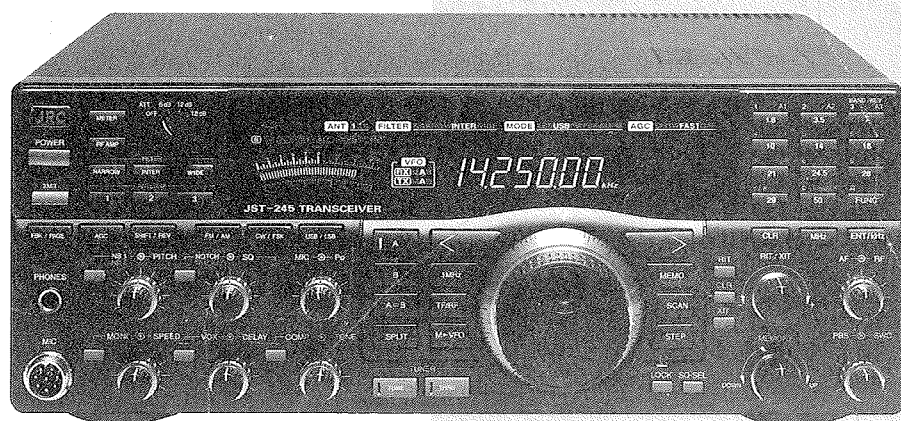


MODEL JST-145 JST-245

Service Manual



TRANSCEIVER

Introduction

The models JST-145/JST-245 are sophisticated HF transceivers from JRC. Based on our extensive experience in building communications equipment, these transceivers incorporate latest circuit technology.

This manual has been arranged to facilitate troubleshooting by presenting circuit diagrams, PCB diagrams and voltage tables in close proximity, separate from the parts list.

This service manual contains important information and precautions to prevent damage and accidents. Please read the manual carefully and follow the indicated procedures to ensure safety.

Differences Between JST-145 and JST-245

JST-145

- **LPF unit**

The LPF unit uses a relay-controlled capacitor and coil network to provide the required time constant for the respective frequency. The high-speed antenna tuner NFG-183 with memory presets can be installed as an option.

- **BWC (Bandwidth control)**

Bandwidth control is possible with when the optional filter is installed.

- **50 MHz band**

The unit is designed only for the HF band. Adding the 50 MHz band is not possible.

JST-245

- **High-speed antenna tuner NFG-183 with memory presets**

The JST-245 incorporates a high-speed automatic tuner with memory presets. It uses a relay-controlled capacitor and coil network. (The tuner can be installed in the JST-145 as an option.)

- **BWC (Bandwidth control)**

Bandwidth control is possible by continuously varying the passband width of the IF filter, to remove interference components. (The filter can be installed in the JST-145 as an option.)

- **50 MHz band**

In addition to the HF band, the JST-245 can also use the 50 MHz band.

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Section 1 Parts and Functions

1-1 Front Panel (1)

