



SERVICE MANUAL

IC-R7000
COMMUNICATIONS RECEIVER

ICOM INCORPORATED

FOREWORD

The most sophisticated, continuous coverage receiver on the market today, the **IC-R7000** is the result of both advanced ICOM engineering and state-of-the-art computer interface technology from ICOM such as the new CI-V System: a feature that allows for easy and convenient computer control of your IC-R7000.

Equipped with 99 internal memories that are completely owner-programmable, the **IC-R7000** is unmatched in scanning and coverage versatility within the 25 to 1300MHz range and may even cover frequencies up to 2000MHz. Low band, aircraft, marine, business, FM, amateur radio, emergency services, government, and television bands - all are conveniently available and immediately accessible with the **IC-R7000**.



ASSISTANCE

Five separate versions of the **IC-R7000** have been designed for use in the U.S.A., Europe, France, Australia, and Germany. This service manual covers every version. When using the manual each model can be referred to by the following assigned version numbers:

- #02 U.S.A. version
- #03 Europe version
- #04 France version
- #05 Australia version
- #06 Germany version

If you require assistance or information regarding the operation and capabilities of the **IC-R7000**, please contact your nearest authorized ICOM Dealer or ICOM Service Center.

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SECTION 1 SPECIFICATIONS

• Receive frequency range :

VERSION	FREQUENCY COVERAGE (MHz)
#02, #03	25~ 999.999 *1025~1999.999
#04, #05	**25~ 999.999 *1025~1999.999
#06	28.0~29.7, 144.0~146.0 430.0~440.0

* Specifications guaranteed from 1240~1300MHz.

** Excluding 87.5~108MHz.

• Receive modes :

A3E (AM), F3E (FM), J3E (SSB)

• Sensitivity :

25~999.999 MHz FM : Less than -113dBm for 12dB SINAD
 FM (wide) : Less than -107dBm for 12dB SINAD
 AM : Less than -107dBm for 10dB S/N
 SSB : Less than -117.5dBm for 10dB S/N
 1240~1300 MHz FM : Less than -113dBm for 12dB SINAD
 FM (wide) : Less than -101dBm for 12dB SINAD
 AM : Less than -101dBm for 10dB S/N
 SSB : Less than -117.5dBm for 10dB S/N

• Squelch sensitivity :

FM (Threshold) Less than -101dBm for noise squelch
 FM (Tight) More than -17dBm for meter squelch at S9+60dB
 SSB (Threshold) More than -97.5dBm for meter squelch

• Selectivity :

FM, AM ±7.5kHz minimum at -6dB
 FM (narrow), AM (narrow) ±3.0kHz minimum at -6dB
 FM (wide) ±75kHz minimum at -6dB
 SSB ±1.4kHz minimum at -6dB

• Spurious and image response rejection :

More than 60dB

• Frequency stability :

25~999.999 MHz ±5ppm at 0°C~+50°C
 1240~1300 MHz ±10ppm at 0°C~+50°C

• Receive system :

25~999.999 MHz : FM, AM, SSB Triple-conversion superheterodyne
 FM (wide) Double-conversion superheterodyne
 1240~1300 MHz : FM, AM, SSB Quadruple-conversion superheterodyne
 FM (wide) Triple-conversion superheterodyne

• Intermediate frequencies :

25~512 MHz : 1st 778.7 MHz
 2nd 10.7 MHz
 3rd 455kHz excluding FM (wide) mode
 512~999.999 MHz: 1st 266.7 MHz
 2nd 10.7 MHz
 3rd 455kHz excluding FM (wide) mode

• Frequency control :

CPU based 100Hz step digital PLL synthesizer

• Number of memory channels :

99 channels

• Supply voltage :

117V (#02), 230V (#03, #04, #05), 220V (#06) AC (50/60Hz)

• Current drain :

Receiving 1.7A at maximum audio output
 Squelched 1.4A

• Antenna impedance :

50Ω

• Audio output :

More than 2.5W at 10% distortion with an 8Ω load

• Audio output impedance :

4~8Ω

• Usable temperature :

-10°C~+60°C

• Dimensions :

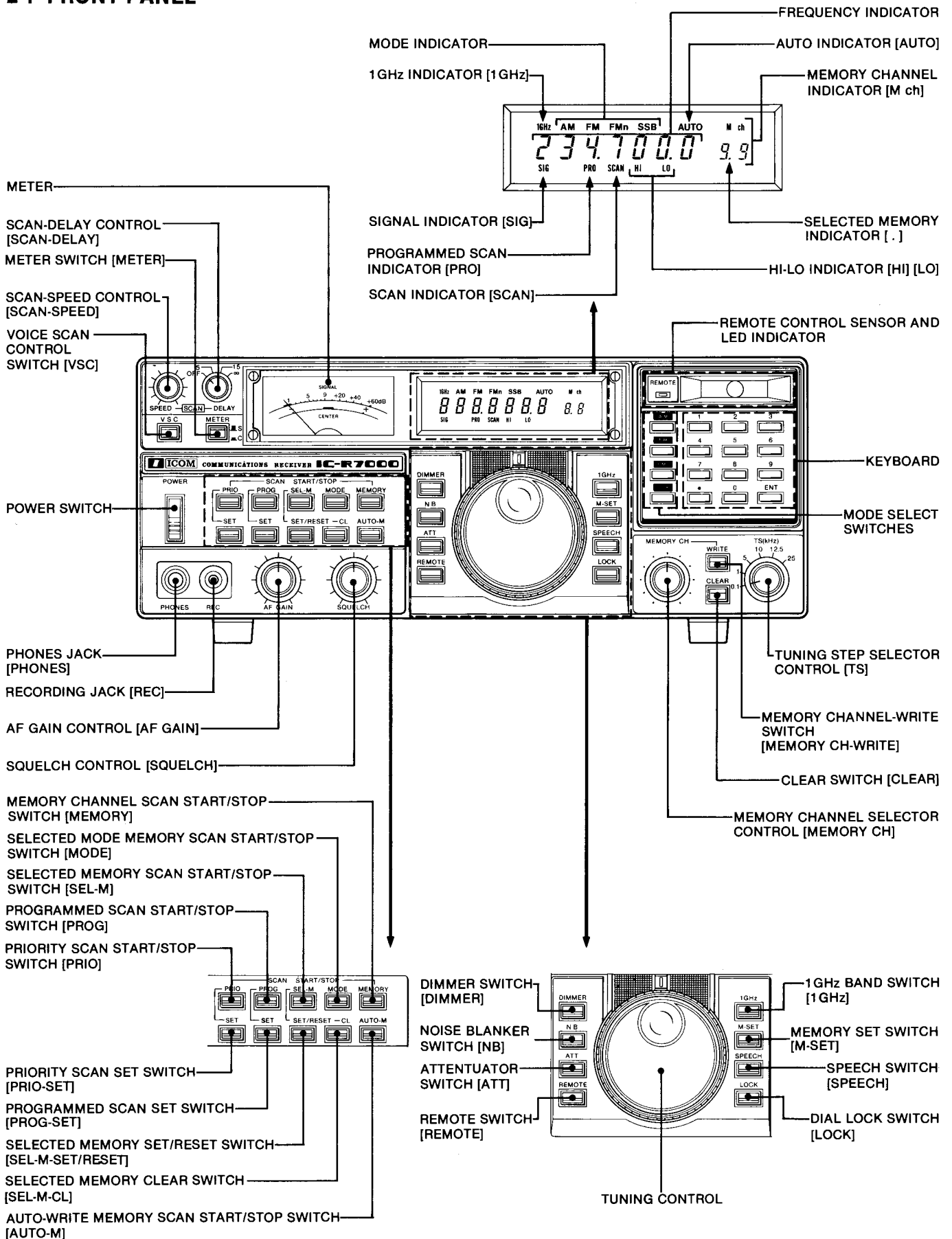
286(303)mm(W) × 110(127)mm(H) × 276(319)mm(D)
 Bracketed values include projections.

• Weight :

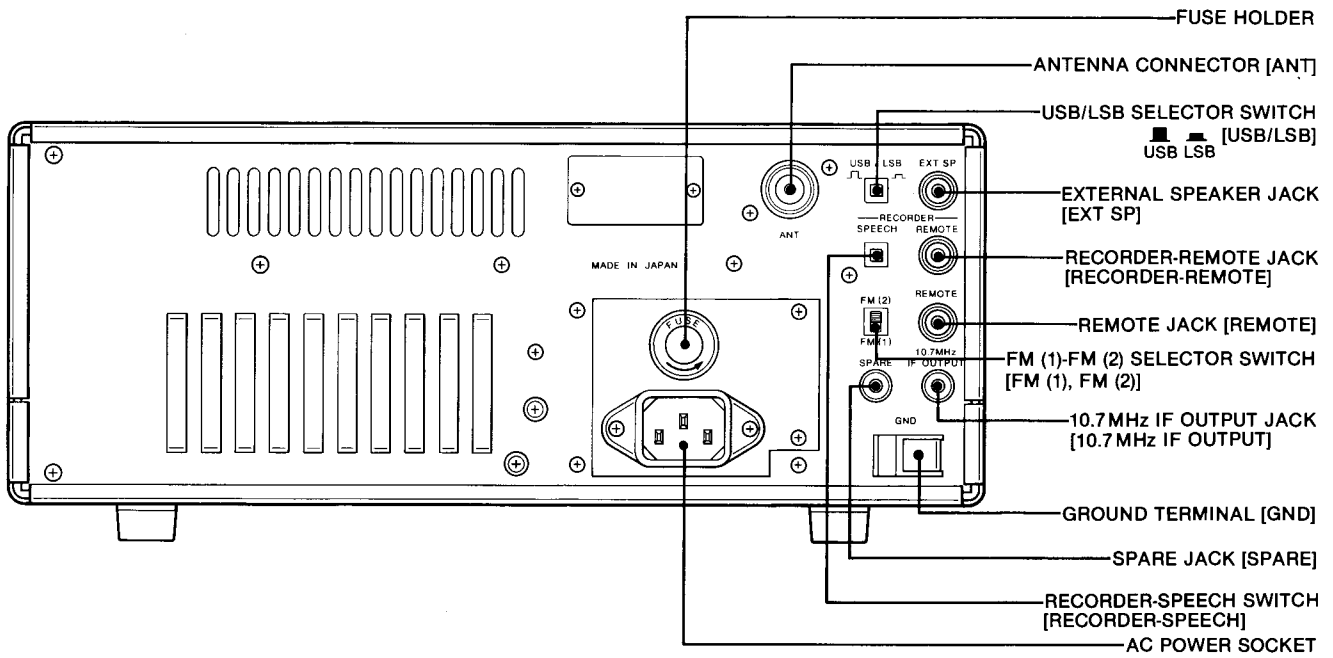
Approximately 8.0kg (excluding options)

All stated specifications are approximate and subject to change without notice or obligation.

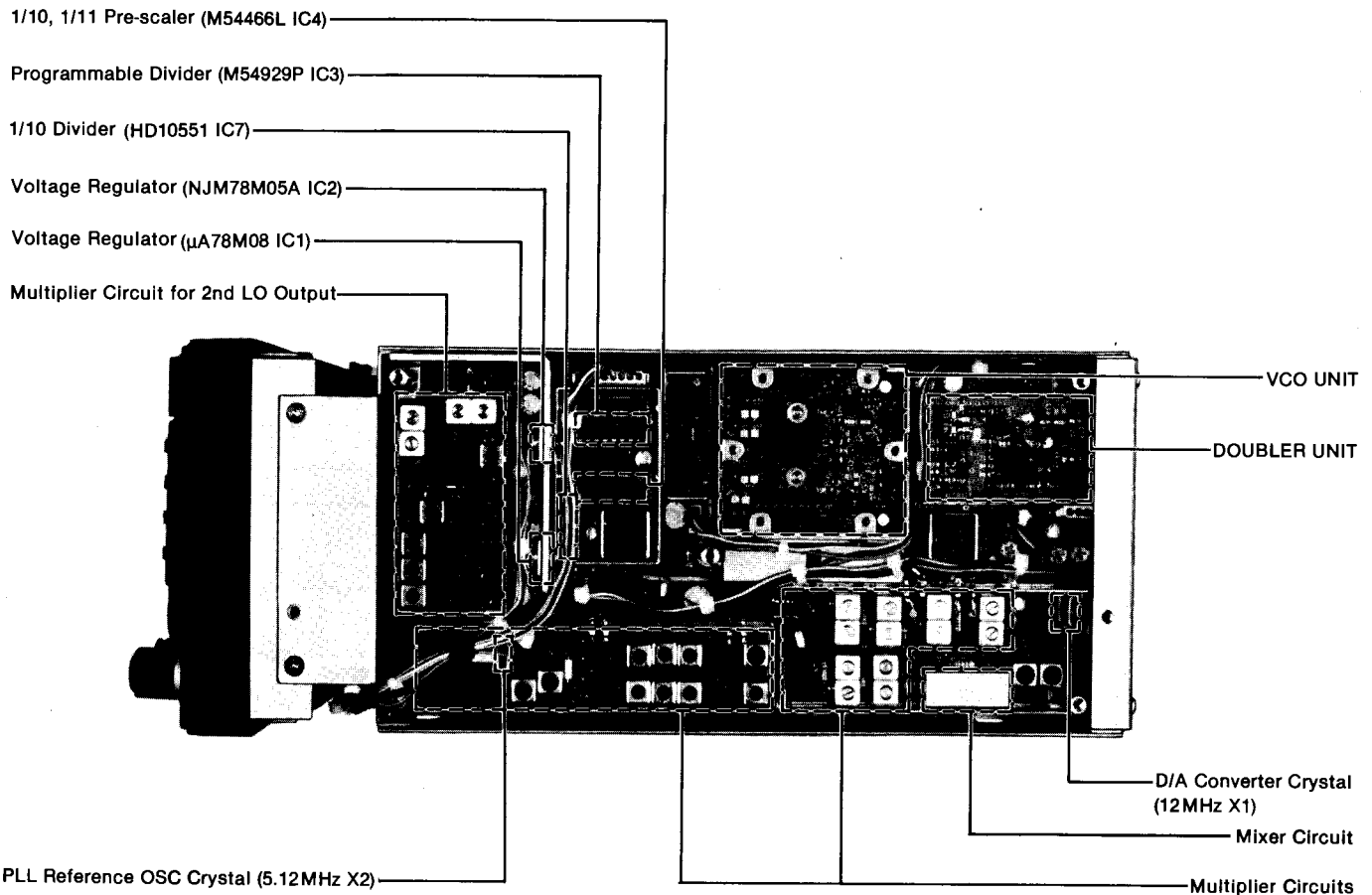
2-1 FRONT PANEL



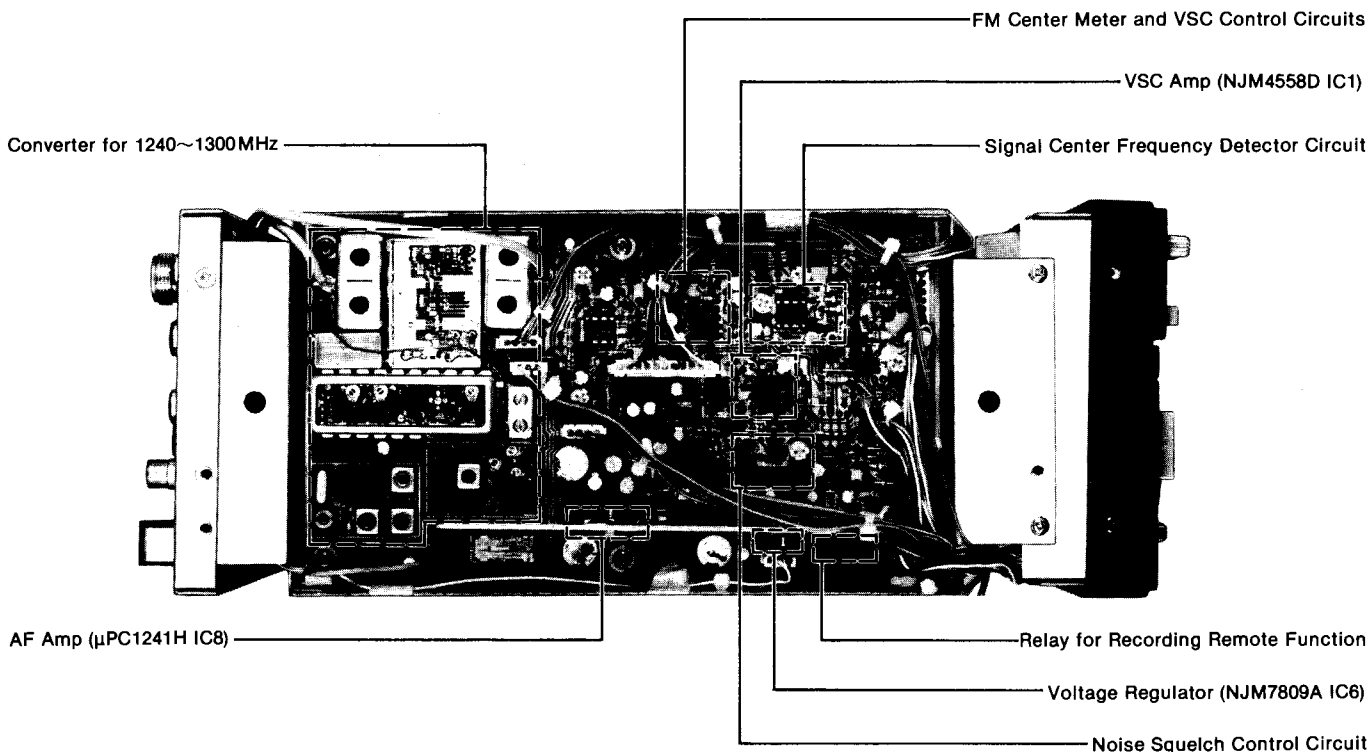
2-2 REAR PANEL



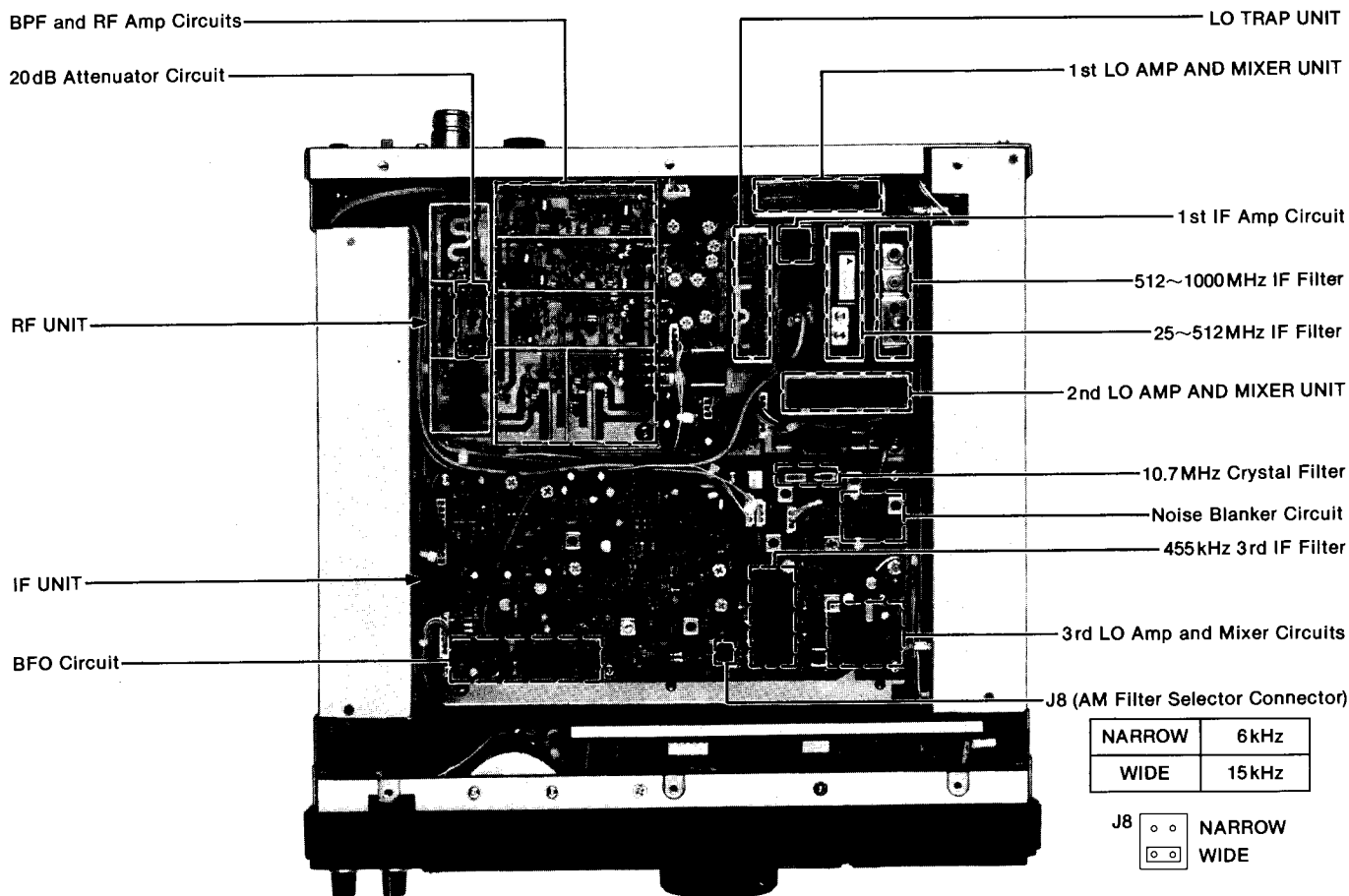
2-3 INSIDE VIEW (PLL UNIT)



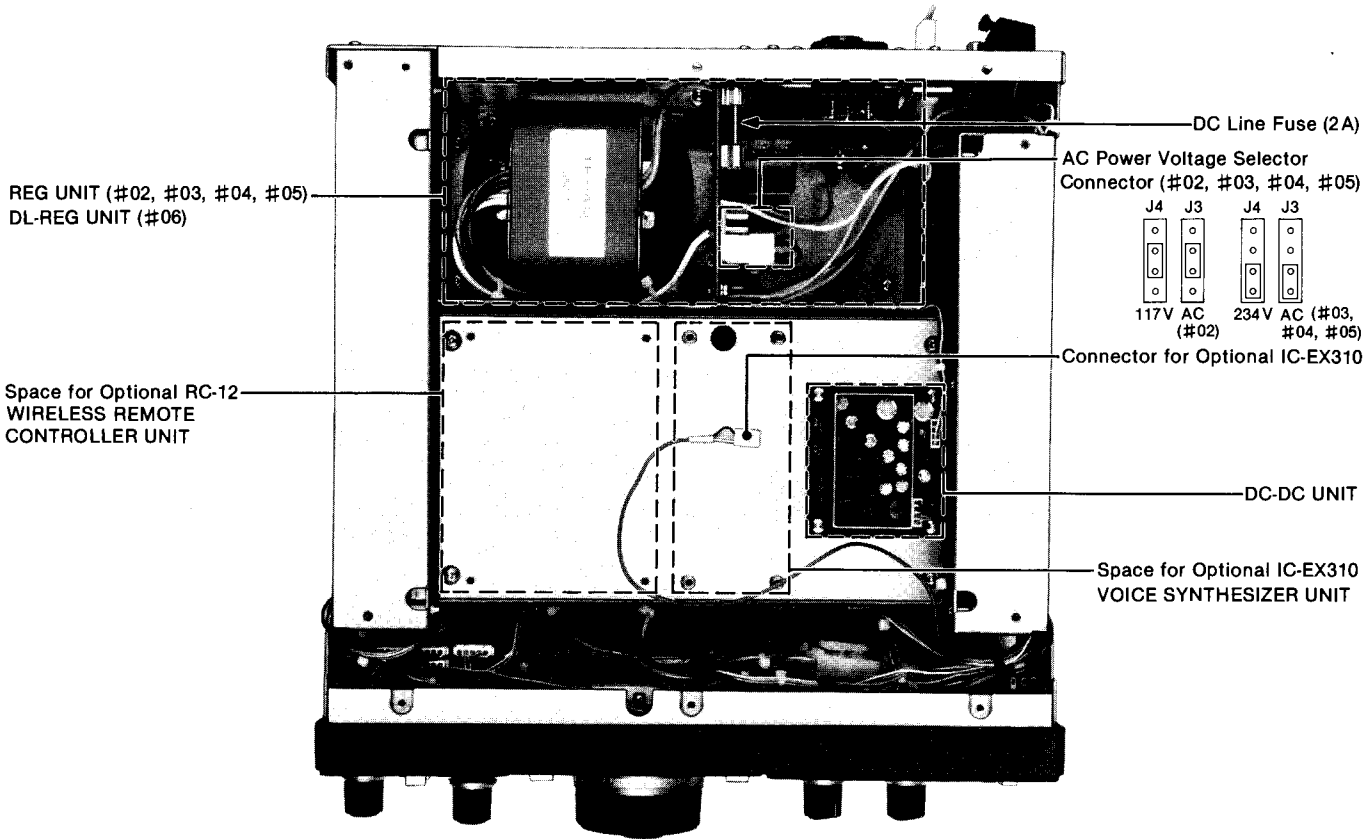
2-4 INSIDE VIEW (MAIN UNIT)



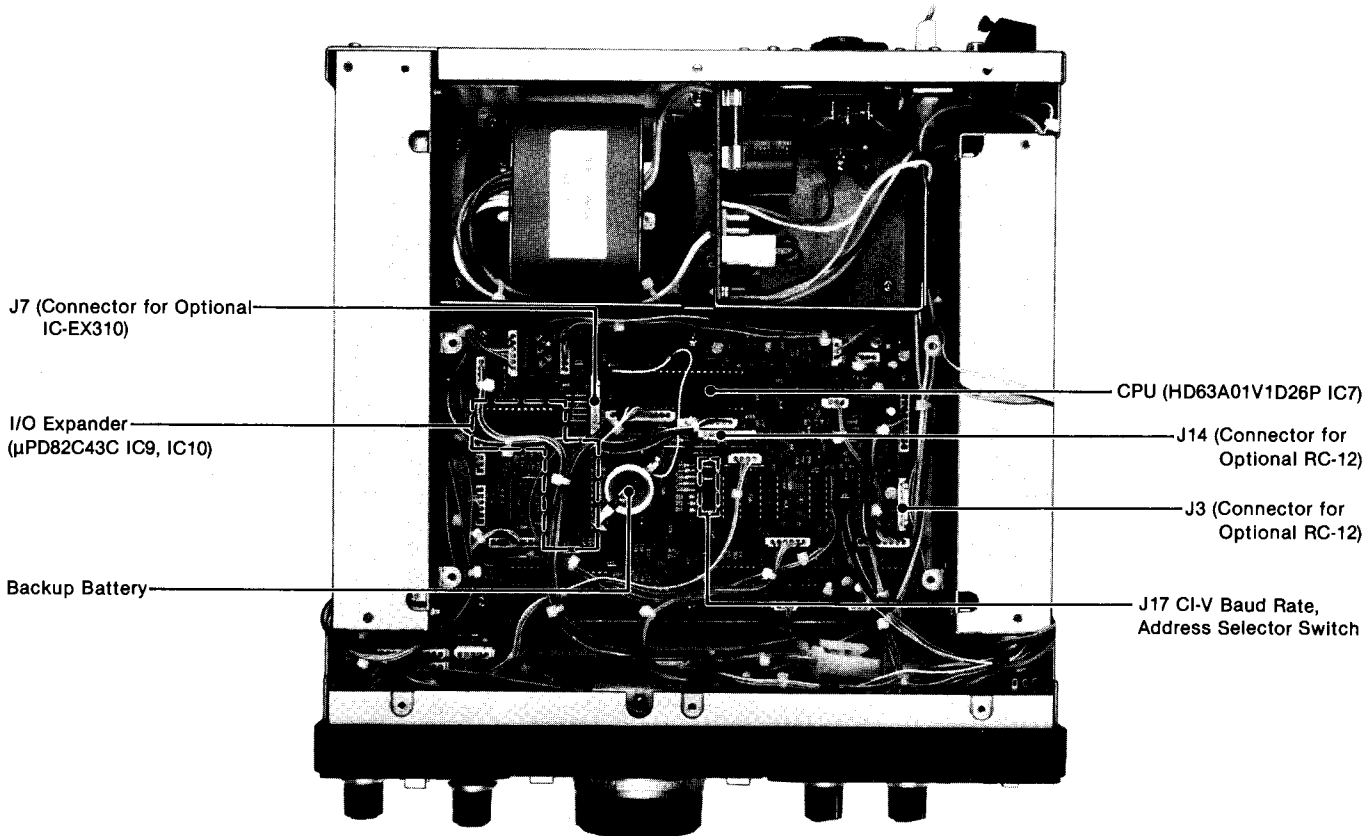
2-5 INSIDE TOP VIEW (RF AND IF UNITS)



