ICOM

SERVICE MANUAL

VHF TRANSCEIVER

IC-H19S1
IC-H19S2

Icom Inc.

INTRODUCTION

This service manual describes the latest service information for the **IC-H19S1/IC-H19S2** VHF TRANSCEIVER at the time of publication.

	MODEL	
	IC-H19S1	IC-H19S2
Intrinsically safe	Class I, II and III, Division 1, Groups C, D, E, F and G	Class I, Division 1, Groups C and D
Nonincentive	Class I, Division 2, Groups A, B, C and D	

DANGER

NEVER connect the transceiver to an AC outlet or to a DC power supply that uses more than 14 V. This will ruin the transceiver.
DO NOT expose the transceiver to rain, snow or any liquids.
DO NOT reverse the polarities of the power supply when connecting the transceiver.
DO NOT apply an RF signal of more than 20 dBm (100 mW) to the antenna connector. This could damage the transceiver's front end.

INTRINSICALLY SAFE QUALIFICATION

When servicing **IC-H19S1** and **IC-H19S2**, the following conditions must be met. Failing to satisfy any of these conditions will invalidate the INTRINSICALLY SAFE certification.

1. Servicing the transceiver should only be undertaken by suitably qualified personnel in a non-hazardous area. Never attempt to remove the case in a hazardous area.
2. **ONLY** the approved battery, ICOM's CM-71, may be used, and this battery may only be removed or charged in a safe area.
3. **USE ONLY** safety critical components as specified in the parts list (SECTION 6), should replacement of any item be necessary.

ORDERING PARTS

Be sure to include the following four points when ordering replacement parts:

1. 10-digit order numbers
2. Component part number and name
3. Equipment model name and unit name
4. Quantity required

<SAMPLE ORDER>

1130000830	IC	μPD4094BG-T1	IC-H19S1/S2	MAIN UNIT	5 pieces
8810004860	Screw	PH M2 × 6 ZK	IC-H19S1/S2	Top cover	10 pieces

Addresses are provided on the inside back cover for your convenience.

REPAIR NOTE

1. Make sure a problem is internal before disassembling the transceiver.
2. **DO NOT** open the transceiver until the transceiver is disconnected from its power source.
3. **DO NOT** force any of the variable components. Turn them slowly and smoothly.
4. **DO NOT** short any circuits or electronic parts. An insulated tuning tool **MUST** be used for all adjustments.
5. **DO NOT** keep power ON for a long time when the transceiver is defective.
6. **DO NOT** transmit power into a signal generator or a sweep generator.
7. **ALWAYS** connect a 30 dB~40 dB attenuator between the transceiver and a deviation meter or spectrum analyzer when using such test equipment.
8. **READ** the instructions of test equipment thoroughly before connecting equipment to the transceiver.

TABLE OF CONTENTS

To program the operating frequency, tone frequency, etc., see the separately available EX-704 PROGRAMMING MANUAL.

SECTION 1 SPECIFICATIONS

■ GENERAL

- Frequency range : 136~174 MHz
- Type of emission : 16K0F3E
- Number of channels : Up to 16 channels
- Frequency stability : ±0.0005 %
- Antenna impedance : 50 Ω unbalanced
- Power supply voltage :

BATTERY PACK	OUTPUT VOLTAGE
CM-71 *1	7.2 V
CM-72 *2	8.4 V
CM-73 *2	13.2 V

(Negative ground)
*1 Intrinsically safe type. Same type as supplied with the IC-H19S1/S2.
*2 Non intrinsically safe type.

- Usable temperature range : −30 °C~+60 °C (−22 °F~+140 °F)
- Dimensions : 65 (W) × 109 (H) × 35 (D) mm
  2.6 (W) × 4.3 (H) × 1.4 (D) in, (without battery pack)
- Weight (with CM-71) : 590 g (1.3 lbs)

■ TRANSMITTER

- RF output power (At 13.2 V DC) : High: 5 W
  Low : 800 mW
- Modulation system : Variable reactance frequency modulation
- Current drain (At 13.2 V DC) : High: 1.8 A
  Low : 1.2 A
- Microphone impedance : 2.2 kΩ
- Maximum deviation : ±5 kHz
- Spurious emissions : −65 dB
- FM hum and noise : −50 dB
- Audio response : +1 dB, −3 dB of +6 dB/octave from 300 Hz to 3000 Hz

■ RECEIVER

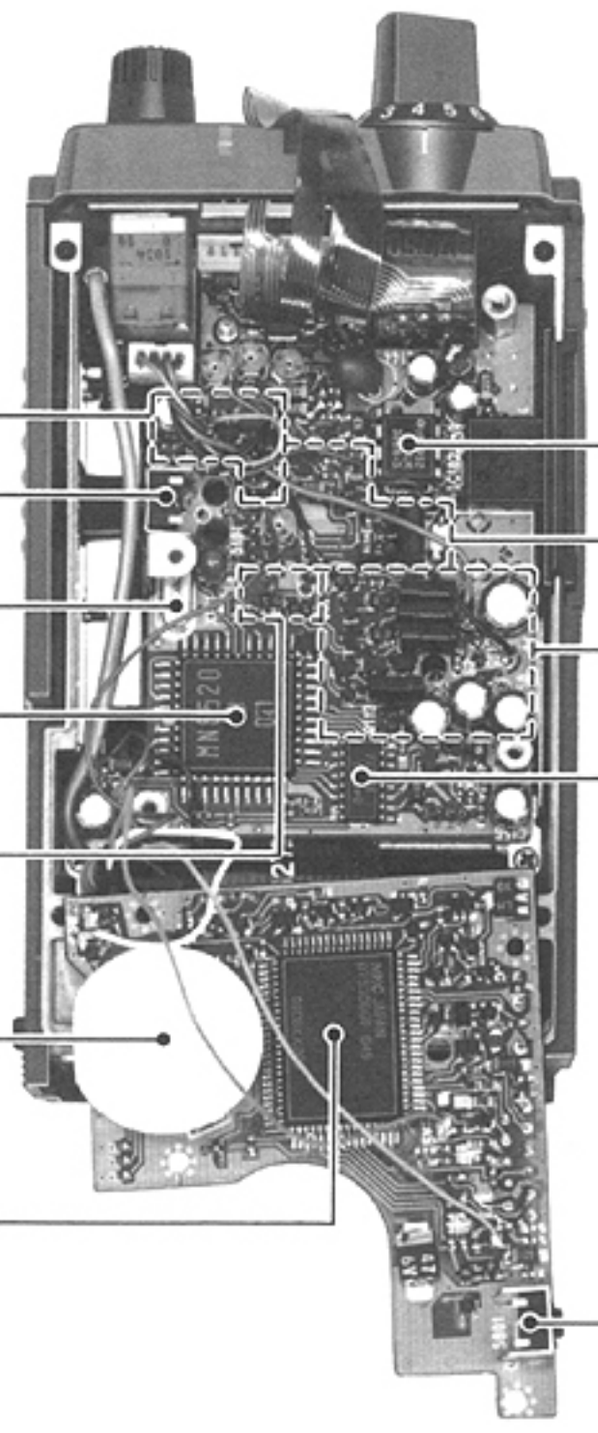
- Sensitivity : 0.25 µV at 12 dB SINAD
- Squelch sensitivity : 0.25 µV
- Modulation acceptance : ±7 kHz
- Current drain (At 13.2 V DC) : Audio max. 0.3 A
  Standby 75 mA
- Audio output power :

BATTERY PACK	OUTPUT POWER (at 10 % distortion with an 8 Ω load)
CM-71	200 mW
CM-72	350 mW
CM-73	500 mW

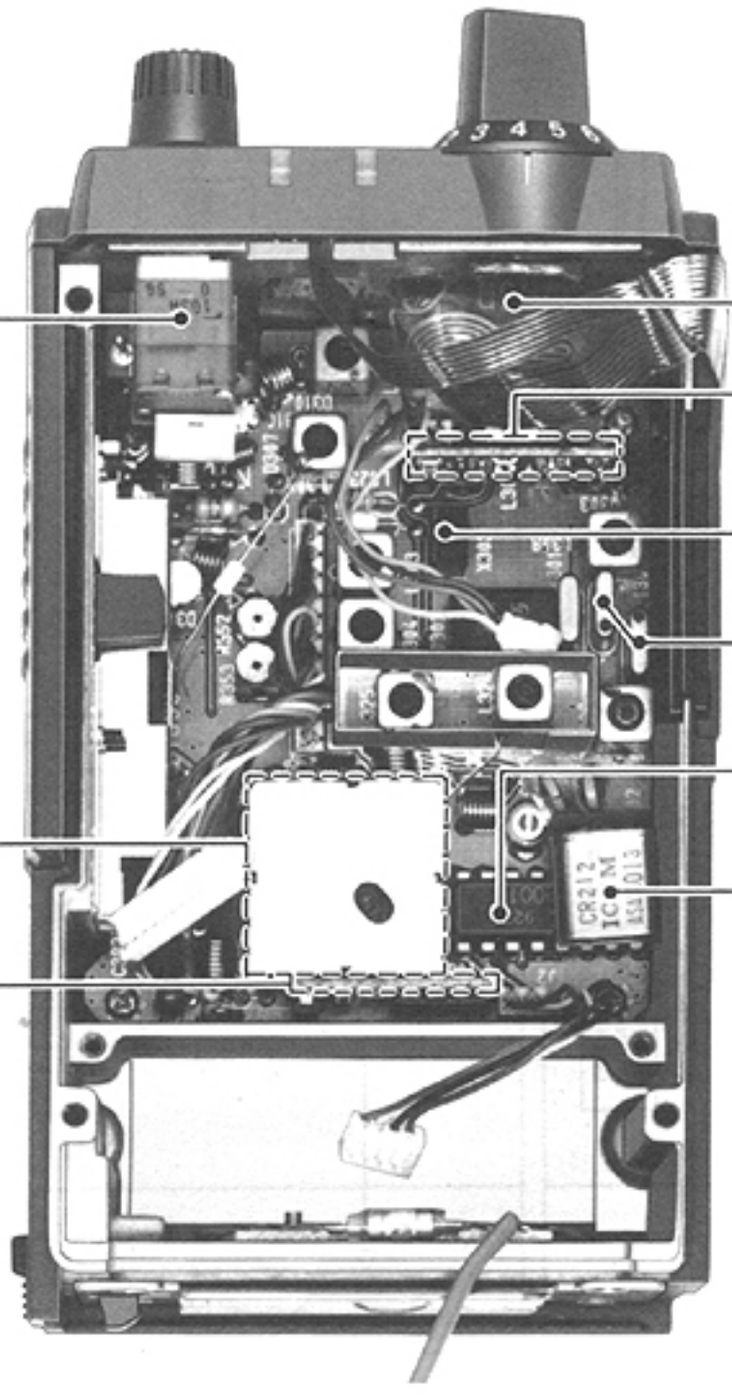
- Adjacent channel selectivity : −70 dB
- Spurious rejection : −70 dB
- Image rejection : −75 dB
- Intermodulation rejection : −70 dB
- Hum and noise : −40 dB
- Audio response : +1 dB, −3 dB of − 6 dB/octave from 300 Hz to 3000 Hz

SECTION 2 INSIDE VIEWS

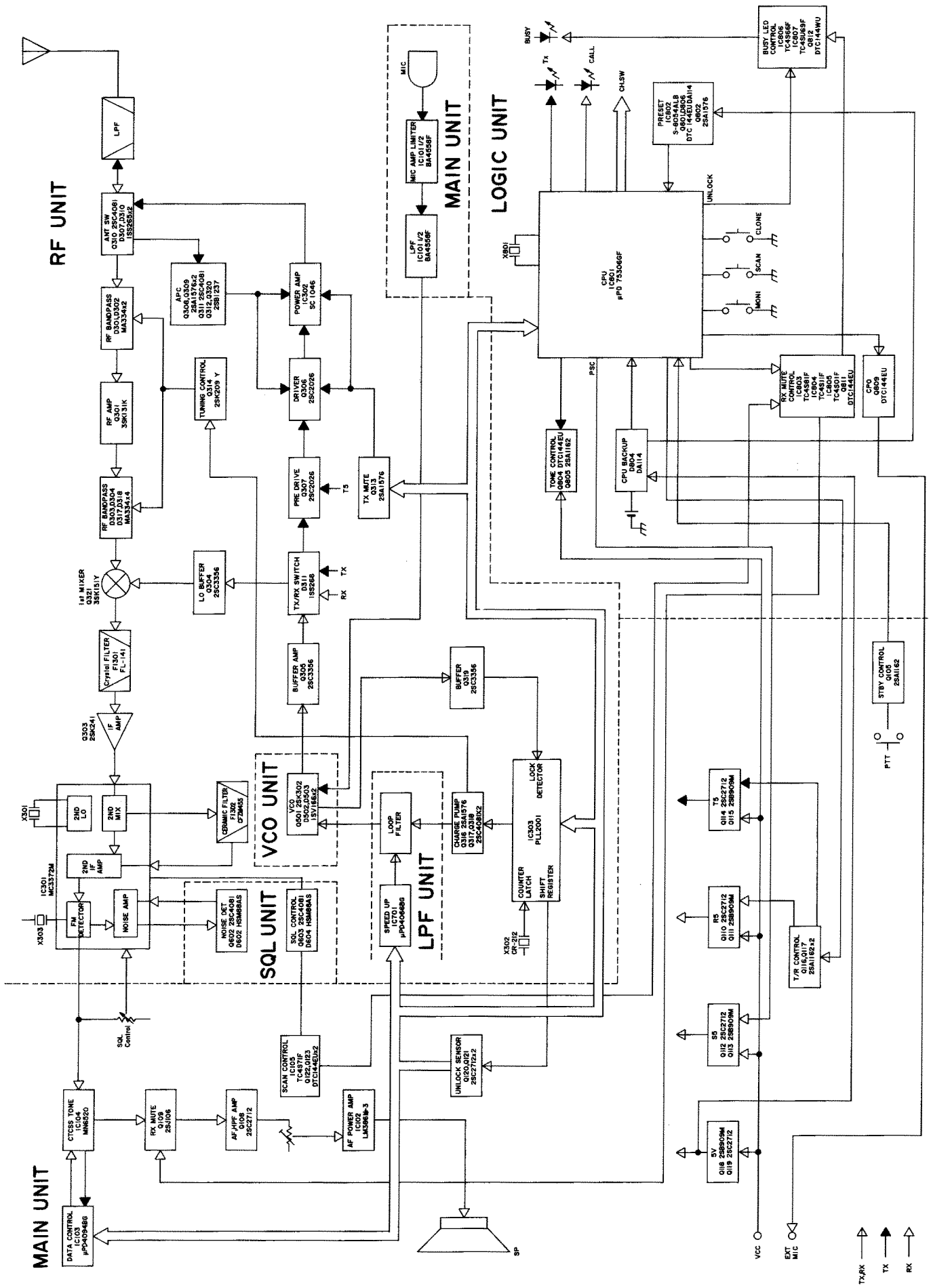
• MAIN AND LOGIC UNITS



• RF UNIT



SECTION 3 BLOCK DIAGRAM



SECTION 4 CIRCUIT DESCRIPTION

4-1 RECEIVER CIRCUITS

4-1-1 ANTENNA SWITCHING CIRCUIT (RF UNIT)

The antenna switching circuit functions as a low-pass filter while receiving and as a resonator circuit while transmitting.

Received signals enter the antenna connector and pass through a two-stage Chebyschev low-pass filter (L311, L312, C340~C344) to suppress out-of-band signals. The filtered signals are applied to the λ/4-type diode switching circuit (D307, D310, L310, C337, C338) and then to a two-stage bandpass filter (L301, L302, D301, D302, C304, C305, C385, C419).

4-1-2 RF CIRCUIT (RF UNIT)

The signals are amplified at an RF amplifier (Q301). The amplified signals enter a four-stage bandpass filter (L303, L304, L324, L325, D303, D304, D317, D318, C309, C310, C312, C313, C420~C426) to suppress unwanted signals.

D301~D304 employ varactor diodes which are controlled by the PLL lock voltage. These diodes tune the center frequency of the RF circuit for wide bandwidth reception and good image response rejection.

4-1-3 1st MIXER AND IF CIRCUITS (RF UNIT)

The 1st mixer circuit converts the received signals to a fixed frequency of the 1st IF signal with a PLL output frequency. By changing the PLL frequency, only the desired frequency can pass through a pair of crystal filters at the next stage of the 1st mixer.

The filtered signals pass through C427 and then enter a first mixer circuit (Q321). The signals are mixed with a 1st LO signal from the VCO UNIT to produce a 21.8 MHz 1st IF signal. The 21.8 MHz 1st IF signal is applied to L307 and then to a pair of crystal filters (FI301) which suppress out-of-band signals. The filtered signal passes through L308 and then enters a 1st IF amplifier (Q303). The amplified signal is applied to a matching transformer (L309).

4-1-4 2nd IF AND DEMODULATOR CIRCUITS (RF UNIT)

The 2nd mixer circuit converts the 1st IF signal to a 2nd IF signal.

The 1st IF signal from L309 is applied to a 2nd mixer section of IC301 (pin 16) and then is mixed with a 2nd LO signal for conversion to a 455 MHz 2nd IF signal.

IC1 contains the 2nd mixer, local oscillator circuit, limiter amplifier, quadrature detector circuit and active filter circuit. The local oscillator section and X301 generate 21.345 MHz for the 2nd LO signal.

The 2nd IF signal from the 2nd mixer (IC301, pin 3) passes through a ceramic filter (FI302) where unwanted signals are suppressed. It is then amplified at the limiter amplifier section (IC301, pin 5) and applied to the quadrature detector section (IC301, pin 8 and ceramic discriminator X303) to demodulate the 2nd IF signal into an AF signal. The AF signal is output from IC301 (pin 9).

4-1-5 AF CIRCUIT (MAIN UNIT)

IC104 contains a CTCSS tone encoder/decoder, an AF amplifier circuit and a two-stage AF filter.

The AF signal is applied to the AF amplifier circuit (IC104, pin 29) and then to the two-stage AF filter. The filtered signal is output from IC104 (pin 18) and then applied to a de-emphasis circuit (R155, C153, C167). This circuit is an integrated circuit with frequency characteristics of −6 dB/octave. The resulting signal is applied to a muting circuit (Q109) and then to an AF preamplifier (Q108).

The AF preamplifier (Q108) amplifies the AF signal to a sufficient level in order to drive an AF power amplifier (IC102). When the squelch is closed, Q109 cuts the AF signal like an AF mute switch. Q108 functions as both an AF amplifier and a high-pass filter. The amplified signal from Q108 is applied to the [VOL] CONTROL (R1) on the VR UNIT and then to an AF power amplifier (IC102, pin 2). The AF power amplifier (IC102, pin 5) outputs more than 500 mW with an 8 Ω load to drive a speaker.

The DC voltage from the battery pack is applied to a voltage regulator circuit (Q106, Q107, D104). This circuit adjusts the voltage to protect IC102 from overloading.

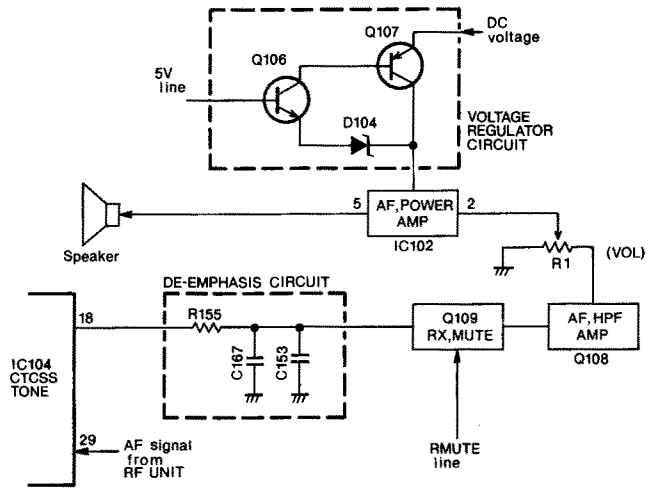


Fig. 1

4-1-6 SQUELCH CIRCUIT (RF AND LOGIC UNITS)

A squelch circuit cuts out AF signals when no RF signal is received. By detecting noise components in the AF signals, the squelch circuit switches the AF mute switches.

Some noise components in the AF signal from IC301 (pin 9) are applied to an active filter section of IC301 (pin 10). It amplifies the noise components of frequencies of 20 kHz and above. The resulting signals are output from IC301 (pin 11) and are then amplified at Q602. The amplified signals are rectified by D602 and D604 and are then converted to DC voltage.

• SQUELCH CIRCUIT

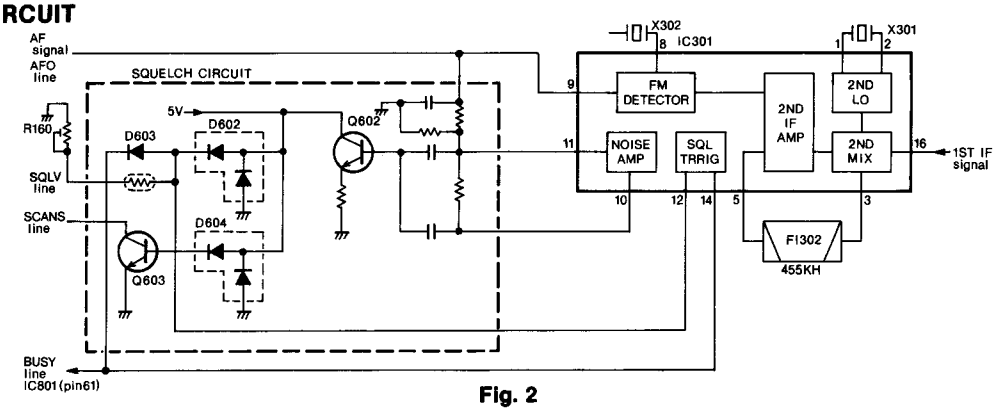


Fig. 2

The rectified voltage from D602 is applied to the SQUELCH CONTROL (R160) on the MAIN UNIT and then to a squelch trigger circuit section of IC301 (pin 12) on the RF UNIT. The squelch signal is output from IC301 (pin 14) and then applied to the CPU (IC801, pin 61) on the LOGIC UNIT through the "BUSY" signal line.

The rectified voltage from D604 outputs a "SCANS" signal. The signal is applied to a scan stop circuit (IC105, Q122, Q123) on the MAIN UNIT.

The squelch circuit is activated when the CPU (IC801, pin 52) outputs an "RMUT" signal to a muting circuit (Q109).

4-2 TRANSMITTER CIRCUITS

4-2-1 MICROPHONE AMPLIFIER (MAIN AND VCO UNITS)

When the PTT SWITCH (S101) is pushed and held to transmit AF signals, a terminal (MIC2) is connected to a ground to activate a built-in condenser microphone (MIC1) on the FRONT UNIT. The AF signals from the microphone are applied to IC101 (pin 3) and obtain +6 dB/octave pre-emphasis at C104 and R102 which are connected to pin 2. IC101 functions as a microphone amplifier and a limiter. The signals are output from IC101 (pin 1).

The output signals from IC101 (pin 1) are applied to the splatter filter circuit (IC101, R107, R110, R111, C108, C109, C111) to attenuate the components of noise frequencies of 3 kHz and above. The signals are output from IC101 (pin 7). The output signals are adjusted at R116 and are applied to D501 on the VCO UNIT as an "MOD" signal.

The "MOD" signal is modulated into an FM signal at D501 on the VCO UNIT.

4-2-2 DRIVE AMPLIFIER (RF UNIT)

The VCO output is buffer-amplified at Q305 and applied to the transmit/receive switching circuit (D311).

After passing through the transmit/receive switching circuit (D311), the VCO output is amplified at a pre-amplifier (Q307) and re-amplified at a drive amplifier (Q306) to obtain 20 mW.

The voltage controlled by the APC circuit is applied to the collector of Q306 and a power amplifier (IC302) to stabilize RF output power.

4-2-3 RF POWER AMPLIFIER (RF UNIT)

IC302 is a power module which provides a stable 5 W (DC 13.2 V) of output power.

RF signals from the drive amplifier (Q306) are applied to the power amplifier (IC302, pin 1). The amplified signals are output from IC302 (pin 5). The output signals are applied to the [ANT] CONNECTOR through the APC circuit, the antenna switching circuit and the low-pass filter circuit.

4-2-4 APC CIRCUIT (RF UNIT)

The APC circuit protects the power module (IC302) from a mismatched output load and selects HIGH and LOW output power.

The output power from the power module (IC302, pin 5) is applied to the mismatch detector circuit (L315, R324, R325, C352, C353) to divide high-frequency components for conversion to DC voltage at D308 and D309. When the antenna impedance is matched at 50 Ω, the detected voltage is at a minimum. However, when antenna impedance is mismatched, the detected voltage is higher than when it is matched.

The detected voltage at D308 and D309 is applied to the differential amplifier circuit (Q308, Q309). This circuit outputs an APC reference voltage. When "HIGH" power is selected, it is divided at R349, R351, and R353. When "LOW" power is selected, it is divided at R349~R353. The APC reference voltage is applied to the base of Q309.

When the antenna impedance is mismatched, the base voltage of Q308 is higher than the reference voltage. The collector voltage of Q308 decreases.

The current from the differential amplifier circuit (Q308, Q309) is amplified at Q311 to control Q312 and Q320. The control voltage changes the supply voltage to IC302 and Q306.

This decreases the output power of the drive amplifier (Q306) and power amplifier (IC302) until the base voltage of Q308 reaches the same level as the voltage of Q309.

• APC CIRCUIT

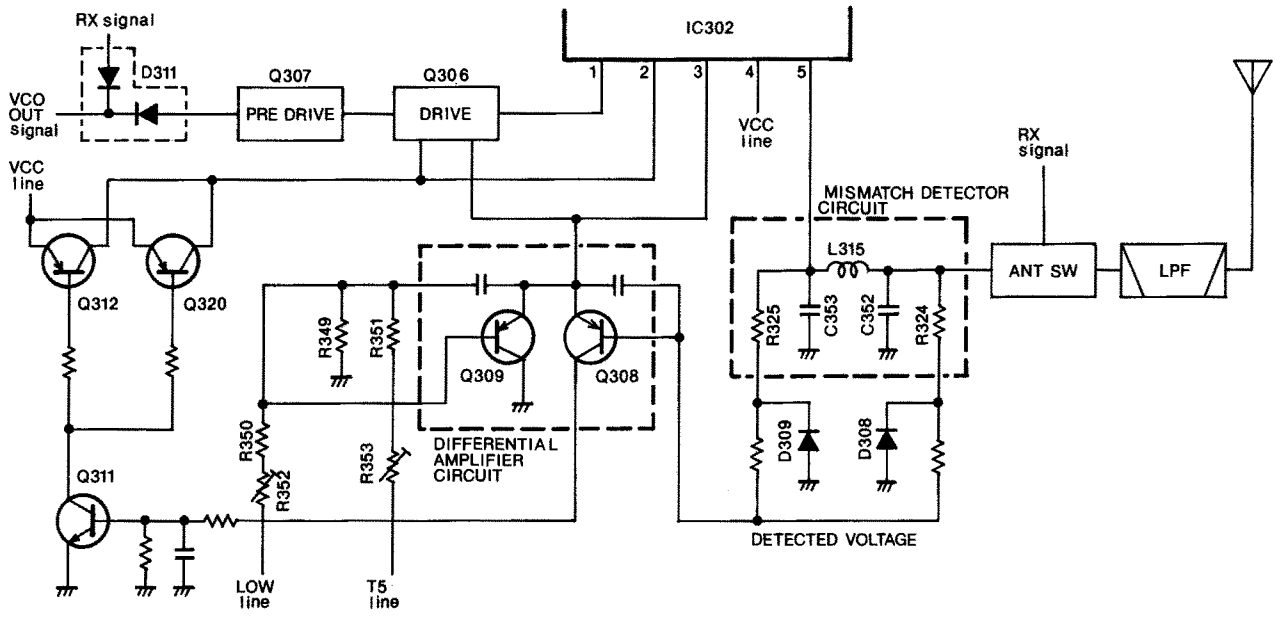


Fig. 3

4-2-5 OUTPUT POWER CONTROL CIRCUIT (RF UNIT)

The output power control circuit consists of R349~R353. This circuit controls the RF output power with the APC reference voltage.