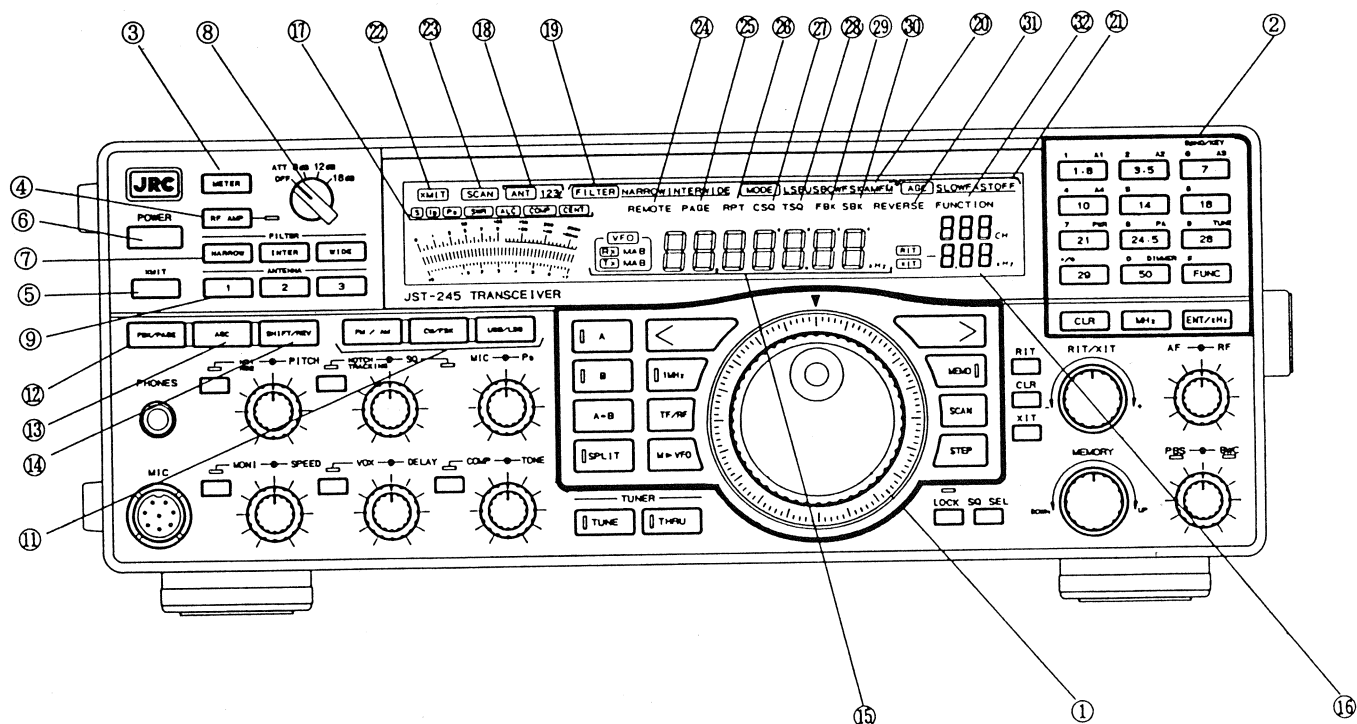


Figure 1.1 Front Panel (Part 1)

① Tuning control

Adjusts transmitting and receiving frequencies, and also use for fine adjustment, for VFO selection, and to specify splits.

See Section 1.4, “The Tuning Control” for details.

② Numeric keypad

Switches bands, selects frequency, and switches functions.

See Section 1.3, “The Numeric Keypad” for details.

③ METER switch

Switches transmission metering. Use this switch when transmitting to select the item (ID), (Po), (SWR), (ALC), (COMP) displayed on the meter 17.

At only FM mode, use this switch when receiving to select (S), (CENT).

④ RF AMP switch

Switches the receiving RF amplifier on and off. The LED to the right of the switch lights when the RF amp is on. The RF amplifier is normally ON, but should be turned OFF if you experience interference or intermodulation distortion due to a strong signal.

⑤ XMIT (transmit) switch

Press to transmit. Press again to return to receiving. The XMIT lamp 22 lights when transmitting.

⑥ POWER switch

⑦ FILTER switch

Switches transmit and receive IF bandwidths. The result is shown on the display 19.

⑧ ATT (RF attenuator) switch

Adjusts attenuation of the RF attenuator at the front end of the receiver. Use this switch to improve reception if there is band noise from IM or interference, or when there is strong interference from local radio stations.

⑨ ANTENNA switch

Switches among the three antenna terminals. The current antenna is shown on the display 18.

⑪ MODE switches

Switch among modes. For example, pressing **CW/FSK** toggles between CW and FSK modes. The selected mode is shown on the display 20.

⑫ FBK/PAGE (full break-in/pager) switch

In CW mode, switches the full break-in on and off.

The FBK display ⑳ lights when FBK is ON.

In FM mode, switches the pager function on and off.

The PAGE display ㉕ lights when the pager function is ON.

⑬ AGC switch

Toggles the AGC time constant SLOW and FAST. Pressing and holding this switch for 2 to 3 seconds turns off the AGC.

The selected status is shown in the AGC display ㉑.

⑭ SHIFT/REV (shift/reverse) switch

In FM mode using repeater operation, switches the transmission frequency shift on and off. When the shift is ON, the RPT (repeater) display ㉖ lights.

In CW and AFSK modes, this switch toggles spectral reversal on and off. The REVERSE lamp ㉓ lights when the spectrum is reversed.

⑮ Frequency display

Displays the reception frequency when receiving and the transmission frequency when transmitting.

The display also shows whether A or B VFO is used for receiving and transmitting, or whether memory is used.

⑯ Memory channel and RIT/XIT display

The upper part shows the memory channel. The lower part shows the RIT/XIT frequency in 10Hz units.

⑰ Meter

When receiving (in other than FM mode), displays the S meter (S). When receiving in FM mode, the meter shows either the S meter (S) or the center meter, as selected using the meter switch ③.