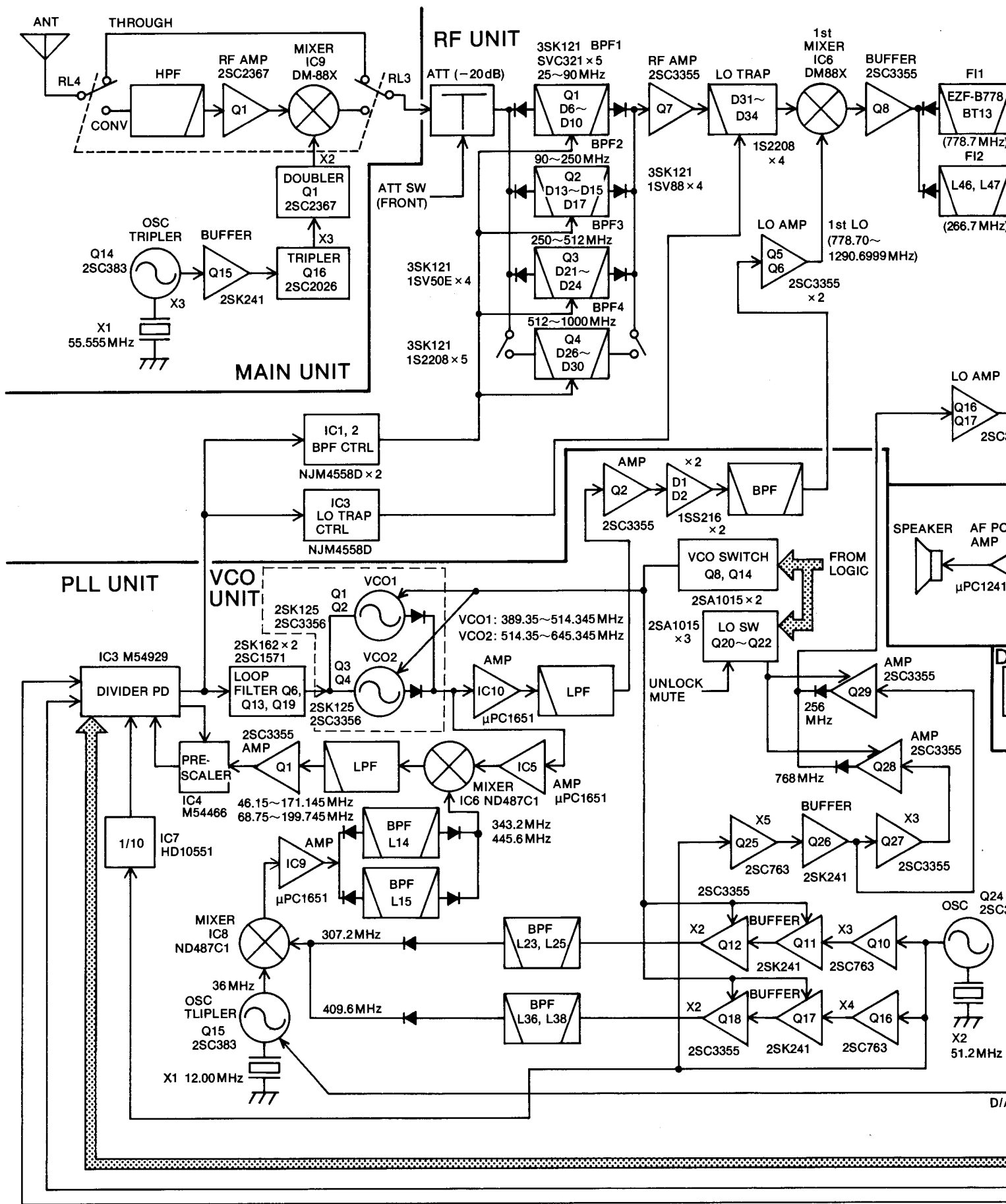
2-6 INSIDE BOTTOM VIEW (POWER SUPPLY AND DC-DC CONVERTER UNITS)

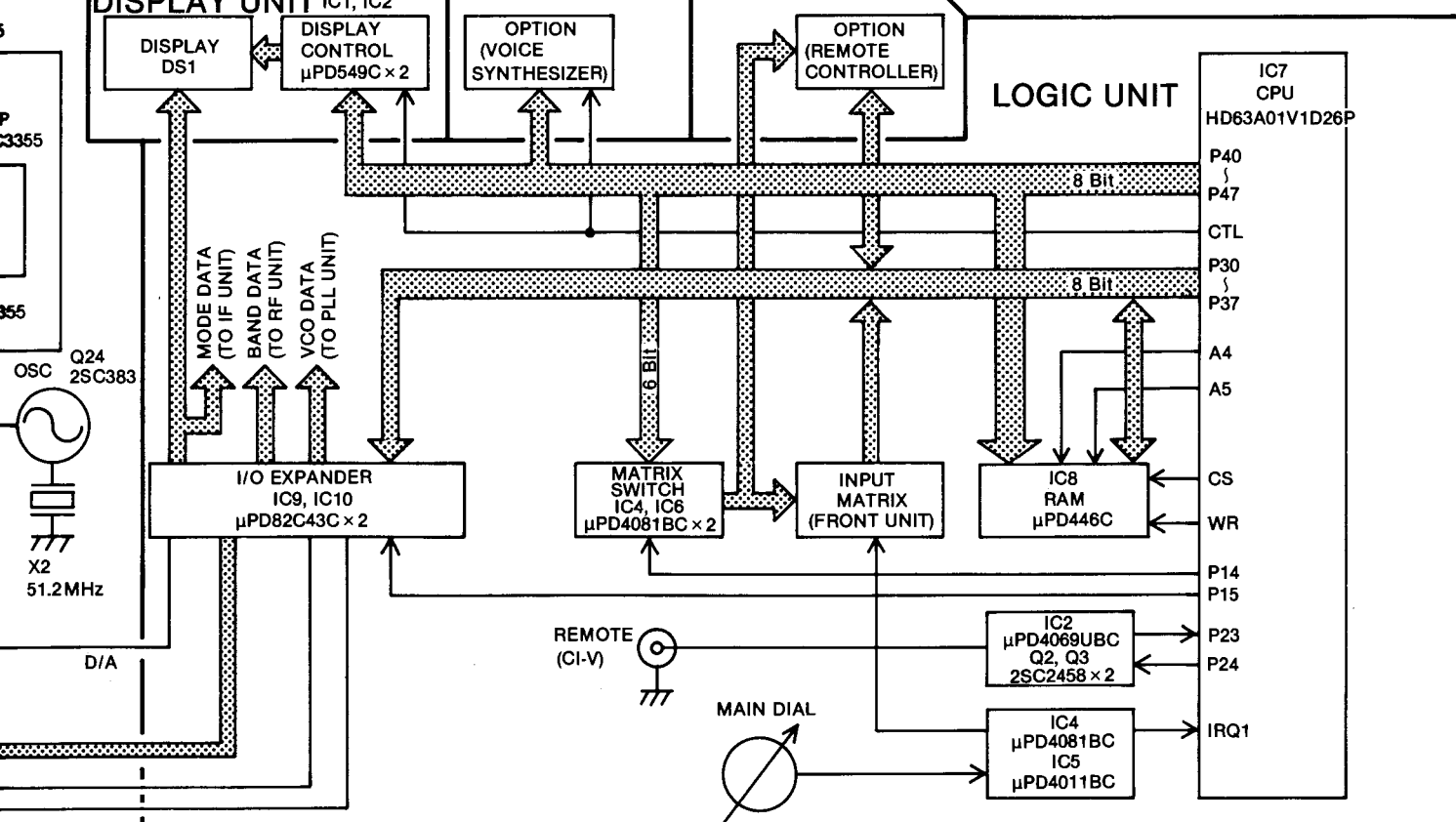
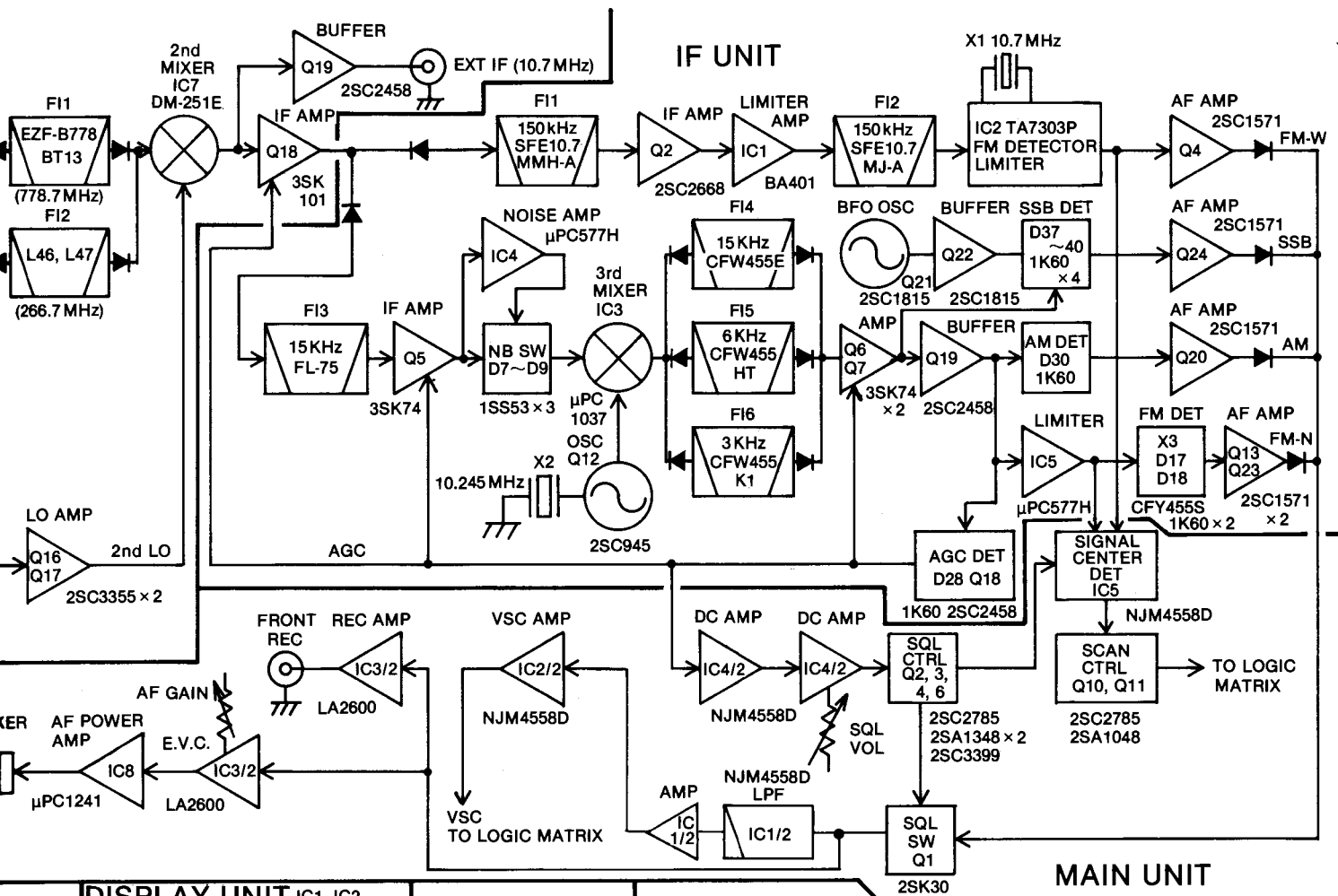


2-7 INSIDE BOTTOM VIEW (LOGIC UNIT)



SECTION 3 BLOCK DIAGRAM





4-1 RECEIVER CIRCUITS

4-1-1 CONVERTER CIRCUIT (MAIN UNIT)

Input signals from the ANTENNA CONNECTOR are switched by RF relays RL3 and RL4 on the MAIN UNIT either to through or to the converter circuit according to receive frequency.

When the receive frequency is 1025~1999.9999MHz, receive signals are applied to the converter circuit for heterodyning. This circuit converts 1025~1999.9999MHz receive signals to 25~999.9999MHz.

A HPF consisting of L9 and C87~C89 attenuates strong interfering signals in the 200MHz band.

When the receive frequency is higher than 1025MHz, signals from the ANTENNA CONNECTOR are applied to the HPF UNIT. This unit consists of a HPF and an RF amplifier. The HPF consists of a strip line, C1~C6, C8 and C10~C16. The HPF attenuates signals with frequencies below 1200MHz and prevents LO signals (1GHz) from leaking through the ANTENNA CONNECTOR. Q1 is an RF amplifier and has a gain of approximately 10dB at 1200MHz.

X1 and Q14 oscillate a frequency of 55.555MHz. Output from Q14 is multiplied by three at L3~L5, C31, C44 and C46 to form a frequency of 166.66MHz. The 166.66MHz frequency is amplified by Q15. Output from Q15 is multiplied by three at Q16 to form a frequency of 500MHz, and then the 500MHz signal (0dBm) is applied to the MAIN DOUBLER UNIT.

In the MAIN DOUBLER UNIT, output from Q16 on the MAIN UNIT is multiplied by two at Q1 to form a LO signal (1000MHz, 10dBm) for the double balanced mixer IC9.

4-1-2 20dB ATTENUATOR CIRCUIT (RF UNIT)

Receive signals from the MAIN UNIT are applied to a BPF consisting of a strip line, L3 and C1~C6. This circuit attenuates signals that exit the passband of the BPF.

IC5 switches receive signals through or to the attenuator.

The attenuator consisting of R2~R8 provides attenuation of approximately 20dB.

4-1-3 RF AMPLIFIER CIRCUIT (RF UNIT)

Receive signals are switched by diodes D5, D11, D12, D18, D19 and D25 to each RF amplifier. With frequencies higher than 512MHz, RF relays RL1 and RL2 are used for the switching.

Receive signals of 25~999.9999 or 1025~1999.9999 MHz are quadrisectioned as indicated in Table 1, and then each signal is applied to the RF amplifiers.

Each tuned amplifier has approximately 10dB gain.

Table 1 shows the relation among receive frequencies (F_{RX}) and RF amplifiers.

RECEIVE FREQUENCY F_{RX} [MHz]	RF AMPLIFIER
25~ 89.9999 1025~1089.9999	BPF1 (Q1)
90~ 249.9999 1090~1249.9999	BPF2 (Q2)
250~ 519.9999 1250~1519.9999	BPF3 (Q3)
512~ 999.9999 1512~1999.9999	BPF4 (Q4)

Table 1

(a) BPF1

Receive signals via D5 are fed to parallel resonance circuit D6, L11 and C15 to attenuate interference signals which frequencies are half of receive frequencies.

Receive signals via D6, L11 and C15 are then applied to the RF amplifier. The input tuning circuit of the RF amplifier is composed of varicaps D7, D8 and L12~L14. The output tuning circuit is composed of varicaps D9, D10 and L16~L18.

These circuits are tuned by the tuning voltage from IC1(A). In addition, D50 prevents varicaps from being charged over their maximum rated voltage.

(b) BPF2

Receive signals via D12 are fed to a parallel resonance circuit consisting of D13, L22 and C25. The circuit attenuates the interference signals which frequencies are half of receive frequencies.

A series-parallel resonance circuit is composed of varicap D14, L70 and C61. The circuit attenuates strong signals of FM and TV broadcasts in a frequency range of 80~110MHz.

The input tuning circuit of the RF amplifier is composed of Q4, varicap D15, L23~L25 and C119. The output tuning circuit is composed of D17, L27~L29 and C120.

These tuning circuits are tuned by the tuning voltage from IC1(B). In addition, D51 protects varicap from being negatively charged.

(c) BPF3

Receive signals via D19 are fed to a HPF consisting of L32, L69, C34, C35, C51 and C133. The cut-off frequency of the HPF is 240MHz.

The receive signals are then input to the RF amplifier. The input tuning circuit of the RF amplifier (Q3) is composed of D21, D22, L33 and L34. The output tuning circuit is composed of D23, D24, L36 and L37.

These circuits are tuned by the tuning voltage from IC2(A).

(d) BPF4

Receive signals via RL1 are fed to the parallel resonance circuit consisting of varicap D26, L39 and C45. The circuits attenuate interference signals to half of the receive frequency.

Input and output tuning circuits of the RF amplifier are composed of a strip line and varicaps D27~D30. By utilizing the strip line, stable operations are maintained at high frequencies.

These circuits are tuned by the tuning voltage from IC2(B).

4-1-4 RF AMPLIFIER (RF UNIT)

Signals from BPF are then applied to wide frequency band amplifier Q7 with a gain of approximately 10dB.

4-1-5 LO TRAP (TUNED NOTCH) CIRCUIT (RF UNIT)

The LO trap circuit consisting of a strip line and D31~D34 prevents the 1st LO signal leakage to the ANTENNA CONNECTOR.

The notch frequency is controlled by a control voltage from IC3(B), matching the 1st LO frequency.

A LPF consisting of a strip line and C78, C82, C89 and C137 attenuates higher harmonics of the 1st LO signal.

4-1-6 1ST LO AND 1ST MIXER CIRCUITS (RF UNIT)

A BPF consisting of a strip line, L78, C134, C59, C77 and C53~C55 attenuates unnecessary signals from the PLL UNIT.

Table 2 shows the relation among receive frequencies (F_{RX}) and 1st LO frequencies ($F_{1st LO}$).

RECEIVE FREQUENCY F_{RX} [MHz]	1st LO FREQUENCY $F_{1st LO}$ [MHz]
25~ 89.9999 1025~1089.9999	803.7~ 868.6999
90~ 249.9999 1090~1249.9999	868.7~1028.6999
250~ 519.9999 1250~1519.9999	1028.7~1290.6999
512~ 999.9999 1512~1999.9999	778.7~1266.6999

Table 2

Q5 and Q6 amplify the 1st LO signal from the PLL UNIT to approximately 10dBm. The output of Q6 is applied to IC6.

A DBM (double-balanced mixer) IC6 converts receive signals to 1st IF (778.7MHz or 266.7MHz) signals.

4-1-7 1ST IF CIRCUIT (RF UNIT)

(a) 1st IF AMPLIFIER

1st IF signals from IC6 are amplified at Q8 and they are applied to FI1 or FI2.

Table 3 shows the relation among receive frequencies (F_{RX}) and 1st IF frequencies ($F_{1st IF}$).

RECEIVE FREQUENCY F_{RX} [MHz]	1st IF $F_{1st IF}$ [MHz]
25~ 89.9999 1025~1089.9999	778.7 (FI1)
90~ 249.9999 1090~1249.9999	778.7 (FI1)
250~ 519.9999 1250~1519.9999	778.7 (FI1)
512~ 999.9999 1512~1999.9999	266.7 (FI2)

Table 3

(b) FI1 CIRCUIT

The FI1 circuit is a BPF with a center frequency of the passband at 778.7MHz and a pass-bandwidth of 5MHz. The image interference signal (757.3MHz) is attenuated by a notch filter consisting of L51, and C79.

(c) FI2 CIRCUIT

The FI2 circuit is a BPF with a center frequency of the passband at 266.7MHz and a pass-bandwidth of 5MHz. The image interference signal (245.3MHz) is attenuated by a notch filter consisting of L67, L68, and C88. Series resonance circuits consisting of L73, C86, L74, and C90 sufficiently attenuate off-band signals.

1st IF signals from the FI1 or FI2 circuits pass through a LPF consisting of a strip line and C139~C141. 1st IF signals are then fed to IC7.

4-1-8 2ND MIXER CIRCUIT (RF UNIT)

The 2nd LO signal (256MHz or 768MHz) from the PLL UNIT is fed to a LPF consisting of a strip line, C104, C105, and C146. The 2nd LO signal is amplified by Q16 and Q17 to approximately 10dBm, and is then fed to a 3dB attenuator (ATT) consisting of R116~R118.

Table 4 shows the relation among receive frequencies (F_{RX}) and 2nd LO frequencies ($F_{2nd LO}$).

RECEIVE FREQUENCY F_{RX} [MHz]	2nd LO FREQUENCY $F_{2nd LO}$ [MHz]
25~ 89.9999 1025~1089.9999	768
90~ 249.9999 1090~1249.9999	768
250~ 519.9999 1250~1519.9999	768
512~ 999.9999 1512~1999.9999	256

Table 4

A double-balanced mixer IC7 converts 1st IF signals to 2nd IF (10.7MHz) signals.

A LPF consisting of C142~C144 attenuates higher harmonics of 2nd LO signal from IC7. Q18 amplifies 2nd IF signals from IC7, and the output of Q18 is fed to the IF UNIT.

A part of 2nd IF signals from IC7 is buffer-amplified at Q19, then is applied to a LPF consisting of L60 and C114~C116. These signals are then fed to the [10.7MHz IF OUTPUT] JACK.

4-1-9 TUNED CONTROL CIRCUIT (RF UNIT)

This circuit converts the lock voltage from the PLL UNIT to tuned voltages for the LO trap (tuned notch) circuit and BPF1~BPF4.

Fig. 1 shows the relation among receive frequencies, the control voltage, the tuned voltage for BPFs and the tuned voltage for the LO trap circuit.

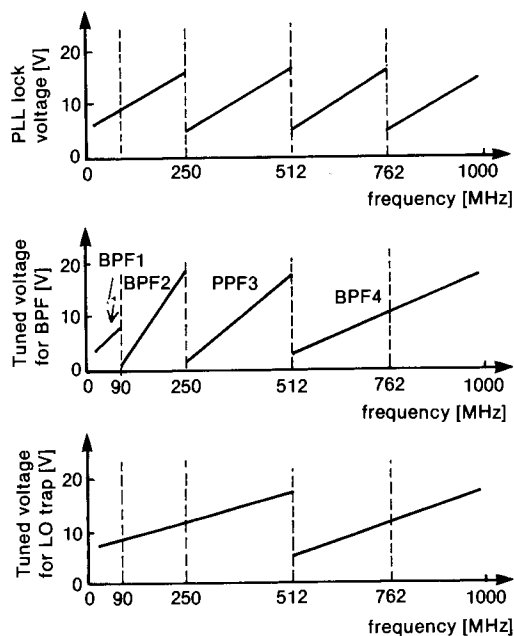


Fig. 1

IC3(A) DC-amplifies the CV from the PLL UNIT, and IC3(A) supplies IC1(A), IC1(B), IC2(A), and IC2(B) with control voltage.

IC1(A) supplies BPF1 with a tuned voltage. The gain and offset voltage of IC1(A) are controlled by R68 and R66, respectively.

IC1(B) supplies BPF2 with a tuned voltage. D53 and R157 adjust the gain of IC1(B) to fit the characteristics of BPF2.

IC2(A) supplies BPF3 with a tuned voltage.

IC2(B) supplies BPF4 with a tuned voltage. The gain and offset voltage of IC2(B) are switched by Q9 and Q10, respectively, to convert the variations of two PLL lock voltages to a continuous tuned voltage.

IC3(B) supplies a tuned voltage with the LO trap (tuned notch) circuit. The offset voltages of IC3(B) are switched by Q11 to convert the variations of two PLL lock voltages to a continuous tuned voltage.

4-1-10 POWER SOURCE SWITCHING CIRCUIT (RF UNIT)

IC5 switches the power source of each RF amplifier and attenuators by signals from the LOGIC UNIT.

Q21 and D52 are voltage converters and regulators of the power source for IC5.

An inverter circuit consisting of Q12 and R106 reverses ATT signals from the LOGIC UNIT to make THROUGH signal.

Q14 and Q15 are power source switches for RF relays RL1 and RL2. Q14 and Q15 turn ON via BPF4 signals.

BPF4 signals control IC4, and IC4 outputs positive voltage to pin 7 (when the receive frequency is 25~511.9999 or 1025~151.9999MHz) or pin 1 (when the receive frequency is 512~999.9999 or 1512~1999.9999MHz).

4-1-11 AGC BUFFER CIRCUIT (RF UNIT)

An AGC voltage buffer Q20 converts AGC voltage variation (4~0V) to the voltage variation that is required for Q1~Q4.

4-1-12 FM (wide) CIRCUIT (IF UNIT)

In FM (wide) mode, 2nd IF signals (10.7MHz) from the RF UNIT are impedance-converted at L1, and fed to F11. 2nd IF signals from F11 are amplified at Q2 and IC1. The gain of Q2 and IC1 is approximately 40dB.

2nd IF signals are then applied to IC2, and are limiter amplified and then detected to obtain AF signals.

AF signals from IC2 are applied to buffer amplifier Q4. This circuit switches AF signals and matches the level of AF signals with other modes.

4-1-13 AGC CIRCUIT FOR FM (wide) MODE (IF UNIT)

IC2 (pin 3) generates a voltage corresponding to the signal strength of IF signals. Q30 is a buffer for DC voltage. When IF signals are strong, Q30 turns Q26 ON to cut off the AGC voltage.

When IF signals become stronger the AGC maintains the voltage of IC2 (pin 3) at a constant value.

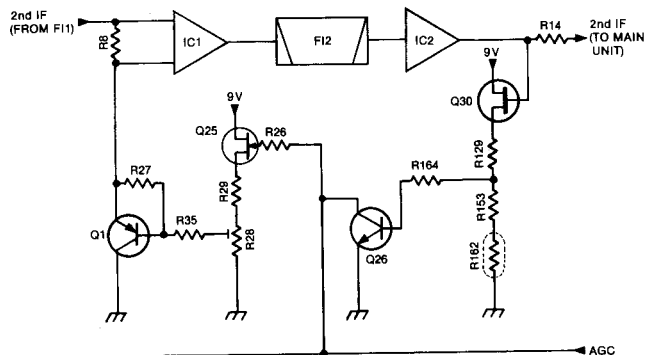


Fig. 2

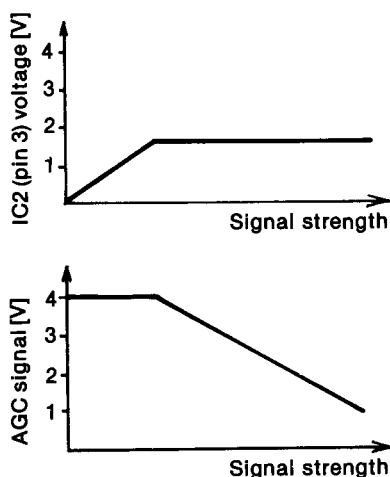


Fig. 3

4-1-14 2ND IF CIRCUIT FOR FM (narrow), SSB AND AM MODES (IF UNIT)

In FM (narrow) mode, SSB mode, or AM mode, 2nd IF signals (10.7MHz) are applied to FI3. FI3 sufficiently attenuates unrequired signals. The 2nd IF signals are then amplified at Q5. The gain from L4 to L5 is approximately 28dB.

4-1-15 NOISE BLANKER CIRCUIT (IF UNIT)

Part of the receive signals from Q5 is amplified by IC4 and detected by D32 and D33. AGC detector Q9 controls the gain of IC4 via DC amplifier Q29. The time constant of the noise blanker circuit is determined by R156, R157 and C65. Q10 turns ON or OFF according to the detected pulses. While pulse-type noise is received, Q10 turns Q11 ON. The noise blanker switch consisting of D7 and D9 is reverse-biased, and the 2nd IF signals are cut OFF.

4-1-16 3RD MIXER AND 3RD LO CIRCUIT (IF UNIT)

2nd IF signals from the noise blanker switch are applied to double-balanced mixer IC3. IC3 converts 2nd IF signals (10.7MHz) to 3rd IF (455kHz) signals utilizing 3rd LO signals (10.245MHz) which are oscillated by X2 and Q12.

Output signals from IC3 is impedance-converted by L13 and C25, and is fed to the 3rd IF circuit.

4-1-17 3RD IF CIRCUIT (IF UNIT)

3rd IF (455kHz) signals from the noise blanker switch are then applied to filters corresponding to each mode.

FI4 (pass-bandwidth 15kHz) is a filter for FM (narrow) and AM modes. FI5 (pass-bandwidth 6kHz) is a filter for AM mode. FI6 is a filter for SSB mode. (pass-bandwidth 2.8kHz.) Ceramic filters are used for all of these.

In AM mode, FI4 and FI5 can be selected by J8 on the IF UNIT.

Q6 and Q7 amplify 3rd IF signals. R165 is a thermistor for temperature compensation.

4-1-18 BFO (BEAT FREQUENCY OSCILLATOR) CIRCUIT AND SSB DETECTOR CIRCUIT (IF UNIT)

A BFO (Beat Frequency Oscillator) consists of Q21 and Q22 and supplies to the SSB detector circuit a beat frequency signal.

In LSB mode, Q31 is turned ON by the LSB mode (LSB) signal from the EF UNIT, and the capacitance of C133 and C134 is added to L15, C130, and C119 to shift the oscillation frequency 3kHz up.

Output signal from the 3rd IF circuit and a beat frequency signal from the BFO circuit are applied to the SSB detector circuit consisting of D37~D40. This circuit detects SSB signals.

AF amplifier Q24 switches AF signals from the SSB detector circuit and Q24 matches the level of AF signals with other modes.

4-1-19 FM (narrow) DETECTOR CIRCUIT (IF UNIT)

In FM (narrow) mode, 3rd IF signals from Q7 are applied to Q19, and then are limiter-amplified by IC5 to remove AM components in 3rd IF signals. Ceramic discriminator X3 is used for FM detection to obtain AF signals.