When "HIGH" output power is selected, RF output power can be adjusted with R353.

When "LOW" output power is selected, the signal for low power selection from the CPU (IC801) is applied to R352 through the "LOW" signal line. RF output power is adjusted with R352.

4-2-6 TX MUTE CIRCUIT (RF UNIT)

When a "TMUT" signal from the CPU (IC801) turns Q313 OFF, transmission is interrupted. The bias voltages are prevented from entering Q306, Q307, and IC302.

4-2-7 ANTENNA SWITCHING CIRCUIT (RF UNIT)

The antenna switching circuit applies the received signal to the receiver circuit and the transmitter signal to the antenna connector.

Q310, D307, and D310 are turned ON to form a parallel resonant circuit (L310, C337, C338) while transmitting. The parallel resonant circuit does not allow the RF output signal from IC302 to enter the receiver circuit. The RF output signal from IC302 passes through L315, D307, C339, and C408. The signal is applied to a low-pass filter (L311, L312, C340~C344) and then to an [ANT] CONNECTOR. The impedance of the parallel resonant circuit increases. The signal leakage from the resonant circuit is bypassed through D310 and Q310.

4-3 PLL CIRCUITS

4-3-1 GENERAL (RF UNIT)

A PLL circuit steadily oscillates the transmit frequency and the receive local frequency. The PLL output frequency is controlled by the divided ratio (N-data) of the programmable divider.

The PLL circuit, using a one chip PLL IC (IC303), directly generates the transmit and 1st LO frequency with a Clapp VCO (Q501). The PLL IC sets the divided ratio based on serial data from the CPU (IC801) and compares the phases of a VCO signal and the reference oscillator frequency. The PLL IC detects the out-of-step phase and output from pin 5 and 12. The reference frequency is oscillated at X302.

• **PLL CIRCUIT**

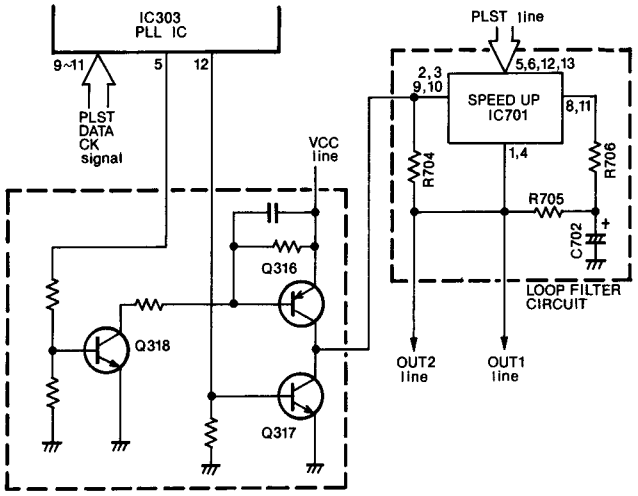


Fig. 4

4-3-2 REFERENCE OSCILLATOR CIRCUIT (RF UNIT)

A 10 MHz reference frequency is produced by Q315 and X302. D313, R361, and R364 stabilize the reference frequency from Q315 and X302 over a wide temperature range.

4-3-3 CHARGE PUMP AND LOOP FILTER CIRCUITS (RF UNIT)

Phase-detected signals from IC303 (pin 5 and 12) are converted to DC voltage by a charge pump (Q316~Q318) and a lag-loop filter (R704, R705, C702).

The frequency at which the VCO oscillates is controlled by varactor diodes (D502, D503). The converted voltage (PLL lock voltage) is provided through the filter.

IC701 is used as an accelerator to ensure rapid PLL lock-up time.

On the other hand, the output voltage from the loop filter is applied to Q314 to control the bandpass filter (D301~D304, D317, D318) in the receiver RF circuit.

R358 and R359 adjust the voltage to stabilize the modulation over a wide frequency range.

4-3-4 UNLOCK CIRCUIT (MAIN UNIT)

When the PLL circuit is unlocked, IC303 (pin 7) is "LOW". A "LOW" signal is applied to the unlock circuit (Q120, Q121). The unlock circuit outputs the resulting signal to the CPU (IC801, pin 62).

4-3-5 VCO CIRCUIT (RF UNIT)

D501 changes the inductive reactance of the Clapp oscillator (Q501) to shift the receive and transmit frequencies. Varactor diodes (D502, D503) provide frequency control. The buffer amplifiers (Q305, Q319) protect the PLL output signal from VCO oscillation.

4-4 OTHER CIRCUITS

4-4-1 VOLTAGE LINES

LINE	DESCRIPTION
VCC	This voltage is applied to Q316, Q317, the 5 V regulator circuit and IC102 through the fuse (F1) and [VOL] CONTROL (R1). This voltage line changes depending on the battery pack type. 7.2 V (CM-71), 8.4 V (CM-72), 13.2 V (CM-73)
5 V	This regulator circuit (Q118, Q119, D111, D112) supplies 5 V with low noise. This circuit is composed of a complementary connection to ensure high current amplification and supplies stable output voltage continuously with good temperature characteristics in all modes.
S5	This regulator circuit (Q112, Q113, D109) forms a complementary circuit. When the power save is turned ON, a "PSC" signal from the CPU (IC801, pin 50) interrupts the "S5" line intermittently to save power.
T5	Transmit 5 V. Q115 supplies T5V when the CPU (IC801, pin 51) becomes "LOW".
R5	Receive 5 V. Q111 supplies R5V when the CPU (IC801, pin 51) becomes "HIGH".

4-4-2 T5/R5 SWITCHING CIRCUIT (MAIN UNIT)

When transmitting, the CPU (IC801, pin 51) becomes "LOW". Q117 is turned ON, and Q116 is turned OFF. Bias voltage is applied to a complementary circuit (Q114, Q115, D110) to supply 5 V on the "T5" voltage line.

When receiving, the CPU (IC801, pin 51) becomes "HIGH". Q117 is turned OFF, and Q116 is turned ON. Bias voltage is applied to a complementary circuit (Q110, Q111, D108) to supply 5V on the "R5" voltage line. Q116 obtains the voltage through the "S5" voltage line. When the power saver function is activated, the CPU (IC801, pin 50) outputs a "PSC" signal to cut off the "S5" voltage line intermittently to reduce current consumption. When the "S5" voltage line is interrupted, the "R5" line voltage becomes zero.

4-4-3 CTCSS TONE CIRCUIT (MAIN UNIT)

IC104 is a programmable CTCSS tone encoder/decoder which generates 37 tone frequencies. The CPU (IC801) outputs the serial data through IC103 to set the CTCSS tone frequency at IC104. IC104 (pin 3~8, S0~S5) receives data for the tone frequency.

When transmitting, IC104 (pin 12) becomes "LOW". When receiving, IC104 (pin 12) becomes "HIGH".

CTCSS TONE FREQUENCIES:

OUTPUT FREQUENCY [Hz]	IC104 INPUT PIN NUMBER					
	3	4	5	6	7	8
67.0	H	L	H	H	H	L
71.9	L	L	H	H	H	L
74.4	H	H	L	H	H	L
77.0	L	H	L	H	H	L
79.7	H	L	L	H	H	L
82.5	L	L	L	H	H	L
85.4	H	H	H	L	H	L
88.5	L	H	H	L	H	L
91.5	H	L	H	L	H	L
94.8	H	L	L	H	H	H
100.0	L	L	L	H	H	H
103.5	H	H	H	L	H	H
107.2	L	H	H	L	H	H
110.9	H	L	H	L	H	H
114.8	L	L	H	L	H	H
118.8	H	H	L	L	H	H
123.0	L	H	L	L	H	H
127.3	H	L	L	L	H	H
131.8	L	L	L	L	H	H
136.5	H	H	H	H	L	H
141.3	L	H	H	H	L	H
146.2	H	L	H	H	L	H
151.4	L	L	H	H	L	H
156.7	H	H	L	H	L	H
162.2	L	H	L	H	L	H
167.9	H	L	L	H	L	H
173.8	L	L	L	H	L	H
179.9	H	H	H	L	L	H
186.2	L	H	H	L	L	H
192.8	H	L	H	L	L	H
203.5	L	L	H	L	L	H
210.7	H	H	L	L	L	H
218.1	L	H	L	L	L	H
225.7	H	L	L	L	L	H
233.6	L	L	L	L	L	H
241.8	H	H	H	H	H	L
250.3	L	H	H	H	H	L
——	—	—	—	—	—	—

4-4-4 CPU (IC801) PORT ALLOCATIONS

• INPUT PORT

PORT No.	PIN No.	TERMINAL NAME	DESCRIPTION
P00	38	INT4	Inputs an interrupt signal for the standby mode of the CPU. The CPU enters the standby mode when the port becomes "LOW". When the port becomes "HIGH", the CPU enters the operation mode.
P03	41	HIGH/ LOW	Input port for the power control signal output. LOW terminal becomes "HIGH" when the port becomes "LOW".
P10	42	PTT	Inputs a signal on the PTT line. The CPU detects that the PTT switch has been pushed when the port becomes "LOW".
P11	43	CLONE	The CPU enters the cloning mode while the port is "LOW", and [VOL] is being turned ON.
P12	44	MONI	The CPU detects that the [MONITOR] switch has been turned ON when the port becomes "LOW" and turns the CTCSS tone OFF.
P13	45	SCAN CONTROL	Scan starts when the port becomes "LOW".
P40~P43	29~32	KR0~KR3	Input ports for the matrix.
P60	60	DET	The CPU detects that the same tone frequency is received when the port becomes "HIGH".
P61	61	BUSY	The CPU detects that the squelch opens when the port is "HIGH".
P62	62	UNLOCK	The CPU detects that the PLL is unlocked when the port becomes "LOW".

• OUTPUT PORT

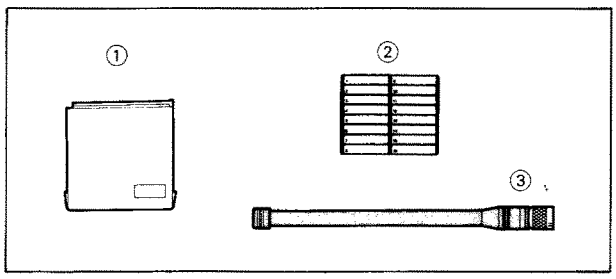
PORT No.	PIN No.	TERMINAL NAME	DESCRIPTION
P50	34	KS4	Outputs a matrix signal for CH selection
P51	35	KS5	Outputs a matrix signal.
P52	36	LOW	Output port for a power control signal. Outputs "LOW" when the transceiver is programmed for low power output.
P53	37	TMUT	Outputs a transmit mute signal.
P01	39	CK	Outputs clock signals for the serial data.
P02	40	DATA	Outputs serial data.
P20	46	BEEP	Outputs a 1 kHz pulse when a beep is emitted over the speaker.
P21	47	PLSTB	Outputs a strobe signal for the PLL.
P22	48	CTSTB	Outputs a strobe signal for the CTCSS tone encoder/decoder.
P23	49	TONEC	Outputs two tone control signals. The port becomes "HIGH" when DTCS or SINGLE tone is selected.
P30	50	PSC	Outputs a power save control signal. The port becomes "LOW" when the power save function is activated.
P31	51	$\overline{T}$/R	Outputs a Transmit/Receive switching signal. The port becomes "LOW" when transmitting.
P32	52	RMUT	Outputs a receiver mute signal. The port becomes "HIGH" when receiver audio output is muted.
P33	53	CALL	Outputs a busy signal synchronized with the "BUSY" input. Directly drives the [TX/BUSY] INDICATOR.
P63	63	CPO	Outputs clone data.

SECTION 5 MECHANICAL PARTS AND DISASSEMBLY

LABEL NUMBER	ORDER NO.	DESCRIPTION	QTY.	LABEL NUMBER	ORDER NO.	DESCRIPTION	QTY.
①	8810004000	Screw PH B0 M2×31.5 ZK	4	㉘	8930012581	Side plate-1	1
②	8010007231	Rear panel-1	1	㉙	8930012620	Side seal	1
③	8810004800	Screw PH B0 No. 0-1 M2×4	4	㉚	8930012510	Standoff (AR)	3
④	8010007240	Front seal	1	㉛	8810004870	Screw PH No. 0-1 M2×2.5	3
⑤	8930012480	SP plate	1	㉜	8810000010	Screw PH M2×4	4
⑥	8930012630	SP seal	1	㉝	8810006520	Screw PH No. 0-1 M2×6	1
⑦	8210006010	Front panel (F)-2	1	㉞	8930012490	Module plate	1
⑧	8610004300	Knob N132 [CHANNEL SELECTOR]	1	㉟	8860000010	Screw lug M 2	2
⑨	8810005100	Screw PH No. 0-1 M2×7 ZK	1	㊱	8930012640	Spring (K)	1
⑩	8610004310	Knob N133 [VOL]	1	㊲	8930012610	Release button	1
⑪	8210003181	TOP panel-1	1	㊳	8810002580	BuH M2×6 NI BS	2
⑫	8930016760	TOP seal (A)	1	㊴	8010007180	Sliding guide plate (A)	1
⑬	8810004860	Screw PH M2×6 ZK	2	㊵	8810002310	Screw FH M2×4 NI BS	4
⑭	8930012600	Lens	1	㊶	8930005980	Connection spring	1
⑮	8810004870	Screw PH No. 0-1 M2×2.5	2	㊷	8930011880	Connection holder	1
⑯	8310012090	TOP plate	1	㊸	2510000270	Speaker 40P-177B	1
⑰	6510007250	Antenna connector TNC-R107	1	㊹	2250000030	Switch KSR16-0-18 [CHANNEL SELECTOR]	1
⑱	8810006520	Screw PH No. 0-1 M2×2.5	1	㊺	2260000490	Switch AS-243-A04 [MONITOR]	1
⑲	8830000550	VR nut (E)	1	㊻	2260000490	Switch AS-243-A04 [SCAN]	1
⑳	8310012281	Switch seal-1	1	㊼	2260000980	Switch SKHHLP014A [PTT]	1
㉑	8810000530	Screw PH No. 0-1 M2×5 ZK	2	㊽	8930013461	LOGIC shield seat-1	1
㉒	8930012500	Switch plate	1	㊾	7210001500	Variable resistor RK097111102AA (10KA) [VOL]	1
㉓	8930012570	PTT button	1				
㉔	8810000530	Screw PH No. 0-1 M2×5 ZK	2	㊿	6450000130	Jack HSJ1102-01-540	1
㉕	8930012590	PTT holder	1	(51)	6450000110	Jack HSJ0836-01-010 (IC-H19$_{S2}$ only)	1
㉖	8810000010	Screw PH M2×4	4	(52)	2260000451	Switch SKHHLM	1
㉗	8810005090	Screw PH M2×3 ZK	2				

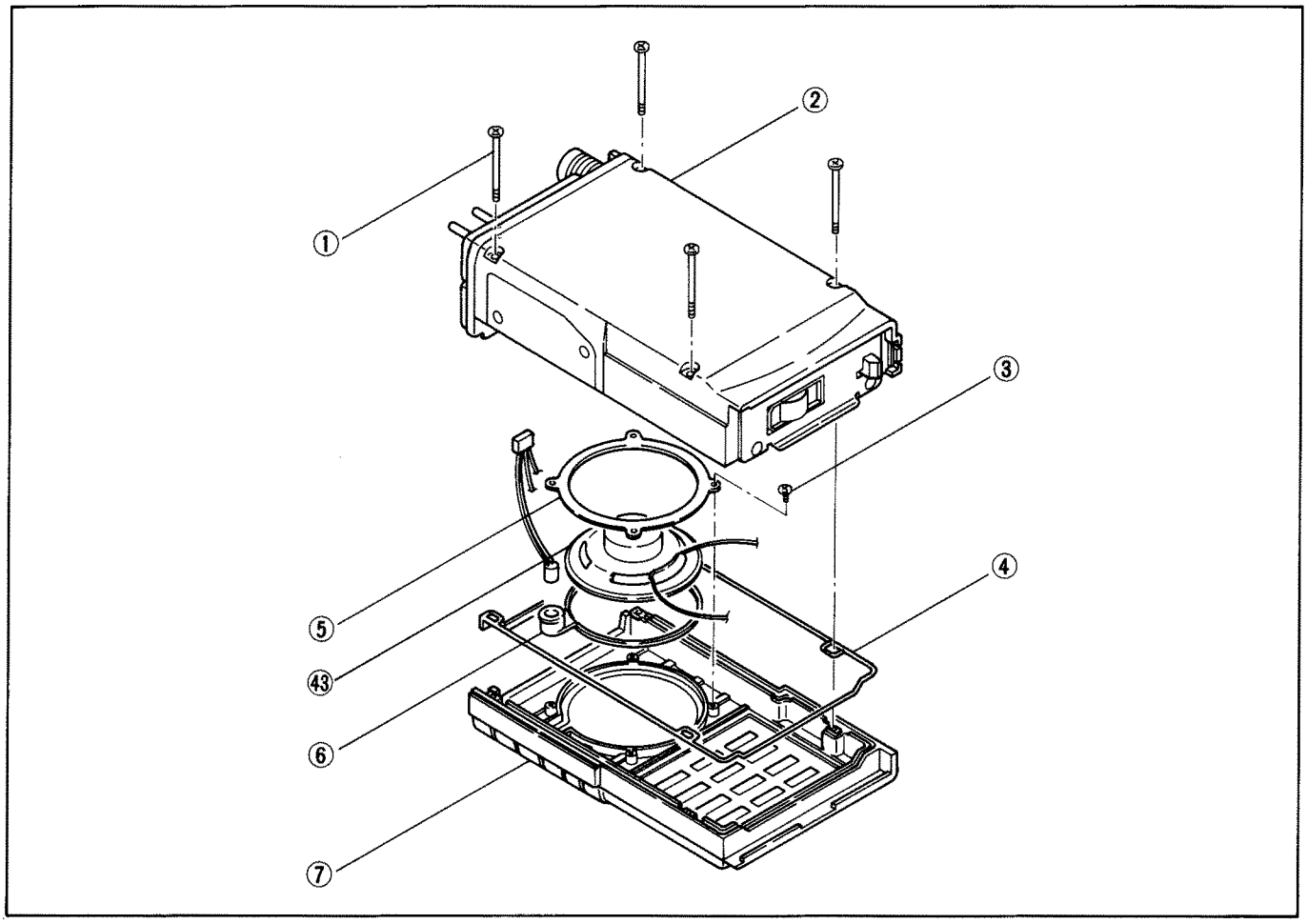
Screw abbreviations FH: Flat head PH: Pan head BuH: Button head NI: Nickel ZK: Black

• ACCESSORIES

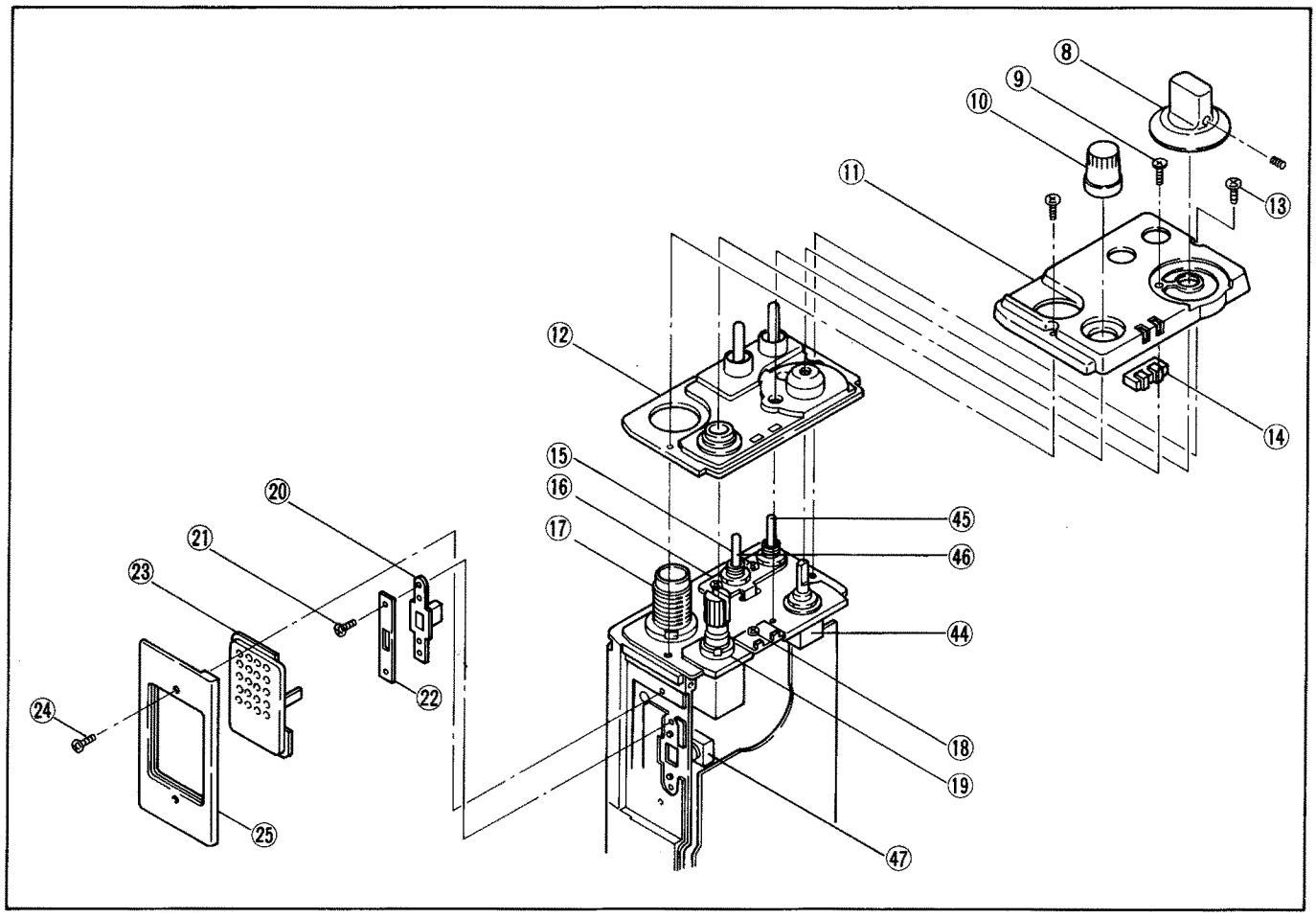


LABEL NUMBER	ORDER NO.	DESCRIPTION	QTY.
①	Optional product	Battery pack (CM-71)	1
②	8310013140	Front plate seal	1
③	Optional product	FA-155T Flexible antenna	1

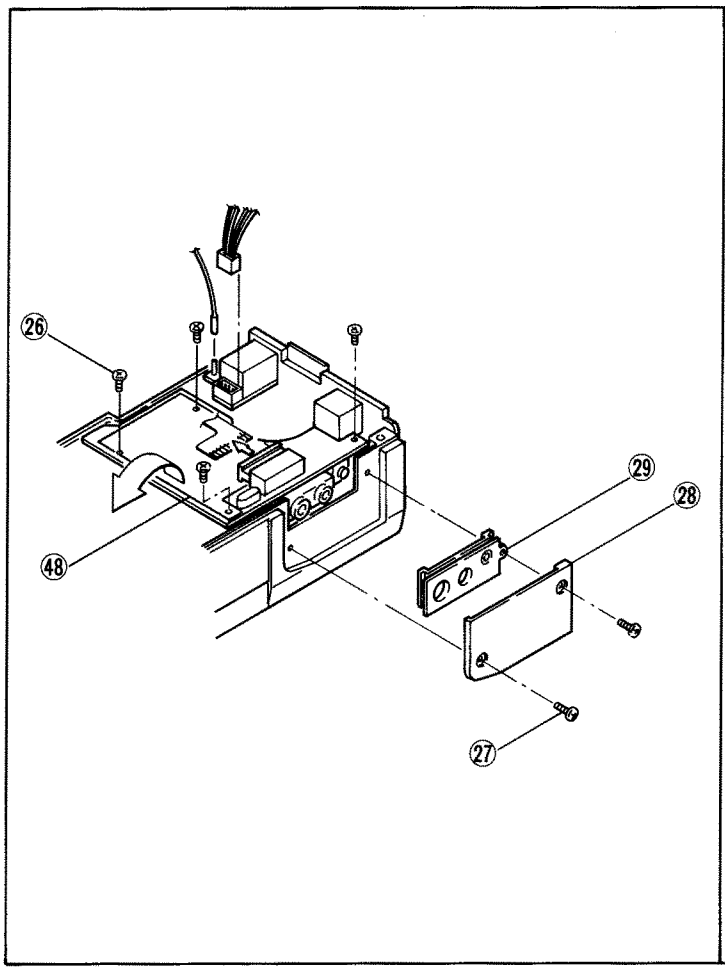
• CASE AND FRONT PANELS



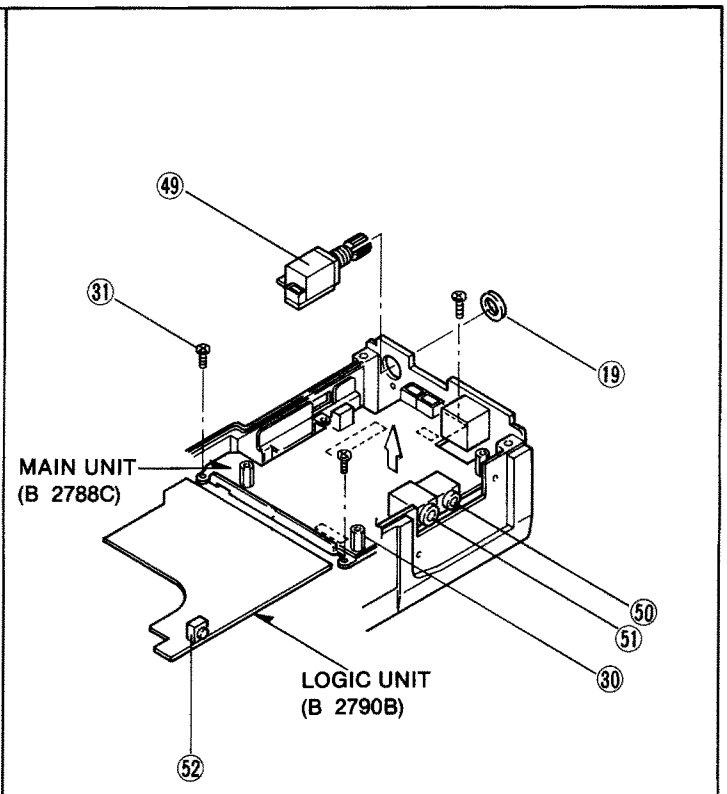
• TOP PANEL



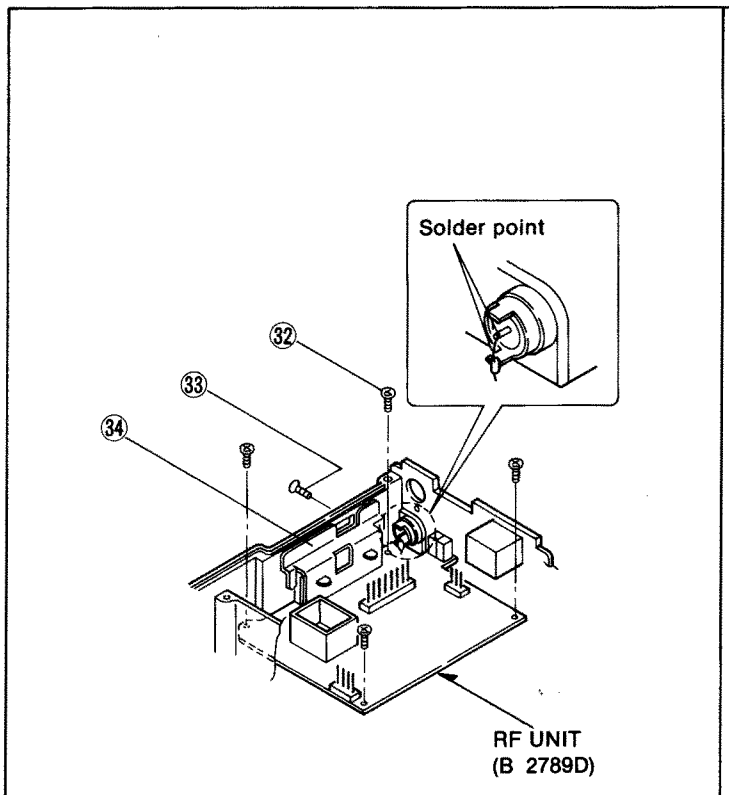
• LOGIC UNIT



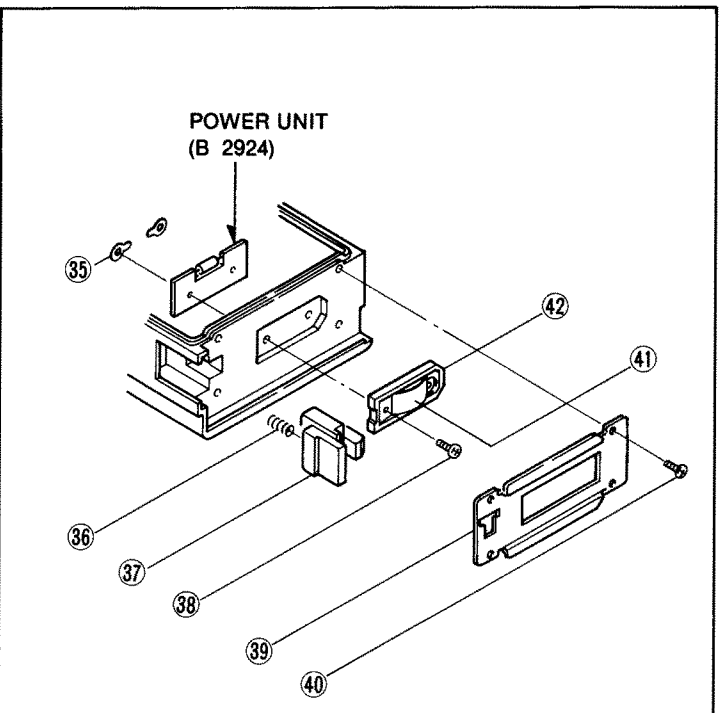
• MAIN UNIT



• RF UNIT



• CONTACT HOLDER



NOTE:
The battery pack cannot be disassembled.

