conversion IC data output. (TC9174F)
	12	STB	Serial/parallel conversion IC data enable output. (TC9174F)
	13	SCK	Serial/parallel conversion IC data clock output (TC9174F)
	14	MOS	Transmit monitor switch input. "H" : Monitor ON
CN4	1	GND	GND
	2	NC	Not used.
	3	S6	Key matrix select signal 6 output. "L" : Select
	4	S5	Key matrix select signal 5 output. "L" : Select
	5	S4	Key matrix select signal 4 output. "L" : Select
	6	S3	Key matrix select signal 3 output. "L" : Select
	7	S2	Key matrix select signal 2 output. "L" : Select
	8	S1	Key matrix select signal 1 output. "L" : Select
	9	S0	Key matrix select signal 0 output. "L" : Select
	10	K7	Key input 7. "L" : SW ON
	11	K6	Key input 6. "L" : SW ON
	12	K5	Key input 5. "L" : SW ON
	13	K4	Key input 4. "L" : SW ON
	14	K3	Key input 3. "L" : SW ON
	15	K2	Key input 2. "L" : SW ON
	16	K1	Key input 1. "L" : SW ON
	17	K0	Key input 0. "L" : SW ON
	18	MU	MIC up signal input. "L" : SW ON
	19	MD	MIC down signal input. "L" : SW ON
	20	GND	GND
CN5	1	GND	GND
	2	FDT	FL tube and LED display data output.
	3	FCK	FL tube and LED display data clock output.
	4	FLE	FL tube and LED display data enable output.
	5	FBY	FL tube and LED display data busy input. "L" : Busy
	6	RES	Reset signal output. "L" : Reset
	7	5DG	+5V.
	8	LH	Dimmer controlled signal input (Latch).
	9	BI	Dimmer controlled signal output (Blanking).
	10	GND	GND
CN6	1	GND	GND
	2	NC	Not used.
	3	VBD	PLL band information D output.
	4	VBC	PLL band information C output. (VCO select of VCO1)
	5	VBB	PLL band information B output. (VCO select of VCO1)
	6	VBA	PLL band information A output. (VCO select of VCO1)
	7	UL1	Unlock signal input.
	8	PCK	PLL controlled data clock output.
	9	PDA	PLL controlled data output.
	10	PLE1	PLL controlled data enable 1 output.
	11	PLE0	PLL controlled data enable 0 output.
	12	MABK	Main AF blanking output. "H" : Blanking
	13	SABK	Sub AF blanking output. "H" : Blanking
	14	GND	GND
CN7	1	5DG	+5V.
	2	EN1	Main encoder pulse 1 input. (1 rotation : 250 pulse)
	3	EN2	Main encoder pulse 2 input. (1 rotation : 250 pulse)
	4	GND	GND

TERMINAL FUNCTION

Connector No.	Terminal No.	Terminal Name	Terminal function
CN8	1	CEN1	Click encoder pulse 1 input. } 1 rotation :
	2	CEN2	Click encoder pulse 2 input. } 25 pulse
	3	GND	GND
	4	REN1	RIT encoder pulse 1 input. } 1 rotation :
	5	REN2	RIT encoder pulse 2 input. } 50 pulse
	6	GND	GND
CN9	1	NC	Not used.
	2	RXD	Personal computer interface receive signal input.
	3	TXD	Personal computer interface transmit signal output.
	4	DGD	GND
	5	CTS	Personal computer interface transmission enable signal input.
	6	RTS	Personal computer interface reception enable signal output.
	7	NC	Not used.
CN10	1	MNS	AT manual/auto switch. "L" : Auto, "H" : Manual
	2	PR2	AT VC2 preset data output.
	3	PR1	AT VC1 preset data output.
	4	5DG	+5V.
	5	GND	GND
CN11	1	–12	–12V.
	2	OK	AT TUNE LED signal input.
	3	APRE	AT manual/auto signal output. "L" : Auto, "H" : Manual
	4	VSWR	AT SWR D/A converter data output.
	5	VREF	A/D converter reference voltage output (5V).
	6	AGND	Analog GND
	7	POD2	AT VC2 position volume signal input.
	8	POD1	AT VC1 position volume signal input.
CN12	1	VRE3	A/D converter reference voltage output (5V).
	2	VBT	VBT volume input.
	3	AGND	Analog GND
CN13	1	VRE2	A/D converter reference voltage output (5V).
	2	VRE1	A/D converter reference voltage output (5V).
	3	SLL	Slope tune low cut volume input.
	4	SLH	Slope tune high cut volume input.
	5	AGND	Analog GND
CN14	1	RWM	Reflected wave voltage input.
	2	MET3	ALC/Ic voltage input. ALMS "L" : ALC "H" : Ic
	3	MET1	Signal/RF voltage input. RX : Signal, TX : RF
	4	PRM	Processor meter voltage input.
	5	AGND	Analog GND
	6	AGND	Analog GND
CN15	1	VRE4	A/D converter reference voltage output (5V).
	2	PIT	PITCH volume input.
	3	AGND	Analog GND
	4	NC	Not used.
CN16	1	BI	Dimmer controlled signal input (Blanking).
	2	LH	Dimmer controlled signal output (Latch).
CN17	1	GND	GND
	2	RB3	Receive band information 3 output.
	3	RB2	Receive band information 2 output.
	4	RB1	Receive band information 1 output.
	5	RB0	Receive band information 0 output.
	6	HIPC	AIP ON/OFF signal output.
CN18	1	GND	GND
	2	LP3	Transmit band information 3 output.
	3	LP2	Transmit band information 2 output.
	4	LP1	Transmit band information 1 output.
	5	LP0	Transmit band information 0 output.
CN19	1	LNOT	NOTCH LED signal output.
	2	LTXB	Transmit LED signal output.
	3	LMTA	AT-TUNE LED signal output.
	4	HIPC	AIP LED signal output.
CN20	1	5DG	+5V.
	2	GND	GND
CN21	1	GND	GND
	2	SRBK	Sub RF blanking output. "H" : Blanking
	3	MRBK	Main RF blanking output. "H" : Blanking
CN22	1	5DG	+5V.
	2	SEN1	Sub encoder pulse 1 input. } 1 rotation :
	3	SEN2	Sub encoder pulse 2 input. } 100 pulse
	4	GND	GND
CN23	1	SMG	Analog GND
	2	SMKR	SM-230 sub-marker data output.
	3	RG0	SM-230 span switch input.
	4	RG1	SM-230 span switch input.
	5	SMKC	SM-230 sub-marker controlled signal output. "L" : ON, "H" : OFF
	6	DGG	GND
	7	NC	Not used.

IF UNIT (X48-3060-00)

Connector No.	Terminal No.	Terminal Name	Terminal function
CN1	1	88FC	2.7kHz filter select.
	2	88FE	CW filter select.
	3	88FD	1.8kHz filter select.
	4	88FB	AM filter select.
	5	88FA	FM filter select.
	6	MNG2	Main NB2 pulse input.
	7	MNG1	Main NB1 pulse input.
	8	PSQ	Packet squelch.
	9	STS	Sidetone switch.
	10	NC	Not used.
CN2	1	SNB1	Sub NB1 switch.
	2	SNB2	Sub NB2 switch.
CN3	1	ALC	ALC voltage.
	2	CKY	Keying controlled signal.
	3	GND	GND
CN4		TIF	TX IF signal output (73.05MHz).
CN5		H642	Main LO2 input (64.22MHz).
CN6		MIF	Main 1st IF signal input (73.05MHz).
CN7		SUBIF	Sub 1st IF signal input (40.055MHz).
CN8	1	NB	Main NB signal output (8.83MHz).
	2	NBG	Main NB signal GND.
CN9		H507	Sub LO2 input (50.75MHz).
CN10	1	SRBK	Sub IF blanking.
	2	MRBK	Main IF blanking.
CN11	1	GND	GND
	2	SP3	Speaker output. (AF output will opened when using EXT. SP.)
	3	GND	GND
	4	SP2	Speaker input.
CN12		PKSS	Packet stand-by switch.
CN13	1	IFO2	IF OUT2 input (455kHz).
	2	GND	GND
CN14	1	SP1	Speaker input.
	2	GND	GND
	3	SS	Stand-by switch.
	4	RAL	External ALC.

TERMINAL FUNCTION

Connector No.	Terminal No.	Terminal Name	Terminal function
	5	EKS	Electric key switch.
	6	COM	Paddle common.
	7	DOT	Paddle dot input.
	8	DASH	Paddle dash input.
	9	KSW	Key switch.
CN15	1	SANO	Sub audio input.
	2	GND	GND
	3	MANO	Main audio input.
	4	GND	GND
	5	ANI	Rear panel MIC signal output.
	6	GND	GND
	7	SAF	Sub detection output.
	8	GND	GND
CN16	1	C107	Sub CAR input (10.695MHz).
	2	GND	GND
	3	GND	GND
CN17	1	TR455	TX/RX 455kHz IF IN/OUT.
	2	GND	GND
CN18	1	GND	GND
	2	GND	GND
	3	H928	Main LO3 input (9.825MHz).
W1	1	GND	GND
	2	AGC	AGC voltage.
	3	NC	Not used.
	4	RXB	15V when receive.
	5	TXB	15V when transmit.
	6	−12	−12V.
	7	+15	+15V
	8	SMET	Analog S-meter.
AF UNIT (X49-3020-00)			
CN1	1	MNG1	NB1 gate controlled signal.
	2	MNG2	NB2 gate controlled signal.
	3	SQ	Squelch signal.
	4	STS	Sidetone switch.
	5	RXB	+15V when receive.
	6	TXB	+15V when transmit.
	7	DB	DSP ON signal.
	8	FSKC	FSK mode controlled signal.
	9	CWC	CW mode controlled signal.
	10	FMC	FM mode controlled signal.
	11	SSBC	SSB mode controlled signal.
	12	FMNC	FM NARROW mode controlled signal.
	13	−12	−12V.
	14	+15	+15V.
CN2	1	NB	Main NB signal output (8.83MHz).
	2	NBG	Main NB signal GND.
CN3	1	GND	GND
	2	SANO	Sub audio output.
	3	GND	GND
	4	MANO	Main audio output.
	5	GND	GND
	6	SAF	Sub detection input.
CN4	1	GND	GND
	2	DAF2	DSP AF input.
	3	GND	GND
	4	DAF1	DSP AF output.
CN5	1	GND	GND
	2	AFVBT1	AF VBT volume.
	3	AFVBT2	AF VBT volume.
	4	GND	GND

Connector No.	Terminal No.	Terminal Name	Terminal function
CN6	1	AFT	AF TUNE clock pulse (80kHz ± 50kHz).
	2	GND	GND
CN7	1	NB1	Noise blanker 1 switch.
	2	NB2	Noise blanker 2 switch.
	3	MONI	Monitor switch.
	4	+15	+15V.
	5	GND	GND
CN8	1	MONVR2	Monitor signal input.
	2	GND	GND
	3	AVR2	ANTI VOX controlled voltage input.
	4	GND	GND
	5	VOXDL	VOX delay controlled voltage input.
	6	GND	GND
	7	VOXVR2	VOX GAIN controlled voltage input.
	8	GND	GND
CN9	1	+15	+15V.
	2	15S	+15V switch.
CN10	1	RBC	Receive timing controlled signal.
	2	VOXO	VOX delay signal.
	3	KEY	KEY signal.
	4	CWB	CW voltage supply +15V.
CN11	1	AF	Audio signal output.
	2	GND	GND
	3	NC	Not used.
CN12	1	GND	GND
	2	MICA0	MIC amplifier signal input.
	3	NC	Not used.
	4	MOVR1	Monitor signal output.
	5	GND	GND
CN13	1	GND	GND
	2	MAINVR2	Main AF volume input.
	3	GND	GND
	4	SUBVR2	Sub AF volume input.
CN14	1	NC	Not used.
	2	MAINVR1	Main AF volume output.
	3	NC	Not used.
	4	SUBVR1	Sub AF volume output.
CN15	1	TON	Repeater tone input.
	2	GND	GND
CN16	1	GND	GND
	2	SABK	Sub AF blanking input.
	3	MABK	Main AF blanking input.
	4	PLE0	PLL controlled data enable 0 input.
	5	PLE1	PLL controlled data enable 1 input.
	6	PDA	PLL controlled data input.
	7	PCK	PLL controlled data clock input.
	8	UL1	Unlock detection signal output.
	9	VBA	PLL band information A.
	10	VBB	PLL band information B.
	11	VBC	PLL band information C.
	12	VBD	PLL band information D.
	13	NC	Not used.
	14	GND	GND
CN17	1	VBD	VCO select signal (VCO7).
	2	VBC	VCO select signal (VCO7).
	3	VBB	VCO select signal (VCO7).
	4	VBA	VCO select signal (VCO7).
	5	GND	GND
CN18	1	10VCO	PLL reference signal (10MHz).
	2	GND	GND

TERMINAL FUNCTION

Connector No.	Terminal No.	Terminal Name	Terminal function
CN19		H642	Main LO2 output (64.22MHz).
CN20		LO	PLL1 loop IF input (35.05~35.55MHz).
CN21		AFTSW	AF VBT ON/OFF controlled input.
W1	1	GND	GND
	2	SCAF	Main SSB, CW AF input.
	3	GND	GND
	4	FAAF	Main FM, AM AF input.
	5	GND	GND
W2	1	TF3	Transmit BPF select signal (14.5~30MHz).
	2	TF2	Transmit BPF select signal (7.5~14.5MHz).
	3	TF1	Transmit BPF select signal (0.01~7.5MHz).
	4	GND	GND
W3		MVCO	Main LO1 output (73.06~103.05MHz).
PLL UNIT (X50-3100-00)			
CN1	1	GND	GND
	2	NC	Not used.
	3	SEL3	Keying pole (shift direction) select signal.
	4	SEL2	Space frequency select signal.
	5	SEL1	Space frequency select signal.
	6	FSKC	FSK mode controlled signal.
	7	UL3	Unlock detection signal (Sub LO).
	8	UL2	Unlock detection signal (Main LO, CAR).
	9	MDA	PLL, DSP data.
	10	MCK	PLL, DSP data clock.
	11	MEN	DSP command enable.
	12	MLE	PLL data enable (DSP).
	13	PCK	PLL data clock.
	14	PDA	PLL data.
	15	NC	Not used.
	16	PLE7	PLL data enable (PLL7).
	17	PLE6	PLL data enable (PLL6).
	18	PLE8	PLL data enable (PLL8).
	19	PLE5	PLL data enable (PLL5).
	20	PLE3	PLL data enable (PLL3).
	21	PLE9	PLL data enable (PLL9).
	22	PLE2	PLL data enable (PLL2).
	23	PLE4	PLL data enable (PLL4).
	24	GND	GND
CN2	1	VBD	VCO select signal (VCO7).
	2	VBC	VCO select signal (VCO7).
	3	VBB	VCO select signal (VCO7).
	4	VBA	VCO select signal (VCO7).
	6	GND	GND
CN3	1	PDA	PLL data.
	2	PCK	PLL data clock.
	3	PLE6	PLL data enable (PLL6).
	4	PLE5	PLL data enable (PLL5).
	5	PLE9	PLL data enable (PLL9).
	6	PLE4	PLL data enable (PLL4).
	7	UL4	Unlock detection signal.
CN4	1	MDA	PLL, DSP data.
	2	MCK	PLL, DSP data clock.
	3	MEN	DSP command enable.
	4	MLE	PLL data enable (DSP).
	5	GND	GND
CN5	1	15PL	+15V.
	2	5PL	+5V.
	3	GND	GND
CN6	1	GND	GND
	2	5PL	+5V.
	3	15PL	+15V.
	4	8PL	+8V.
CN7		LO	PLL1 loop IF output (35.05~35.55MHz).
CN8		SVCO	Sub LO1 output (40.066~70.056MHz).
CN9		H607	Sub LO2 output (50.75MHz).
W1	1	FSKC	FSK mode controlled signal.
	2	SEL1	Space frequency select signal.
	3	SEL2	Space frequency select signal.
	4	SEL3	Keying pole (shift direction) select signal.
W2		20M	Reference signal (20MHz).
CAR UNIT (X50-3110-XX)			
CN1	1	C355	Main LO4 output (355kHz).
	2	GND	GND
	3	H928	Main LO3 output (9.285MHz).
	4	GND	
CN2	1	AFT	AF TUNE clock (60kHz ± 50kHz).
	2	GND	GND
CN3	1	C107	Sub CAR output (10.7MHz).
	2	GND	GND
	3	C100	Main CAR output (100kHz).
	4	GND	GND
CN4	1	10M	PLL reference signal (10MHz).
	2	GND	GND
	3	NC	Not used.
CN5	1	10VCO	PLL reference signal (10MHz).
	2	GND	GND
CN6	1	FSKC	FSK mode controlled signal.
	2	SEL1	Space frequency select signal.
	3	SEL2	Space frequency select signal.
	4	SEL3	Keying pole (shift direction) select signal.
CN7	1	AFSK	FSK mark, space signal.
	2	GND	GND
	3	NC	Not used.
CN8	1	RTTY	FSK KEY.
	2	GND	GND
CN9	1	CALS	MKR switch.
	2	GND	GND
CN10		20M	Reference signal (20MHz).
CN11	1	MKR	MKR signal (500kHz).
	2	NC	Not used.
CN12	1	DGG	Digital GND
	2	SMKC	Sub marker control.
	3	RG1	Monitor scope SPAN switch.
	4	RG0	Monitor scope SPAN switch.
	5	SMKR	Sub marker voltage.
	6	SMG	Analog GND
CN13	1	GND	GND
	2	RTS	Transmit request output.
	3	CTS	Transmit possible input.
	4	DGG	Signal GND
	5	TXD	Transmit data output.
	6	RXD	Receive data input.
	7	GND	GND
W1	1	PDA	PLL data.
	2	PCK	PLL data clock.
	3	PLE6	PLL data enable (PLL6).
	4	PLE5	PLL data enable (PLL5).
	5	PLE9	PLL data enable (PLL9).
	6	PLE4	PLL data enable (PLL4).

TERMINAL FUNCTION

Connector No.	Terminal No.	Terminal Name	Terminal function
	7	UL4	Unlock detection signal.
W2	1	GND	GND
	2	5PL	+5V.
	3	15PL	+15V.
	4	8PL	+8V.
J1		EXT STD	External reference input (10kHz, 1Vp-p/600Ω)
J2		RKEY	FSK KEY.
J3	1	SMG	Analog GND
	2	SMKC	Sub marker control.
	3	RG1	Monitor scope SAPN switch
	4	NC	Not used.
	5	RG0	Monitor scope SPAN switch
	6	NC	Not used.
	7	SMKR	Sub marker voltage.
	8	DGG	Digital GND
J4	1	GND	GND
	2	TXD	Transmit data output.
	3	RXD	Receive data input.
	4	CTS	Transmit possible input.
	5	RTS	Transmit request output.
	6	NC	Not used.

FILTER UNIT (X51-3060-XX)

CN1		AT1	AT input.
CN2		AT2	AT output.
CN3	1	RANT	Receive antenna.
	2	GND	GND
CN4		PO	Filter input.
CN5	1	GND	GND
	2	F15	+15V.
	3	F5	+5V.
CN6	1	VSR	Reflector detection.
	2	GND	GND
	3	GND	GND
	4	VSF	Forward detection.
	5	PD	Power output drop.
CN7	1	10A	7.5~10.5MHz.
	2	25A	21.5~24.5MHz.
	3	28A	24.5~30MHz.
	4	7A	4~7.5MHz.
	5	18A	14.5~18.5MHz.
	6	21A	18.5~21.5MHz.
	7	4A	2.5~4MHz.
	8	14A	10.5~14.5MHz
	9	NC	Not used.
	10	GND	GND
CN8	1	LP0	Filter select.
	2	LP1	Filter select.
	3	LP2	Filter select.
	4	LP3	Filter select.
	5	GND	GND
W23	1	F15	+15V
	2	TXB	+15V when transmit.

AT coiltap band information

4 digit BCD input.

CONTROL UNIT (X53-3230-00)

CN1 (A/3)	1	GND	GND
	2	GND	GND
	3	BZ	Beep level input.
CN2 (A/3)	1	GND	GND
	2	VO	Voice synthesizer signal.

Connector No.	Terminal No.	Terminal Name	Terminal function
CN3 (A/3)	1	GND	GND
	2	AF	Audio signal input.
CN4 (A/3)	1	NC	Not used.
	2	CWB	CW mode voltage supply.
	3	VOXQ	VOX DELAY signal.
CN5 (A/3)	1	KEY	KEY signal.
	2	RBC	Receive timing controlled signal.
CN6 (A/3)	1	SP1	AF signal output.
	2	GND	GND
CN7 (A/3)	1	TPT	Temperature power down voltage +5V.
	2	-12CN	-12V for control unit.
	3	15CN	+15V for control unit.
	4	AF15	Voltage supply +15V for audio amplifier.
	5	GND	GND
CN8 (A/3)	1	ATS	AT switch.
	2	ATA	AT AUTO switch.
	3	FULL	Full break-in signal.
	4	VOX	VOX signal.
	5	SS	Stand-by switch.
	6	GND	GND
	7	+15	+15V.
CN9 (A/3)	1	NC	Not used.
	2	DATC	Data controlled signal.
	3	SS	Stand-by switch.
CN10 (A/3)	1	GND	GND
	2	SP1	Audio signal.
	3	CKY	Keying control.
	4	SS	Stand-by switch.
	5	ALC	ALC signal.
CN11 (A/3)	1	KSW	Key switch.
	2	RAL	External ALC input.
	3	EKS	Electric key switch.
CN12 (A/3)	1	KSP2	Electric keyer speed.
	2	KSP1	Electric keyer speed.
	3	CWD	CW delay.
	4	+15	+15V.
CN13 (A/3)	1	TXB	Voltage supply for transmit (+15V).
	2	CKY	Keying controlled signal.
	3	NC	Not used.
CN14 (A/3)	1	AGO	AGC OFF.
	2	SLOW	AGC time constant SLOW select signal.
	3	MID	AGC time constant MID select signal.
	4	AGS	AGC switch.
CN15 (A/3)	1	TXB	Voltage supply for transmit (+15V).
	2	TXI	Transmit stop signal.
	3	IC-	Collector current (-) signal.
	4	IC+	Collector current (+) signal.
CN16 (A/3)	1	NC	Not used.
	2	NC	Not used.
	3	ATA	AT AUTO switch.
	4	ATS	AT switch.
	5	NC	Not used.
CN17 (A/3)	1	GND	GND
	2	VSR	Reflector voltage.
CN18 (A/3)	1	AGND	GND
	2	AGND	GND
	3	PRM	Processor meter.
	4	MET1	Meter signal input.
	5	MET3	Meter signal.
	6	RWM	SWR meter signal.

TERMINAL FUNCTION

Connector No.	Terminal No.	Terminal Name	Terminal function
CN19 (A/3)	1	GND	GND
	2	+15	+15V.
	3	−12	−12V.
	4	ATA	AT AUTO switch.
	5	ATS	AT switch.
	6	ALMS	ALC meter switch.
	7	NC	Not used.
	8	NC	Not used.
	9	DATC	Data controlled signal.
	10	NC	Not used.
	11	CSS	Stand-by controlled signal.
	12	TXI	Transmit stop signal.
	13	ESS	Personal computer interface STBY switch.
	14	LTXB	ON AIR LED signal
	15	PROC	
	16	5DIG	+5V voltage supply for digital unit.
CN20 (A/3)	1	RXB	Receive voltage supply +15V.
	2	TXB	Transmit voltage supply +15V.
	3	RBC	Receive timing controlled signal.
	4	PRS	Processor switch.
	5	AGS	AGC switch.
	6	MID	AGC time constant MID select signal.
	7	SLOW	AGC time constant SLOW select signal.
	8	AGO	AGC OFF.
	9	SSBB	SSB mode voltage supply (+15V).
	10	PRM1	Processor meter signal input.
	11	GND	GND
	12	SMET	S-meter signal.
	13	NC	Not used.
	14	D15	+15V supply when connect to DSP-10.
CN21 (A/3)	1	8V	+8V.
	2	ALCC	ALC signal connection.
	3	−12	−12V.
	4	GND	GND
CN22 (A/3)	1	NC	Not used.
	2	MET1	Meter signal input.
	3	TPT	Temperature power down voltage +5V.
	4	ATS	AT switch.
	5	+15	+15V.
	6	GND	GND
CN23 (A/3)	1	SSBB	SSB mode voltage supply (+15V).
	2	PRCSW	Processor switch.
CN24 (B/3)	1	PD	Power output drop signal.
	2	GND	GND
	3	VSF	Forward voltage.
CN25 (B/3)	1	GND	GND
	2	8V	+8V.
	3	POV3	Power output volume GND.
	4	POV2	Power output volume output.
	5	POV1	Power output volume input.
CN26 (C/3)	1	COM	Paddle input common.
	2	DASH	Paddle dash input.
	3	DOT	Paddle dot input.
CN27 (C/3)	1	EKS	Electric keyer switch.
	2	KEY	Key signal (Key down : 0V, Key up : 15V).
	3	FULL	Full break-in signal.
	4	CWB	CW mode voltge supply.
	5	+5	+5V.
	6	GND	GND
CN28 (A/3)	1	EKS	Electric key switch.
	2	KEY	Key signal (Key down : 0V, Key up : 15V).
	3	FULL	Full break-in signal.
	4	CWB	CW mode voltage supply.
	5	+5	+5V.
	6	GND	GND
CN29 (A/3)	1	NC	Not used.
	2	KSP1	Electric keyer speed.
	3	KSP2	Electric keyer speed.
CN30 (C/3)	1	NC	Not used.
	2	KSP1	Electric keyer speed.
	3	KSP2	Electric keyer speed.
CN31 (C/3)	1	GND	GND
	2	AUTO	AUTO waiting.
	3	REV	Reverse.
	4	WT1	Waiting (Manual setting 1).
	5	WT0	Waiting (Manual setting 0).
CN32 (C/3)		KEY	Key signal (Key down : 0V, Key up : 15V).
CN33 (A/3)		KEY	Key signal (Key down : 0V, Key up : 15V).
W3 (A/3)	1	GND	GND
	2	AUTO	AUTO waiting.
	3	REV	Reverse.
	4	WT1	Waiting (Manual setting 1).
	5	WT0	Waiting (Manual setting 0).
W4 (B/3)	1	8V	+8V.
	2	ALCC	ALC signal connection.
	3	−12	−12V.
	4	GND	GND
W5 (B/3)	1	NC	Not used.
	2	MET1	Meter signal.
	3	ATS	AT switch.
	4	TPT	Temperature power down voltage +5V.
	5	GND	GND
	6	+15	+15V.

AT UNIT (X53-3240-00)

CN1		AT1	AT input terminal.
CN2		AT2	AT output terminal.
CN3	1	VRE	+5V reverence.
	2	POD2	Volume 2 output.
	3	GND	GND
	4	POD1	Volume 1 output.
CN4	1	NC	Not used.
	2	M2−	Motor 2 drive (−).
	3	M2+	Motor 2 drice (+).
	4	M1−	Motor 1 drive (−).
	5	M1+	Motor 1 drive (+).
CN5	1	F5	+5V.
	2	F15	+15V.
	3	GND	GND
CN101	1	28A	24.5~30MHz. (AT coiltap band information)
	2	25A	21.5~24.5MHz.
	3	21A	18.5~21.5MHz.
	4	18A	14.5~18.5MHz.
	5	14A	10.5~14.5MHz.
	6	10A	7.5~10.5MHz.
	7	7A	4~7MHz.
	8	4A	2.5~4MHz
	9	GND	GND
W1		VC1	VC1 hot side.

TERMINAL FUNCTION

Connector No.	Terminal No.	Terminal Name	Terminal function
W2		VC2	VC2 hot side.
W3		GND	GND
W4	1	OK	"H" when tuning.
	2	VSWR	VSWR.
	3	APRE	"L" when auto tuning.
	4	VRE	+5V reference.
	5	PRE1	Preset data 1.
	6	PRE2	Preset data 2.
	7	POD2	Position 2.
	8	GND	GND
	9	GND	GND
	10	POD1	Position 1.
	11	GND	Analog GND for digital unit.
W5	1	ATA	AT AUTO switch.
	2	ATS	AT switch.
W101		VC	VC1, VC2 common side.
W102		GND	GND

DSP UNIT (X53-3260-00)

CN1	1	GND	GND
	2	DMIC	MIC input.
	3	DAF1	Audio input.
	4	DAF2	Audio output.
	5	GND	GND
	6	GND	GND
	7	DB	+15V.
	8	D455	455kHz output.
CN2	1	-12	-12V.
	2	GND	GND
	3	GND	GND
	4	+15	+15V.
CN3	1	10M	10MHz reference.
	2	GND	GND
CN4	1	GND	GND
	2	MIX	MIX.
	3	GND	GND
	4	SH	Sample hold amplifier, sampling timing.
	5	LEC	D/A convert command.
	6	CC	A/D convert command.
	7	GND	GND
	8	ADDT	Data from A/D converter.
	9	CK17	Serial clock.
	10	DADT	Data to D/A converter.
	11	GND	GND
	12	ANSW	D/A converter output duty adjust.
	13	MOD2	LPF input mute.
	14	MOD0	DMIC-DAF1 select, DAF1-DAF2 through.
	15	MOD1	ATT control.
	16	+15A	+15V.
	17	+15A	+15V.
	18	HPF1	HPF control.
	19	HPF2	HPF control.
	20	GND	GND
CN5	1	GND	GND
	2	HPF2	HPF control.
	3	HPF1	HPF control.
	4	+15A	+15V
	5	+15A	+15V.
	6	MOD1	ATT control.
	7	MOD0	DMIC-DAF1 select, DAF1-DFA2 through.
	8	MOD2	LPF input mute.
	9	ANSW	D/A converter output duty adjust.

Connector No.	Terminal No.	Terminal Name	Terminal function
	10	GND	GND
	11	DADT	Data to D/A converter.
	12	CK17	Serial clock.
	13	ADDT	Data from A/D converter.
	14	GND	GND
	15	CC	A/D convert command.
	16	LEC	D/A convert command.
	17	SH	Sample hold amplifier, sampling timing.
	18	GND	GND
	19	MIX	MIX.
	20	GND	GND
CN6	1	GND	GND
	2	5DMS	+5V voltage supply for digital section.
	3	MLE	PLL data enable.
	4	MEN	DSP command enable.
	5	MCK	PLL, DSP data clock.
	6	MDA	PLL, DSP data.
	7	RTTY	FSK, KEY.
	8	CKY	CW KEY.
	9	TXB	TX +15V.
CN7	1	GND	GND
	2	CLK	Reference signal.
	3	GND	GND
	4	+5	+5V.
	5	MCK2	PLL data clock.
	6	MLE2	PLL data enable.
	7	MDA2	PLL data.
	8	+15B	+15V.
W1	1	+15B	+15V.
	2	MDA2	PLL data.
	3	MLE2	PLL data enable.
	4	MCK2	PLL data clock.
	5	+5	+5V.
	6	GND	GND
	7	CLK	Reference signal.
	8	GND	GND
DSPA	1	GND	GND
	2	5DMS	+5V voltage supply for digital section.
	3	MLE	PLL data enable.
	4	MEN	DSP command enable.
	5	MCK	PLL, DSP data clock.
	6	MDA	PLL, DSP data.
	7	RTTY	FSK KEY.
	8	CKY	CW KEY.
	9	TXB	TX +15V.
	10	NC	Not used.
	11	-12	-12V voltage supply for analog section.
	12	GND	GND
	13	GND	GND
	14	+15	+15V voltage supply for analog section.
	15	10DMS	Reference.
	16	GND	10DMS GND
	17	NC	Not used.
	18	NC	Not used.
DSPB	1	GND	GND
	2	DMIC	MIC input.
	3	DAF1	Audio input.
	4	DAF2	Audio output.
	5	GND	GND
	6	GND	GND
	7	D455	455kHz IF output.
	8	DB	Analog-DSP select signal.

TERMINAL FUNCTION

Connector No.	Terminal No.	Terminal Name	Terminal function
DISPLAY UNIT (X54-3080-00)			
CN1	1	5DG	+5V voltage supply for keyboard (+5V).
	2	TR	TX/RX signal input.
	3	LFM	FM mode LED output. Active "H"
	4	NC	Not used.
	5	NC	Not used.
	6	LAM	AM mode LED output. Active "H"
	7	LCW	CW mode LED output. Active "H"
	8	LUSB	USB mode LED output. Active "H"
	9	LLSB	LSB mode LED output. Active "H"
	10	LFSK	FSK mode LED output. Active "H"
	11	LTA	Function TX-A LED output. Active "H"
	12	LK1	Key top LED output. Active "H".
	13	LRM	Function RX-M LED output. Active "H"
	14	LRA	Function RX-A LED output. Active "H"
	15	LTM	Function TX-M LED output. Active "H"
	16	LTB	Function TX-B LED output. Active "H"
	17	LRB	Function RX-B LED output. Active "H"
	18	GND	GND
CN2	1	TN1	67.0–250.3Hz repeater tone output.
	2	GND	GND
CN3	1	TN2	1750Hz repeater tone output.
	2	GND	GND
CN4	1	BZ	Beep level output.
	2	GND	GND
CN5	1	GND	GND
	2	BI	Dimmer blanking signal input.
	3	LH	Dimmer controlled output.
	4	5DG	+5V voltage supply input.
	5	RES	Reset signal input. "L" : Reset
	6	FBY	Serial busy output. "L" : Busy
	7	FLE	Serial enable input.
	8	FCK	Serial clock input.
	9	FDT	Serial data input.
	10	GND	GND
CN6	1	F	FL tube filament power supply input. Between F to F : Approx. AC 9.6V
	2	FG	FL tube filament power supply output. Center tap DC bias : Approx. –28V
	3	F	FL tube filament power supply input. Between F to F : Approx. AC 9.6V
	4	HV	FL tube drive voltage supply input (approx. –40V).
	5	HG	FL tube drive voltage supply GND.
	6	15DS	FL tube drive voltage supply input (+15V).
	7	GND	GND
	8	5DS	FL tube drive voltage supply input (+5V).
CN7	1	5C	Voltage supply output for option VS-2.
	2	SO	Serial data output for option VS-2.
	3	SCK	Serial clock output for option VS-2.
	4	BSY	Busy input for option VS-2.
	5	STR	Start signal output for option VS-2.
	6	GND	GND
SIGNAL UNIT (X57-3380-00)			
CN1	1	RXB	+15V when receive.
	2	TXB	+15V when transmit.
	3	RBC	Receive timing signal.
	4	PRS	Processor switch.
	5	AGS	+15V except data mode.
	6	MID	AGC time constant MID select signal.
	7	SLOW	AGC time constant SLOW select signal.
	8	AGO	AGC OFF signal.

Connector No.	Terminal No.	Terminal Name	Terminal function
	9	SSBB	+15V when SSB mode.
	10	PRM1	Compression meter voltage output.
	11	GND	GND
	12	SMET	S-meter voltage output.
	13	NC	Not used.
	14	D15	+15V voltage supply output for DSP-10.
CN2	1	MOS	Monitor switch.
	2	CK	TC9174F clock signal.
	3	STB	TC9174F strobe signal.
	4	SD	TC9174F data signal.
	5	GND	GND
	6	LNOT	NOTCH LED voltage.
	7	DB	On signal for DSP-10.
	8	DATAC	Data mode controlled signal.
	9	FSKC	FSK mode controlled signal.
	10	AMC	AM mode controlled signal.
	11	CWC	CW mode controlled signal.
	12	FMC	FM mode controlled signal.
	13	SSBC	SSB mode controlled signal.
	14	GND	GND
CN3	1	AFSK1	AFSK signal.
	2	GND	GND
	3	MPV	MIC signal.
	4	GND	GND
CN4	1	CV2	CAR volume 2.
	2	CV1	CAR volume 1.
CN5	1	GND	MIC GND for DSP-10.
	2	DMC	MIC signal for DSP-10.
CN8	1	RFB1	RF GAIN reference voltage.
	2	RFB2	GND
	3	PRL2	Processor level controlled signal.
	4	GND	GND
CN7	1	GND	GND
	2	SCAF	Main band SSB and CW mode AF output.
	3	GND	GND
	4	FAAF	Main band FM and AM mode AF output.
	5	GND	GND
CN8	1	+15	+15V.
	2	GND	GND
	3	–12	–12V.
CN9	1	+15	+15V.
	2	–12	–12V.
	3	FMNC	FM NARROW mode controlled signal.
	4	SSBC	SSB mode controlled signal.
	5	FMC	FM mode controlled signal.
	6	CWC	CW mode controlled signal.
	7	FSKC	FSK mode controlled signal.
	8	DB	On signal for DSP-10.
	9	TXB	+15V when transmit.
	10	RXB	+15V when receive.
	11	STS	Sidetone switch.
	12	SQ	Squelch signal.
	13	NG2	NB2 gate controlled signal.
	14	NG1	NB1 gate controlled signal.
CN10	1	88FD	455kHz IF filter select signal.
	2	88FE	455kHz IF filter select signal.
	3	88FC	455kHz IF filter select signal.
	4	88FB	455kHz IF filter select signal.
	5	88FA	455kHz IF filter select signal.
	6	MNG2	NB2 gate controlled signal.
	7	MNG1	NB1 gate controlled signal.

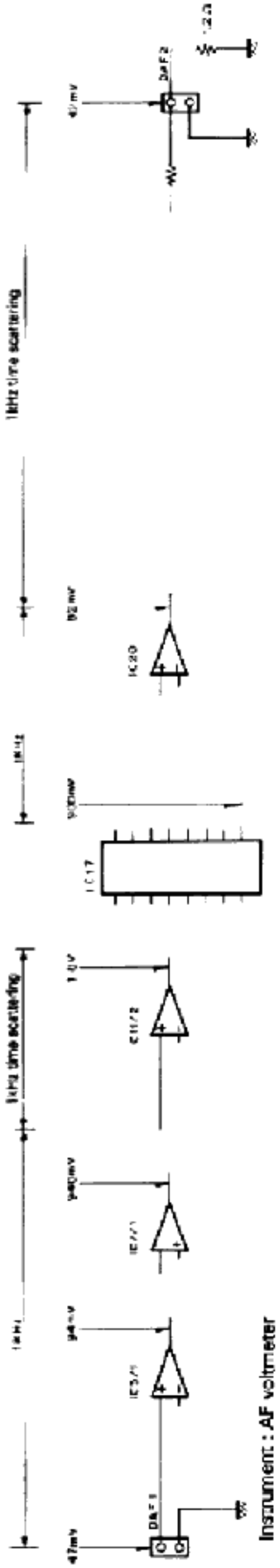
TERMINAL FUNCTION

Connector No.	Terminal No.	Terminal Name	Terminal function
	8	SQ	Squelch signal.
	9	STS	Sidetone switch.
	10	NC	Not used.
CN11	1	ATS	Antenna tuner switch.
	2	MOS	Monitor switch.
CN12	1	GND	GND
	2	ATS1	Antenna tuner switch.
	3	MOS	Monitor switch.
	4	AGC	AGC line.
	5	TXB	+15V when transmit.
	6	RXB	+15V when receive.
	7	+15	+15V.
CN13	1	AGC	AGC line.
	2	MOS	Monitor switch.
	3	RXB	+15V when receive.
	4	TXB	+15V when transmit.
	5	−12	−12V.
	6	+15	+15V.
	7	GND	GND
	8	SMET	S-meter voltage output.

Connector No.	Terminal No.	Terminal Name	Terminal function
CN14	1	NOTS	NOTCH switch.
	2	NFM15	+15V except FM mode.
	3	FSQ1	FM squelch volume 1.
	4	FSQ2	FM squelch volume 2.
	5	SQ2	CAR squelch volume 2.
	6	NOTS	NOTCH switch.
	7	NOV2	NOTCH volume 2.
	8	SQ1	CAR squelch volume 1.
	9	GND	GND
CN15	1	IFO2	IF OUT2 output.
	2	GND	GND
CN16	1	C100	100kHz CAR input.
	2	GND	GND
	3	C355	355kHz local input.
	4	GND	GND
CN17	1	TR455	TX/RX 455kHz I/O.
	2	GND	GND
CN18	1	DB	On signal for DSP-10.
	2	GND	GND
	3	D455	455kHz input from DSP-10.

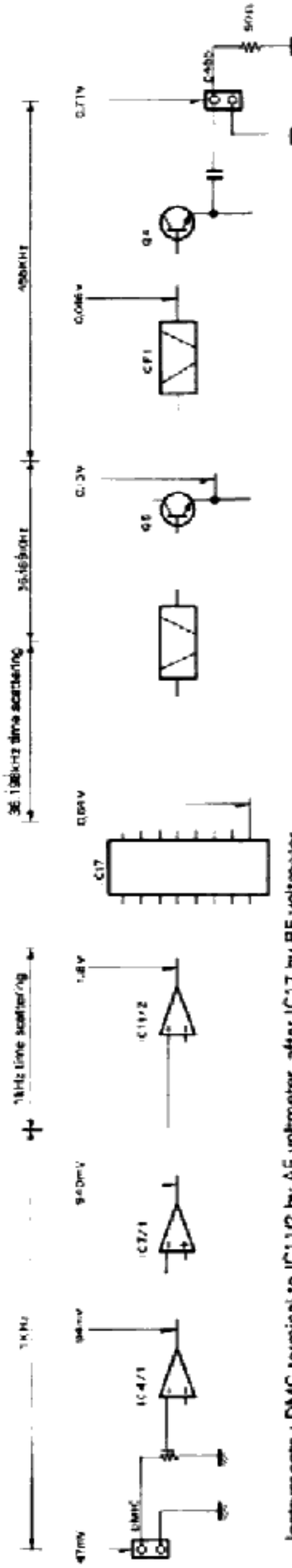
LEVEL DIAGRAM

DSP-10 receiver section (AF-SLOPE)



Instrument : AF voltmeter

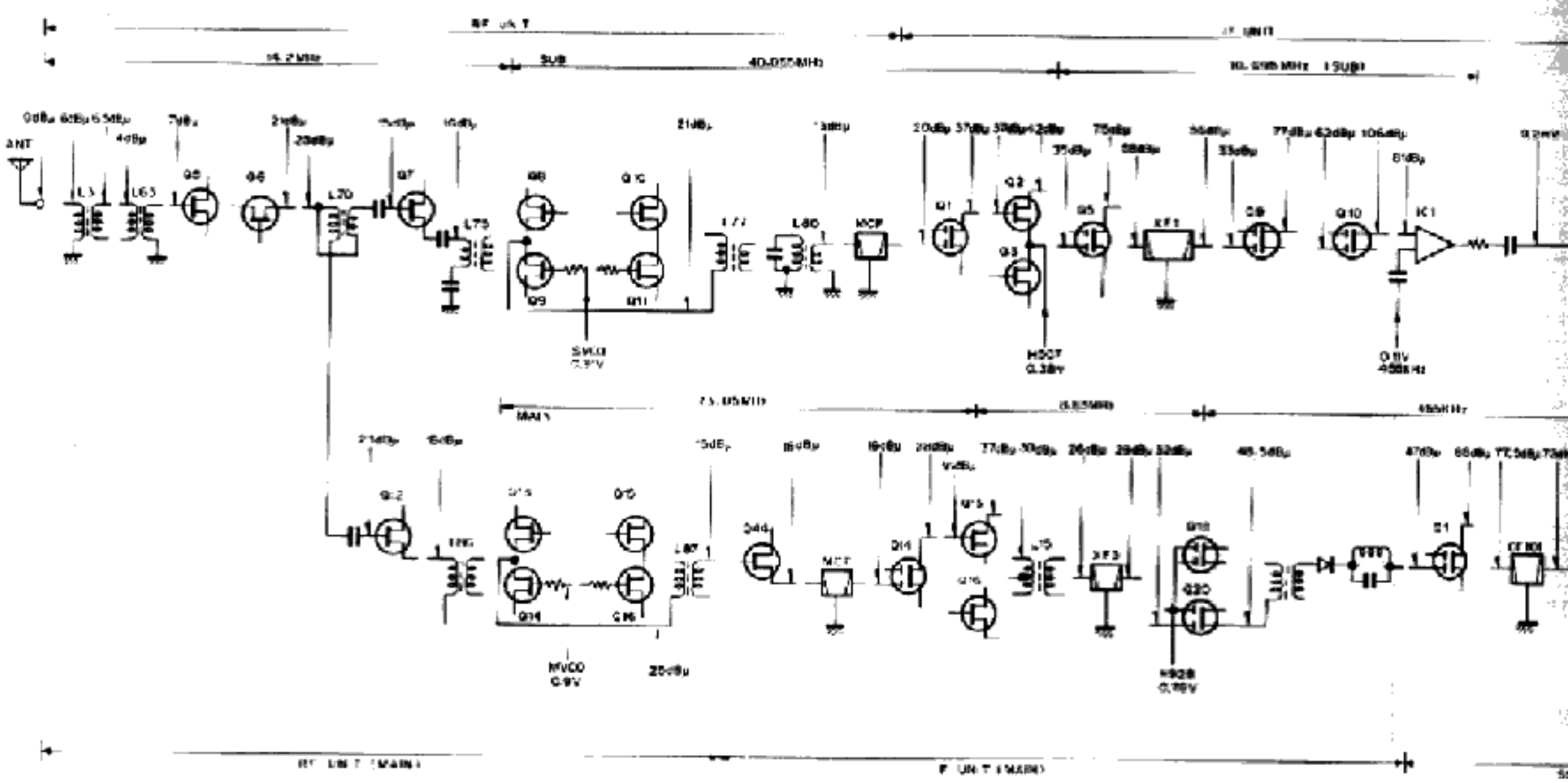
DSP-10 transmitter section (USB)



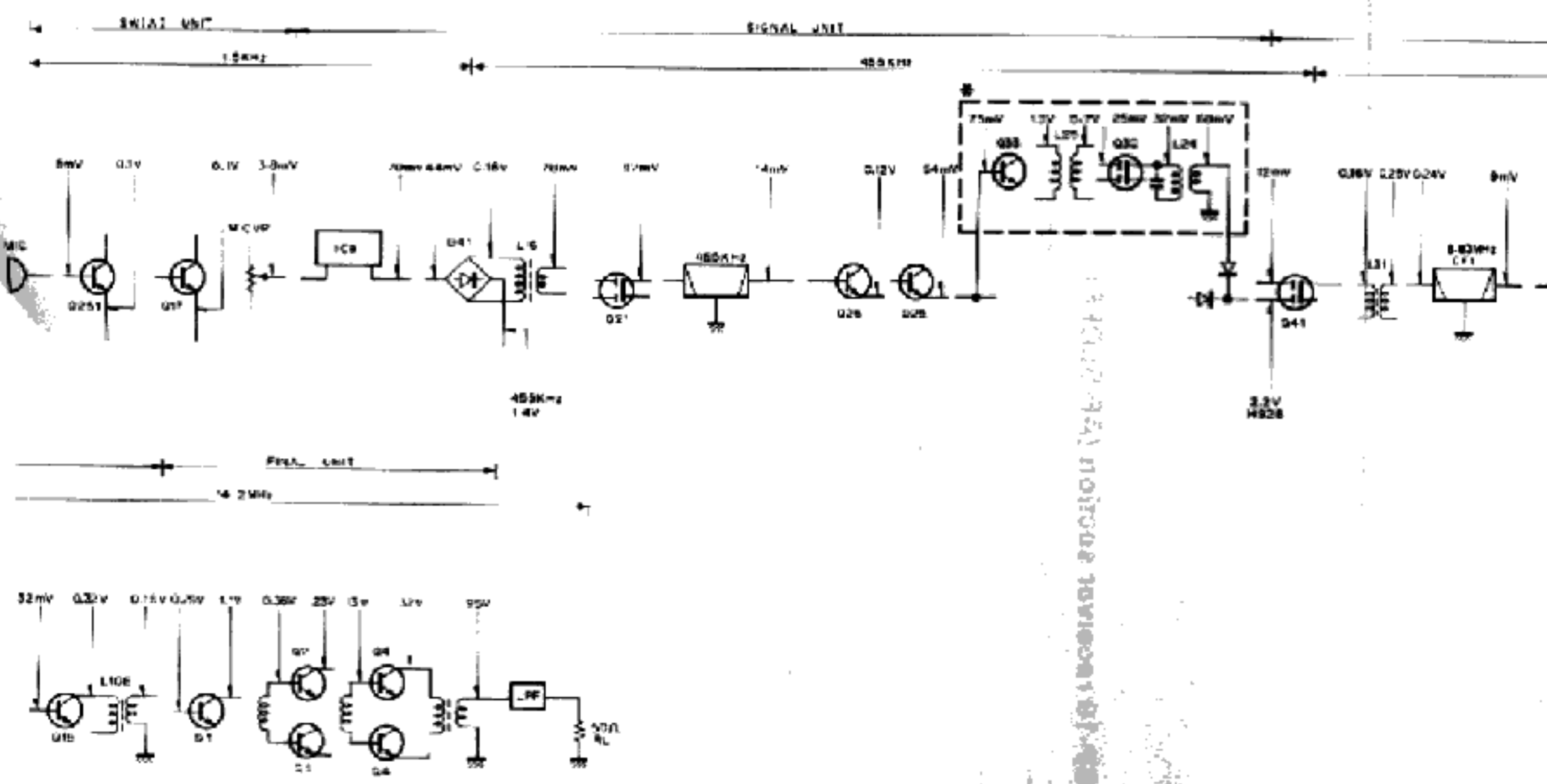
Instruments : DMC terminal to IC1 1/2 by AF voltmeter, after IC17 by RF voltmeter