Q13 and Q23 form a deemphasis circuit and a HPF to attenuate low frequency (below 200Hz) components in AF signals.

4-1-20 AM DETECTOR CIRCUIT (IF UNIT)

In AM mode, 3rd IF signals from Q19 are detected at D30. AF signals from D30 are amplified by Q20.

4-1-21 AGC CIRCUIT FOR FM (narrow), SSB AND AM MODES (IF UNIT)

In FM (narrow) mode, SSB mode and AM mode, a part of 3rd IF signals from Q19 are applied to AGC detector circuit D28 to rectify 3rd IF signals. The DC voltage from D28 is DC-amplified at Q18.

In AM mode and SSB mode, Q16 turns Q17 ON and C89 is applied to C91, resulting in a longer time constant than in FM (narrow) mode. The rise (attack) time constant for AGC is determined by C89, C91 and R114, and the fall (delay) time constant is determined by R113.

The AGC voltage (when the IC-R7000 receives no signal) is offset by approximately 4V by R117 and R116.

Q18 supplies IF, RF and MAIN UNITS with the AGC signal.

4-1-22 5kHz NOTCH CIRCUIT (IF UNIT)

AF signals in each mode are fed to a 5kHz notch filter consisting of IC6(A), R167~R172, and C135~C140. This circuit attenuates the 5kHz AF signal generated by leakage of the PLL reference frequency. In this circuit, the Q-factor can be adjusted by R171.

IC6 (A) sends the AF signals to the MAIN UNIT.

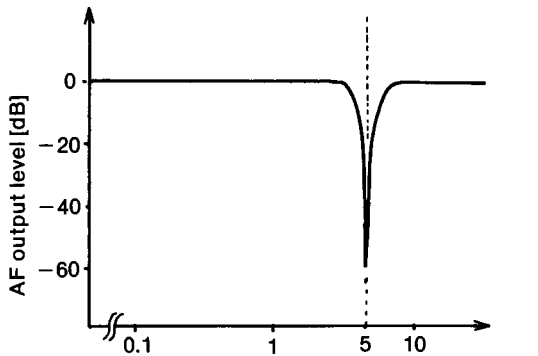


Fig. 4 Audio frequency [kHz]

4-1-23 POWER SUPPLY CIRCUIT (IF UNIT)

Q14 and Q15 switch 9V in FM (wide) mode and other modes. In FM (wide) mode, Q15 is switched ON, while Q14 is switched ON in other modes.

Mode signals from the LOGIC UNIT switch the AF amplifier of each mode and IF filters by the diode matrix composed of D22~D26, D29, D45 and D46.

4-1-24 NOISE SQUELCH CIRCUIT (IF UNIT)

Noise squelch operates in FM (narrow) mode and AM mode.

A part of AF signals from X3 is fed to active filter IC6(B). The noise components of AF signals pass through the active filter, and are double voltage rectified by D35 and D36. The voltage from D35 and D36 is then charged to C30. The voltage of C30 is fed to the squelch circuit in the MAIN UNIT as squelch voltage (SQLV).

(MAIN UNIT)

Noise voltage from the IF UNIT is DC-amplified at IC7(A). The output of IC7(A) passes through a voltage limiter circuit consisting of D28, D29 and R116, and then enters comparator IC7(B). The reference voltage of IC7(B) is varied by the [SQUELCH] CONTROL, and controls the squelch threshold level.

4-1-25 METER SQUELCH CIRCUIT (MAIN UNIT)

AGC signal from the IF UNIT is applied to IC4(A), and is inversion-amplified. Reference voltage of the meter squelch is varied by the [SQUELCH] CONTROL, and is applied to IC4(B) via Q9 and D19.

The meter squelch is switched ON and OFF depending on the output of the above comparator.

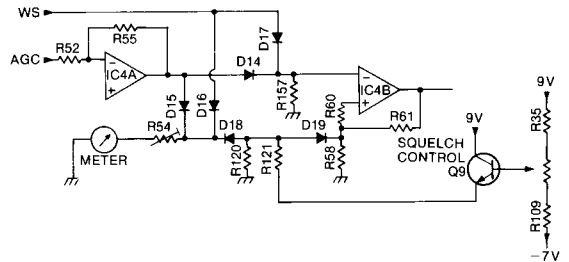


Fig. 5

4-1-26 CENTER DETECTOR CIRCUIT

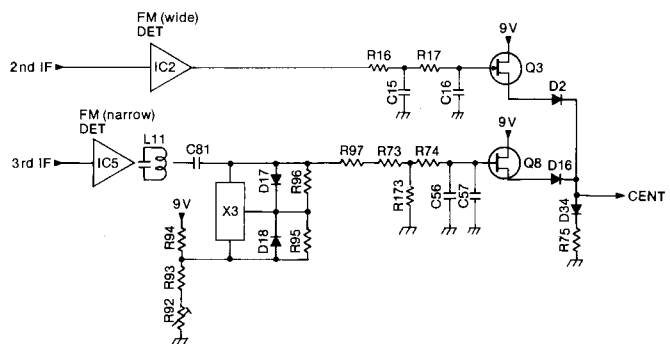


Fig. 6

(IF UNIT)

Output voltage of the FM (wide) and FM (narrow) detector circuits differ from each other in the center frequency of IF signals. Therefore, in FM (narrow) mode the offset voltage is applied to the output of the detector circuit by R92~R94, and is adjusted at R92 to the same output voltage of FM (wide) mode. Q3 and Q8 are DC voltage buffers.

(MAIN UNIT)

CENT signal is applied to a window comparator consisting of IC5(A) and IC5(B). The offset voltage is adjusted at R66 to make the window comparator output 0V when the IC-R7000 receives the center frequency of the signal. IC5(A) and IC5(B) output the STOP signal to the LOGIC UNIT.

4-1-27 SQUELCH SWITCH CIRCUIT (MAIN UNIT)

The base of Q2 receives output voltage from IC7(B) via D27 when the noise squelch is activated, or output voltage from IC4(B) via D20 when the meter squelch is activated. Q2 switches Q3. Q6 turns Q1 (the squelch switch) ON and OFF, and Q1 switches AF signals. The collector voltage of Q3 is applied to the base of Q4. The, and the output of Q4 lights up the "SIG" INDICATOR on the FREQUENCY DISPLAY.

4-1-28 VSC (Voice Scanning Control) CIRCUIT (MAIN UNIT)

This circuit sends the VSC signal to the LOGIC UNIT when the IC-R7000 receives signals with AF signal components.

Output from Q1 is fed to IC1(A). An active low-pass filter consisting of IC1(A), R7~R12, and C6~C10 blocks signals higher than 1kHz to prevent circuit malfunctions. Output from IC1(A) is amplified by IC1(B). D2 detects AF signal components in the output of IC1(B), and then the detected voltage is charged at C15. The voltage of C15 is applied to comparator IC2(A). IC2(A) outputs "HIGH" output to pin 7 only when receiving signals with AF signal components.

Q5 and Q7 control relay RL1 for the [RECORDER-REMOTE] JACK. RL1 turns ON when the squelch opens. VSC operation is given priority even when the squelch opens. When the VSC function is activated, the MO signal from the LOGIC UNIT is applied to Q7, and RL1 turns OFF.

4-1-29 SCANNING CONTROL CIRCUIT (MAIN UNIT)

Output from the center detector circuit and the MUTE signal from the LOGIC UNIT is applied to the base of Q10. Q10 turns OFF only when the CENT signal and MUTE signal is "LOW" (the squelch opens when the receiver is tuned to the center frequency). When Q10 turns OFF, a STOP signal is sent to the LOGIC UNIT via R72 and Q11, and scanning stops.

Q11 switches the STOP signal OFF when the [SQUELCH] CONTROL is turned fully counterclockwise.

4-1-30 METER CIRCUIT (MAIN UNIT)

(a) S-METER CIRCUIT

In FM (wide) mode, the METER receives S-meter (SM) signals via D16 when receiving a strong signal, or SM signals from IC4(A) via D15 when receiving a weak signal.

In FM (narrow), SSB or AM modes, the METER receives SM signals via D18.

(b) CENTER METER CIRCUIT

CENT signal from the IF UNIT is inversion-amplified at IC2(B). Output voltage from IC2(B) is applied to the METER as a center meter (CM) signal.

In SSB mode, Q17 turns the center (CENT) signal from IC5 and the center meter (CM) signal from IC2(B) OFF.

4-1-31 AUDIO FREQUENCY (AF) AMPLIFIER CIRCUIT (MAIN UNIT)

Output from Q1 is applied to IC3(B) (pin 1). The [AF GAIN] CONTROL controls the voltage of IC3(B) (pin 13) to vary the AF gain.

Output from IC3(B) is amplified up to a sufficient AF level by IC8 to drive the speaker SP1.

Output from Q1 is also applied to buffer amplifier IC3(A). Output from IC3(A) is fed to the [RECORDER-REMOTE] JACK.

Q18 amplifies SPK signals from the optional IC-EX310 VOICE SYNTHESIZER UNIT, and signals from Q18 are applied to IC3(B).

4-2 POWER SUPPLY CIRCUITS

4-2-1 REG CIRCUIT (REG UNIT)

The AC power source from the AC POWER SOCKET is fed to T1.

Voltage from T1 is rectified by D1, next it is then fed to the stabilization circuit consisting of Q1, Q2, and Q3, and then it is supplied to other circuits.

4-2-2 DC-DC CONVERTER CIRCUIT (DC-DC UNIT)

This circuit converts 13.8V DC from the REG UNIT to -7V, -12V and +24V DC voltage. This circuit consists of a oscillation circuit, a voltage step up/down transformer, and three regulator circuits.

(MAIN UNIT)

RL2 is a power ON/OFF switch operated by the optional RC-12 WIRELESS REMOTE CONTROLLER. The power control (POC) signal from the RC-12 switches Q13 and Q13 switches RL12.

IC6 is a voltage regulator that supplies a stabilized 9V to the MAIN UNIT, IF UNIT and RF UNIT.

4-3 PLL CIRCUIT (PLL UNIT)

This circuit generates the 1st LO signals (778.70~

1290.699MHz) for the 1st mixer, and 2nd LO signals (256 or 768MHz) for the 2nd mixer.

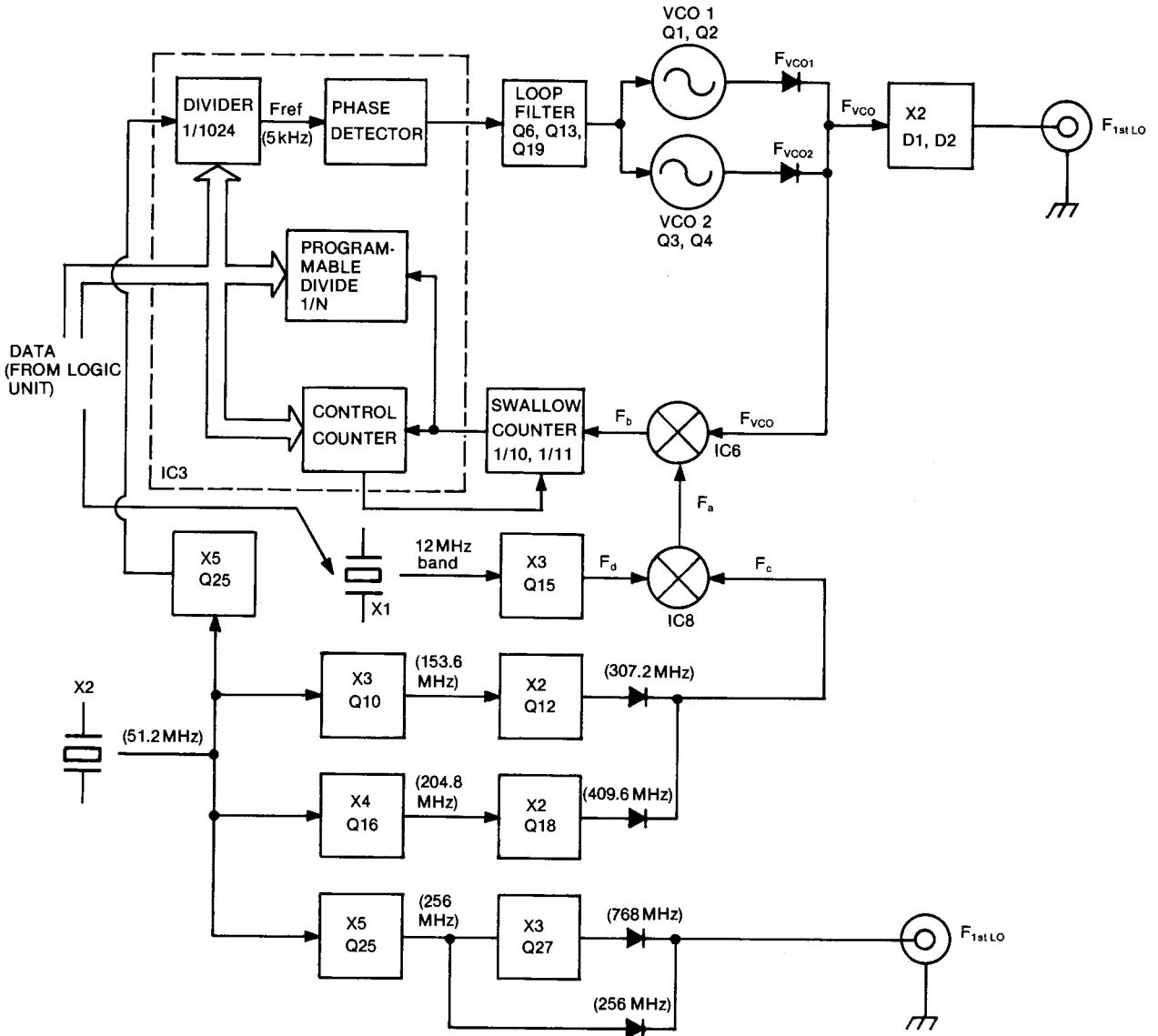


Fig. 7

4-3-1 REFERENCE OSCILLATOR CIRCUIT

This circuit consists of crystal X1 and Q24.

The output (51.2MHz) of Q24 is used to make for the reference frequency of the PLL (F_{ref}), the LO frequency in the PLL loop (F_a), and 2nd LO signal ($F_{2nd LO}$).

In addition, the output of Q24 is divided into 1/10 at IC7, and then fed to IC3.

4-3-2 2_{ND} LO CIRCUIT

(a) 256 MHz 2_{ND} LO SIGNAL CIRCUIT

The signal from Q24 is multiplied by five at Q25, and passes through L41~L43, Q26, and Q29. Q29 outputs a 2nd LO signal ($F_{2nd LO}=256\text{MHz}$, 0dBm).

(b) 768 MHz 2_{ND} LO SIGNAL CIRCUIT

The signal from Q26 is multiplied by three at Q27, and Q28 outputs the another 2nd LO signal ($F_{2nd LO}=768\text{MHz}$, 0dBm).

The band signal (BS) switches the above two kinds of 2nd LO signals according to the receive frequency.

Q20 and Q21 turns OFF according to the MUTE signal when in an unlocked condition or by the BLK signal when in blank memory channel.

4-3-3 PLL LOOP SYSTEM

This circuit generates the 1st LO signal for the RF UNIT.

(a) VCO CIRCUIT

The VCO circuit consists of the λ -resonator circuit with a micro-strip line. This allows for a variable range of 389.35~645.35MHz by two VCOs.

IC3 controls oscillation frequencies of this circuit. The VCO selector (VS) signal switches VCOs according to receive frequencies.

(b) PLL LOOP CIRCUIT

The VCO output is amplified by IC10 and passes through a LPF, Q2 and is multiplied by two at a doubler circuit consisting of D1, D2 and L5. It is fed to the BPF, and then is applied to the MAIN UNIT as a 1st LO signal.

A part of the VCO output signals (F_{vco}) is amplified by IC5, and is mixed with the LO signal in the PLL loop (F_a) from the VCO UNIT at IC6 for heterodyning. The relation of F_b , F_{vco} and F_a is as follows:

$$F_b = F_{vco} - F_a \quad (\text{See Fig. 7})$$

The signal from IC6 (F_b) passes through L9, L10, and Q1, and it is fed to IC4. The limiter D5 and D6 prevents excessive signal input.

(c) LO CIRCUIT IN PLL LOOP

When F_{RX} is between 25 and 249.9999MHz or 512 and 761.9999MHz:

The output of X2 (51.2MHz) is multiplied by three at Q10. The signal from Q10 passes through L18~L20, and Q11, and then it is multiplied by two at Q12 to obtain F_c (307.2MHz). The output of Q12 passes through L23 and L25 and then is fed to mixer IC8.

When F_{RX} is between 250 and 511.9999MHz or 762 and 999.9999MHz:

The output of X2 (51.2MHz) is multiplied by four at Q16. The signal from Q16 passes through L31~L33, and Q17 and then is multiplied by two at Q18 to obtain F_c (409.6MHz). The output of Q18 passes through L36 and L38 and then is fed to mixer IC8.

X1 oscillates 12MHz band signals, and the DA signal from the LOGIC UNIT controls oscillation frequencies of X1. Signals from X1 are multiplied by three at Q15 to obtain F_d .

F_d varies between 36 and 36.00495MHz in 50Hz steps. In addition, F_d shifts $\pm 0.75\text{kHz}$ depending on the [USB/LSB] SELECTOR SWITCH. The output of the 1st LO signal (F_{1stLO}) is obtained by double multiplication, so F_{1stLO} shifts $\pm 1.5\text{kHz}$.

F_d and F_c are mixed at IC8 to obtain F_a (the LO frequency in the PLL loop). The relation of F_a , F_c and F_d is as follows:

$$F_a = F_c + F_d \quad (\text{See Fig. 7})$$

4-4 LOGIC CIRCUIT (LOGIC UNIT)

4-4-1 CPU

IC7 (a high-speed 8-bit COMS CPU) controls data such as mode, receive band, VCOs and expanded output ports IC9 and IC10.

The CPU's port addressing is shown in Fig. 9.

CPU PIN CONNECTION

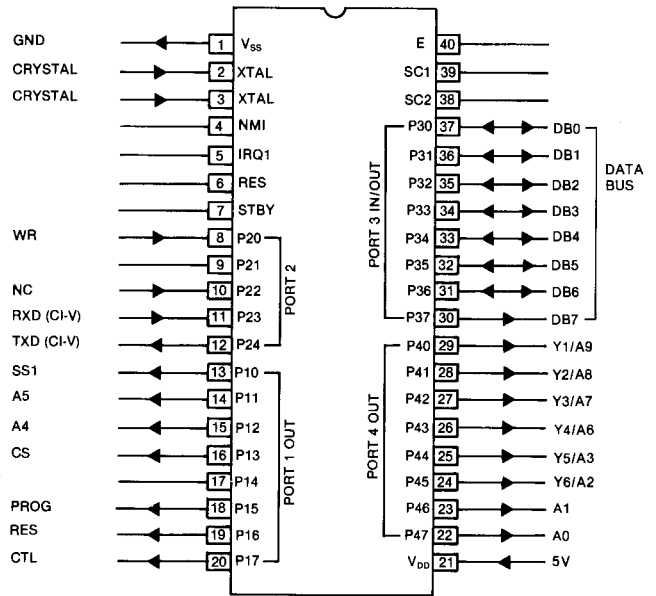


Fig. 8

4-4-2 MATRIX ALLOCATION

The matrix allocation is shown in Fig. 10.

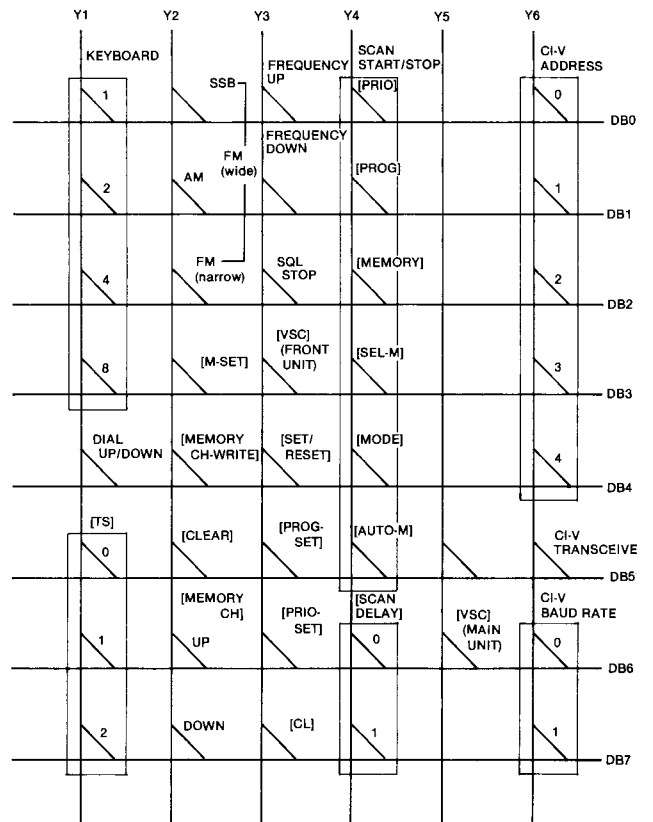


Fig. 9

(a) Y1 → DB0~DB3 (KEYBOARD, MEMORY-CH ENTER)
 Following is a matrix for the KEYBOARD, MEMORY-CH ENTER and the optional RC-12 WIRELESS REMOTE CONTROLLER.

KEY \ Y1 →	DB0	DB1	DB2	DB3	HEX CODE
1	H	L	L	L	1
2	L	H	L	L	2
3	H	H	L	L	3
4	L	L	H	L	4
5	H	L	H	L	5
6	L	H	H	L	6
7	H	H	H	L	7
8	L	L	L	H	8
9	H	L	L	H	9
0	L	H	L	H	A
*1 MEMORY CH ENTER	H	H	L	H	B
•	L	L	H	H	C
ENT	H	L	H	H	D
*2 CE	L	H	H	H	E

*1: Used in [MEMORY CH] CONTROL.
 *2: Used in the optional RC-12 WIRELESS REMOTE CONTROLLER.

Table 5

(b) Y1 → DB4 (DIAL UP/DOWN)
 When a TUNING CONTROL clock signal is input, the following results will occur.

Y1 → DB4	RESULT
H	The receive frequency increases.
L	The receive frequency decreases.

Table 6

(c) Y1 → DB5~7 [TS]
 This matrix sets frequency steps.

TS \ Y1 →	DB5	DB6	DB7
0.1kHz	L	L	L
1kHz	H	L	L
5kHz	L	H	L
10kHz	H	H	L
12.5kHz	L	L	H
25kHz	H	L	H

Table 7

(d) Y3 → DB0~1 (FREQUENCY UP/DOWN)
 This matrix increments receive frequencies for the optional RC-12 WIRELESS REMOTE CONTROLLER.

(e) Y3 → DB2 (SQUELCH STOP)
 This matrix stops the scan when the squelch opens.

(f) Y4 → DB6~7 [SCAN-DELAY]
 This matrix sets the scan delay time.

SETTING \ Y4 →	DB6	DB7
OFF	H	L
5 (seconds)	L	H
15 (seconds)	H	H
∞ (infinity)	L	L

Table 8

(g) Y6 → DB0~4 (CI-V ADDRESS)
 This matrix sets the address for the *CI-V. The desired address for IC-R7000 may be 1 to 31 and consists of 5 bits.

*CI-V: ICOM Communication Interface-V.

(h) Y6 → DB5 (CI-V TRANSCEIVE)
 This matrix sets the transceive operation for the CI-V.

(i) Y6 → DB6~7 (CI-V BAUD RATE)
 This matrix sets the baud rate.

BAUD RATE \ Y6 →	DB6	DB7
76800	L	L
9600	H	L
1200	L	H
300	H	H

Table 9

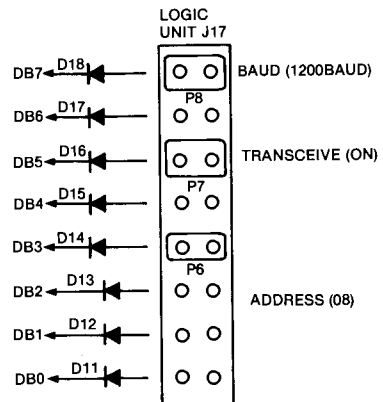


Fig. 10

4-4-3 CPU RESET CIRCUIT

The CPU reset circuit detects the power supply voltage to reset the CPU.

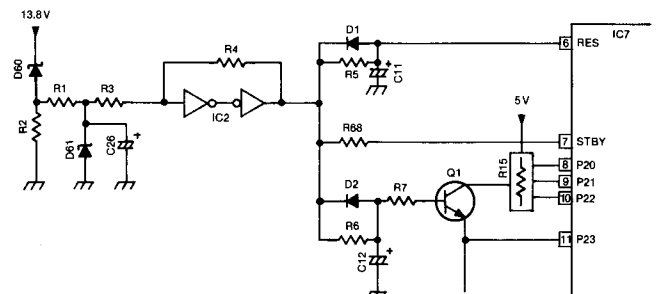
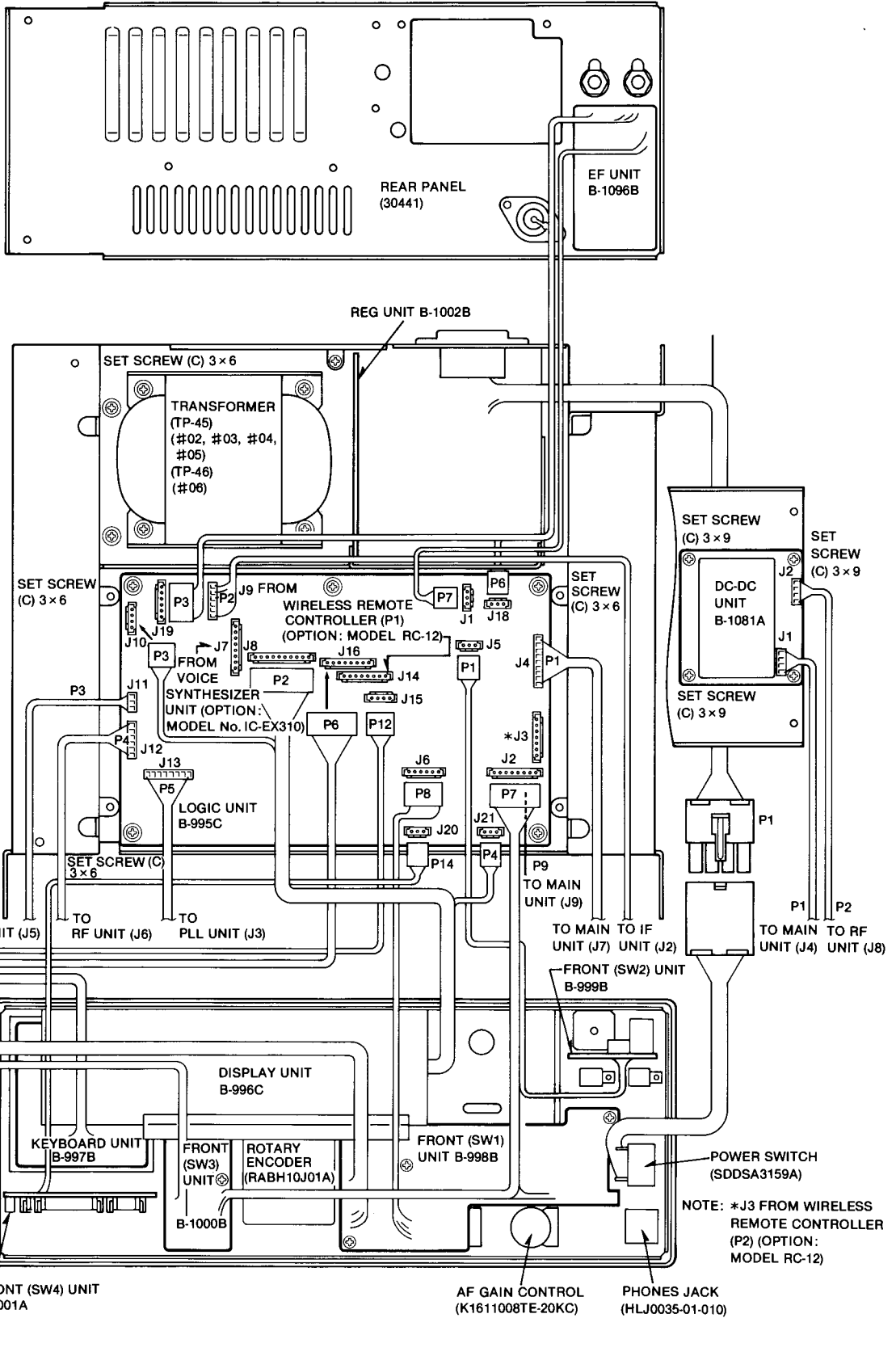