SECTION 6 PARTS LIST

[FRONT UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
C1	4010000460	Ceramic	DD104 B 471K 50V
SP1 *	2510000270	Speaker	40P-177B

[LED UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
DS1	5040001120	LED	TLSG222 [TX/BUSY]
DS2	5040001120	LED	TLSG222 [CALL]
S1	2250000030	Switch	KSR16-0-18 [CHANNEL SELECTOR]
S2	2260000490	Switch	AS-243-A04 [MONITOR]
S3	2260000490	Switch	AS-243-A04 [SCAN]
EP1	0910030142	P.C. Board	B 1704B (LED)
EP2	0910017994	F.P.C. Board	B 1705D

[VR UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
R1	7210001500	Variable Resistor	RK097111102AA (10KA) [VOL]
EP1	0910018231	P.C. Board	B 1703A (VR)

[POWER UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
C1	4010000500	Ceramic	DD104 B 102K 50V
C2	4010000500	Ceramic	DD104 B 102K 50V
F1	5210000230	Fuse	MC2 1/2
EP1	0910029010	P.C. Board	B 2924 (POWER)

[LOGIC UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
IC801	1140000950	IC	μPD75306GF-045-3B 9
IC802	1110001550	IC	S-8054ALB-LM-T1
IC803	1130003760	IC	TC4S81F (TE85R)
IC804	1130004500	IC	TC4S11F (TE85R)
IC805	1130004170	IC	TC4S01F (TE85R)
IC806	1130004200	IC	TC4S66F (TE85R)
IC807	1130003610	IC	TC4SU69F (TE85R)
Q801	1590000430	Transistor	DTC144EU T107
Q802	1510000510	Transistor	2SA1576 T107R
Q803	1530002060	Transistor	2SC4081 T107R
Q804	1590000430	Transistor	DTC144EU T107
Q805	1510000500	Transistor	2SA1162-GR (TE85R)
Q806	1590000430	Transistor	DTC144EU T107
Q807	1590000430	Transistor	DTC144EU T107
Q808	1590000430	Transistor	DTC144EU T107
Q809	1590000430	Transistor	DTC144EU T107
Q810	1590000720	Transistor	DTA144EU T107
Q811	1590000430	Transistor	DTC144EU T107
Q812	1590001030	Transistor	DTC144WU T107
D801	1160000050	Diode	DAP202U T107
D802	1160000050	Diode	DAP202U T107
D803	1160000060	Diode	DAN202U T107
D804	1750000160	Diode	DA114 T107
D806	1750000160	Diode	DA114 T107
D807	1750000160	Diode	DA114 T107
D808	1160000060	Diode	DAN202U T107
X801	6050003110	Crystal	RF-4A3 FAC NKD (4.194304M)
R801	7030002360	Resistor	MCR03EZHJ 47 kΩ (473)
R802	7030002360	Resistor	MCR03EZHJ 47 kΩ (473)
R803	7030002360	Resistor	MCR03EZHJ 47 kΩ (473)
R804	7030002360	Resistor	MCR03EZHJ 47 kΩ (473)
R805	7030002360	Resistor	MCR03EZHJ 47 kΩ (473)
R806	7030002360	Resistor	MCR03EZHJ 47 kΩ (473)

*safety critical component

[LOGIC UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
R807	7030002550	Resistor	MCR03EZHJ 1 MΩ (105)
R808	7030002550	Resistor	MCR03EZHJ 1 MΩ (105)
R809	7030002360	Resistor	MCR03EZHJ 47 kΩ (473)
R810	7030002360	Resistor	MCR03EZHJ 47 kΩ (473)
R811	7030002360	Resistor	MCR03EZHJ 47 kΩ (473)
R812	7030002360	Resistor	MCR03EZHJ 47 kΩ (473)
R813	7030000340	Resistor	MCR10EZHJ 470 Ω (471)
R814	7030000340	Resistor	MCR10EZHJ 470 Ω (471)
R815	7030000340	Resistor	MCR10EZHJ 470 Ω (471)
R816	7030002320	Resistor	MCR03EZHJ 22 kΩ (223)
R817	7030002420	Resistor	MCR03EZHJ 100 kΩ (104)
R818	7030002360	Resistor	MCR03EZHJ 47 kΩ (473)
R820	7030002150	Resistor	MCR03EZHJ 1 kΩ (102)
R821	7030002420	Resistor	MCR03EZHJ 100 kΩ (104)
R822	7030002550	Resistor	MCR03EZHJ 1 MΩ (105)
R823	7030002420	Resistor	MCR03EZHJ 100 kΩ (104)
R827	7030002360	Resistor	MCR03EZHJ 47 kΩ (473)
R828	7030002550	Resistor	MCR03EZHJ 1 MΩ (105)
R829	7030002470	Resistor	MCR03EZHJ 220 kΩ (224)
R831	7030002170	Resistor	MCR03EZHJ 1.5 kΩ (152)
R832	7030002360	Resistor	MCR03EZHJ 47 kΩ (473)
R833	7030002420	Resistor	MCR03EZHJ 100 kΩ (104)
R834	7030002320	Resistor	MCR03EZHJ 22 kΩ (223)
R835	7030002550	Resistor	MCR03EZHJ 1 MΩ (105)
R836	7030002360	Resistor	MCR03EZHJ 47 kΩ (473)
R837	7030002420	Resistor	MCR03EZHJ 100 kΩ (104)
C801	4030006890	Ceramic	C1608 JF 1H 103Z-T-A
C802 *	4550002720	Tantalum	TESVD2 0J 476M-12 L
C803	4030006890	Ceramic	C1608 JF 1H 103Z-T-A
C804	4030007030	Ceramic	C1608 CH 1H 150J-T-A
C805	4030007030	Ceramic	C1608 CH 1H 150J-T-A
C806	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C807	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C808	4030006890	Ceramic	C1608 JF 1H 103Z-T-A
C809	4030006890	Ceramic	C1608 JF 1H 103Z-T-A
C810	4030006890	Ceramic	C1608 JF 1H 103Z-T-A
C811 *	4550000460	Tantalum	TESVA 1C 105M1-8L
C812 *	4550000460	Tantalum	TESVA 1C 105M1-8L
S801	2260000451	Switch	SKHHLM
BT801*	3020000070	Lithium Battery	BR2032-1HF
EP1	0910027832	P.C. Board	B 2790B (LOGIC)

[MAIN UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
IC101	1110001220	IC	BA4558FT1
IC102	1110000530	IC	LM386N-3
IC103	1130000830	IC	μPD4094BG-T1
IC104	1130001830	IC	MN6520
IC105	1130003710	IC	TC4S71F (TE85R)

[MAIN UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
Q101	1530001940	Transistor	2SC2712-BL (TE85R)
Q102	1530001940	Transistor	2SC2712-BL (TE85R)
Q103	1510000500	Transistor	2SA1162-GR (TE85R)
Q104	1510000500	Transistor	2SA1162-GR (TE85R)
Q105	1510000500	Transistor	2SA1162-GR (TE85R)
Q106	1530001940	Transistor	2SC2712-BL (TE85R)
Q107	1520000080	Transistor	2SB909M R
Q108	1530001940	Transistor	2SC2712-BL (TE85R)
Q109	1590000380	FET	2SJ106-Y (TE85R)
Q110	1530001940	Transistor	2SC2712-BL (TE85R)
Q111	1520000080	Transistor	2SB909M R
Q112	1530001940	Transistor	2SC2712-BL (TE85R)
Q113	1520000080	Transistor	2SB909M R
Q114	1530001940	Transistor	2SC2712-BL (TE85R)
Q115	1520000080	Transistor	2SB909M R
Q116	1510000500	Transistor	2SA1162-GR (TE85R)
Q117	1510000500	Transistor	2SA1162-GR (TE85R)
Q118	1520000080	Transistor	2SB909M R
Q119	1530001940	Transistor	2SC2712-BL (TE85R)
Q120	1530001940	Transistor	2SC2712-BL (TE85R)
Q121	1530001940	Transistor	2SC2712-BL (TE85R)
Q122	1590000430	Transistor	DTC144EU T107
Q123	1590000430	Transistor	DTC144EU T107
Q124	1590000700	Transistor	DTC144EK T147
D101	1790000490	Diode	HSM88AS-TR
D102	1160000060	Diode	DAN202U T107
D103	1750000160	Diode	DA114 T107
D104	1730000010	Zener	RD4.7M-T2B3
D105	1750000020	Diode	1SS184 (TE85R)
D106	1750000120	Diode	DWA010-TE
D108	1750000020	Diode	1SS184 (TE85R)
D109	1750000160	Diode	DA114 T107
D110	1750000040	Diode	1SS190 (TE85R)
D111	1750000010	Diode	1SS181 (TE85R)
D112	1730000360	Zener	RD5.1JS B2
D113	1790000620	Diode	MA77 (TW)
X101	6050003110	Crystal	RF-4A3 FAC NKD (4.194304M)
R101	7030002340	Resistor	MCR03EZHJ 33 kΩ (333)
R102	7030002120	Resistor	MCR03EZHJ 560 Ω (561)
R103	7030002440	Resistor	MCR03EZHJ 150 kΩ (154)
R104	7310002510	Trimmer	RH04A1AN5X01A (334)
R105	7030002450	Resistor	MCR03EZHJ 180 kΩ (184)
R106	7030002150	Resistor	MCR03EZHJ 1 kΩ (102)
R107	7030002450	Resistor	MCR03EZHJ 180 kΩ (184)
R108	7030002430	Resistor	MCR03EZHJ 120 kΩ (124)
R109	7030002470	Resistor	MCR03EZHJ 220 kΩ (224)
R110	7030002410	Resistor	MCR03EZHJ 82 kΩ (823)
R111	7030002410	Resistor	MCR03EZHJ 82 kΩ (823)
R112	7030002160	Resistor	MCR03EZHJ 1.2 kΩ (122)
R113	7030002230	Resistor	MCR03EZHJ 3.9 kΩ (392)
R114	7030002500	Resistor	MCR03EZHJ 390 kΩ (394)
R115	7030002550	Resistor	MCR03EZHJ 1 MΩ (105)
R116	7310002460	Trimmer	RH04A1AS4X0NA (473)
R117	7030002300	Resistor	MCR03EZHJ 15 kΩ (153)
R118	7310002510	Trimmer	RH04A1AN5X01A (334)
R119	7030002410	Resistor	MCR03EZHJ 82 kΩ (823)
R120	7030002330	Resistor	MCR03EZHJ 27 kΩ (273)
R121	7030002360	Resistor	MCR03EZHJ 47 kΩ (473)
R122	7030002150	Resistor	MCR03EZHJ 1 kΩ (102)
R123	7030002360	Resistor	MCR03EZHJ 47 kΩ (473)
R124	7030002380	Resistor	MCR03EZHJ 56 kΩ (563)
R125	7030002150	Resistor	MCR03EZHJ 1 kΩ (102)
R126	7030000190	Resistor	MCR10EZHJ 27 Ω (270)
R127	7030002250	Resistor	MCR03EZHJ 5.6 kΩ (562)

*safety critical component

[MAIN UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
R128	7030002360	Resistor	MCR03EZHJ 47 kΩ (473)
R129	7030002360	Resistor	MCR03EZHJ 47 kΩ (473)
R130	7030002150	Resistor	MCR03EZHJ 1 kΩ (102)
R131	7030002270	Resistor	MCR03EZHJ 8.2 kΩ (822)
R132	7030002440	Resistor	MCR03EZHJ 150 kΩ (154)
R133	7030002140	Resistor	MCR03EZHJ 820 Ω (821)
R134	7030002260	Resistor	MCR03EZHJ 6.8 kΩ (682)
R135	7030002570	Resistor	MCR03EZHJ 1.5 MΩ (155)
R136	7030002510	Resistor	MCR03EZHJ 470 kΩ (474)
R137	7030002340	Resistor	MCR03EZHJ 33 kΩ (333)
R138	7030002550	Resistor	MCR03EZHJ 1 MΩ (105)
R140	7030002550	Resistor	MCR03EZHJ 1 MΩ (105)
R141	7030002550	Resistor	MCR03EZHJ 1 MΩ (105)
R142	7030002290	Resistor	MCR03EZHJ 12 kΩ (123)
R143	7030002090	Resistor	MCR03EZHJ 330 Ω (331)
R144	7030002290	Resistor	MCR03EZHJ 12 kΩ (123)
R145	7030002160	Resistor	MCR03EZHJ 1.2 kΩ (122)
R146	7030002280	Resistor	MCR03EZHJ 10 kΩ (103)
R147	7030002110	Resistor	MCR03EZHJ 470 Ω (471)
R148	7030002360	Resistor	MCR03EZHJ 47 kΩ (473)
R149	7030002380	Resistor	MCR03EZHJ 56 kΩ (563)
R150	7030002360	Resistor	MCR03EZHJ 47 kΩ (473)
R151	7030000390	Resistor	MCR10EZHJ 1.2 kΩ (122)
R152	7030002360	Resistor	MCR03EZHJ 47 kΩ (473)
R153	7030002280	Resistor	MCR03EZHJ 10 kΩ (103)
R154	7030002300	Resistor	MCR03EZHJ 15 kΩ (153)
R155	7030002420	Resistor	MCR03EZHJ 100 kΩ (104)
R156	7030002440	Resistor	MCR03EZHJ 150 kΩ (154)
R158	7030002280	Resistor	MCR03EZHJ 10 kΩ (103)
R159	7030002280	Resistor	MCR03EZHJ 10 kΩ (103)
R160	7310002480	Trimmer	RH04A1A15X0KA (104)
R161	7030002150	Resistor	MCR03EZHJ 1 kΩ (102)
R163	7030002360	Resistor	MCR03EZHJ 47 kΩ (473)
R164	7030002360	Resistor	MCR03EZHJ 47 kΩ (473)
R165	7030002300	Resistor	MCR03EZHJ 15 kΩ (153)
R166	7030002280	Resistor	MCR03EZHJ 10 kΩ (103)
R167	7030002150	Resistor	MCR03EZHJ 1 kΩ (102)
R168	7030002280	Resistor	MCR03EZHJ 10 kΩ (103)
R169	7030002260	Resistor	MCR03EZHJ 6.8 kΩ (682)
R170	7030002280	Resistor	MCR03EZHJ 10 kΩ (103)
R171	7030002450	Resistor	MCR03EZHJ 180 kΩ (184)
R172	7030002340	Resistor	MCR03EZHJ 33 kΩ (333)
R173	7030002280	Resistor	MCR03EZHJ 10 kΩ (103)
R174	7030002280	Resistor	MCR03EZHJ 10 kΩ (103)
R175	7030002260	Resistor	MCR03EZHJ 6.8 kΩ (682)
R177	7030002510	Resistor	MCR03EZHJ 470 kΩ (474)
R181	7030002340	Resistor	MCR03EZHJ 33 kΩ (333)
R182	7030002430	Resistor	MCR03EZHJ 120 kΩ (124)
R184	7030002520	Resistor	MCR03EZHJ 560 kΩ (564)
R185	7030002380	Resistor	MCR03EZHJ 56 kΩ (563)
R186	7030002240	Resistor	MCR03EZHJ 4.7 kΩ (472)
R187	7030002420	Resistor	MCR03EZHJ 100 kΩ (104)
R188	7030000140	Resistor	MCR10EZHJ 10 Ω (100)
R189	7030002360	Resistor	MCR03EZHJ 47 kΩ (473)
R190	7030002420	Resistor	MCR03EZHJ 100 kΩ (104)
R191	7030002280	Resistor	MCR03EZHJ 10 kΩ (103)
R192	7030002470	Resistor	MCR03EZHJ 220 kΩ (224)
R193	7030002420	Resistor	MCR03EZHJ 100 kΩ (104)
R194	7030002420	Resistor	MCR03EZHJ 100 kΩ (104)
R195	7310002480	Trimmer	RH04A1A15X0KA (104)
R196	7030002200	Resistor	MCR03EZHJ 2.2 kΩ (222)
R197	7030002150	Resistor	MCR03EZHJ 1 kΩ (102)
R198	7030002260	Resistor	MCR03EZHJ 6.8 kΩ (682)
R199	7030002200	Resistor	MCR03EZHJ 2.2 kΩ (222)
C101	4030006850	Ceramic	C1608 JB 1H 471K-T-A
C102	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C103	4030006880	Ceramic	C1608 JB 1H 472K-T-A
C104	4550000530	Tantalum	TESVA 1V 104M1-8L
C105	4030006860	Ceramic	C1608 JB 1H 102K-T-A

[MAIN UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
C106	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C107	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C108	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C109	4030006870	Ceramic	C1608 JB 1H 222K-T-A
C110	4030006850	Ceramic	C1608 JB 1H 471K-T-A
C111	4030007130	Ceramic	C1608 CH 1H 101J-T-A
C112	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C113 *	4550002980	Tantalum	TEMSVA 1C 225M-8L
C114	4030008630	Ceramic	C1608 JF 1C 104Z-T-A
C115 *	4550002980	Tantalum	TEMSVA 1C 225M-8L
C116	4030008630	Ceramic	C1608 JF 1C 104Z-T-A
C117	4030008630	Ceramic	C1608 JF 1C 104Z-T-A
C118	4030008630	Ceramic	C1608 JF 1C 104Z-T-A
C119	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C120	4030008630	Ceramic	C1608 JF 1C 104Z-T-A
C121	4030004300	Ceramic	GRM39 B 682K 50PT
C122	4030004300	Ceramic	GRM39 B 682K 50PT
C123	4030006710	Ceramic	C1608 SL 1H 470J-T-A
C124	4030006710	Ceramic	C1608 SL 1H 470J-T-A
C125	4030006710	Ceramic	C1608 SL 1H 470J-T-A
C126 *	4550001950	Tantalum	DN 0J 101M
C127 *	4510001550	Electrolytic	16 RC3 10 µF
C128 *	4550002980	Tantalum	TEMSVA 1C 225M-8L
C129	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C130 *	4510001620	Electrolytic	50 RC3 1 µF
C131 *	4550000460	Tantalum	TESVA 1C 105M1-8L
C132	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C133	4030008630	Ceramic	C1608 JF 1C 104Z-T-A
C134	4030004300	Ceramic	GRM39 B 682K 50PT
C135	4030006880	Ceramic	C1608 JB 1H 472K-T-A
C136	4030006890	Ceramic	C1608 JF 1H 103Z-T-A
C137 *	4510001520	Electrolytic	6.3 RC3 47 µF
C138	4030008630	Ceramic	C1608 JF 1C 104Z-T-A
C139	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C140	4030008630	Ceramic	C1608 JF 1C 104Z-T-A
C141	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C142	4550003250	Tantalum	TEMSVA 1V 474M-8L
C143	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C144 *	4510001550	Electrolytic	16 RC3 10 µF
C145	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C146	4030008630	Ceramic	C1608 JF 1C 104Z-T-A
C147	4030006890	Ceramic	C1608 JF 1H 103Z-T-A
C148 *	4510002280	Electrolytic	16 RC3 22 µF
C149	4030007040	Ceramic	C1608 CH 1H 180J-T-A
C150	4030007040	Ceramic	C1608 CH 1H 180J-T-A
C151	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C152 *	4550003490	Tantalum	DSB 0J 686M
C153	4030006900	Ceramic	C1608 JB 1E 103K-T-A
C154	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C155 *	4510002280	Electrolytic	16 RC3 22 µF
C156 *	4510001520	Electrolytic	6.3 RC3 47 µF
C158 *	4510001520	Electrolytic	6.3 RC3 47 µF
C159	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C160	4030006850	Ceramic	C1608 JB 1H 471K-T-A
C161	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C162 *	4510002280	Electrolytic	16 RC3 22 µF
C163 *	4510003390	Electrolytic	16 RC3 47 µF
C164	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C165 *	4550002950	Tantalum	TESVA 0J 335M1-8L
C166	4550000360	Tantalum	DN 1V R47M
C167	4030006900	Ceramic	C1608 JB 1E 103K-T-A
C168	4030006880	Ceramic	C1608 JB 1H 472K-T-A
C169 *	4550000010	Tantalum	DN 1C 4R7M
C170	4030006850	Ceramic	C1608 JB 1H 471K-T-A
C171	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C172	4030006890	Ceramic	C1608 JF 1H 103Z-T-A
C174	4030006890	Ceramic	C1608 JF 1H 103Z-T-A
C175	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C176	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C177	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C178 *	4550000460	Tantalum	TESVA 1C 105M1-8L

* safety critical component

[MAIN UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
C179	4030006870	Ceramic	C1608 JB 1H 222K-T-A
C180	4030006850	Ceramic	C1608 JB 1H 471K-T-A
C181	4550000530	Tantalum	TESVA 1V 104M1-8L
S101	2260000980	Switch	SKHHLP014A
EP1	0910027993	P.C. Board	B 2788C (MAIN)
EP3	0910027700	F.P.C. Board	B 2792

[RF UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
IC301	1110002200	IC	MC3372MR
IC302	1150000400	IC	SC1046
IC303	1130003050	IC	PLL2001
Q301	1580000390	FET	3SK131K-T1
Q303	1560000110	FET	2SK241-GR
Q304	1530000370	Transistor	2SC3356-T2B
Q305	1530000370	Transistor	2SC3356-T2B
Q306	1530000520	Transistor	2SC2026
Q307	1530000520	Transistor	2SC2026
Q308	1510000510	Transistor	2SA1576 T107R
Q309	1510000510	Transistor	2SA1576 T107R
Q310	1530002060	Transistor	2SC4081 T107R
Q311	1530002060	Transistor	2SC4081 T107R
Q312	1520000260	Transistor	2SB1237 TV2R
Q313	1510000510	Transistor	2SA1576 T107R
Q314	1560000360	FET	2SK209-Y (TE85R)
Q315	1530002060	Transistor	2SC4081 T107R
Q316	1510000510	Transistor	2SA1576 T107R
Q317	1530002060	Transistor	2SC4081 T107R
Q318	1530002060	Transistor	2SC4081 T107R
Q319	1530000370	Transistor	2SC3356-T2B
Q320	1520000260	Transistor	2SB1237 TV2R
Q321	1580000400	FET	3SK151-Y (TE85R)
Q322	1560000360	FET	2SK209-Y (TE85R)
D301	1790000460	Diode	MA334B (TX)
D302	1790000460	Diode	MA334B (TX)
D303	1790000460	Diode	MA334B (TX)
D304	1790000460	Diode	MA334B (TX)
D306	1750000070	Diode	1SS226 (TE85R)
D307	1710000580	Diode	1SS265
D308	1790000250	Diode	1SS97
D309	1790000250	Diode	1SS97
D310	1710000580	Diode	1SS265
D311	1750000140	Diode	1SS268 (TE85R)
D313	1720000220	Varicap	1SV166-T2B
D314	1790000240	Diode	1SS99
D315	1750000160	Diode	DA114 T107
D316	1730000490	Zener	RD6.8M-T2B2
D317	1790000460	Diode	MA334B (TX)
D318	1790000460	Diode	MA334B (TX)