LEVEL DIAGRAM

Receiver section

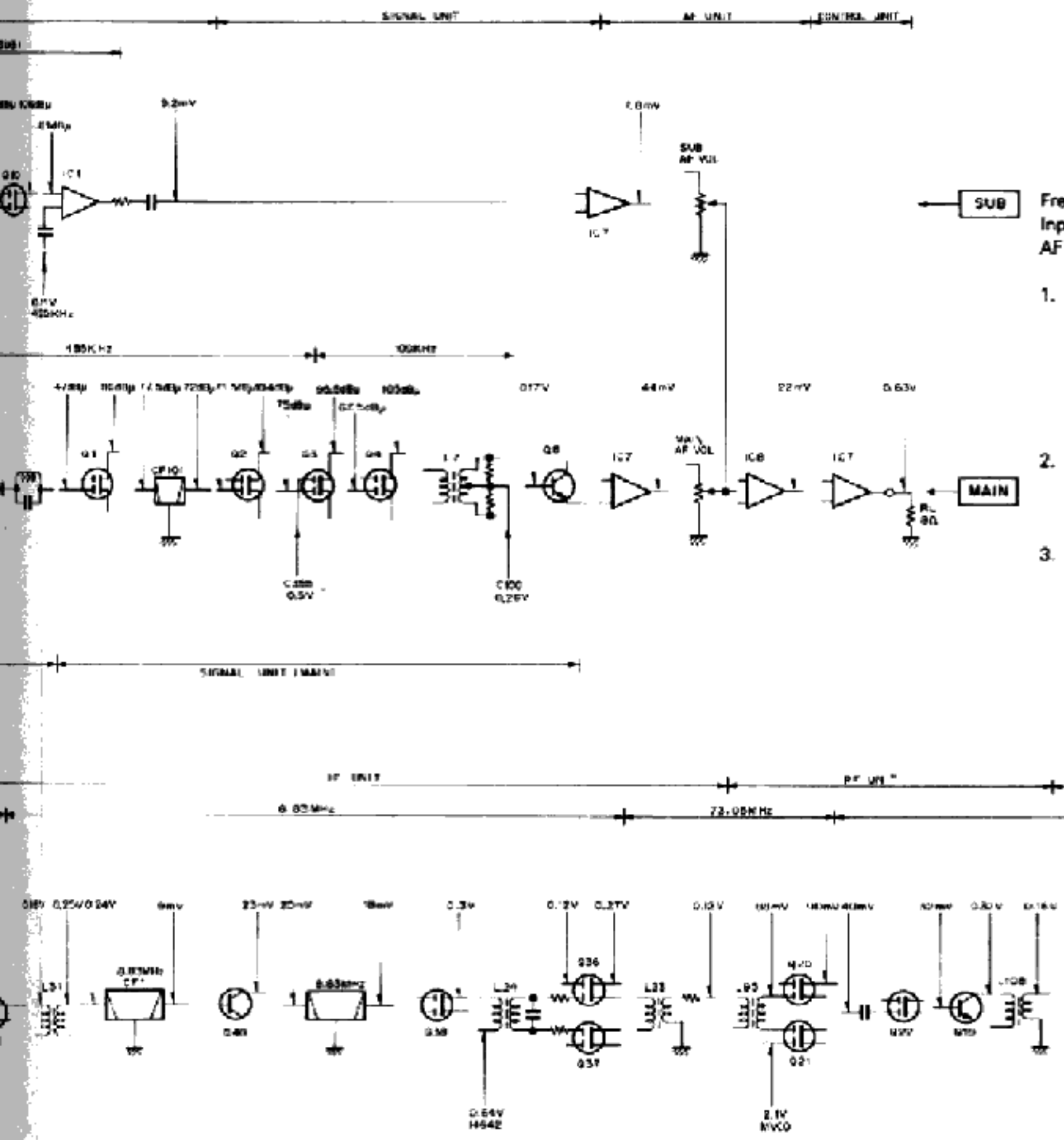


Transmitter section



TS-950S/SD

L DIAGRAM



SUB

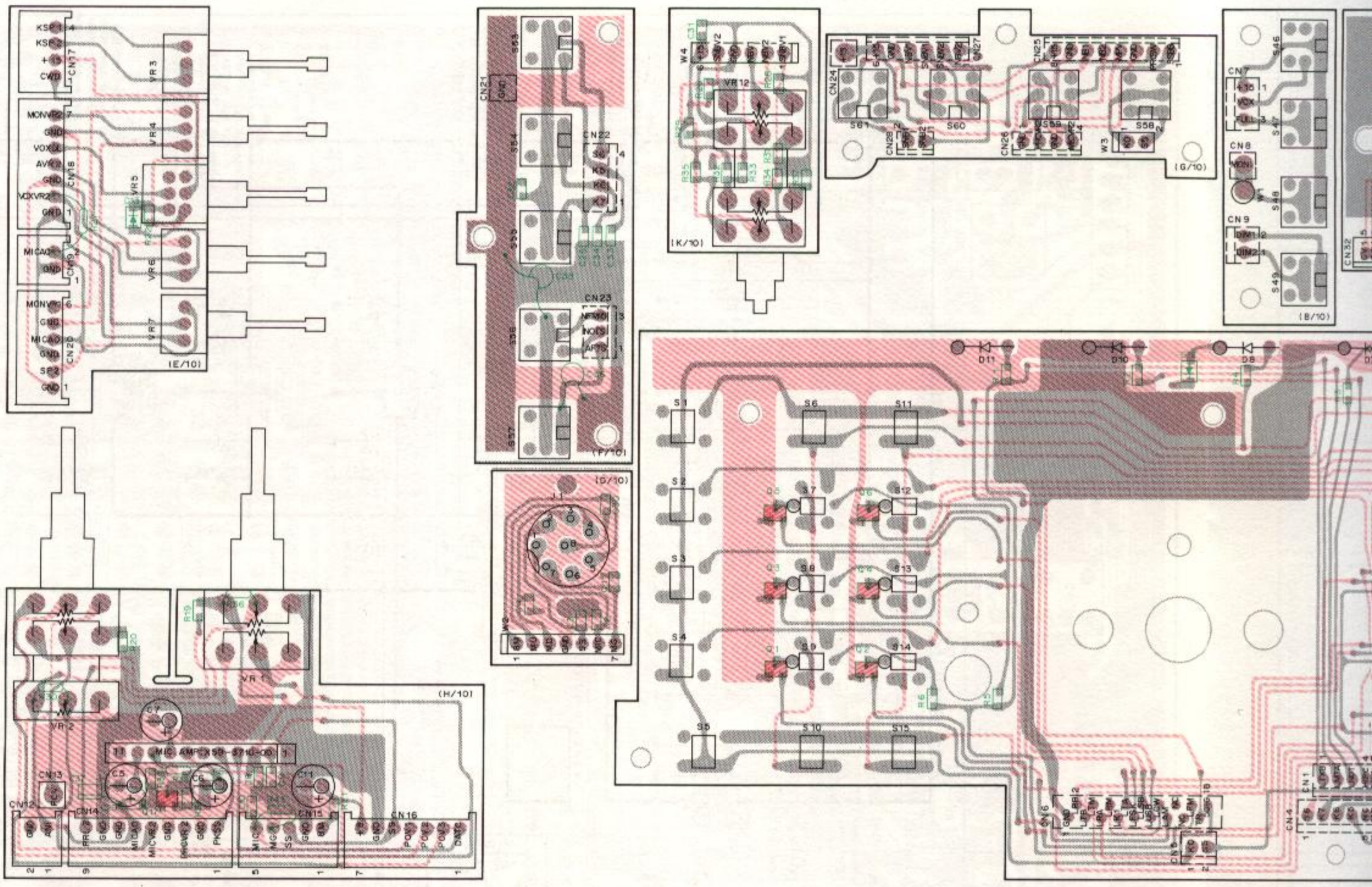
Frequency : 14.200MHz
Input : 0dBμ
AF output : 0.63V/8Ω

1. The figures shown are signal generator output required for a constant audio output with a constant AF gain control setting
   Set the AF gain control for 0.63V/8Ω audio output at 0dBμ signal generator input at 14.200MHz.
2. To measure signal generator output connect a 0.01μF capacitor between the signal generator and the check point.
3. AIP : OFF

Frequency : 14.200MHz

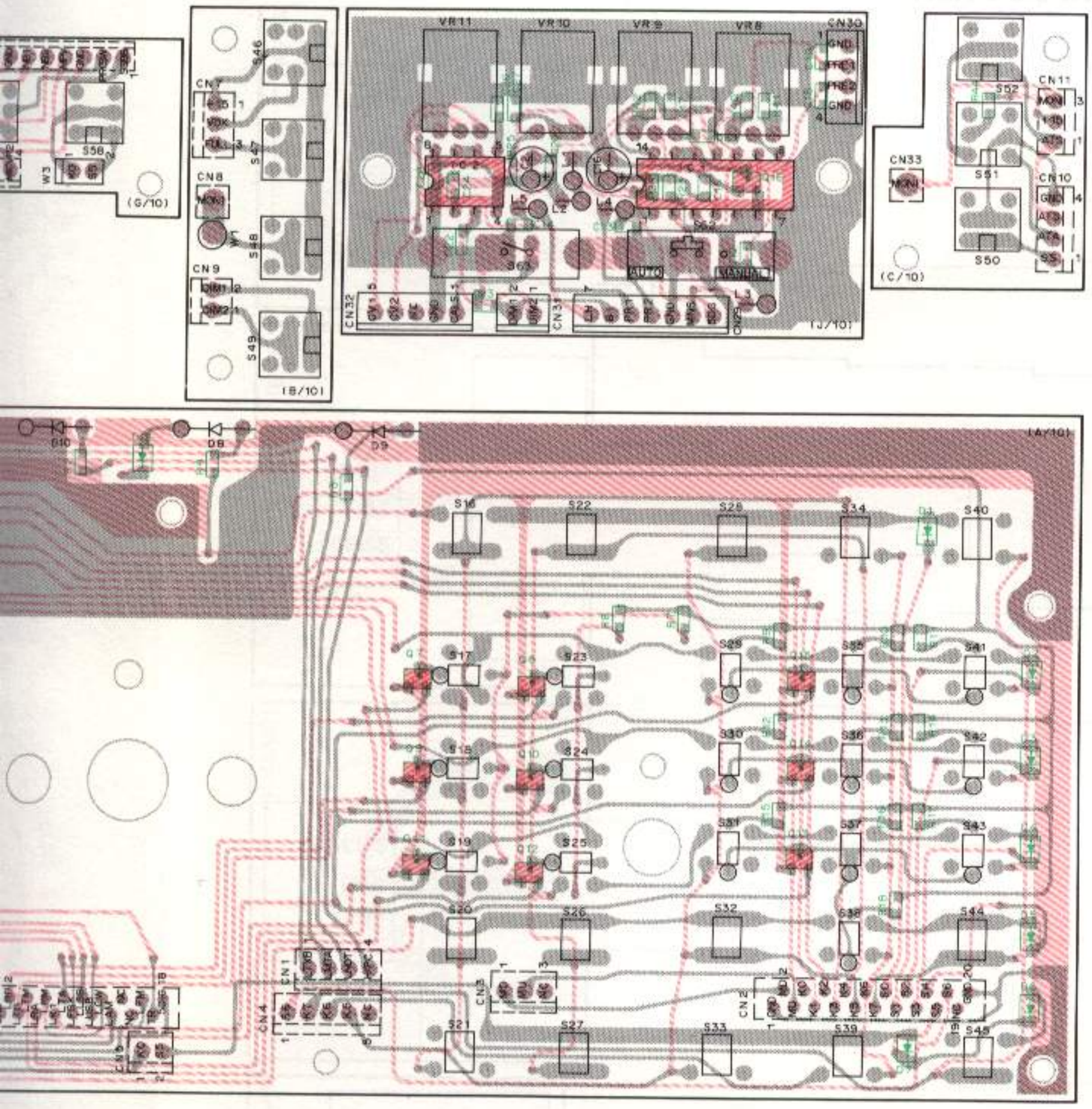
1. The high frequency section is measured by the RF voltmeter in the CW mode, and the low frequency section is measured using the AF voltmeter in the USB mode to obtain this value.
2. The value of the audio input signal is obtained by the 1kHz/5mV single tone which measures almost full scale within the ALC zone of the meter in the USB mode or standard modulation (±3kHz, dev.) in the FM mode.
*3. When the value of the audio input signal is obtained by the 4kHz single tone which adjusts almost full scale within the ALC zone of the meter by PROC OUT VR, and also, adjust starting level within the COMP zone of the meter by PROC IN VR.

SWITCH UNIT (A) (X41-3080-00) Component side view

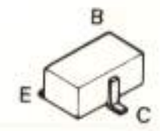


SWITCH UNIT (A) (X41-3080-00) Foil side view

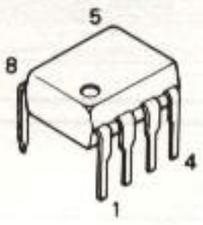
PC BOARD VIEWS TS-950S/SD



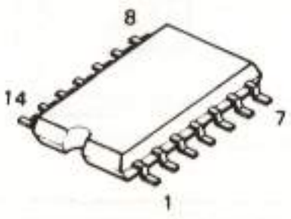
2SC3324
DTC143EK
DTC143TK



NE555P

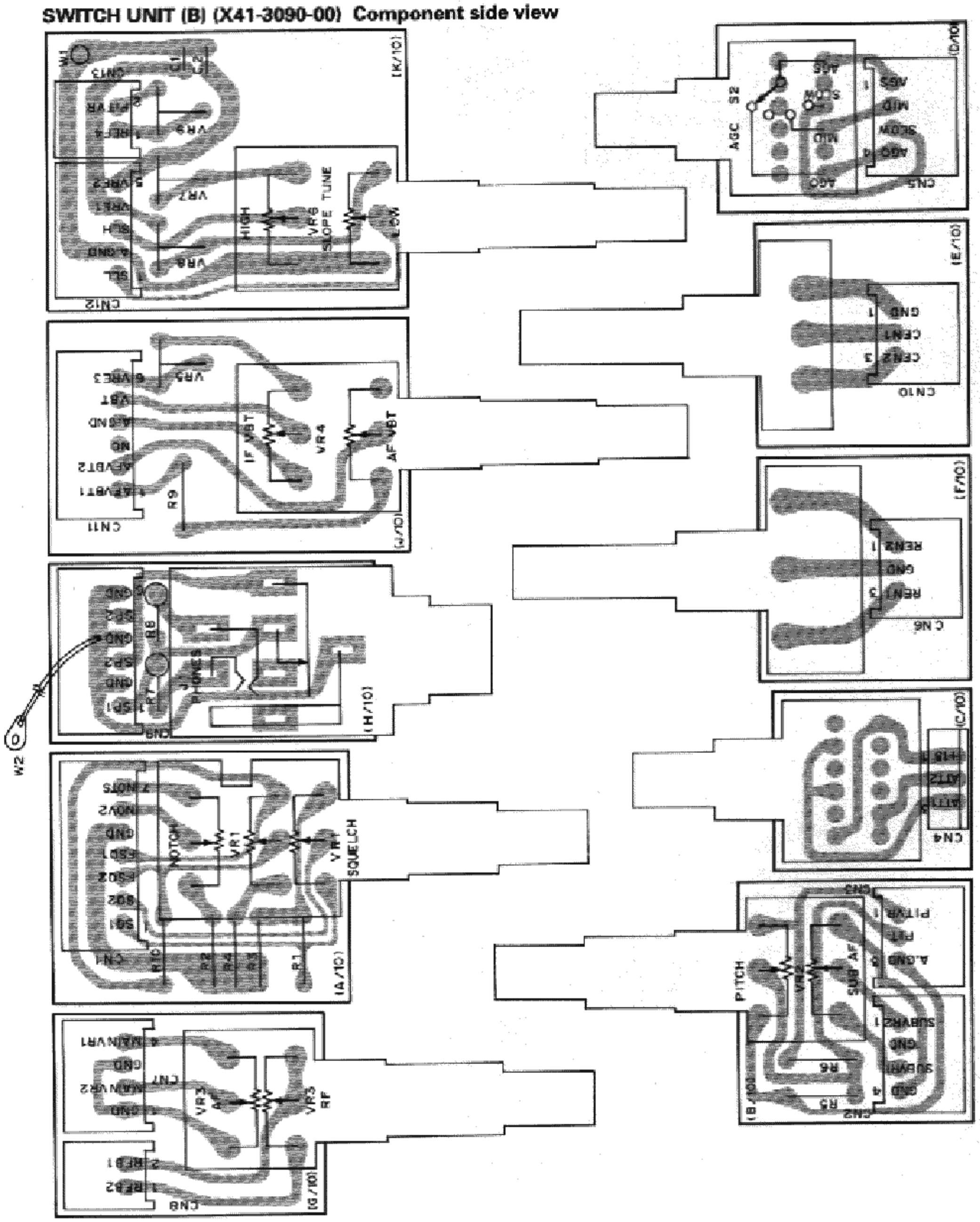


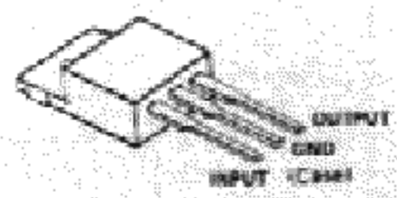
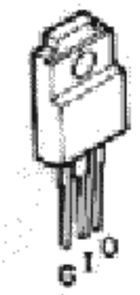
TC4066BP



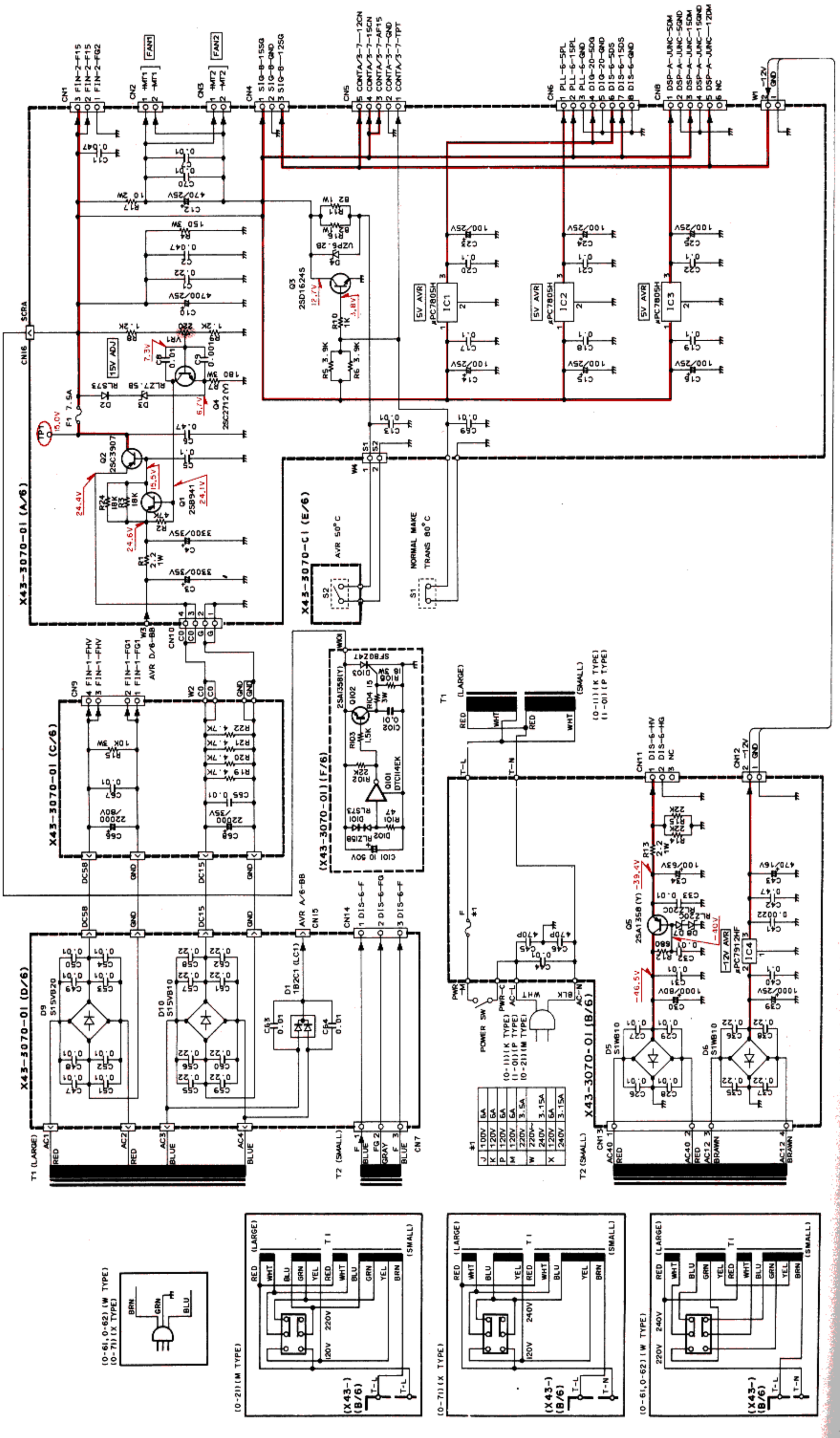
TS-950S/SD PC BOARD VIEW / CIRCUIT DIAGRAM

SWITCH UNIT (B) (X41-3090-00) Component side view

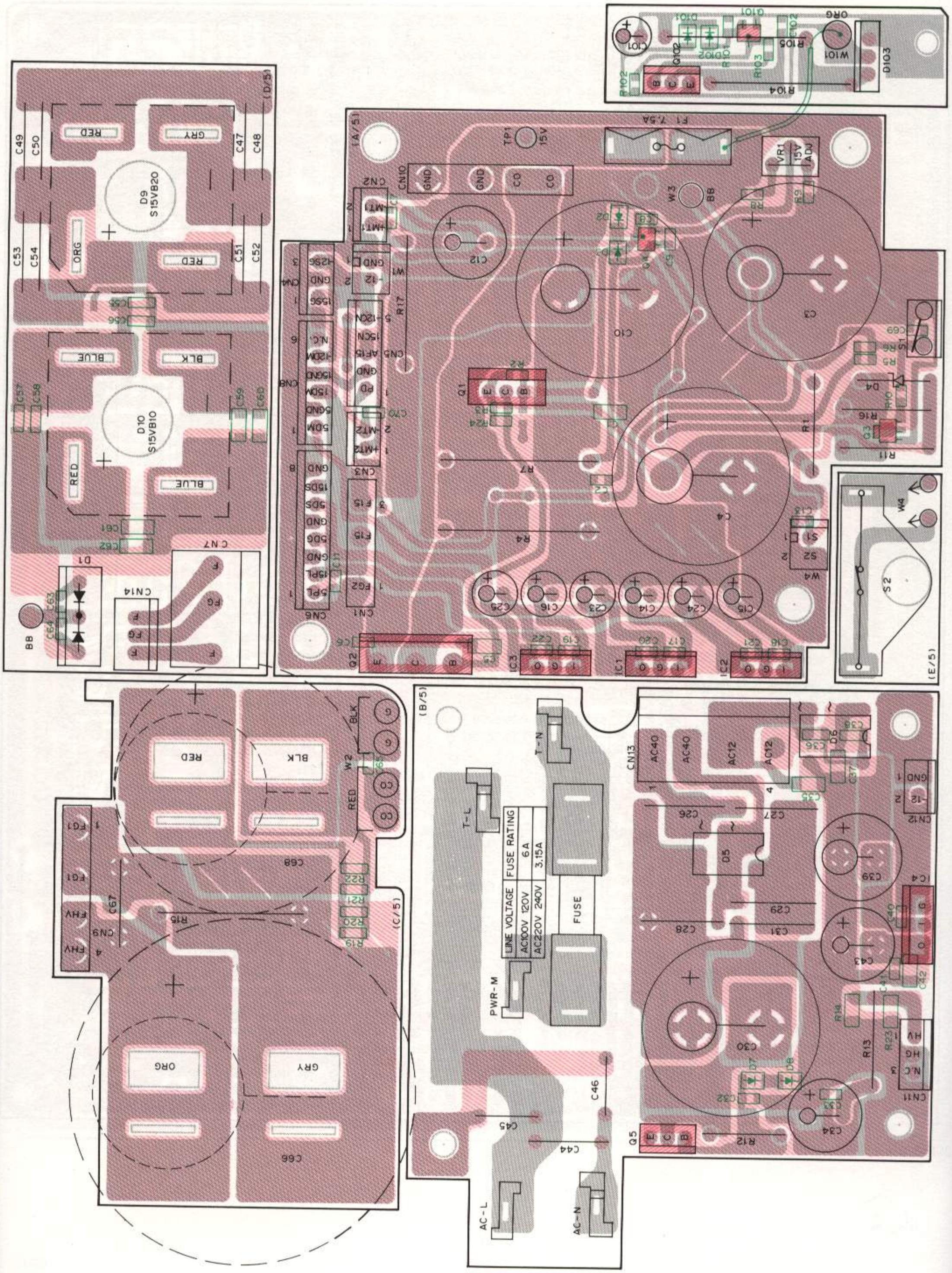


2SC2712 2SC3907 DTC114EK	2SA1358	2SB941	2SD1624S	µPC7805HI	µPC7912HF
					

AVR UNIT (X43-3070-01)

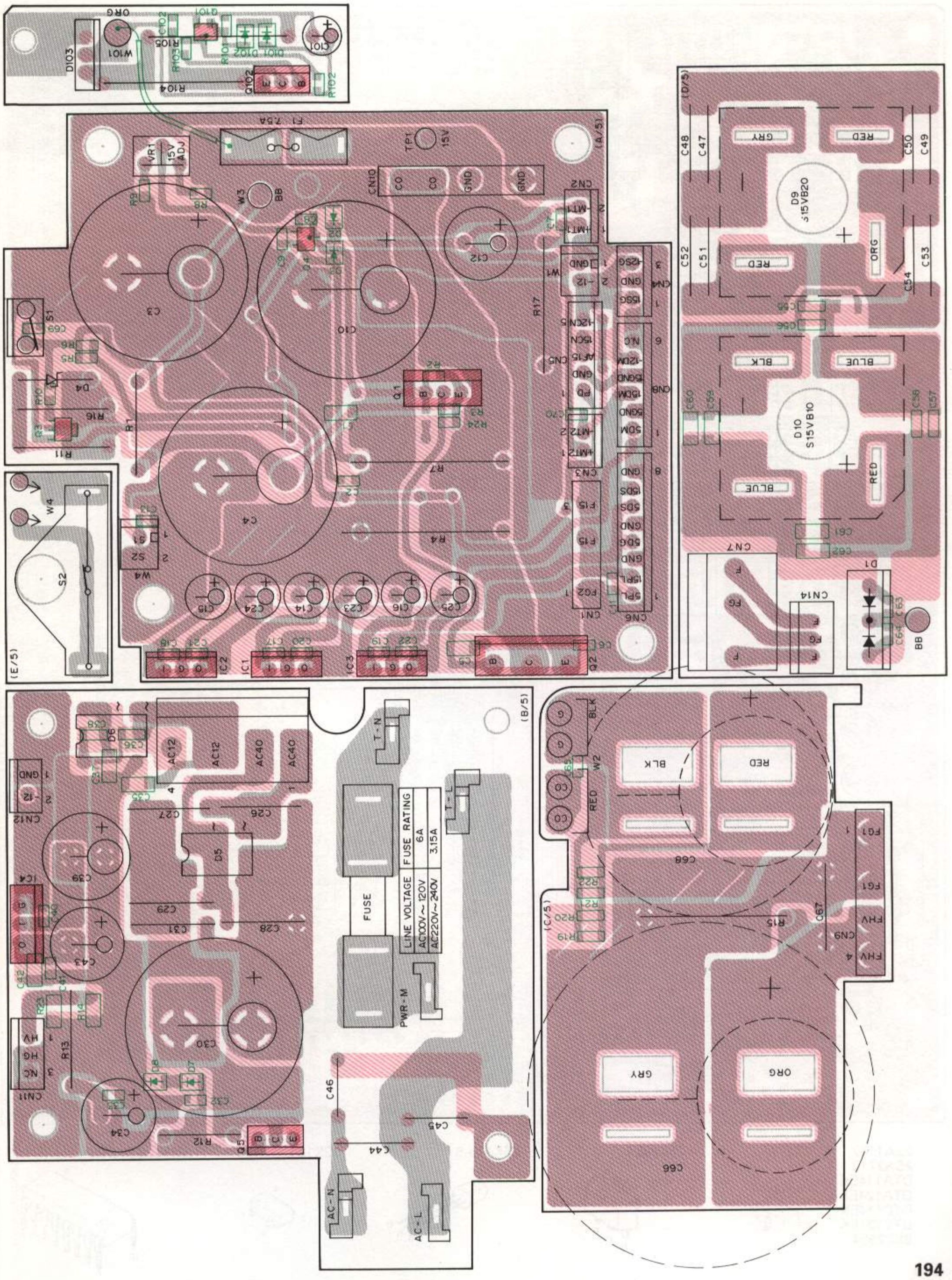


AVR UNIT (X43-3070-01) Component side view



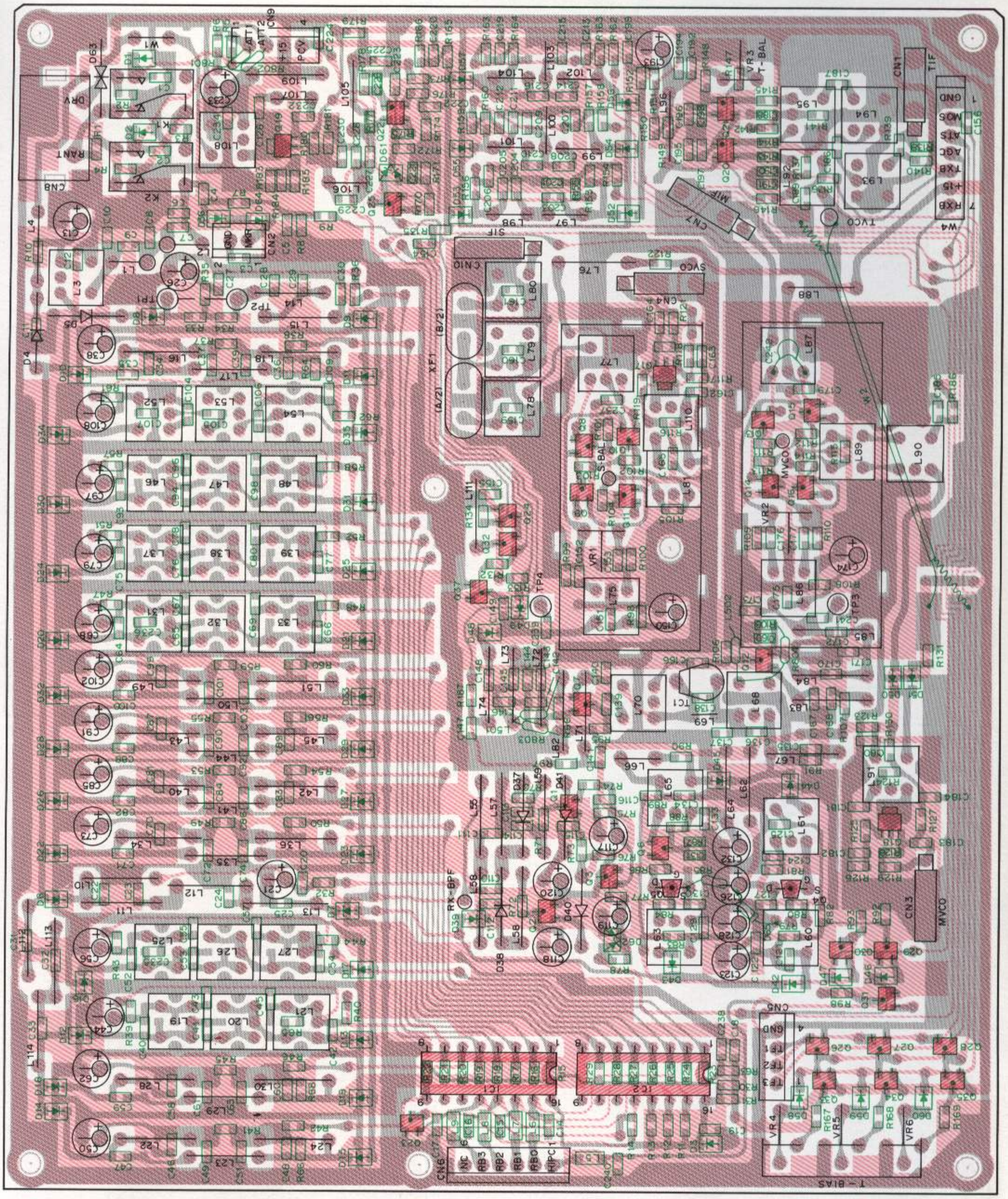
PC BOARD VIEWS TS-950S/SD

AVR UNIT (X43-3070-01) Foil side view

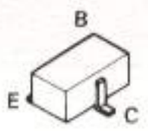


TS-950S/SD PC BOARD VIEWS

RF UNIT (X44-3100-00) Component side view

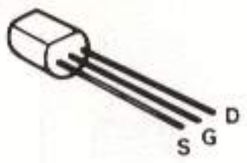


2SA1162
2SA2712
DTA114EK
DTA124EK
DTC114EK
DTC124EK
2SC2954

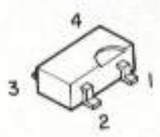


2SC2954

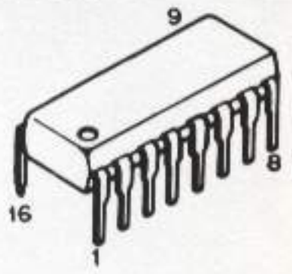
2SK125-5



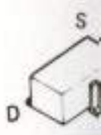
3SK131



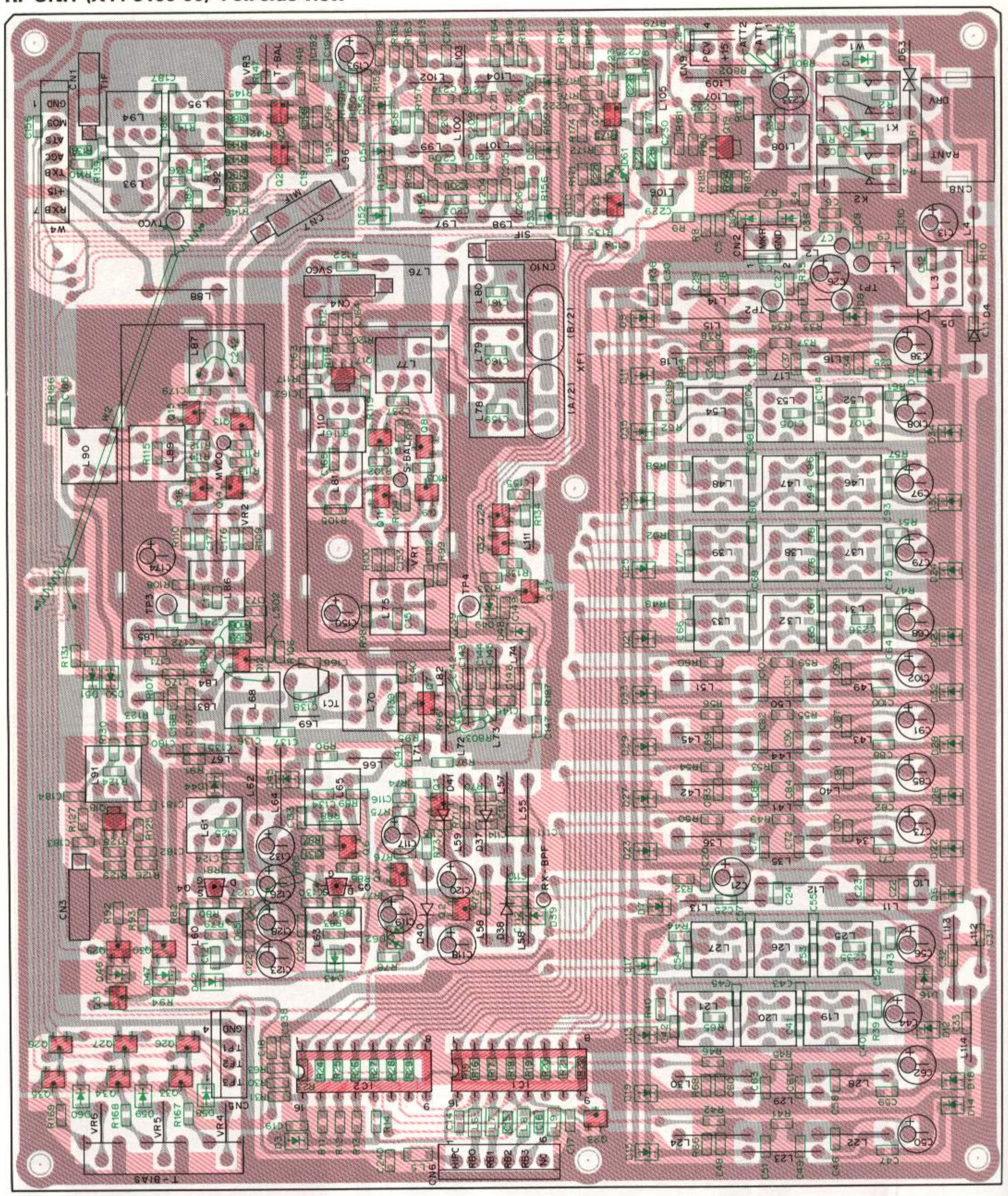
SN74LS145N



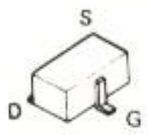
2SK520



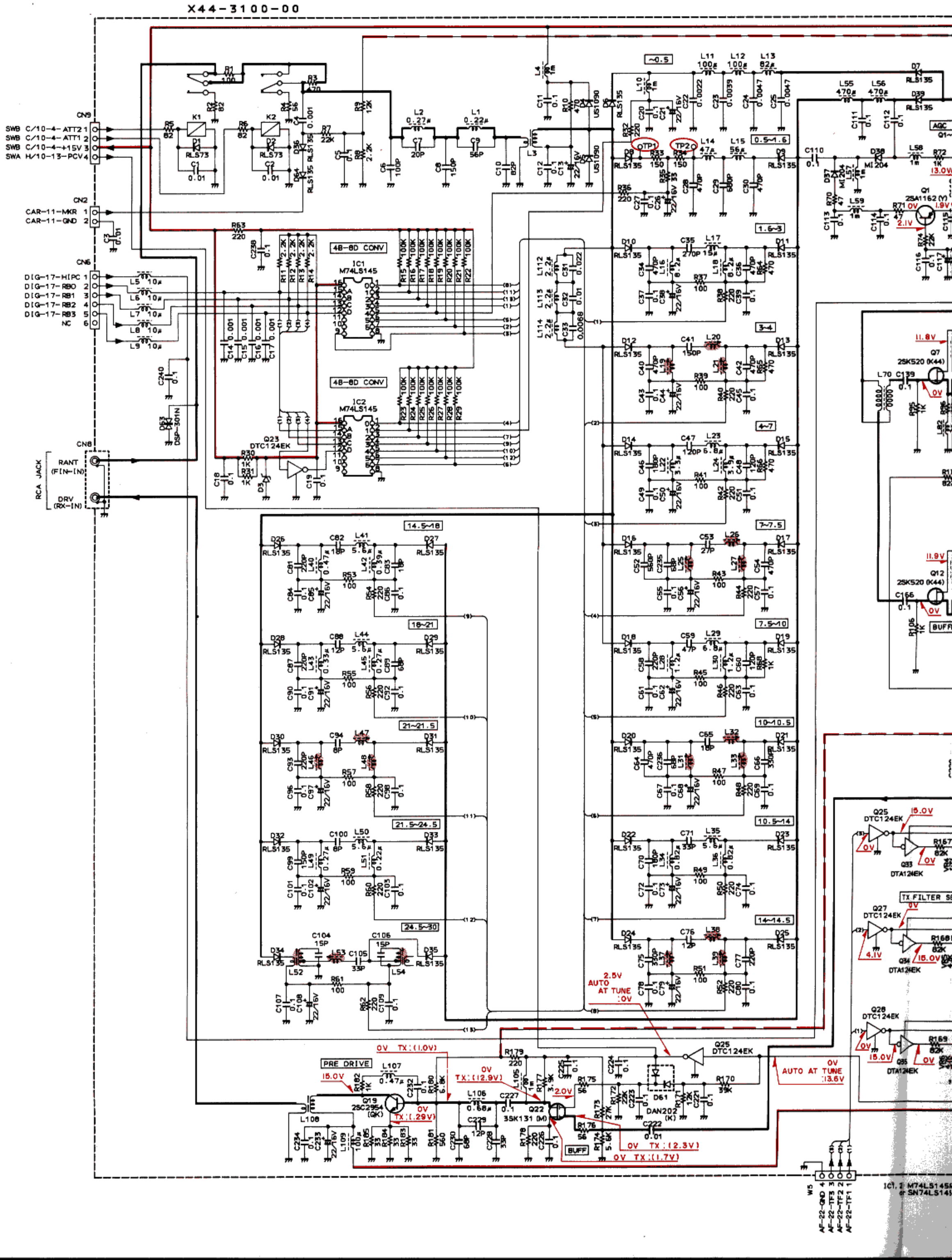
RF UNIT (X44-3100-00) Foil side view



2SK520



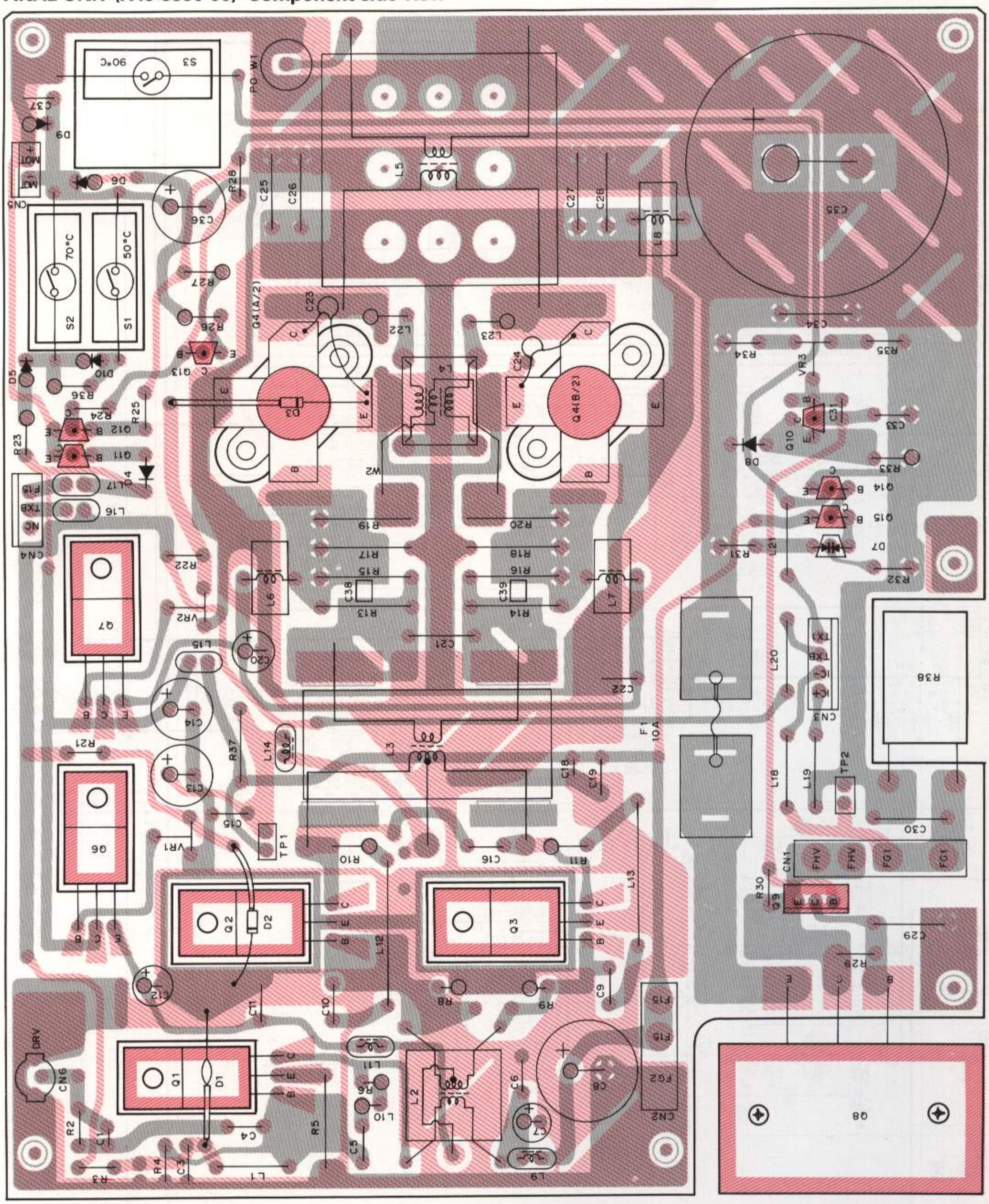
RF UNIT (X44-3100-00)



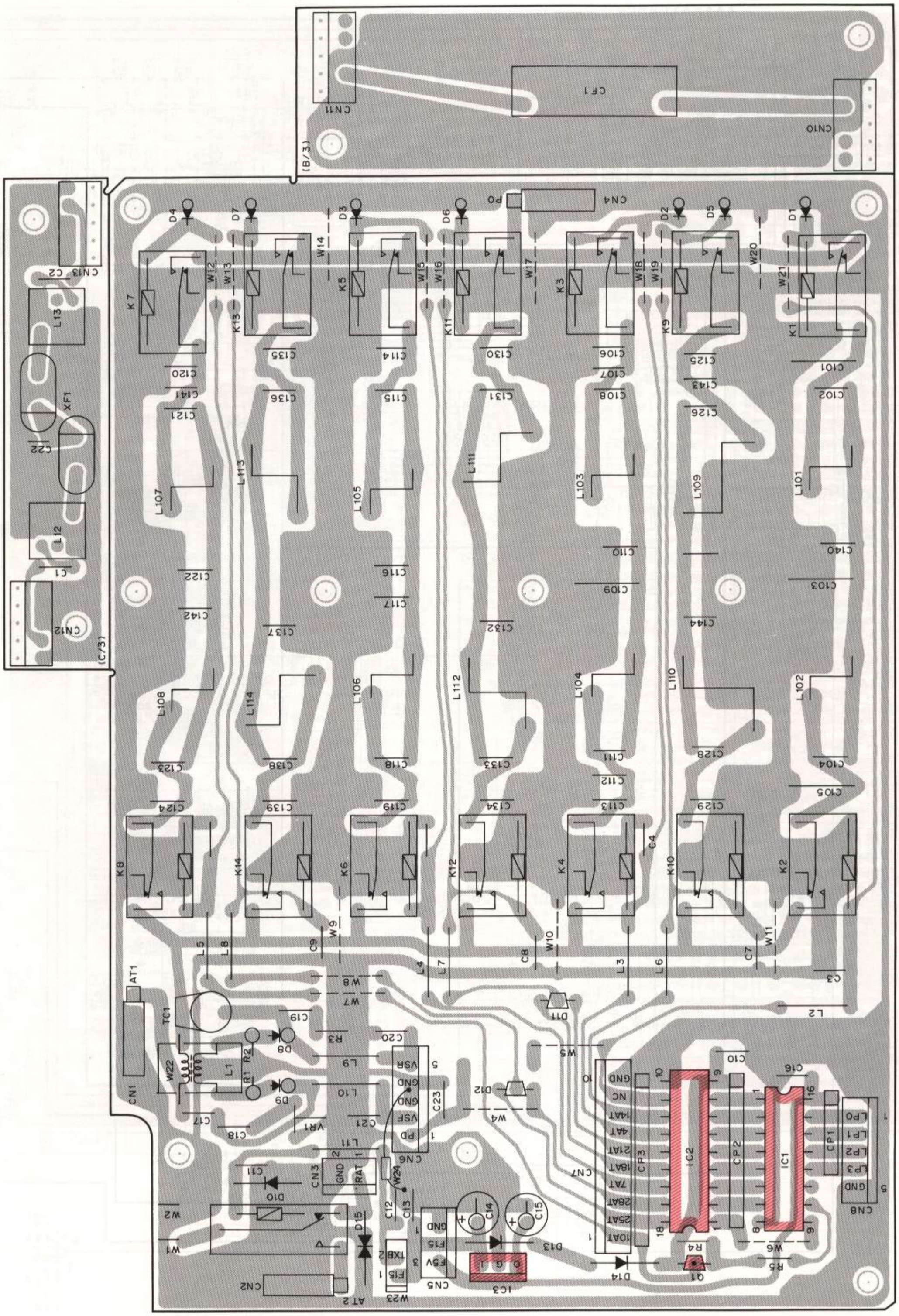
CIRCUIT DIAGRAM TS-950S/SD

TS-950S/SD PC BOARD VIEWS

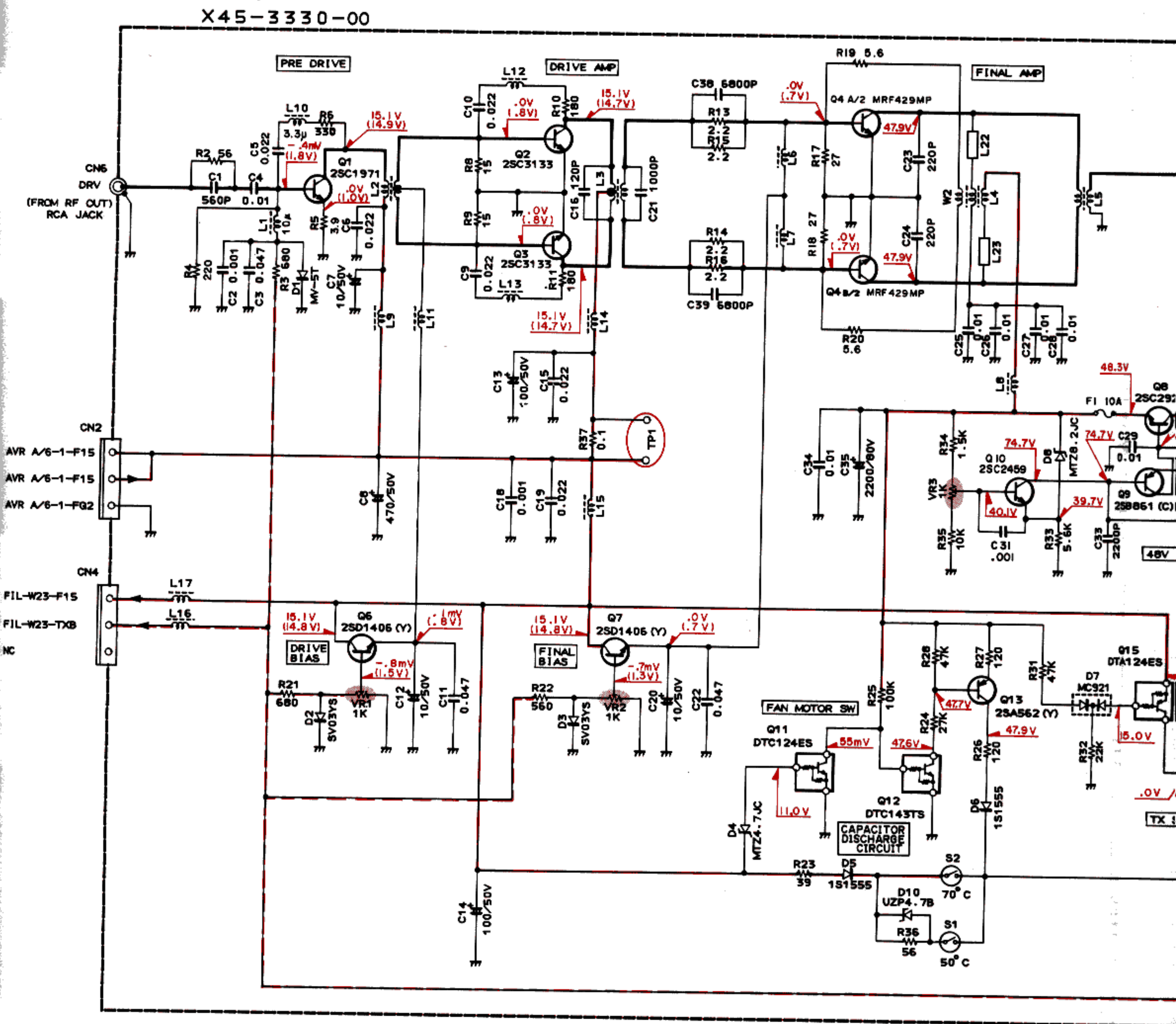
FINAL UNIT (X45-3330-00) Component side view