Fig. 11

5-5 BOTTOM SIDE CONNECTOR CONNECTIONS



6-1 PREPARATION BEFORE SERVICING

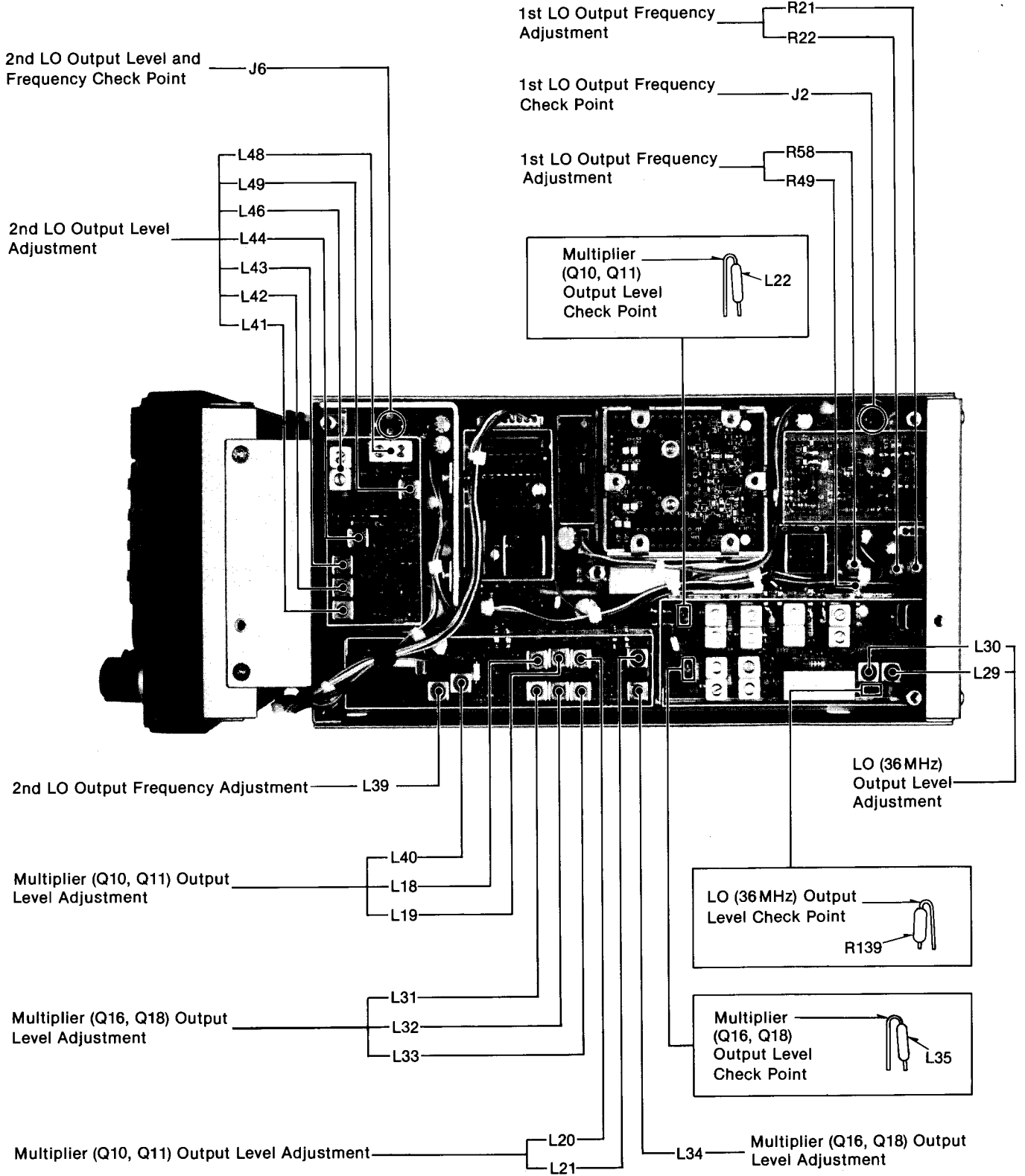
1. Detach the power cable and turn OFF the POWER SWITCH before performing any work on the receiver.
2. DO NOT short circuit components while marking adjustments.
3. Use an insulated tuning tool for all adjustments.
4. DO NOT force any of the variable components. Tune them slowly and smoothly.
5. Follow the instructions exactly. If an indicated result is not obtained, repeat the instruction until the correct result is obtained.
6. Check the condition of connectors, solder joints and screws when adjustments are complete. Confirm that components do not touch each other.
7. Confirm defective operation of the receiver first when checking an out-of-service unit.
8. Use the correct tools and test equipment.
9. To remove the receiver covers, refer to SECTION 5-1.
10. Re-check for the suspected malfunction with the POWER SWITCH ON.
11. Check the defective circuit. Measure the DC voltages of the collector, base and emitter of each transistor.

6-2 PLL ADJUSTMENT

INSTRUMENTS REQUIRED	CONNECTIONS
(1) FREQUENCY COUNTER • FREQUENCY RANGE : 0.1MHz~1.3GHz • ACCURACY : BETTER THAN ± 1 ppm • SENSITIVITY : 100mV OR BETTER (2) RF VOLTMETER • MEASURING RANGE : AT LEAST 500MHz (3) OSCILLOSCOPE • FREQUENCY RANGE : DC~50MHz • MEASURING RANGE : 0.01~10V (4) VOLTMETER • INPUT IMPEDANCE : 50k Ω /DC OR BETTER	<pre> graph TD FC[FREQUENCY COUNTER] -- TO J6, J2 --> R[RECEIVER] RFV[RF VOLT-METER] -- TO J6 --> R OS[OSCILLOSCOPE] -- TO R139 --> R VM[VOLT-METER] -- TO L22, L35 --> R </pre>

ADJUSTMENT	ADJUSTMENT CONDITIONS	MEASUREMENT		VALUE	ADJUSTMENT POINT	
		UNIT	LOCATION		UNIT	ADJUST
LO (36MHz) OUTPUT LEVEL	1 • Mode: any	PLL	Connect an oscilloscope to R139.	Maximum (More than 100mVp-p)	PLL	L29, L30
MULTIPLIER (Q10, Q11) OUTPUT LEVEL	1 • Display freq.: 249.9999MHz		Connect a voltmeter to L22.	Minimum (5~6V)		L18, L19, L20, L21, L40
MULTIPLIER (Q16, Q18) OUTPUT LEVEL	1 • Display freq.: 250.0000MHz		Connect a voltmeter to L35.	Minimum (5~6V)		L31, L32, L33, L34
2nd LO OUTPUT LEVEL	1 • Display freq.: 512.0000MHz		Connect a spectrum analyzer or RF voltmeter to J6.	Maximum (Approx. 0dBm/0.22V)		L41, L42, L43, L44, L49
	2 • Display freq.: 511.9999MHz	L46, L48				
NOTE: If measured value is not within $-2\text{dBm} \sim +3\text{dBm}$ (0.18V~0.32V), repeat steps 1 and 2.						
2nd LO OUTPUT FREQUENCY	1 • Display freq.: 511.9999MHz	PLL	Connect a frequency counter to J6.	768.0000 MHz	PLL	L39
	2 • Display freq.: 512.0000MHz			256.0000 MHz		Verify
1st LO OUTPUT FREQUENCY	1 • Mode: FM • Display freq.: 145.0000MHz		Connect a frequency counter to J2.	923.7000 MHz		R58
	2 • Display freq.: 149.9999MHz			923.6999 MHz		R49
NOTE: Repeat steps 1 and 2.						
	3 • Mode: SSB • USB/LSB SELECTOR SWITCH: LSB • Display freq.: 145.0000MHz	PLL	Connect a frequency counter to J2.	923.6985 MHz	PLL	R22
	4 • USB/LSB SELECTOR SWITCH: USB • Display freq.: 145.0000MHz			923.7015 MHz		R21

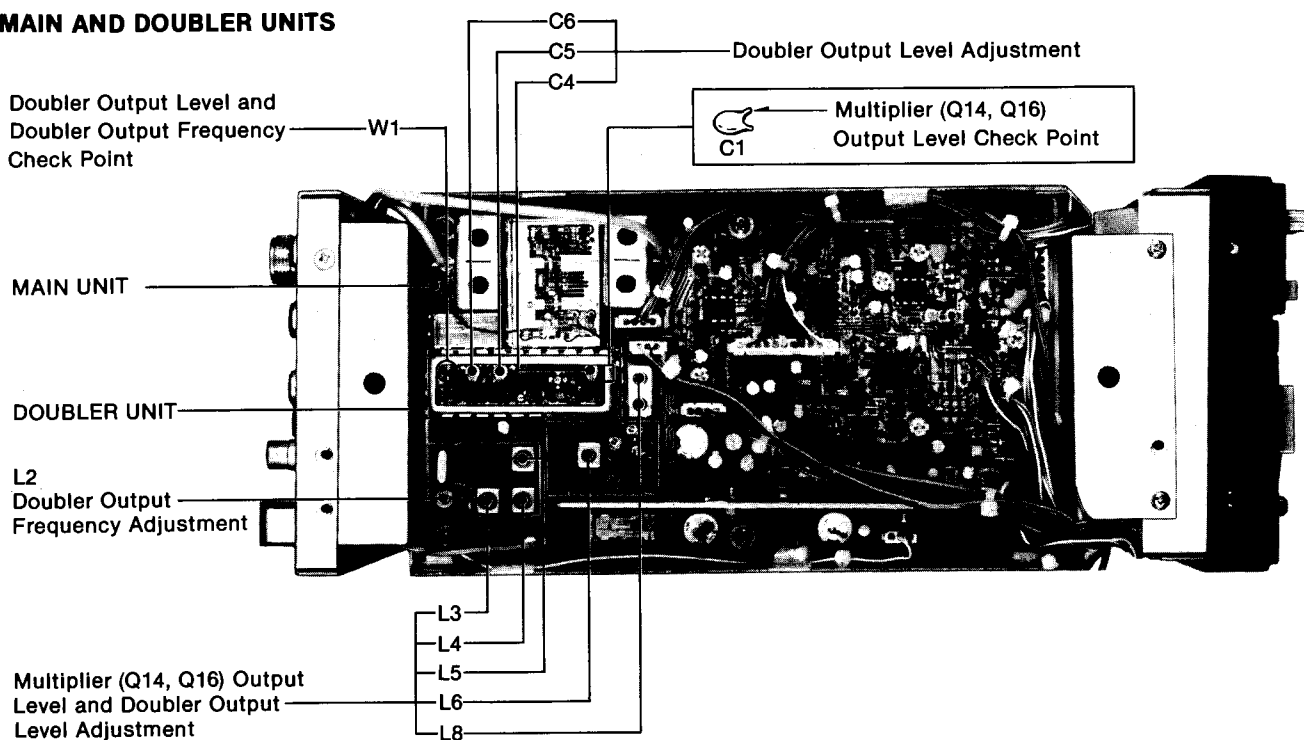
PLL UNIT



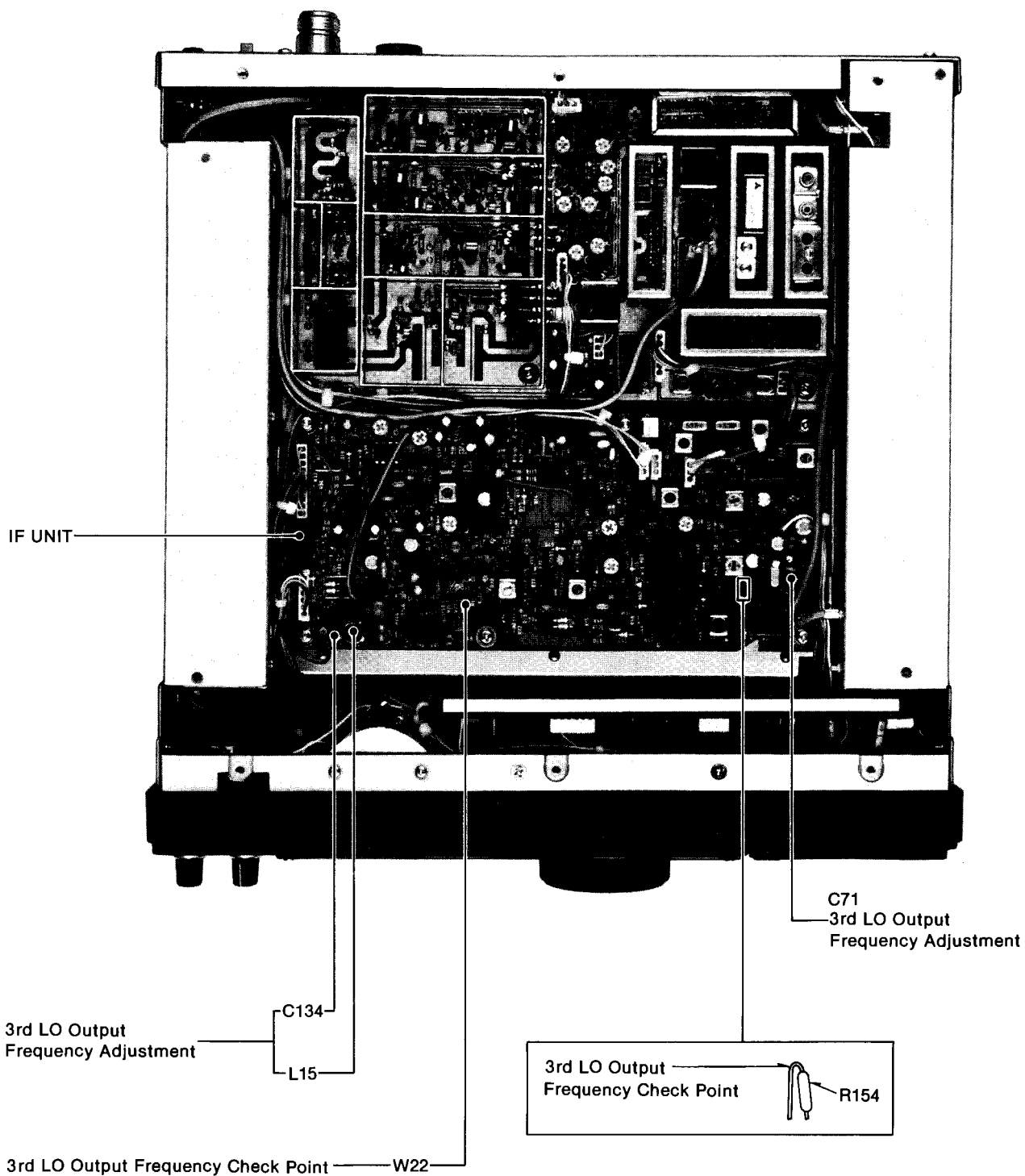
6-3 LOCAL OSCILLATOR ADJUSTMENT

INSTRUMENTS REQUIRED		CONNECTIONS					
(1) FREQUENCY COUNTER • FREQUENCY RANGE : 0.1MHz~1.3GHz • ACCURACY : BETTER THAN ± 1 ppm • SENSITIVITY : 100mV OR BETTER (2) RF VOLT METER • FREQUENCY RANGE : AT LEAST 500MHz • MEASURING RANGE : 0.01~10V							
ADJUSTMENT	ADJUSTMENT CONDITIONS	MEASUREMENT		VALUE	ADJUSTMENT POINT		
		UNIT	LOCATION		UNIT	ADJUST	
3rd LO OUTPUT FREQUENCY (IF UNIT)	1 • Mode: SSB	IF	Connect a frequency counter to R154.	10.2450 MHz	IF	C71	
	2 • Mode: SSB • USB/LSB SELECTOR SWITCH: USB		Connect a frequency counter to W22.	456.5 kHz		L15	
	3 • Mode: SSB • USB/LSB SELECTOR SWITCH: LSB			453.5 kHz		C134	
MULTIPLIER (Q14, Q16) OUTPUT LEVEL (MAIN UNIT)	1 • 1GHz BAND SWITCH: ON	DOUBLER	Connect a spectrum analyzer or RF voltmeter to C1.	Maximum	MAIN	L3, L4, L5, L6, L8	
DOUBLER OUTPUT LEVEL (DOUBLER UNIT)	1 • 1GHz BAND SWITCH: ON		Connect a spectrum analyzer or RF voltmeter to output terminal (W1) of DOUBLER UNIT.	Maximum		DOUBLER	C4, C5, C6
DOUBLER OUTPUT FREQUENCY (MAIN UNIT)	1 • 1GHz BAND SWITCH: ON		Connect a frequency counter to output terminal (W1) of DOUBLER UNIT.	1GHz		MAIN	L2

MAIN AND DOUBLER UNITS



IF UNIT

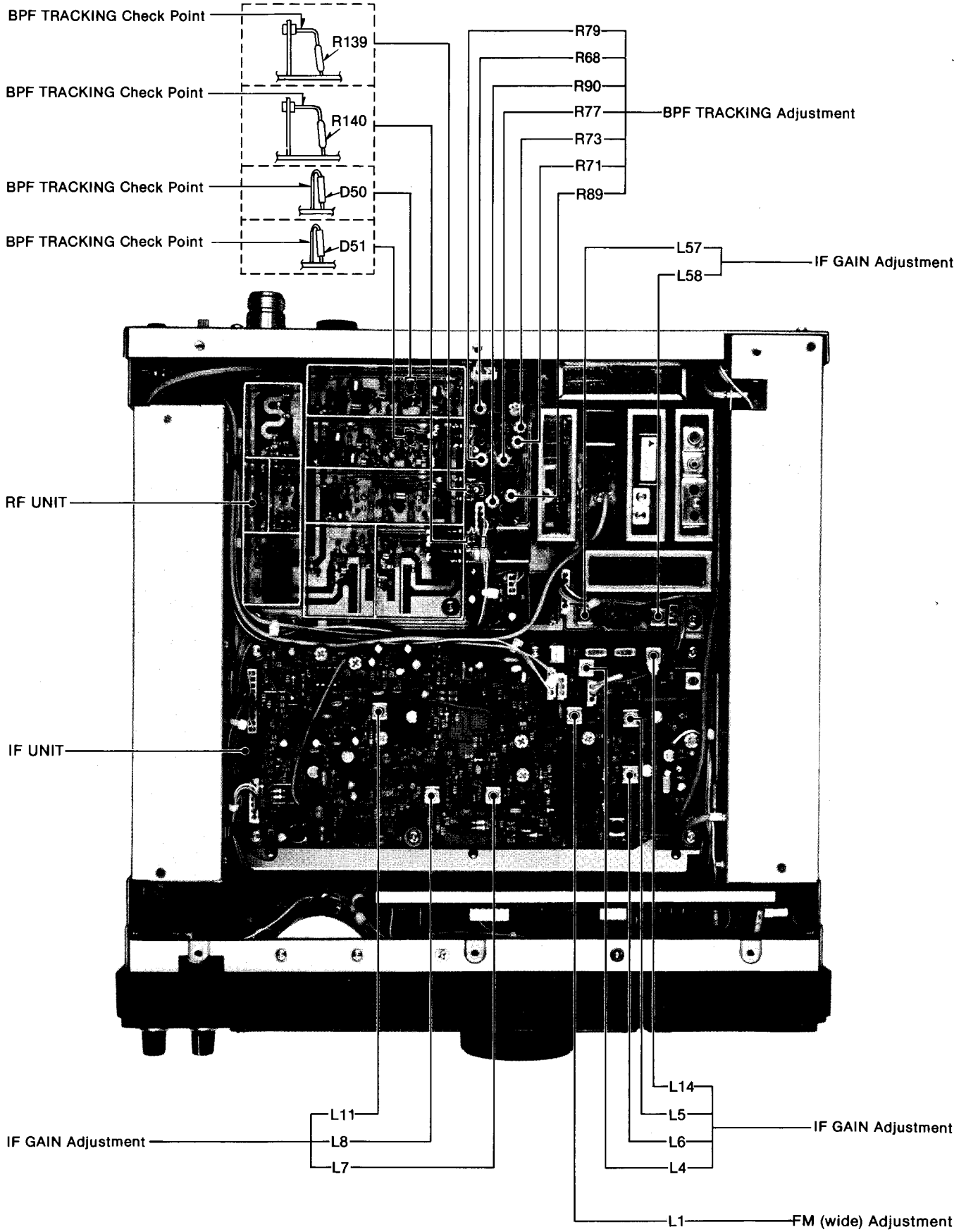


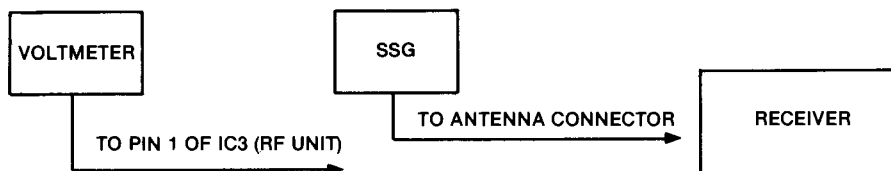
6-4 RECEIVER ADJUSTMENT

INSTRUMENTS REQUIRED	CONNECTIONS
(1) VOLTMETER • INPUT IMPEDANCE : 50k Ω /V DC OR BETTER (2) SIGNAL GENERATOR (SSG) • FREQUENCY RANGE : 0.1MHz~1GHz • OUTPUT VOLTAGE : 0.1 μ V~32mV (-127dBm~-17dBm) (3) AC MILLIVOLTMETER • MEASURING RANGE : 10mV~10V (4) EXTERNAL SPEAKER • IMPEDANCE : 8 Ω (5) OSCILLOSCOPE • FREQUENCY RANGE : DC~20MHz • MEASURING RANGE : 0.01~10V	

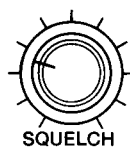
ADJUSTMENT	ADJUSTMENT CONDITIONS	MEASUREMENT		VALUE	ADJUSTMENT POINT	
		UNIT	LOCATION		UNIT	ADJUST
BPF TRACKING	1 • Display freq.: 850.0000MHz	RF	Connect a voltmeter to R140.	12V	RF	R90
	2 • Display freq.: 999.0000MHz			Approx. 17V		Verify
	3 • Display freq.: 762.0000MHz			Approx. 9.5V		
	4 • Display freq.: 650.0000MHz			6.5V		R89
	5 • Display freq.: 761.0000MHz			Approx. 9.5V		Verify
	6 • Display freq.: 513.0000MHz			Approx. 3.5V		
	7 • Display freq.: 350.0000MHz • R77 (RF UNIT): Center	RF	Connect a voltmeter to R139.	7.5V	RF	R79
	8 • Display freq.: 511.0000MHz			Approx. 17.5V		Verify
	9 • Display freq.: 250.0000MHz			Approx. 2.2V		
	10 • Display freq.: 150.0000MHz	RF	Connect a voltmeter to D51.	8V	RF	R71
	11 • Display freq.: 90.0000MHz			1V		R73
	12 • Display freq.: 249.0000MHz			Approx. 17.5V		Verify
NOTE: Repeat steps 10, 11 and 12 several times.						
13 • Display freq.: 55.0000MHz • R66 (RF UNIT): Center	RF	Connect a voltmeter to D50.	6V	RF	R68	
14 • Display freq.: 89.0000MHz			Approx. 9.5V		Verify	
15 • Display freq.: 25.0000MHz			Approx. 3V			
IF GAIN	1 • Display freq.: 762.0000MHz • Mode: FM (narrow)	FRONT PANEL	METER	Maximum	RF	L57, L58
	2 • Apply RF signal to ANTENNA CONNECTOR. Level: 5.0 μ V (-93dBm) Dev.: \pm 3.5kHz Mod.: 1kHz					REAR PANEL
	3				L11	
NOTE: To prevent noise blanker circuit malfunction, set the core positions of L5 and L6 to equal each other.						
FM (wide)	1 • Display freq.: 762.0000MHz • Mode: FM (wide) • Apply RF signal to ANTENNA CONNECTOR. Level: 5.0 μ V (-93dBm) Dev.: \pm 3.5kHz Mod.: 1kHz	FRONT PANEL	METER	Maximum	IF	L1

RF AND IF UNITS



RECEIVER ADJUSTMENT (Continued)
CONNECTIONS


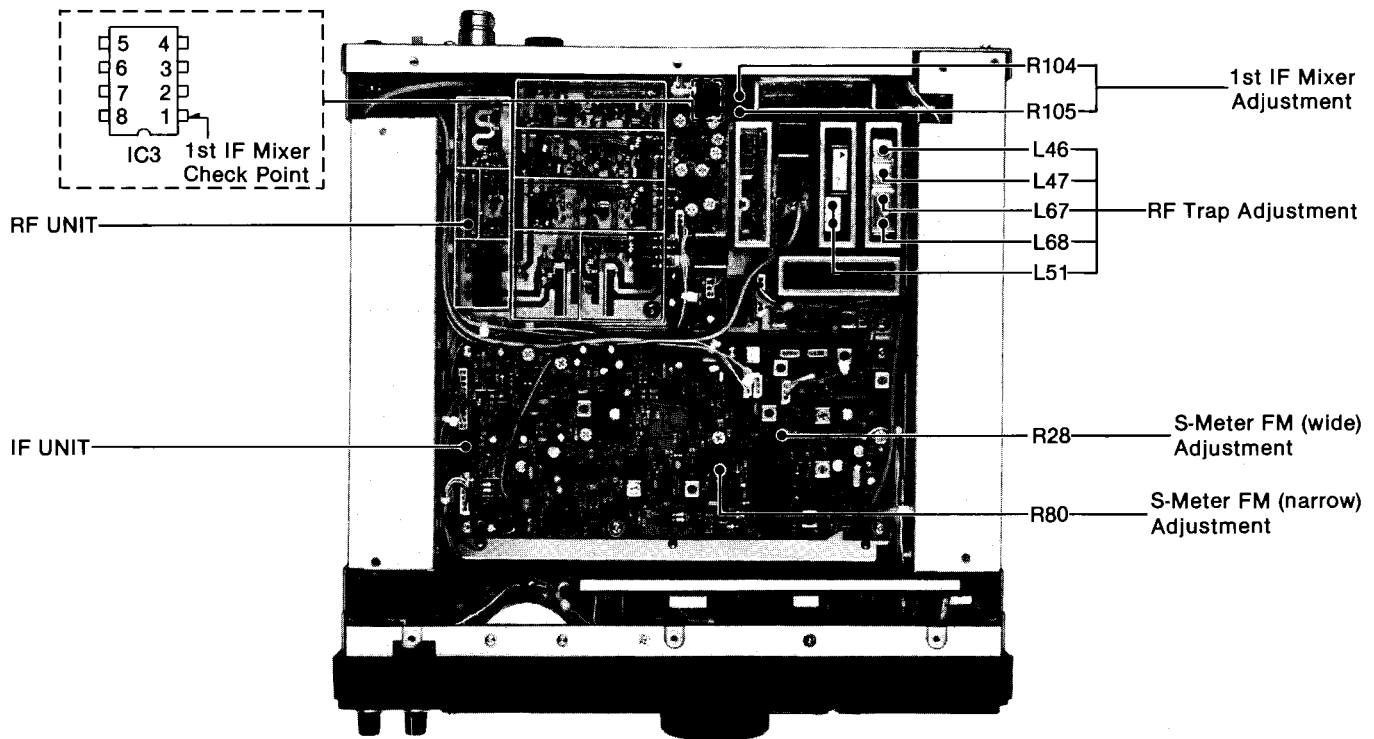
ADJUSTMENT	ADJUSTMENT CONDITIONS	MEASUREMENT		VALUE	ADJUSTMENT POINT		
		UNIT	LOCATION		UNIT	ADJUST	
1st IF MIXER	1	• Display freq.: 250.0000MHz	RF	Connect a voltmeter to pin 1 of IC3.	9V	RF	R105
	2	• Display freq.: 249.0000MHz			9V		R104
	3	• Display freq.: 25.0000MHz			4~5V		Verify
	4	• Display freq.: 511.0000MHz			More than 14V		
RF TRAP	1	• Display freq.: 800.0000MHz • Mode: FM (narrow) • Apply RF signal to ANTENNA CONNECTOR. Level: 32 μ V (-77 dBm) Dev.: \pm 3.5kHz Mod.: 1kHz Freq.: 800.0000MHz	FRONT PANEL	METER	Maximum	RF	L46, L47
		2			• Display freq.: 800.0000MHz • Mode: FM (narrow) • Apply RF signal to ANTENNA CONNECTOR. Level: 100mV (-7 dBm) Dev.: \pm 3.5kHz Mod.: 1kHz Freq.: 800.0000MHz		S9+60dB
	3	• Display freq.: 778.6000MHz • RF signal freq.: 800.0000MHz			Less than S5		L67, L68
		• Display freq.: 400.0000MHz • Mode: FM (narrow) • Apply RF signal to ANTENNA CONNECTOR. Level: 100mV (-7 dBm) Dev.: \pm 3.5kHz Mod.: 1kHz Freq.: 400.0000MHz			S9+60dB		Verify
	3	• Display freq.: 378.6000MHz • RF signal freq.: 400.0000MHz			Less than S5		L51
SQUELCH	1	• Display freq.: 762.0000MHz • Mode: FM (narrow) • SQUELCH CONTROL:			Squelch closes.	MAIN	R37
S-METER • FM (narrow)	1	• Display freq.: 762.0000MHz • Mode: FM (narrow) • R80 (IF UNIT): Center • Apply RF signal to ANTENNA CONNECTOR. Level: 100mV (-7 dBm) Dev.: \pm 3.5kHz	FRONT PANEL	METER	S9+60dB	MAIN	R54
	2	• RF signal level: 0.1mV (-67 dBm)			S9		R51
	3	• RF signal level: 1 μ V (-107 dBm)			S1~S3		Verify