[RF UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
X301	6050002000	Crystal	CR-70
X302	6050004930	Crystal	CR-212
X303	6070000080	Discriminator	CDBM455C16
FI301	2010001050	Filter	21M15B3 (FL-141)
FI302	2020000490	Ceramic Filter	CFZM455E10
L301	6150003170	Coil	LS-334
L302	6150003250	Coil	LS-335
L303	6150003180	Coil	LS-336
L304	6150003250	Coil	LS-335
L307	6150003140	Coil	LS-330
L308	6150003160	Coil	LS-332
L309	6150003330	Coil	LS-372
L310	6110001540	Coil	LA-234
L311	6110001540	Coil	LA-234
L312	6110002070	Coil	LA-227
L313	6180000850	Coil	LAL 03NA 4R7K
L315	6110001550	Coil	LA-235
L316	6110001570	Coil	LA-237
L317	6110001570	Coil	LA-237
L318	6110001570	Coil	LA-237
L319	6110001570	Coil	LA-237
L320	6110001570	Coil	LA-237
L321	6180000680	Coil	LAL 02NA 4R7K
L322	6180000680	Coil	LAL 02NA 4R7K
L323	6180001510	Coil	LAL 02NA 101K
L324	6150003250	Coil	LS-335
L325	6150003180	Coil	LS-336
L326	6200000760	Coil	LQN 2A 56NM
R301	7030002360	Resistor	MCR03EZHJ 47 kΩ (473)
R302	7030002470	Resistor	MCR03EZHJ 220 kΩ (224)
R303	7030002470	Resistor	MCR03EZHJ 220 kΩ (224)
R304	7030002360	Resistor	MCR03EZHJ 47 kΩ (473)
R305	7030002410	Resistor	MCR03EZHJ 82 kΩ (823)
R306	7030002440	Resistor	MCR03EZHJ 150 kΩ (154)
R307	7030002000	Resistor	MCR03EZHJ 56 Ω (560)
R308	7030001910	Resistor	MCR03EZHJ 10 Ω (100)
R309	7030002470	Resistor	MCR03EZHJ 220 kΩ (224)
R310	7030002470	Resistor	MCR03EZHJ 220 kΩ (224)
R312	7030002080	Resistor	MCR03EZHJ 270 Ω (271)
R313	7030002240	Resistor	MCR03EZHJ 4.7 kΩ (472)
R314	7030002420	Resistor	MCR03EZHJ 100 kΩ (104)
R315	7030001990	Resistor	MCR03EZHJ 47 Ω (470)
R316	7030001950	Resistor	MCR03EZHJ 22 Ω (220)
R319	7030002360	Resistor	MCR03EZHJ 47 kΩ (473)
R319	7030002180	Resistor	MCR03EZHJ 1.8 kΩ (182)
R320	7030002360	Resistor	MCR03EZHJ 47 kΩ (473)
R321	7030002240	Resistor	MCR03EZHJ 4.7 kΩ (472)
R322	7030000290	Resistor	MCR10EZHJ 180 Ω (181)
R323	7030000410	Resistor	MCR10EZHJ 1.8 kΩ (182)
R324	7030000510	Resistor	MCR10EZHJ 12 kΩ (123)
R325	7030000510	Resistor	MCR10EZHJ 12 kΩ (123)
R326	7030000410	Resistor	MCR10EZHJ 1.8 kΩ (182)
R327	7030000220	Resistor	MCR10EZHJ 47 Ω (470)
R328	7030002160	Resistor	MCR03EZHJ 1.2 kΩ (122)
R329	7030002150	Resistor	MCR03EZHJ 1 kΩ (102)
R330	7030000340	Resistor	MCR10EZHJ 470 Ω (471)
R331	7030002250	Resistor	MCR03EZHJ 5.6 kΩ (562)
R332	7030002240	Resistor	MCR03EZHJ 4.7 kΩ (472)
R333	7030002280	Resistor	MCR03EZHJ 10 kΩ (103)
R334	7030002320	Resistor	MCR03EZHJ 22 kΩ (223)
R335	7030002060	Resistor	MCR03EZHJ 180 Ω (181)
R336	7030002310	Resistor	MCR03EZHJ 18 kΩ (183)
R337	7030002250	Resistor	MCR03EZHJ 5.6 kΩ (562)
R338	7030002280	Resistor	MCR03EZHJ 10 kΩ (103)
R340	7030002050	Resistor	MCR03EZHJ 150 Ω (151)

*safety critical component

[RF UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
R341	7030002250	Resistor	MCR03EZHJ 5.6 kΩ (562)
R342	7030002240	Resistor	MCR03EZHJ 4.7 kΩ (472)
R343	7030002320	Resistor	MCR03EZHJ 22 kΩ (223)
R344	7030002550	Resistor	MCR03EZHJ 1 MΩ (105)
R345	7030002360	Resistor	MCR03EZHJ 47 kΩ (473)
R346	7030002410	Resistor	MCR03EZHJ 82 kΩ (823)
R347	7030002420	Resistor	MCR03EZHJ 100 kΩ (104)
R348	7030002520	Resistor	MCR03EZHJ 560 kΩ (564)
R349	7030002320	Resistor	MCR03EZHJ 22 kΩ (223)
R350	7030002180	Resistor	MCR03EZHJ 1.8 kΩ (182)
R351	7030002240	Resistor	MCR03EZHJ 4.7 kΩ (472)
R352	7310001760	Trimmer	RH0421CJ4J09A (223)
R353	7310001810	Trimmer	RH0421CN4J02A (333)
R354	7030000400	Resistor	MCR10EZHJ 1.5 kΩ (152)
R355	7030000400	Resistor	MCR10EZHJ 1.5 kΩ (152)
R357	7030002260	Resistor	MCR03EZHJ 6.8 kΩ (682)
R358	7030002540	Resistor	MCR03EZHJ 820 kΩ (824)
R359	7030002430	Resistor	MCR03EZHJ 120 kΩ (124)
R360	7030002300	Resistor	MCR03EZHJ 15 kΩ (153)
R361	7510000090	Thermistor	ERT-D2FGL202S
R362	7030002280	Resistor	MCR03EZHJ 10 kΩ (103)
R363	7030002250	Resistor	MCR03EZHJ 5.6 kΩ (562)
R364	7510000090	Thermistor	ERT-D2FGL202S
R365	7030002260	Resistor	MCR03EZHJ 6.8 kΩ (682)
R366	7030002430	Resistor	MCR03EZHJ 120 kΩ (124)
R367	7030002400	Resistor	MCR03EZHJ 68 kΩ (683)
R368	7030002200	Resistor	MCR03EZHJ 2.2 kΩ (222)
R369	7030002030	Resistor	MCR03EZHJ 100 Ω (101)
R370	7030000400	Resistor	MCR10EZHJ 1.5 kΩ (152)
R371	7030002240	Resistor	MCR03EZHJ 4.7 kΩ (472)
R372	7030002280	Resistor	MCR03EZHJ 10 kΩ (103)
R373	7030002220	Resistor	MCR03EZHJ 3.3 kΩ (332)
R374	7030002380	Resistor	MCR03EZHJ 56 kΩ (563)
R375	7030002420	Resistor	MCR03EZHJ 100 kΩ (104)
R376	7030002280	Resistor	MCR03EZHJ 10 kΩ (103)
R377	7030000140	Resistor	MCR10EZHJ 10 Ω (100)
R378	7030002220	Resistor	MCR03EZHJ 3.3 kΩ (332)
R379	7030000270	Resistor	MCR10EZHJ 120 Ω (121)
R380	7030002180	Resistor	MCR03EZHJ 1.8 kΩ (182)
R381	7030000300	Resistor	MCR10EZHJ 220 Ω (221)
R383	7030002360	Resistor	MCR03EZHJ 47 kΩ (473)
R384	7030001990	Resistor	MCR03EZHJ 47 Ω (470)
R388	7030002200	Resistor	MCR03EZHJ 2.2 kΩ (222)
R389	7030002510	Resistor	MCR03EZHJ 470 kΩ (474)
R390	7030002110	Resistor	MCR03EZHJ 470 Ω (471)
R391	7030002440	Resistor	MCR03EZHJ 150 kΩ (154)
R392	7030002420	Resistor	MCR03EZHJ 100 kΩ (104)
R393	7030002430	Resistor	MCR03EZHJ 120 kΩ (124)
R394	7030002420	Resistor	MCR03EZHJ 100 kΩ (104)
R395	7030002420	Resistor	MCR03EZHJ 100 kΩ (104)
R396	7030002470	Resistor	MCR03EZHJ 220 kΩ (224)
R397	7030002470	Resistor	MCR03EZHJ 220 kΩ (224)
R398	7030001970	Resistor	MCR03EZHJ 33 Ω (330)
C301	4030006750	Ceramic	C1608 SL 1H 101J-T-A
C302	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C303	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C304	4030006520	Ceramic	C1608 SL 1H 010C-T-A
C305	4030006660	Ceramic	C1608 SL 1H 220J-T-A
C306	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C307	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C308	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C309	4030006660	Ceramic	C1608 SL 1H 220J-T-A
C310	4030006510	Ceramic	C1608 SL 1H 0R5C-T-A
C312	4030006670	Ceramic	C1608 SL 1H 270J-T-A
C313	4030006580	Ceramic	C1608 SL 1H 070D-T-A
C319	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C320	4030006560	Ceramic	C1608 SL 1H 050C-T-A
C321	4030006780	Ceramic	C1608 SL 1H 181J-T-A
C322	4030006860	Ceramic	C1608 JB 1H 102K-T-A

[RF UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
C323	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C324	4030006700	Ceramic	C1608 SL 1H 390J-T-A
C325	4030008630	Ceramic	C1608 JF 1C 104Z-T-A
C326	4030006800	Ceramic	C1608 SL 1H 221J-T-A
C328	4030006760	Ceramic	C1608 SL 1H 121J-T-A
C329	4030006730	Ceramic	C1608 SL 1H 680J-T-A
C330	4030008430	Ceramic	C1608 JF 1H 223Z-T-A
C331	4030008630	Ceramic	C1608 JF 1C 104Z-T-A
C332	4030006670	Ceramic	C1608 SL 1H 270J-T-A
C333	4030008630	Ceramic	C1608 JF 1C 104Z-T-A
C334 *	4550003030	Tantalum	TEMSVA 0J 475M-8L
C336	4030006780	Ceramic	C1608 SL 1H 181J-T-A
C337	4030006670	Ceramic	C1608 SL 1H 270J-T-A
C338	4030006670	Ceramic	C1608 SL 1H 270J-T-A
C339	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C340	4030006620	Ceramic	C1608 SL 1H 120J-T-A
C341	4030006590	Ceramic	C1608 SL 1H 080D-T-A
C342	4030006670	Ceramic	C1608 SL 1H 270J-T-A
C343	4030006530	Ceramic	C1608 SL 1H 020C-T-A
C344	4030006630	Ceramic	C1608 SL 1H 150J-T-A
C345	4030006850	Ceramic	C1608 JB 1H 471K-T-A
C346	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C347	4030006850	Ceramic	C1608 JB 1H 471K-T-A
C348	4030006850	Ceramic	C1608 JB 1H 471K-T-A
C350 *	4550003030	Tantalum	TEMSVA 0J 475M-8L
C351	4030006850	Ceramic	C1608 JB 1H 471K-T-A
C352	4030006640	Ceramic	C1608 SL 1H 180J-T-A
C353	4030006640	Ceramic	C1608 SL 1H 180J-T-A
C354	4030006850	Ceramic	C1608 JB 1H 471K-T-A
C355	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C356	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C357	4030008630	Ceramic	C1608 JF 1C 104Z-T-A
C358	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C359	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C360	4030006630	Ceramic	C1608 SL 1H 150J-T-A
C361 *	4550000400	Tantalum	DN 1C 2R2M
C362	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C363	4030008630	Ceramic	C1608 JF 1C 104Z-T-A
C364	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C365	4030008630	Ceramic	C1608 JF 1C 104Z-T-A
C366	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C367	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C368	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C369	4030006670	Ceramic	C1608 SL 1H 270J-T-A
C370	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C371	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C372	4030006530	Ceramic	C1608 SL 1H 020C-T-A
C373	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C374	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C375	4030006610	Ceramic	C1608 SL 1H 100D-T-A
C376	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C377	4030006660	Ceramic	C1608 SL 1H 220J-T-A
C379	4030006550	Ceramic	C1608 SL 1H 040C-T-A
C381 *	4550000740	Tantalum	TESVB2 0J 685M-8L
C382 *	4550000010	Tantalum	DN 1C 4R7M
C383	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C385	4030006660	Ceramic	C1608 SL 1H 220J-T-A
C386	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C389	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C390	4030006960	Ceramic	C1608 CH 1H 050C-T-A
C391	4030007070	Ceramic	C1608 CH 1H 330J-T-A
C393	4610000380	Trimmer	ECRGA020E30
C394	4030006800	Ceramic	C1608 SL 1H 221J-T-A
C395	4030006750	Ceramic	C1608 SL 1H 101J-T-A
C396	4030008430	Ceramic	C1608 JF 1H 223Z-T-A
C397	4030008630	Ceramic	C1608 JF 1C 104Z-T-A
C398 *	4550003100	Tantalum	TEMSVB 1A 106M-12 L
C399	4030008630	Ceramic	C1608 JF 1C 104Z-T-A
C400	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C401	4030006750	Ceramic	C1608 SL 1H 101J-T-A
C402	4030006860	Ceramic	C1608 JB 1H 102K-T-A

* safety critical component

[RF UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
C403	4030008630	Ceramic	C1608 JF 1C 104Z-T-A
C404	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C405	4030006690	Ceramic	C1608 SL 1H 330J-T-A
C406	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C407 *	4550003030	Tantalum	TEMSVA 0J 475M-8L
C408	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C410	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C411	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C412	4030006630	Ceramic	C1608 SL 1H 150J-T-A
C413	4030006850	Ceramic	C1608 JB 1H 471K-T-A
C414	4030006620	Ceramic	C1608 SL 1H 120J-T-A
C415	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C419	4030006580	Ceramic	C1608 SL 1H 070D-T-A
C420	4030006550	Ceramic	C1608 SL 1H 040C-T-A
C421	4030006550	Ceramic	C1608 SL 1H 040C-T-A
C422	4030006630	Ceramic	C1608 SL 1H 150J-T-A
C423	4030006510	Ceramic	C1608 SL 1H 0R5C-T-A
C424	4030006550	Ceramic	C1608 SL 1H 040C-T-A
C425	4030006660	Ceramic	C1608 SL 1H 220J-T-A
C426	4030006540	Ceramic	C1608 SL 1H 030C-T-A
C427	4030006540	Ceramic	C1608 SL 1H 030C-T-A
C428	4030006630	Ceramic	C1608 SL 1H 150J-T-A
C429	4030006710	Ceramic	C1608 SL 1H 470J-T-A
C430	4030006630	Ceramic	C1608 SL 1H 150J-T-A
C431	4030006570	Ceramic	C1608 SL 1H 060D-T-A
C432	4030008630	Ceramic	C1608 JF 1C 104Z-T-A
C433	4030006850	Ceramic	C1608 JB 1H 471K-T-A
C434 *	4550002840	Tantalum	TESVB 0J 475M-12L
C435	4030006890	Ceramic	C1608 JF 1H 103Z-T-A
C436	4030008430	Ceramic	C1608 JF 1H 223Z-T-A
C437	4030006870	Ceramic	C1608 JB 1H 222K-T-A
C438	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C439	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C440	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C441	4030006860	Ceramic	C1608 JB 1H 102K-T-A
FI301	2010001050	Filter	21M15B3 (FL-141)
FI302	2020000490	Ceramic Filter	CFZM455E10
EP1	0910027924	P.C. Board	B 2789D (RF)
EP5	6910000970	Lead Frame	DL 2OP 2.6-3-1.2H

[VCO UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
Q501	1560000270	FET	2SK302-Y (TE85R)
D501	1710000580	Diode	1SS265
D502	1720000220	Varicap	1SV166-T2B
D503	1720000220	Varicap	1SV166-T2B
L501	6130002390	Coil	LB-262
L502	6180000680	Coil	LAL 02NA 4R7K
L503	6180002380	Coil	LAL 02NA 2R2K
L504	6180000680	Coil	LAL 02NA 4R7K

[VCO UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
L505	6180002380	Coil	LAL 02NA 2R2K
L506	6180002380	Coil	LAL 02NA 2R2K
R501	7030000620	Resistor	MCR10EZHJ 100 kΩ (104)
R502	7030000140	Resistor	MCR10EZHJ 10 Ω (100)
C501	4030004710	Ceramic	C2012 JB 1H 471K-T-A
C503	4030004980	Ceramic	C2012 CH 1H 820J-T-A
C504	4030004870	Ceramic	C2012 CH 1H 100D-T-A
C505	4030004720	Ceramic	C2012 JB 1H 102K-T-A
C506	4030004990	Ceramic	C2012 CH 1H 101J-T-A
C507	4030004970	Ceramic	C2012 CH 1H 680J-T-A
C508	4030004820	Ceramic	C2012 CH 1H 050C-T-A
C509	4030004800	Ceramic	C2012 CH 1H 030C-T-A
C510	4030004720	Ceramic	C2012 JB 1H 102K-T-A
C512	4010000010	Ceramic	DD104 SL 0R5C 50V
C514	4030004820	Ceramic	C2012 CH 1H 050C-T-A
C515	4030004720	Ceramic	C2012 JB 1H 102K-T-A
C516	4030006450	Ceramic	C2012 JF 1H 103Z-T-A
EP1	0910027641	P.C. Board	B 2721A (VCO)

[SQL UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
Q602	1530002060	Transistor	2SC4081 T107R
Q603	1530002060	Transistor	2SC4081 T107R
D602	1790000490	Diode	HSM88AS-TR
D603	1750000160	Diode	DA114 T107
D604	1790000490	Diode	HSM88AS-TR
R602	7030002410	Resistor	MCR03EZHJ 82 kΩ (823)
R603	7030002170	Resistor	MCR03EZHJ 1.5 kΩ (152)
R604	7030002220	Resistor	MCR03EZHJ 3.3 kΩ (332)
R613	7030002480	Resistor	MCR03EZHJ 270 kΩ (274)
R614	7030002220	Resistor	MCR03EZHJ 3.3 kΩ (332)
R615	7030002030	Resistor	MCR03EZHJ 100 Ω (101)
R616	7030002330	Resistor	MCR03EZHJ 27 kΩ (273)
R617	7030002420	Resistor	MCR03EZHJ 100 kΩ (104)
R618	7030002420	Resistor	MCR03EZHJ 100 kΩ (104)
R619	7030002340	Resistor	MCR03EZHJ 33 kΩ (333)
R620	7030002360	Resistor	MCR03EZHJ 47 kΩ (473)
R621	7030002420	Resistor	MCR03EZHJ 100 kΩ (104)
R623	7510000440	Thermistor	DTN-T203E681LS (T)
R624	7030002130	Resistor	MCR03EZHJ 680 Ω (681)
C602	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C603	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C604	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C606	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C610	4030006860	Ceramic	C1608 JB 1H 102K-T-A
C611	4030006860	Ceramic	C1608 JB 1H 102K-T-A

* safety critical component

[SQL UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
C612	4030008430	Ceramic	C1608 JF 1H 223Z-T-A
C613 *	4550002860	Tantalum	TESVA 1V 224K1-8L
C614 *	4550000540	Tantalum	TESVA 1V 154M1-8L
C615	4030006900	Ceramic	C1608 JB 1E 103K-T-A
EP1	0910027681	P.C. Board	B 2786A (SQL)

[LPF UNIT]

REF. NO.	ORDER NO.	DESCRIPTION	
IC701	1130001250	IC	μPD4066BG-T1
R702	7030002210	Resistor	MCR03EZHJ 2.7 kΩ (272)
R704	7030002150	Resistor	MCR03EZHJ 1 kΩ (102)
R705	7030002200	Resistor	MCR03EZHJ 2.2 kΩ (222)
R706	7030002090	Resistor	MCR03EZHJ 330 Ω (331)
C701	4030008630	Ceramic	C1608 JF 1C 104Z-T-A
C702 *	4550003280	Tantalum	TEMSVB 1V 225M-12 L
C703	4030008630	Ceramic	C1608 JF 1C 104Z-T-A
C704	4030008630	Ceramic	C1608 JF 1C 104Z-T-A
EP1	0910028541	P.C. Board	B 2897A (LPF)

*safety critical component

SECTION 7 ADJUSTMENT PROCEDURES

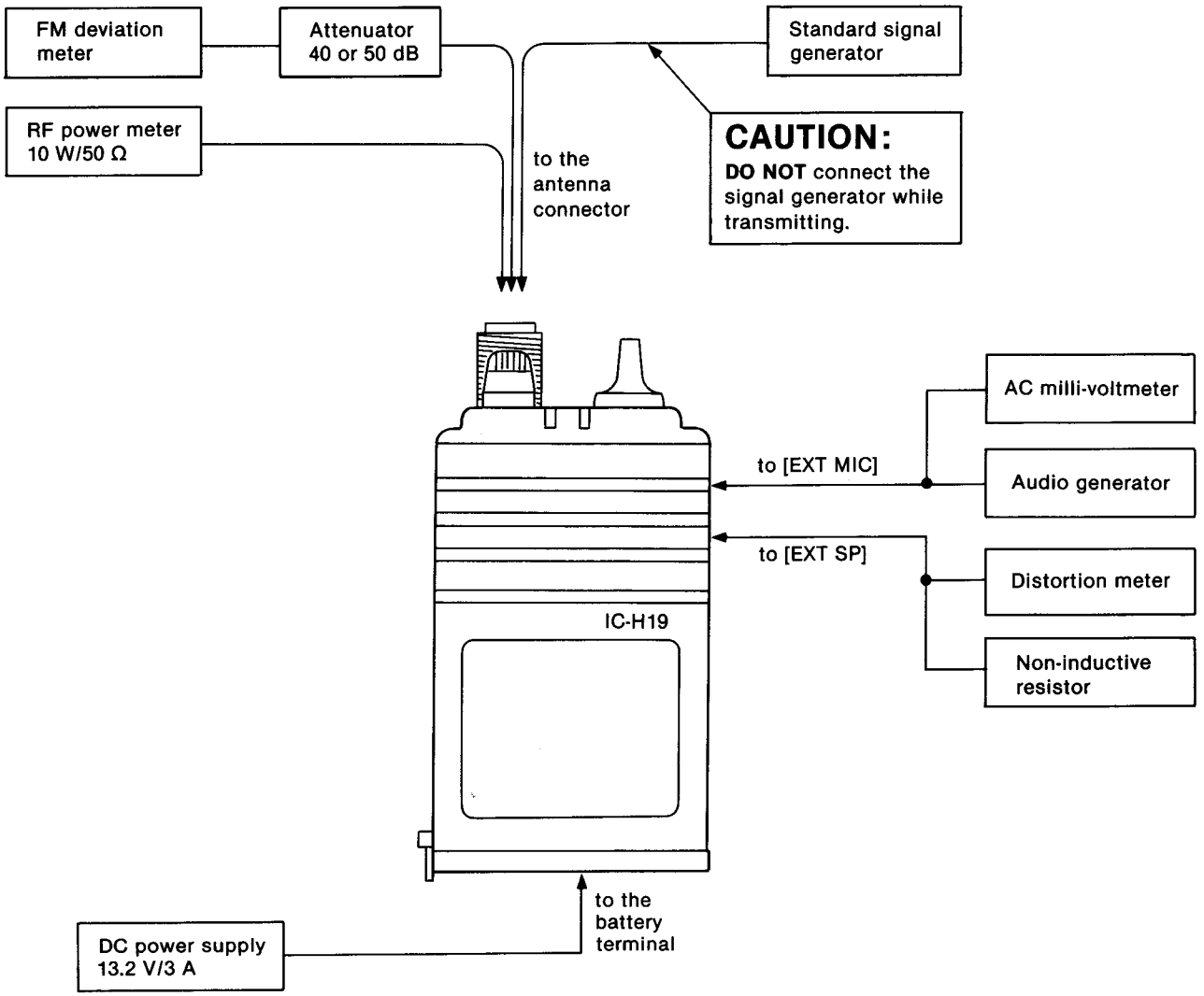
7-1 PREPARATION BEFORE SERVICING

■ REQUIRED TEST EQUIPMENT

EQUIPMENT	GRADE AND RANGE	EQUIPMENT	GRADE AND RANGE
DC power supply	Output voltage : 13.2 V DC Current capacity : 3 A or more	Audio generator	Frequency range : 300~3000 Hz Output level : 1~200 mV
RF power meter (terminated type)	Measuring range : 1~10 W Frequency range : 120~180 MHz Impedance : 50 Ω SWR : Less than 1.2 : 1	Attenuator	Power attenuation : 40 or 50 dB Capacity : 10 W or more
		AC milli-voltmeter	Measuring range : 2~200 mV
Frequency counter	Frequency range : 0.1~180 MHz Frequency accuracy : ±1 ppm or better Sensitivity : 100 mV or better	Non-inductive resistor	Impedance : 8 Ω
		DC voltmeter	Input impedance : 50 kΩ/DC or better
Distortion meter	Frequency range : 1 kHz±10 Hz Measuring range : 1~100 %	FM deviation meter	Frequency minimum : 480 MHz Measuring range : 0~±5 kHz
Standard signal generator (SSG)	Frequency range : 0.1~180 MHz Output level : −127~−17 dBm (0.1 μV~32 mV)		

CW: Clockwise
CCW: Counterclockwise

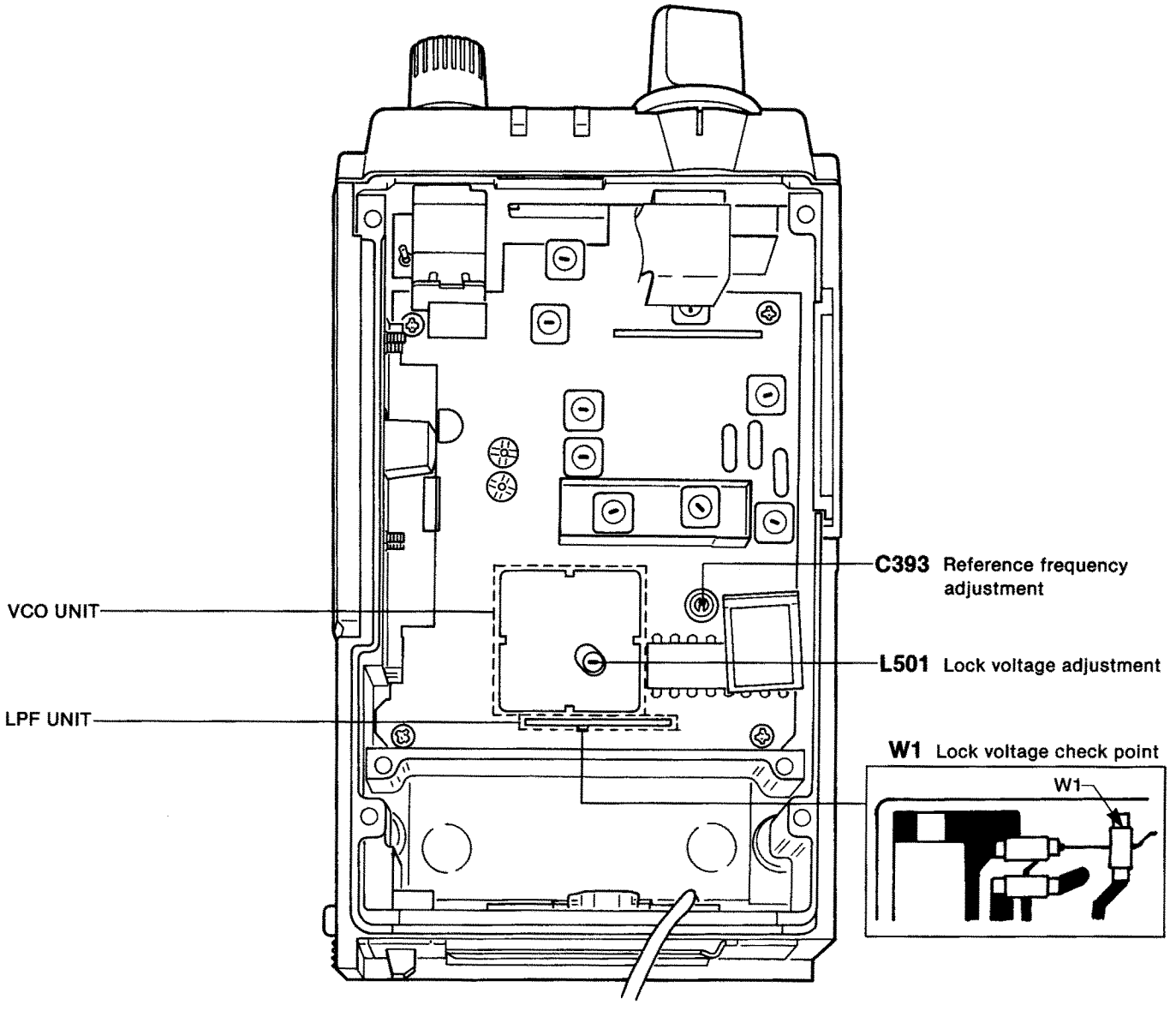
■ CONNECTION



7-2 PLL ADJUSTMENT

ADJUSTMENT		ADJUSTMENT CONDITIONS	MEASUREMENT		VALUE	ADJUSTMENT POINT	
			UNIT	LOCATION		UNIT	ADJUST
REFERENCE FREQUENCY	1	• Select any channel. • Connect the RF power meter or a 50 Ω dummy load. • Transmitting	Top panel	Loosely couple the frequency counter to the antenna connector.	Same frequency as the programmed one. To check the programmed frequency, use the EX-704.	RF	C393
LOCK VOLTAGE		NOTE: Lock voltage affects the C/N ratio. If you adjust the lock voltage, set the frequency with the EX-704.					
	1	• Operating frequency : 150.0000 MHz • Receiving	LPF	Connect the DC voltmeter to W1.	1.0 V	VCO	L501