FILTER UNIT (X51-3060-XX) Component side view



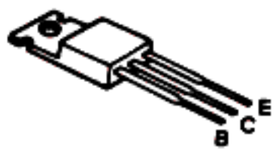
FINAL UNIT (X45-3330-00)



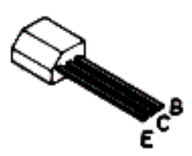
Q1	: 2SC1971	Q11, 14	: DTC124ES
Q2, 3	: 2SC3133	Q12	: DTC143TS
Q5, 7	: 2SD1406 (Y)	Q13	: 2SA562(Y)
Q8	: 2SC2922	Q15	: DTA124ES
Q9	: 2SB861 (C)		
Q10	: 2SC2459 (BL)	D1	: KB-365
		D2, 3	: SV03YS
Q4	: MRF429MP	D4	: MTZ4.7JC
		D5, 6, 9	: 1S1555
		D7	: MC921
		D8	: MTZ8.2JC
		D10	: UZP4.7B

2SA562

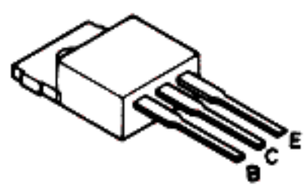
2SB861
2SC1971



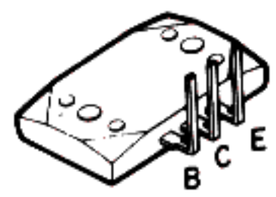
DTC124ES



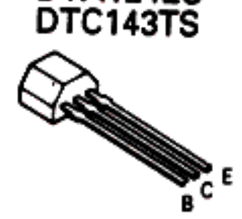
2SD1406



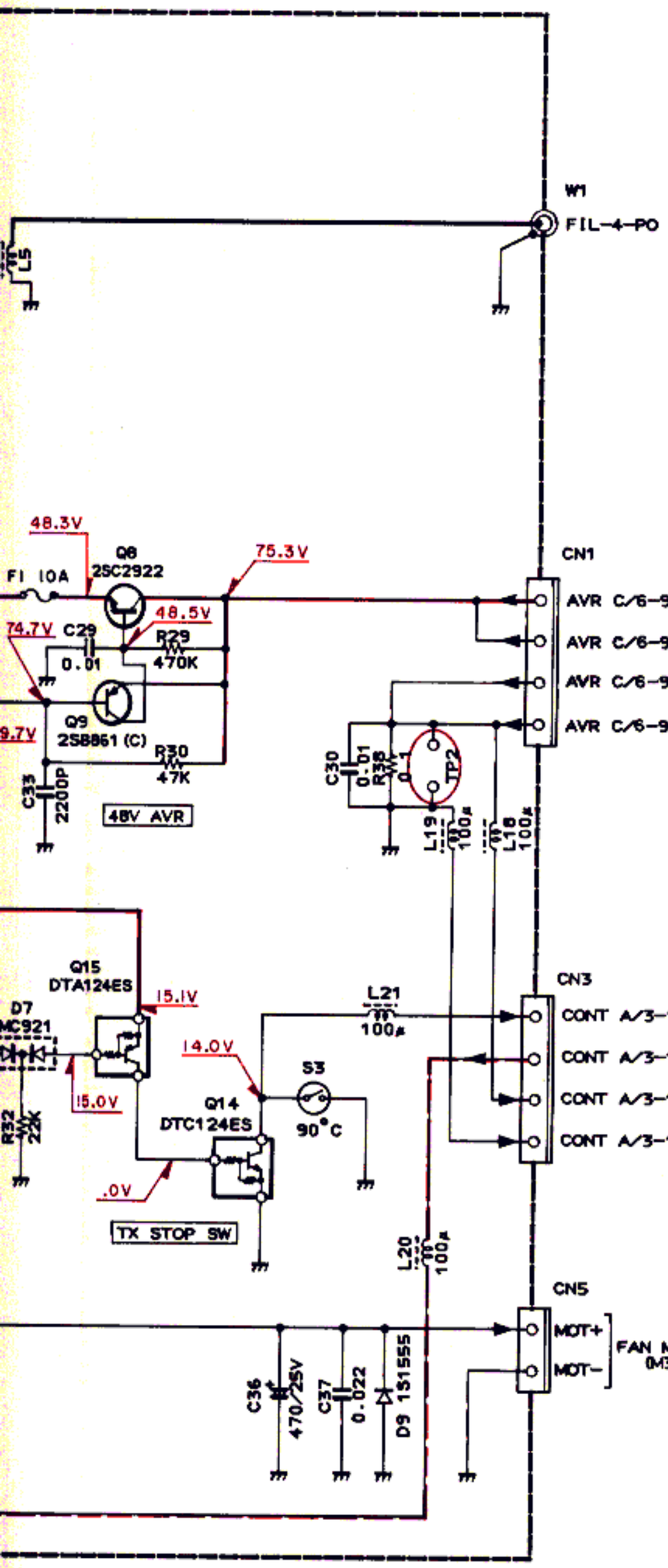
2SC2922



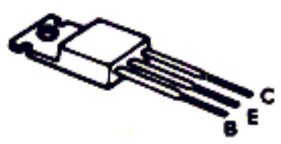
2SC2459
DTA124ES
DTC143TS



FILTER UNIT (X51-3060-XX) -01 : TS-950S (K,M,W,X,P) -61 : TS-950S (W2)

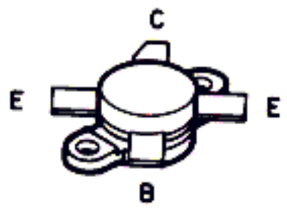


2SC3133

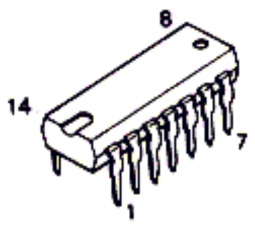


AN78N05

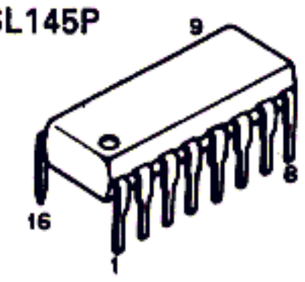
MRF427
MRF429MP



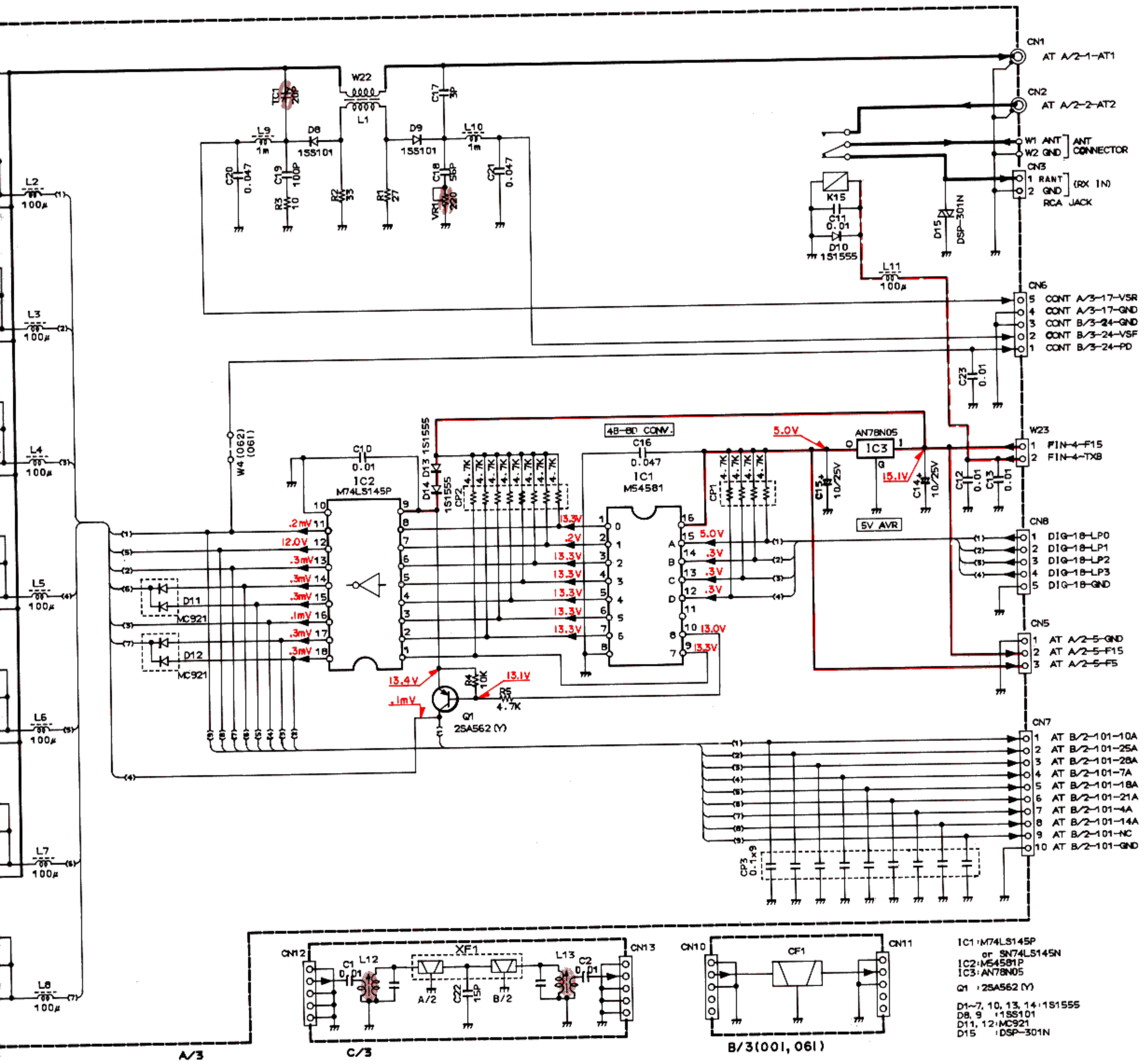
M54581P



M74LS145N
M74SL145P



1 : TS-950S (W2) -11 : TS-950SD (K,M,W,X,P) -62 : TS-950SD (W2)



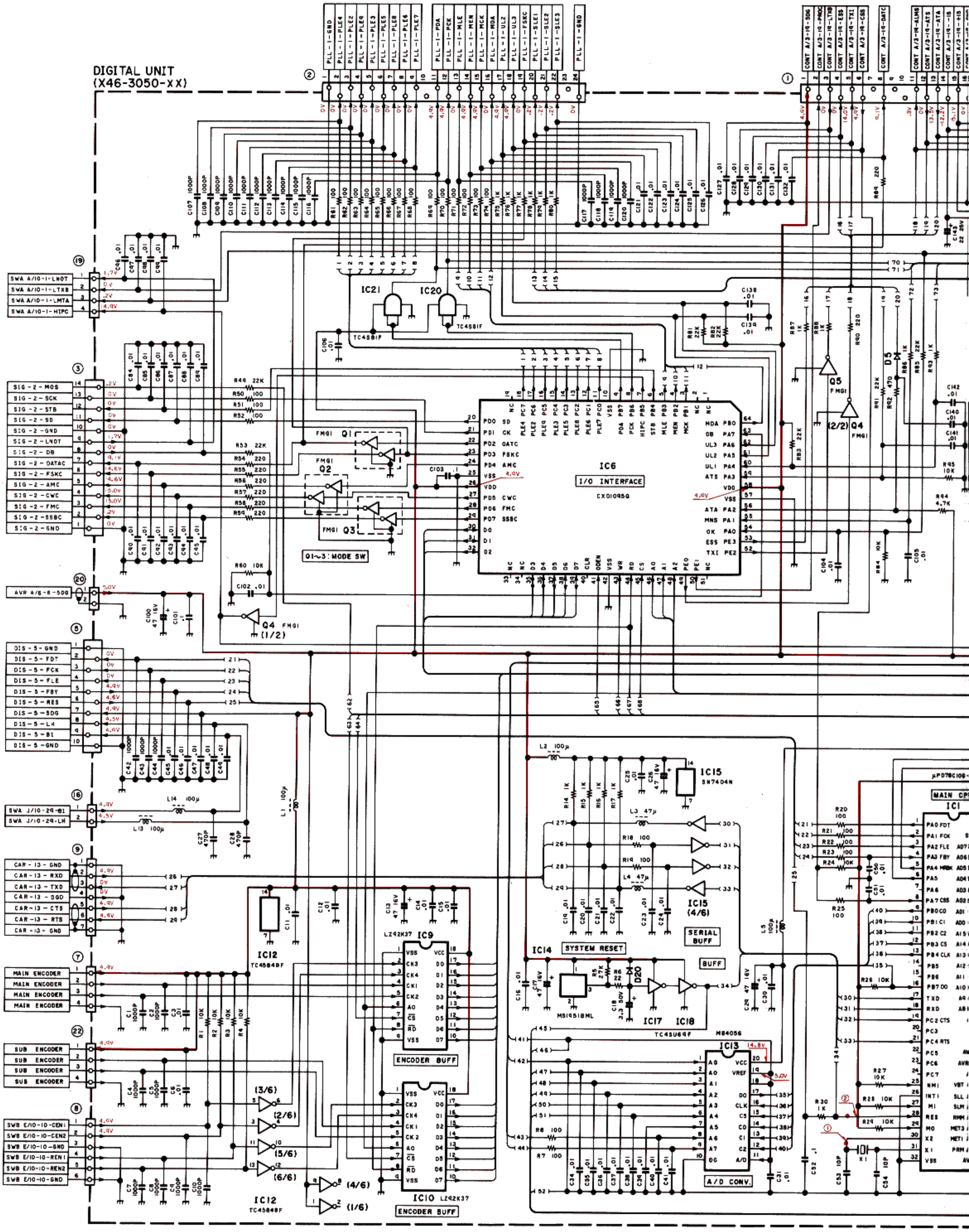
IC1 : M74LS145P
or SN74LS145N
IC2 : M54581P
IC3 : AN78N05

Q1 : 2SA562 (Y)

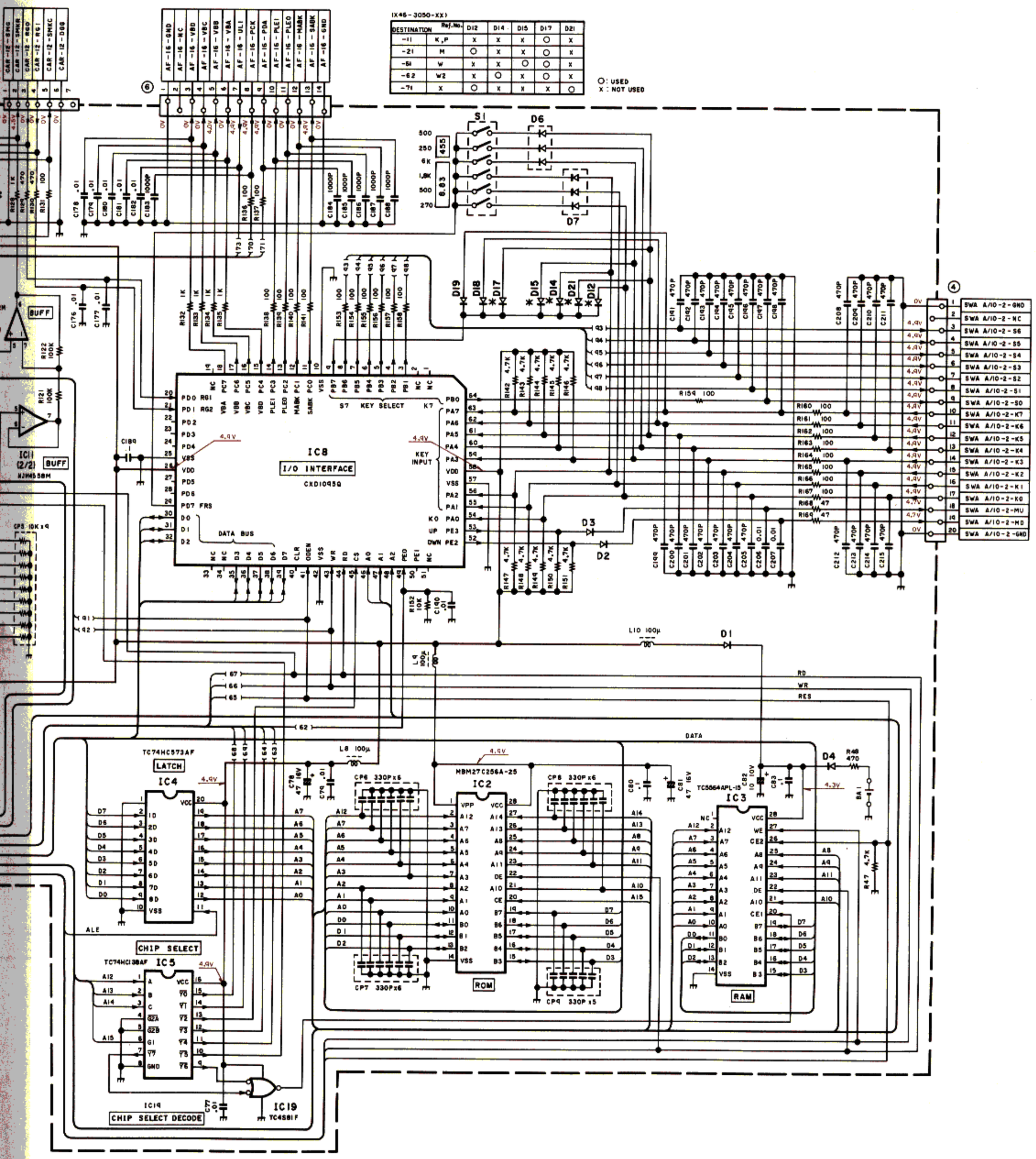
D1~7, 10, 13, 14 : 1S1555
D8, 9 : 1SS101
D11, 12 : MC921
D15 : DSP-301N

TS-950S/SD CIRCUIT DIAGRAM

DIGITAL UNIT (X46-3050-XX) -11 : K,P -21 : M -61 : W -62 : W2 -71 : X



IC1	μPD78C100-36
IC2	MBM27C256A-25
IC3	TC5564APL-15
IC4	TC74HC573AF
IC5	TC74HC138AF
IC6,8	CXD1095Q
IC7	M6893638
IC9,10	LZ52K37
IC11	NJM4558M
IC12	TC4584BF
IC13	M54056
IC14	M51951BML
IC15	SN7404N
IC16	NJM2902M
IC17,18	TC4SU69F
IC19~21	TC4S81F
Q1~11	FMG1
D1~5,20,21	RLS73
D6,7	1MN10
D8~11	02CZ5.1
D12~19	1SS133


(X46-3050-XX)
DESTINATION Ref.No. D12 D14 D15 D17 D21
-11 K,P X X X O X
-21 M O X X O X
-51 W X X O O X
-62 W2 X O X O X
-71 X O X X X O
O: USED
X: NOT USED
CAR-12-GND
CAR-12-SNKR
CAR-12-RGO
CAR-12-RG1
CAR-12-SNKC
CAR-12-D00
AF-16-GND
AF-16-NC
AF-16-VBD
AF-16-VBC
AF-16-VBB
AF-16-VBA
AF-16-ULI
AF-16-PCK
AF-16-PDA
AF-16-PLEI
AF-16-PLEO
AF-16-MABK
AF-16-SABK
AF-16-GND
S1
D6
D7
D19
D18
D17
D15
D14
D21
D12
D3
D2
D1
D4
IC8
I/O INTERFACE
CXD1095Q
S7 KEY SELECT K7
KEY INPUT
DATA BUS
IC4
TC74HC573AF
LATCH
IC2
MBM27C256A-25
ROM
IC3
TC5564APL-15
RAM
IC5
TC74HC138AF
CHIP SELECT
IC19
TC4S81F
CHIP SELECT DECODE
BUFF
IC11 (2/2)
M5M5558M
SWA A/10-2-GND
SWA A/10-2-NC
SWA A/10-2-S6
SWA A/10-2-S5
SWA A/10-2-S4
SWA A/10-2-S3
SWA A/10-2-S2
SWA A/10-2-S1
SWA A/10-2-S0
SWA A/10-2-K7
SWA A/10-2-K6
SWA A/10-2-K5
SWA A/10-2-K4
SWA A/10-2-K3
SWA A/10-2-K2
SWA A/10-2-K1
SWA A/10-2-K0
SWA A/10-2-MU
SWA A/10-2-MD
SWA A/10-2-GND
RD
WR
RES
DATA
ALE

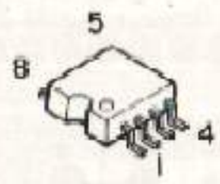
DIGITAL UNIT (X46-3050-XX) Component side view

M51951BML

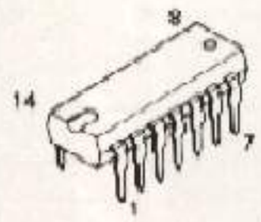
FMG1

TC4S81F
TC4SU69F

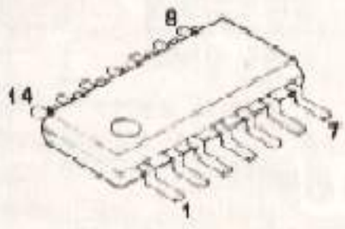
NJM4558M



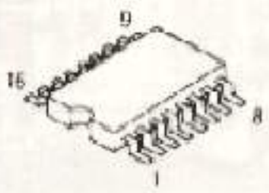
SN7404N



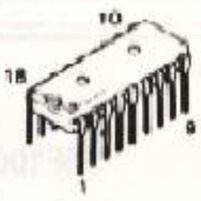
NJM2902M

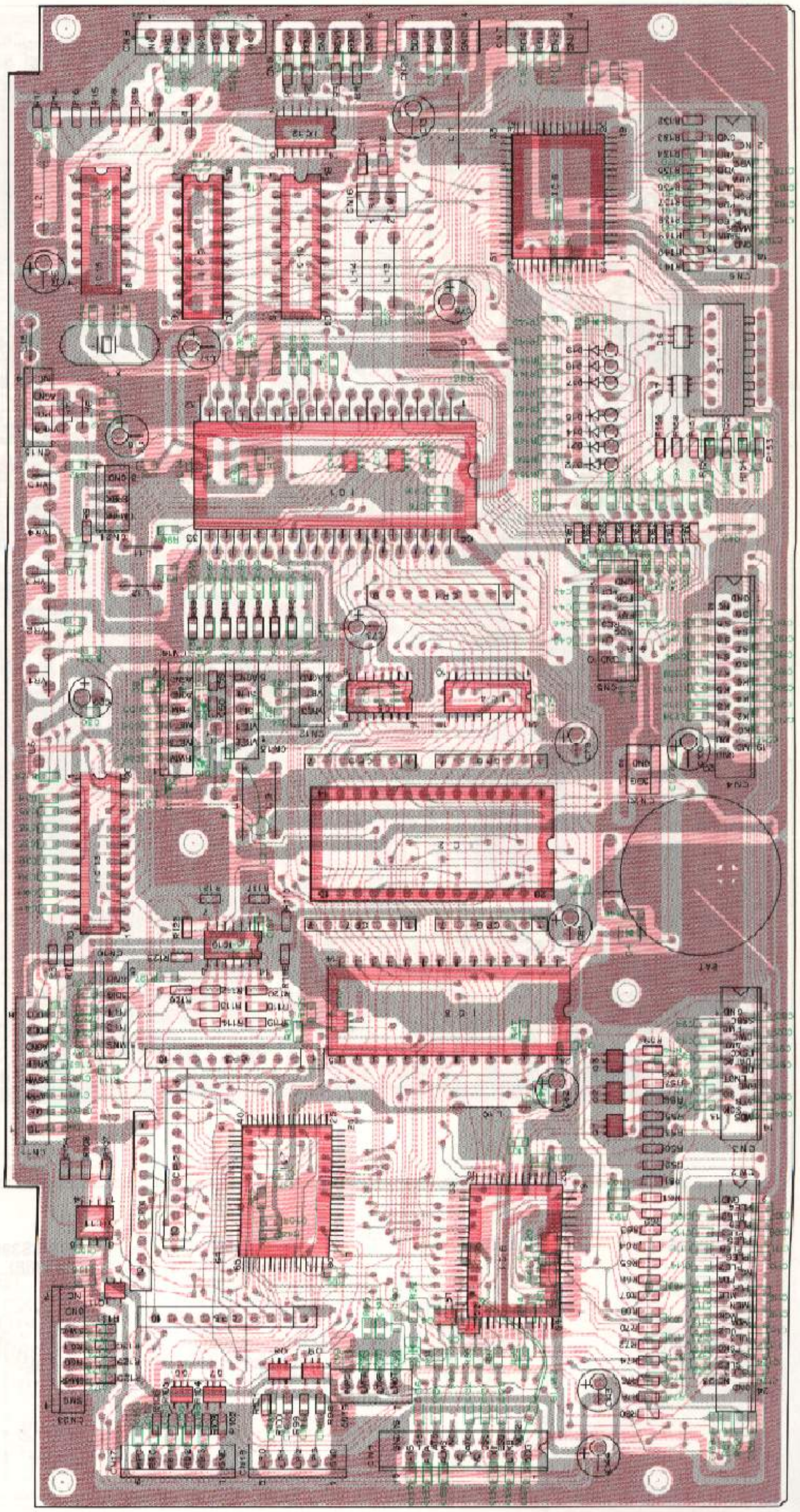


TC74HC138AF
TC4584BF



LZ92K37

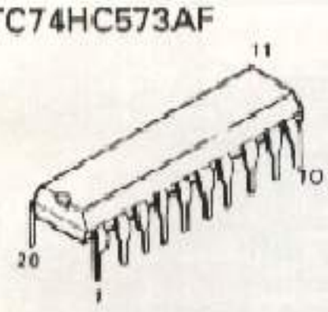




PC BOARD VIEWS TS-950S/SD

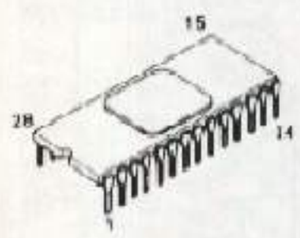
DIGITAL UNIT (X46-3050-XX) Foil side view

TC74HC573AF

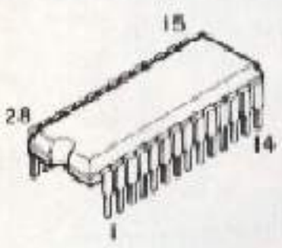


MB4056

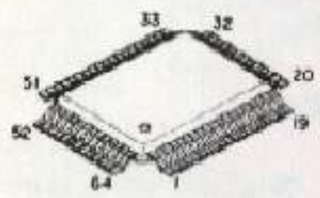
27C256A-25JAW3



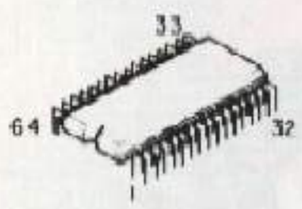
TC5564APL-15



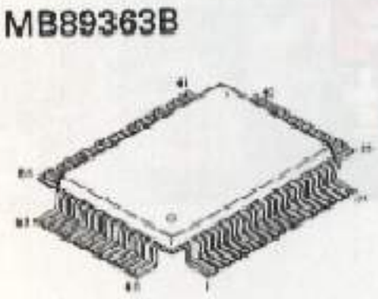
CXD1095Q



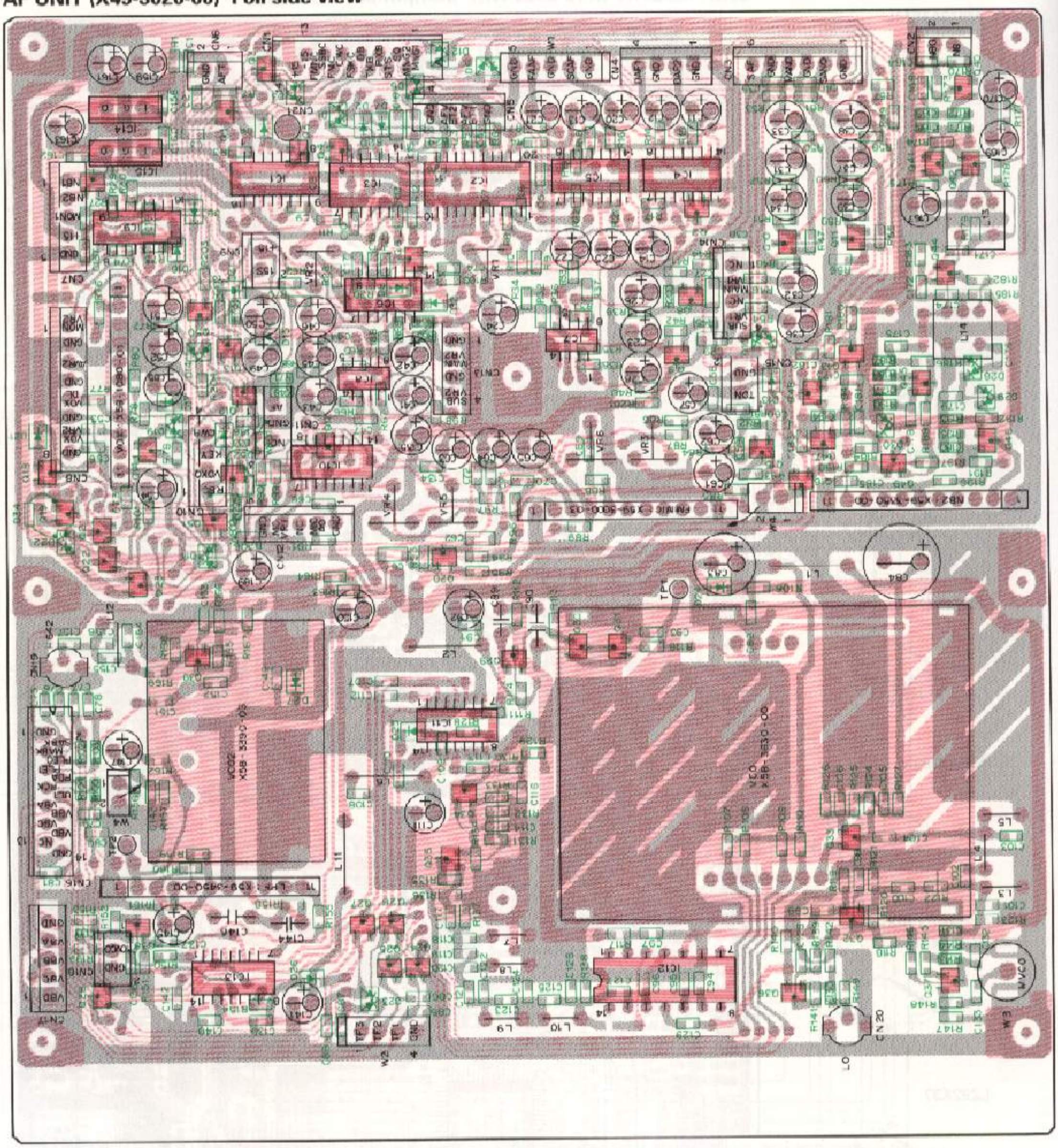
µPD78C10G-36



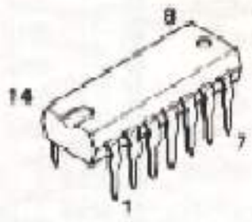
MB89363B



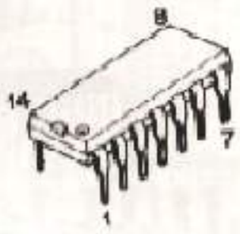
AF UNIT (X49-3020-00) Foil side view



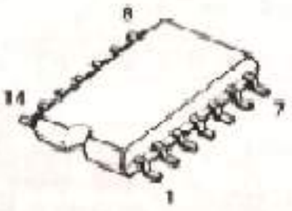
SN76514N



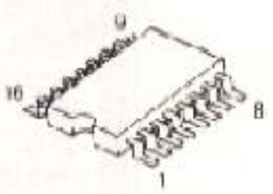
CXD1225M



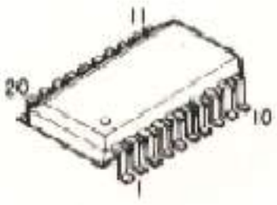
MF5CCWM
TC4066BF



SN74LS390NS
TC4538BF

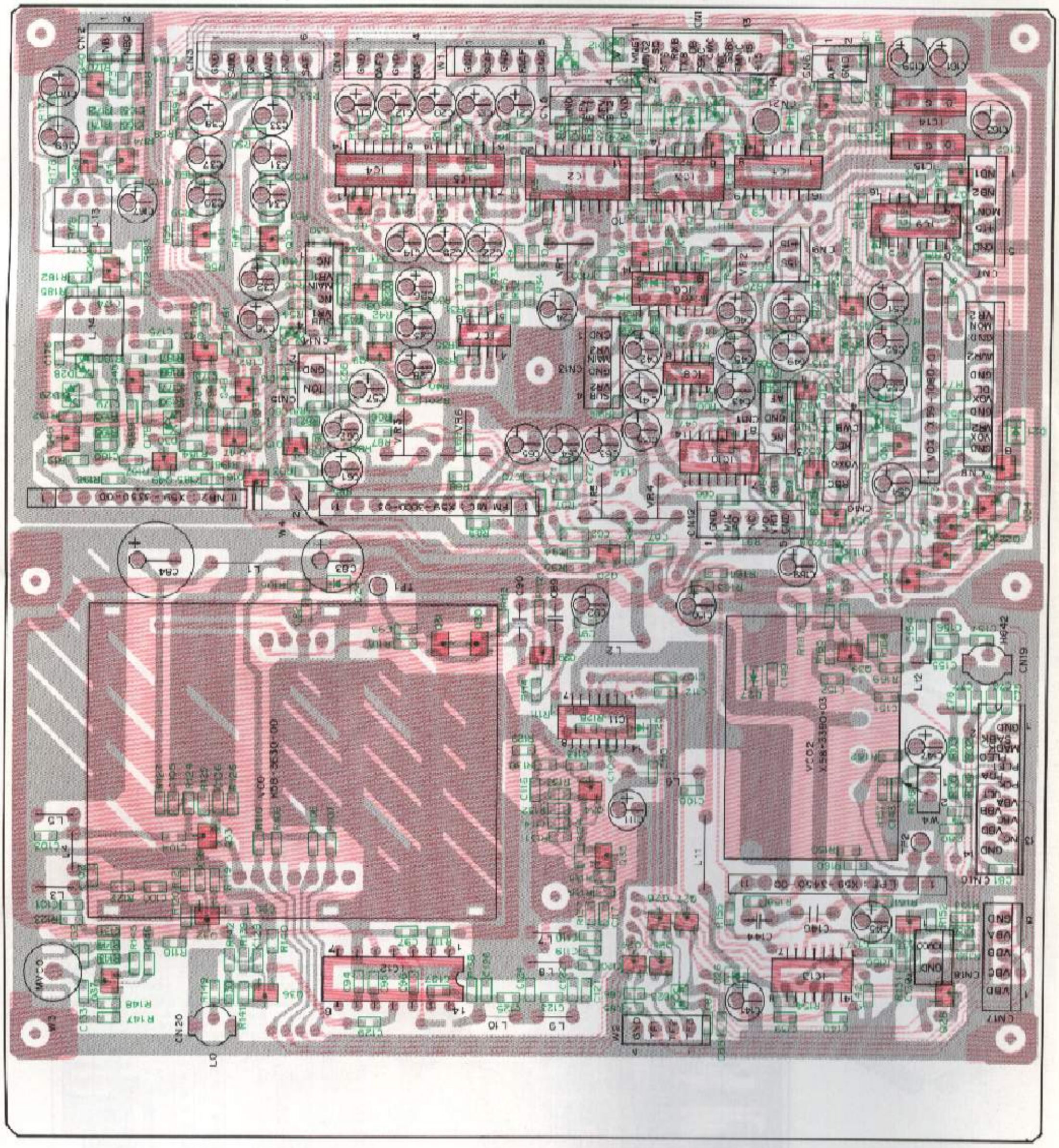


MF10CCWM

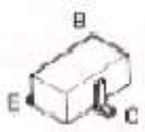


TS-950S/SD PC BOARD VIEWS

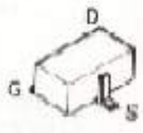
AF UNIT (X49-3020-00) Component side view



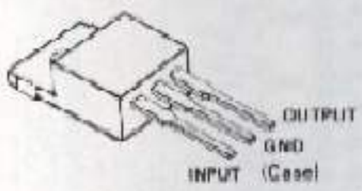
2SA1162
2SC2712
2SC2714
2SC3324
2SD1757
DTA124EK
DTC114EK
DTC114TK
DTC124EK
DTC114WK
2SC2996



2SK210

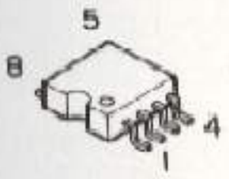


AN78N10

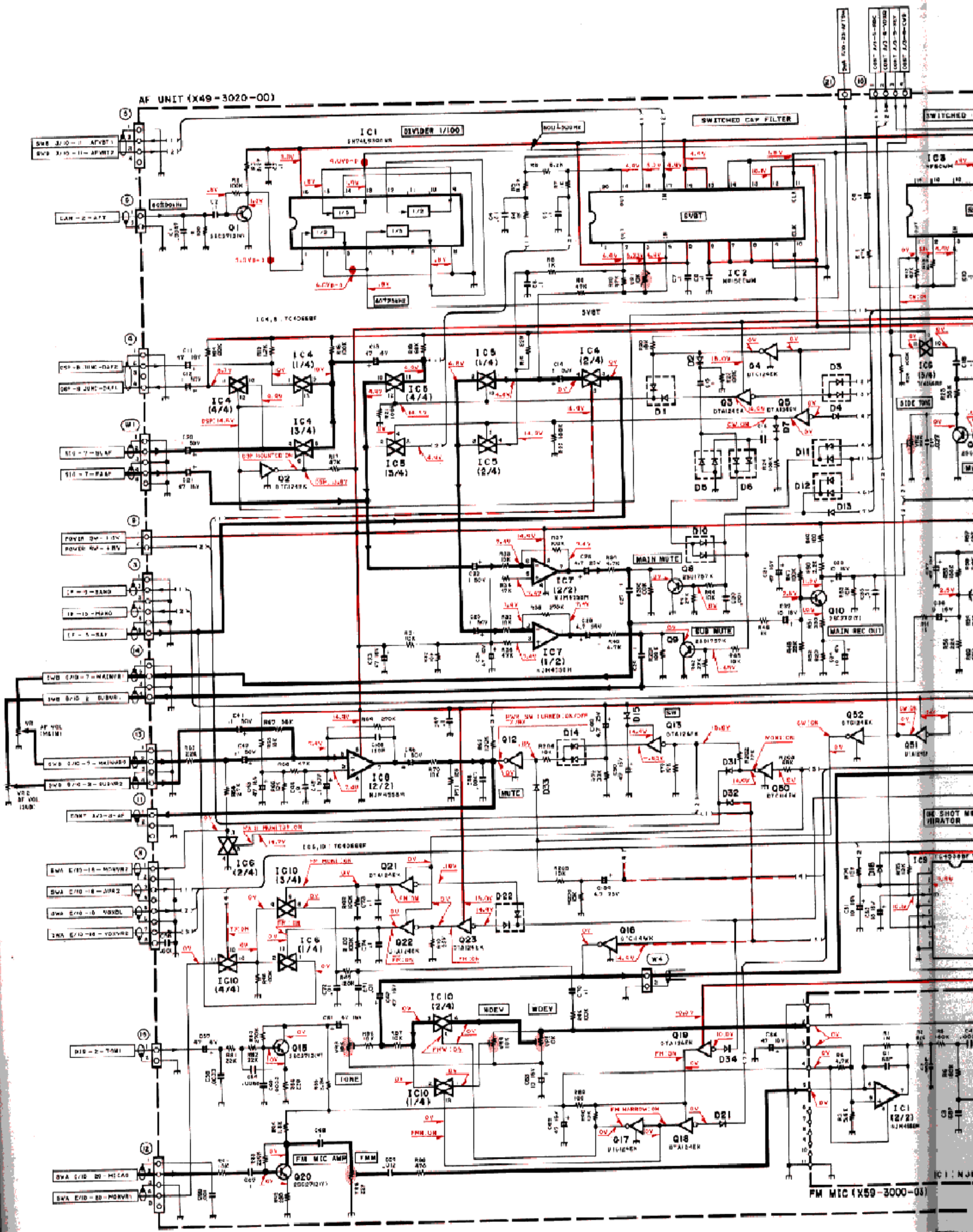


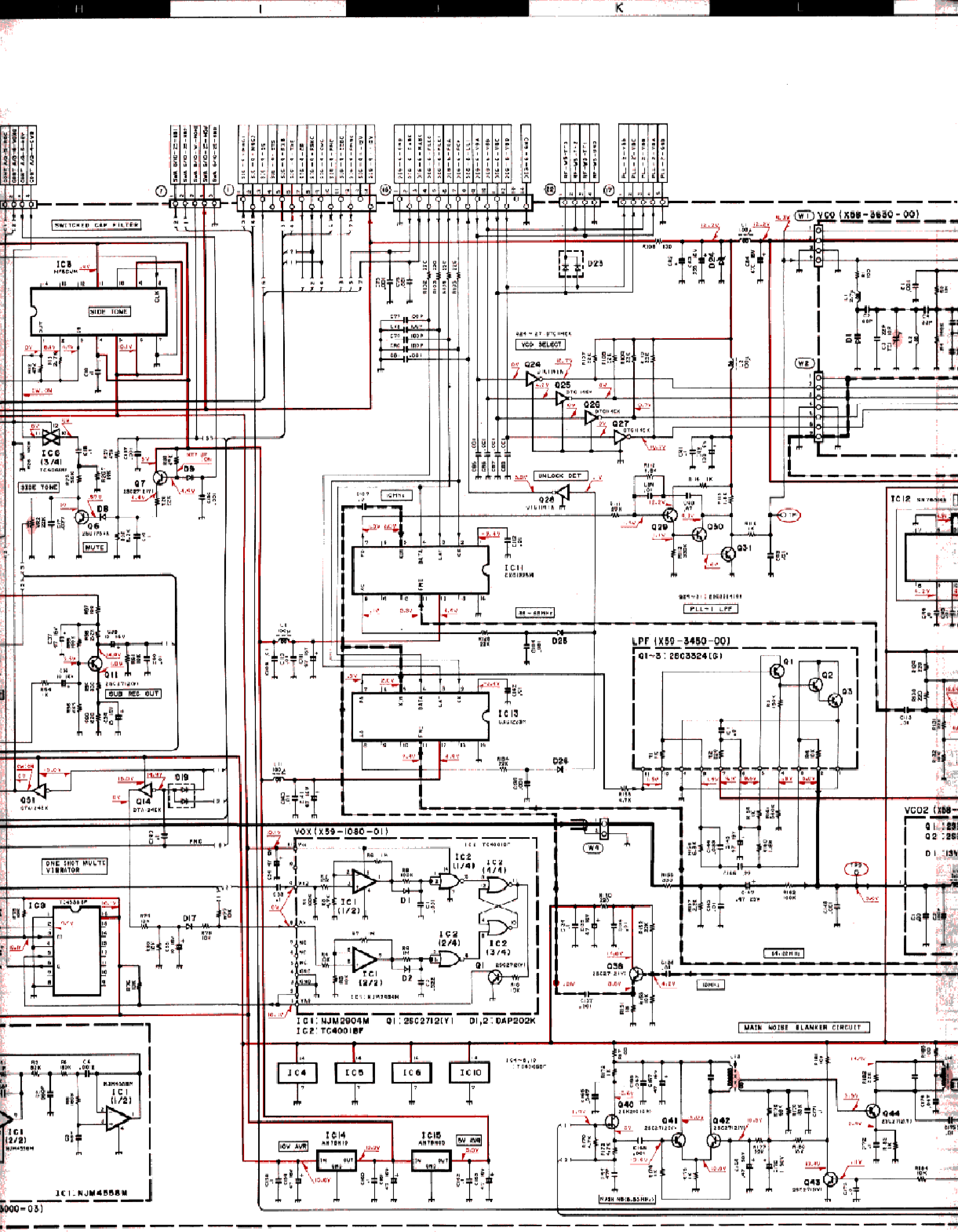
AN78N05

NJM4558M



AF UNIT (X49-3020-00)




H
I
J
K
L
SWITCHED CAP FILTER
IC8
SIDE TONE
IC6 (3/4)
SIDE TONE
Q7
D9
Q6
D8
MUTE
Q11
SUB REC OUT
Q51
Q14
D19
ONE SHOT MULTI VIBRATOR
IC9
D17
IC1 (1/2)
IC1 (2/2)
IC1 : NJM4558M
VCO (X58-3630-00)
D23
D24
VCO SELECT
Q24
Q25
Q26
Q27
UNLOCK DET
Q28
Q29
Q30
Q31
PLL-1 LPF
IC11
IC13
D25
D26
LPF (X59-3450-00)
Q1~3 : 2SC3324(G)
Q1
Q2
Q3
IC12
VCO2 (X58-
VOX (X59-1080-01)
IC2 (1/4)
IC2 (4/4)
IC2 (2/4)
IC2 (3/4)
D1
D2
Q1
IC1 : NJM2904M
IC2 : TC4001BF
Q1 : 2SC2712(Y)
D1,2 : DAP202K
IC4
IC5
IC6
IC10
IC14
IC15
10V AVR
5V AVR
Q38
MAIN NOISE BLANKER CIRCUIT
Q40
Q41
Q42
Q43
Q44
NASH NB(8.83MHz)

CIRCUIT DIAGRAM TS-950S/SD

IC1	: SN74LS390NS
IC2	: MF10CCWM
IC3	: MF5CWM
IC4~6,10	: TC4066BF
IC7, 8	: NJM4558M
IC9	: TC4538BF
IC11, 13	: CXD1225M
IC12	: SN76514N
IC14	: AN78N10
IC15	: AN78N05

Q1,7,10,11,15,20,36,41~47	: 2SC2712(Y)
Q2,4,16,17,52	: DTC124EK
Q3,5,13,14,18,19,21~25,48,51	: DTA124EK
Q6,8,9,12	: 2SD1757K
Q24~27,50	: DTC114EK
Q28	: DTC114TK
Q29~31	: 2SC3324(G)
Q32~36,39	: 2SC2714(Y)
Q37	: 2SC2996(Y)
Q40	: 2SK210(GR)
Q49	: 2SA1162(Y)

Q1~4 : 2SK210(GR)

D1,11,12,14,22,23	: DAN202(K)
D2,4,7~9,15,16~17,21,25,26,31~34	: RLS73
D3,5,10,19	: DAP202(K)
D24	: RLZJ12B
D27	: RLZJ9.1B
D28~30	: HSM88AS

D1,3,5,7 : 1SV166
D2,4,6,8 : RLS135

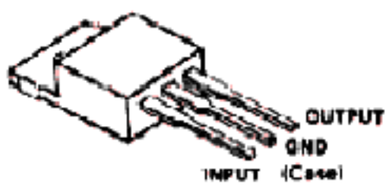
Freq : 14,000MHz Mode : USB

12.4V : DC VOLTAGE
0.24V : SIGNAL LEVEL (Vrms)
4.5Vp : SIGNAL LEVEL (Vp-p)