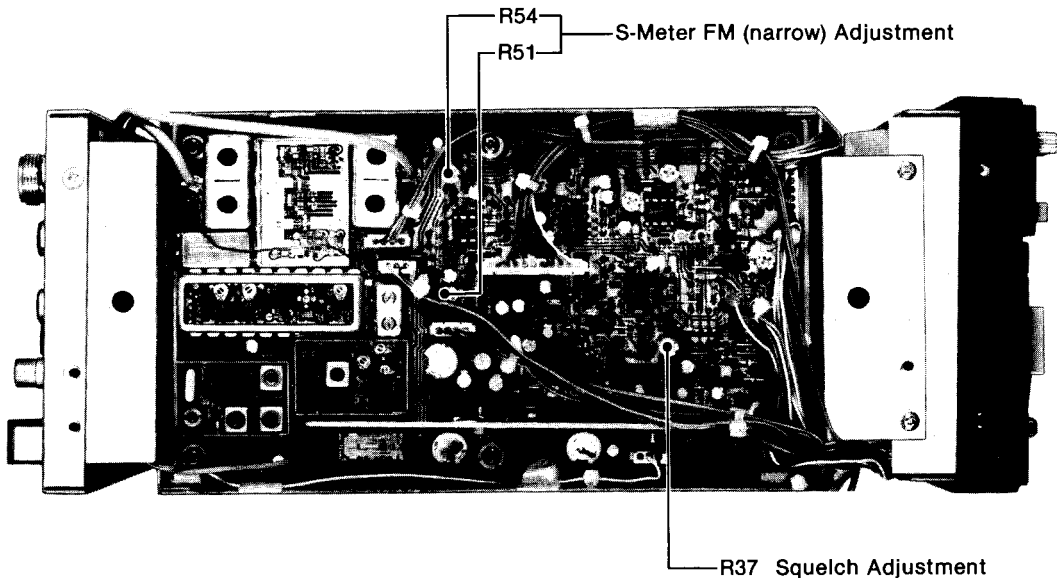
RECEIVER ADJUSTMENT (Continued)

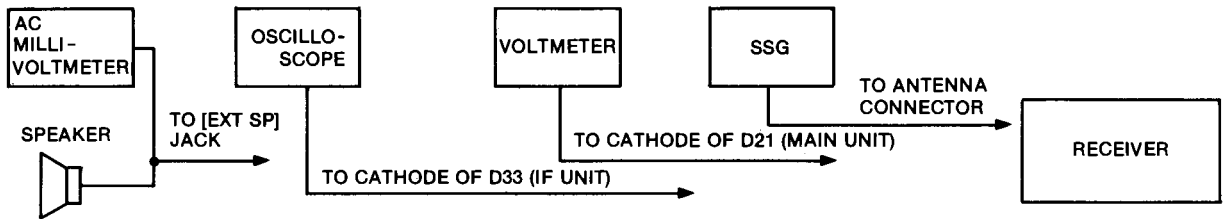
ADJUSTMENT	ADJUSTMENT CONDITIONS	MEASUREMENT		VALUE	ADJUSTMENT POINT		
		UNIT	LOCATION		UNIT	ADJUST	
S-METER • FM (narrow)	4	• Apply no signal to ANTENNA CONNECTOR.	FRONT PANEL	METER	Approx. S1		Verify
	NOTE: R80 controls total gain adjustment, so it is not be touched as noise will increase. However, it may be necessary to adjust R80 under the following condition: If the METER indicates more than S1 in step 4, adjust R51 to S1 and then follow step 1 again. After completing the above adjustment, adjust R80 to S9 with 0.1mV input.						
S-METER • FM (wide)	1	• Display freq.: 762.0000MHz • Mode: FM (wide) • Apply RF signal to ANTENNA CONNECTOR. Level: 100mV (-7dBm) Dev.: ±3.5kHz	FRONT PANEL	METER	S9+60dB	IF	R28

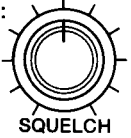
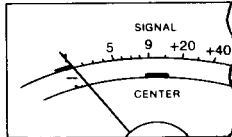
RF AND IF UNITS



MAIN UNIT



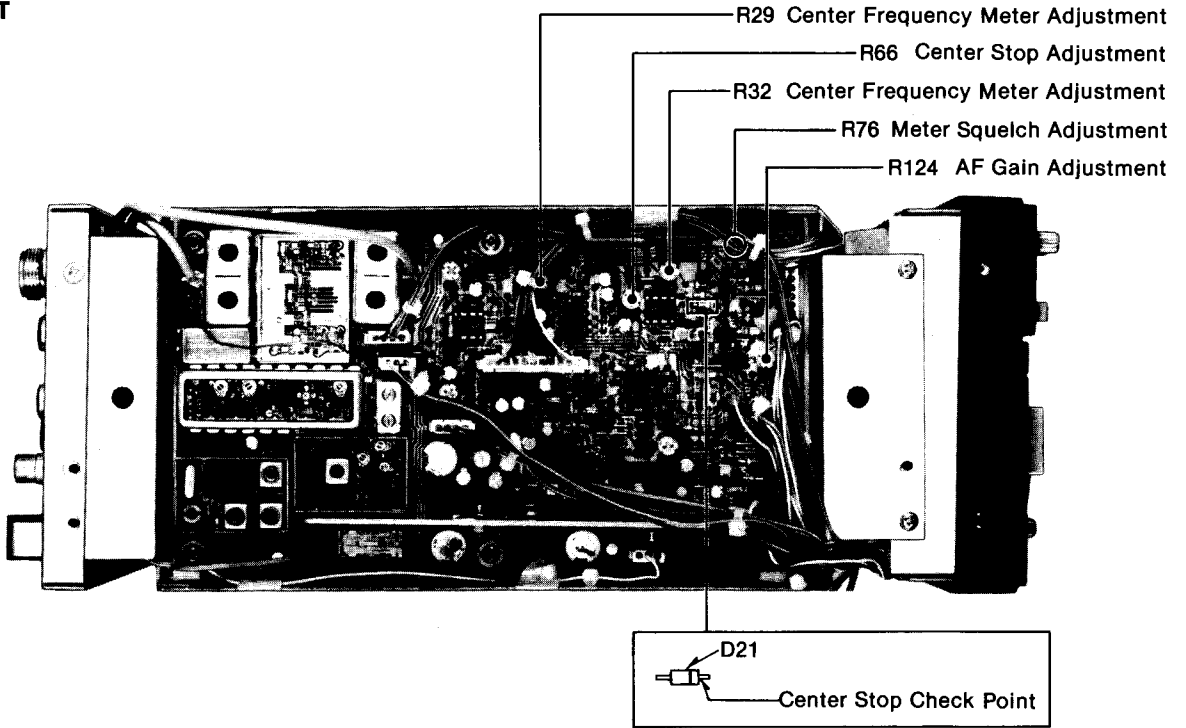
RECEIVER ADJUSTMENT (Continued)
CONNECTIONS


ADJUSTMENT	ADJUSTMENT CONDITIONS	MEASUREMENT		VALUE	ADJUSTMENT POINT		
		UNIT	LOCATION		UNIT	ADJUST	
METER SQUELCH	1 <ul style="list-style-type: none"> • Display freq.: any (except 762MHz) • Mode: FM (narrow) • SQUELCH CONTROL: 	FRONT PANEL	METER		MAIN	R76	
	2 <ul style="list-style-type: none"> • SQUELCH CONTROL: Max. clockwise 					More than S9+60dB	Verify
NOTE: If the METER does not indicate more than S9+60dB at step 2, repeat "S-METER" adjustment.							
CENTER METER	1 <ul style="list-style-type: none"> • Display freq.: 26.0000 MHz • Mode: FM (wide) • R29, R32 (MAIN UNIT): Center • Apply RF signal to ANTENNA CONNECTOR. Level: 32μV (-77 dBm) Mod.: OFF Freq.: 26.0000 MHz 	FRONT PANEL	METER	Same value as no signal receiving.	IF	R127	
	2 <ul style="list-style-type: none"> • Display freq.: 26.1000 MHz • RF signal freq.: 26.0000 MHz 			S9+50dB		MAIN	R32
	3 <ul style="list-style-type: none"> • Display freq.: 26.0000 MHz • RF signal freq.: 26.0000 MHz 			Center			R29
	4 <ul style="list-style-type: none"> • Display freq.: 26.0000 MHz • Mode: FM (narrow) 	FRONT PANEL	METER	Center	IF	R92	
NOTE: Repeat steps 2 and 3 several times.							
CENTER STOP	1 <ul style="list-style-type: none"> • Display freq.: 26.0000 MHz ± 3.5~5 kHz • Mode: FM (narrow) • Apply RF signal to ANTENNA CONNECTOR. Level: 32μV (-77 dBm) Freq.: 26.0000 MHz 	MAIN	Connect a voltmeter to cathode of D21.	Frequency differences in the (+) and (-) directions should be the same, i.e., 26.0035 MHz and 25.9965 MHz when the voltage of D21 is HIGH (8V).	MAIN	R66	
NOISE BLANKER	1 <ul style="list-style-type: none"> • Display freq.: 26.0000 MHz • Mode: SSB • NOISE BLANKER SWITCH: ON • Apply noise signal to ANTENNA CONNECTOR. 	IF	Connect an oscilloscope to cathode of D33.	Noise wave form maximum	IF	L10	
AF GAIN	1 <ul style="list-style-type: none"> • Mode: FM (narrow) • AF GAIN CONTROL: Max. 	REAR PANEL	Connect an AC millivoltmeter to [EXT SP] JACK with an 8Ω speaker.	4.8V	MAIN	R124	

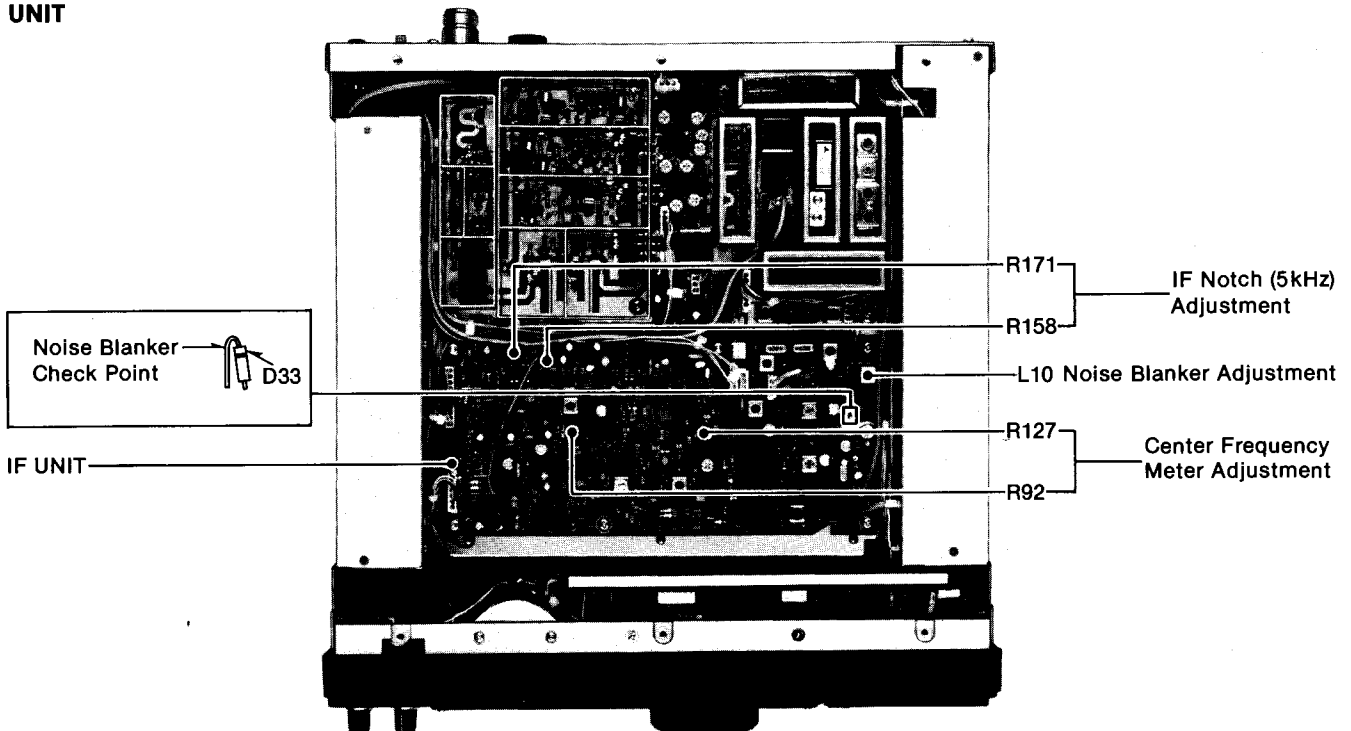
RECEIVER ADJUSTMENT (Continued)

ADJUSTMENT	ADJUSTMENT CONDITIONS	MEASUREMENT		VALUE	ADJUSTMENT POINT	
		UNIT	LOCATION		UNIT	ADJUST
IF NOTCH (5kHz)	1 <ul style="list-style-type: none"> • Display freq.: 762.0000 MHz • Mode: FM (wide) • Apply RF signal to ANTENNA CONNECTOR. Level: 0.1mV (-67dBm) Dev.: 50kHz Mod.: 5kHz 	REAR PANEL	Connect a voltmeter to [EXT SP] JACK with an 8Ω speaker.	Minimum	IF	R171, R158

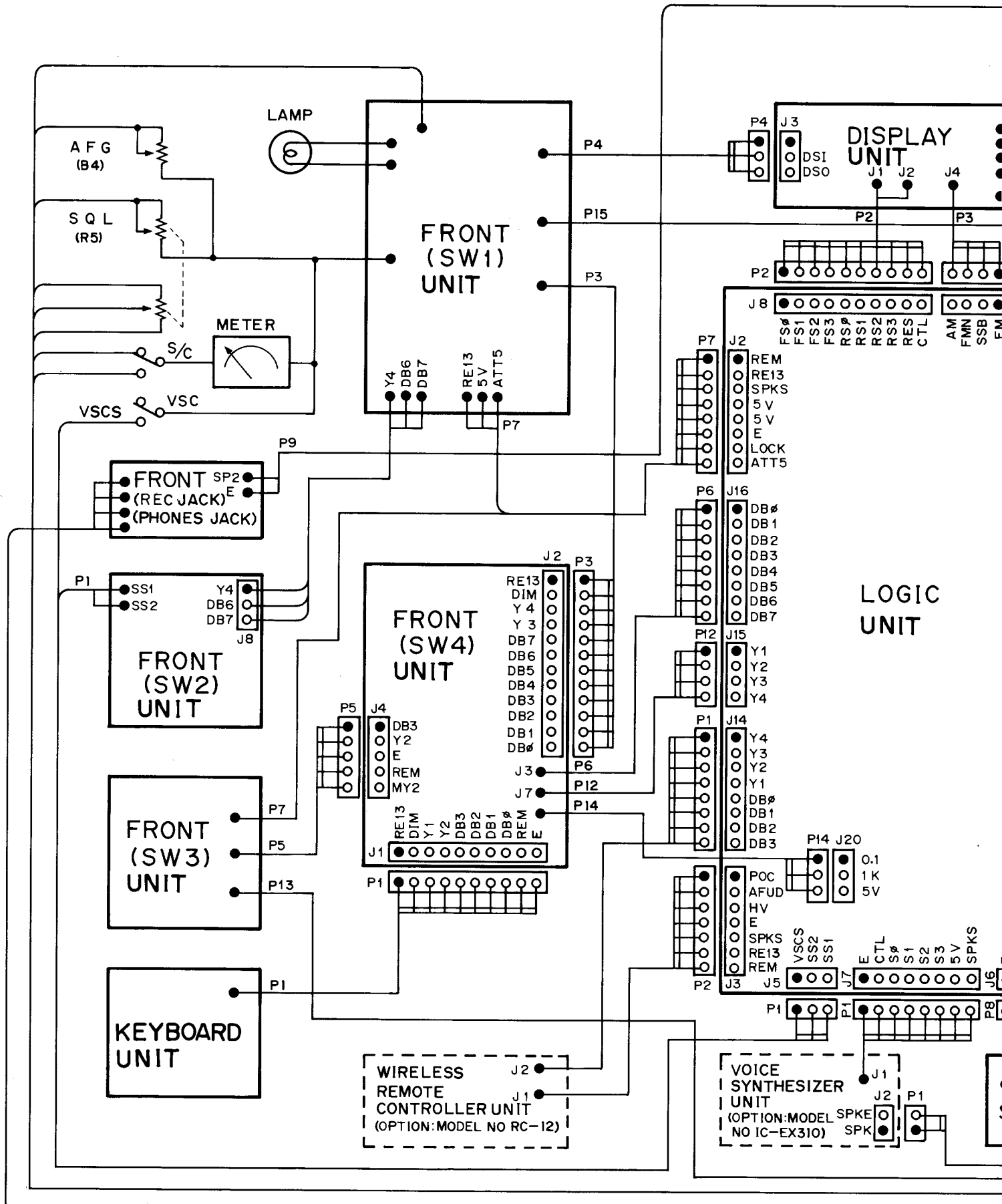
MAIN UNIT

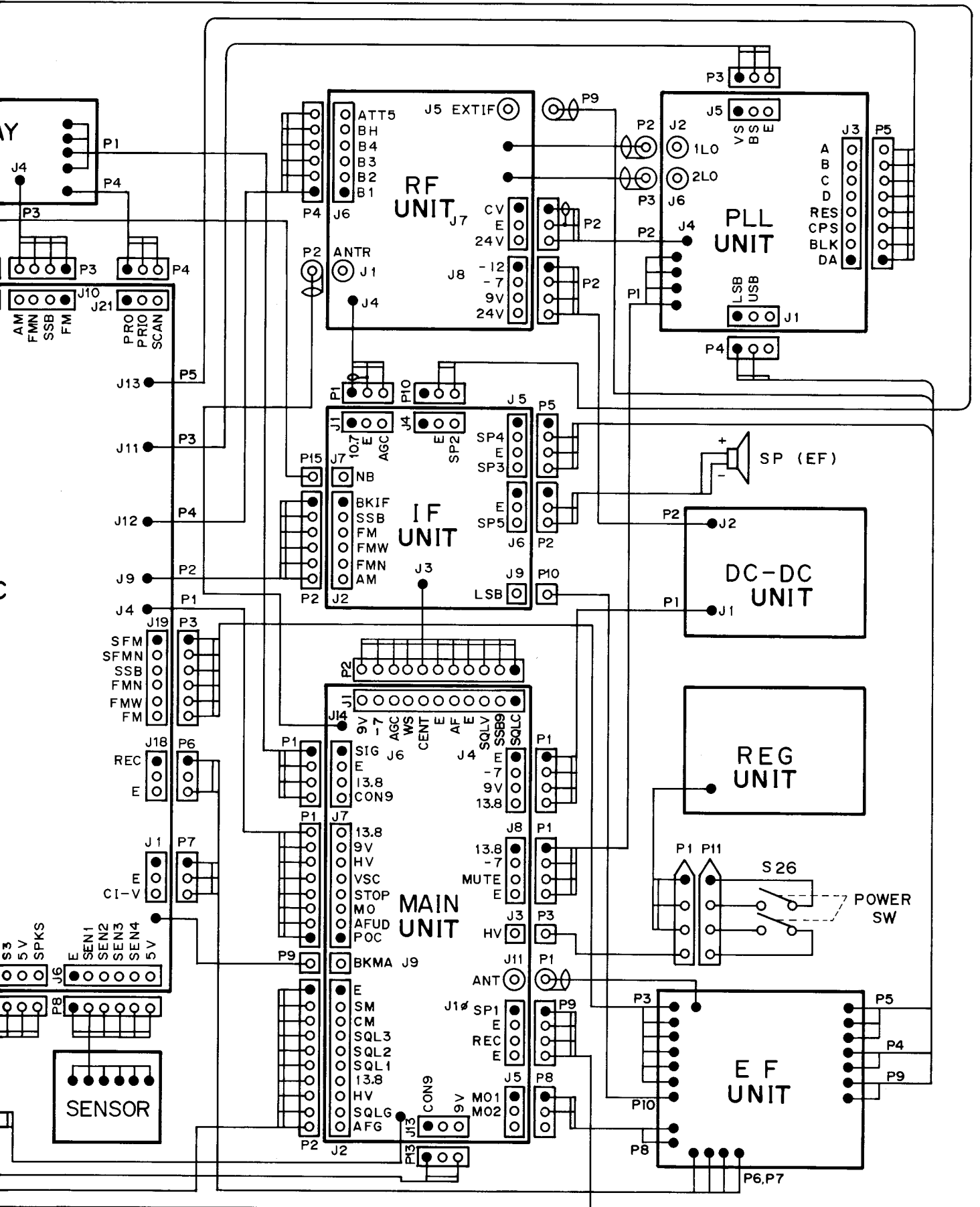


IF UNIT



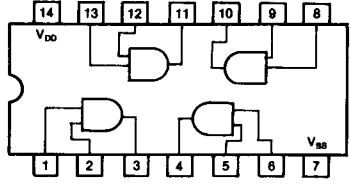
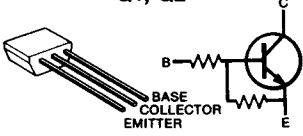
7-1 INTERCONNECTION



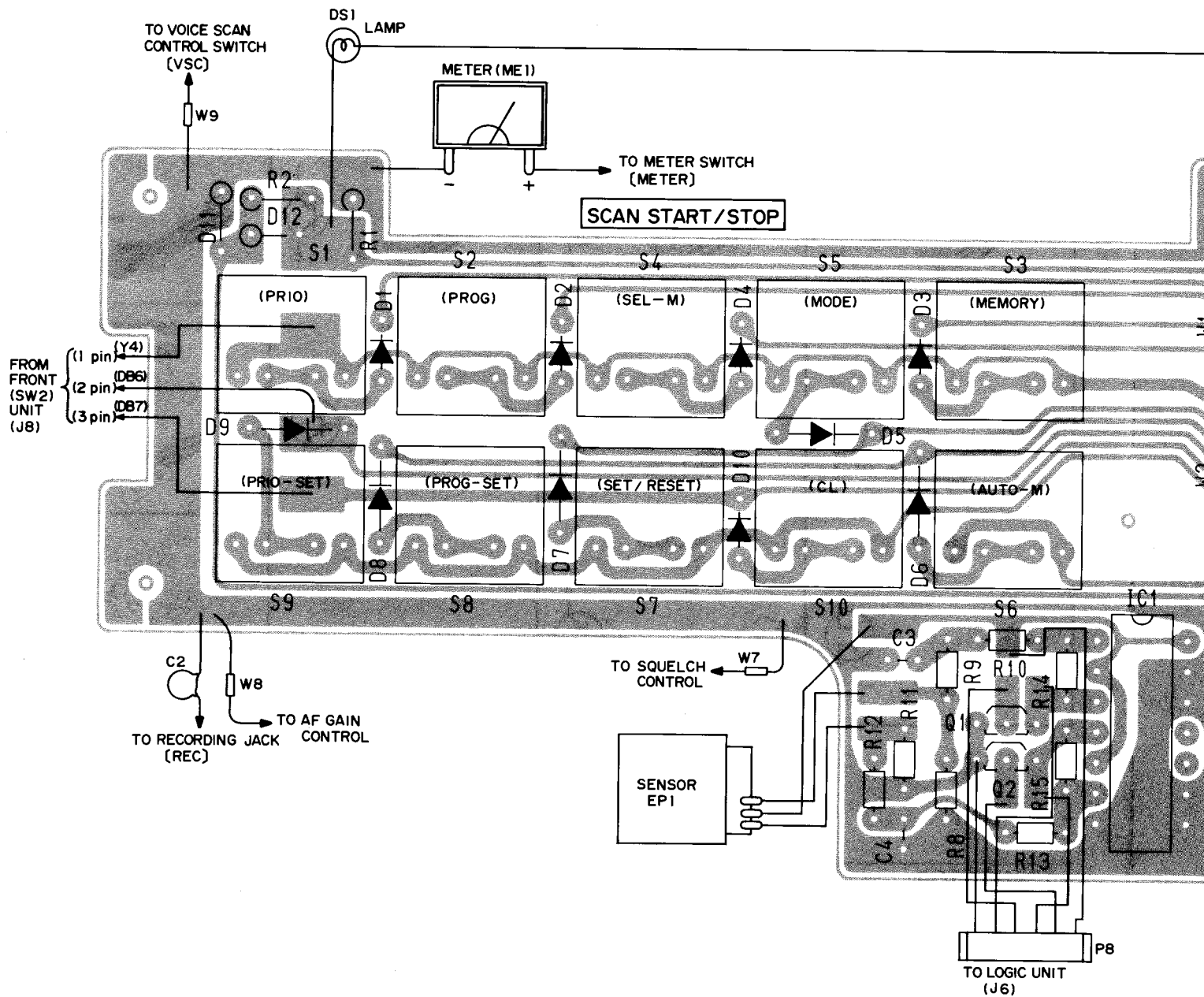


7-2 FRONT UNITS

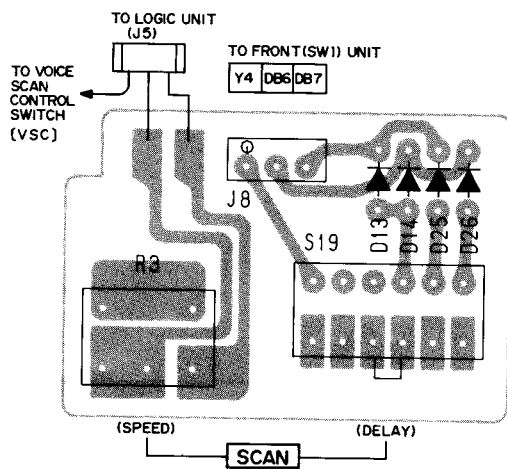
• FRONT (SW4) UNIT

IC	
IC1	<p>μPD4081BC (QUAD 2-INPUT AND GATE)</p> 
TRANSISTOR	
<p>2SC3399 Q1, Q2</p>  <p>BASE COLLECTOR EMITTER</p>	

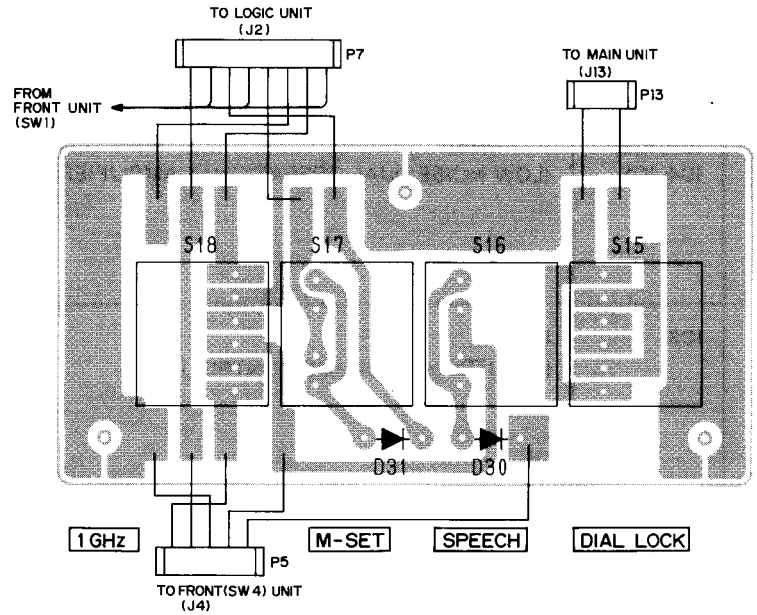
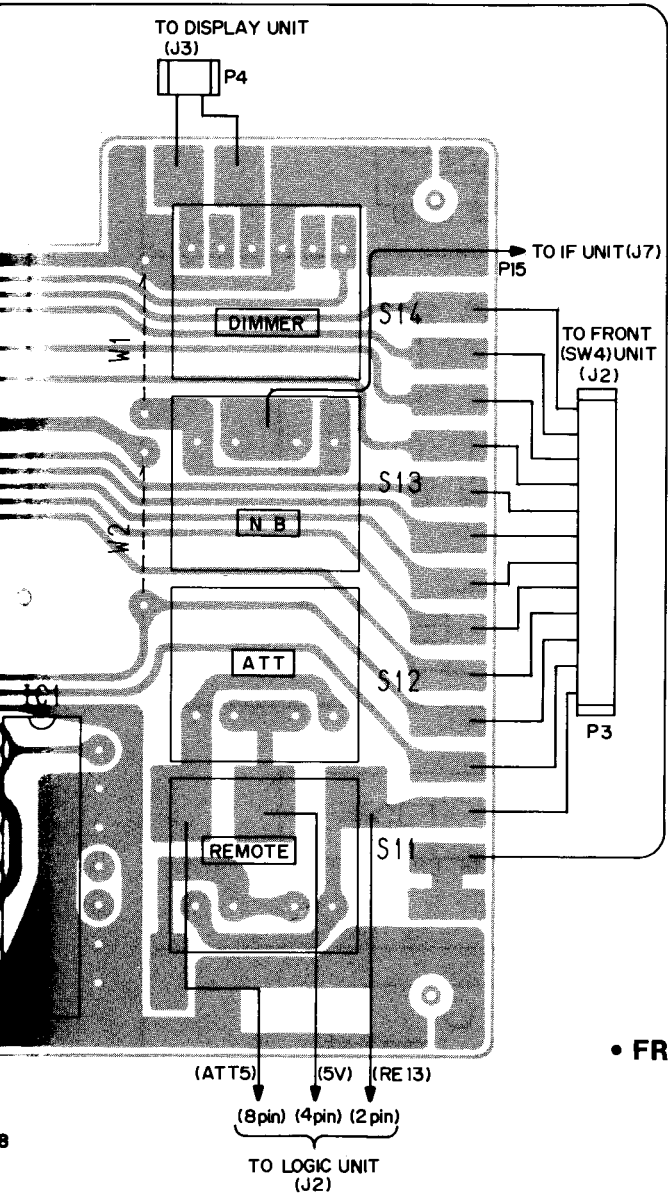
• FRONT (SW1) UNIT