• RF UNIT

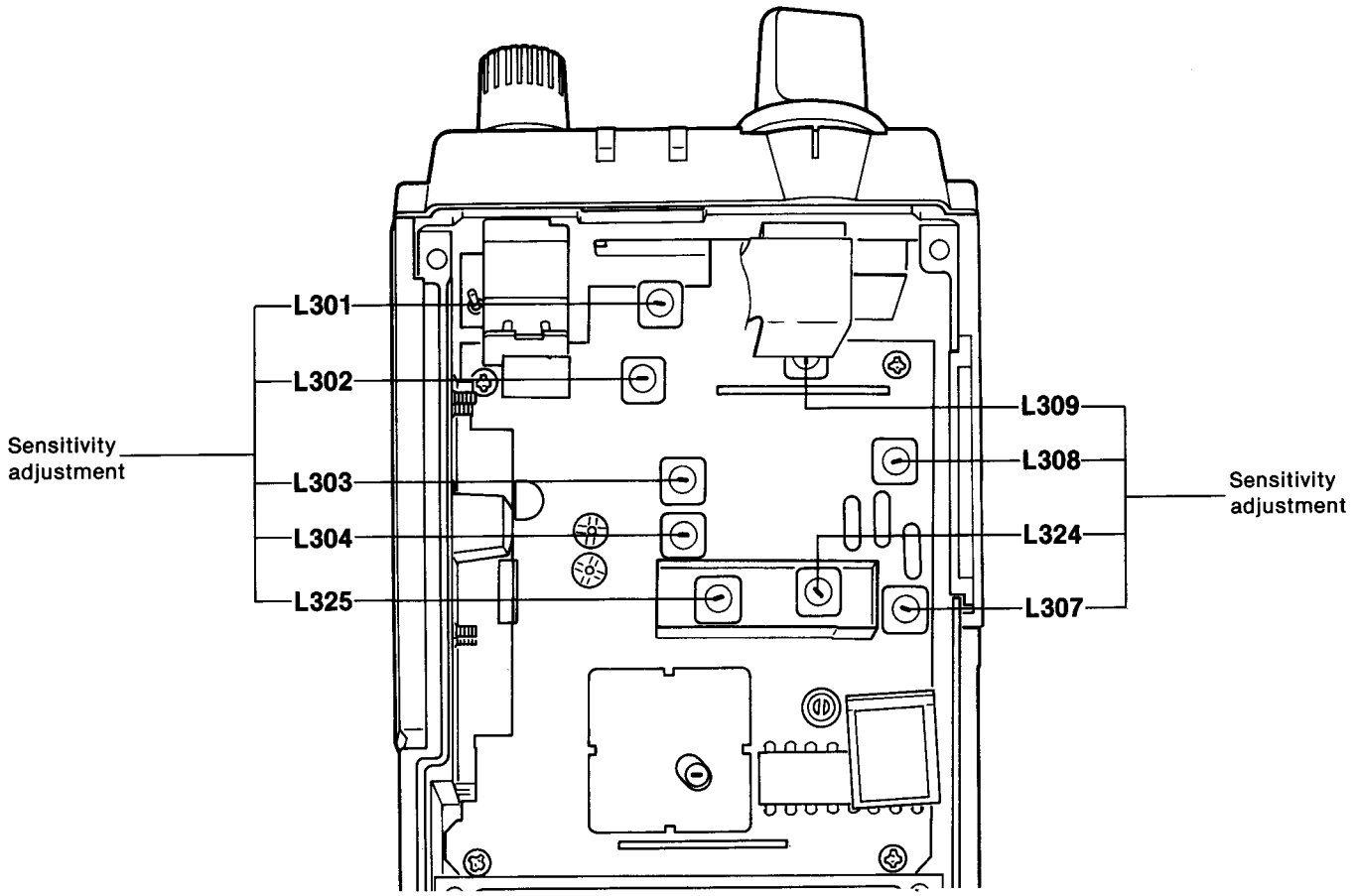


7-3 RECEIVER ADJUSTMENT

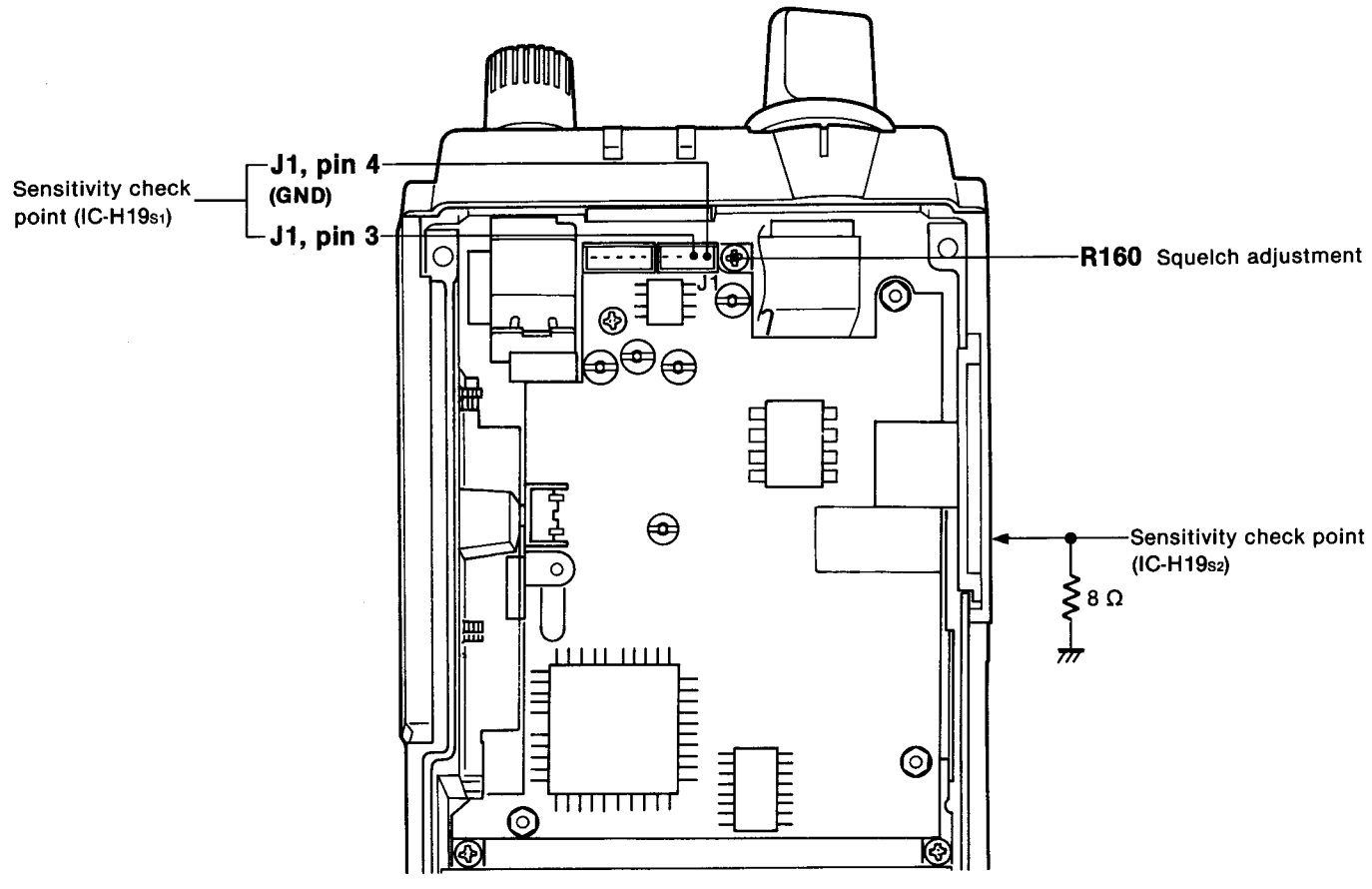
ADJUSTMENT		ADJUSTMENT CONDITIONS	MEASUREMENT		VALUE	ADJUSTMENT POINT	
			UNIT	LOCATION		UNIT	ADJUST
SENSITIVITY		NOTE: When the sensitivity is less than 0.25 μV (12 dB SINAD) on every channel, the following sensitivity adjustment is not necessary. Skip to squelch adjustment below.					
	1	• Operating frequency: Center of the frequency edge. • Connect the SSG to the antenna connector and set as: Level : 1.0 mV* (−47 dBm) Modulation: 1 kHz Deviation : ±3.5 kHz • [MONITOR] switch: ON • Receiving	MAIN or Side panel	IC-H19$_{S1}$: Connect the distortion meter to J1, pins 3 and 4. IC-H19$_{S2}$: Connect the distortion meter to the [EXT SP] jack with an 8 Ω load.	Minimum distortion level	RF	Adjust in sequence L301 L302 L303 L304 L325 L324 L307 L308 L309
	2	• Connect the SSG to the antenna connector and set as: Level : 0.1 V* (−7 dBm) Modulation: 1 kHz Deviation : ±3.5 kHz					Adjust in sequence L307 L308 L309
SQUELCH		NOTE: Before squelch adjustment, be sure that the sensitivity on every channel is less than 0.25 μV (12 dB SINAD).					
	1	• Connect the SSG to the antenna connector and set as: Level : 0.2 μV* (−121 dBm) Modulation: 1 kHz Deviation : ±3.5 kHz • R160 (MAIN): Max. CCW • Receiving	Front panel	Speaker	Squelch threshold point	MAIN	R160

*This output level of the standard signal generator (SSG) is indicated as SSG's open circuit.

• **RF UNIT**



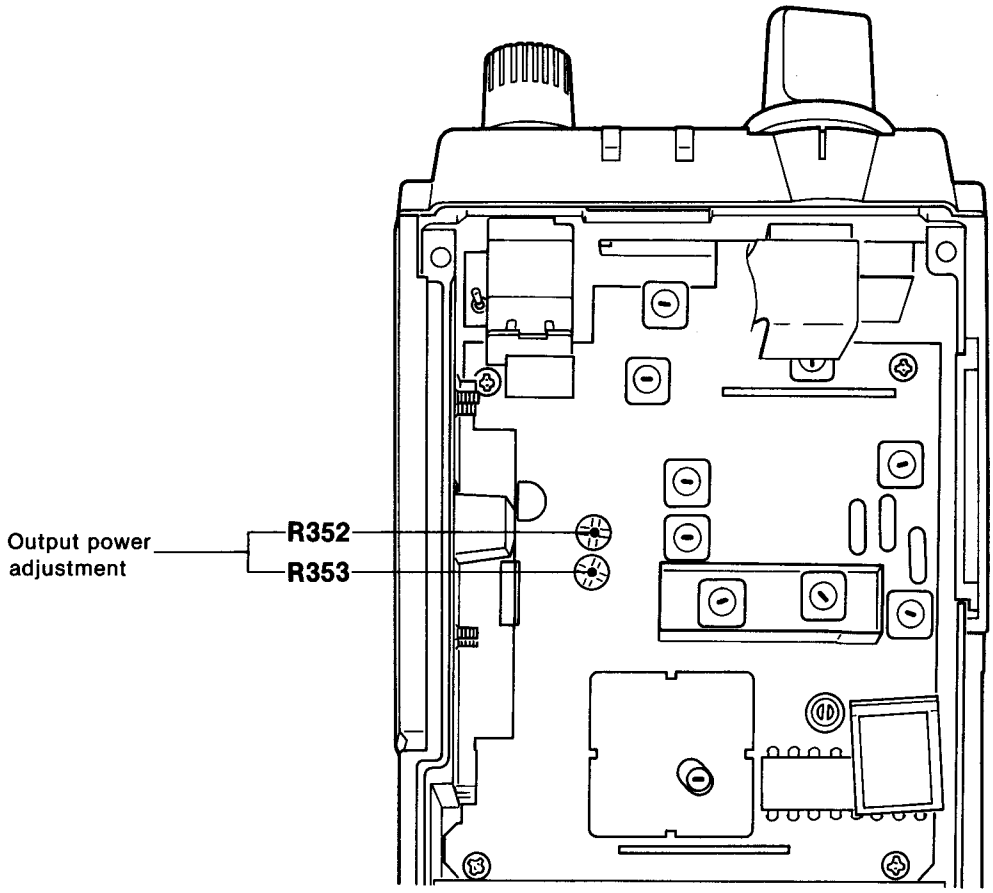
• **MAIN UNIT**



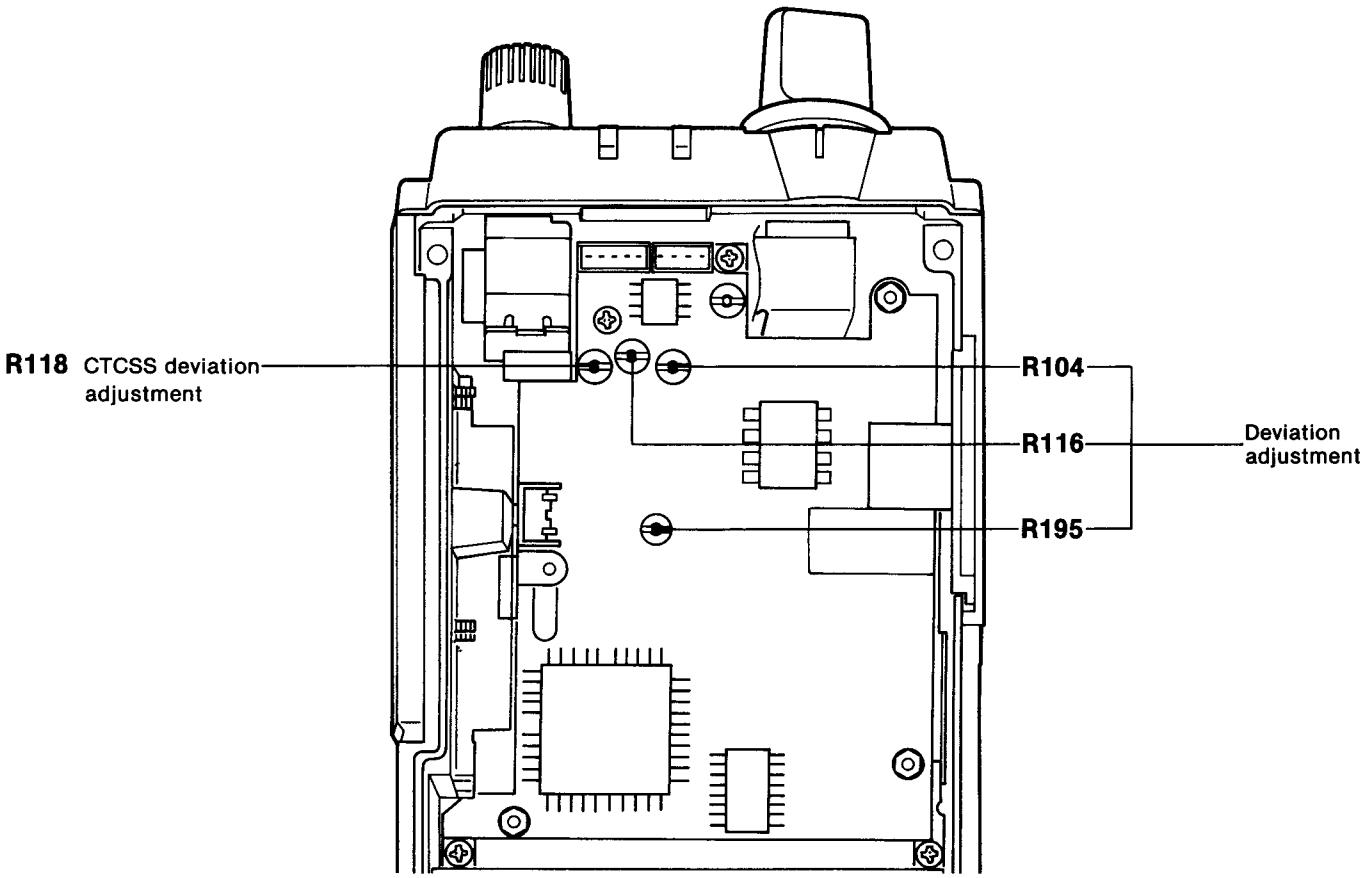
7-4 TRANSMITTER ADJUSTMENT

ADJUSTMENT		ADJUSTMENT CONDITIONS	MEASUREMENT		VALUE	ADJUSTMENT POINT	
			UNIT	LOCATION		UNIT	ADJUST
OUTPUT POWER	1	• Select any channel. • Output power: HIGH • Transmitting	Top panel	Connect the RF power meter to the antenna connector.	5.0 W (13.2 V DC) 3.5 W (8.75 V DC) 2.5 W (7.5 V DC)	RF	R353
	2	• Output power: LOW (if programmed.)			800 mW		R352
DEVIATION	1	• Select any channel. • Output power: HIGH • Connect the audio generator to the [EXT MIC] connector with an AC milli-voltmeter and set as: Level : 250 mV Modulation : 1.0 kHz • Set the FM deviation meter as: HPF : OFF LPF : 20 kHz De-emphasis: OFF Detector : (P-P)/2 • Transmitting	Top panel	Connect the FM deviation meter to the antenna connector via the attenuator.	Preset to center.	MAIN	R195
	2				±4.3 kHz		R116
	3	• Set the FM deviation meter as: HPF : OFF LPF : 20 kHz De-emphasis: OFF Detector : P and -P			Symmetrical deviation level		R104
CTCSS DEVIATION	1	• Select a tone encoder programmed channel, if programmed. • Output power: HIGH • Set the FM deviation meter as: HPF : OFF LPF : 20 kHz De-emphasis: OFF Detector : (P-P)/2 • Apply no signal to the [EXT MIC] connector. • Transmitting	Top panel	Connect the FM deviation meter to the antenna connector via the attenuator.	±0.75 kHz	MAIN	R118

• **RF UNIT**



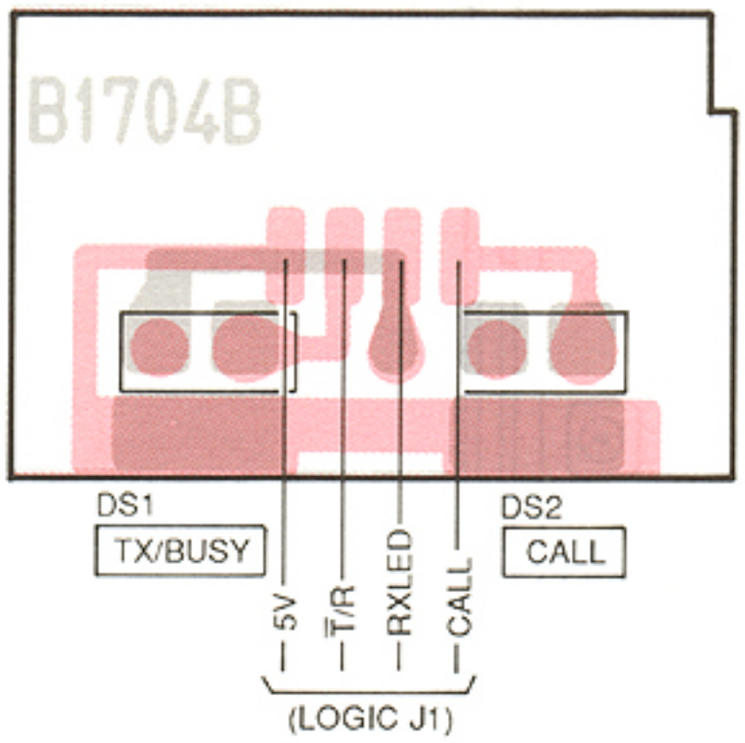
• **MAIN UNIT**



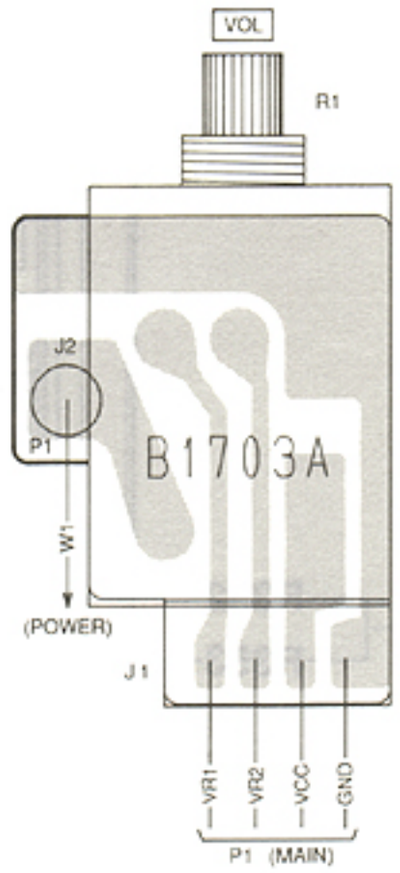
SECTION 8 BOARD LAYOUTS

8-1 LED, VR, POWER AND LOGIC UNITS

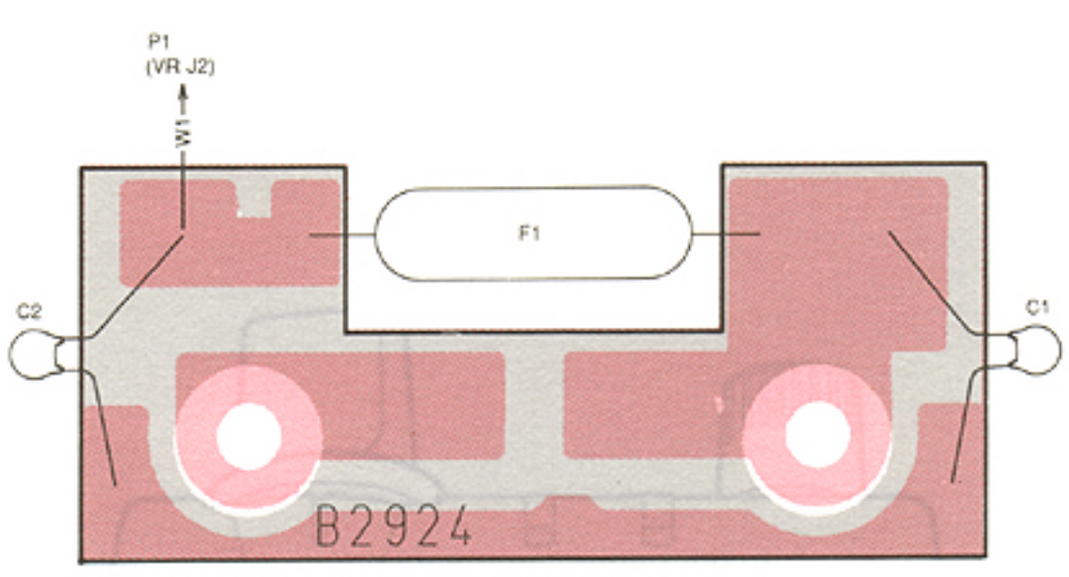
• **LED UNIT**



• **VR UNIT**

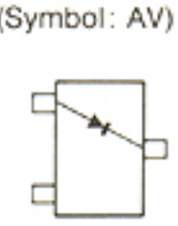


• **POWER UNIT**



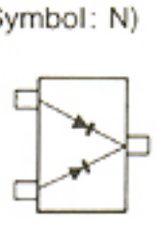
• **LOGIC UNIT**

DA114
(Symbol: AV)



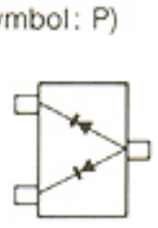
D804, D806, D807

DAN202U
(Symbol: N)



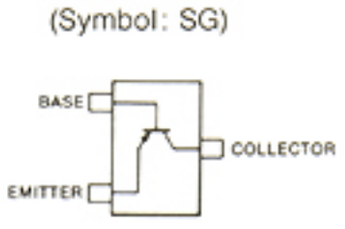
D803, D808

DAP202U
(Symbol: P)



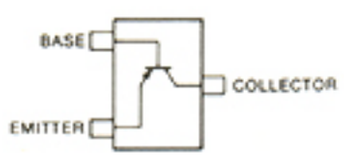
D801, D802

2SA1162 GR
(Symbol: SG)



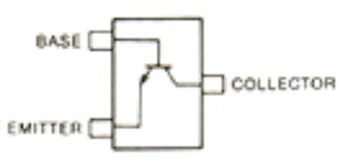
Q805

2SA1576R
(Symbol: FR)



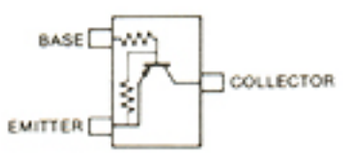
Q802

2SC4081 R
(Symbol: BR)



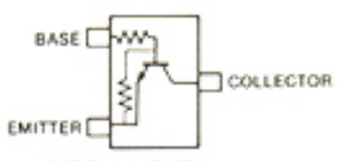
Q803

DTA144EU
(Symbol: 16)



Q810

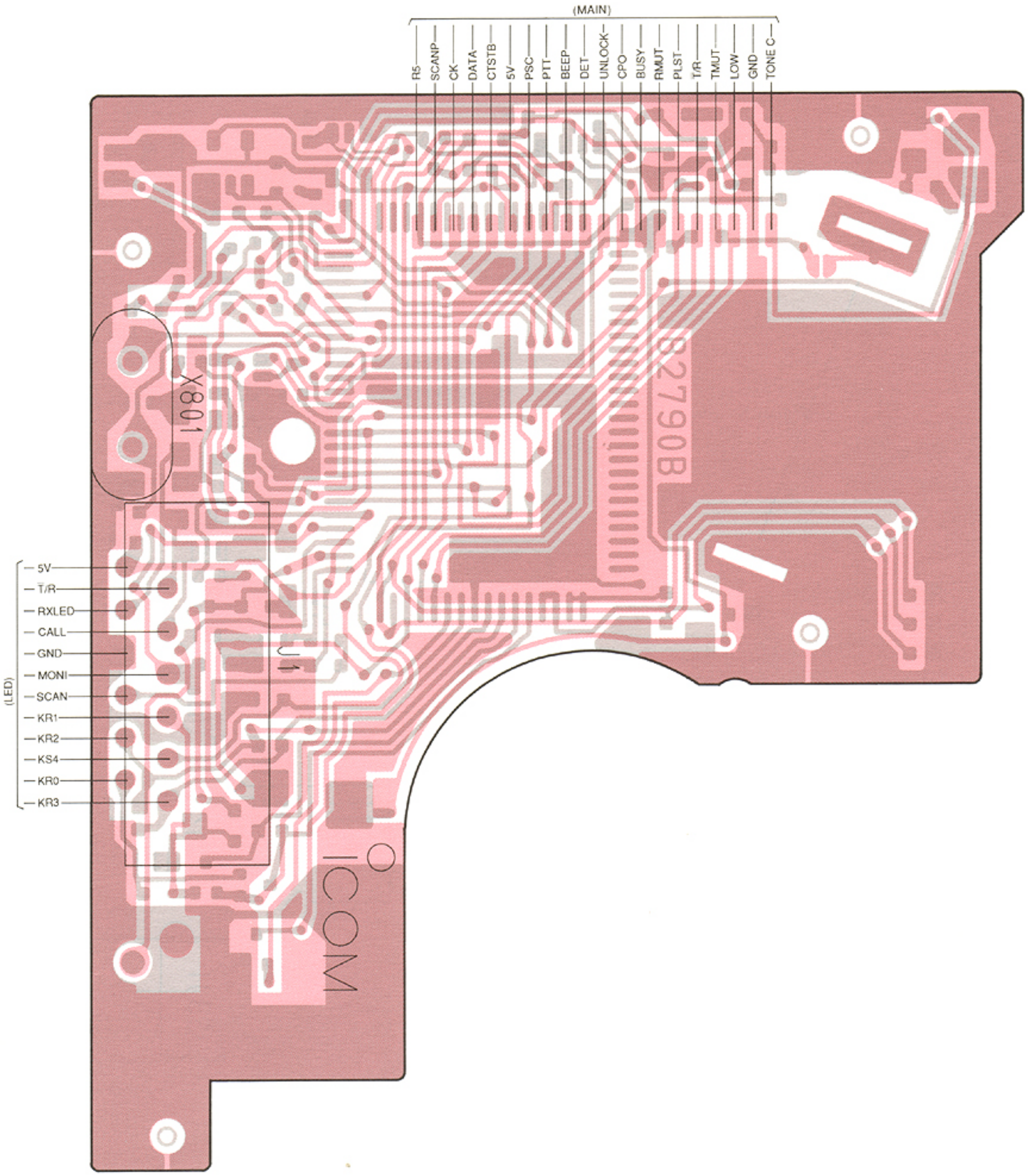
DTC144EU
(Symbol: 26)
DTC144WU
(Symbol: 86)