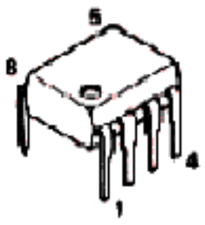
2SC2712
2SC2714
DTC114EK
DTC114TK

2SC2996

AN78M08H
μPC78M08H



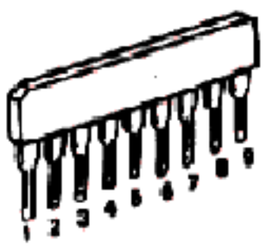
SN16913P



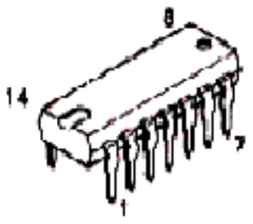
M54459L

MB467

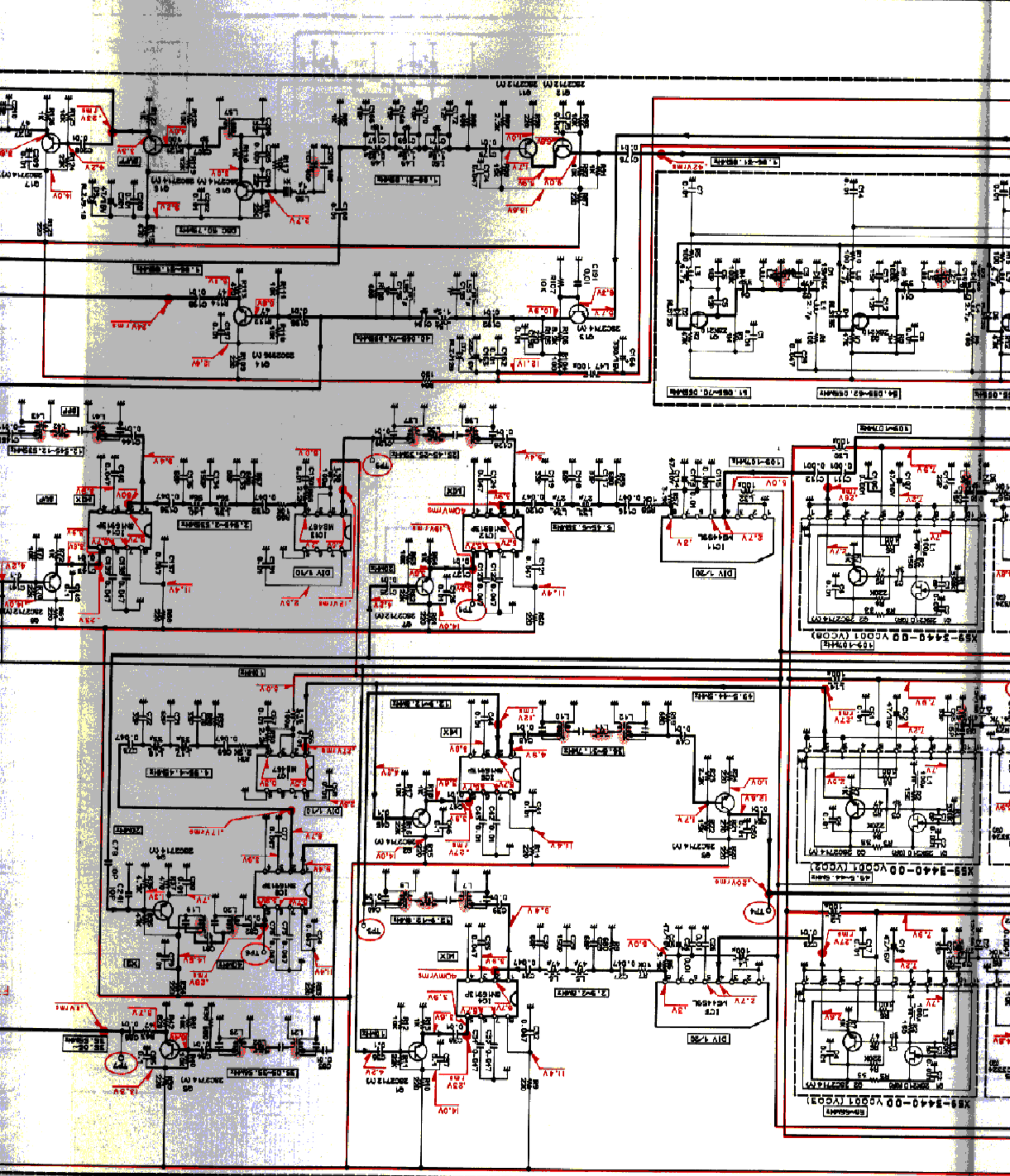
NJM4558SD



SN74LS73AN

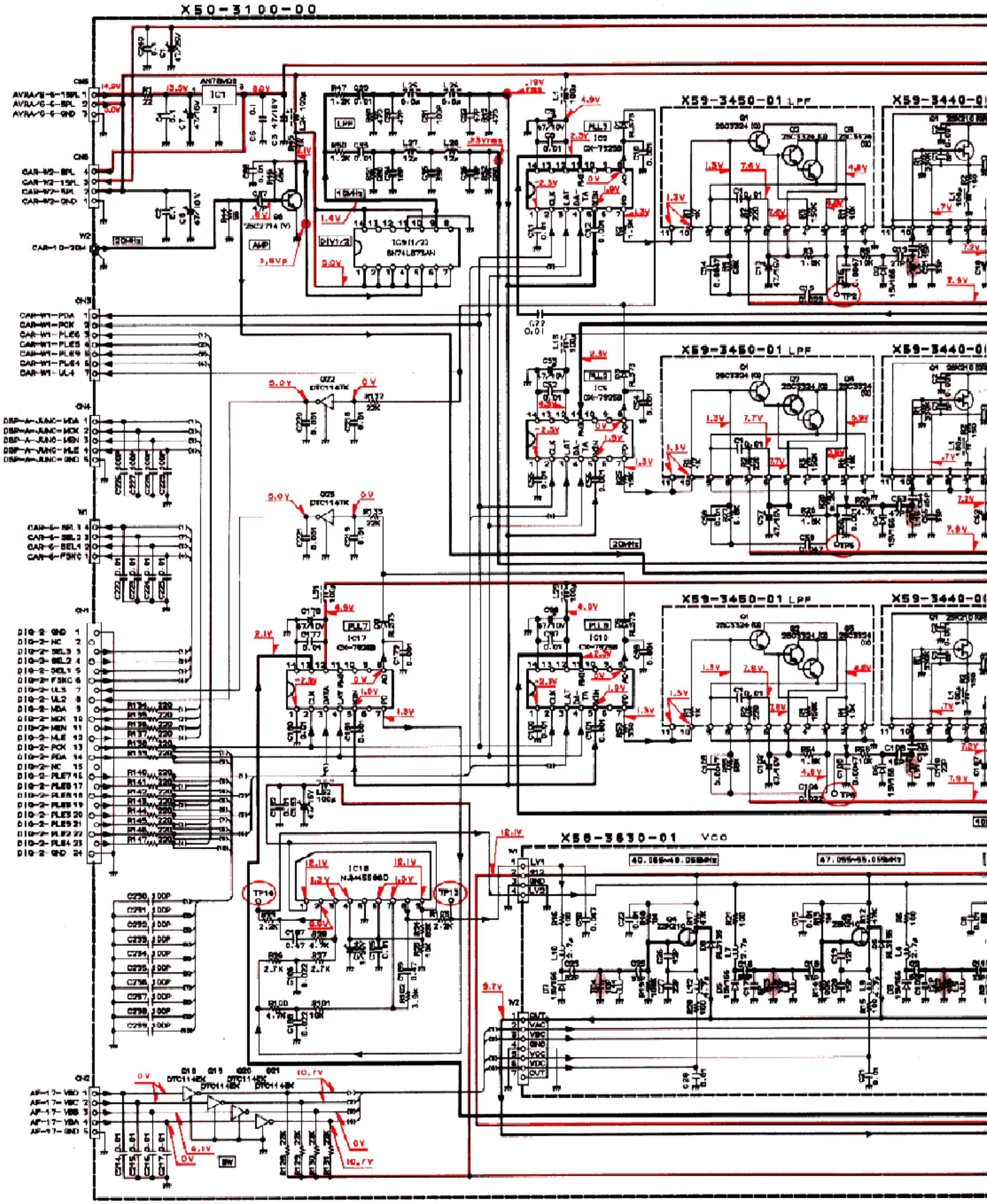


CX-7925B

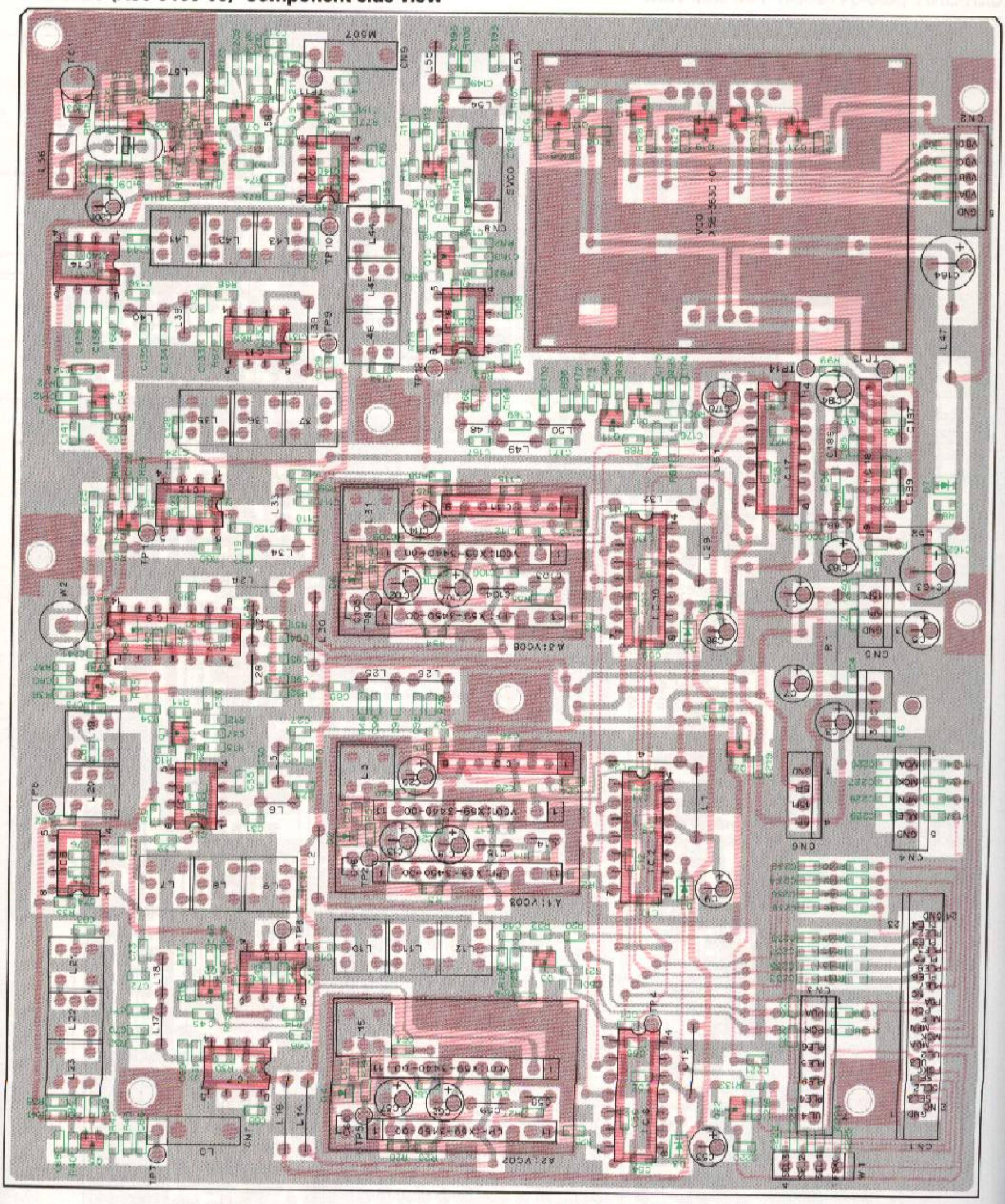


TS-950S/SD CIRCUIT DIAGRAM

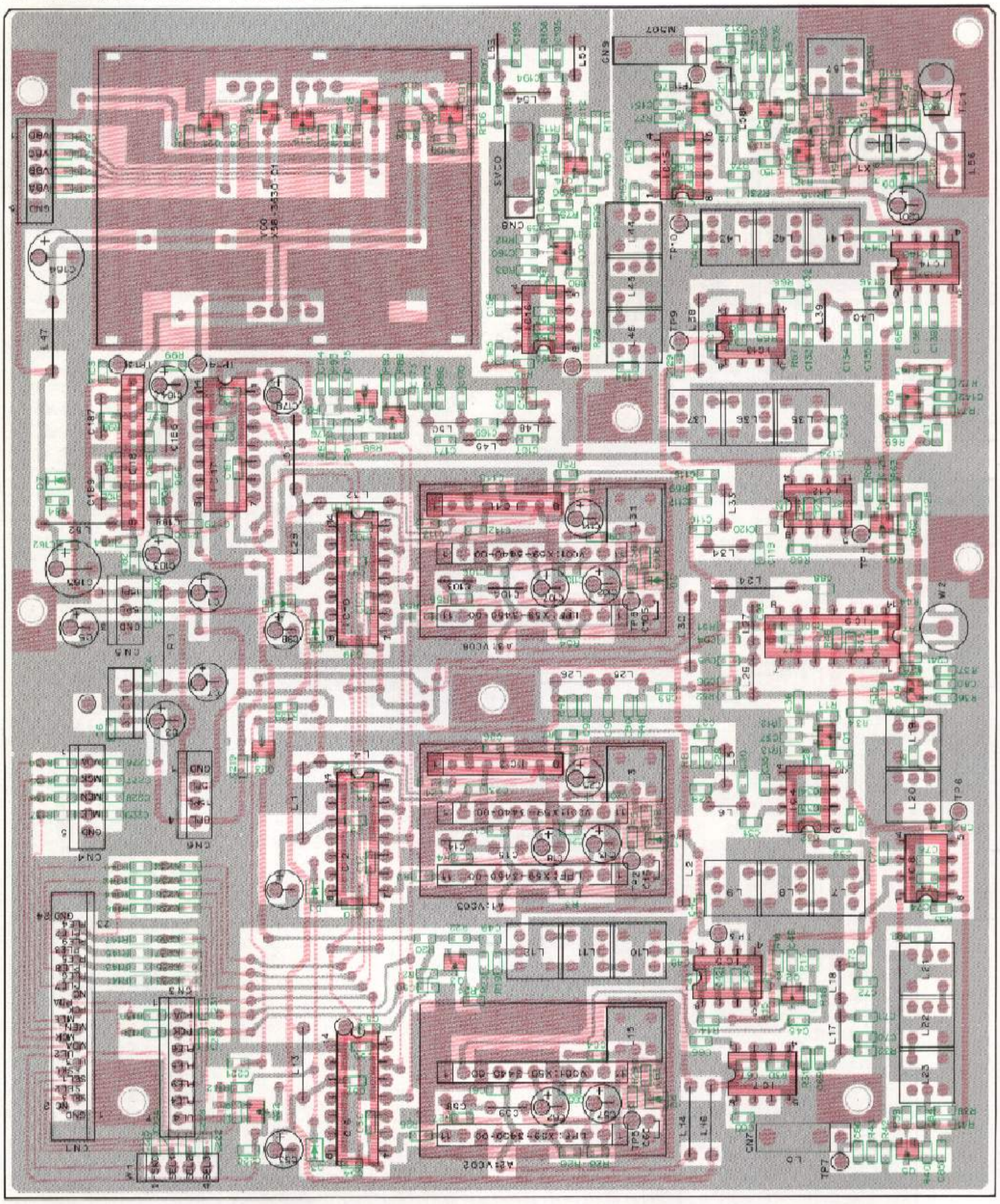
PLL UNIT (X50-3100-00)



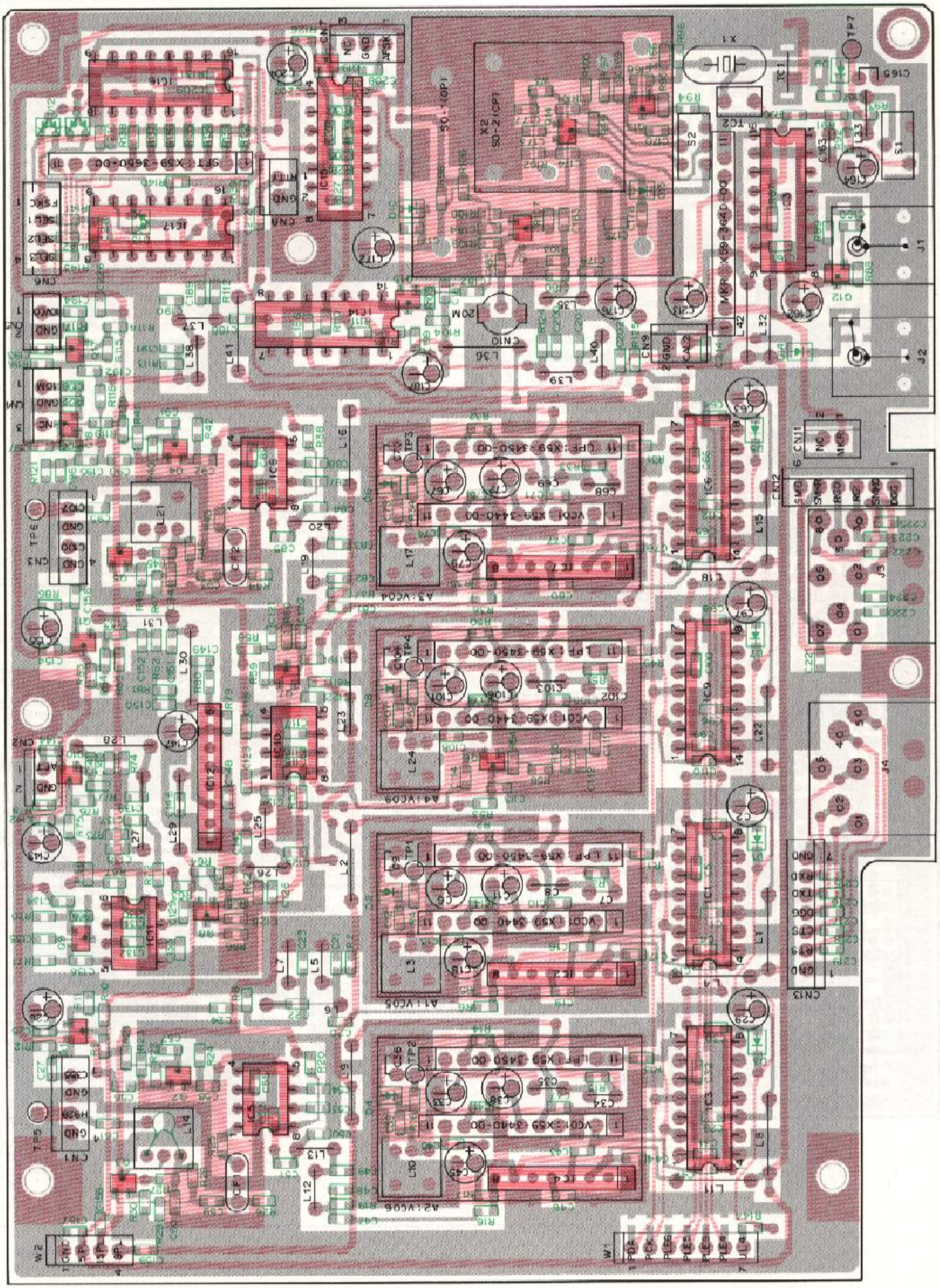
PLL UNIT (X50-3100-00) Component side view



PLL UNIT (X50-3100-00) Foil side view



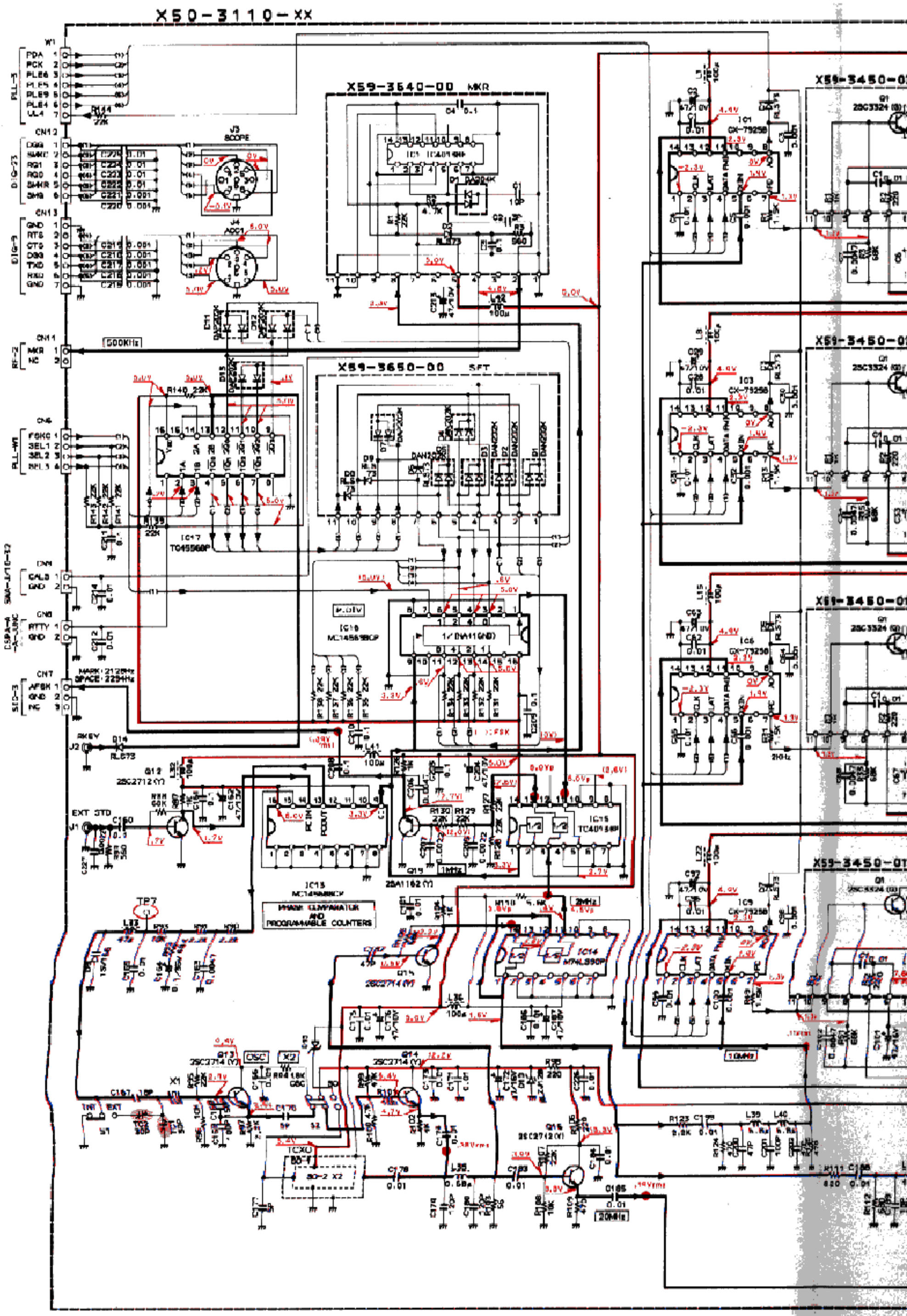
CAR UNIT (X50-3110-XX) Foil side view



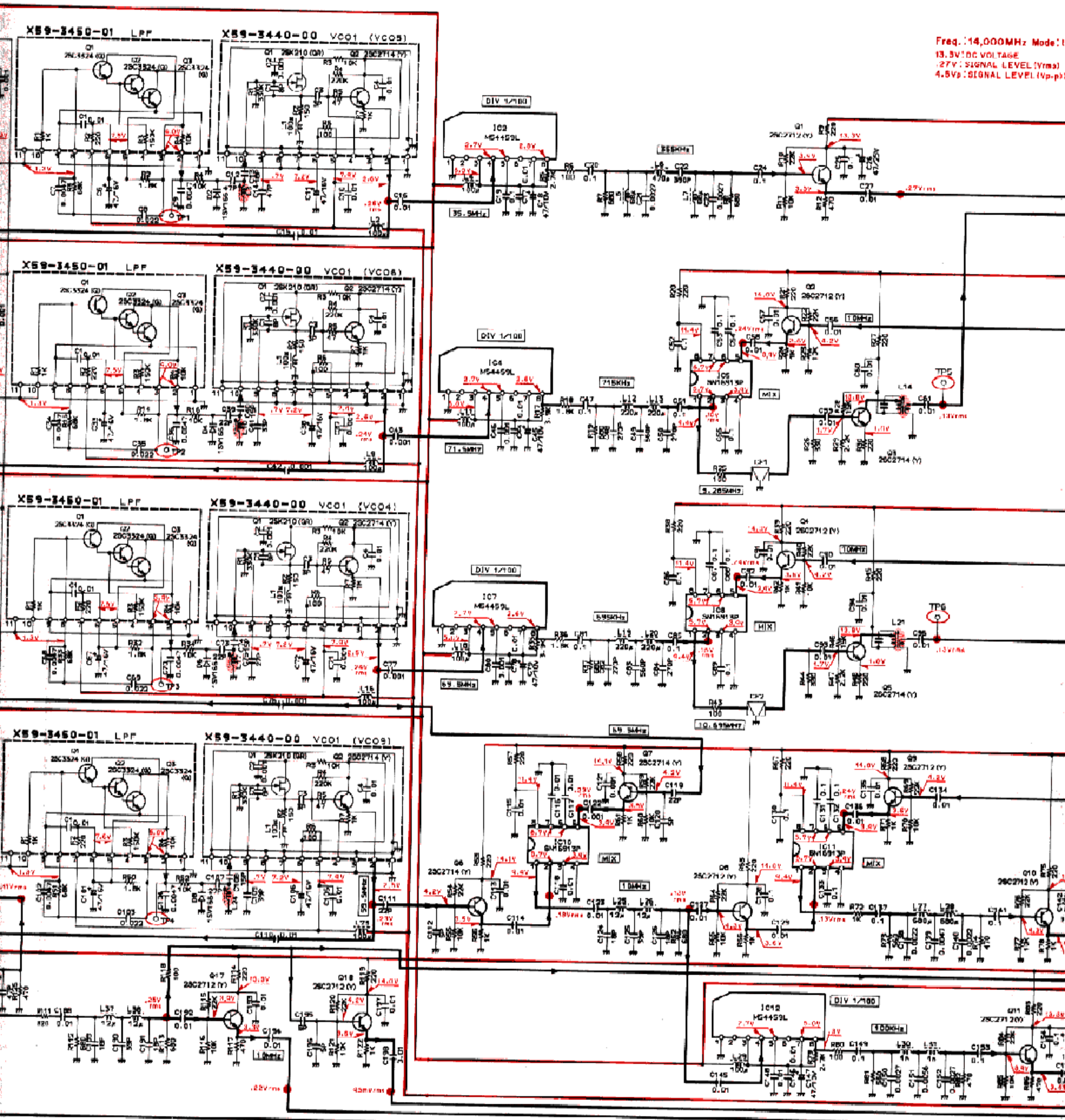
TS-950S/SD PC BOARD VIEWS

CAR UNIT (X50-3110-XX) Component side view

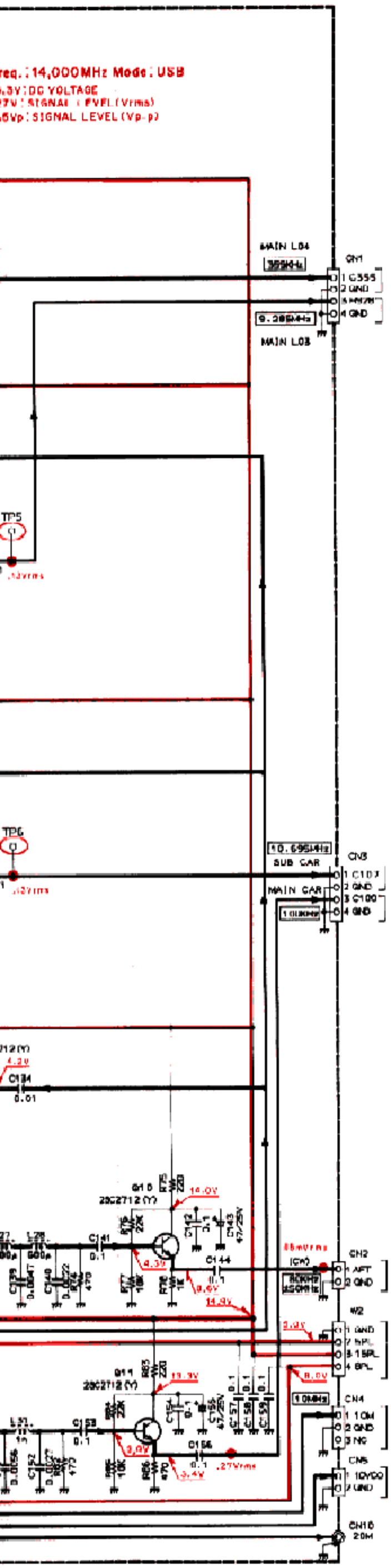
CAR UNIT (X50-3110-XX) -00 : TS-950 -01 : TS-950SD



CX77250	:IC1, 3, 5, 9	2SC2712 (Y)	:Q1, 2, 4, 8~12, 16~18	RLZ36.88	:D15
M5445SL	:IC2, 4, 7, 11	2SC2714 (Y)	:Q3, 5~7, 13~15		
SN16013P	:IC5, 8, 10, 11	2SA1162 (Y)	:Q19		
MC14568BCP	:IC13				
M74LS90P or SN74LS90N	:IC14	RLS73	:D1, 3, 5, 7, 14		
TC4013BP	:IC15	1SV166	:D2, 4, 6, 8, 9		
MC14555BCP	:IC16	RLZ13B	:D10		
TC45568P	:IC17	DAP202K	:D11~13		

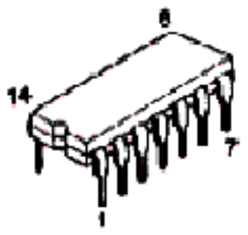

X59-3450-01 LPF
X59-3440-00 VCO1 (VCO5)
X59-3440-00 VCO1 (VCO6)
X59-3440-00 VCO1 (VCO4)
X59-3440-00 VCO1 (VCO9)
Freq. : 14,000MHz Mode : L
13.3V : DC VOLTAGE
.27V : SIGNAL LEVEL (Vrms)
4.5Vp : SIGNAL LEVEL (Vp-p)
DIV 1/100
IC2 MB4159L
35.5MHz
355KHz
IC4 MB4459L
71.5MHz
715KHz
IC7 MB4459L
59.5MHz
595KHz
IC9 MB4459L
10.695MHz
1.07MHz
IC12 MB4459L
100KHz
MIX
TP1
TP2
TP3
TP4
TP5
TP6

CIRCUIT DIAGRAM TS-950S/SD

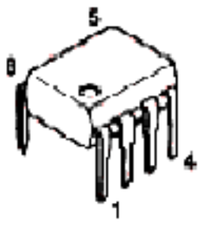


2SA1162
2SC2712
2SC2714

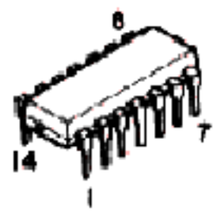
TC4013P



SN16913P

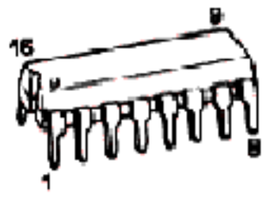


CX-7925B

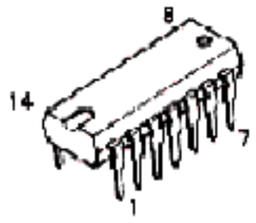


M54459L

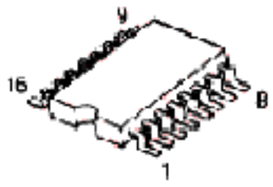
MC14568BCP
MC14569BCP



M74LS90P
SN74LS90N

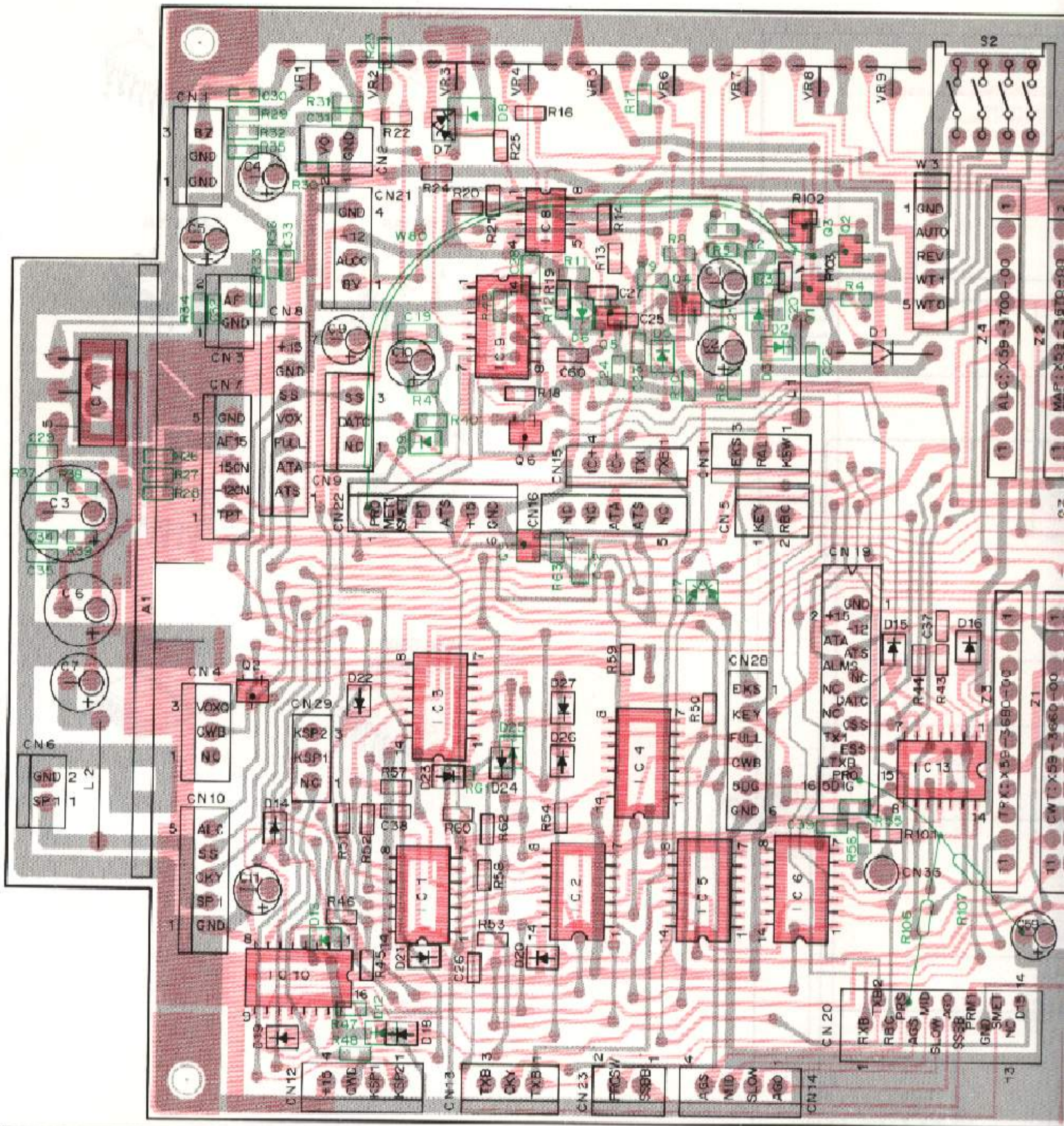


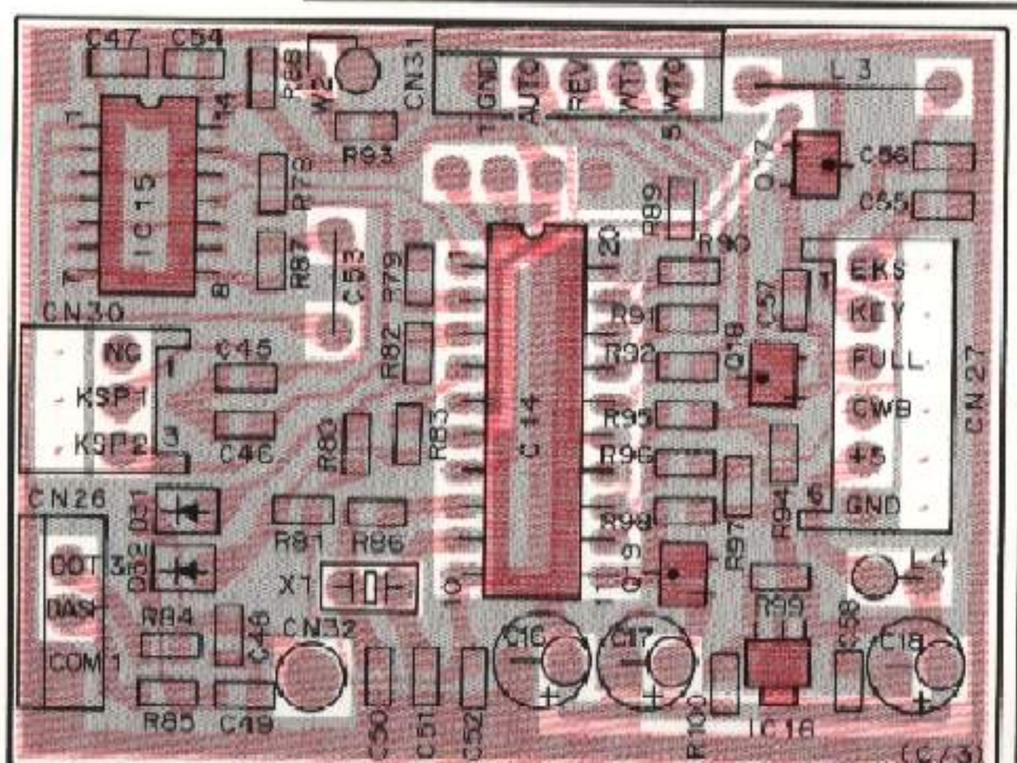
TC4556BP

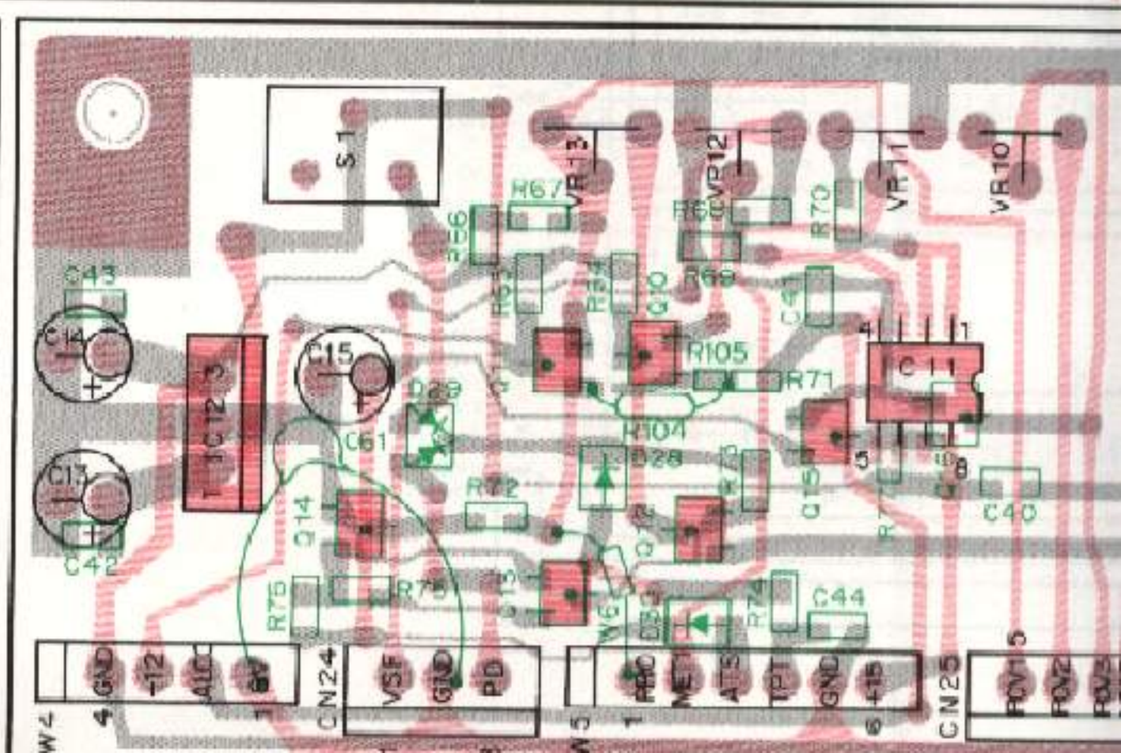


TS-950S/SD PC BOARD VIEWS

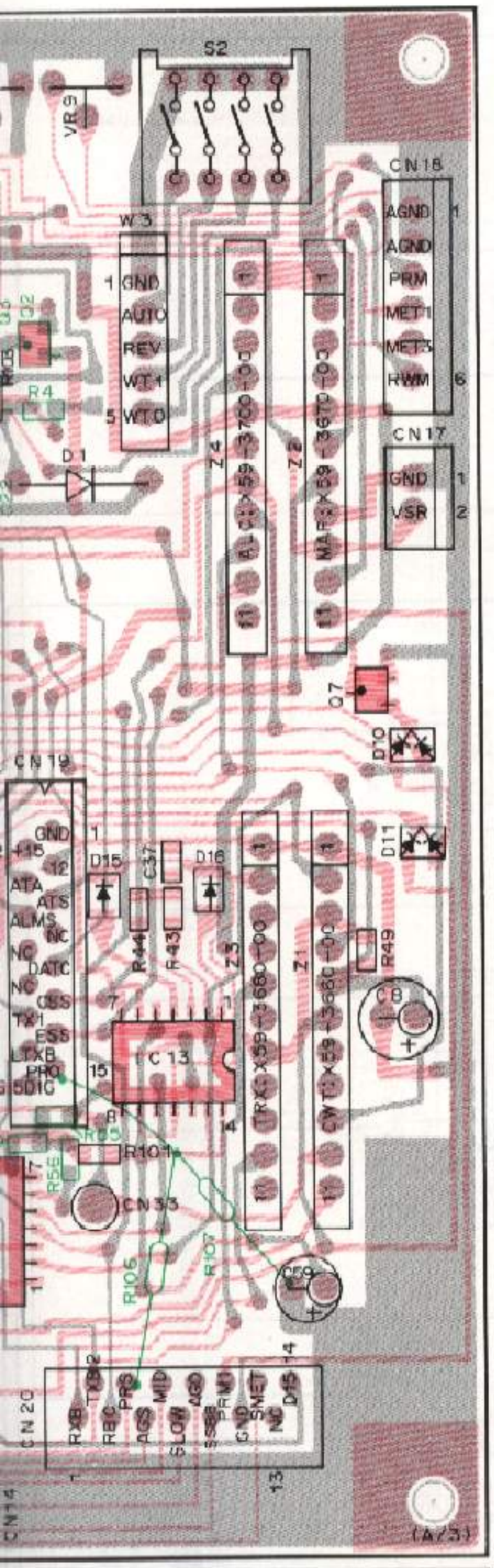
CONTROL UNIT (X53-3230-00) Component side view

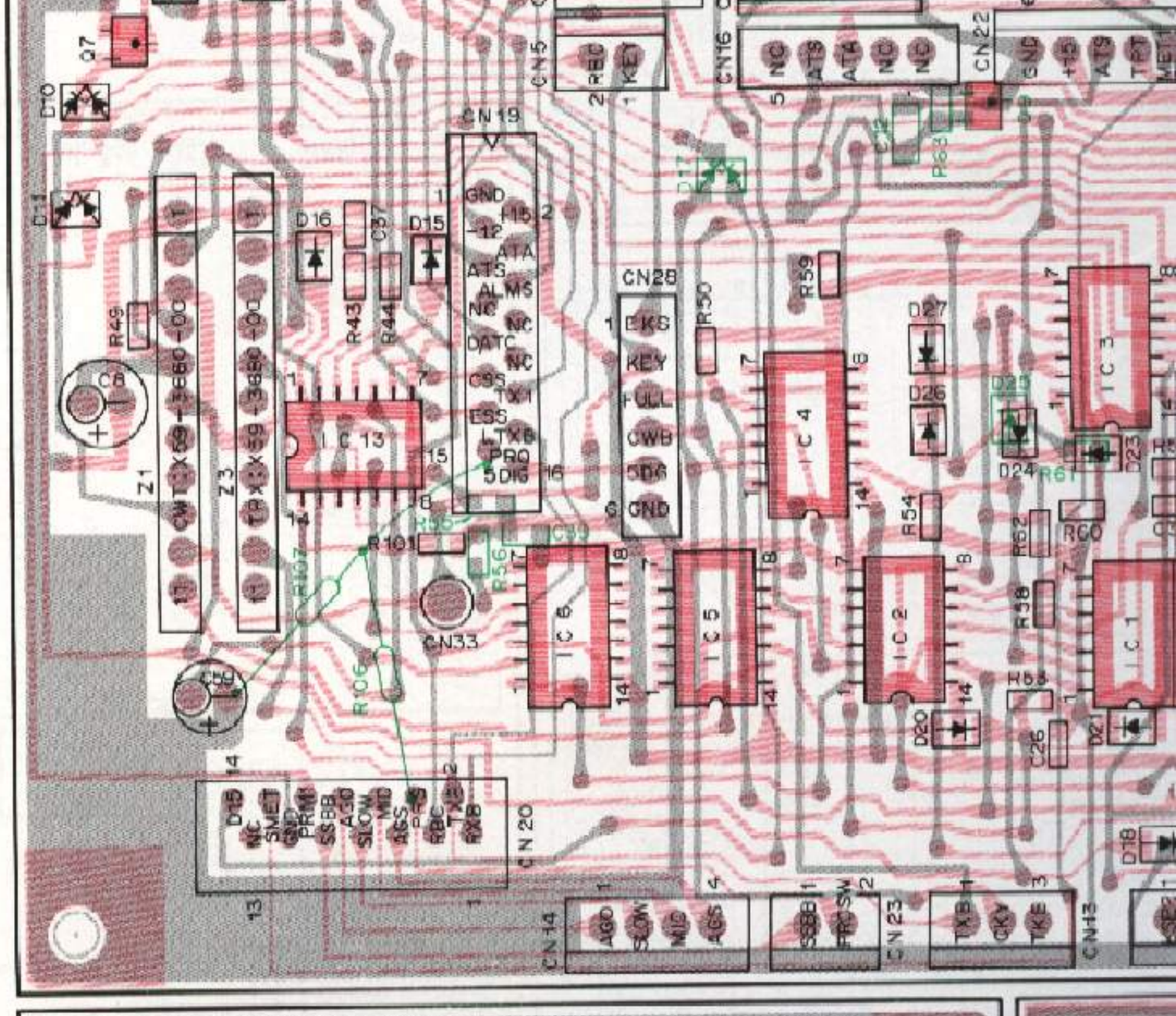


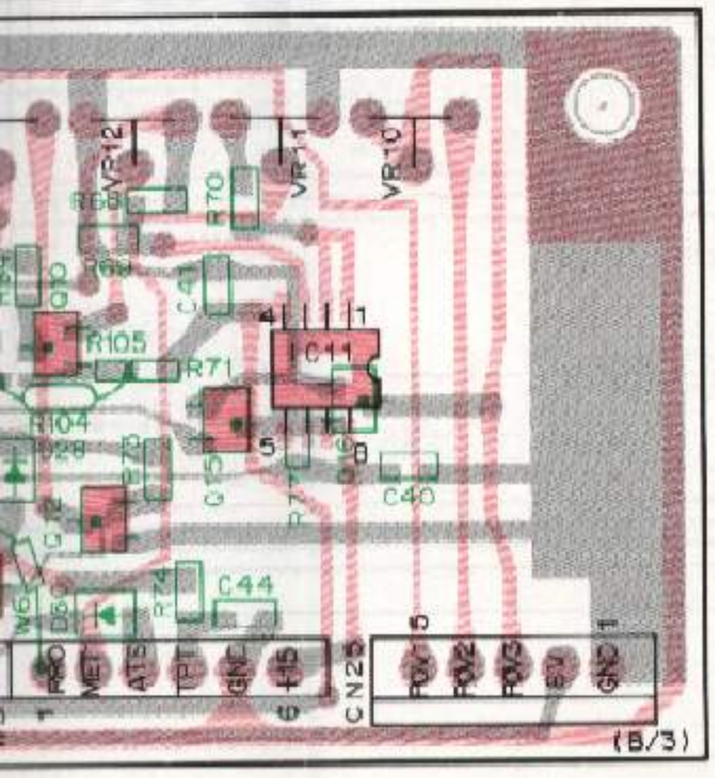


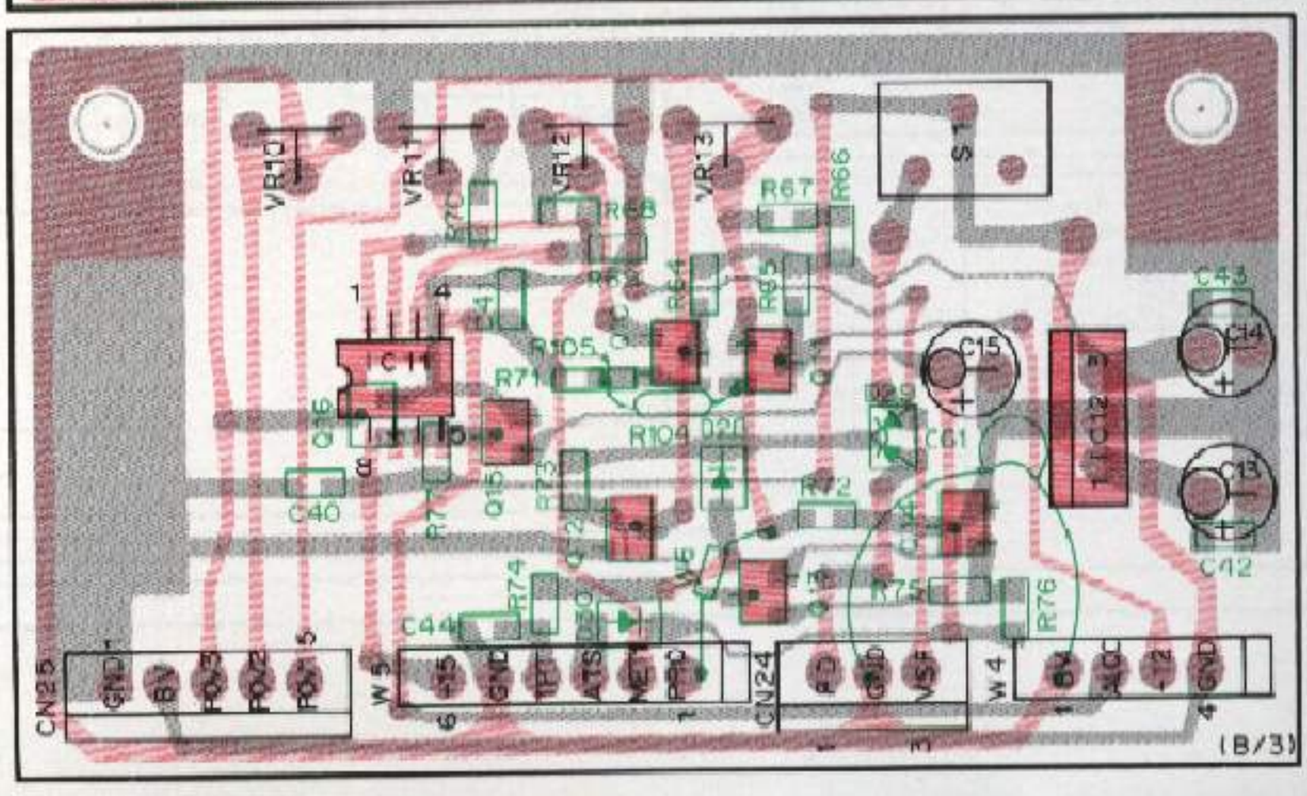


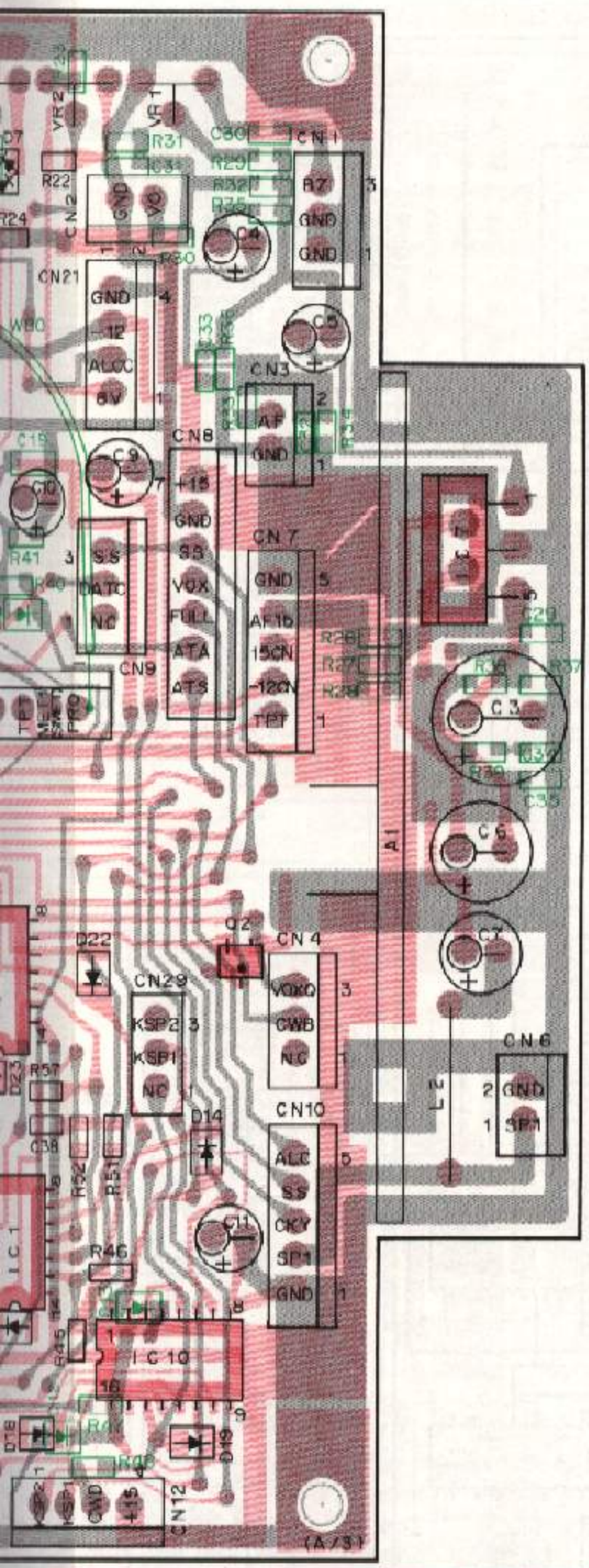
CONTROL UNIT (X53-3230-00) Foil side view