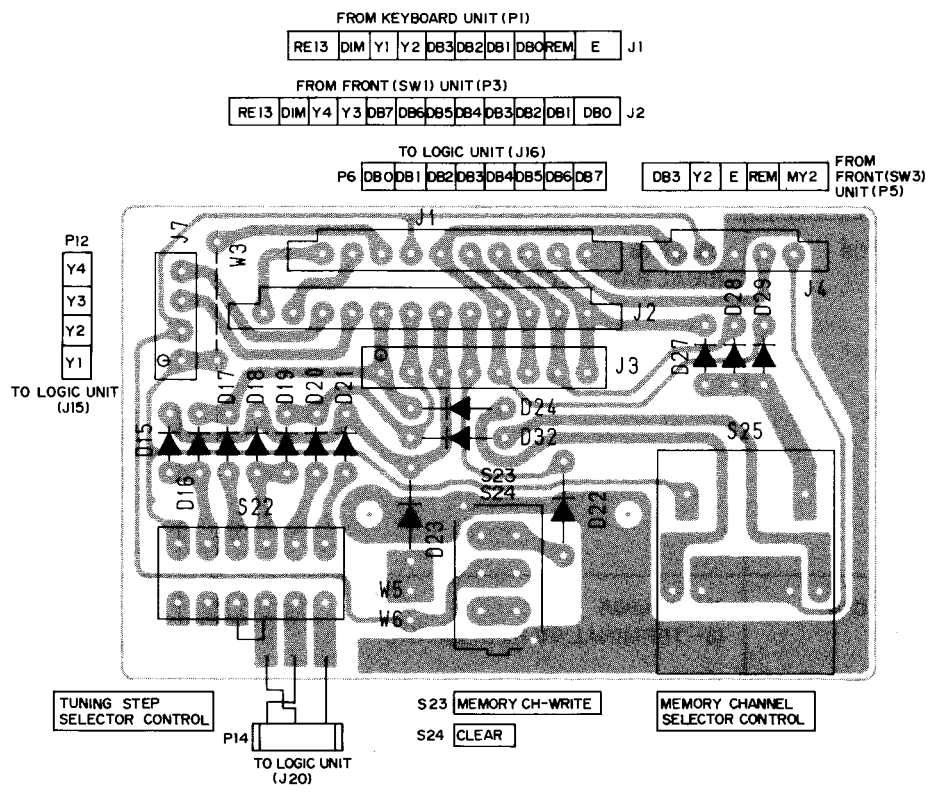
• FRONT (SW2) UNIT



• FRONT (SW3) UNIT

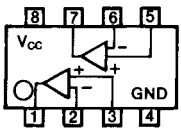
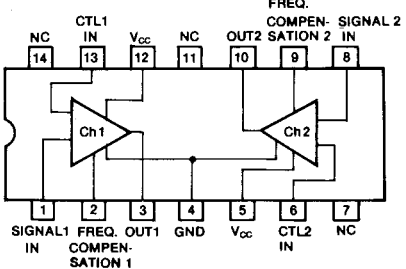
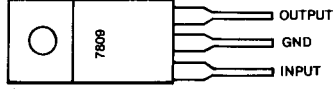
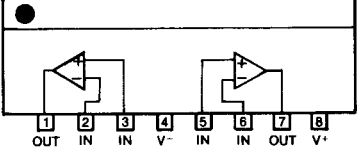
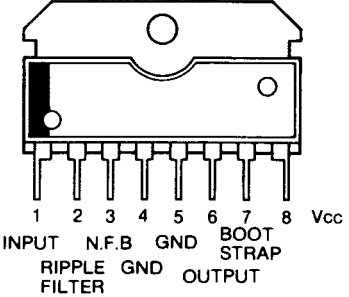
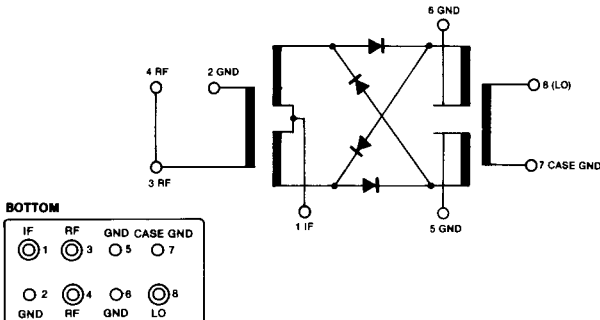
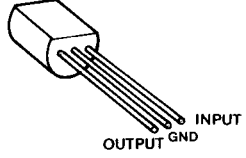


• FRONT (SW4) UNIT

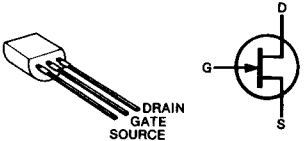
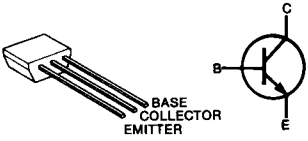
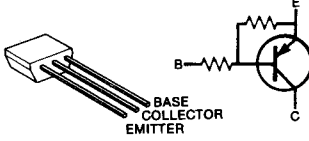
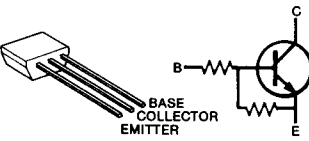
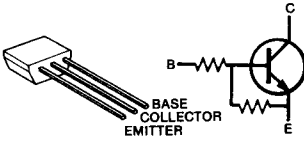
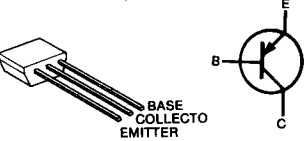
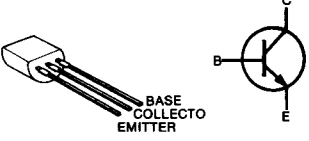
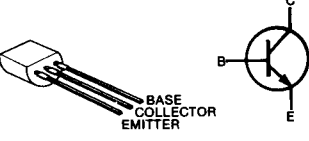
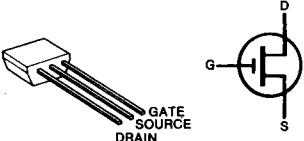
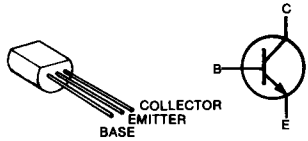


7-3 MAIN UNIT

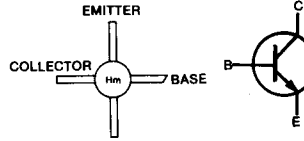
• MAIN UNIT

IC		
IC1, IC2, IC4, IC5	NJM4558D (LOW NOISE DUAL OPERATIONAL AMPLIFIER)	
IC3	LA2600 (ELECTRONIC VOLUME CONTROL)	
IC6	NJM7809A (3-TERMINAL 9V REGULATOR)	
IC7	M5218L (LOW NOISE DUAL OPERATIONAL AMPLIFIER)	
IC8	μPC1241H (5.8W AUDIO POWER AMPLIFIER)	
IC9	DM-88XB (DUAL BALANCED MODULATE)	
IC10	NJM78L09A (3-TERMINAL 9V REGULATOR)	

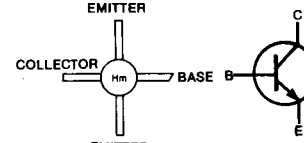
TRANSISTORS

<p>2SK30AT Q1</p> 	<p>2SC2785 Q2, Q9, Q10, Q18</p> 	<p>2SA1348 Q3, Q4</p> 	<p>2SC3402 Q5</p> 
<p>2SC3399 Q6, Q7, Q17, Q19</p> 	<p>2SA1048 Q11</p> 	<p>2SC945 Q13</p> 	<p>2SC383TM Q14</p> 
<p>2SK241 Q15</p> 	<p>2SC2026 Q16</p> 		

• HPF UNIT

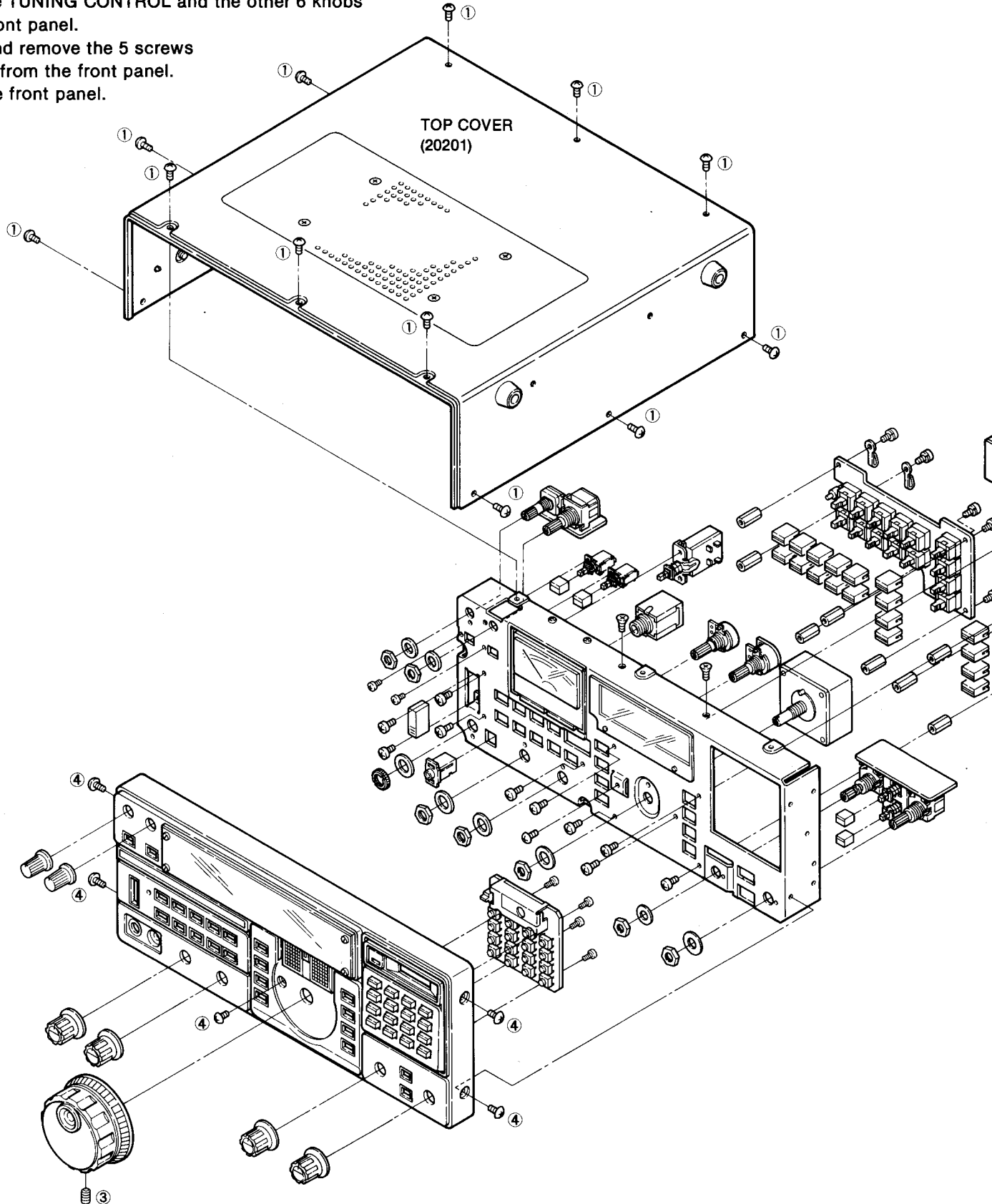
TRANSISTOR	
<p>2SC2367 Q1</p> 	

• DOUBLER UNIT

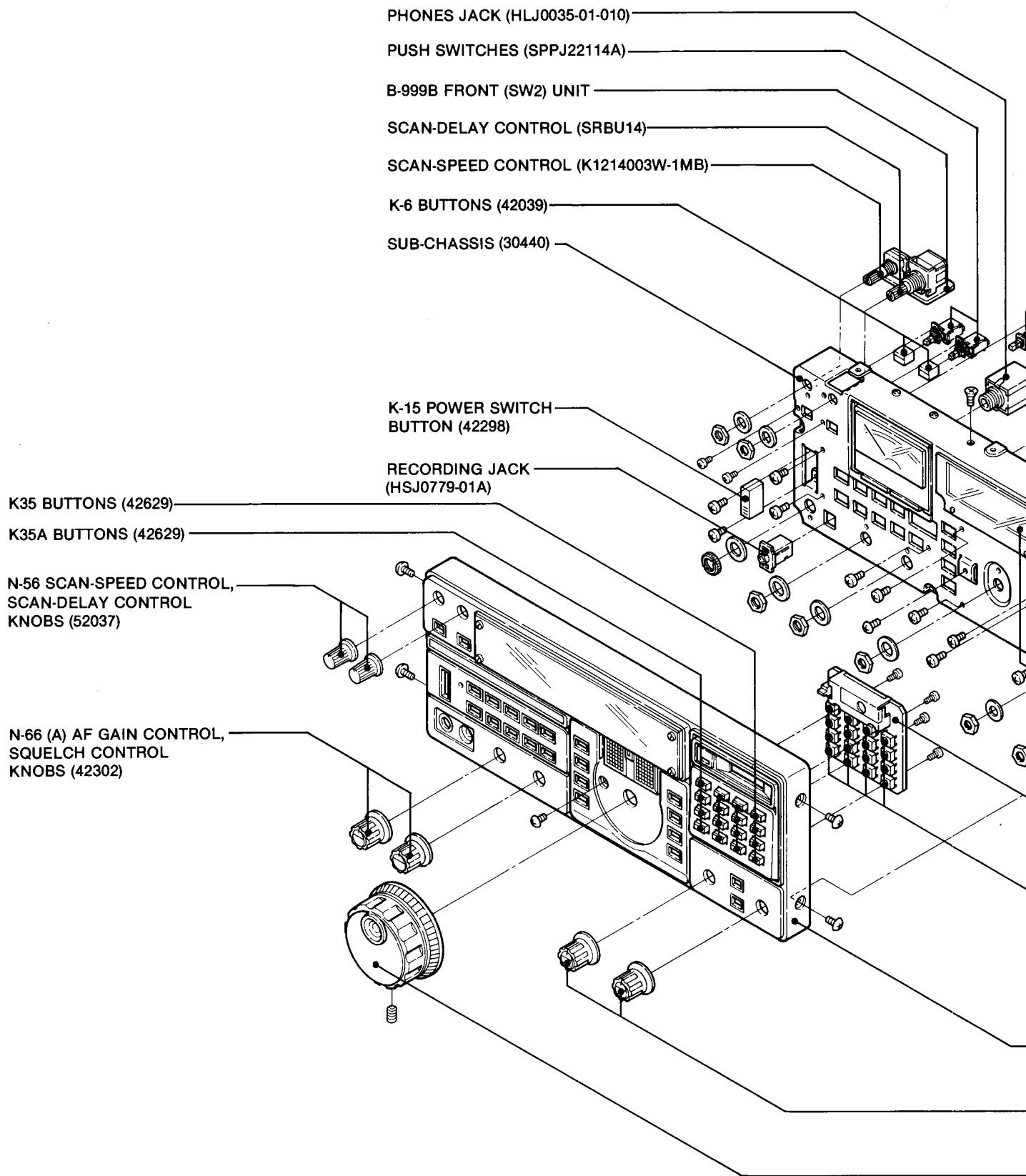
TRANSISTOR	
<p>2SC2367 Q1</p> 	

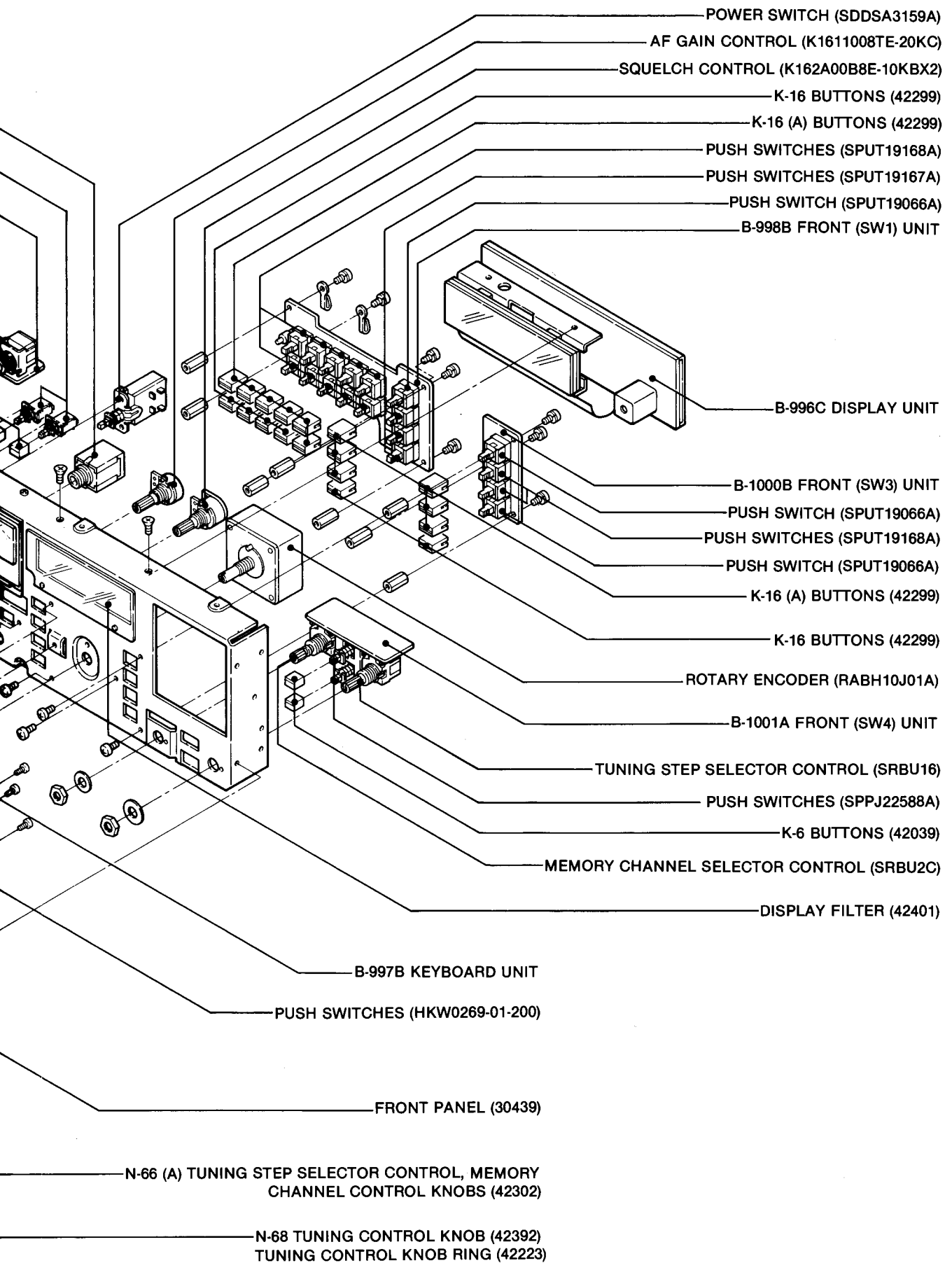
5-1 FRAME DISASSEMBLY

1. Unscrew and remove the 12 screws labelled ① from the top cover.
Remove the top cover.
2. Unscrew and remove the 6 screws labelled ② from the bottom cover.
Remove the bottom cover.
3. Remove the hex screw labelled ③ from the TUNING CONTROL.
Pull out the TUNING CONTROL and the other 6 knobs from the front panel.
4. Unscrew and remove the 5 screws labelled ④ from the front panel.
Remove the front panel.



2 FRONT PANEL DISASSEMBLY





5-3 REAR PANEL DISASSEMBLY

CHASSIS (L) (20199)

AC POWER SOCKET (CM-3)

FUSE HOLDER (FH-032C) (#02, #03, #04, #05)
(FH-033) (#06)

REMOTE JACK (HSJ0780-01-010)

RECORDER-REMOTE JACK (HSJ0780-01-010)

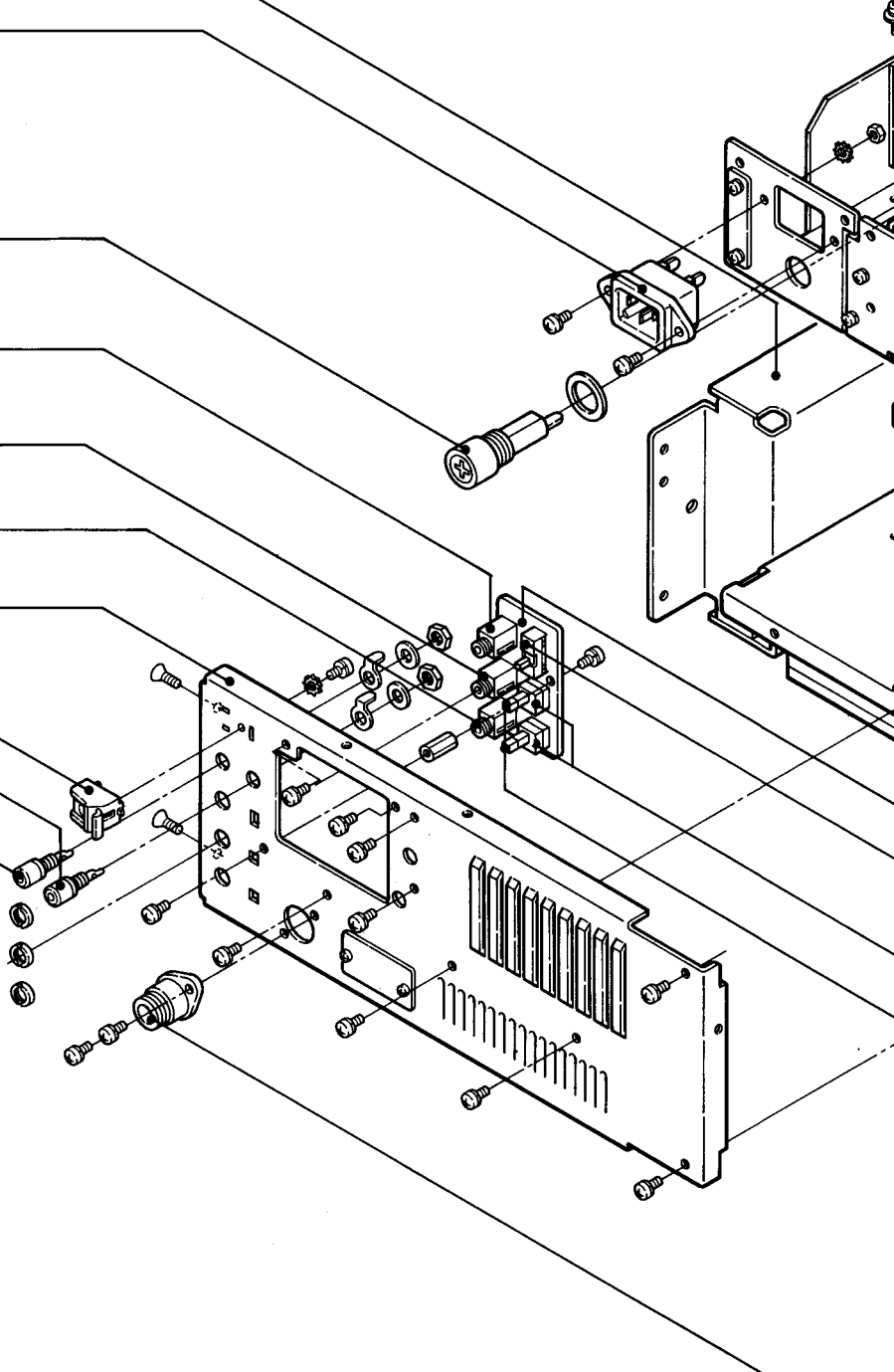
EXTERNAL SPEAKER JACK (HSJ0780-01-010)

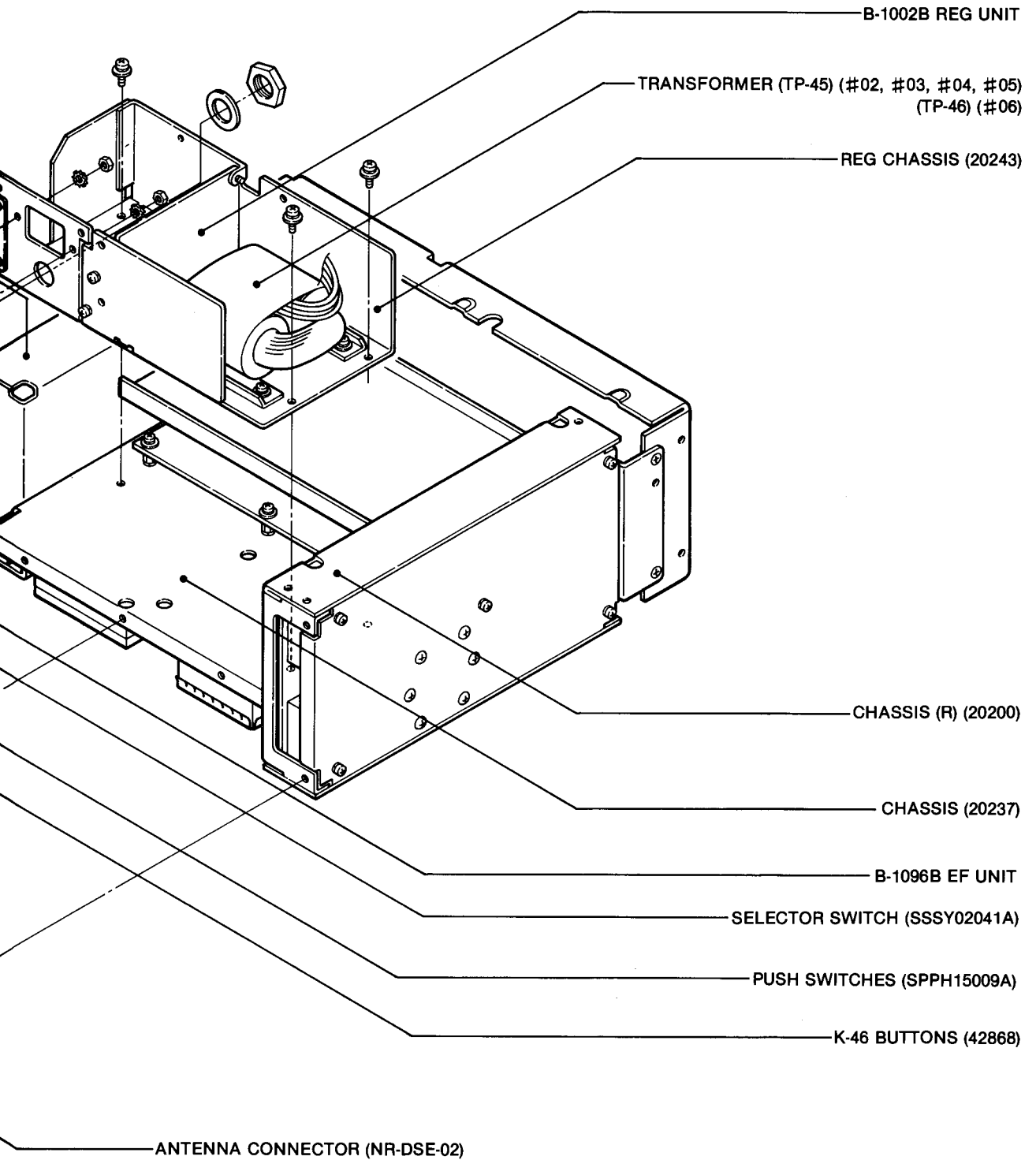
REAR PANEL (30441)