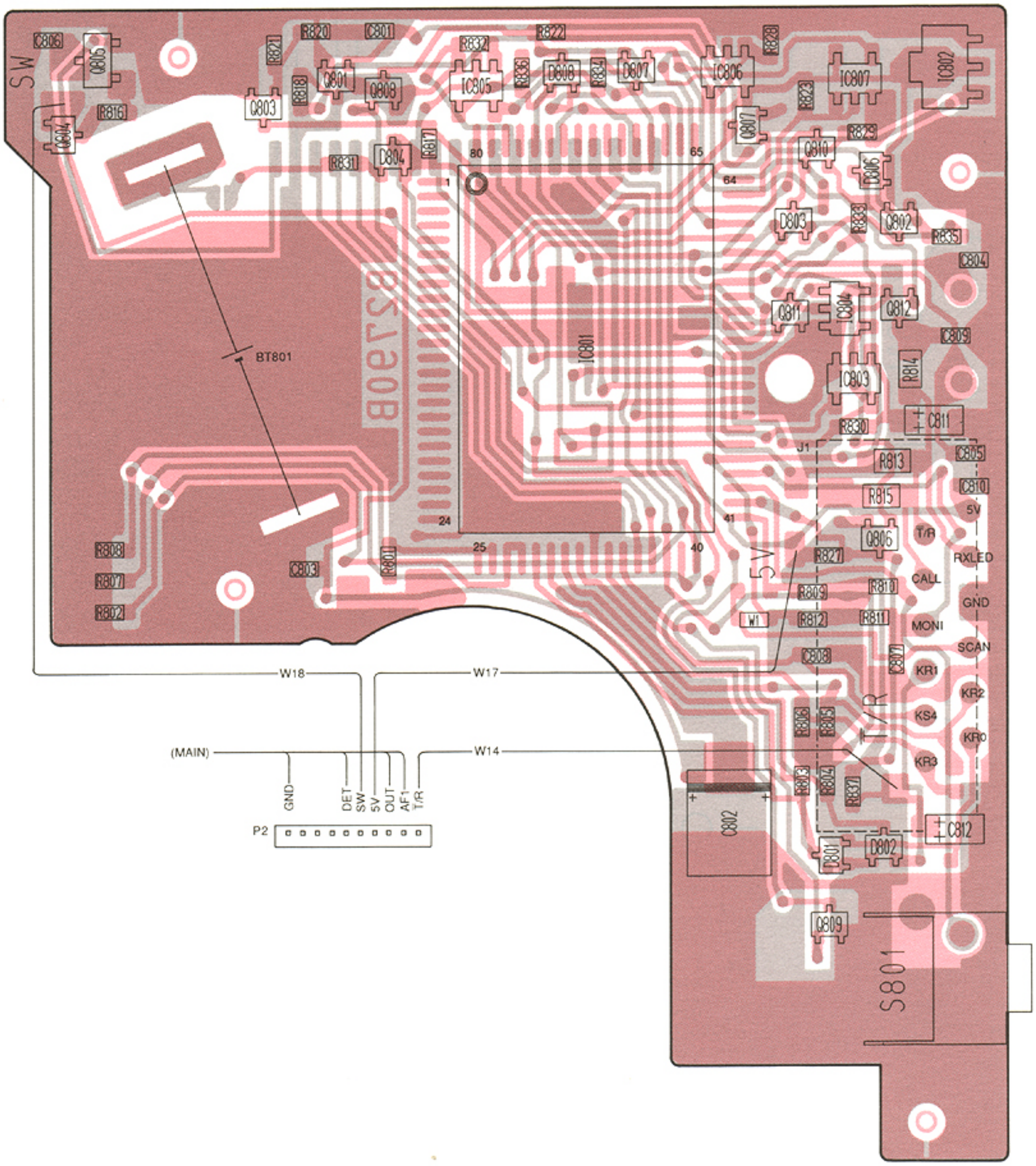
DTC144WU
Q812
DTC144EU
Q801, Q804, Q806, Q807, Q808, Q809, Q811

• LOGIC UNIT

The combination of this page and the next page shows the unit layout in the same configuration as the actual P.C. Board.

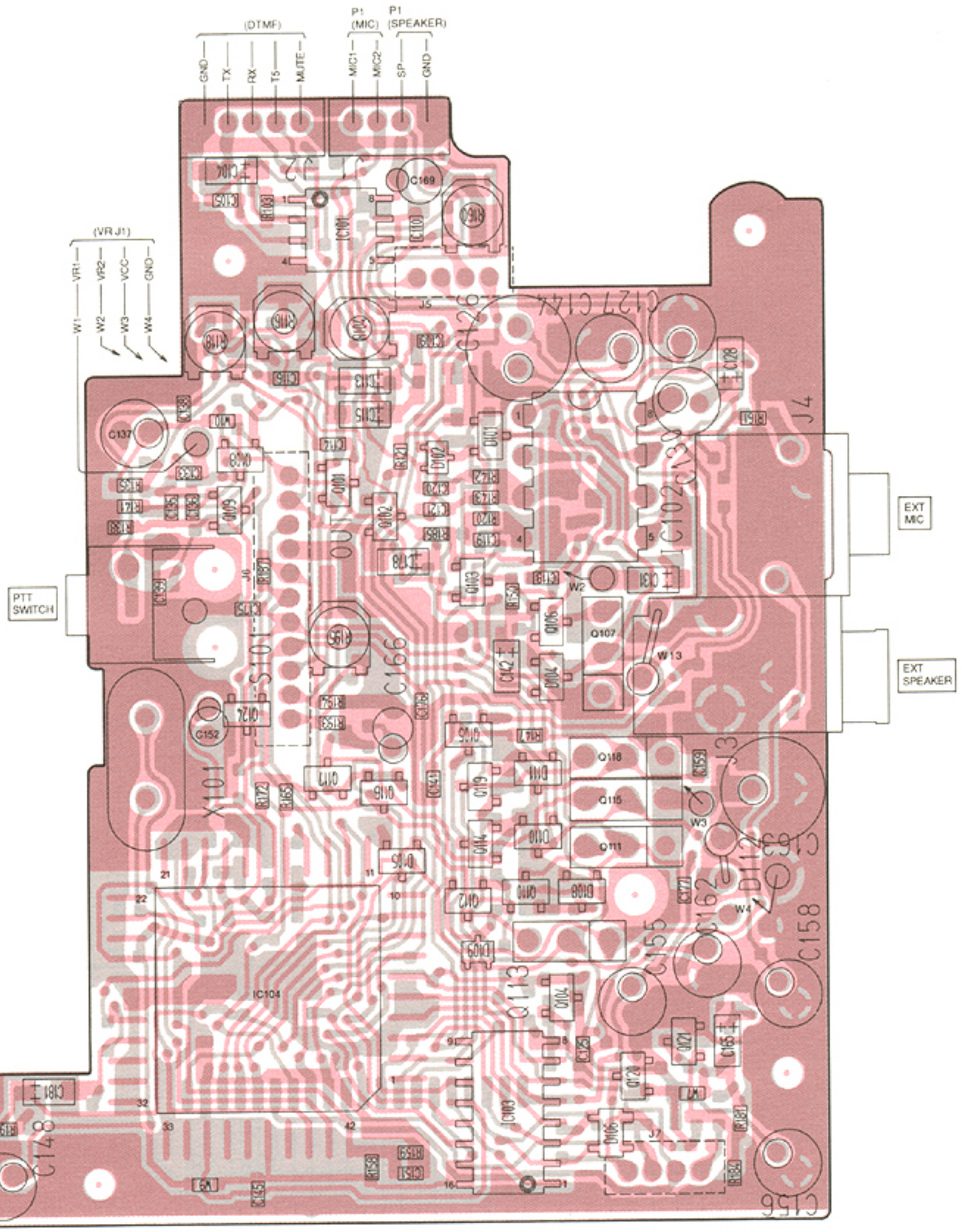


- **LOGIC UNIT**

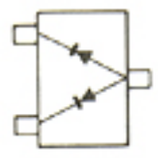

SW
C806
Q805
R821
R820
C801
R832
R822
R828
R836
R834
Q804
R816
Q803
R818
Q801
Q808
IC805
D808
D807
IC806
Q807
R823
IC807
IC802
R829
Q810
D806
R831
D804
R817
80
65
1
64
D803
R833
Q802
R835
C804
BT801
IC801
Q811
IC804
Q812
C809
IC803
R814
C811
R830
J1
C805
R813
C810
R815
5V
T/R
RXLED
Q806
R827
CALL
R808
R809
R810
GND
R807
W1
R812
R811
MONI
R802
C808
C807
SCAN
KR1
W18
W17
KR2
KS4
R806
R805
KR0
(MAIN)
W14
KR3
R803
R804
R837
GND
DET
SW
5V
OUT
AF1
T/R
P2
C802
C812
D801
D802
Q809
S801

8-2 MAIN UNIT

The combination of this page and the next page shows the unit layout in the same configuration as the actual P.C. Board.

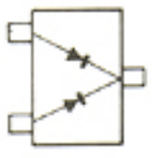


1SS181
(Symbol: A3)



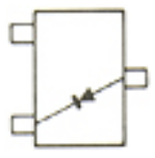
D111

1SS184
(Symbol: B3)



D105, D108

1SS190
(Symbol: E3)

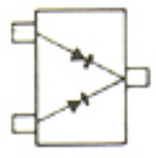


D110

DA114
(Symbol: AV)

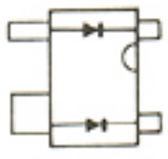
D103, D109

DAN202U
(Symbol: N)



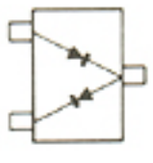
D102

DWA010
(Symbol: W8)



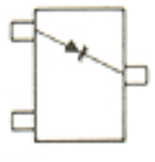
D106

HSM88AS
(Symbol: C1)



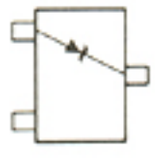
D101

RD4.7M B3
(Symbol: 473)



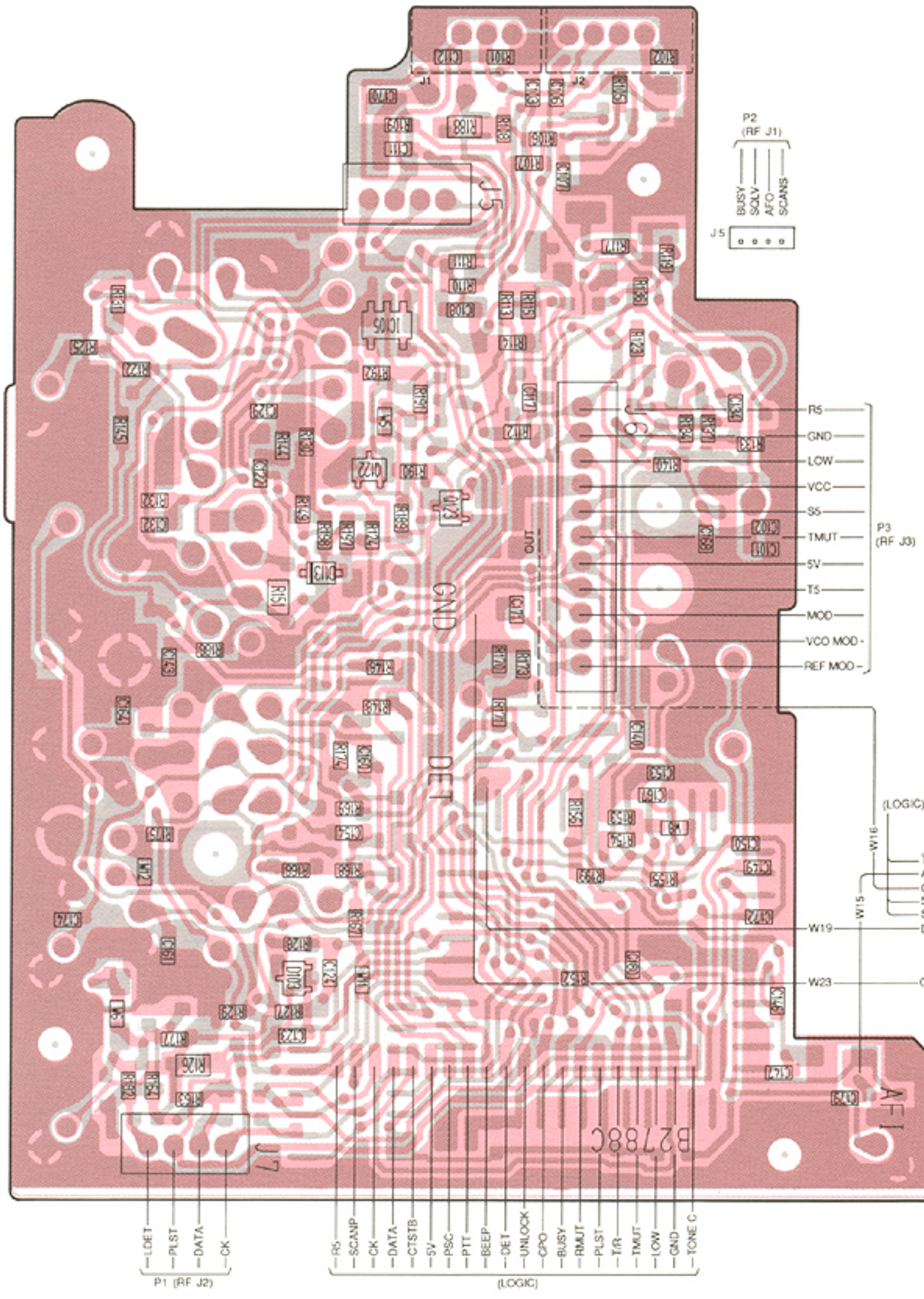
D104

RD5.1M B2
(Symbol: 512)

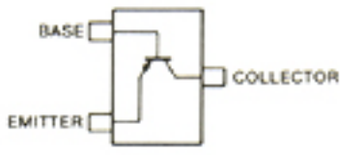


D112

• MAIN UNIT

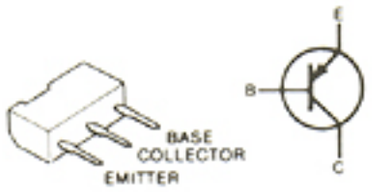


2SA1162 GR
(Symbol: SG)



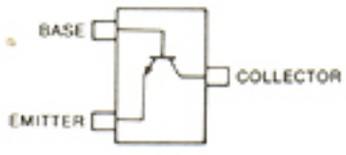
Q103, Q104, Q105, Q116, Q117

2SB909M R



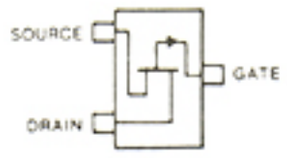
Q107, Q111, Q113, Q115, Q118

2SC2712 BL
(Symbol: LL)



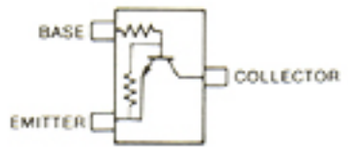
Q101, Q102, Q106, Q108, Q110, Q112, Q114, Q119, Q120, Q121

2SJ106 Y
(Symbol: VY)



Q109

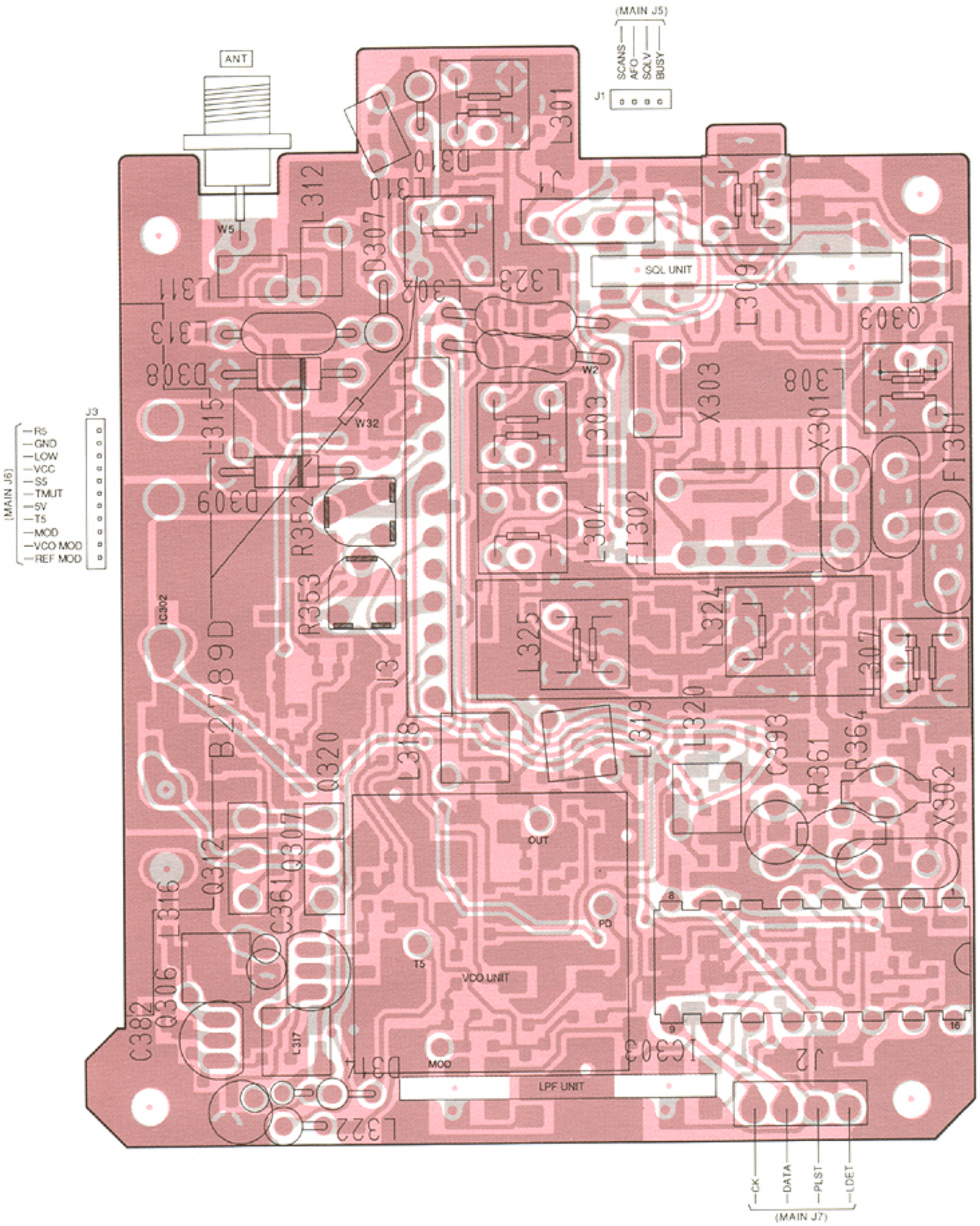
DTC144 EU/EK
(Symbol: 26)



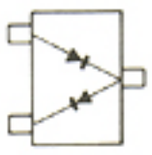
Q122, Q123, Q124

8-3 RF UNIT

The combination of this page and the next page shows the unit layout in the same configuration as the actual P.C. Board.

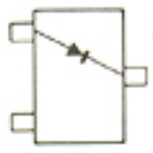


1SS226
(Symbol: C3)



D306

DA114
(Symbol: AV)

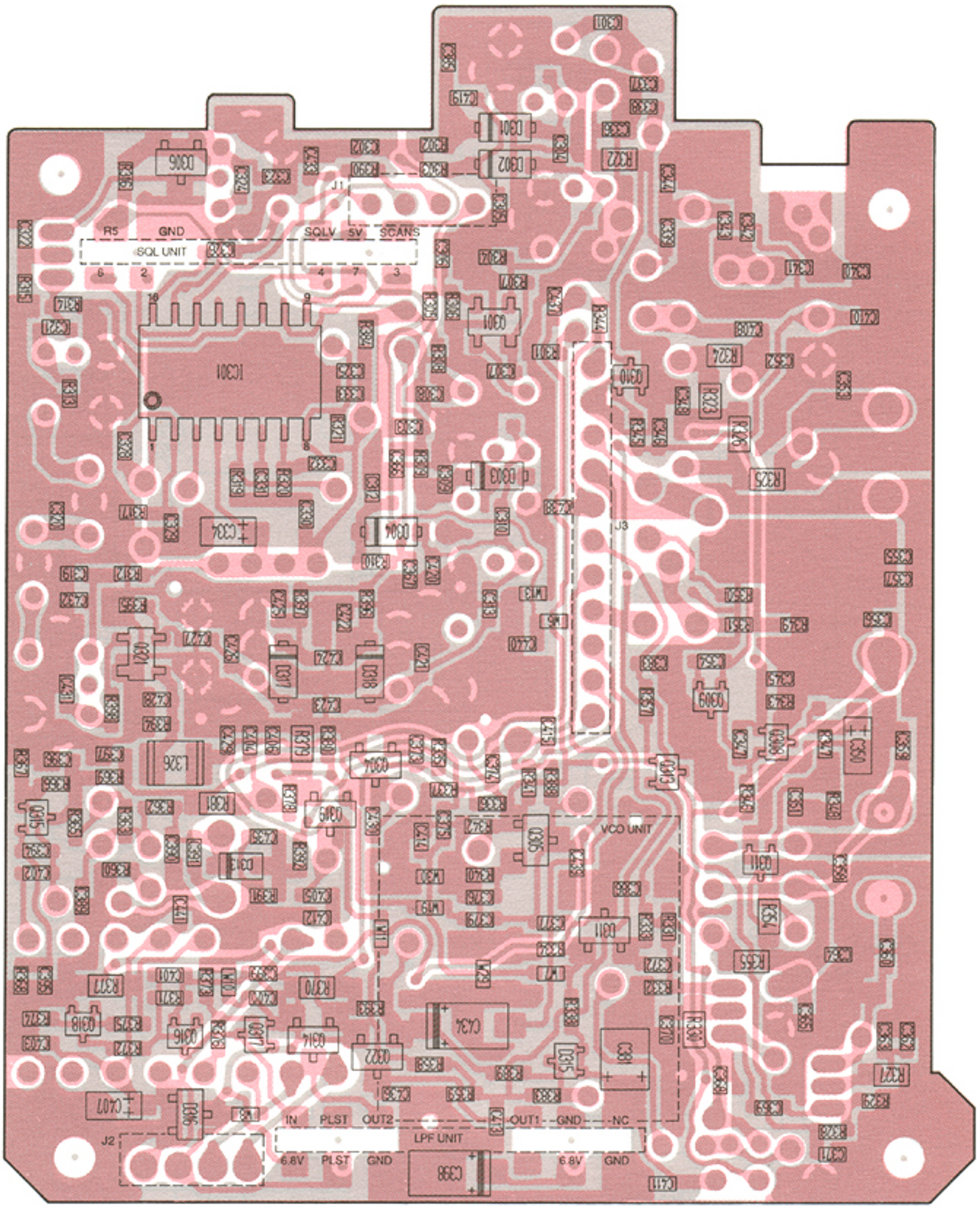


D315

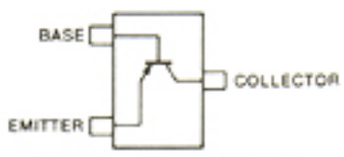
RD6.8M B2
(Symbol: 682)

D316

• RF UNIT

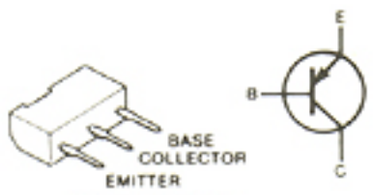


2SA1576 R
(Symbol: FR)



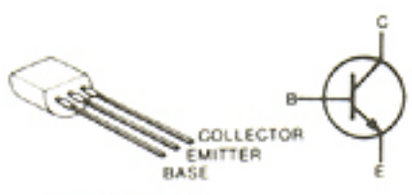
Q308, Q309, Q313, Q316

2SB1237



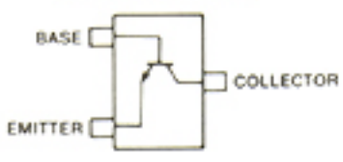
Q312, Q320

2SC2026



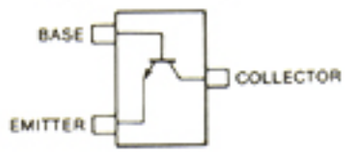
Q306, Q307

2SC3356
(Symbol: R22)



Q304, Q305, Q319

2SC4081 R
(Symbol: BR)

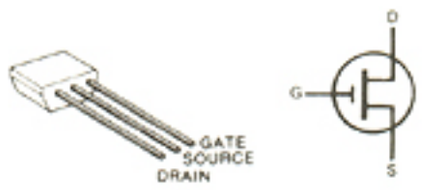


Q310, Q311, Q315, Q317, Q318

2SK209 Y
(Symbol: XY)

Q314, Q322

2SK241 GR



Q303

3SK131K T1
(Symbol: V13)