When transmitting metering is switched using the meter switch ③ to show the transmission final stage drain current (ID), the transmission power (Po), SWR, automatic level control (ALC) or compression level (COMP).

⑰ ANT (antenna) display

Shows which antenna is currently in use.

⑱ FILTER display

Shows the filter currently in use.

⑳ MODE display

Shows the current mode.

㉑ AGC display

Shows the reception AGC time constant.

㉒ XMIT (transmit) display

Lights when transmitting.

㉓ SCAN display

Lights during the scanning operation.

㉔ REMOTE display

Lights when the transceiver is remotely controlled from a PC, etc., via the RS-232C port.

㉕ PAGE (pager) display

Lights when the pager function is ON in FM mode.

㉖ RPT (repeater) display

Lights when repeater operation is specified in FM mode by pressing the SHIFT/REV switch.

㉗ CSQ (code squelch) display

Lights when the code squelch function is ON in FM mode.

㉘ TSQ (tone squelch) display

Lights when the tone squelch function is ON in FM mode.

②⑨ FBK (full break-in) display

Lights when, in CW mode, full break-in (transmitting with the key down, receiving with the key up with no delay time) is selected.

③⑩ SBK (semi break-in) display

Lights when semi break-in is selected in CW mode.

③① REVERSE display

Lights when, in CW mode or AFSK mode, the SHIFT/REV key ①④ is pressed to reverse the carrier point or mark/space.

③② FUNCTION display

Lights when the keypad key ② is in function mode.

1-2 Front Panel (2)

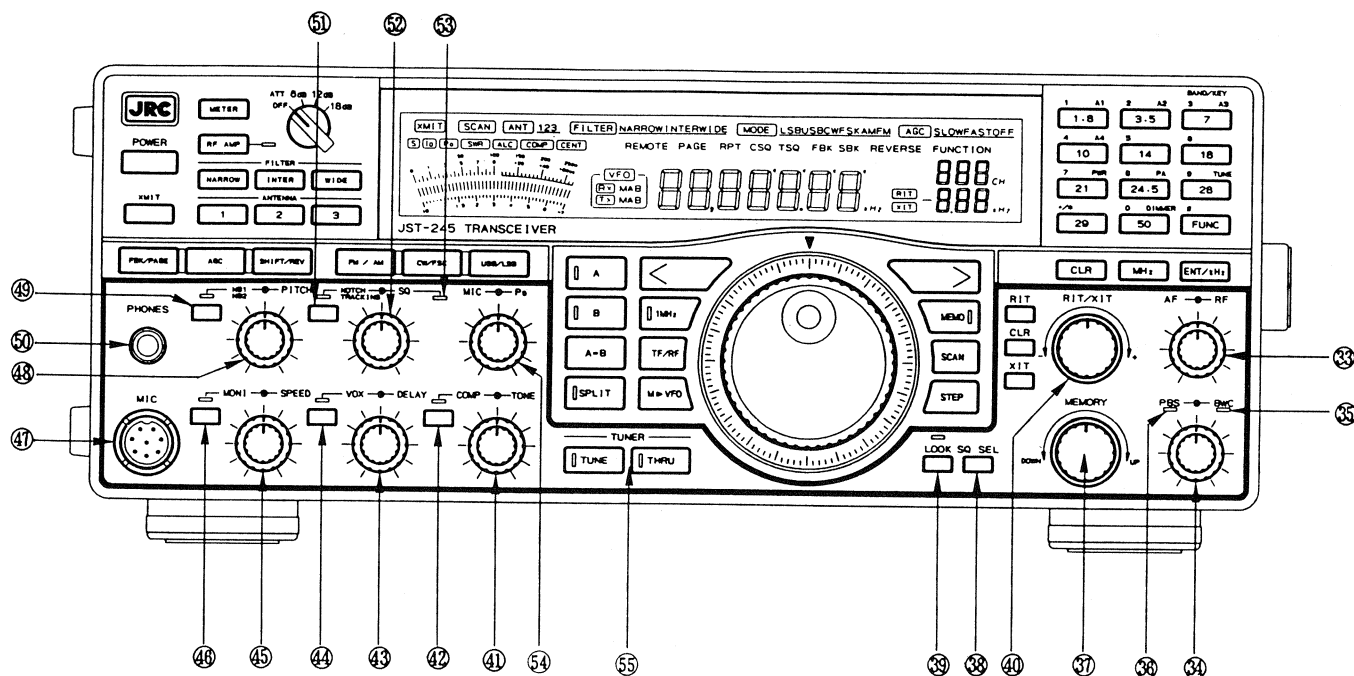


Figure 1.2 Front Panel (Part 2)

33 (inner) AF (AF gain)

The inner knob adjusts the AF gain. Rotating this knob changes the audio amplifier gain to adjust the volume.