GROUND TERMINAL (SQ-2054)

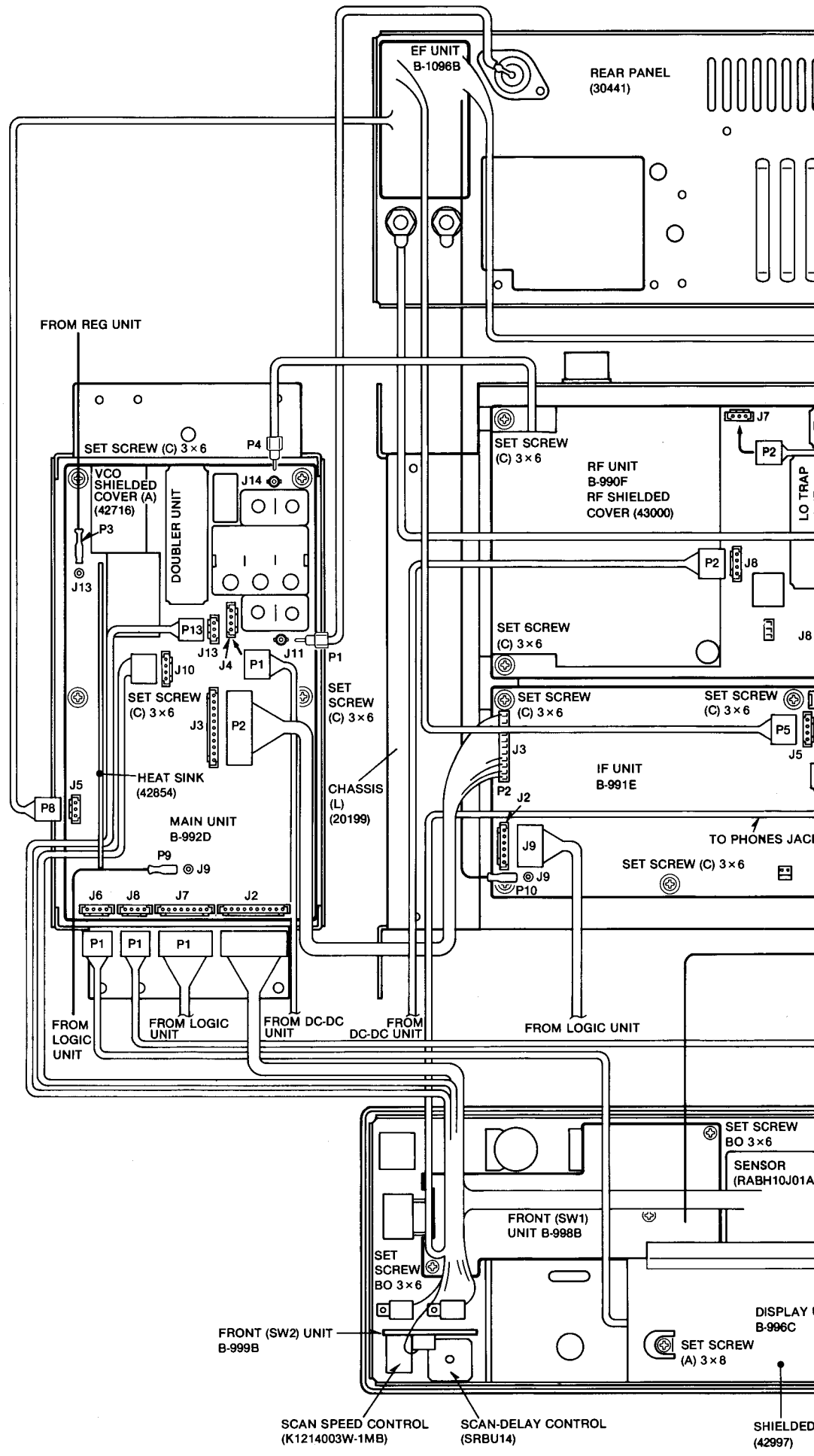
SPARE JACK (AT-700)

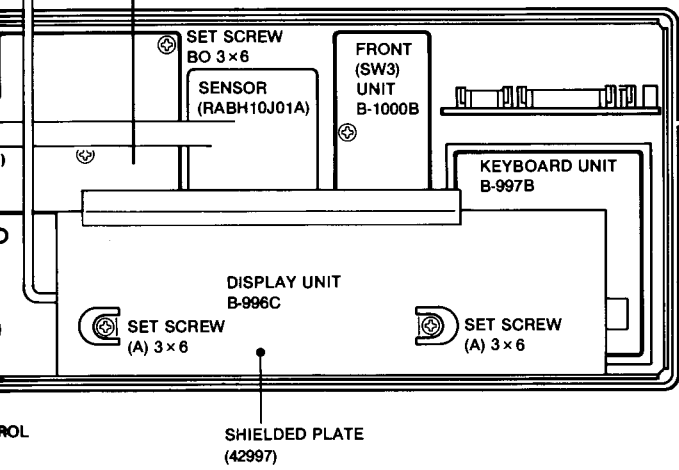
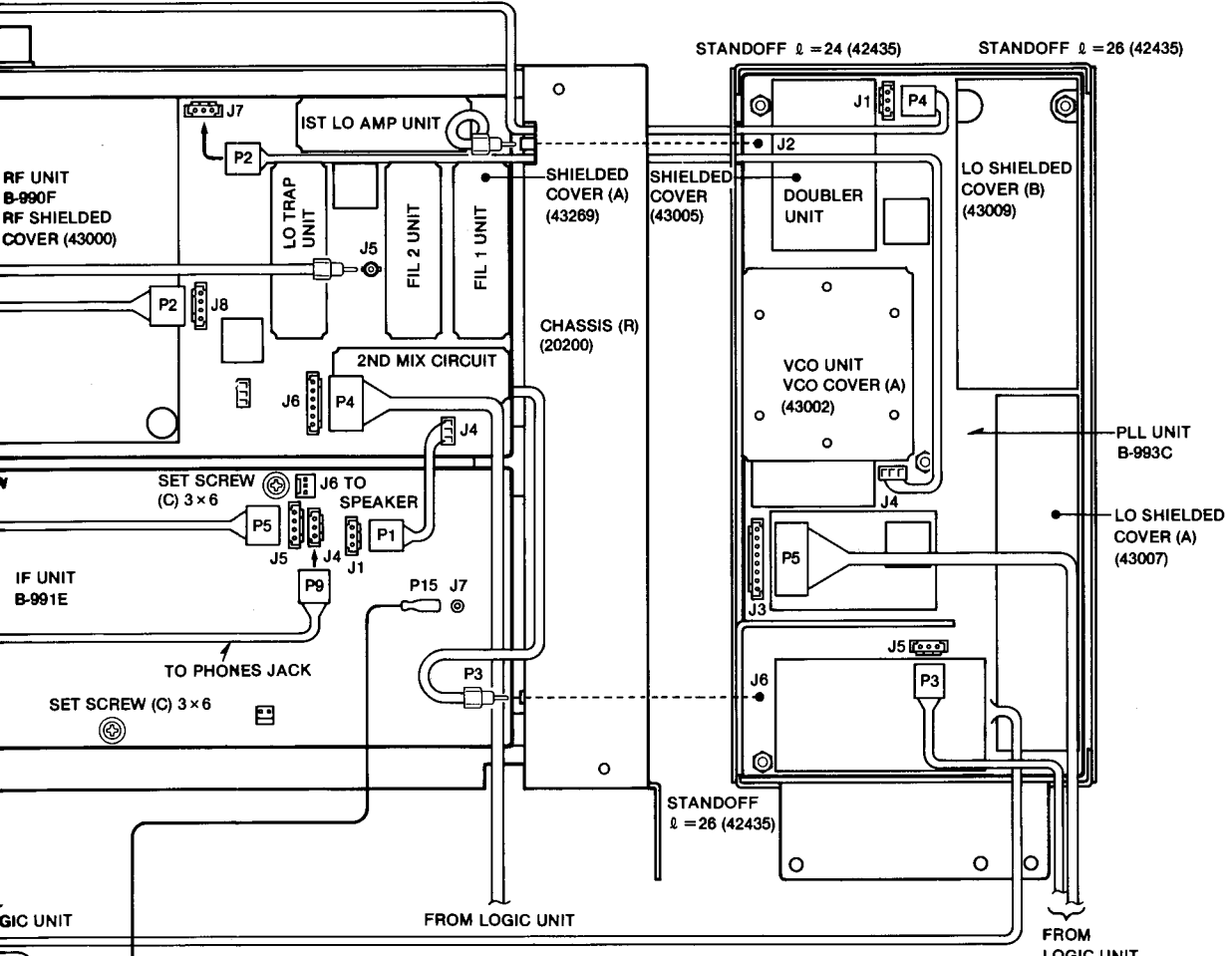
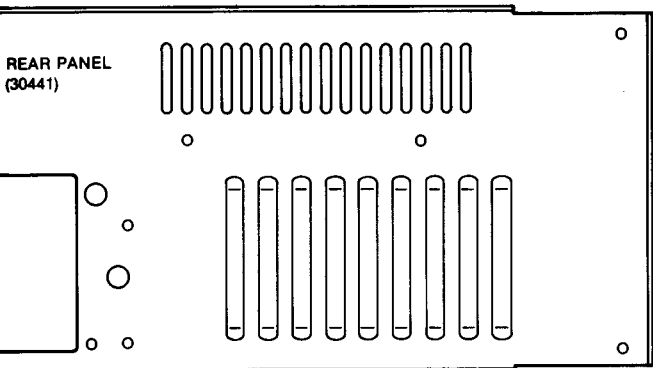
10.7MHz IF OUTPUT JACK (AT-700)



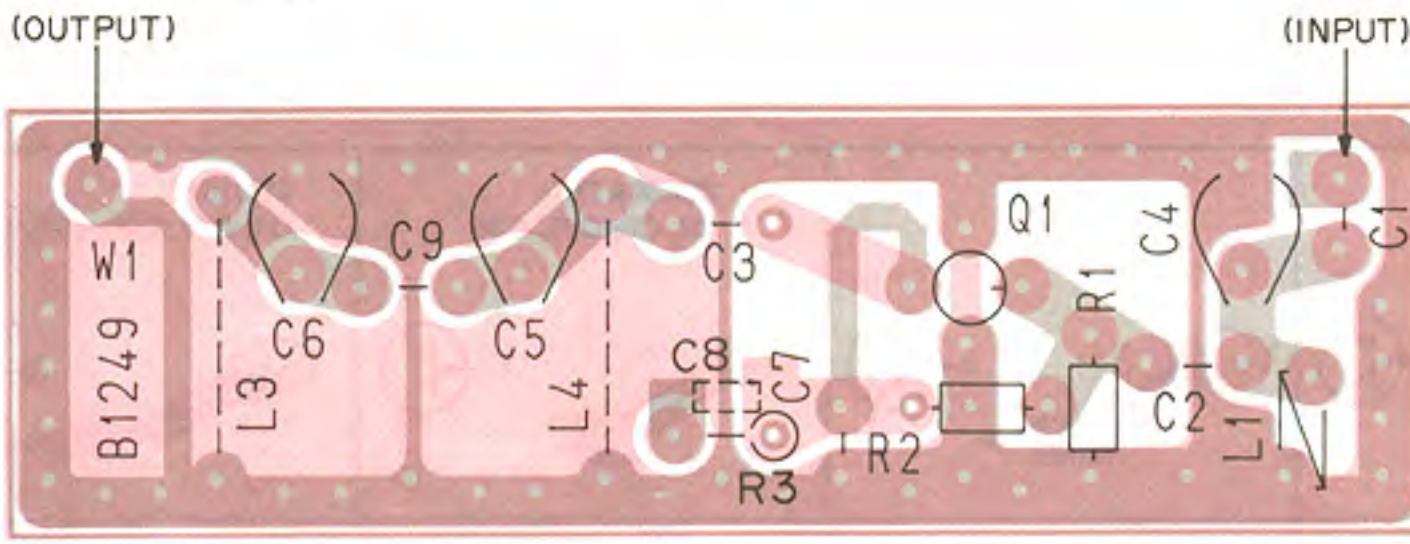


5-4 TOP SIDE CONNECTOR CONNECTIONS

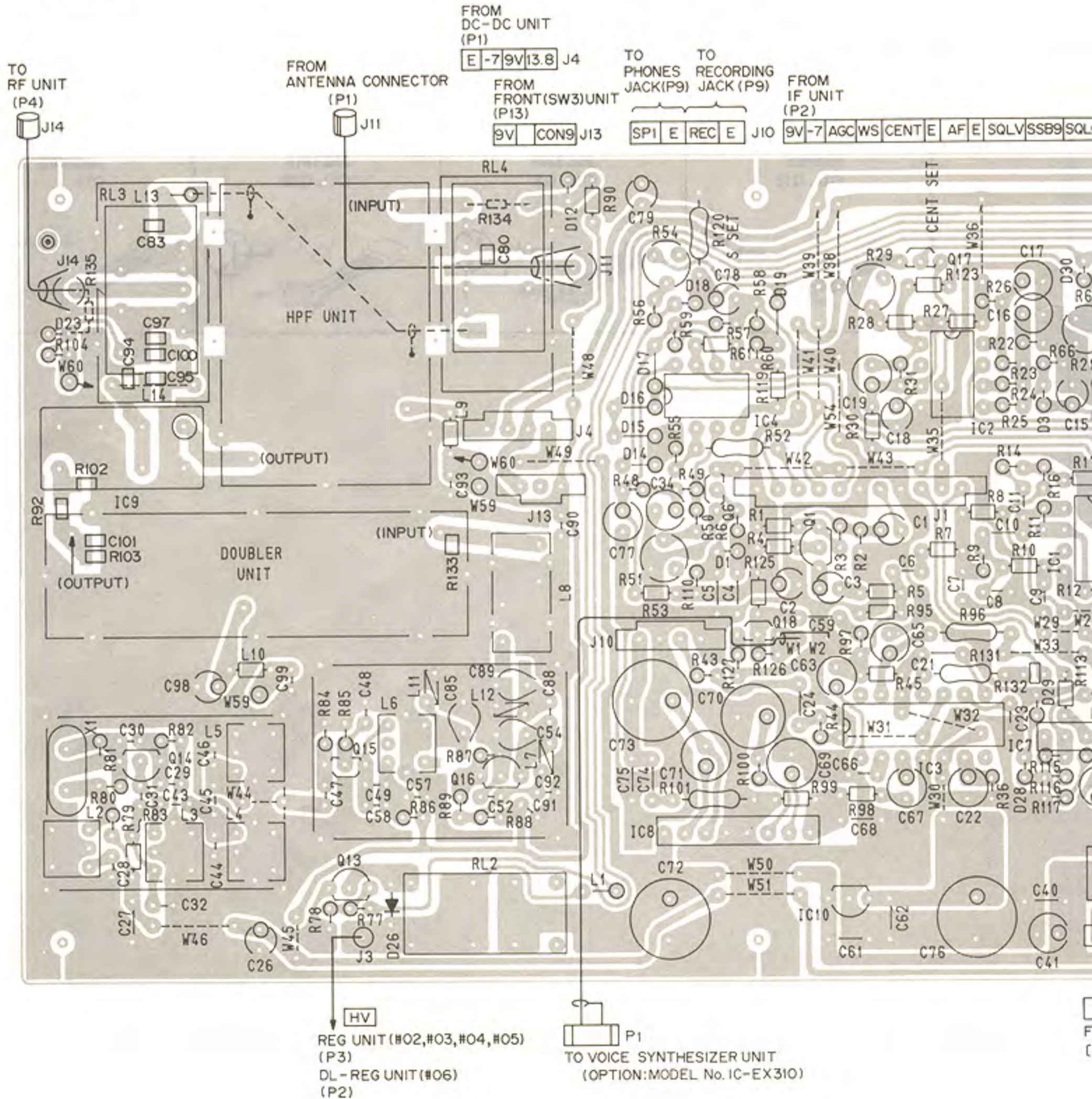




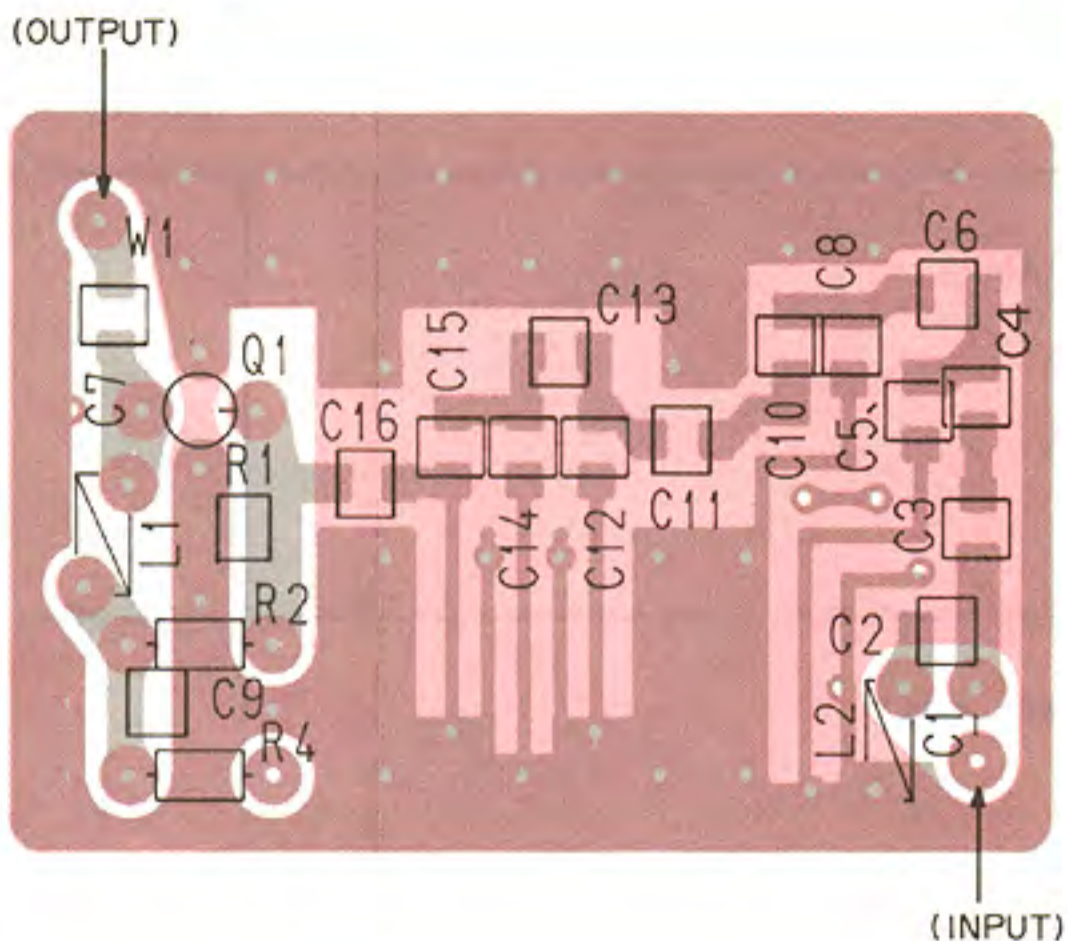
• DOUBLER UNIT



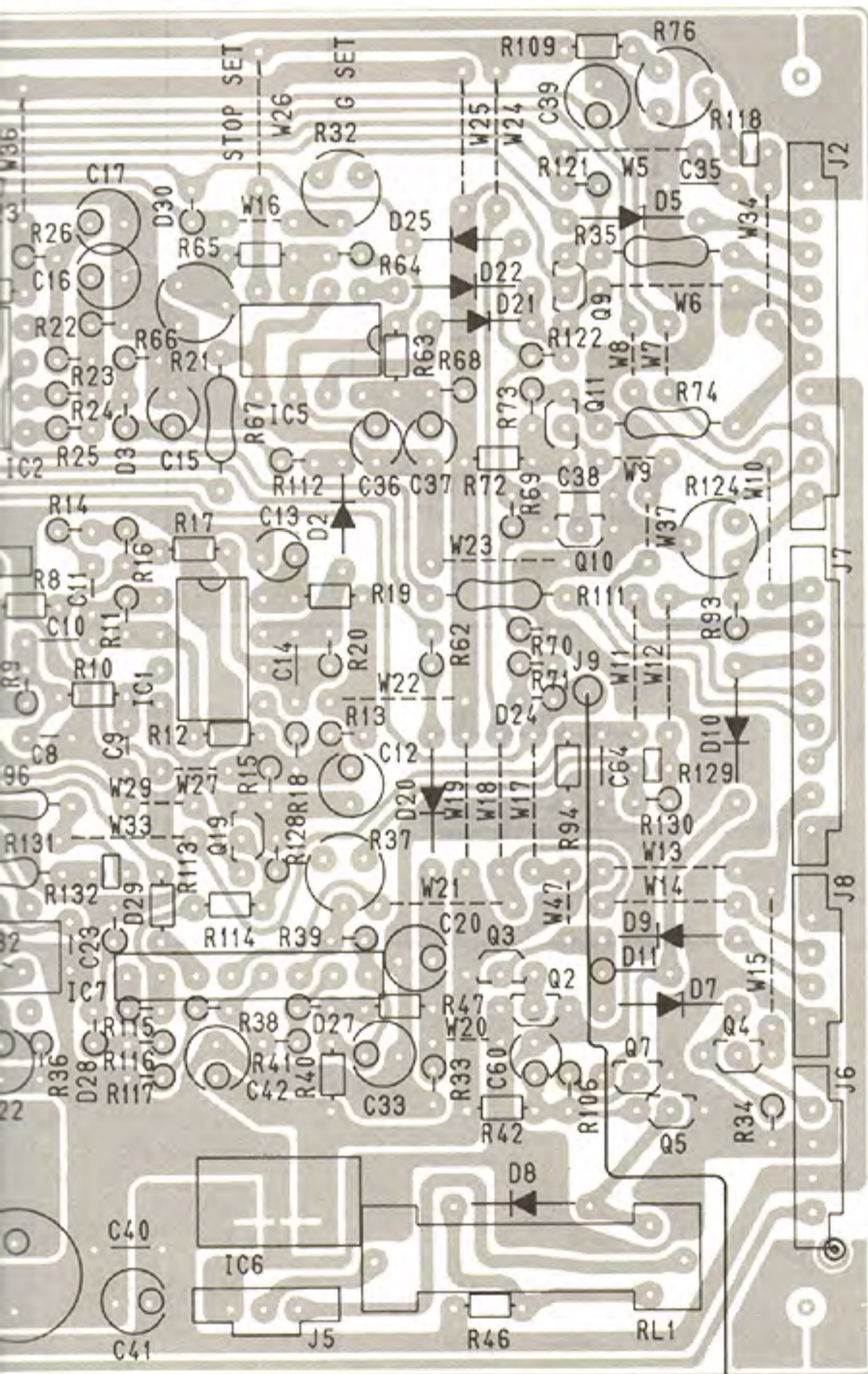
• MAIN UNIT



• HPF UNIT



E SQLV SSB9 SQLC J1



J2

E
SM
CM
SQL3
SQL2
SQL1
13.8
HV
SQLG
AFG

FROM METER SWITCH
FROM SQUELCH CONTROL
FROM FRONT (SW1) UNIT
FROM SQUELCH CONTROL
FROM AF GAIN CONTROL

J7

POC
AFUO
MO
STOP
VSC
HV
9V
13.8

FROM LOGIC UNIT (P1)

J8

13.8
-7
MUTE
E

FROM PLL UNIT (P1)

J6

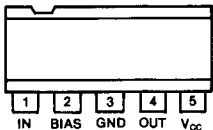
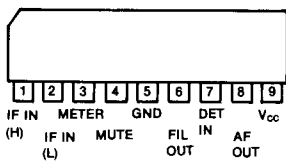
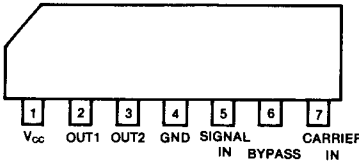
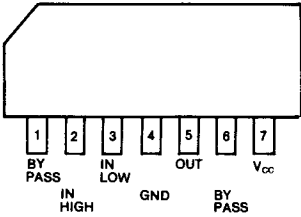
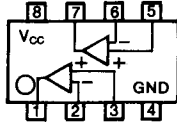
SIG
E
13.8
CON9

TO DISPLAY UNIT (P1)

MO2 MO1 J5
FROM EF UNIT (P8)
[RECORDER-REMOTE]

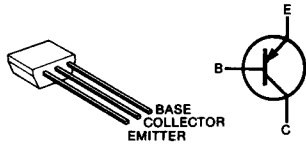
BKMA
LOGIC UNIT (P9)

7-4 IF UNIT

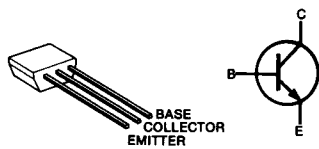
IC		
<p>IC1</p>	<p>BA401 (LIMITER AMP.)</p>	
<p>IC2</p>	<p>TA7303P (FM IF AMP., DET.)</p>	
<p>IC3</p>	<p>μPC1037H (DOUBLE-BALANCED MIXER)</p>	
<p>IC4, IC5</p>	<p>μPC577H (FM IF AMPLIFIER)</p>	
<p>IC6</p>	<p>NJM4558D (LOW NOISE DUAL OPERATIONAL AMPLIFIER)</p>	

TRANSISTORS

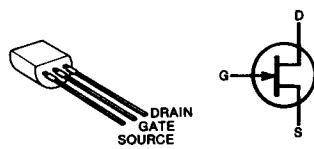
2SA1048
Q1, Q29



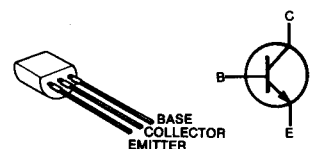
2SC2668
Q2



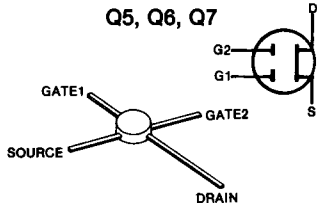
2SK30ATM
Q3, Q8, Q25, Q30



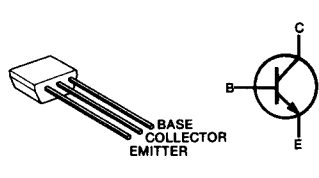
2SC1571
Q4, Q13, Q20, Q23, Q24



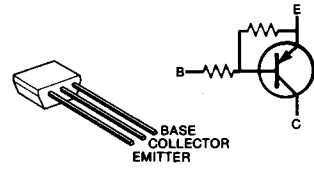
3SK74
Q5, Q6, Q7



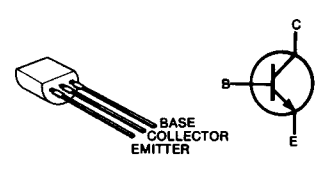
2SC2458
Q9, Q10, Q18, Q19, Q26



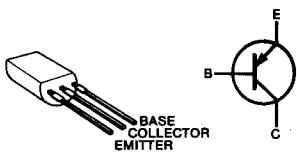
2SA1348
Q11, Q17, Q28



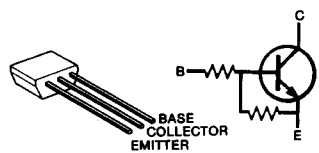
2SC945
Q12



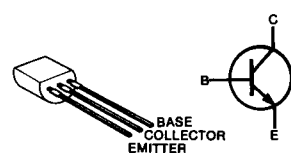
2SB562
Q14, Q15



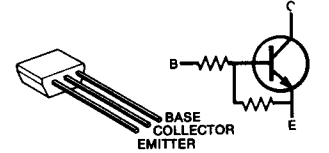
2SC3399
Q16, Q27



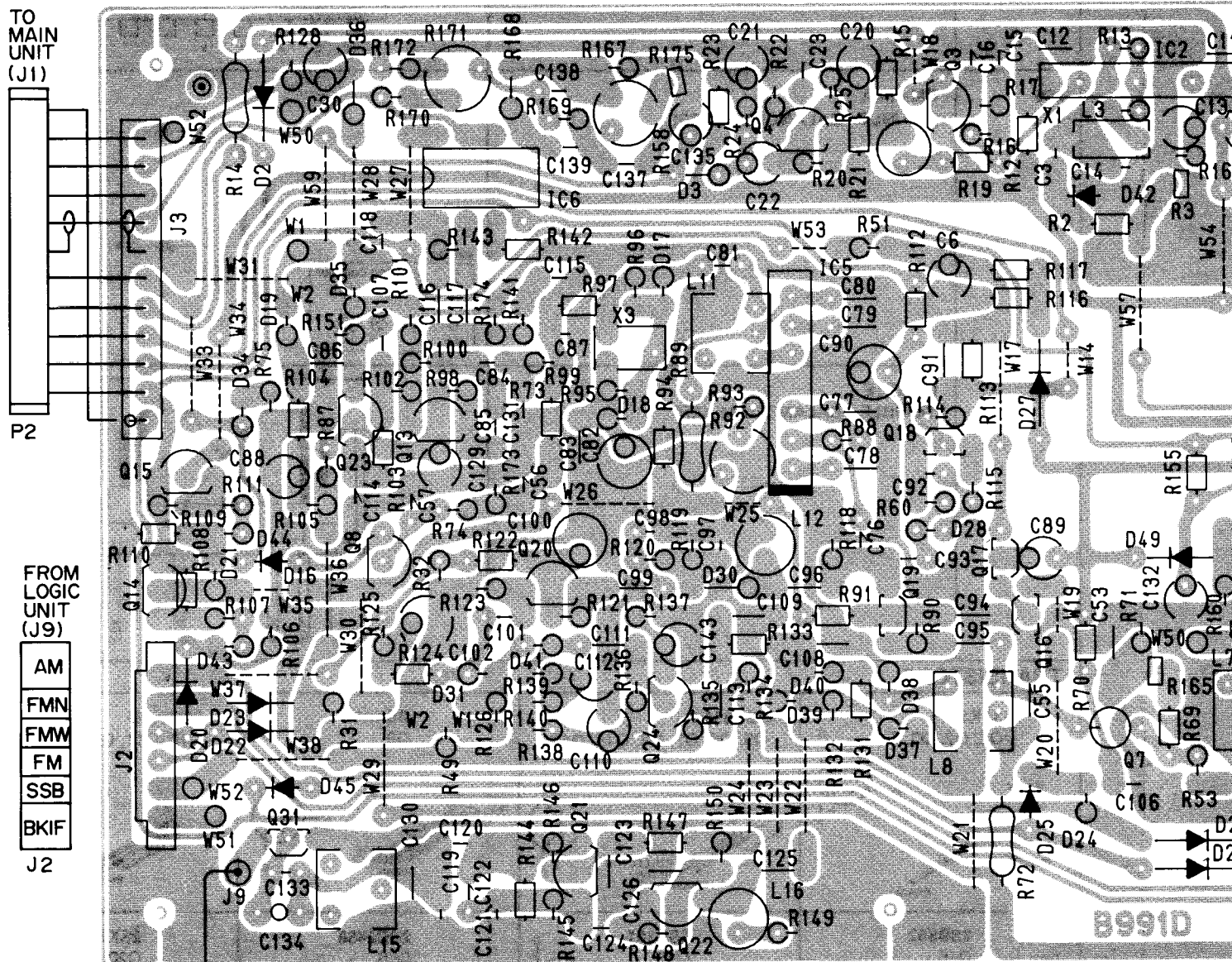
2SC1815
Q21, Q22



2SC3402
Q31



• IF UNIT



TO MAIN UNIT (J1)