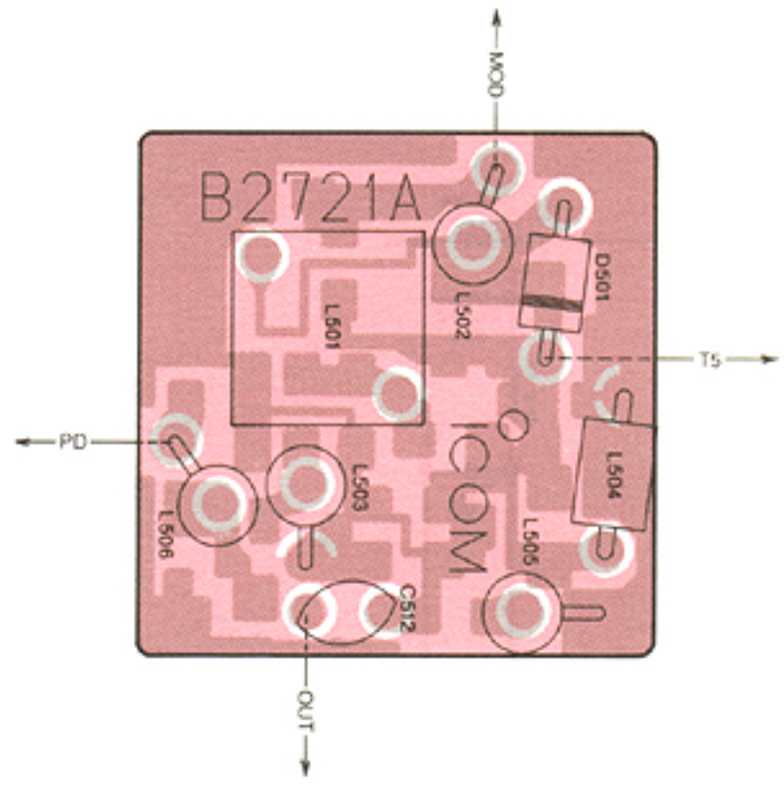
Q301

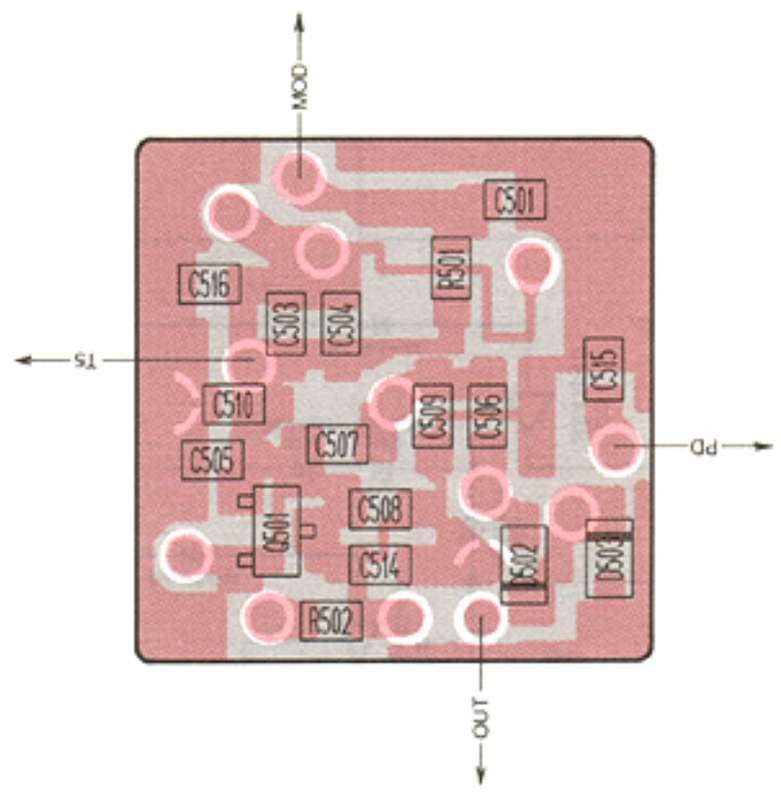
3SK151 Y
(Symbol: UH)

Q321

8-4 VCO, SQL AND LPF UNITS

• VCO UNIT

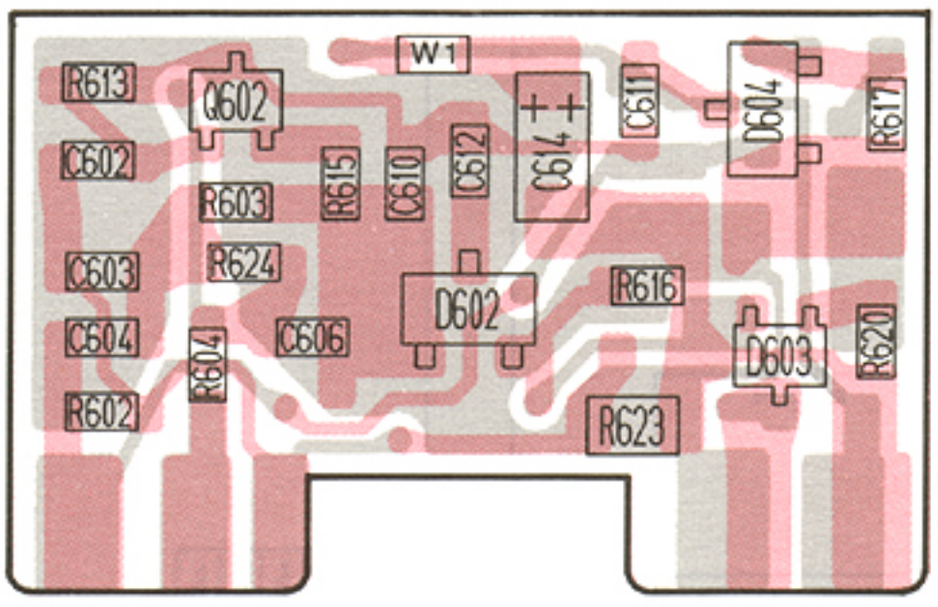




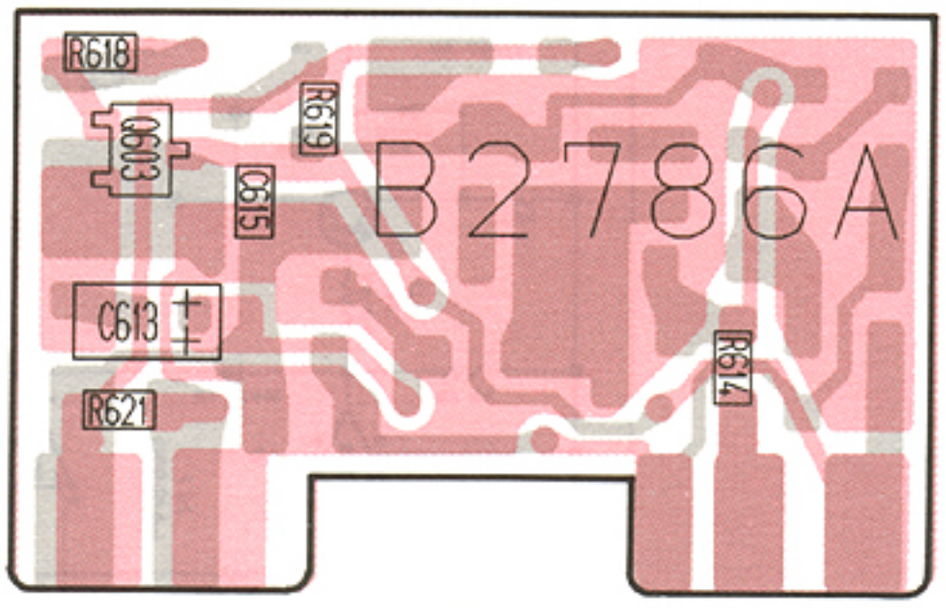
2SK302 Y
(Symbol: TY)

Q501

• SQL UNIT

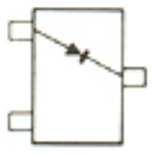


3 7 4 2 6



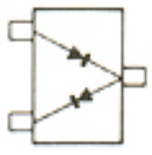
R5 GND SQLV 5V SCANS

DA114
(Symbol: AV)



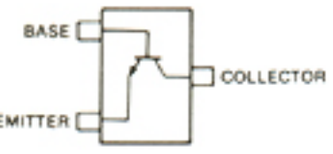
D603

HSM88AS
(Symbol: C1)



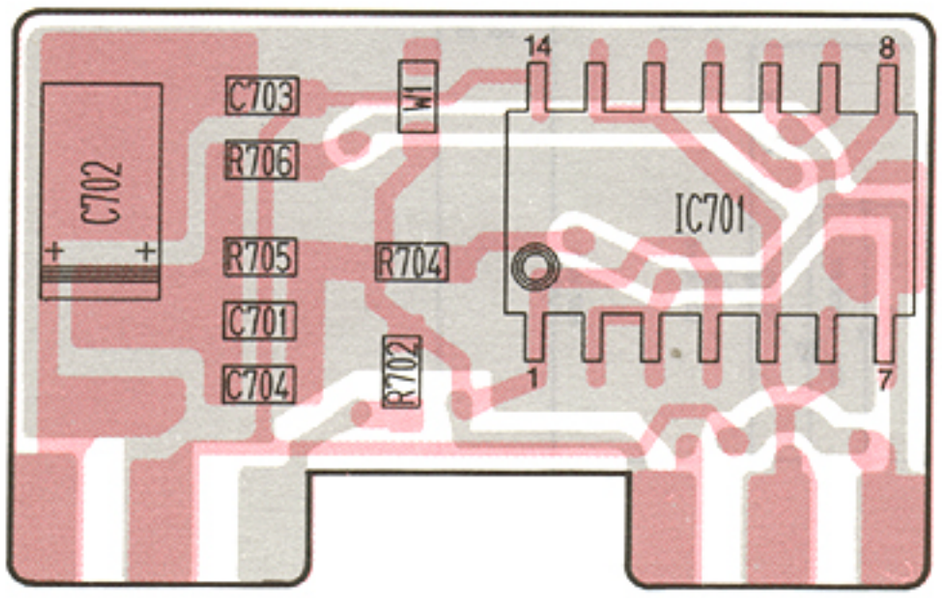
D602, D604

2SC4081 R
(Symbol: BR)



Q602, Q603

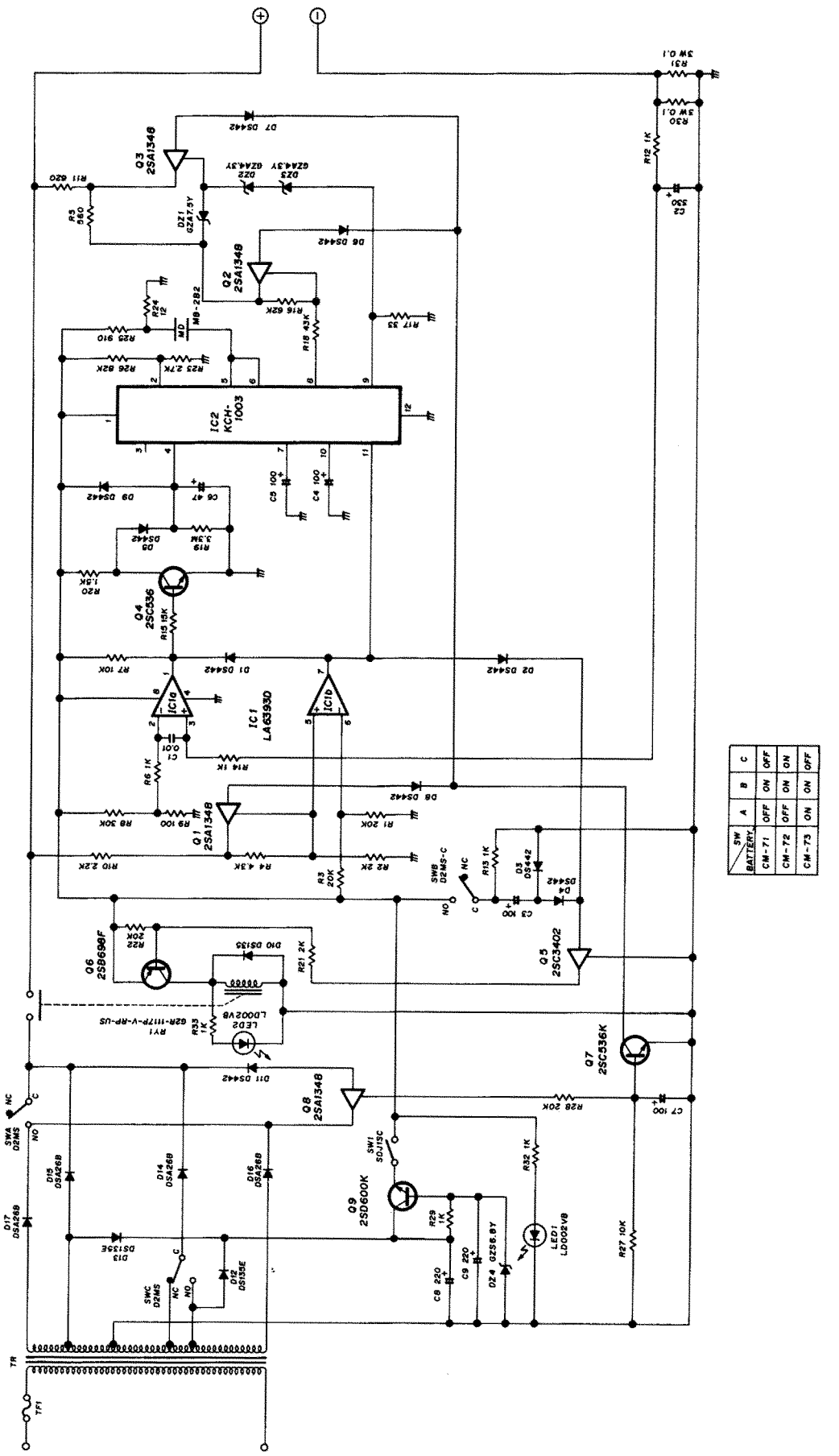
• LPF UNIT



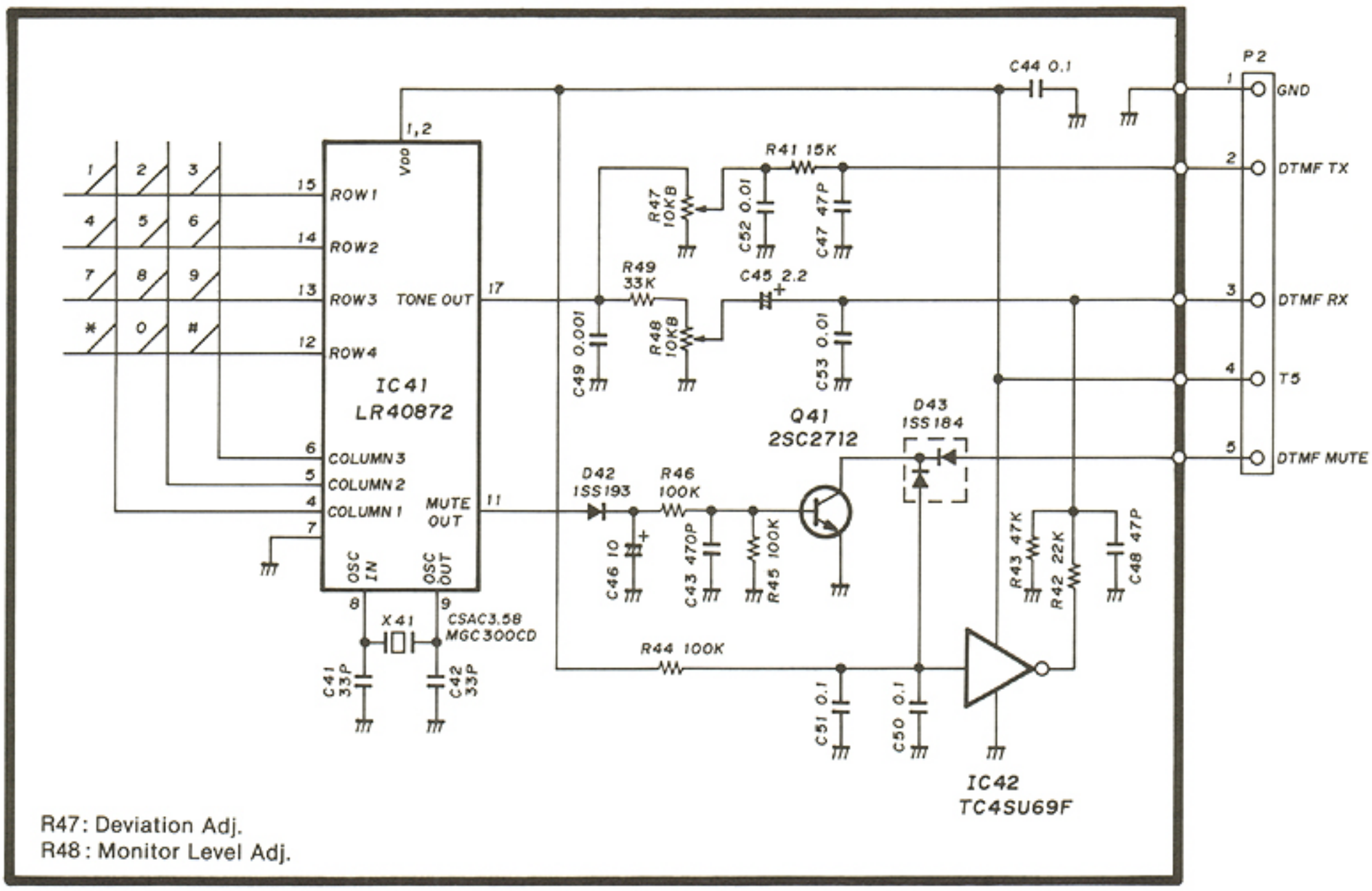
GND (NC) 6.8V (GND) (OUT1) GND (OUT2) PLST (PLST) 6.8V (IN)