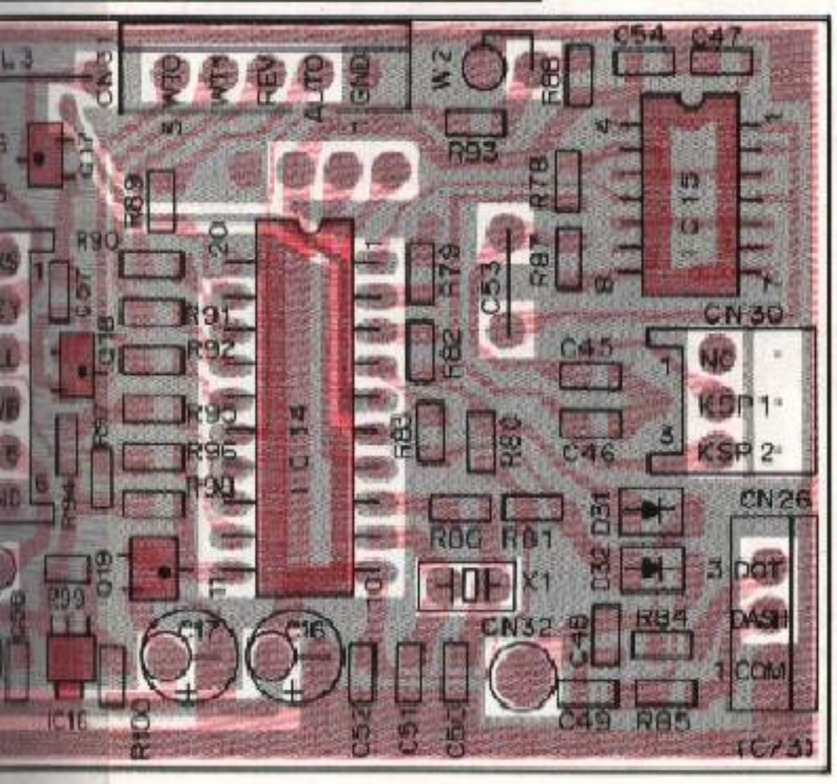












2SC2712
DTA124EK
DTC114TK
DTC124EK
DTC144EK
DTC144WK

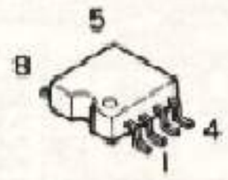
2SK208

M51951BML

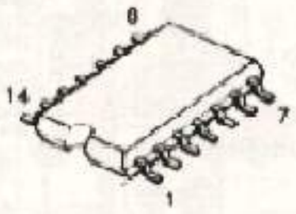
AN78N08

µPC2002V

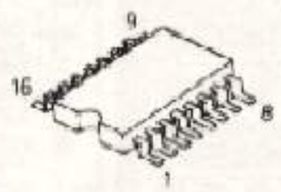
NJM4558M



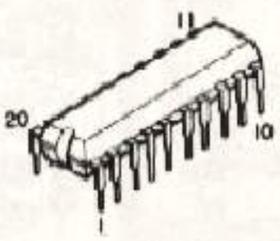
TC4011BF
TC4066BF
TC4069UBF



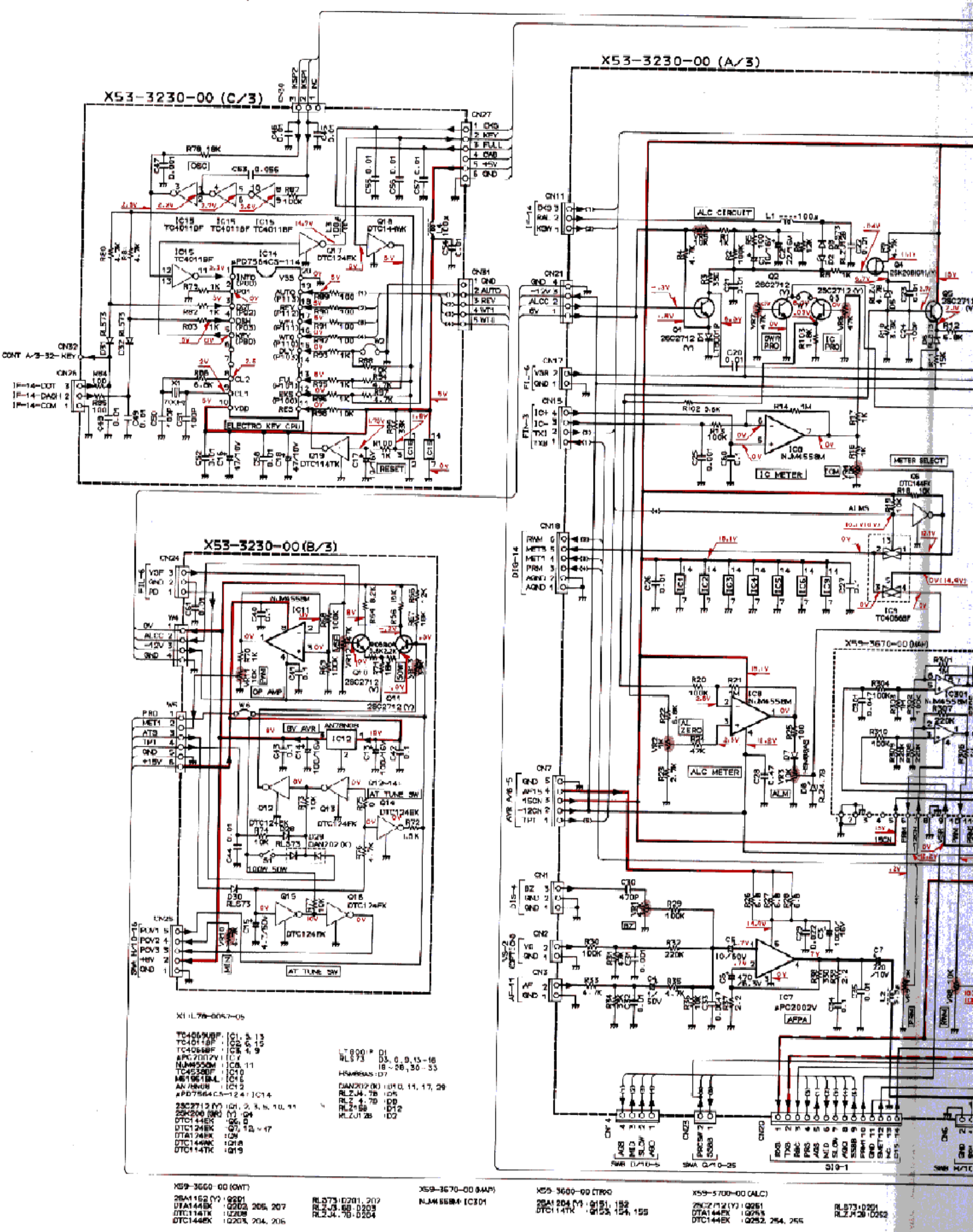
TC4538BF



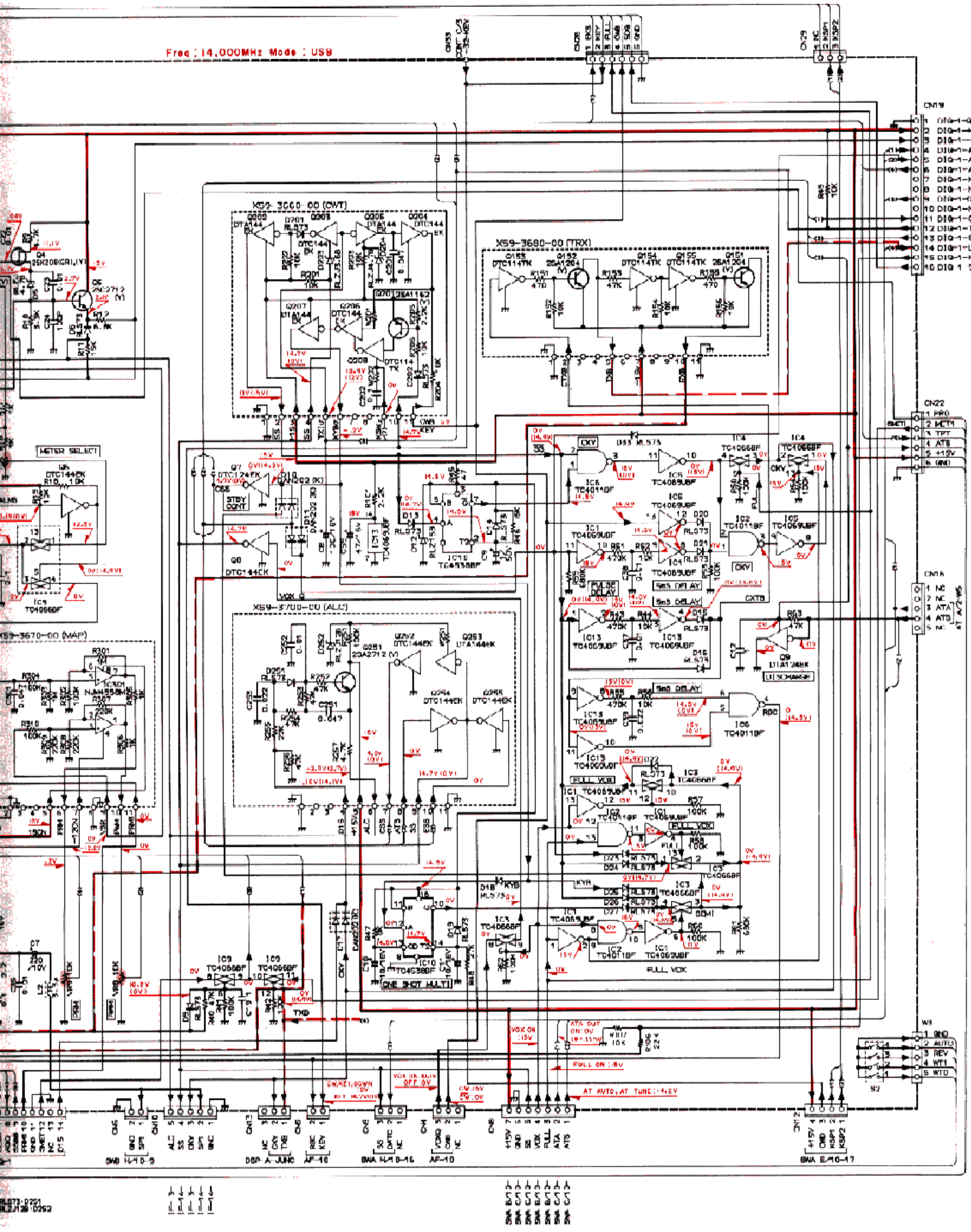
µPD7564CS-114



CONTROL UNIT (X53-3230-00)

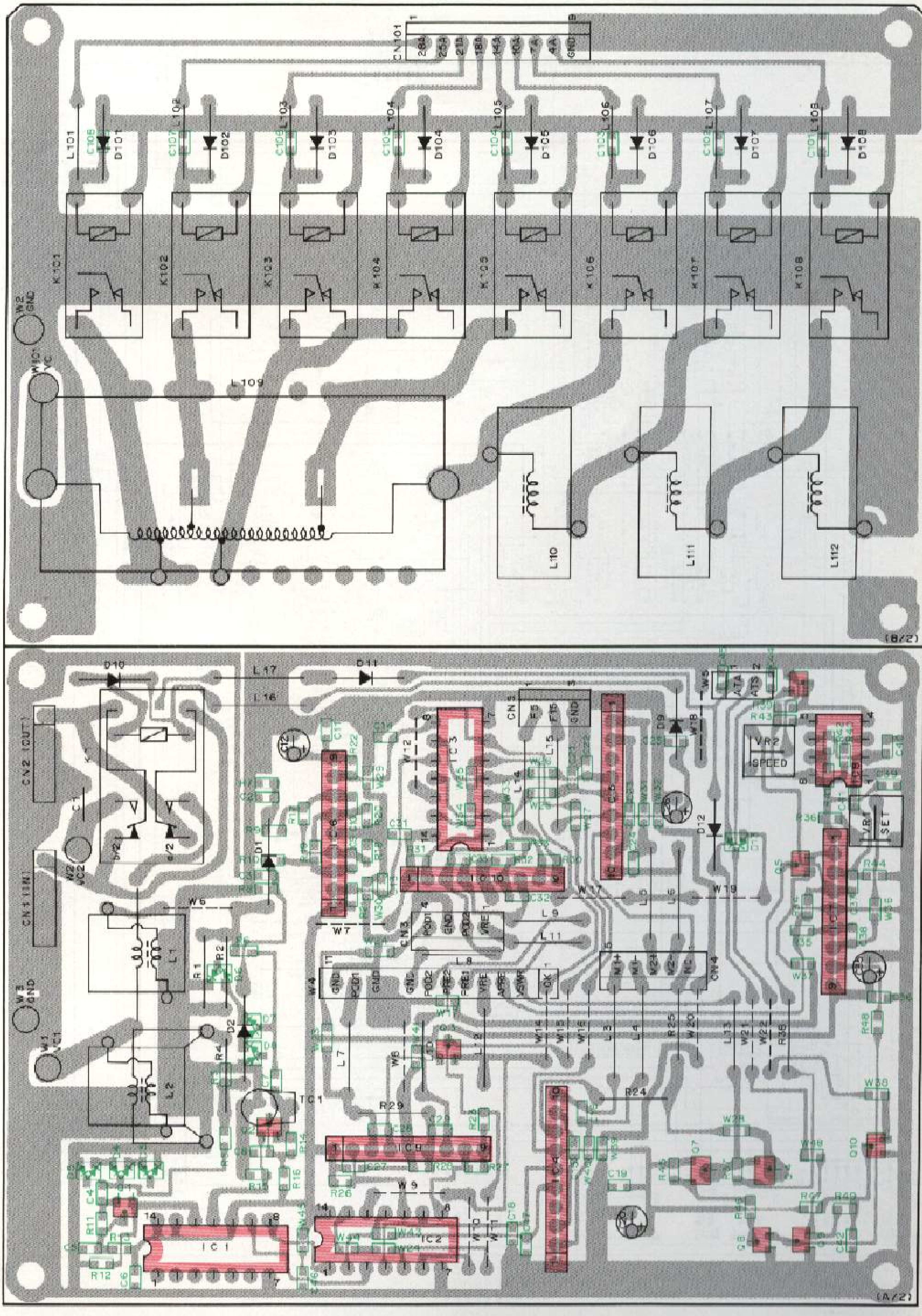


CIRCUIT DIAGRAM TS-950S/SD



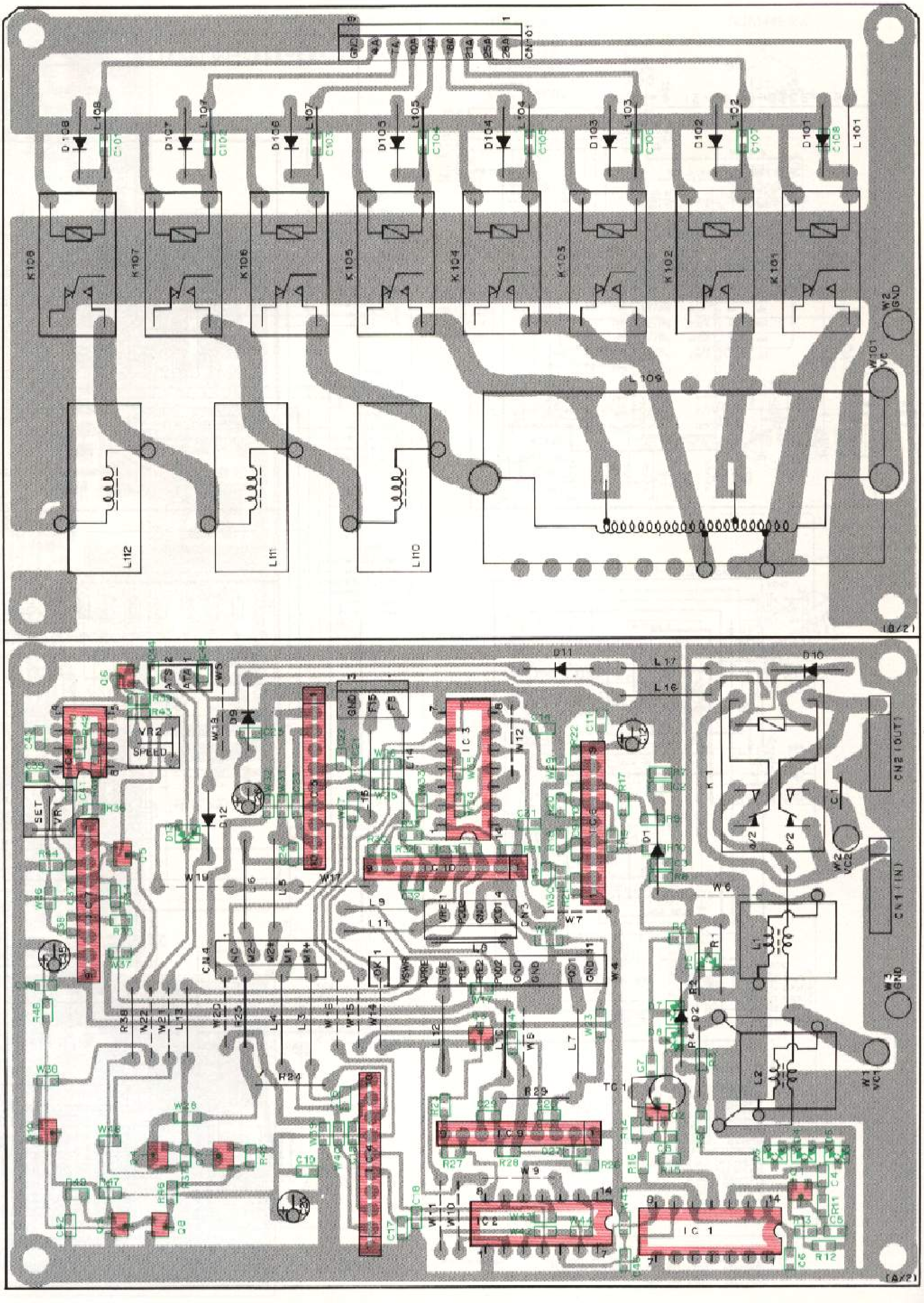
TS-950S/SD PC BOARD VIEWS

AT UNIT (X53-3240-00) Component side view



AT UN

AT UNIT (X53-3240-00) Foil side view

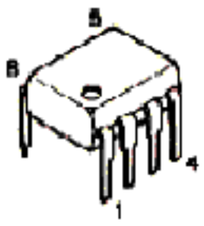


AT UNIT (X53-3240-00)

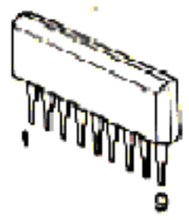
2SC2714
DTC114EK

2SA1204

NE555P

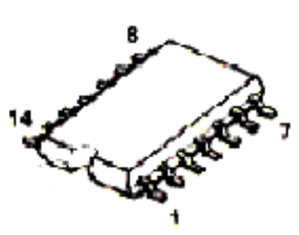


NJM2903S
NJM2904S

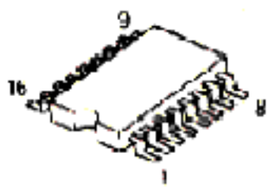


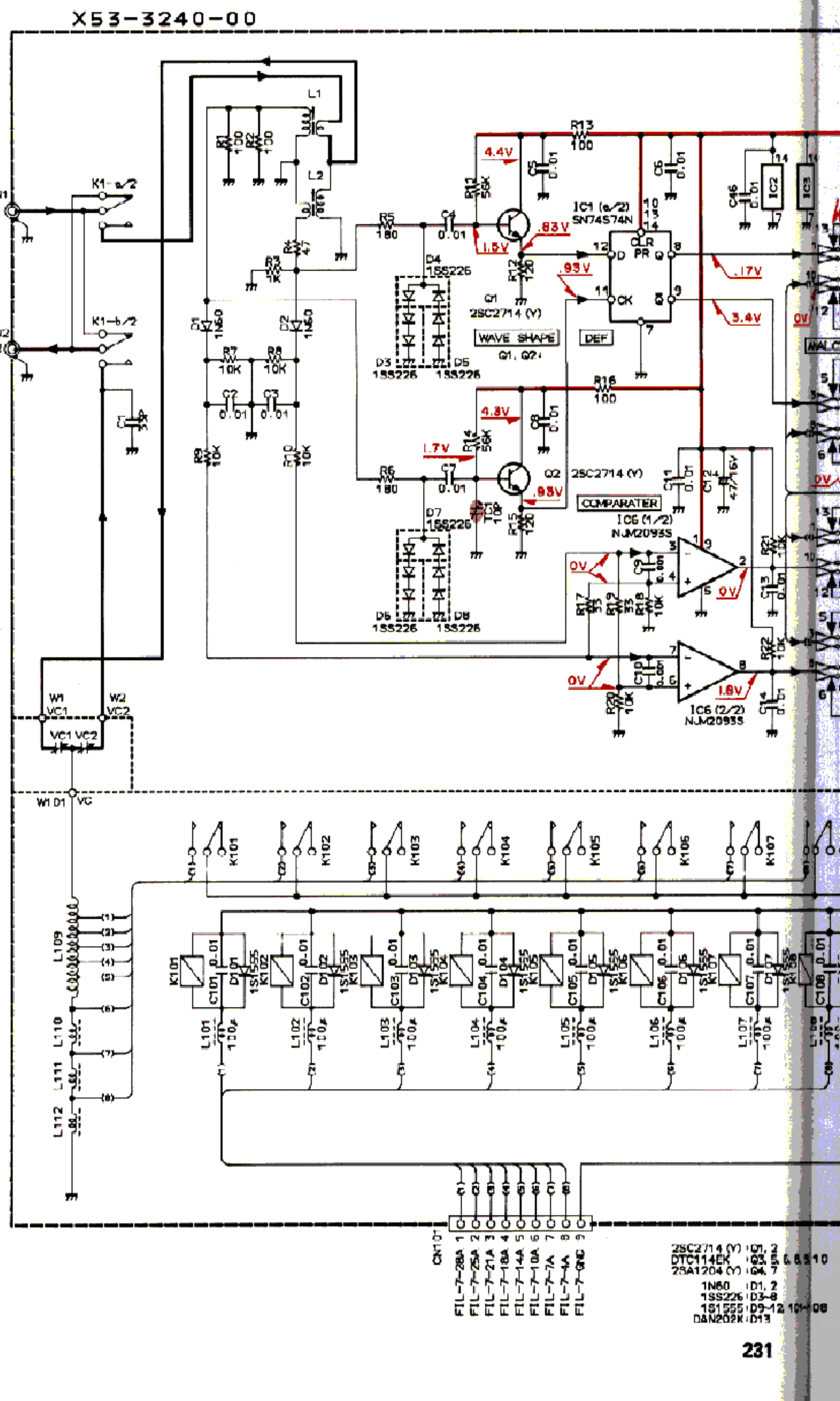
BA6109U2

TC4066BP



SN74S74N

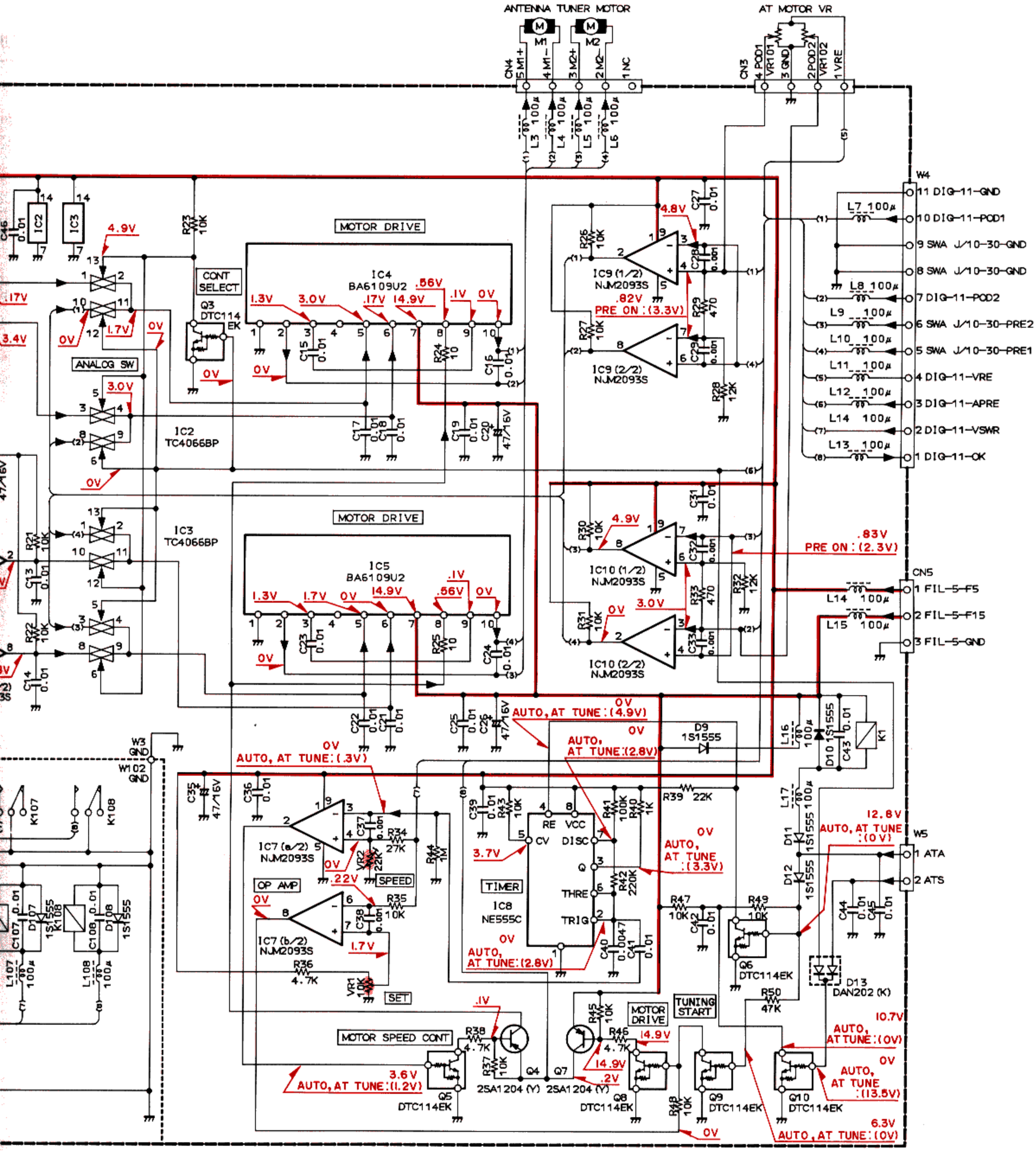




2SC2714 (Y) : Q1, 2
DTC114EK : Q3, 4, 6, 8, 9, 10
2SA1204 (Y) : Q5, 7

1N60 : D1, 2
1SS226 : D3-8
1S1555 : D9-12, 101-108
DAN202K : D13

CIRCUIT DIAGRAM TS-950S/SD

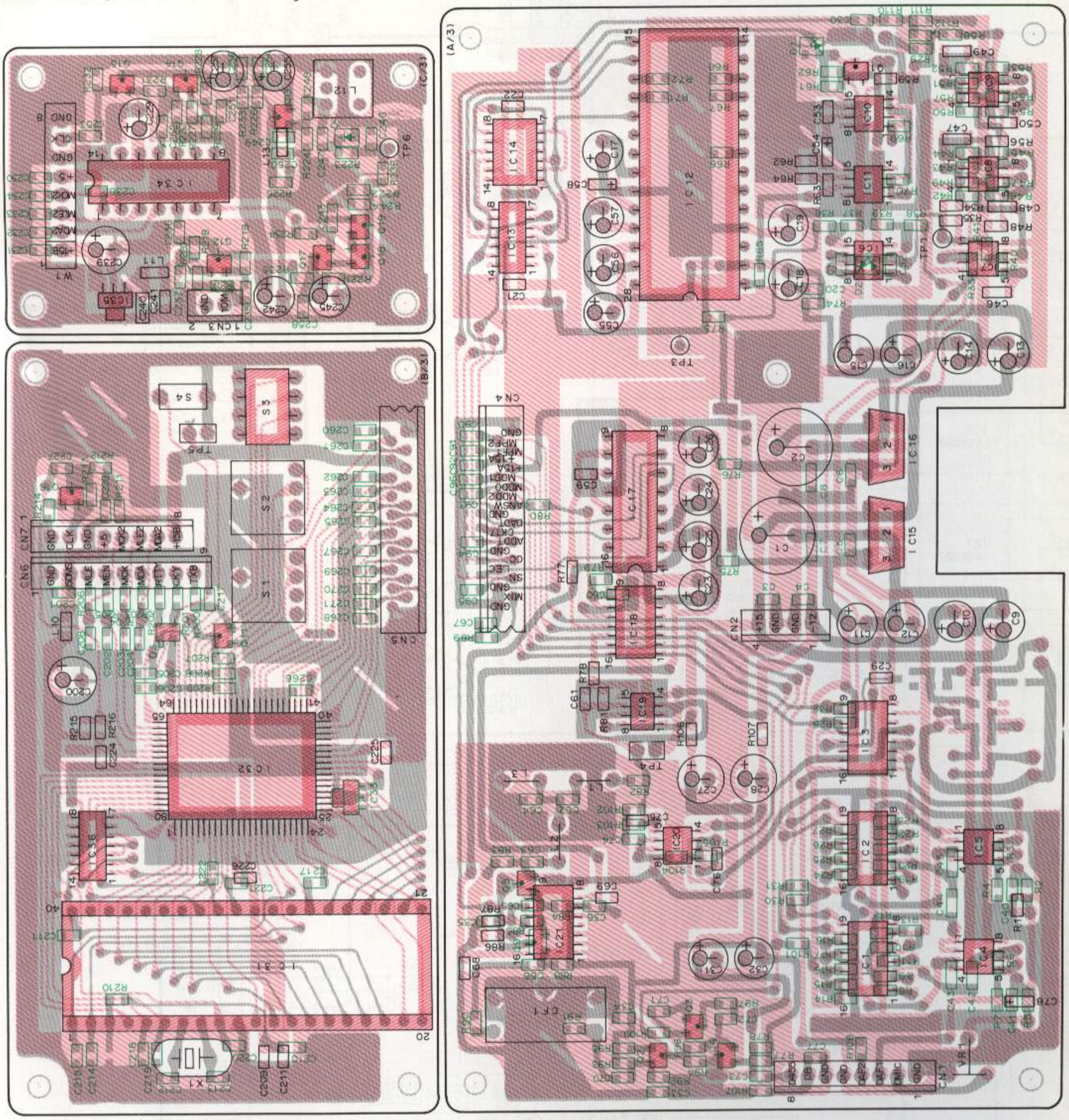


(Y) : Q1, 2
: Q3, 5, 6, 8, 9, 10
(Y) : Q4, 7
: D1, 2
26 : D3~8
55 : D9~12, 101~108
2K : D13

SN74S74N : IC1
TC4066BP : IC2, 3
BA6109U2 : IC4, 5
NJM2903S : IC6, 9, 10
NJM2904S : IC7
NE555C : IC8

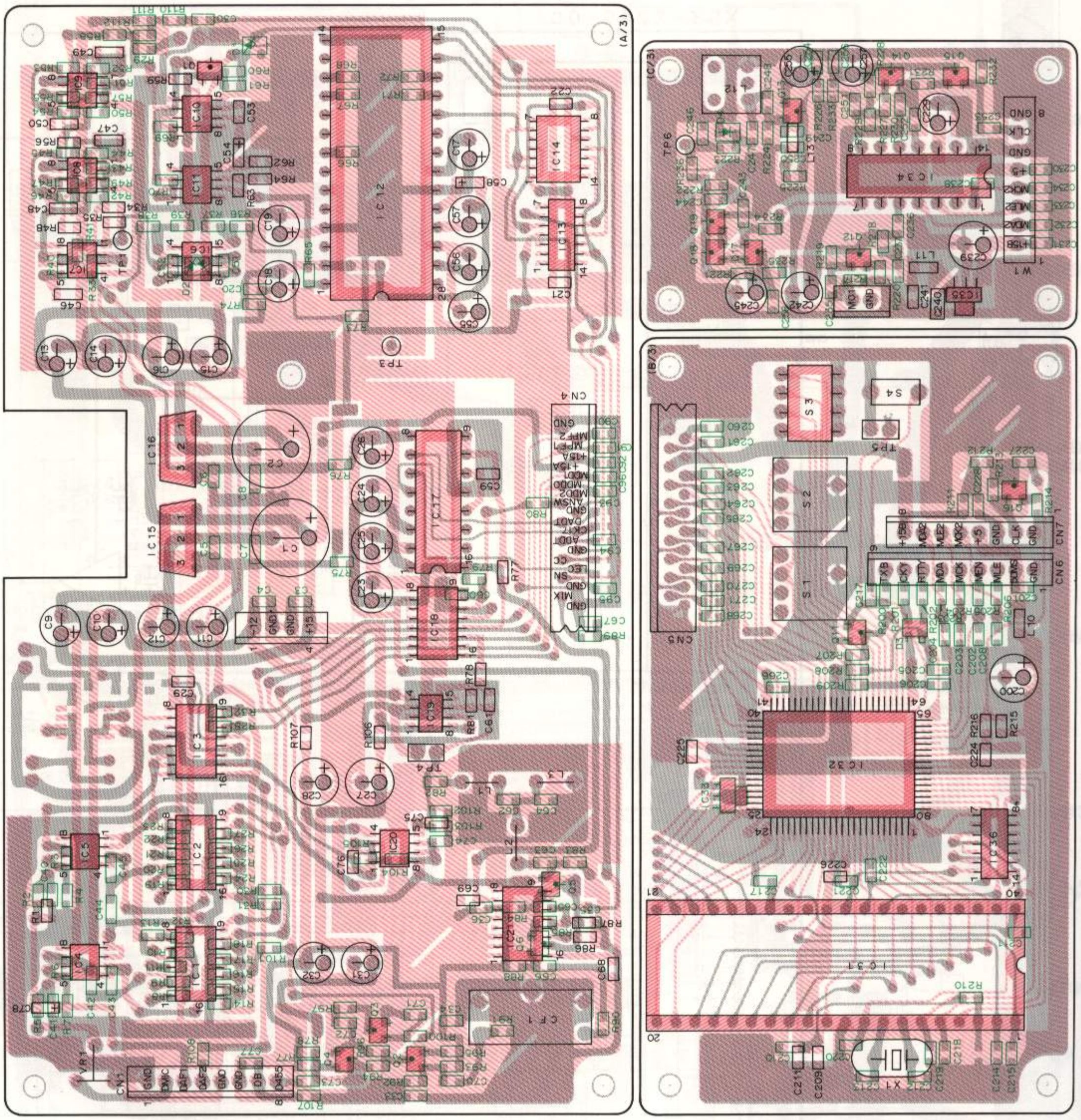
TS-950S/SD PC BOARD VIEWS

DSP UNIT (X53-3260-00) Component side view

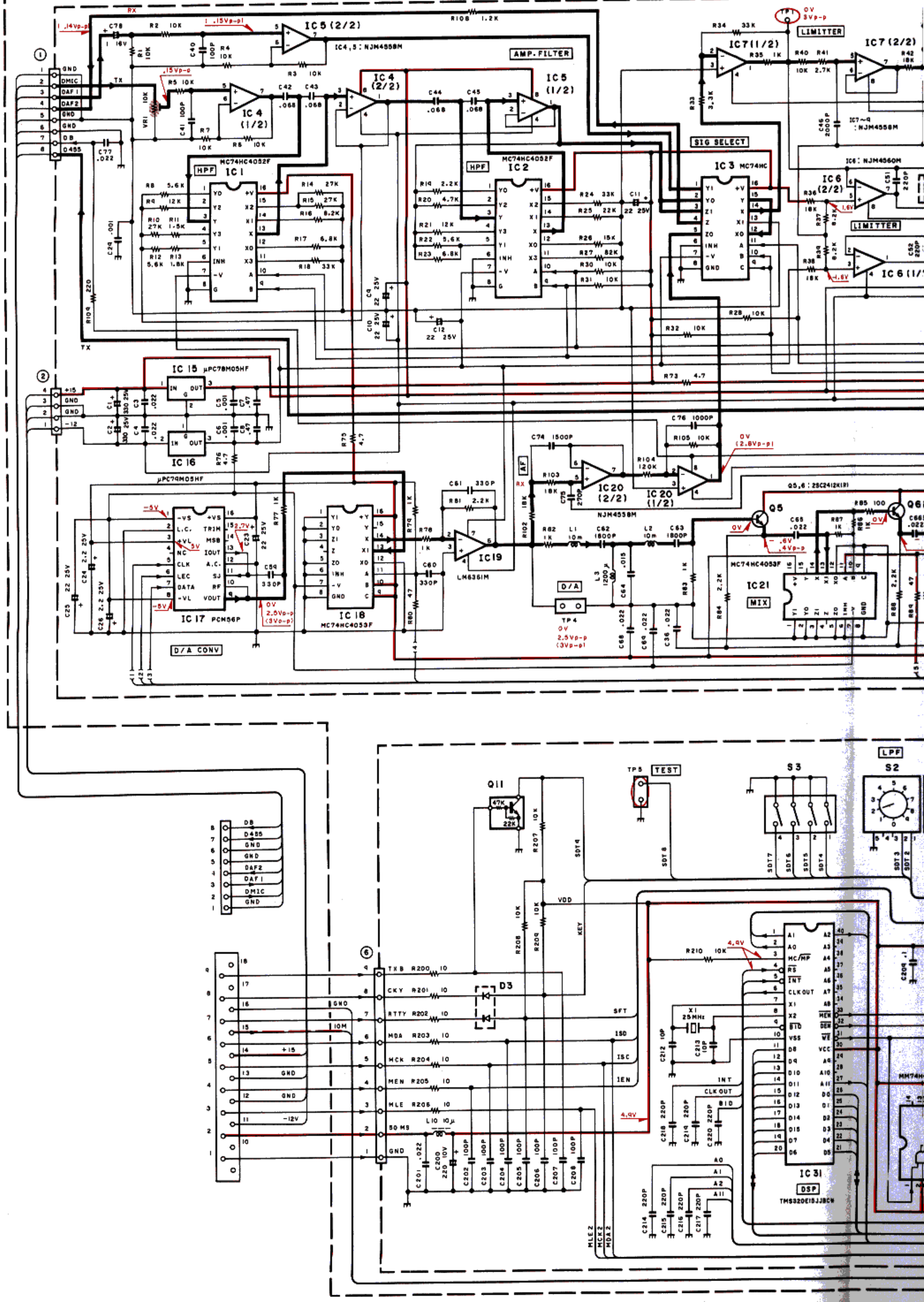


DSP UN

DSP UNIT (X53-3260-00) Foil side view



DSP UNIT (X53-3260-00) : TS-950SD



F G H I J

( ) RX – SSB
DMIC .15Vp
DAF I .15Vp

IC 1, 2
IC 3, 18, 21
IC 4, 5, 7~9, 20
IC 6
IC 10, 11
IC 12
IC 13, 36
IC 14
IC 15
IC 16
IC 17
IC 19
IC 31
IC 32
IC 33
IC 34
IC 35

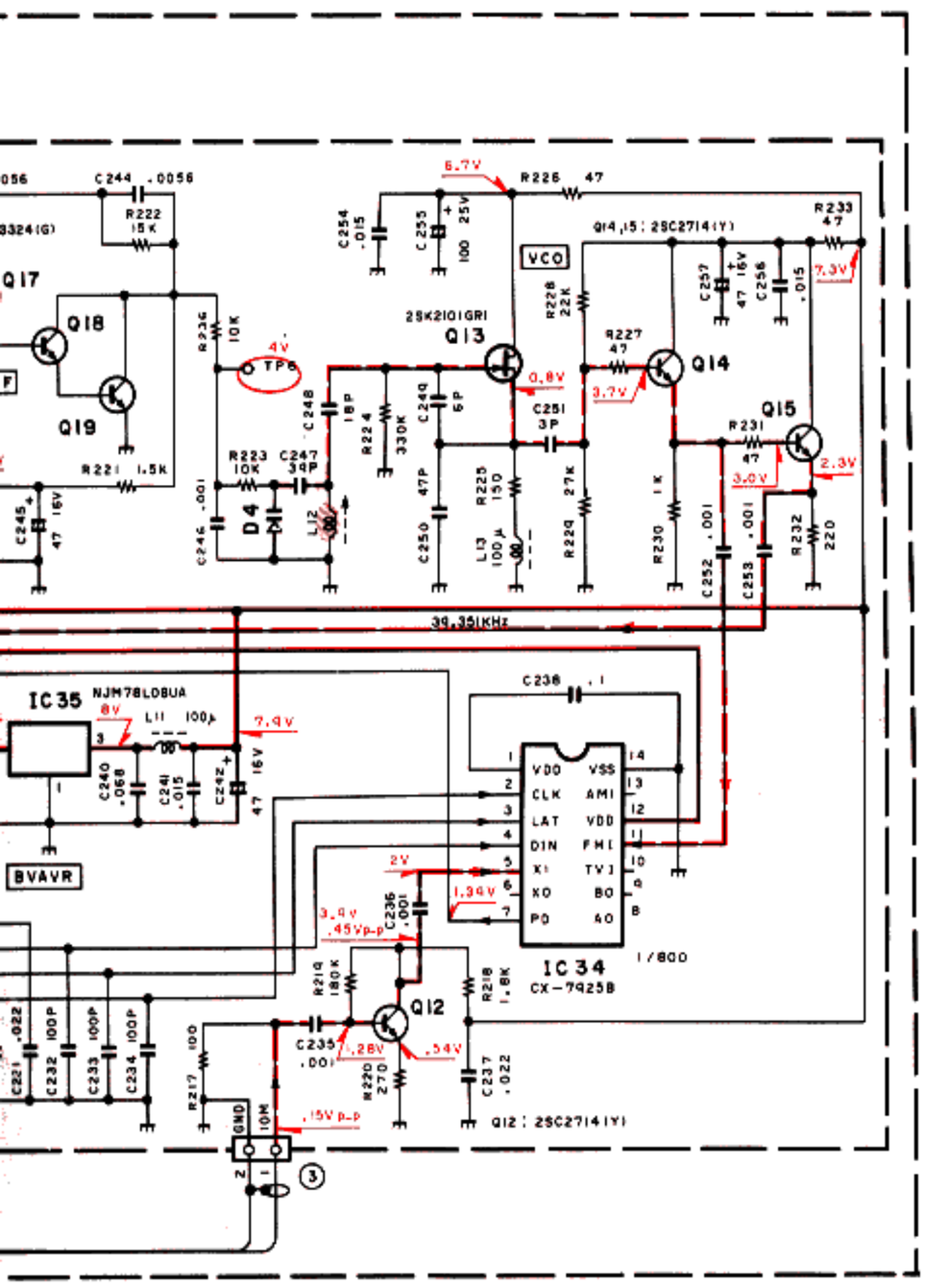
Q 1
Q 2~6
Q 11
Q 12, 14~16
Q 13
Q 17~19

D1
D2
D3
D4

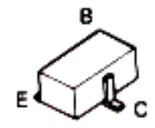
CIRCUIT DIAGRAM TS-950S/SD

( )RX – SSB
DMIC .15Vp-p 1KHz VR1 MAX
DAF1 .15Vp-p 1KHz

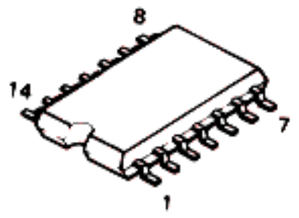
IC1,2	: MC74HC4052F
IC3,18,21	: MC74HC4053F
IC4,5,7~9,20	: NJM4558M
IC6	: NJM4560M
IC10,11	: NJM072BM
IC12	: PCM78AP
IC13,36	: MM74HCT00M
IC14	: TC74HC74F
IC15	: μPC78M05HF
IC16	: μPC79M05HF
IC17	: PCM56P
IC19	: LM6361M
IC31	: TMS320E15JJBC*
IC32	: μPD65012GF-350
IC33	: S-8054ALR-LN
IC34	: CX-7925B
IC35	: NJM78L08UA
Q1	: 2SK508(K53)
Q2~6	: 2SC2412K(R)
Q11	: DTC144WK
Q12,14~16	: 2SC2714(Y)
Q13	: 2SK210(GR)
Q17~19	: 2SC3324(G)
D1	: RD3.9M
D2	: 1SS226
D3	: 1SS272
D4	: 1SV166



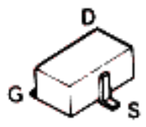
2SC2412K
2SC2714
2SC3324
DTC124WK



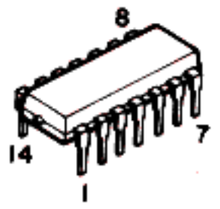
MM74HCT00M



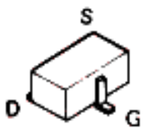
2SK210



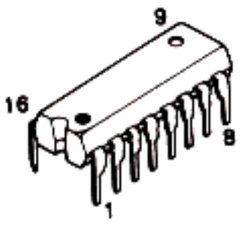
CX-7925B



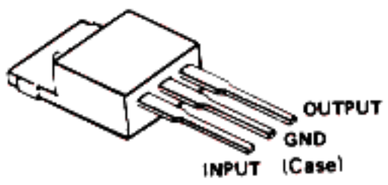
2SK508



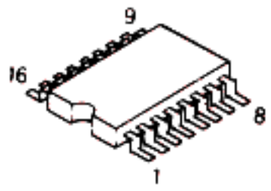
PCM56P



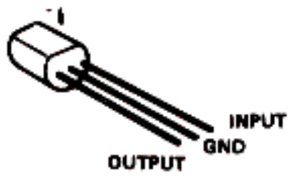
NJM78L08UA
μPC78M05HF
μPC79MO5HF



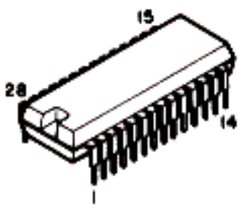
MC74HC4052F
MC74HC4053F
TC74HC74AF



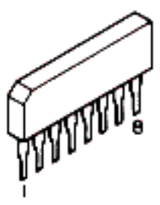
S-8054ALR-LN



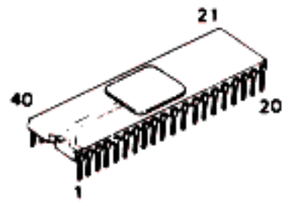
PCM78AP



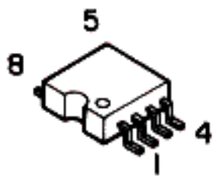
NJM072BM



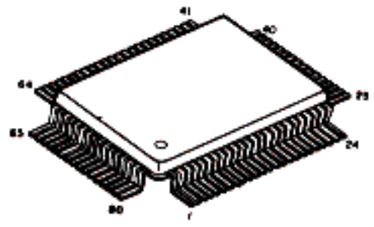
TMS320E15JJBC1



LM6361M
NJM4558M
NJM4560M

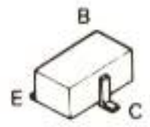


μPD65012GF-350

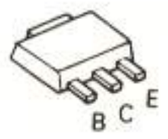


TS-950S/SD PC BOARD VIEWS

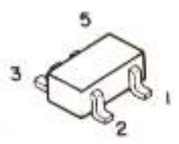
2SA1163



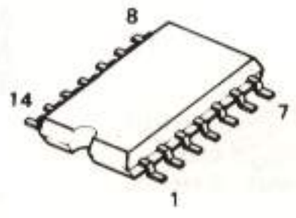
2SA1201



FMG1



TC74HC00AF
TC74HC04AF
TC4011BF



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TC74HC175AF
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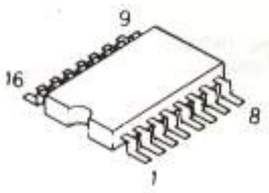
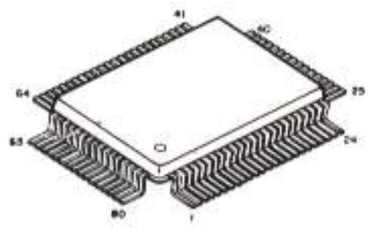
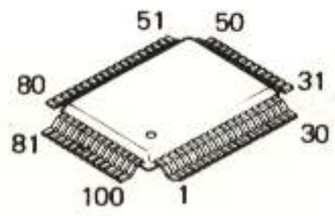