P2

FROM LOGIC UNIT (J9)

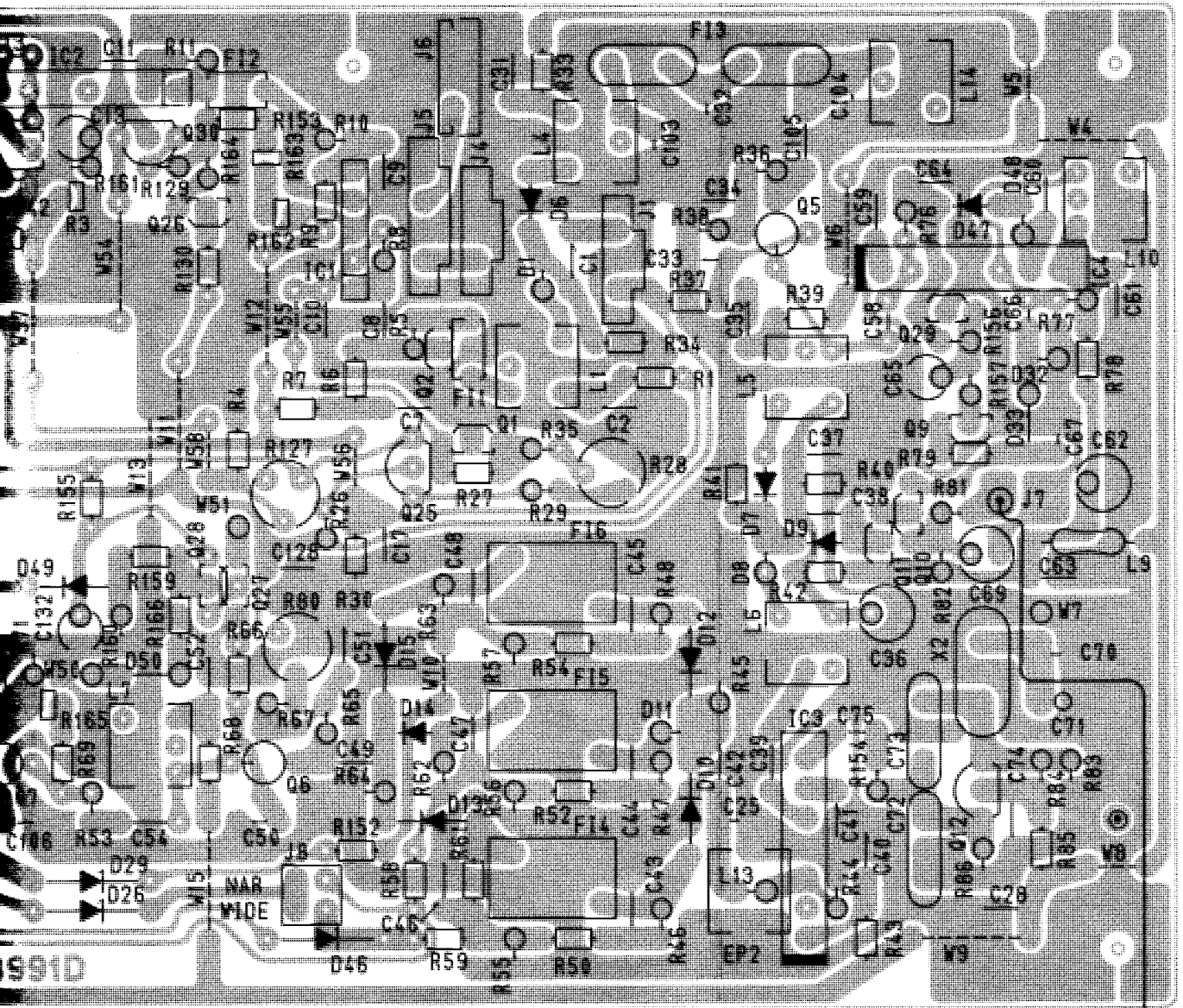
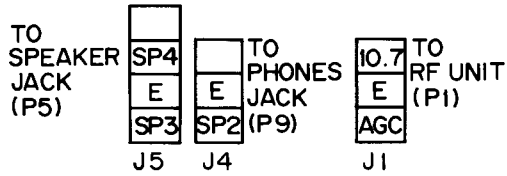
- AM
- FMN
- FMW
- FM
- SSB
- BKIF

J2

LSB J9

FROM USB/LSB SELECTOR SWITCH (P10)

B991D



J8



FROM
FRONT (SW 1)
UNIT
(P15)

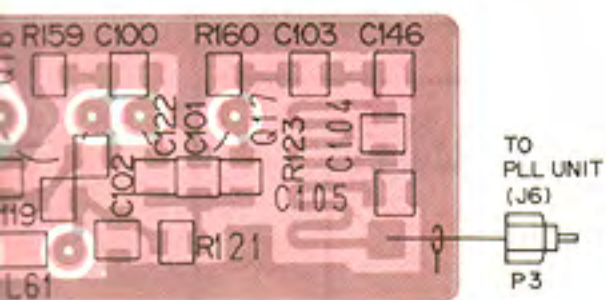
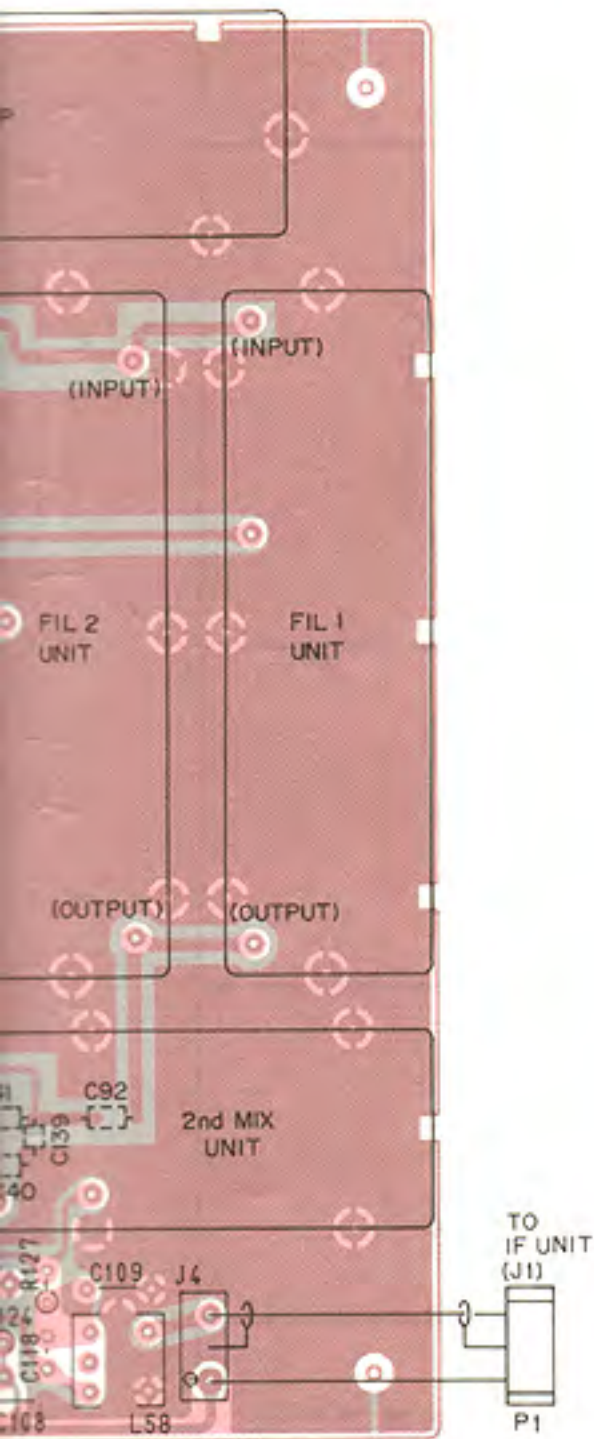
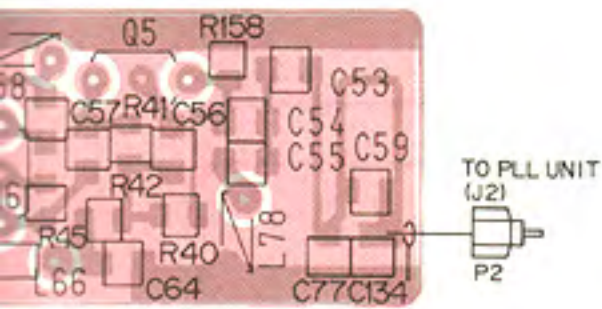
7-5 RF UNIT

• RF UNIT

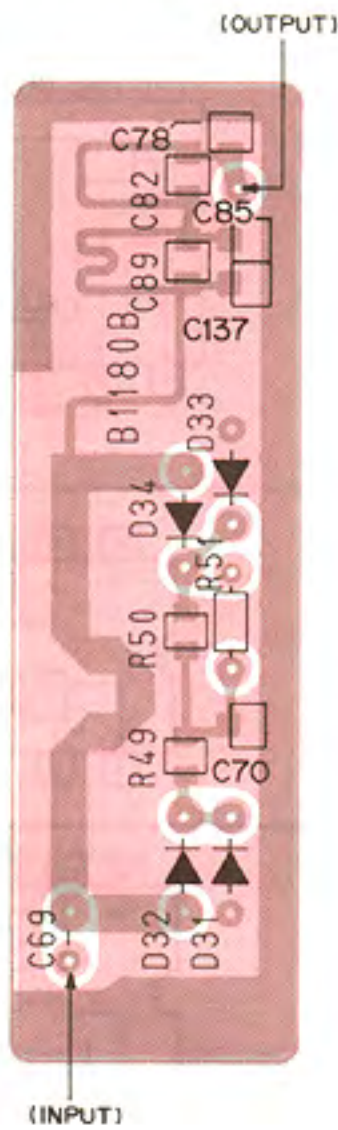
IC		
IC1, IC2, IC3, IC4	NJM4558D (LOW NOISE DUAL OPERATIONAL AMPLIFIER)	
IC5	BA618 (LED DRIVER)	
IC6	DM-88XA (DOUBLE-BALANCED MIXER)	
IC7	DM-251E (DOUBLE-BALANCED MIXER)	

TRANSISTORS

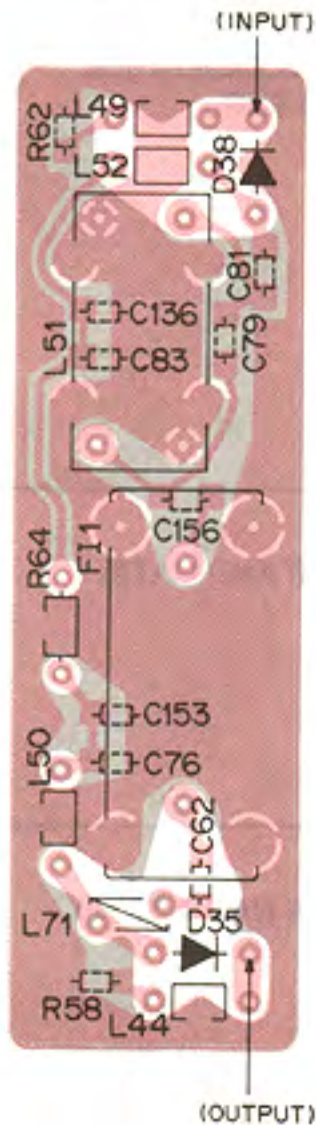
3SK121 Q1, Q2, Q3, Q4 	2SC3355 Q5, Q6, Q7, Q8, Q16, Q17 	2SK241 Q9 	2SC3399 Q10, Q11, Q12, Q13, Q14
2SB562 Q15 	3SK101 Q18 	2SC2458 Q19 	2SK30ATM Q20
2SC945 Q21 			



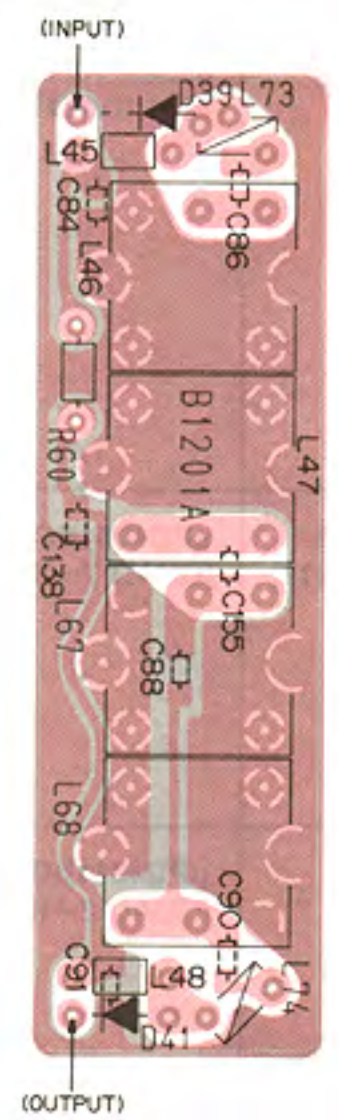
• LO TRAP UNIT



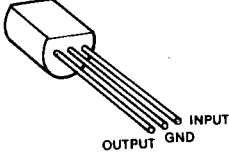
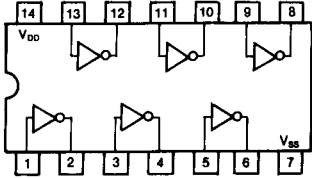
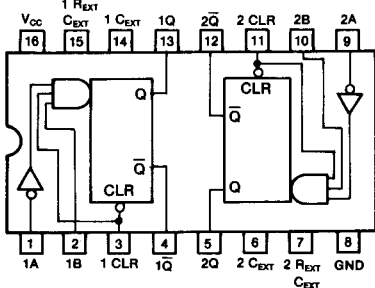
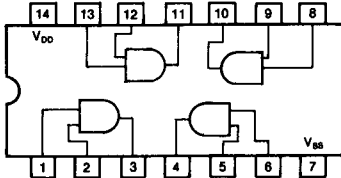
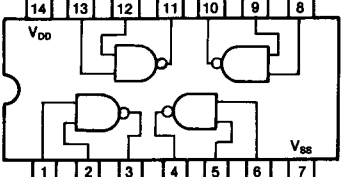
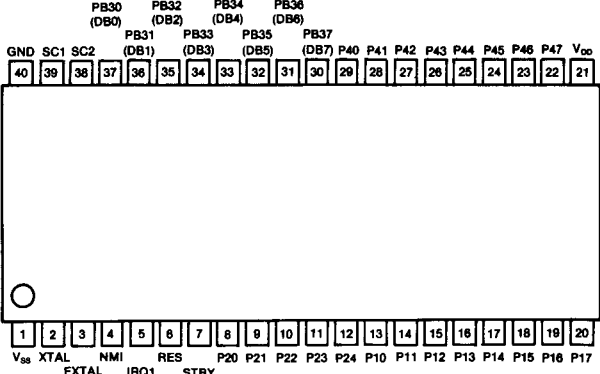
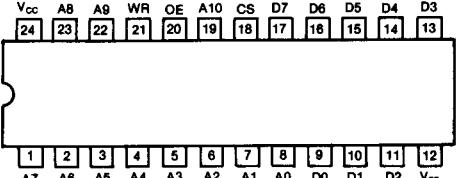
• FIL2 UNIT



• FIL1 UNIT



7-6 LOGIC UNIT

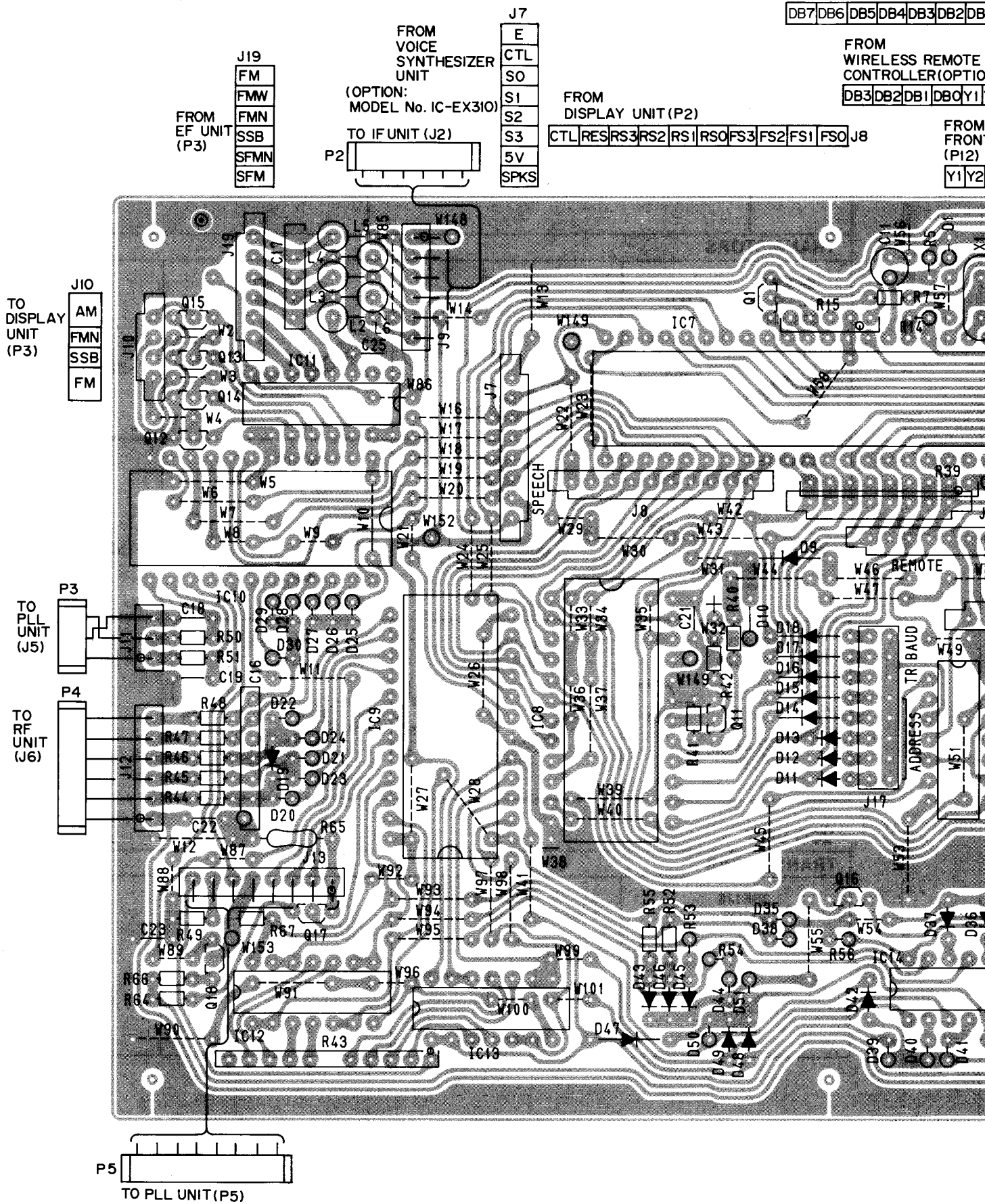
IC		
IC1	TA78L005AP (3-TERMINAL 5V REGULATOR)	
IC2, IC14	μPD4069UBC (HEX INVERTER)	
IC3	SN74LS123 (DUAL RETRIGGERABLE MONOSTABLE MULTIVIBRATOR WITH CLEAR)	
IC4, IC6, IC12, IC13, IC15	μPD4081BC (QUAD 2-INPUT POSITIVE AND GATE)	
IC5	μPD4011BC (QUAD 2-INPUT POSITIVE NAND GATE)	
IC7	HD63A01V1D26P (CPU)	
IC8	μPD448C (16K CMOS STATIC RAM)	

IC9, IC10	μPD82C43C (I/O EXPANSION PORT)	
IC11	BA618 (LED DRIVER)	
IC16	μPD4528BC (DUAL MONOSTABLE MULTIVIBRATOR)	

TRANSISTORS

<p>2SC2458 Q1, Q2, Q3, Q7, Q8, Q9, Q10, Q11, Q17, Q18</p>	<p>2SA1348 Q4, Q12, Q13, Q14, Q15, Q22</p>	<p>2SC3402 Q5, Q6</p>	<p>2SC3399 Q16, Q19, Q20</p>
<p>2SK30ATM Q21</p>			

• LOGIC UNIT



J19
 FM
 FMW
 FMN
 SSB
 SFMN
 SFM

FROM EF UNIT (P3)

FROM VOICE SYNTHESIZER UNIT
 (OPTION: MODEL No. IC-EX310)
 TO IF UNIT (J2)
 P2

J7
 E
 CTL
 SO
 S1
 S2
 S3
 5V
 SPKS

FROM DISPLAY UNIT (P2)
 CTL RES RS3 RS2 RS1 RS0 FS3 FS2 FS1 FS0 J8

DB7 DB6 DB5 DB4 DB3 DB2 DB1
 FROM WIRELESS REMOTE CONTROLLER (OPTION)
 DB3 DB2 DB1 DB0 Y1

FROM FRONT (P12)
 Y1 Y2

J10
 AM
 FMN
 SSB
 FM

TO DISPLAY UNIT (P3)

P3
 TO PLL UNIT (J5)

P4
 TO RF UNIT (J6)

P5
 TO PLL UNIT (P5)

DB5 DB4 DB3 DB2 DB1 DB0 J16

FROM WIRELESS REMOTE (P1)
 CONTROLLER(OPTION:MODEL No. RC-12)
 DB3 DB2 DB1 DB0 Y1 Y2 Y3 Y4 J14

J1
 FROM DEF UNIT (P7)

E
CI-V

FROM DEF UNIT(P6)

REC	E
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 J18

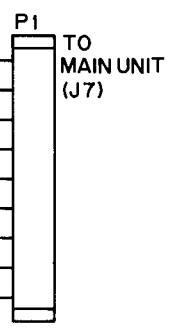
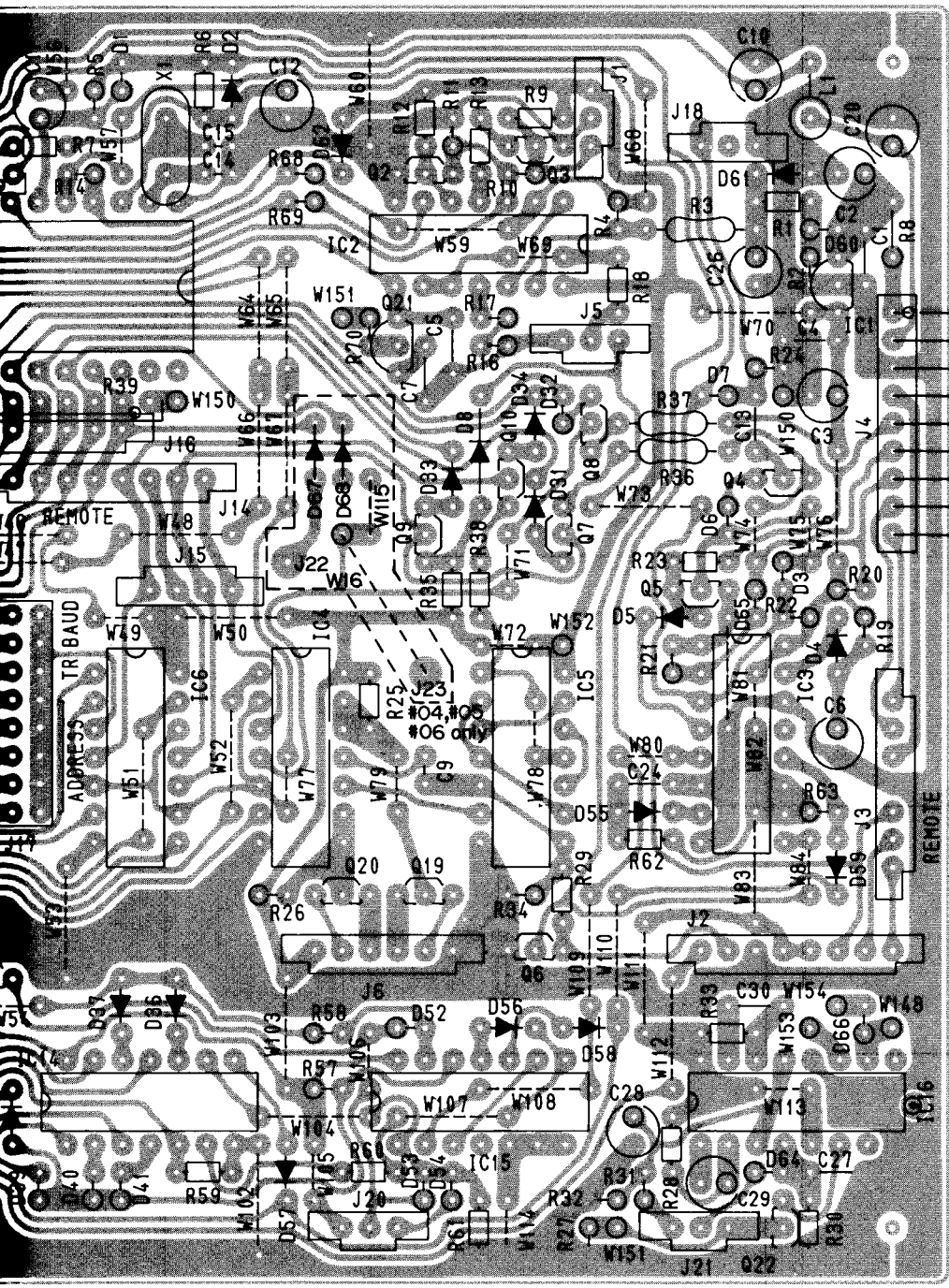
FROM FRONT(SW4)UNIT (P12)

Y1	Y2	Y3	Y4
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 J15

FROM FRONT(SW2)UNIT (P1)
 J5

SS1	SS2	VSCS
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J3

POC	FROM WIRELESS REMOTE CONTROLLER (OPTION:MODEL No. RC-12)
AF UD	(P2)
HV	
E	
SPKS	
REI3	
REM	

J6

5V	SEN	SEN	SEN	SEN	E
4	3	2	1		

 FROM SENSOR UNIT (P8)

J2

ATT5	LOCK	E	5V	5V	SPKS	REI3	REM
------	------	---	----	----	------	------	-----

 FROM FRONT(SW1) UNIT AND FRONT(SW3) UNIT (P7)

J20

5V	IK	0.1
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 FROM FRONT(SW4)UNIT (P14)

J21

SCAN	PRI	PRO
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 FROM DISPLAY UNIT (P4)