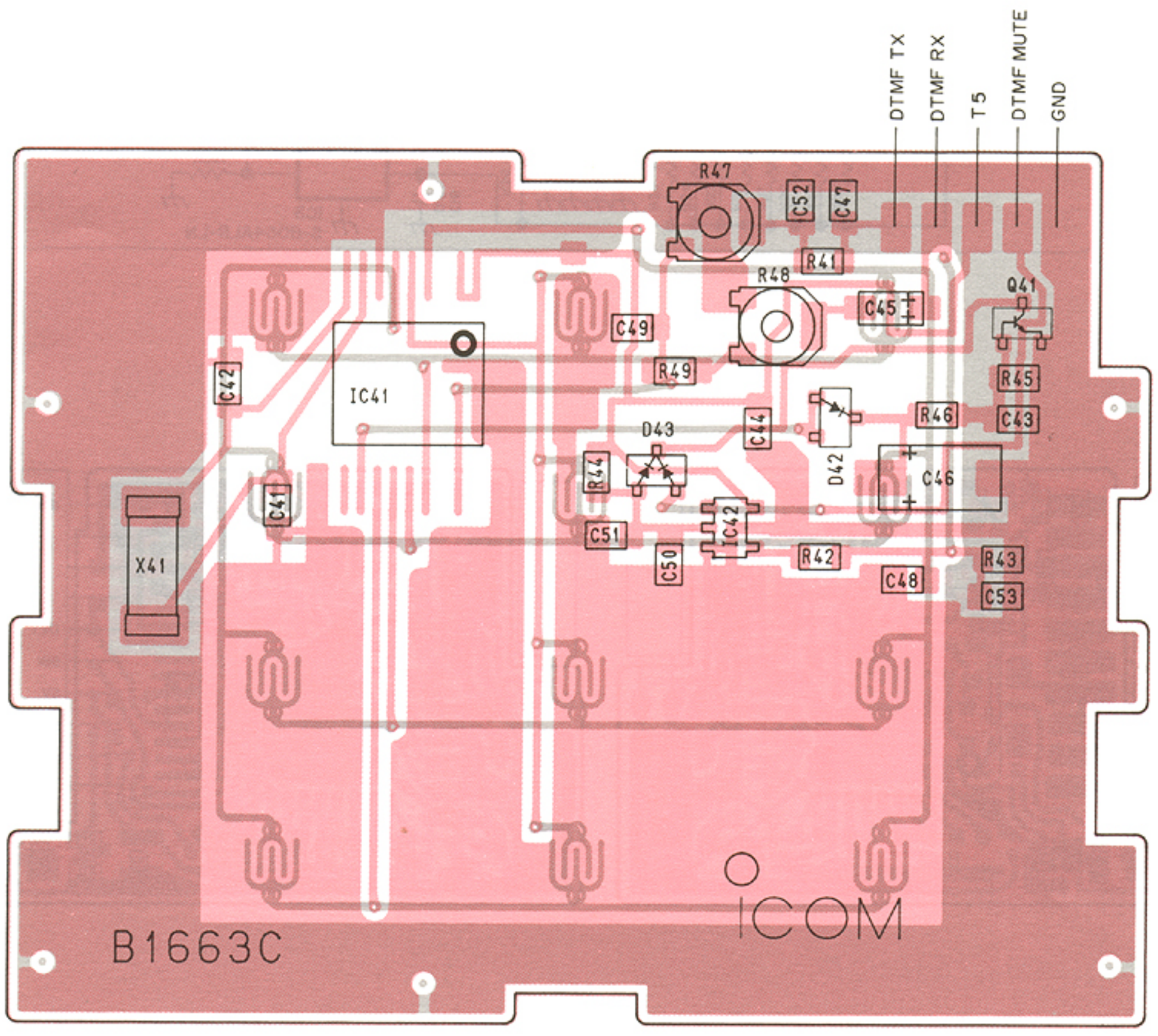
SECTION 9 OPTIONS INFORMATION

9-1 BM-70 AC BATTERY CHARGER

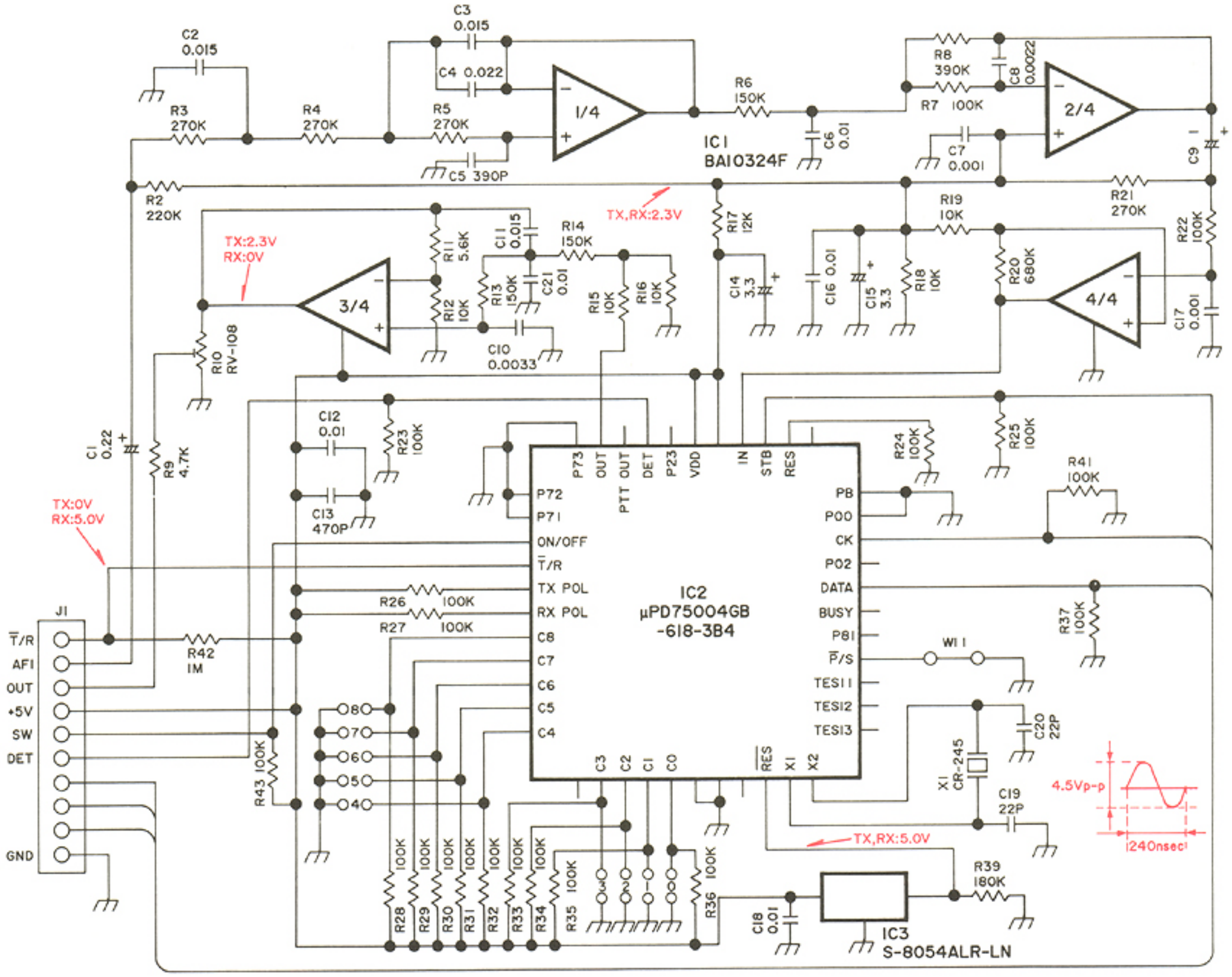


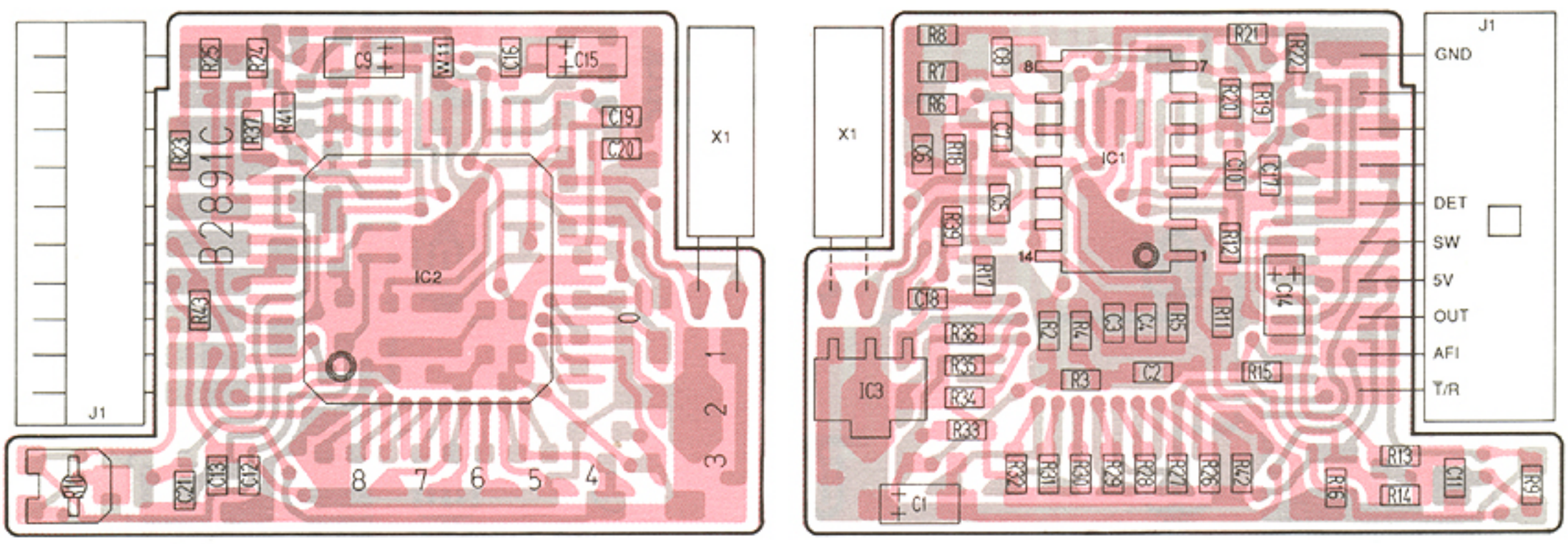
9-2 UT-42 DTMF ENCODER UNIT



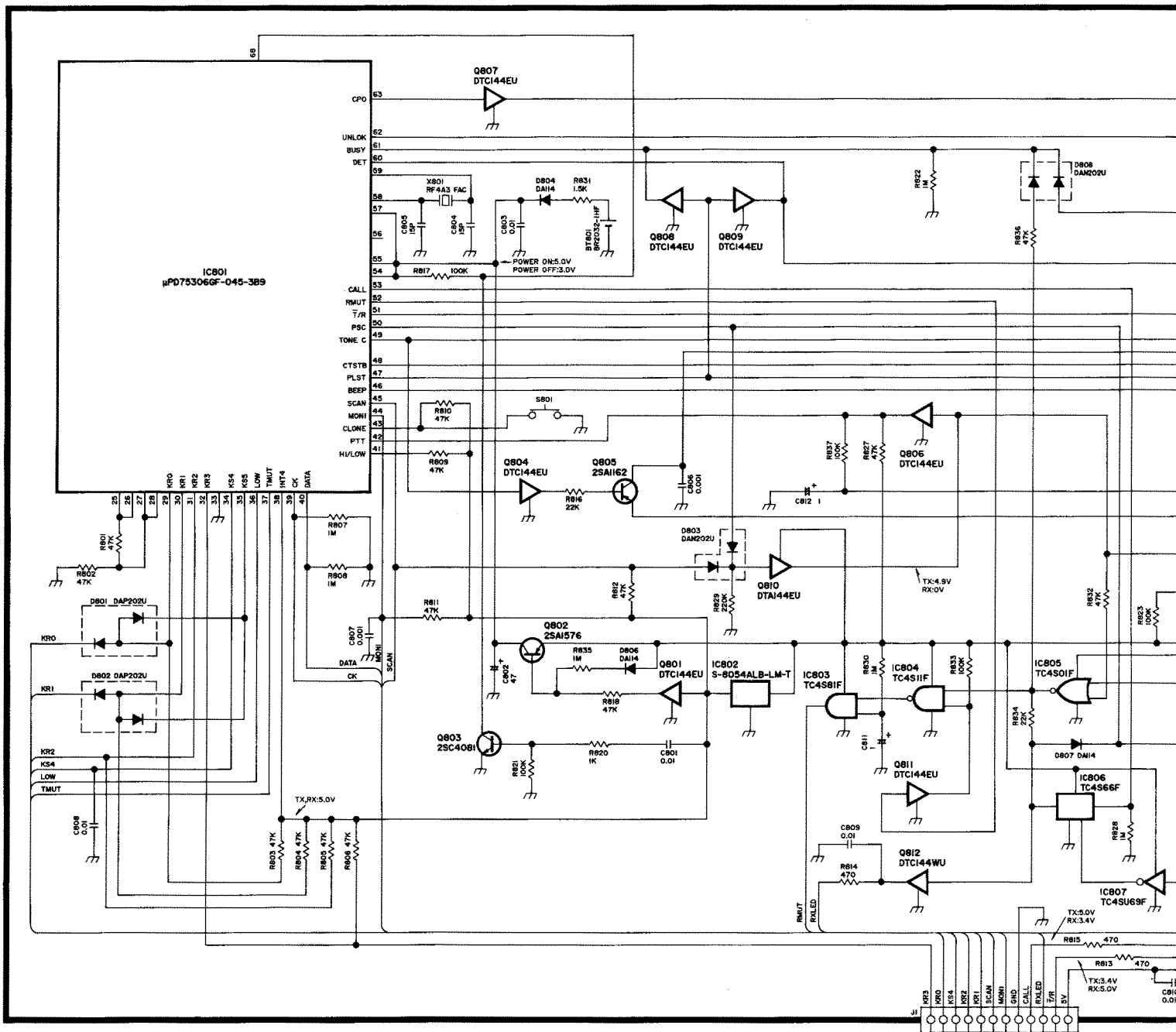


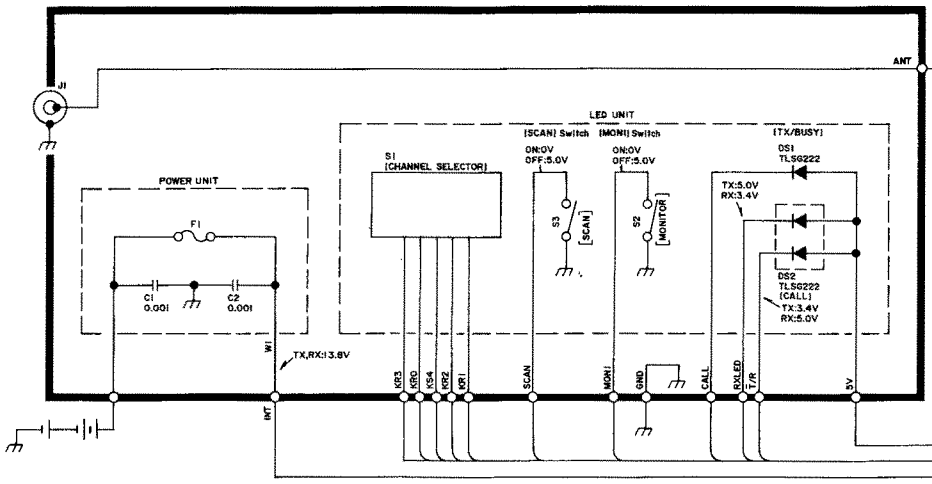
9-3 UT-59 DTCS ENCODER/DECODER UNIT

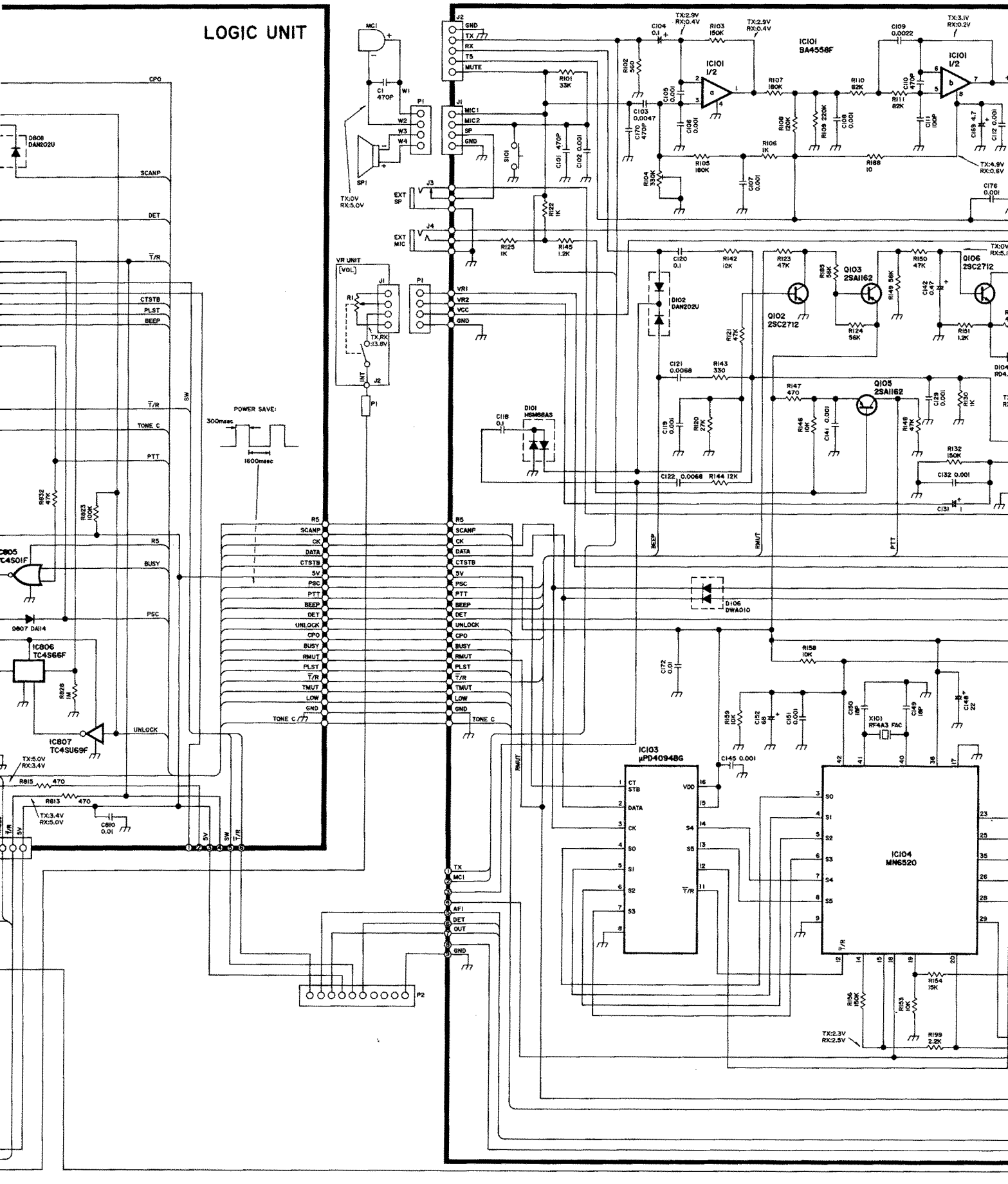


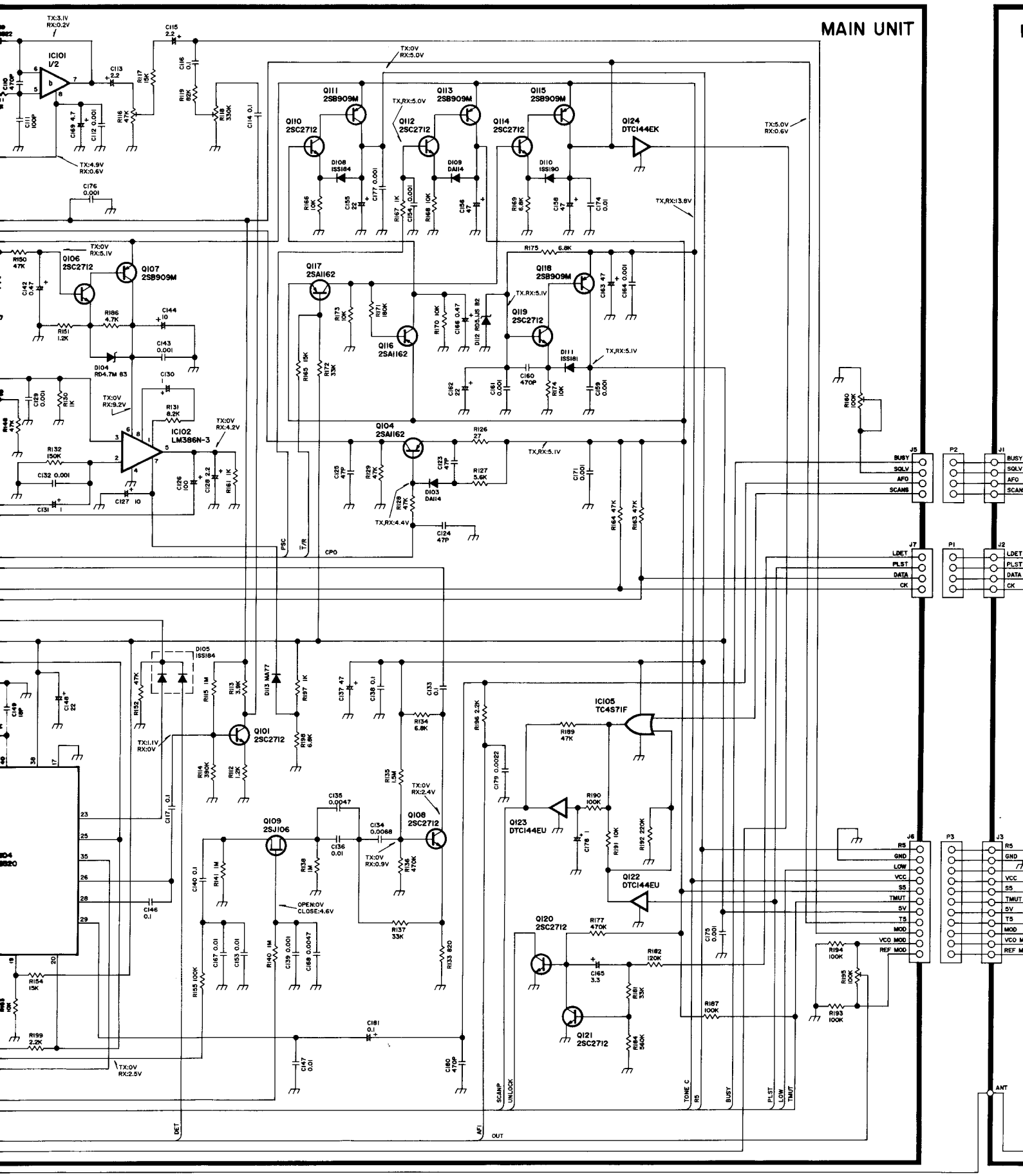


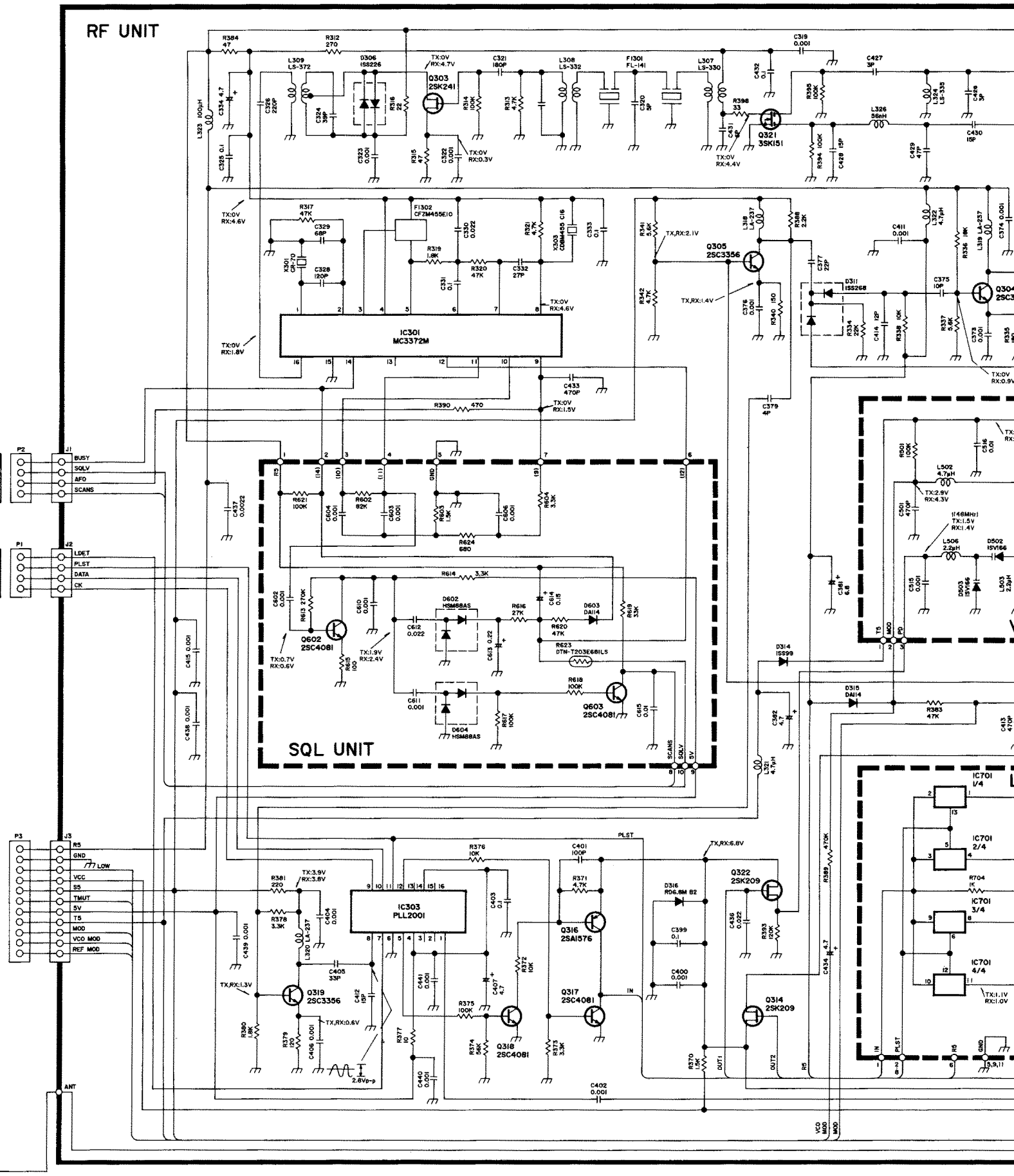
SECTION 10 VOLTAGE DIAGRAM

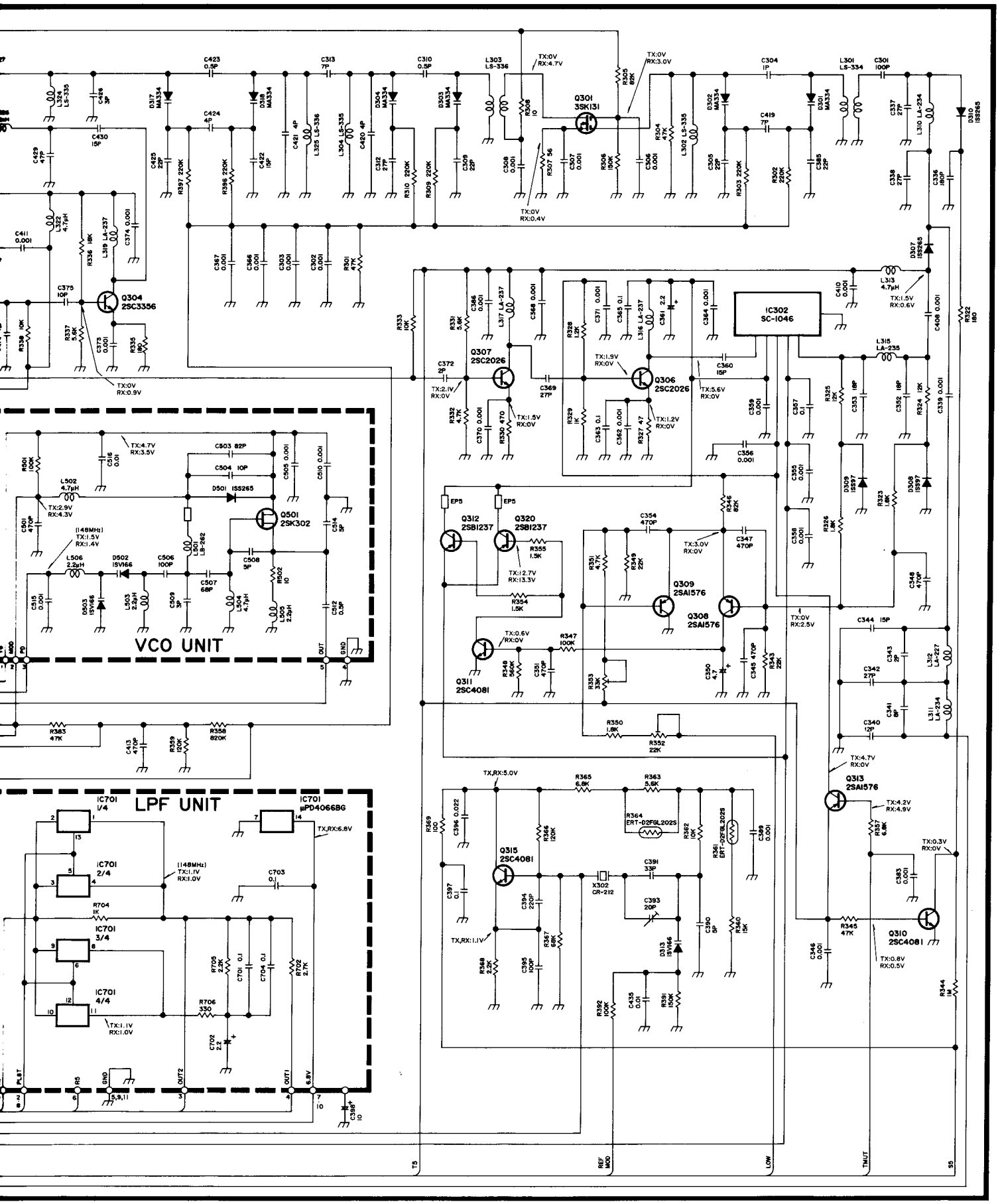





LOGIC UNIT
CPO
D808 DAN202U
SCANP
DET
T/R
CTSTB
PLST
BEEP
SW
POWER SAVE:
300msec
1600msec
TONE C
PTT
R832 47K
R823 100K
R5
BUSY
PSC
IC805 TC4S01F
D807 DAN4
IC806 TC4S66F
R826 1M
UNLOCK
IC807 TC4SU69F
TX:5.0V RX:3.4V
R815 470
R813 470
TX:3.4V RX:5.0V
C810 0.01
5V
P2
MC1
C1 470P
W1
P1
W2
W3
W4
SP1
TX:0V RX:5.0V
J2
GND
TX
RX
T5
MUTE
J1
MIC1
MIC2
SP
GND
S101
C101 470P
C102 0.001
J3
EXT SP
J4
EXT MIC
R101 33K
R122 1K
R125 1K
R145 1.2K
VR UNIT
(VOL)
R1
TX,RX 13.8V
INT
J2
P1
VR1
VR2
VCC
GND
R5
SCANP
CK
DATA
CTSTB
5V
PSC
PTT
BEEP
DET
UNLOCK
CPO
BUSY
RMUT
PLST
T/R
TMUT
LOW
GND
TONE C
TX
MCI
AFI
DET
OUT
GND
C104 0.1
TX:2.9V RX:0.4V
R103 150K
R102 560
IC101 I/2
C105 0.001
C103 0.0047
C170 470P
C106 0.001
R104 330K
R105 180K
R106 1K
C107 0.001
R107 180K
R108 120K
R109 220K
C108 0.001
R110 82K
C109 0.0022
C110 470P
R111 82K
C111 100P
IC101 BA4558F
IC101 I/2
TX:3.1V RX:0.2V
C169 4.7
C112 0.001
R188 10
TX:4.9V RX:0.6V
C176 0.001
C120 0.1
R142 12K
D102 DAN202U
R121 47K
C121 0.0068
R143 330
C118 0.1
D101 HSM88AS
C122 0.0068
R144 12K
Q102 2SC2712
R123 47K
R124 56K
Q103 2SA1162
R125 56K
R149 56K
C142 0.47
R150 47K
Q106 2SC2712
R151 1.2K
TX:0V RX:5.1
Q105 2SA1162
R147 470
R146 10K
C141 0.001
C129 0.001
R130 1K
R148 47K
R132 150K
C132 0.001
C131
D104 RD4...
D106 DWA010
C172 0.01
R158 10K
R159 10K
C152 68
C151 0.001
C150 18P
C149 18P
C148 22
X101 RF4A3 FAC
C145 0.001
IC103 μPD40948G
IC104 MN6520
R156 15K
R163 15K
R164 15K
R199 2.2K
TX:2.3V RX:2.5V


MAIN UNIT
IC101 1/2
IC102 LM386N-3
IC105 TC4S71F
Q101 2SC2712
Q102 2SC2712
Q103 2SC2712
Q104 2SA1162
Q105 2SC2712
Q106 2SC2712
Q107 2SB909M
Q108 2SC2712
Q109 2SJ106
Q110 2SC2712
Q111 2SB909M
Q112 2SC2712
Q113 2SB909M
Q114 2SC2712
Q115 2SB909M
Q116 2SA1162
Q117 2SA1162
Q118 2SB909M
Q119 2SC2712
Q120 2SC2712
Q121 2SC2712
Q122 DTC144EU
Q123 DTC144EU
Q124 DTC144EK
D101 1SS184
D102 MA77
D103 DA114
D104 RD4.7M B3
D105 1SS184
D108 1SS184
D109 DA114
D110 1SS190
D111 1SS181
D112 RD5.1J B2
TX:3.1V RX:0.2V
TX:4.9V RX:0.6V
TX:0V RX:5.0V
TX:5.0V RX:0.6V
TX,RX:5.0V
TX,RX:13.8V
TX:0V RX:5.1V
TX,RX:5.1V
TX:0V RX:9.2V
TX:0V RX:4.2V
TX,RX:4.4V
TX:1.1V RX:0V
TX:0V RX:2.4V
TX:0V RX:0.9V
TX:0V RX:2.5V
OPEN:0V CLOSE:4.6V
J5
J7
J6
P2
P1
P3
J1
J2
J3
BUSY
SQLV
AFO
SCANS
LDET
PLST
DATA
CK
R5
GND
LOW
VCC
S5
TMUT
5V
T5
MOD
VCO MOD
REF MOD
ANT
DET
AF1
OUT
FSC
T/R
CPO
SCANP
UNLOCK
TONE C
BUSY
PLST
LOW
TMUT


RF UNIT
SQL UNIT
IC301
MC3372M
IC303
PLL2001
Q303
2SK241
Q321
3SK151
Q305
2SC3356
Q602
2SC4081
Q603
2SC4081
Q319
2SC3356
Q316
2SA1576
Q317
2SC4081
Q318
2SC4081
Q322
2SK209
Q314
2SK209
D306
1SS226
D311
1SS268
D314
1SS99
D315
DA114
D316
RD6.8M B2
D602
HSM88AS
D603
DA114
D604
HSM88AS
D502
1SV166
D503
1SV166
F1301
FL-141
F1302
CFZM455E10
X303
CDBM455 C16
X501
CR-70
L309
LS-372
L308
LS-332
L307
LS-330
L326
56nH
L304
LS-335
L323
100μH
L322
4.7μH
L320
LA-237
L318
LA-237
L319
LA-237
L502
4.7μH
L506
2.2μH
L503
2.2μH
L321
4.7μH
IC701
1/4
IC701
2/4
IC701
3/4
IC701
4/4
J1
J2
J3
P1
P2
P3
BUSY
SQLV
AFO
SCANS
LDET
PLST
DATA
CK
R5
GND
LOW
VCC
SS
TMUT
5V
T5
MOD
VCO MOD
REF MOD
ANT
TX:0V
RX:4.7V
TX:0V
RX:0.3V
TX:0V
RX:4.4V
TX:0V
RX:4.6V
TX:0V
RX:1.8V
TX:0V
RX:1.5V
TX,RX:2.1V
TX,RX:1.4V
TX:0V
RX:0.9V
TX:0.7V
RX:0.6V
TX:1.9V
RX:2.4V
TX:3.9V
RX:3.8V
TX,RX:1.3V
TX,RX:0.6V
TX,RX:6.8V
2.8Vp-p
TX:2.9V
RX:4.3V
TX:1.5V
RX:1.4V
TX:1.1V
RX:1.0V
11.46MHz
TX:1.5V
RX:1.4V
VCO MOD
MOD


VCO UNIT
LPF UNIT
Q301 3SK131
Q304 2SC3356
Q307 2SC2026
Q306 2SC2026
IC302 SC-1046
Q501 2SK302
Q312 2SB1237
Q320 2SB1237
Q309 2SA1576
Q308 2SA1576
Q311 2SC4081
Q313 2SA1576
Q315 2SC4081
Q310 2SC4081
X302 CR-212
IC701 μPD4066BG
IC701 1/4
IC701 2/4
IC701 3/4
IC701 4/4
TX:0V RX:4.7V
TX:0V RX:3.0V
TX:0V RX:0.4V
TX:4.7V RX:3.5V
TX:2.9V RX:4.3V
TX:0V RX:0.9V
TX:2.1V RX:0V
TX:1.9V RX:0V
TX:1.5V RX:0V
TX:1.2V RX:0V
TX:5.6V RX:0V
TX:1.5V RX:0.6V
TX:3.0V RX:0V
TX:2.7V RX:3.3V
TX:0.6V RX:0V
TX:0V RX:2.5V
TX:4.7V RX:0V
TX:4.2V RX:4.9V
TX:0.3V RX:0V
TX:0.8V RX:0.5V
TX,RX:5.0V
TX,RX:1.1V
TX,RX:6.8V
TX:1.1V RX:1.0V
(148MHz) TX:1.5V RX:1.4V
(148MHz) TX:1.1V RX:1.0V
T5
REF MOD
LOW
TMUT
S5

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