647180X0FS6JBE1



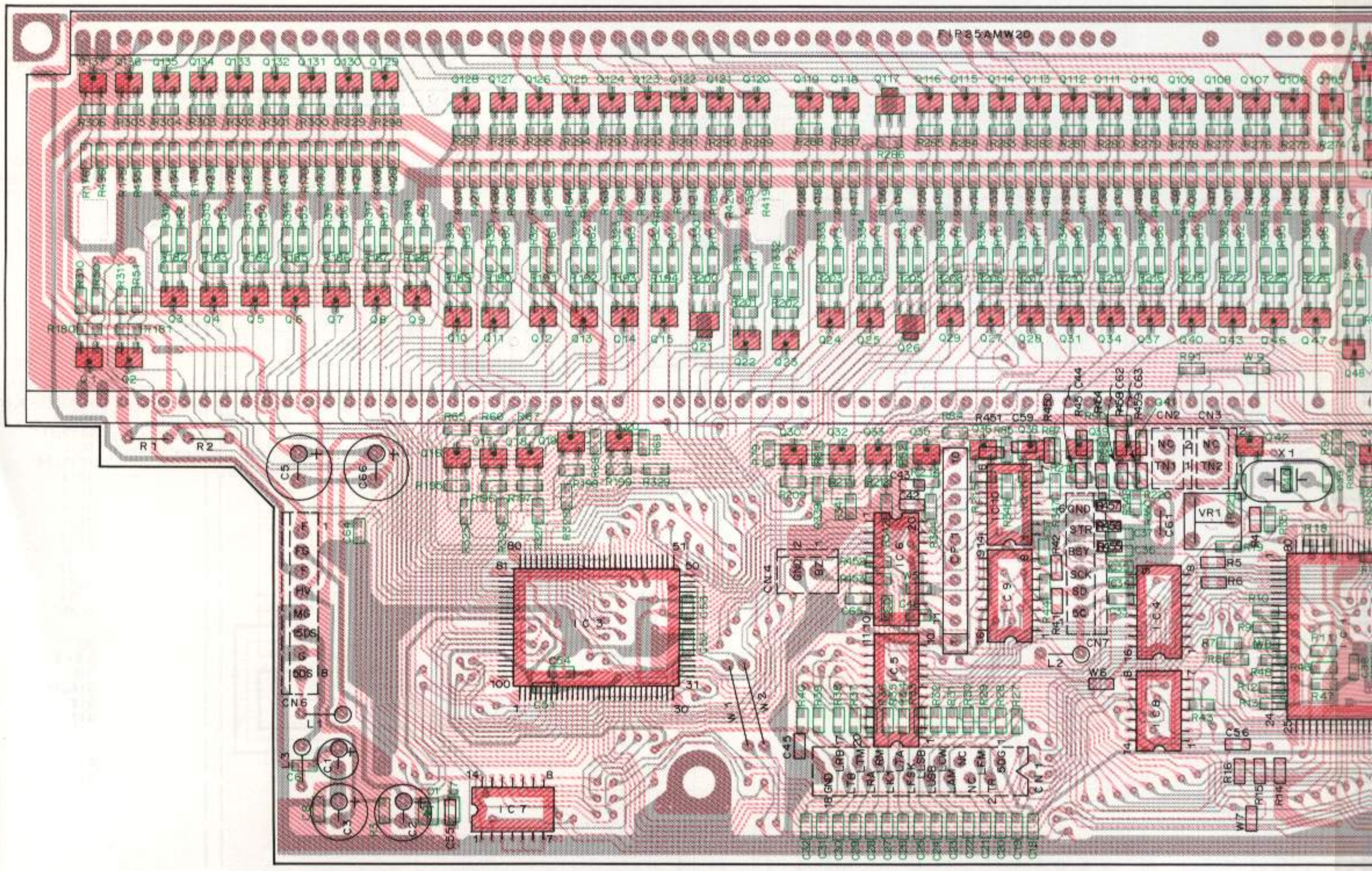
MB622180PF



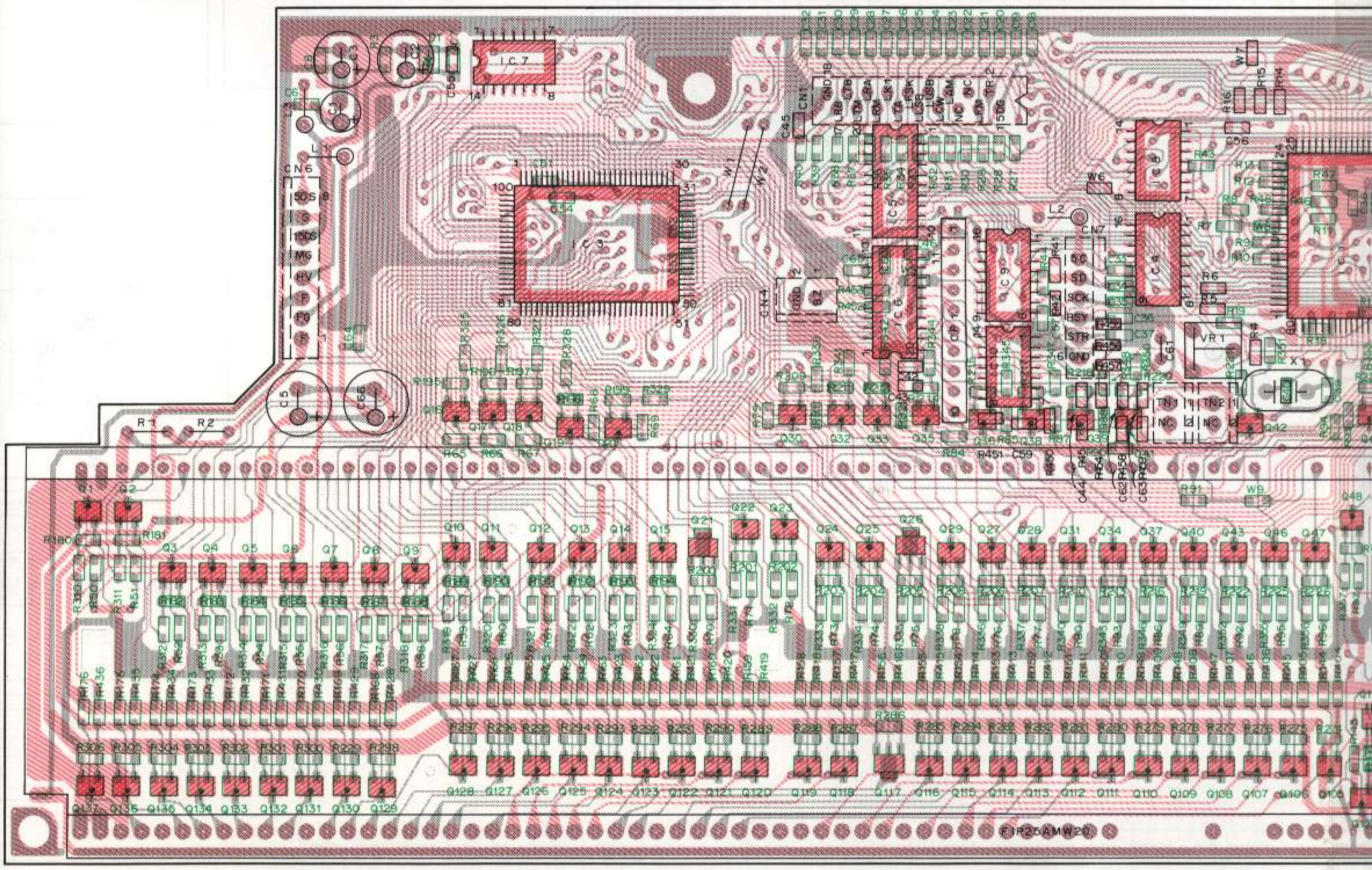
DISPLA

DISPLAY

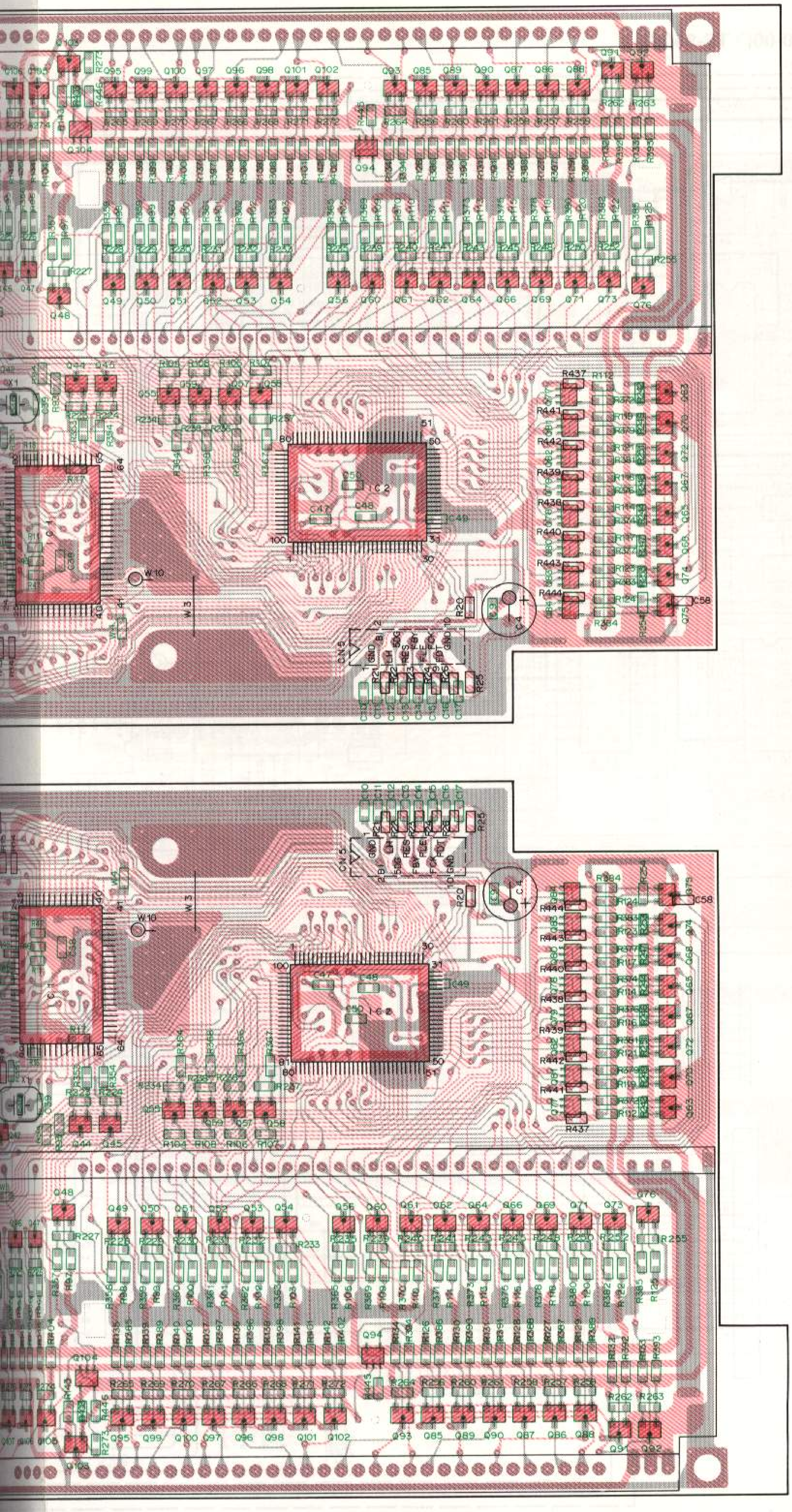
DISPLAY UNIT (X54-3080-00) Component side view



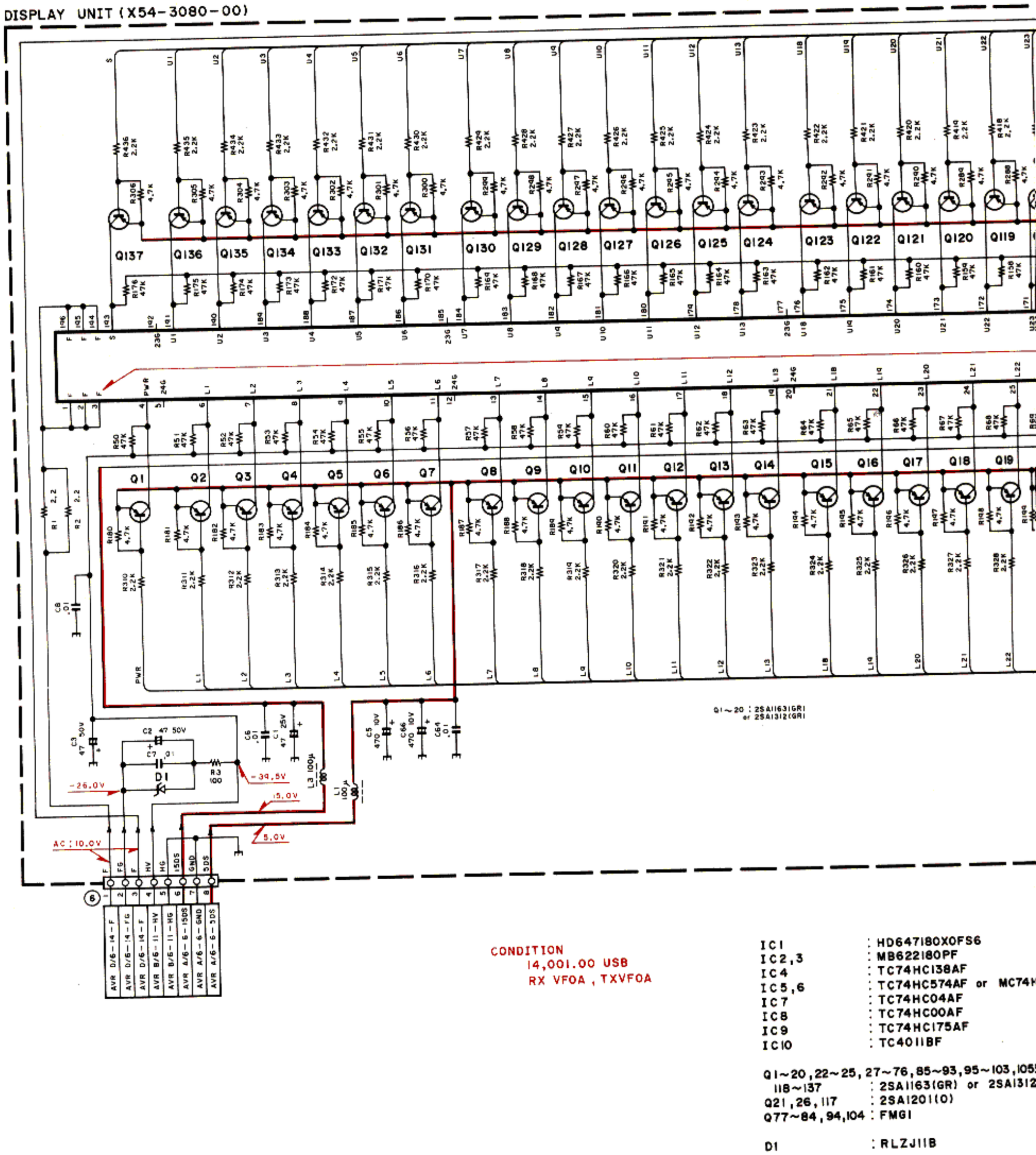
DISPLAY UNIT (X54-3080-00) Foil side view



J K L M N O


IC2
CN5
W10
W3
C4
C58
X1
Q44 Q45 Q55 Q57 Q58 Q59
Q48 Q49 Q50 Q51 Q52 Q53 Q54 Q56 Q60 Q61 Q62 Q64 Q66 Q69 Q71 Q73 Q76
Q95 Q99 Q100 Q97 Q96 Q98 Q101 Q102 Q93 Q85 Q89 Q90 Q87 Q86 Q88 Q91 Q92
Q94 Q104 Q105
Q63 Q70 Q72 Q67 Q65 Q68 Q74 Q75
R437 R441 R442 R439 R438 R440 R443 R444
R104 R108 R106 R107 R234 R237 R227 R233 R255 R262 R263 R273 R446
GND RES FBY FCE FDT FCK 5DS BI
1 2 10 30 31 50 51 64 80 81 100

DISPLAY UNIT (X54-3080-00)



IC1	: HD647180X0FS6
IC2,3	: MB622180PF
IC4	: TC74HC138AF
IC5,6	: TC74HC574AF or MC74H
IC7	: TC74HC04AF
IC8	: TC74HC00AF
IC9	: TC74HC175AF
IC10	: TC4011BF
Q1~20,22~25,27~76,85~93,95~103,105 118~137	: 2SA1163(GR) or 2SA1312
Q21,26,117	: 2SA1201(O)
Q77~84,94,104	: FMGI
D1	: RLZJ11B

F G H I J

Q105 ~ 116, 118 ~ 137 : 2SA1163(GR)
or 2SA1312(GR)
Q117 : 2SA1201(O,Y)

Q120 Q119 Q118 Q117 Q116 Q115 Q114 Q113 Q112 Q111 Q110 Q109 Q108 Q107 Q106 Q105

FL1 FIP25AMW20

AC : 9.7V

Q18 Q19 Q20 Q21 Q22 Q23 Q24 Q25 Q26 Q27 Q28 Q29 Q30 Q31 Q32 Q33 Q34 Q35 Q36 Q37 Q38 Q39 Q40 Q41 Q42 Q43 Q44 Q45

Q21 : 2SA1201(O,Y)

Q22 ~ 25 : 2SA1163(GR)
or 2SA1312(GR)
Q26 : 2SA1201(O,Y)

Q27 ~ 76 : 2SA1163(GR)
or 2SA1312(GR)

① TONE ON
TX : 5V
CH1 : 0V
131μSec

② DIM SW OFF
LH : 5V
CH1 : 0V
BI : 5V
524μSec
CH2 : 0V

DIM SW ON DIM VR LEFT
LH : 5V
CH1 : 0V
BI : 5V
CH2 : 0V
524μSec

DIM SW ON DIM VR RIGHT
524μSec
LH : 5V
CH1 : 0V
BI : 5V
CH2 : 0V

③ IC1 74pin XTAL
5V
CH1 : 0V
40.5nSec

RX : 4.9V
CH1 : 0V

0X0FS6
0PF
38AF
574AF or MC74HC574AF
04AF
00AF
75AF
F
~93,95~103,105~116
GR) or 2SA1312(GR)
O)

IC3
M66221B0PF
GATE ARRAY

IC7 : TC74HC04AF

IC7(1/7) IC7(2/7) IC7(3/7) IC7(4/7) IC7(5/7) IC7(6/7)

IC10 TC4011BF
IC8 TC74HC00AF
IC7 TC74HC04AF

4.9V

LH
BI

CK1 NCL1 DOUT P44 P45 P46 P47 P50 P51 VSS P52 P53 P54 P55 P56 P57 P60 P61 P62 P63

P17 P16 P15 P14 P13 P12 P11 P10 P07 P06 VSS P05 P04 P03 P02 P01 P00

FLE FBY RES RD WR MREQ Y2 Y3 Y0 Y6

K L M N O

Q85~93, Q95~103 : 2SA1163(GR) or 2SA1312(GR)
Q94, 104 : FMG1

Q104 Q103 Q102 Q101 Q100 Q99 Q98 Q97 Q96 Q95 Q94 Q93 Q92 Q91 Q90 Q89

FIP 25 AMW 20

Q44 Q45 Q46 Q47 Q48 Q49 Q50 Q51 Q52 Q53 Q54 Q55 Q56 Q57 Q58 Q59 Q60 Q61 Q62 Q63 Q64 Q65 Q66 Q67 Q68 Q69 Q70 Q71

Q77 Q78 Q79 Q80 Q81

IC10 : TC4011BF

IC10(4/4) IC10(3/4)

BZ OSC

IC9 TC74HC175AF

LATCH

IC5 TC74HC574AF or MC74HC574AF

LTM LTA LTB LKI LRM LRA LRB

LATCH

IC6 TC74HC574AF or MC74HC574AF

R40~R48 : 10K CP1

TONE ON : 4.9V
TX ON : 4.9V

IC4 TC74HC138AF

CHIP SELECT

IC8(2/4) IC8(1/4) TC74HC00AF

IC8 : TC74HC00AF

IC8(4/4) IC8(3/4)

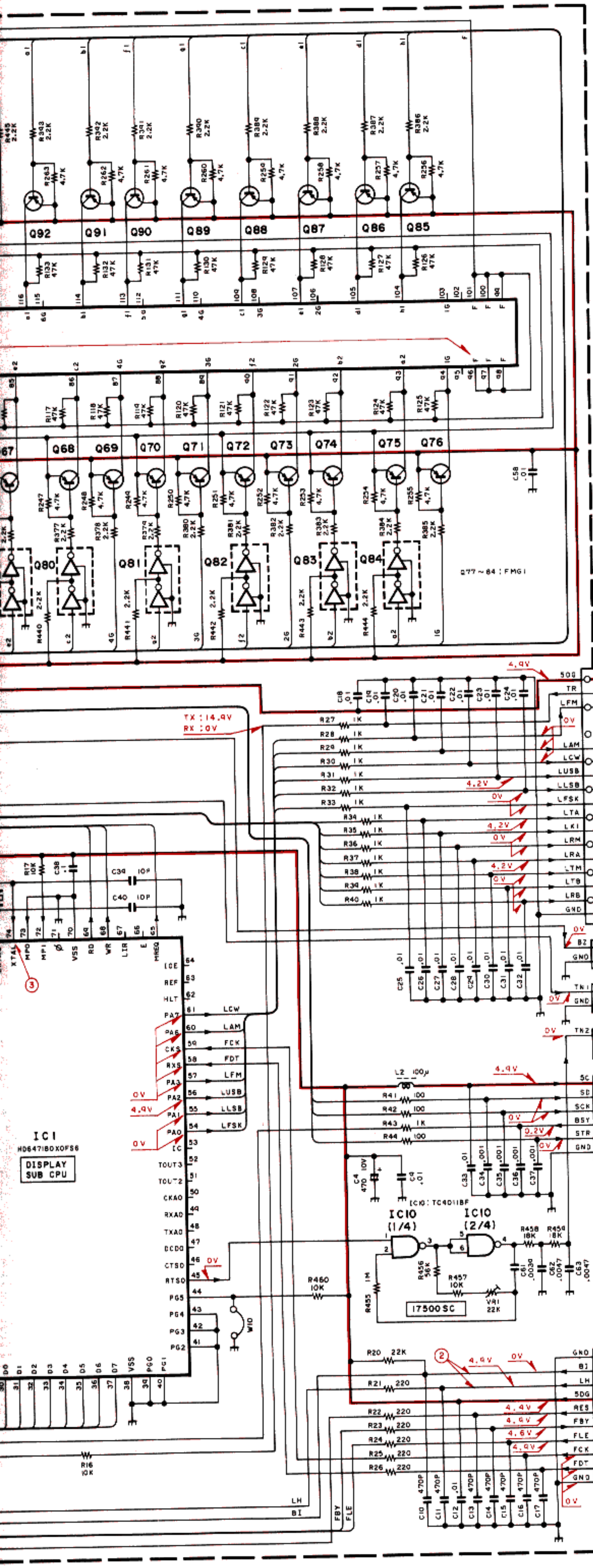
IC2
MB622180PF
GATE ARRAY

IC1
HD647180X0FS6
DISPLAY SUB CPU

TX : 14
RX : 0V

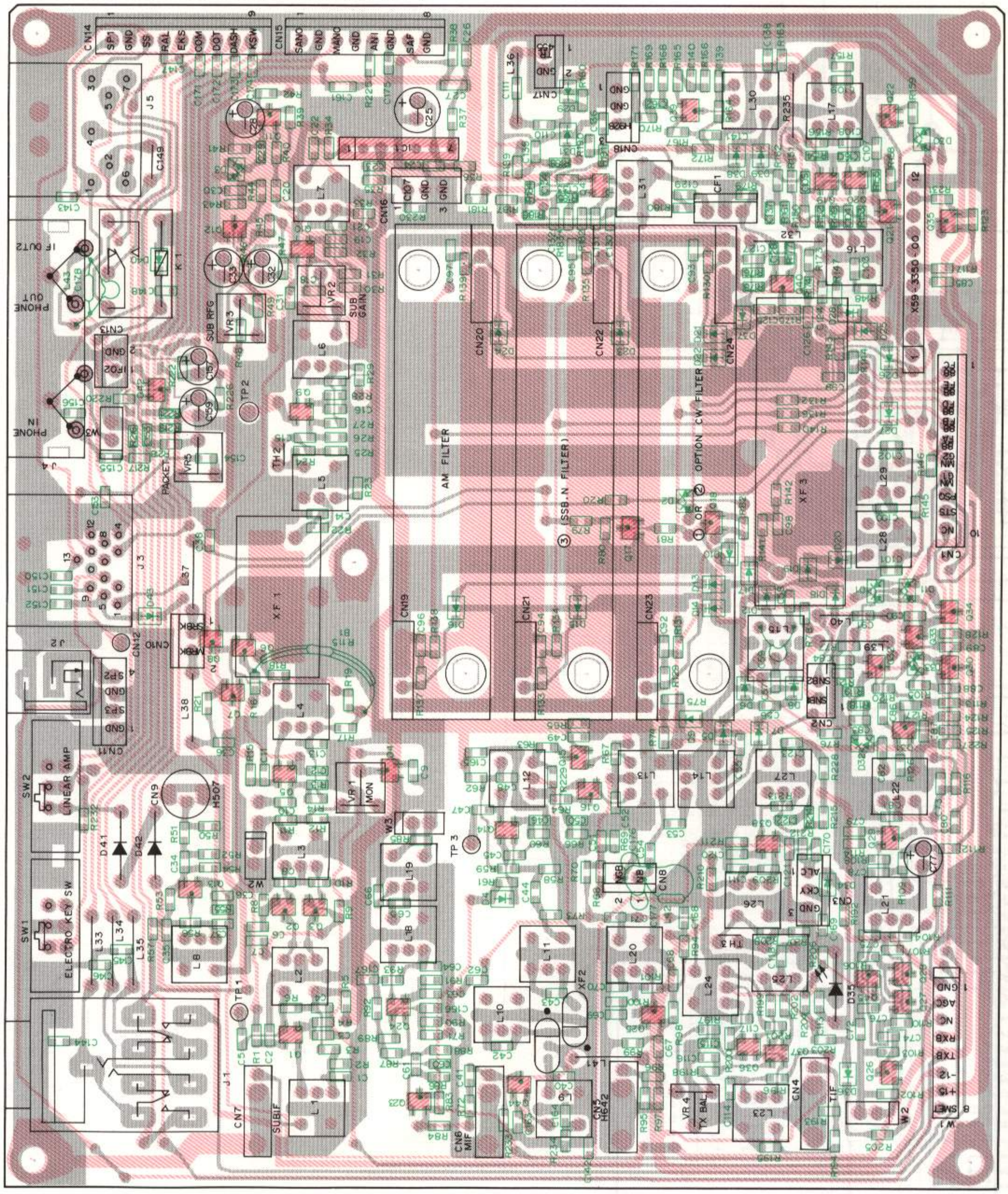
LH
RES

CIRCUIT DIAGRAM TS-950S/SD



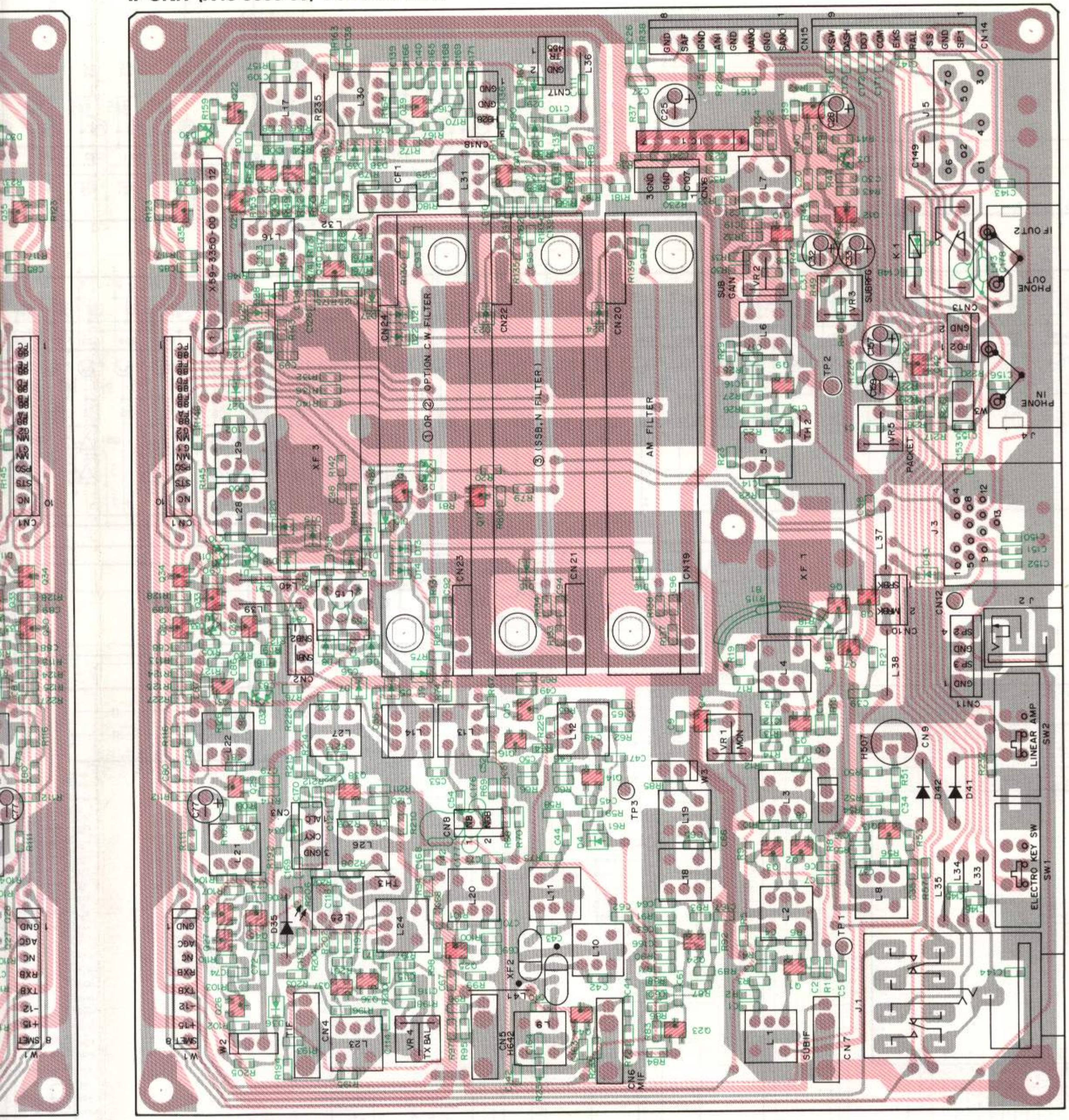
TS-950S/SD PC BOARD VIEWS

IF UNIT (X48-3060-00) Component side view

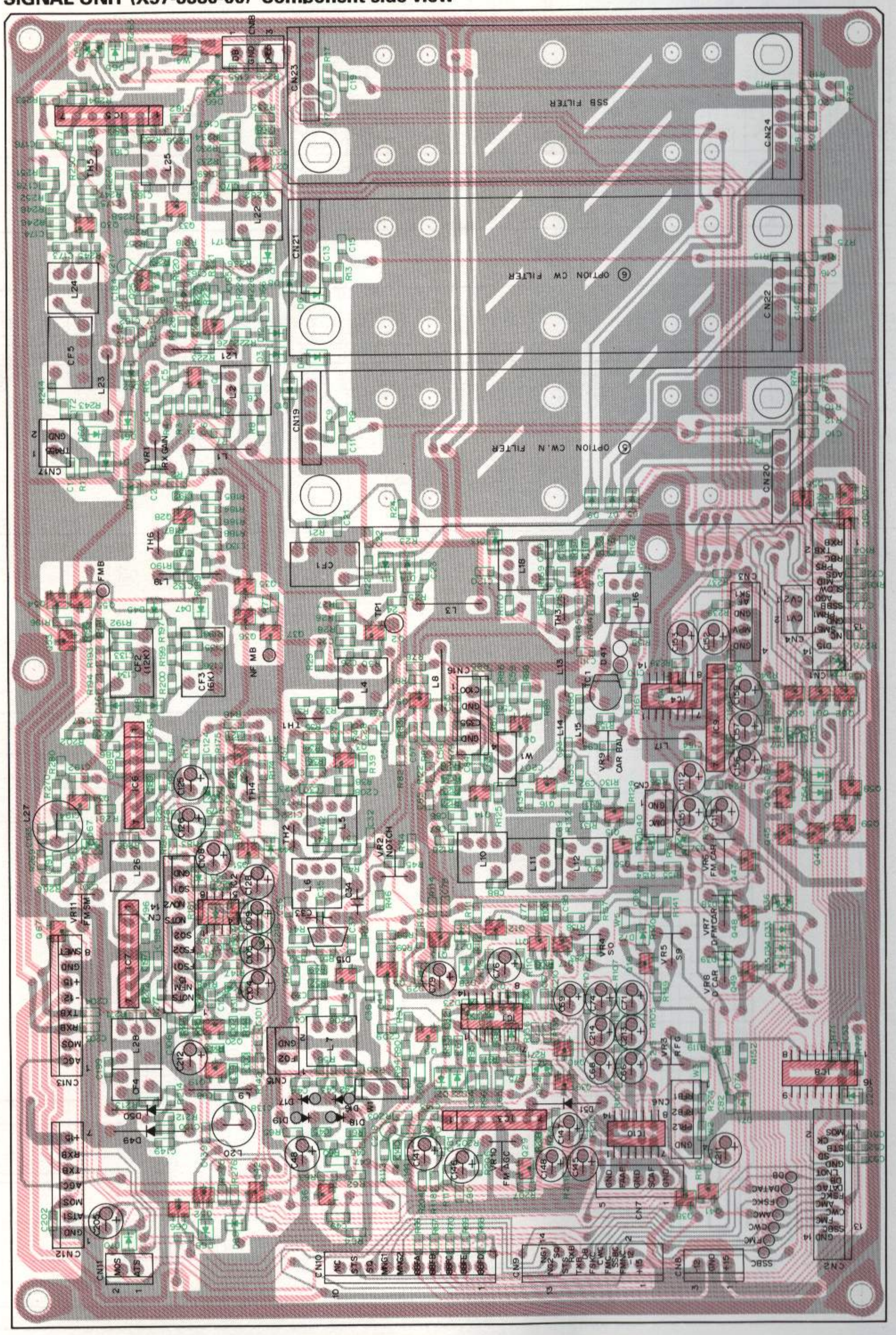


IF UNIT

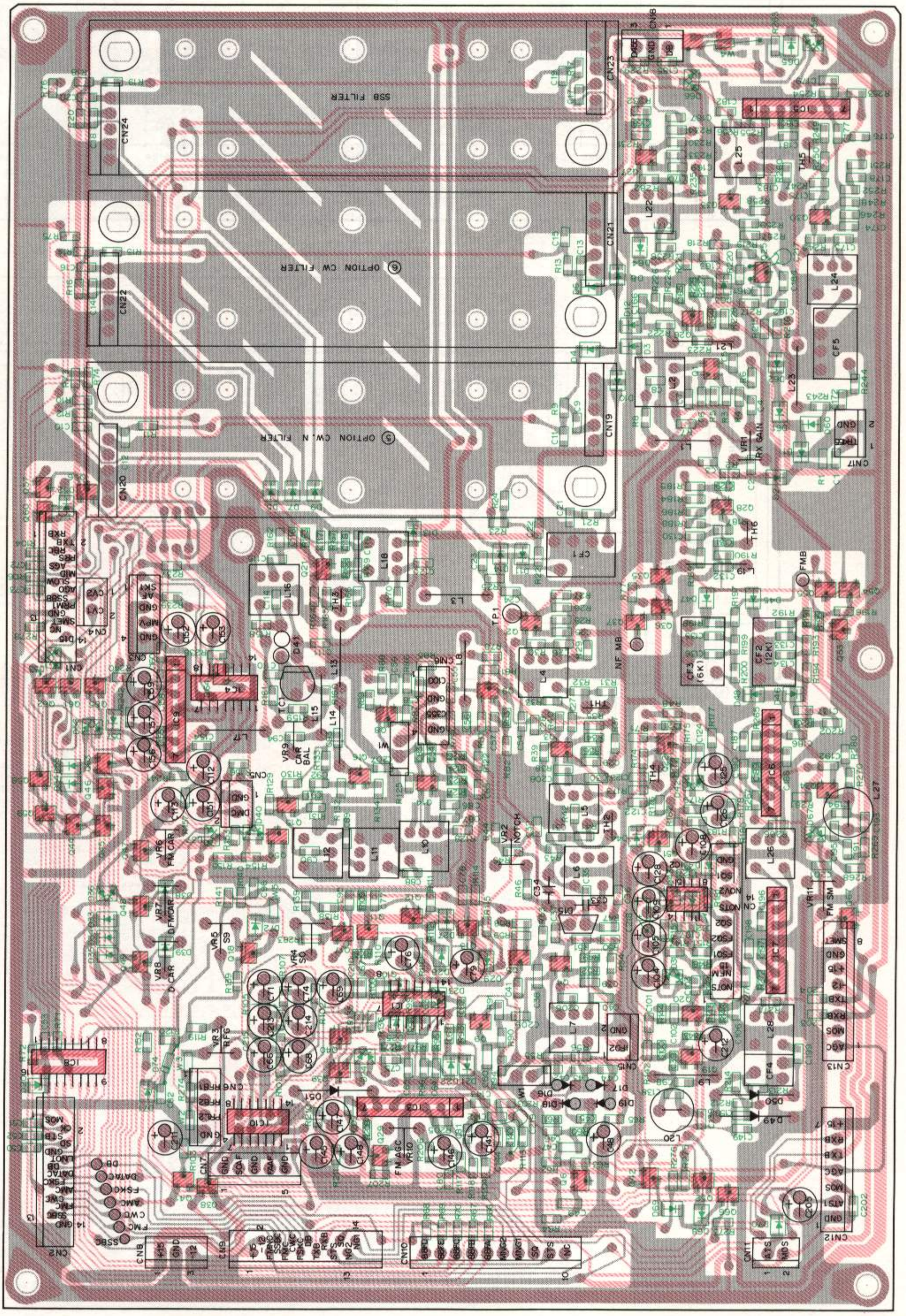
IF UNIT (X48-3060-00) Foil side view



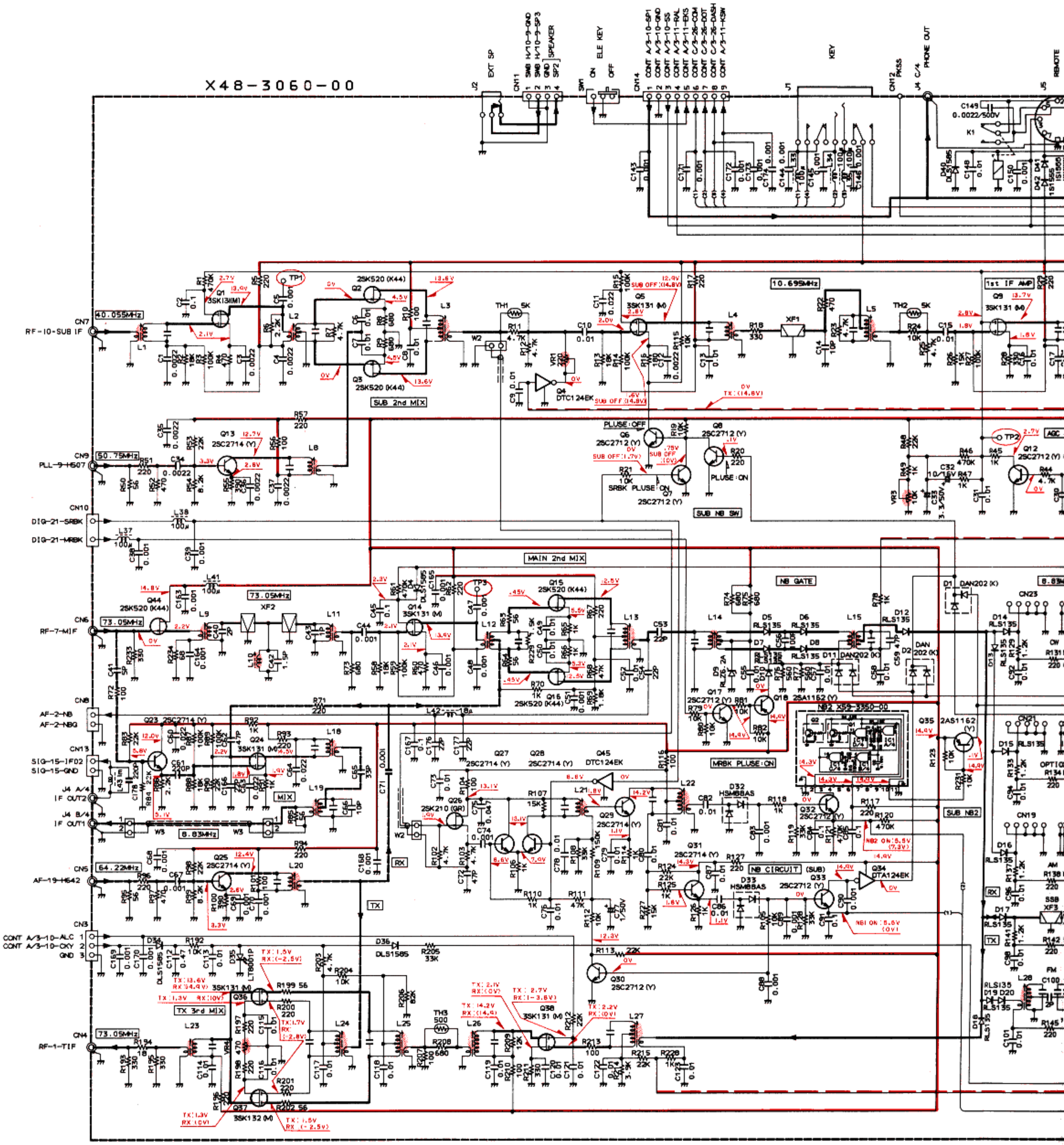
SIGNAL UNIT (X57-3380-00) Component side view



SIGNAL UNIT (X57-3380-00) Foil side view



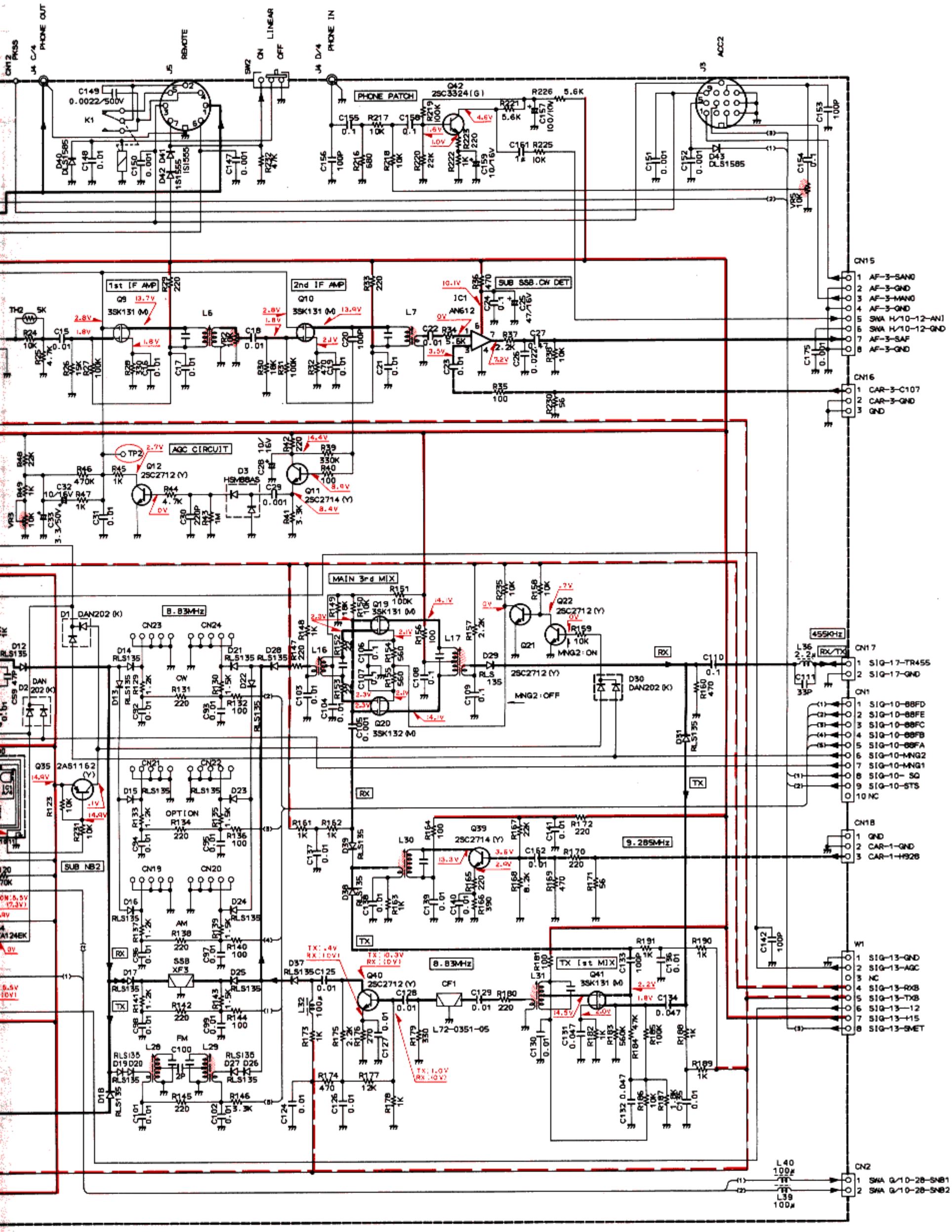
IF UNIT (X48-3060-00)

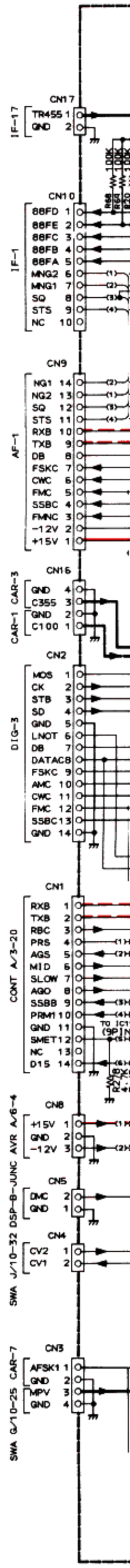


D1, 2, 11, 30	: DAN202 (K)	IC1	: AN612	Q1, 13, 23, 25, 27, 28	
D3, 32, 33	: HSM88AS	Q1, 5, 9, 10, 14, 19, 20		29, 31, 39	
D4, 34, 36, 40, 43	: DLS1585	24, 36, 37, 38, 41	: 3SK131 (M)	Q18, 35	
D5~8, 10	: RLS135	Q2, 3, 15, 16, 44	: 2SK520 (K44)	Q26	
12~29, 31, 37~39		Q4, 45	: DTC124EK	Q34	
D9	: RLZ6.2A	Q6, 7, 8, 12, 17, 21, 22		Q42	
D35	: LT8001P	30, 32, 33, 40	: 2SC2712 (Y)		
D41, 42	: 1S1555	Q42	: 2SC3324(G)		

F G H I J

SIGNAL UN





AN612
3SK131 (M)
2SK520 (K44)
DTC124EK

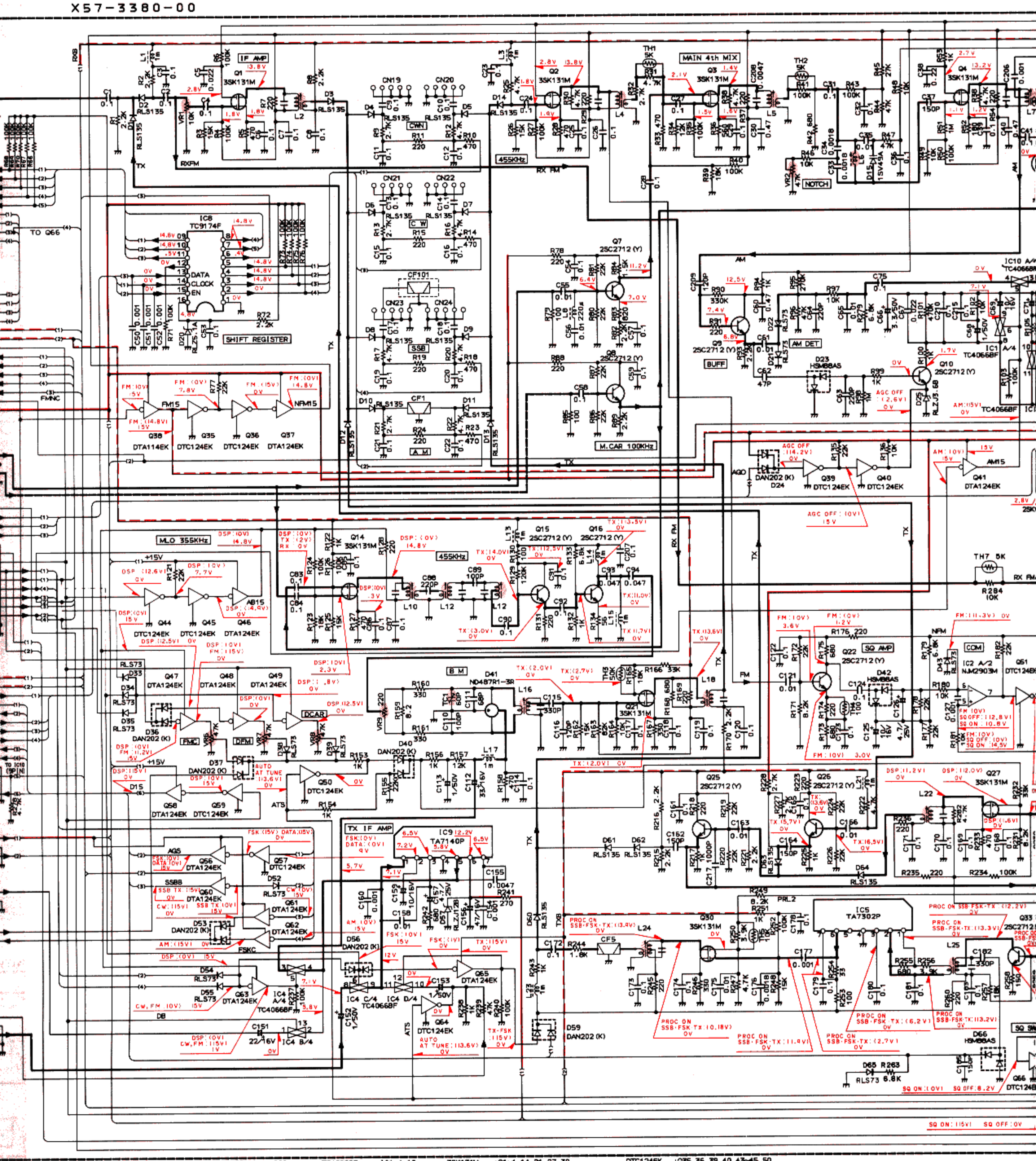
2SC2712 (Y)
2SC3324(G)

Q11, 13, 23, 25, 27, 28, 29, 31, 39 : 2SC2714 (Y)
Q18, 35 : 2SA1162 (Y)
Q26 : 2SK210 (GR)
Q34 : DTA124EK
Q42 : 2SC3324(G)

X59-3350-00(NB2)
IC1 : TC4011BF
Q1,2 : DTC114EK

UNIT (X57-3380-00)

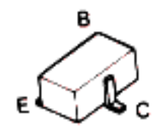
X57-3380-00



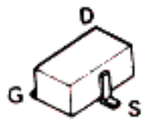
RLS135	D1~14, 45~48, 60~64	RLZ5.1A	D20	TC40668F	IC1, 4, 10	3SK131M	Q1~4, 14, 21, 27, 30	DTC124EK	Q35, 36, 39, 40, 43~45, 50
RLS73	D21, 22, 27~30, 32~35, 38, 39, 43	RLZJ3.6B	D25	µPC1158H2	IC3	2SK210 (Y)	Q11		Q51, 53, 54, 57, 59, 64, 66, 67
	D44, 52, 54, 58, 65, 68~70, 72, 74	RLZJ5.1C	D71	TA7302P	IC5	2SK210 (GR)	Q17	DTA114EK	Q38
HSM88AS	D23, 42, 66, 67, 31	RLZJ12B	D57	µPC577H	IC6, 7	2SC2712 (Y)	Q5~10, 12, 15, 16, 19, 20	DTA124EK	Q37, 41, 42, 46~49, 52, 55
DAN202 (K)	D24, 36, 37, 40, 53, 56, 59	ND487R1-3R	D41	TC9174F	IC8		Q22, 25, 26, 28, 29, 32~34		Q56, 58, 60~63, 65
1N60	D15~19, 49~51			TA7140P	IC9	2SA1162 (Y)	Q13, 18		
1SV49A	D15			NJM2903M	IC2				

CIRCUIT DIAGRAMS TS-95

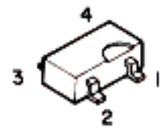
2SA1162
2SC2712
2SC2714
2SC3324
DTA114EK
DTA124EK
DTA124EK
DTA124EK
DTC124EK



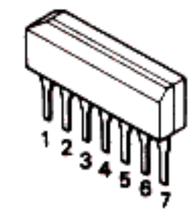
2SK210



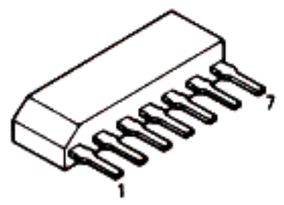
3SK131



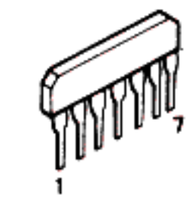
TA7140P
TA7302P
µPC1158H2



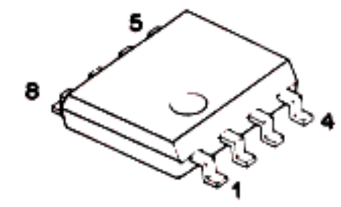
AN612



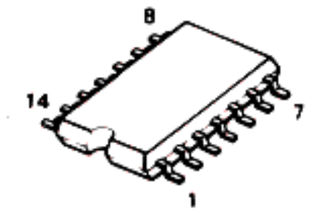
µPC577H



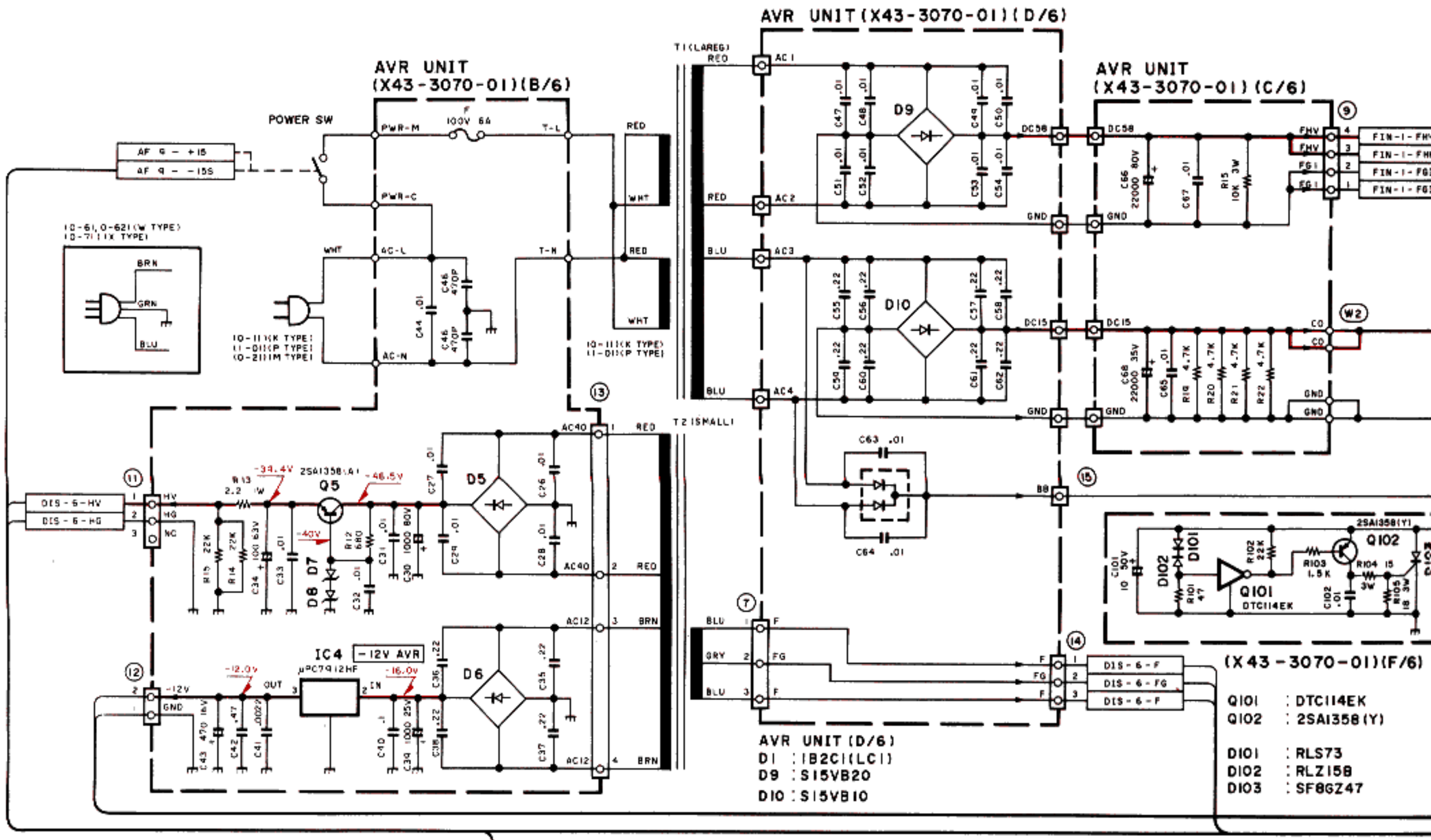
NJM2903M



TC4066BF



TS-950S/SD SCHEMATIC DIAGRAM



AVR UNIT (X43-3070-01) (A/6)

AVR UNIT (A/6)
IC1~3 : μPC7805H
Q1 : 2SB941
Q2 : 2SC3907
Q3 : 2SD1624S
Q4 : 2SC2712(Y)
D2 : RLS73
D3 : RLZ7.5B
D4 : UZP6.2B

(X43-)(E/6)

DISPLAY UNIT
(X54-3080-00)

VS-2 UNI

DIGITAL UNIT
(X46-3050-XX)

MIC AMP (X59-3710-00)

Q251 : 2SC3324(G)
Q252, 253 : DTA114EK
Q254 : DTC114TK
Q255 : DTC114EK
D251 : DAN202(K)

SW UNIT (A) (H/10)
Q17 : 2SC3324(G)

MIC AMP
Q251 : 2SC3324(G)
Q252, 253 : DTA114EK
Q254 : DTC114TK
Q255 : DTC114EK
D251 : DAN202(K)

SW UNIT (B)
(X41-3090-00) (K/10)

SW UNIT (B)
(X41-3090-00) (E/10)

SW UNIT (B)
(X41-3090-00) (F/10)

SW UNIT (B)
(X41-3090-00) (J/10)

L M N O P

AT UNIT(A/2)
(X53-3240-00)

AT UNIT(B/2)
(X53-3240-00)

SW UNIT(A)(X41-3080-00)(A/10)

SW UNIT(A)(A/10)
Q1~15 : DTC143EK
D1~7,12,14 : RLS73
D8,9 : LN0130IC(Q)
D10 : LN0140IC
D11 : LN0120IC

SW UNIT(B)
(X41-3090-00)(B/10)

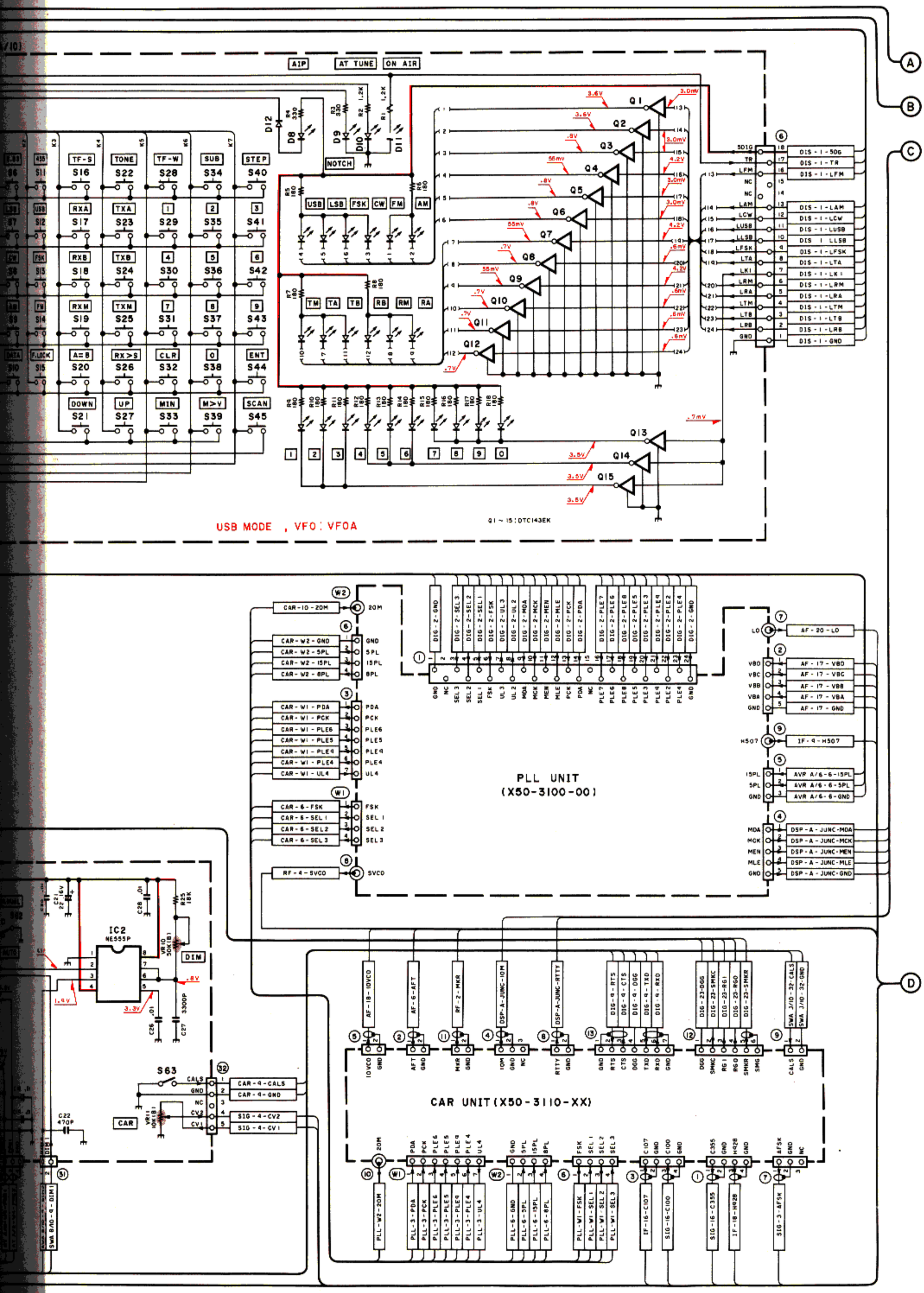
SW UNIT(A)
(X41-3080-00)(G/10)

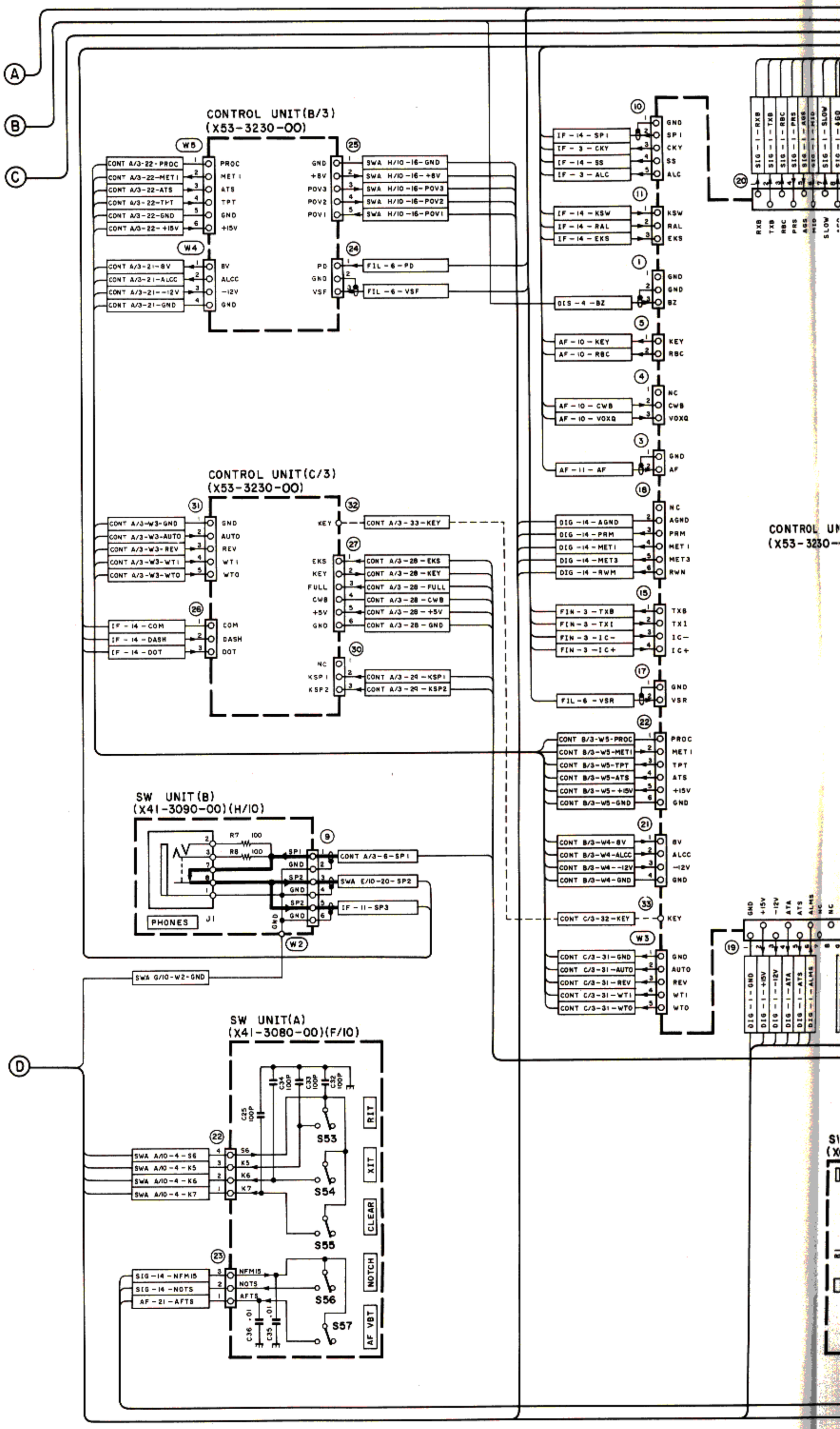
SW UNIT(A)(X41-3080-00)(J/10)

VR8,9
: CENTER (12 o'clock)

SW UNIT(A)(J/10)
IC1 : TC4066BP
IC2 : NE555P
Q16 : DTC143TK

SW UNIT(A)(X41-3080-00)(K/10)


AIP
AT TUNE
ON AIR
NOTCH
USB
LSB
FSK
CW
FM
AM
TM
TA
TB
RB
RM
RA
TF-S
TONE
TF-W
SUB
STEP
RXA
TXA
RXB
TXB
RXM
TXM
A=B
RX>S
CLR
ENT
DOWN
UP
MIN
M>V
SCAN
Q1 ~ 15 : DTC143EK
USB MODE , VFO : VFOA
PLL UNIT
(X50-3100-00)
CAR UNIT (X50-3110-XX)
IC2
NE555P
DIM
CAR
S63
SWA 8/10-9-DIM1
SWA 8/10-9-CALS
SWA 8/10-9-GND
CAR-9-CALS
CAR-9-GND
SIG-9-CV2
SIG-9-CV1
DIS-1-5DG
DIS-1-TR
DIS-1-LFM
DIS-1-LAM
DIS-1-LCW
DIS-1-LUSB
DIS-1-LLSB
DIS-1-LFSK
DIS-1-LTA
DIS-1-LKI
DIS-1-LRM
DIS-1-LRA
DIS-1-LTM
DIS-1-LTB
DIS-1-LRB
DIS-1-GND
AF-20-LO
AF-17-V80
AF-17-V8C
AF-17-V8B
AF-17-V8A
AF-17-GND
IF-9-H507
AVR A/6-6-15PL
AVR A/6-6-5PL
AVR A/6-6-GND
DSP-A-JUNC-MDA
DSP-A-JUNC-MCK
DSP-A-JUNC-MEN
DSP-A-JUNC-MLE
DSP-A-JUNC-GND
CAR-10-20M
CAR-W2-GND
CAR-W2-5PL
CAR-W2-15PL
CAR-W2-8PL
CAR-W1-PDA
CAR-W1-PCK
CAR-W1-PLE6
CAR-W1-PLE5
CAR-W1-PLE9
CAR-W1-PLE4
CAR-W1-UL4
CAR-6-FSK
CAR-6-SEL1
CAR-6-SEL2
CAR-6-SEL3
RF-4-SVCO
PLL-W2-20M
PLL-3-PDA
PLL-3-PCK
PLL-3-PLE6
PLL-3-PLE5
PLL-3-PLE9
PLL-3-PLE4
PLL-3-UL4
PLL-6-GND
PLL-6-5PL
PLL-6-15PL
PLL-6-8PL
PLL-W1-FSK
PLL-W1-SEL1
PLL-W1-SEL2
PLL-W1-SEL3
IF-16-C107
SIG-16-C100
SIG-16-C355
IF-18-H928
SIG-3-AFSK
AF-18-10VCO
AF-6-AFT
RF-2-MKR
DSP-A-JUNC-10M
DSP-A-JUNC-RTTY
DIG-9-RTS
DIG-9-CTS
DIG-9-DGG
DIG-9-TXD
DIG-9-RXD
DIG-23-DGG
DIG-23-SMKC
DIG-23-RGI
DIG-23-RGO
DIG-23-SMKR
SWA J/10-32-CALS
SWA J/10-32-GND
DIG-2-GND
DIG-2-SEL3
DIG-2-SEL2
DIG-2-SEL1
DIG-2-FSK
DIG-2-UL3
DIG-2-UL2
DIG-2-MDA
DIG-2-MCK
DIG-2-MEN
DIG-2-MLE
DIG-2-PCK
DIG-2-PDA
DIG-2-PLE7
DIG-2-PLE6
DIG-2-PLE8
DIG-2-PLE5
DIG-2-PLE3
DIG-2-PLE9
DIG-2-PLE2
DIG-2-PLE4
DIG-2-GND


A
B
C
D
CONTROL UNIT(B/3)
(X53-3230-00)
W5
CONT A/3-22-PROC
CONT A/3-22-MET1
CONT A/3-22-ATS
CONT A/3-22-TPT
CONT A/3-22-GND
CONT A/3-22-+15V
PROC
MET 1
ATS
TPT
GND
+15V
W4
CONT A/3-21-8V
CONT A/3-21-ALCC
CONT A/3-21-−12V
CONT A/3-21-GND
8V
ALCC
−12V
GND
25
GND
+8V
POV3
POV2
POV1
SWA H/10-16-GND
SWA H/10-16-+8V
SWA H/10-16-POV3
SWA H/10-16-POV2
SWA H/10-16-POV1
24
PD
GND
VSF
FIL-6-PD
FIL-6-VSF
CONTROL UNIT(C/3)
(X53-3230-00)
31
CONT A/3-W3-GND
CONT A/3-W3-AUTO
CONT A/3-W3-REV
CONT A/3-W3-WT1
CONT A/3-W3-WTO
GND
AUTO
REV
WT1
WTO
26
IF-14-COM
IF-14-DASH
IF-14-DOT
COM
DASH
DOT
32
KEY
CONT A/3-33-KEY
27
EKS
KEY
FULL
CWB
+5V
GND
CONT A/3-28-EKS
CONT A/3-28-KEY
CONT A/3-28-FULL
CONT A/3-28-CWB
CONT A/3-28-+5V
CONT A/3-28-GND
30
NC
KSP1
KSP2
CONT A/3-24-KSP1
CONT A/3-24-KSP2
SW UNIT(B)
(X41-3090-00)(H/10)
R7 100
R8 100
PHONES
J1
9
SP1
GND
SP2
GND
SP2
GND
CONT A/3-6-SP1
SWA E/10-20-SP2
IF-11-SP3
W2
SWA G/10-W2-GND
SW UNIT(A)
(X41-3080-00)(F/10)
C34 100P
C33 100P
C32 100P
C25 100P
22
SWA A/10-4-S6
SWA A/10-4-K5
SWA A/10-4-K6
SWA A/10-4-K7
S6
K5
K6
K7
S53
S54
S55
RIT
XIT
CLEAR
23
SIG-14-NFM15
SIG-14-NOTS
AF-21-AFTS
NFM15
NOTS
AFTS
S56
S57
NOTCH
AF VBT
C36 .01
C35 .01
10
IF-14-SP1
IF-3-CKY
IF-14-SS
IF-3-ALC
GND
SP1
CKY
SS
ALC
11
IF-14-KSW
IF-14-RAL
IF-14-EKS
KSW
RAL
EKS
1
DIS-4-BZ
GND
GND
BZ
5
AF-10-KEY
AF-10-RBC
KEY
RBC
4
AF-10-CWB
AF-10-VOXQ
NC
CWB
VOXQ
3
AF-11-AF
GND
AF
18
DIG-14-AGND
DIG-14-PRM
DIG-14-MET1
DIG-14-MET3
DIG-14-RWM
NC
AGND
PRM
MET 1
MET3
RWN
15
FIN-3-TXB
FIN-3-TX1
FIN-3-IC-
FIN-3-IC+
TXB
TX1
IC−
IC+
17
FIL-6-VSR
GND
VSR
22
CONT B/3-W5-PROC
CONT B/3-W5-MET1
CONT B/3-W5-TPT
CONT B/3-W5-ATS
CONT B/3-W5-+15V
CONT B/3-W5-GND
PROC
MET 1
TPT
ATS
+15V
GND
21
CONT B/3-W4-8V
CONT B/3-W4-ALCC
CONT B/3-W4-−12V
CONT B/3-W4-GND
8V
ALCC
−12V
GND
33
CONT C/3-32-KEY
KEY
W3
CONT C/3-31-GND
CONT C/3-31-AUTO
CONT C/3-31-REV
CONT C/3-31-WT1
CONT C/3-31-WTO
GND
AUTO
REV
WT1
WTO
20
SIG-1-RXB
SIG-1-TXB
SIG-1-RBC
SIG-1-PRS
SIG-1-AGS
SIG-1-MIO
SIG-1-SLOW
RXB
TXB
RBC
PRS
AGS
MIO
SLOW
19
DIG-1-GND
DIG-1-+15V
DIG-1-−12V
DIG-1-ATA
DIG-1-ATS
DIG-1-ALMS
GND
+15V
−12V
ATA
ATS
ALMS
NC

F G H I J

DSP-B JUNC

DSP-A JUNC

DSP UNIT
(X53-3260-00)

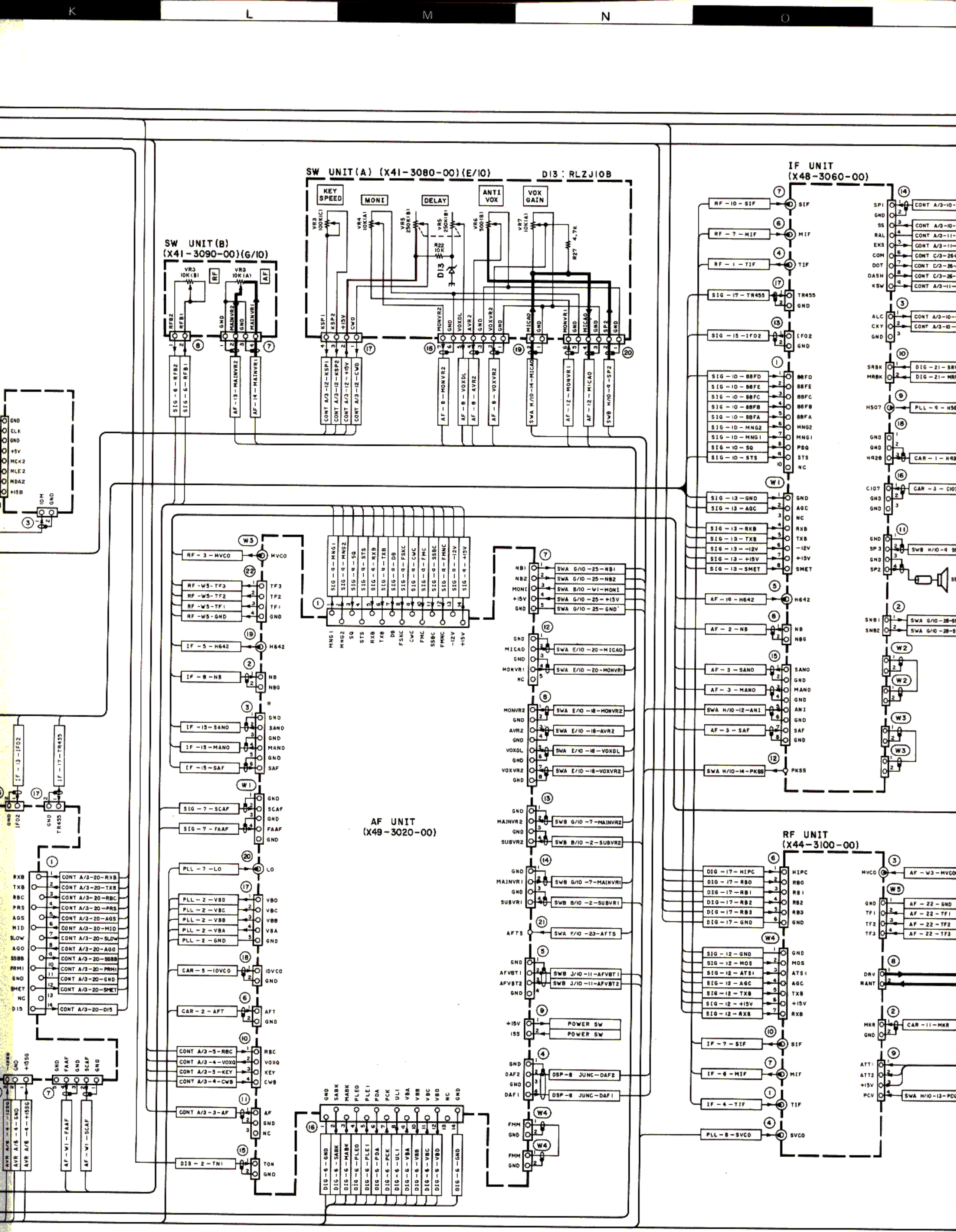
DSP UNIT
(X53-3260-00)

CONTROL UNIT (A/3)
(X53-3230-00)

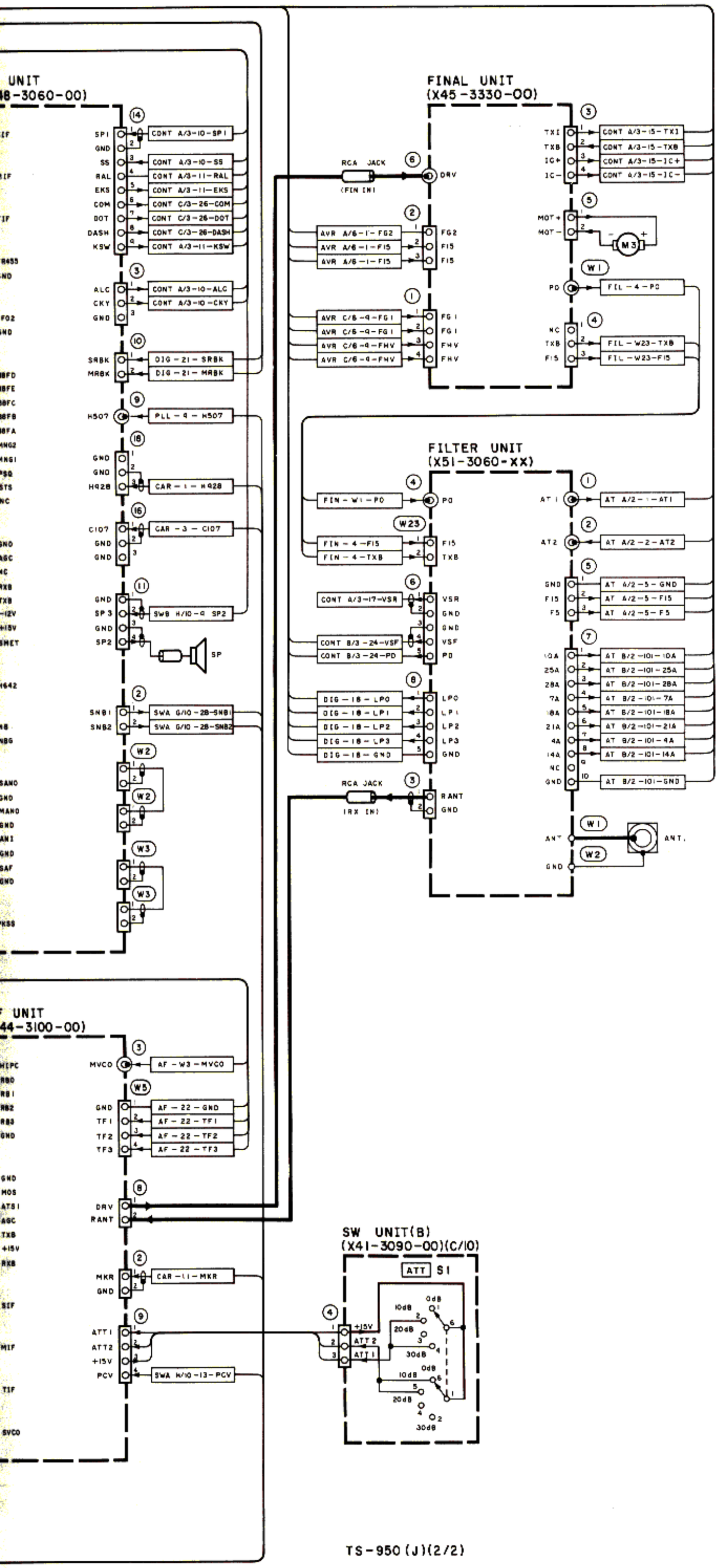
SW UNIT(B)
(X41-3090-00)(D/10)

SIGNAL UNIT
(X57-3380-00)

SW UNIT(B)
(X41-3090-00)(A/10)


SW UNIT(A) (X41-3080-00)(E/10)
D13 : RLZJ10B
KEY SPEED
MONI
DELAY
ANTI VOX
VOX GAIN
SW UNIT(B) (X41-3090-00)(G/10)
IF UNIT (X48-3060-00)
AF UNIT (X49-3020-00)
RF UNIT (X44-3100-00)

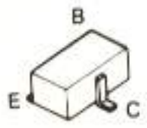
SCHEMATIC DIAGRAM TS-950S/SD



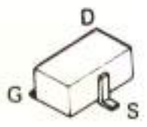
TS-950(J)(2/2)

TS-950S/SD PC BOARD VIEWS

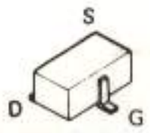
2SA1162
2SC2712
2SC2714
2SC3324
DTA114EK
DTA144EK
DTC114EK
DTC114TK
DTC144EK



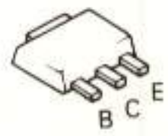
2SK210



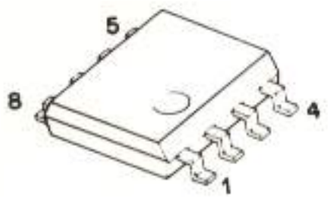
2SK508NV



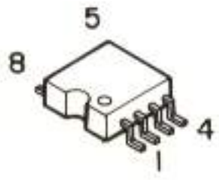
2SA1204



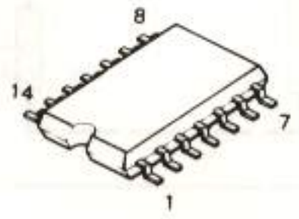
NJM2904M



NJM4558M



TC4001BF
TC4011BF
TC4013BF



VOX (X

IC1 : NJM
D1, 2 : DA

FM MIC

IC1 : NJM

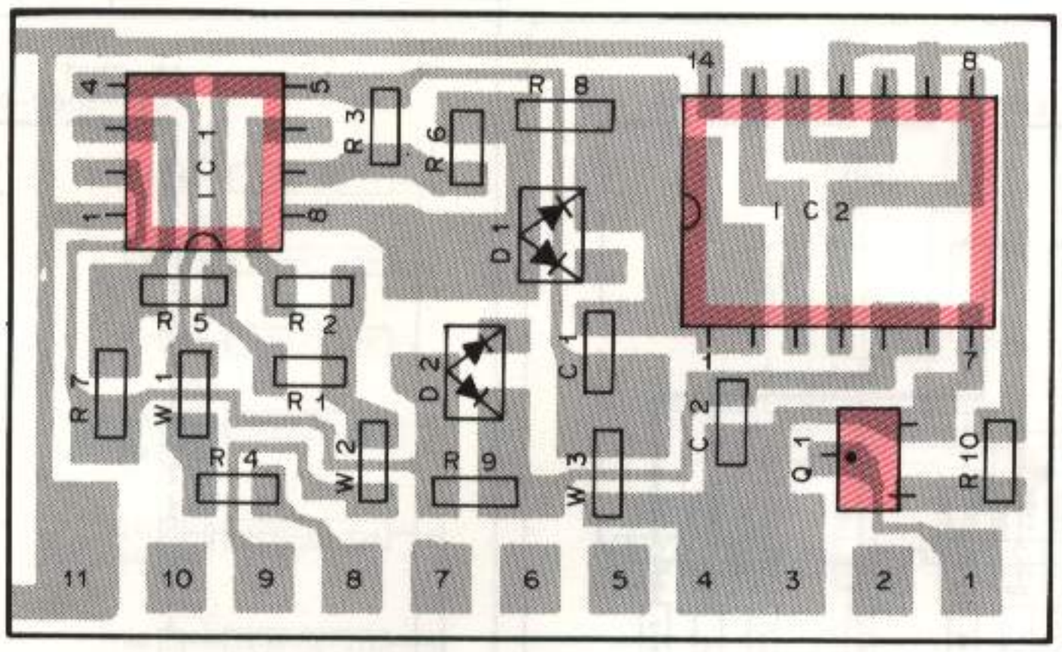
VCO1 (X

Q1 : 2SK2

LPF (X5

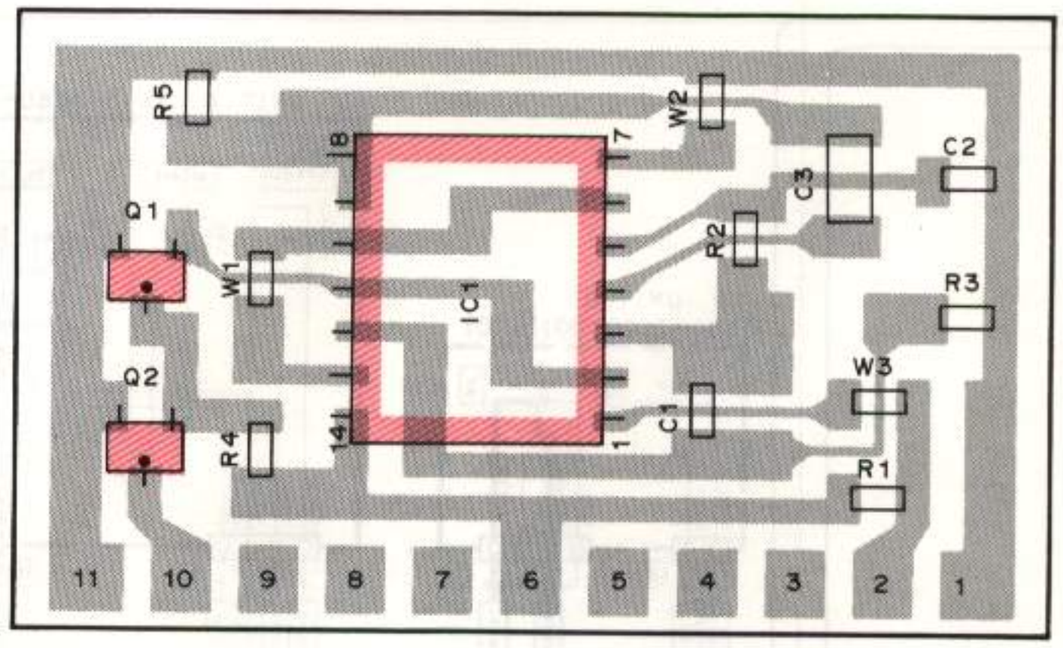
Q1–3 : 2S

VOX (X59-1080-01) Component side view



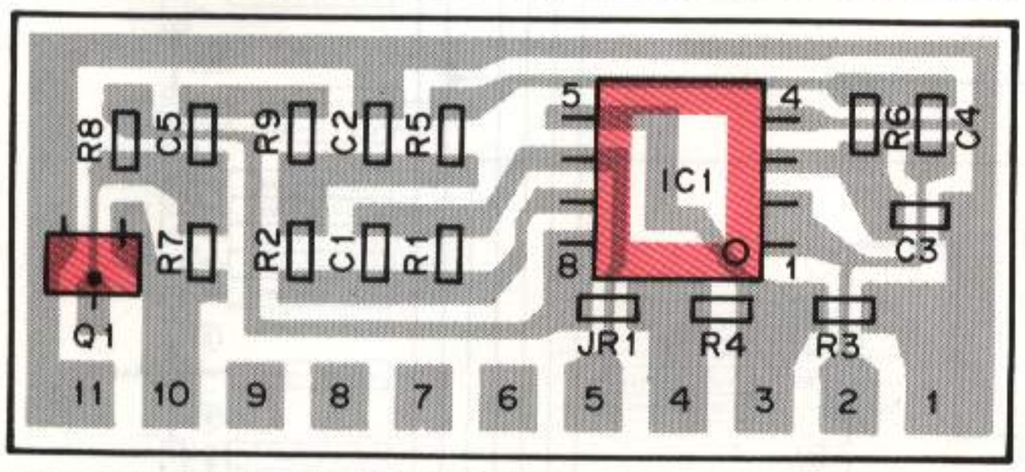
IC1 : NJM2904M IC2 : TC4001BF Q1 : 2SC2712(Y)
D1, 2 : DAP202(K)

NB2 (X59-3350-00) Component side view



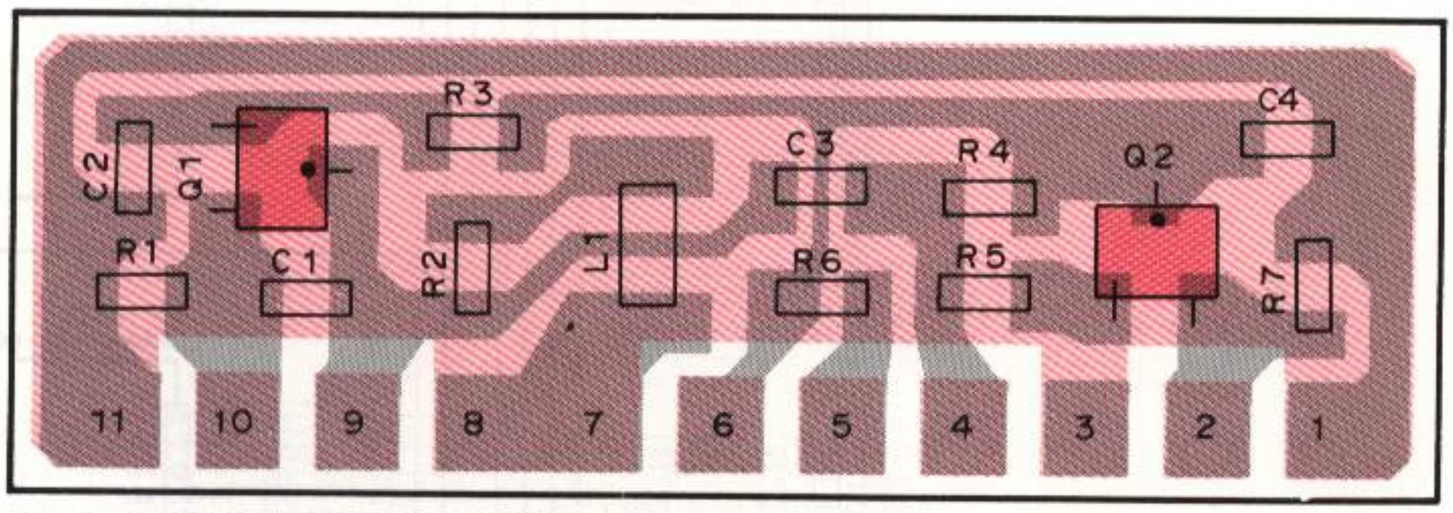
IC1 : TC4011BF Q1,2 : DTC114EK

FM MIC AMP (X59-3000-03) Component side view



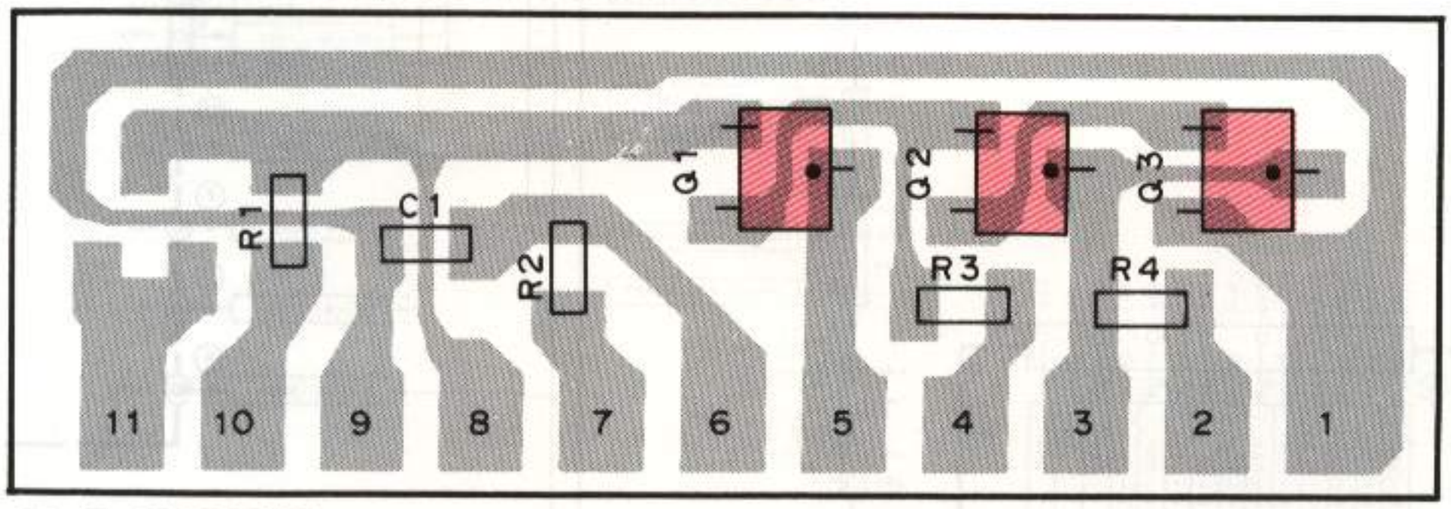
IC1 : NJM4558M Q1 : 2SC2712(Y)

VCO1 (X59-3440-00) Component side view



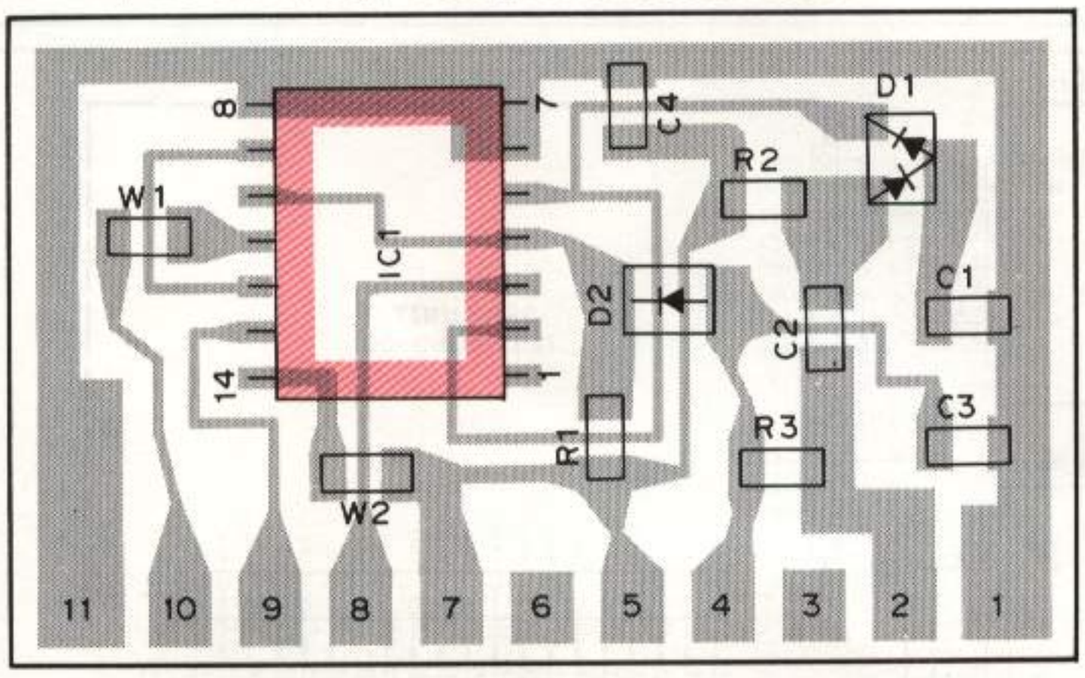
Q1 : 2SK210(GR) Q2 : 2SC2714(Y)

LPF (X59-3450-XX) Component side view



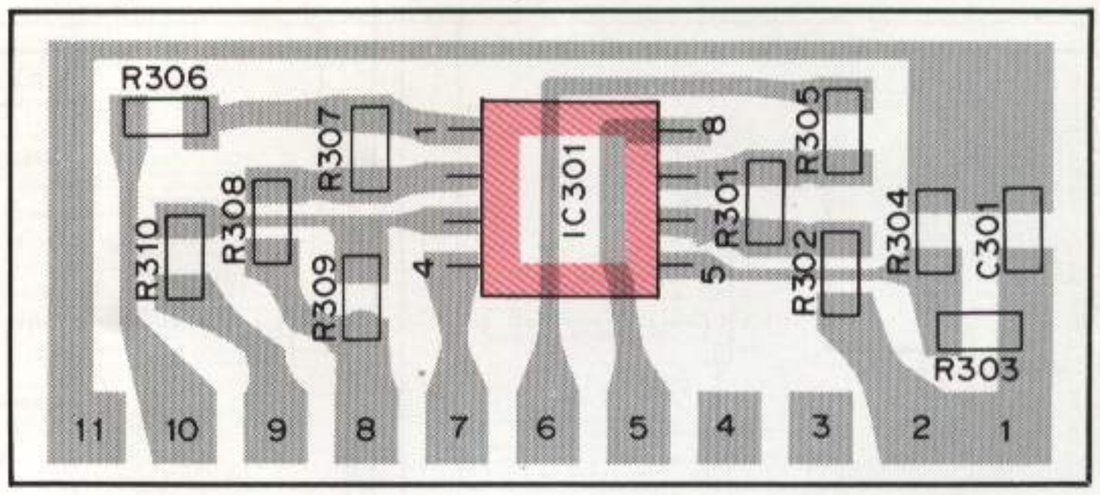
Q1–3 : 2SC3324(G)

MKR (X59-3640-00) Component side view



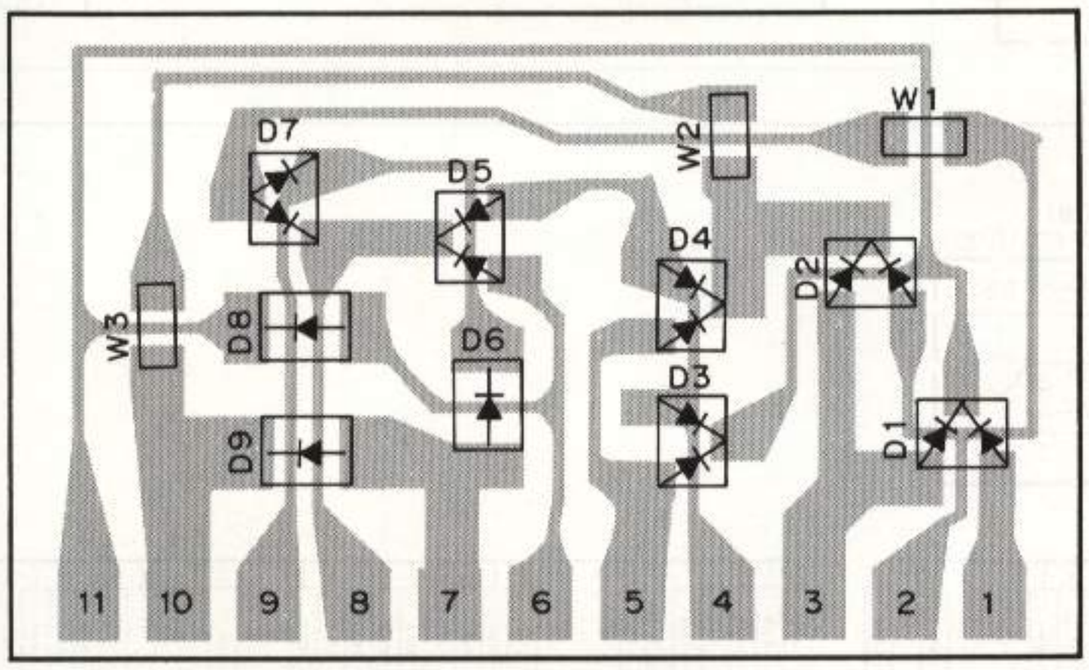
IC1 : TC4013BF D1 : DA204K D2 : RLS73

MAP (X59-3670-00) Component side view



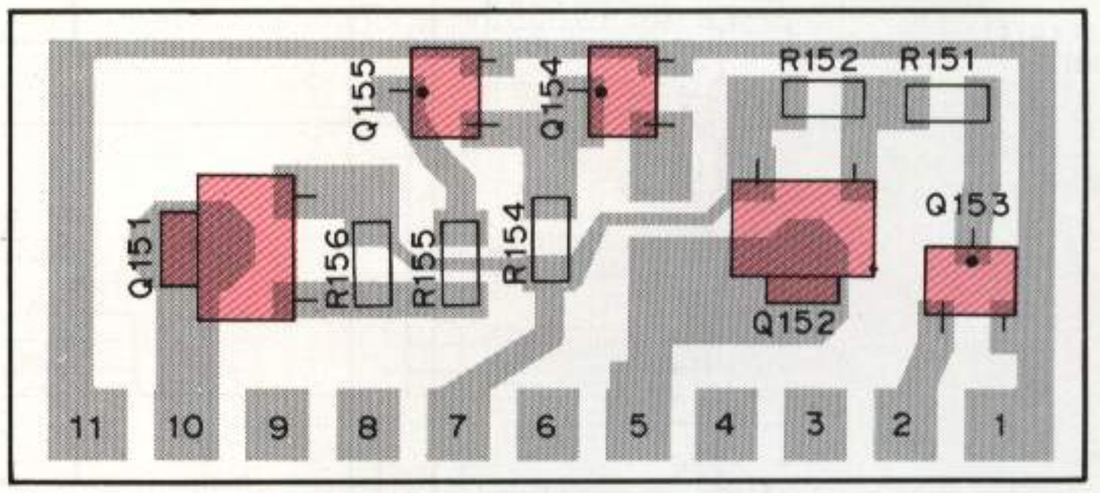
IC301 : NJM4558M

SFT (X59-3650-00) Component side view



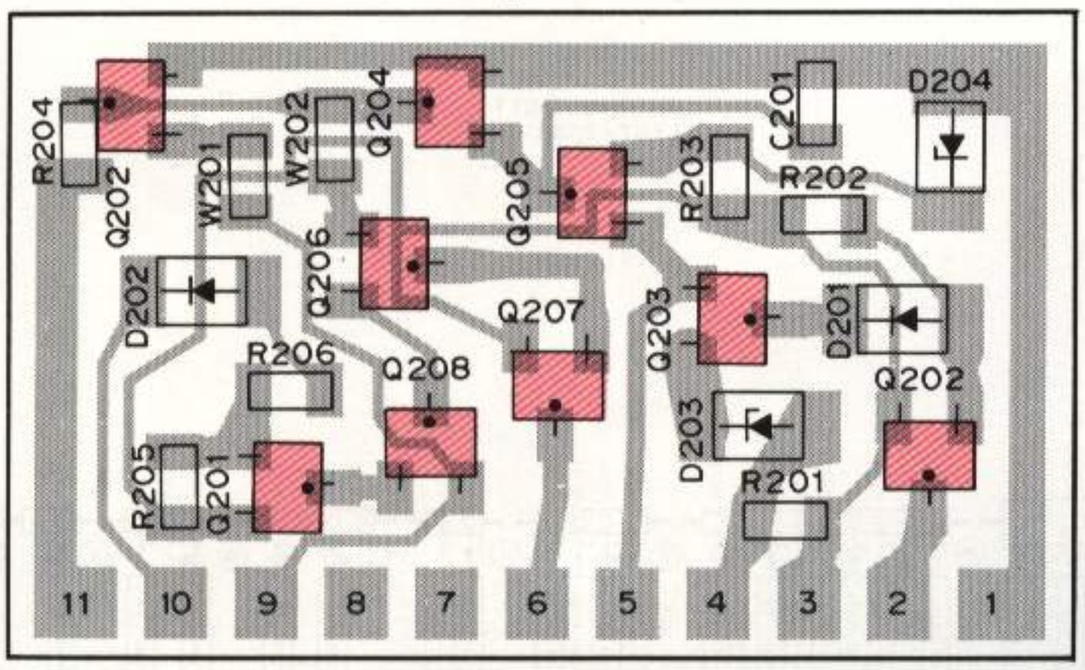
D1–5 : DAN202(K) D6, 8, 9 : RLS73 D7 : DAP202(K)

TRX (X59-3680-00) Component side view



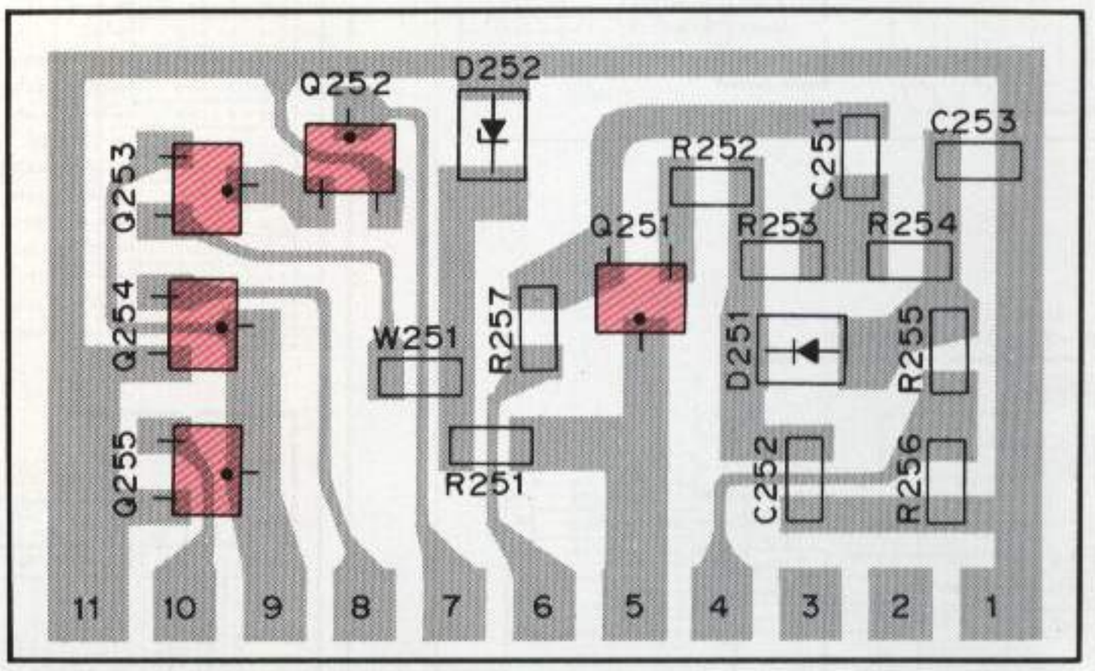
Q151, 152 : 2SA1204(Y) Q153–155 : DTC114TK

CWT (X59-3660-00) Component isde view



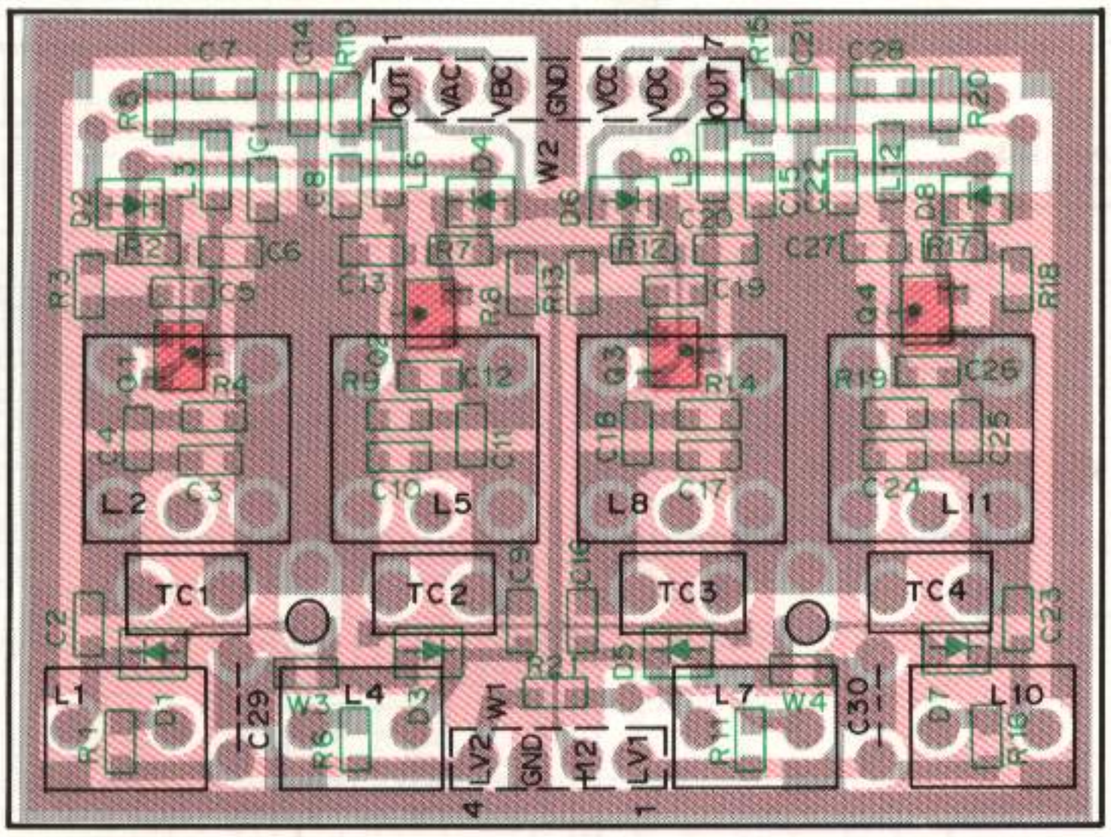
Q201 : 2SA1162(Y) Q202, 205, 207 : DTA144EK
Q203, 204, 206 : DTC144EK Q208 : DTC114TK
D201, 202 : RLS73 D203 : RLZJ3.6B D204 : RLZJ4.7B

ALC (X59-3700-00) Component side view

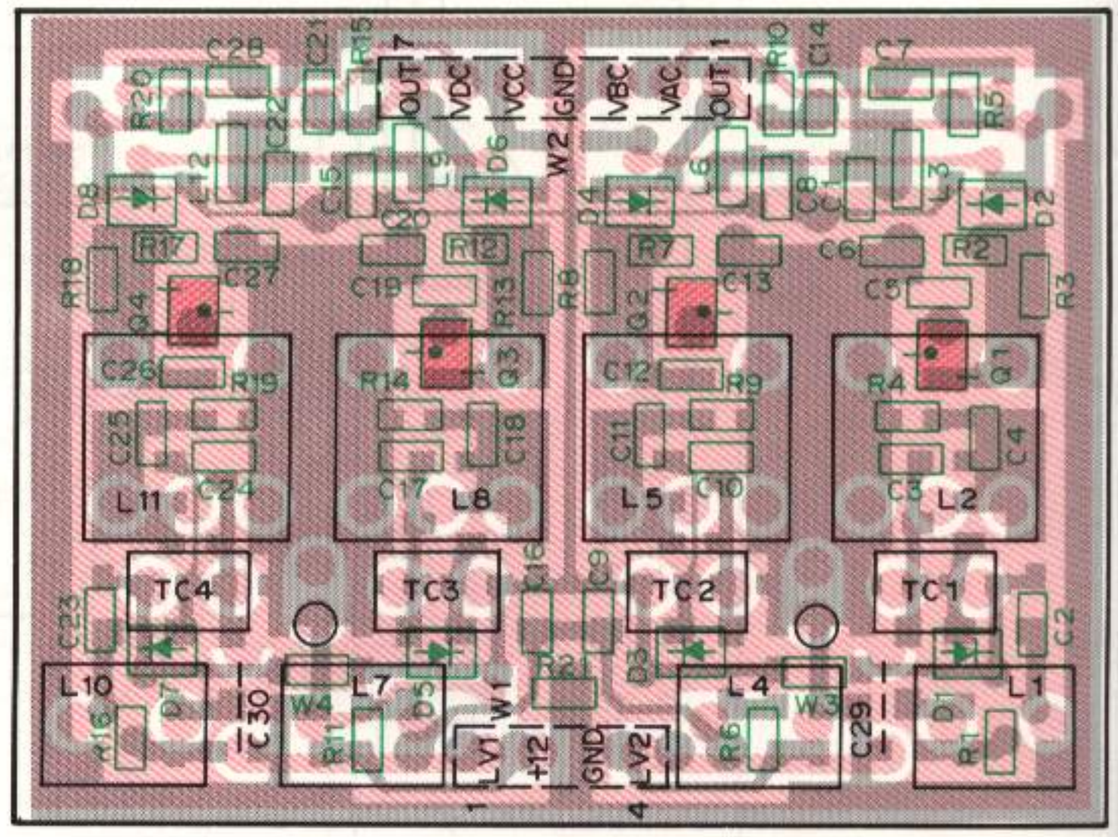


Q251 : 2SC2712(Y) Q252, 254, 255 : DTC144EK Q253 : DTA144EK
D251 : RLS73 D252 : RLZJ12B

VCO (X58-3630-XX) Component side view

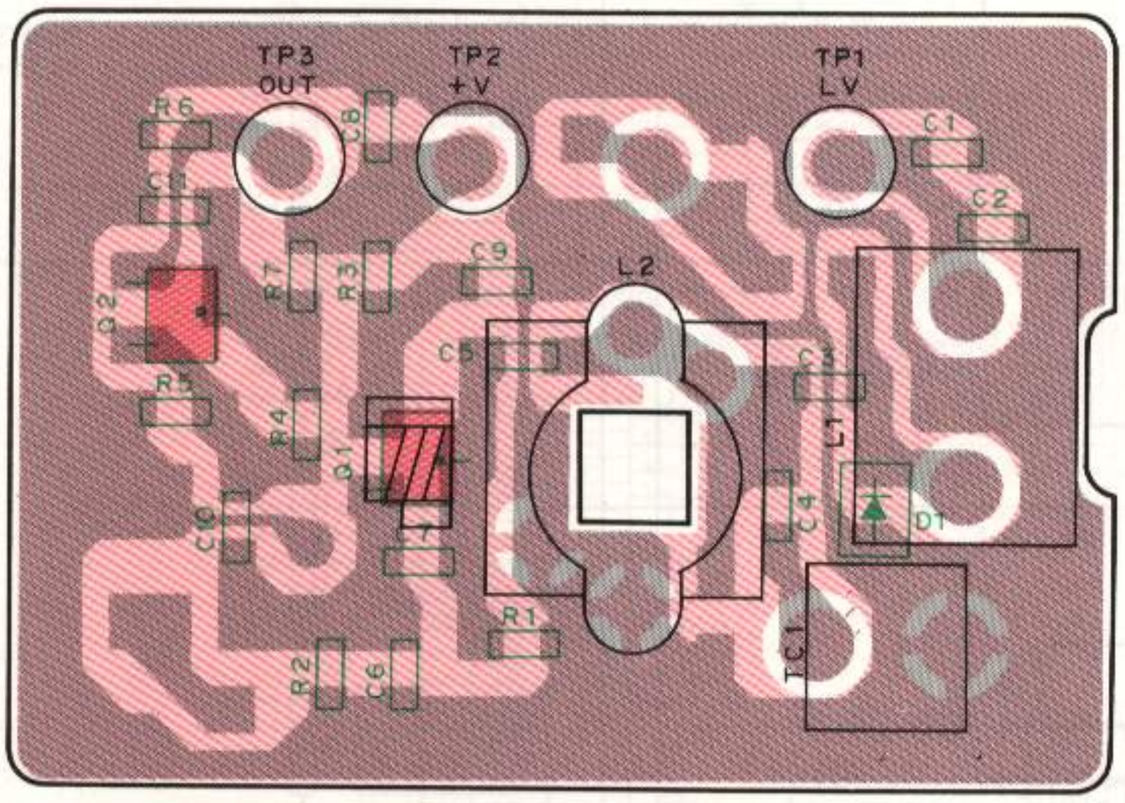


VCO (X58-3630-XX) Foil side view

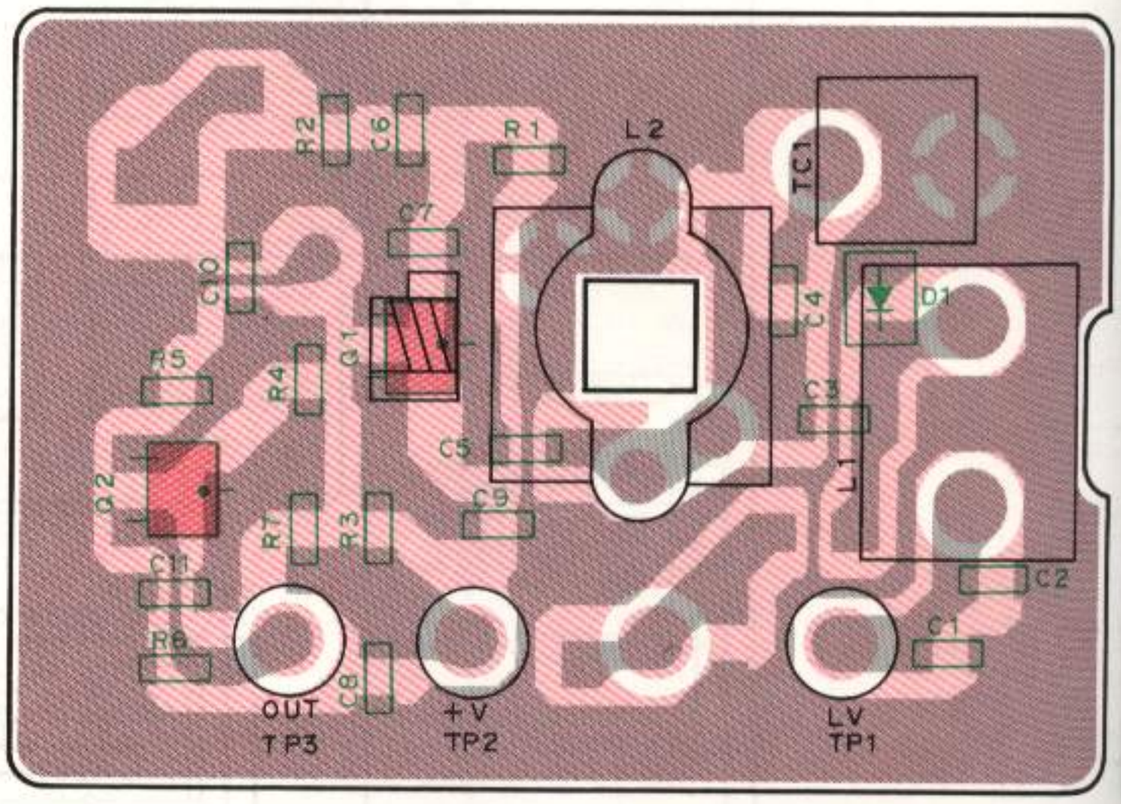


Q1–4 : 2SK210(GR) D1, 3, 5, 7 : 1SV166 D2, 4, 6, 8 : RLS135

VCO2 (X59-3390-03) Component side view

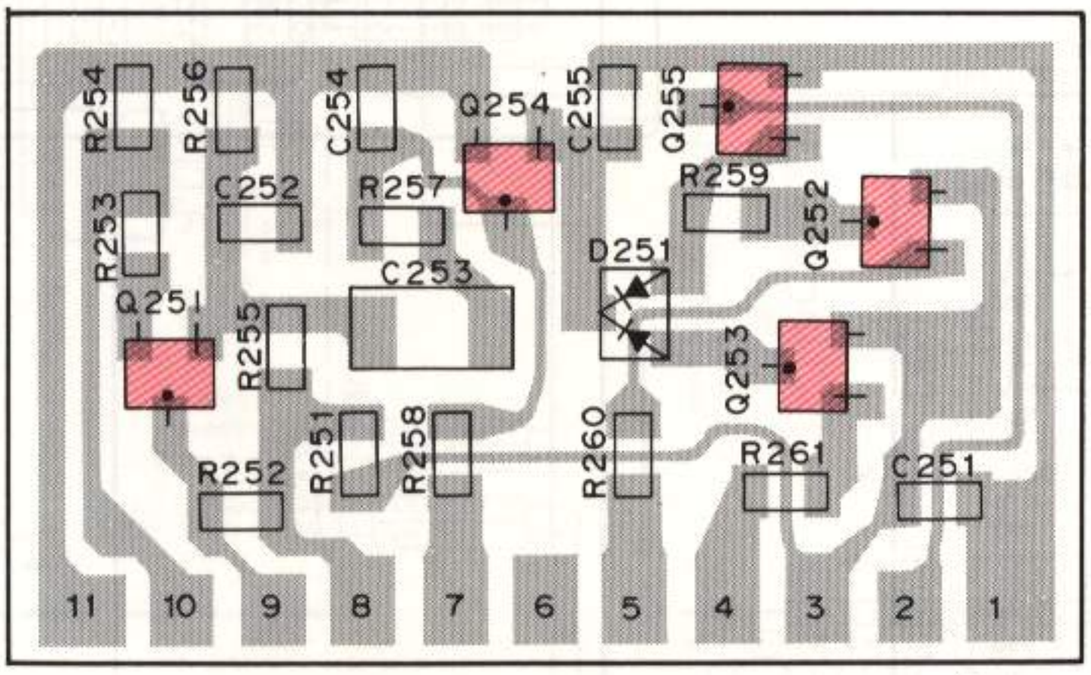


VCO2 (X58-3390-03) Foil side view

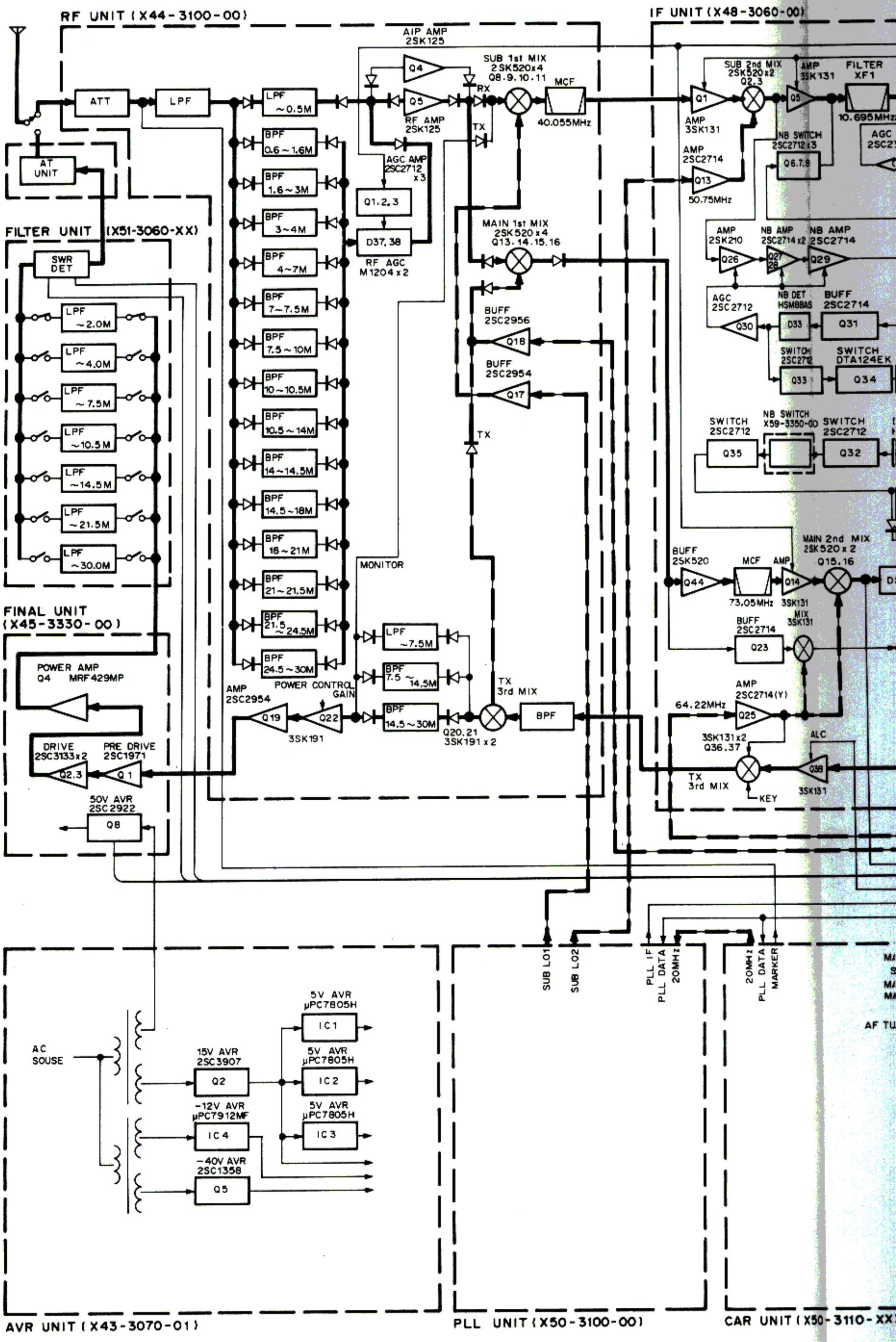


Q1 : 2SK508NV(K52) G2 : 2SC2714(Y) D1 : 1SV164

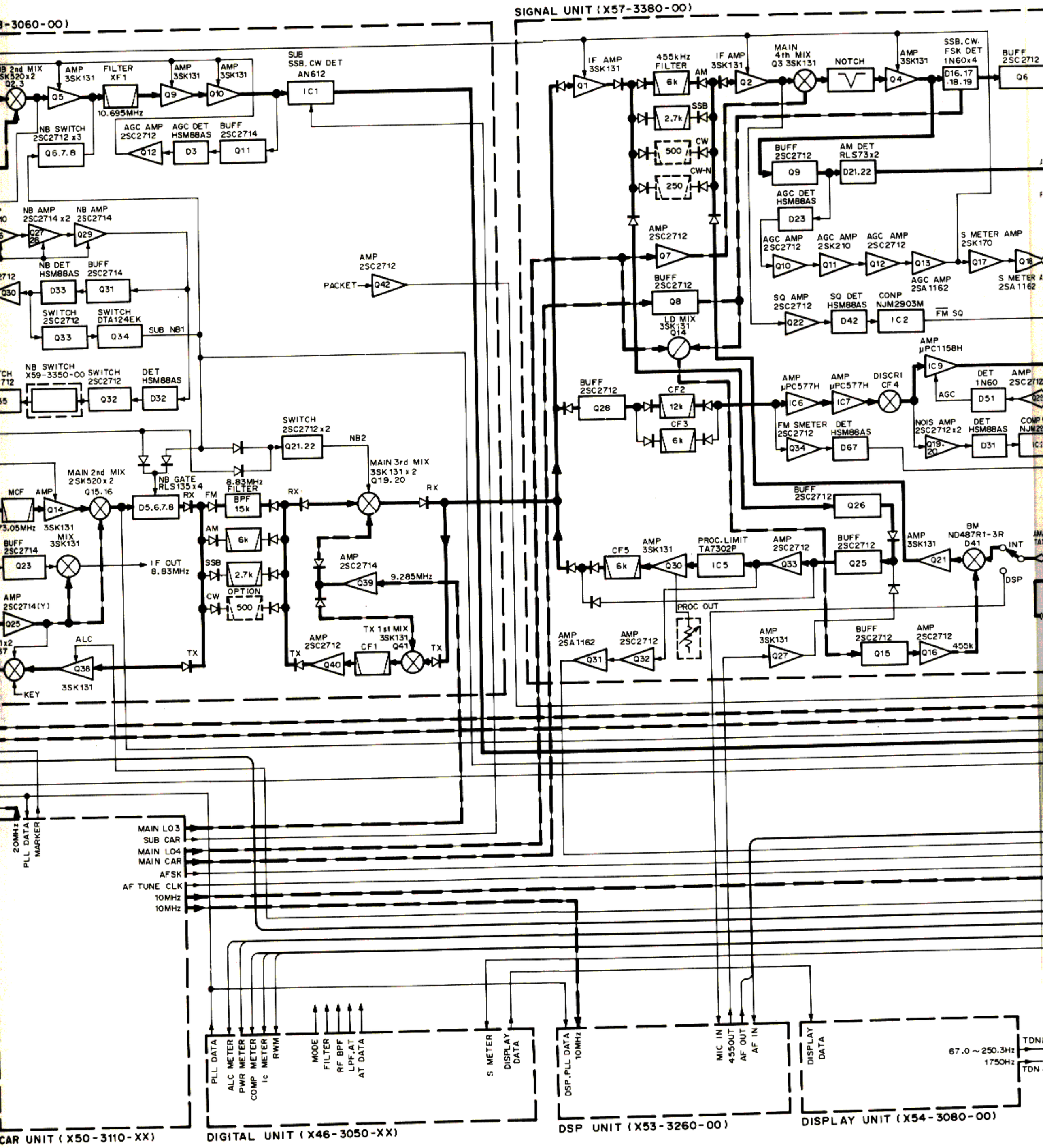
MIC AMP (X59-3710-00) Component side view

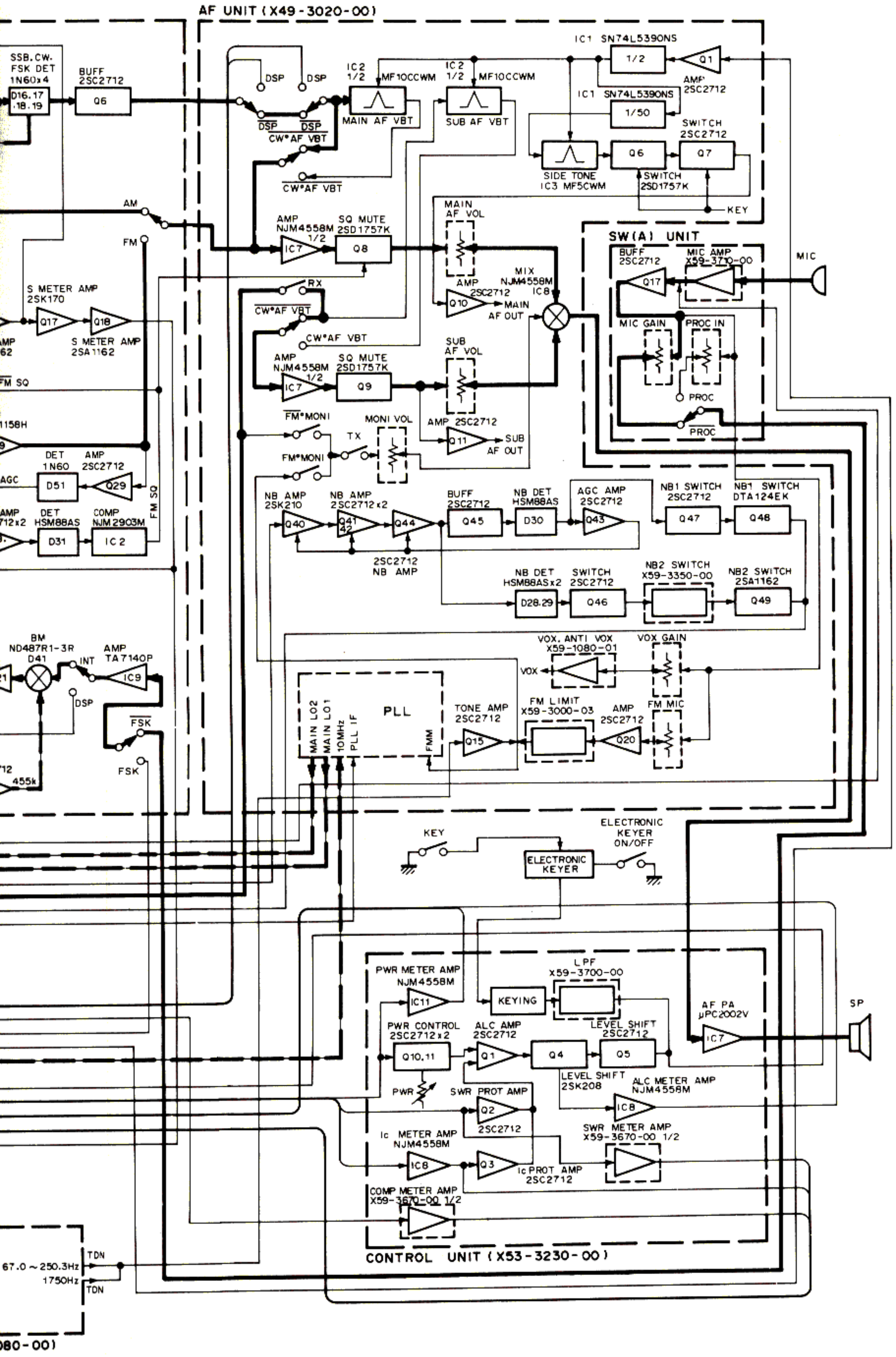


Q251 : 2SC3324(G) Q252, 253 : DTA114EK Q254 : DTC114TK
Q255 : DTC114EK D251 : DAN202(K)


RF UNIT (X44-3100-00)
IF UNIT (X48-3060-00)
ATT
LPF
AT UNIT
FILTER UNIT (X51-3060-XX)
SWR DET
LPF ~0.5M
BPF 0.6~1.6M
BPF 1.6~3M
BPF 3~4M
BPF 4~7M
BPF 7~7.5M
BPF 7.5~10M
BPF 10~10.5M
BPF 10.5~14M
BPF 14~14.5M
BPF 14.5~18M
BPF 18~21M
BPF 21~21.5M
BPF 21.5~24.5M
BPF 24.5~30M
LPF ~2.0M
LPF ~4.0M
LPF ~7.5M
LPF ~10.5M
LPF ~14.5M
LPF ~21.5M
LPF ~30.0M
AIP AMP 2SK125
Q4
Q5
RF AMP 2SK125
AGC AMP 2SC2712 x3
Q1,2,3
D37,38
RF AGC M1204 x2
SUB 1st MIX 2SK520x4 Q8.9.10.11
RX
TX
MCF
40.055MHz
MAIN 1st MIX 2SK520 x4 Q13.14.15.16
BUFF 2SC2956
Q18
BUFF 2SC2954
Q17
TX
SUB 2nd MIX 2SK520x2 Q2,3
AMP 3SK131
Q1
Q5
FILTER XF1
10.695MHz
AGC 2SC2
NB SWITCH 2SC2712 x3
Q6,7,8
AMP 2SC2714
Q13
50.75MHz
AMP 2SK210
NB AMP 2SC2714 x2
NB AMP 2SC2714
Q26
Q27,28
Q29
AGC 2SC2712
Q30
NB DET HSM88AS
Q33
BUFF 2SC2714
Q31
SWITCH 2SC2712
SWITCH DTA124EK
Q33
Q34
SWITCH 2SC2712
Q35
NB SWITCH X59-3350-00
SWITCH 2SC2712
Q32
MAIN 2nd MIX 2SK520 x 2 Q15,16
BUFF 2SK520
Q44
MCF
AMP
Q14
73.05MHz
3SK131
MIX 3SK131
BUFF 2SC2714
Q23
AMP 2SC2714(Y)
64.22MHz
Q25
3SK131 x2 Q36,37
ALC
Q38
3SK131
TX 3rd MIX
KEY
MONITOR
LPF ~7.5M
BPF 7.5~14.5M
BPF 14.5~30M
Q20,21 3SK191 x2
TX 3rd MIX
BPF
AMP 2SC2954
Q19
Q22
3SK191
POWER CONTROL GAIN
FINAL UNIT (X45-3330-00)
POWER AMP Q4 MRF429MP
DRIVE 2SC3133x2 Q2,3
PRE DRIVE 2SC1971 Q1
50V AVR 2SC2922
Q8
SUB LO1
SUB LO2
PLL IF
PLL DATA
20MHz
20MHz
PLL DATA
MARKER
AF TU
AC SOUSE
15V AVR 2SC3907
Q2
5V AVR µPC7805H
IC1
5V AVR µPC7805H
IC2
-12V AVR µPC7912MF
IC4
5V AVR µPC7805H
IC3
-40V AVR 2SC1358
Q5
AVR UNIT (X43-3070-01)
PLL UNIT (X50-3100-00)
CAR UNIT (X50-3110-XX)

BLOCK DIAGRAM

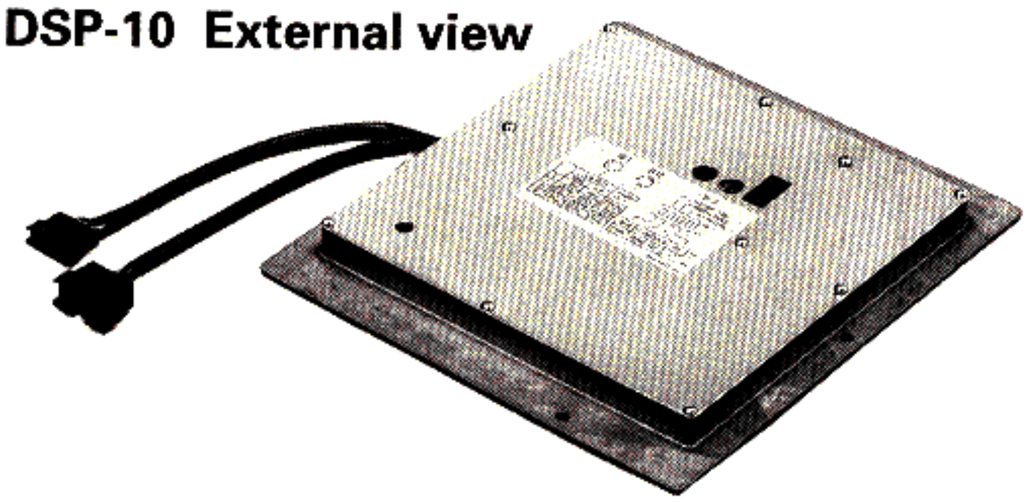



AF UNIT (X49-3020-00)
SSB.CW.FSK DET 1N60x4
D16.17.18.19
BUFF 2SC2712
Q6
DSP
DSP
IC2 1/2 MF10CCWM
MAIN AF VBT
IC2 1/2 MF10CCWM
SUB AF VBT
IC1 SN74L5390NS
1/2
Q1
AMP 2SC2712
IC1 SN74L5390NS
1/50
SWITCH 2SC2712
Q6
Q7
SIDE TONE IC3 MF5CWM
SWITCH 2SD1757K
KEY
DSP DSP
CW*AF VBT
CW*AF VBT
AM
FM
AMP NJM4558M 1/2
IC7
SQ MUTE 2SD1757K
Q8
MAIN AF VOL
AMP 2SC2712
Q10
MIX NJM4558M IC8
MAIN AF OUT
SW(A) UNIT
BUFF 2SC2712
Q17
MIC AMP X59-3770-00
MIC
MIC GAIN
PROC IN
PROC
PROC
S METER AMP 2SK170
Q17
Q18
S METER AMP 2SA1162
RX
CW*AF VBT
CW*AF VBT
AMP NJM4558M 1/2
IC7
SQ MUTE 2SD1757K
Q9
SUB AF VOL
FM SQ
FM*MONI
FM*MONI
MONI VOL
TX
AMP 2SC2712
Q11
SUB AF OUT
DET 1N60
AMP 2SC2712
D51
Q29
AGC
FM SQ
DET HSM88AS
COMP NJM2903M
D31
IC2
NB AMP 2SK210
NB AMP 2SC2712x2
Q40
Q41 42
Q44
2SC2712 NB AMP
BUFF 2SC2712
Q45
NB DET HSM88AS
D30
AGC AMP 2SC2712
Q43
NB1 SWITCH 2SC2712
Q47
NB1 SWITCH DTA124EK
Q48
NB DET HSM88ASx2
D28.29
SWITCH 2SC2712
Q46
NB2 SWITCH X59-3350-00
NB2 SWITCH 2SA1162
Q49
BM ND487R1-3R
D41
INT
AMP TA7140P
IC9
DSP
FSK
FSK
455k
VOX. ANTI VOX X59-1080-01
VOX
VOX GAIN
PLL
MAIN LO2
MAIN LO1
10MHz
PLL IF
FMM
TONE AMP 2SC2712
Q15
FM LIMIT X59-3000-03
AMP 2SC2712
Q20
FM MIC
KEY
ELECTRONIC KEYER
ELECTRONIC KEYER ON/OFF
PWR METER AMP NJM4558M
IC11
KEYING
LPF X59-3700-00
AF PA μPC2002V
IC7
SP
PWR CONTROL 2SC2712x2
Q10,11
ALC AMP 2SC2712
Q1
Q4
Q5
LEVEL SHIFT 2SC2712
LEVEL SHIFT 2SK208
ALC METER AMP NJM4558M
IC8
PWR
SWR PROT AMP
Q2
2SC2712
SWR METER AMP X59-3670-00 1/2
Ic METER AMP NJM4558M
IC8
Q3
Ic PROT AMP 2SC2712
COMP METER AMP X59-3670-00 1/2
CONTROL UNIT (X53-3230-00)
67.0~250.3Hz
1750Hz
TDN
TDN
080-00)

TS-950S/SD

DSP-10 (DIGITAL SIGNAL PROCESSOR) / SO-2 (TCXO UNIT) / YG-455S-1 (SSB FILTER)

DSP-10 External view



SO-2 External view

DSP-10 Speficications

Dimensions (W x D x H) ..... 220 x 200 x 28 (mm)
..... 8-21/32" x 7-7/8" x 1-3/32"
Weight ..... 1 kg (2.2 lbs)

SO-2 Specifications

Oscillating frequency ..... 20 MHz
Temperature stability ..... ±5 x 10^{-7} (–10°C to +50°C)
Frequency stability (Long term) ..... ±1 x 10^{-6}/year
Output ..... 1 V peak-to-peak (20 kΩ/5 pF)

DSP-10 Parts list

Ref. No.	New	Parts No.	Description
	*	B40-7612-04	Model name plate
		B42-3343-04	Serial label
	*	B50-8352-00	Instruction manual
	*	H01-8297-04	Item carton box
	*	H12-1420-03	Packing fixture
		H25-0029-04	Protection bag
		N89-3008-45	Binding head taptite screw
	*	X53-3260-00	DSP unit

SO-2 Parts list

Ref. No.	New	Parts No.	Description
	*	B50-8314-08	Instruction manual
		L77-1394-15	TCXO

YG-455S-1 External view

TG-455S-1 Specifications

Center frequency ..... 455.0 kHz
Pass band width ..... 2.4 kHz (–6dB)
Attenuation band width ..... 4.1 kHz (–60dB)

ER)

SP-950 (EXTERNAL SPEAKER)

SP-950 External view

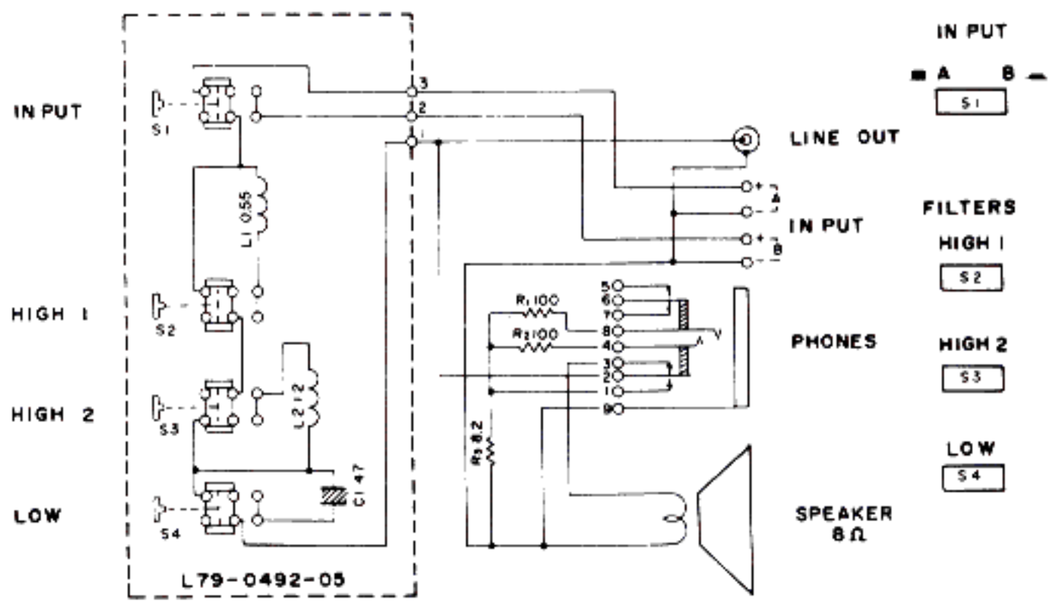
SP-950 Specifications

Speaker used	10 cm dia.
Rated input	1 W
Impedance	8 Ω
Frequency response	160 Hz to 7 kHz
Filter cut-off frequency	
HIGH1	3.0 kHz/–3dB
HIGH2	1.2 kHz/–3dB
HIGH1, 2	900 Hz/–3dB
LOW	400 Hz/–3dB
Filter attenuation	–6dB/oct.
Dimensions (W x H x D)	180 x 141 x 310 (mm)
Wight	2.0 kg

SP-950 Parts list

Ref. No.	New	Parts No.	Description
		A01-1052-02	Metallic cabinet (Bottom)
	*	A01-1077-02	Metallic cabinet (Top)
	*	A20-7023-03	Panel
	*	A23-1517-03	Rear panel
		B04-0404-03	Speaker grill
	*	B40-3948-04	Model name plate
		B43-1098-04	Badge
	*	B50-8301-00	Instruction manual
		E30-1711-15	Speaker cord (Accessory)
		G10-0662-04	Non-woven fabric
	*	H01-8265-04	Item carton box
	*	H10-2668-02	Polystyrene foamed fixture
		H20-1433-03	Protection cover
		H25-0705-04	Protection bag
		J02-0049-14	Foot (Rear)
		J02-0423-04	Foot (Front outside)
		J02-0424-04	Foot (Front inside)
		J19-1325-04	Mounting hardware (Panel)
		J61-0307-05	Wire band
	*	K29-4519-04	Knob
		N33-3006-41	Flat head machine screw (Case)
		N87-3006-41	Brazier head taptite screw
		N87-4008-41	Brazier head taptite screw (Foot, SP)
		T07-0222-15	Speaker
		X41-3060-00	Switch unit

SP-950 Schematic diagram



SPECIFICATIONS

Specifications / Model				TS-950S	TS-950S DIGITAL
General	Mode			J3E (LSB, USB), A1A (CW), A3E (AM), F3E (FM), F1A (FSK)	
	Memory channels			100	
	Antenna impedance			50Ω With Antenna Tuner 20 to 150Ω	
	Power requirement	K and P type		120V AC ± 10%	
		M type		120/220V AC ± 10%	
		W type		220/240V AC ± 10%	
		X type		120/240V AC ± 10%	
	Power dissipation	Receive mode with no input signal		110W	
		Transmit mode		700W (7.5A)	
	Operating temperature			–10 to +50°C (+14 to +122°F)	
	Frequency stability			Less than ±10 PPM	Less than ±0.5 PPM
	Frequency accuracy			Less than ±10 PPM	Less than ±0.5 PPM
	Dimensions (W x H X D) (Projections included)			409 x 154 x 446 mm (16-3/22" x 6-1/16" x 17-9/16")	
	Weight			23 kg (50.6 lbs)	
Transmitter	Frequency range	160m band		1.800 to 2.000MHz	
		80m band		3.500 to 4.000MHz	
		40m band		7.000 to 7.300MHz	
		30m band		10.100 to 10.150MHz	
		20m band		14.000 to 14.350MHz	
		17m band		18.068 to 18.168MHz	
		15m band		21.000 to 21.450MHz	
		12m band		24.890 to 24.990MHz	
		10m band		28.000 to 29.700MHz	
	Output power	1.9 to 24MHz	SSB, CW, FSK, FM	MAX	150W
				MIN	20W
			AM	MAX	40W
				MIN	10W
		28MHz	SSB, CW, FSK, FM	MAX	110W
				MIN	20W
			AM	MAX	40W
				MIN	10W
	Modulation		SSB		Balanced modulation
			FM		Reactance modulation
			AM		Low level modulation
	Spurious radiation			Less than –40dB	
	Carrier suppression (with 1.5kHz reference)			More than 40dB	More than 50dB
	Unwanted sideband suppression (with 1.5kHz reference)			More than 50dB	More than 60dB
	Maximum frequency deviation (FM)			Less than ±5kHz	
	Frequency response (–6dB)			400 to 2600Hz	200 to 3100Hz
	XIT variable range			±9.99kHz	
	Microphone impedance			500Ω to 50kΩ	

SPECIFICATIONS

Specifications \ Model				TS-950S	TS-950S DIGITAL
Receiver	Circuitry	Main	SSB, CW, FSK, AM	Quadruple conversion superheterodyne	
			FM	Triple conversion superheterodyne	
		Sub	SSB, CW, FSK	Double conversion superheterodyne	
	Frequency range			100kHz to 30MHz	
	Intermediate frequency		Main	1st : 73.05MHz, 2nd : 8.83MHz 3rd : 455kHz, 4th : 100kHz	
			Sub	1st : 40.055MHz, 2nd : 10.695MHz	
	Sensitivity	SSB, CW (at 10dB S + N/N)	100kHz to 150kHz	Less than 2.5μV	
			150kHz to 500kHz	Less than 1μV	
			500kHz to 1.62MHz	Less than 4μV	
			1.62MHz to 30MHz	Less than 0.2μV	
		AM (at 10dB S + N/N)	100kHz to 150kHz	Less than 25μV	
			150kHz to 500kHz	Less than 10μV	
			500kHz to 1.62MHz	Less than 32μV	
			1.62MHz to 30MHz	Less than 2.0μV	
		FM (at 12dB SINAD)	28MHz to 30MHz	Less than 0.5μV	
	Selectivity		SSB, AM (N), FSK	–6dB : 2.4kHz, –60dB : 3.8kHz	
			AM (W)	–6dB : 6kHz, –50dB : 15kHz	
			CW (N)	–	–6dB : 250kHz, –60dB : 550kHz
			CW (W)	–6dB : 2.4kHz, –60dB : 3.8kHz	–6dB : 400kHz, –60dB : 900kHz
			FM	–6dB : 12kHz, –60dB : 24kHz	
	Image ratio			More than 80dB	
	1st IF rejection			More than 70dB	
	Notch filter rejection			More than 45dB	
	RIT variable range			±9.99kHz	
	Squelch sensitivity	SSB, CW, FSK, AM	100kHz to 150kHz	Less than 6.3μV	
			150kHz to 500kHz	Less than 2.5μV	
			500kHz to 1.62MHz	Less than 10μV	
			1.62MHz to 30MHz	Less than 0.5μV	
		FM	28MHz to 30MHz	Less than 0.32μV	
	Output			1.5W across 8Ω load (10% distortion)	
	Output load impedance			8Ω	

Notes
1. Circuit and ratings are subjest to change without notice due to advancements in technology.
2. Remember to keep the transmitting output power within the power limitations of your license.

TS-950S/SD

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