33 (outer) RF (RF gain)

The outer ring adjusts the RF gain. Rotating this ring in other than FM mode changes the receiver's 1st IF, 2nd IF, and 3rd IF gain. Rotate fully clockwise for maximum gain. As you rotate counterclockwise from full gain, gain is decreased and S meter starts moving.

For normal use, rotate the RF gain fully clockwise.

34 (inner) PBS (pass band shift)

The inner knob adjusts the pass band shift. Adjust the PBS when there is interference from a neighboring frequency. Rotating the PBS knob varies the apparent center frequency of the IF filter in 10Hz steps.

The PBS does not function when the PBS knob is centered.

NOTE

Using the PBS may distort the received sound.

The PBS knob should therefore be rotated until it clicks into its central position when you are not using the PBS.

34 (outer) BWC (bandwidth control)

The outer ring is used for bandwidth control. This control continuously adjusts the effective bandwidth of the receiver's IF to prevent interference.

The BWC should normally be OFF (fully counterclockwise).

35 BWC (bandwidth control) LED

Lights when bandwidth control is ON.

36 PBS (pass-band shift) LED

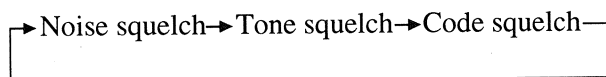
Lights when the pass band shift is ON.

37 MEMORY

Selects a memory channel.

③⑧ SQ SEL (squelch selector) switch

Selects the squelch method when in FM mode. There are three types of squelch in FM mode: noise squelch, tone squelch (optional), and code squelch (optional). Press SQ SEL to select tone squelch, which lights the TSQ lamp ②⑨. Press again to select code squelch, which lights the CSQ lamp ②⑦. Press again to return to noise squelch.



③⑨ LOCK switch

Electrically locks the main tuning control. Press this switch to prevent the frequency from being inadvertently changed.

④① RIT/XIT adjuster and RIT/XIT switch

This adjuster and switch are for controlling the RIT (receiver incremental tuning) and XIT (transmitter incremental tuning). Press to lock in both the RIT and XIT switches, then rotate the adjuster to simultaneously adjust the transmitting and receiving frequencies. The frequency change is shown on the display ①⑥. Press the **[CLR]** key to clear the **[RIT]** and XIT settings. When only the RIT key is pressed, the reception frequency is altered up/down by up to 10kHz. The degree of change is displayed by ①⑥ on the LCD in 10Hz units. Similarly, when only the **[XIT]** key is pressed, the transmission frequency is altered up/down by up to 10kHz. The degree of change is also displayed on the LCD.

④① (inner) COMP (compressor)

Adjust the compression of fluctuations in the audio level to increase talking power. Rotate COMP clockwise to increase compression. However, this results in a slightly deteriorated sound quality. Note also that, the greater the degree of compression, the greater the risk of noise being picked up from around the microphone.

④① (outer) TONE control

Adjusts the tone of received sound. Rotate TONE clockwise to increase bass, or counterclockwise to cut bass and increase treble. The central position is for flat tone.

④② COMP (compressor) switch

Turns the speech compressor on and off. The LED lights when speech compression is ON.

④③ (inner) VOX

Adjusts the VOX amp gain. Rotate clockwise so that VOX picks up smaller vocal sounds, allowing them to be transmitted.

④③ (outer) DELAY

Adjusts the transmission delay when using VOX. Rotate clockwise to increase the delay.

④④ VOX ON/OFF switch

Switches VOX on and off. The LED lights when VOX is ON. In CW mode, pressing the VOX ON/OFF switch selects semi break-in. The SBK display lights.

④⑤ (inner) MONI (monitor)

Adjusts the volume of the transmission IF monitor (optional). In CW mode, this knob adjusts the side tone volume.

④⑤ (outer) SPEED

Adjusts the keying speed of the built-in electric keyer. Rotate clockwise to increase keying speed.

④⑥ MONI (monitor) ON/OFF switch

Switches the transmission IF monitor on and off. The LED lights when the monitor is ON. In FM mode, the monitor does not function.

④⑦ MIC connector

Connect a microphone to this connector.

④⑧ (inner) NB (noise blanker)

Adjusts noise blanker sensitivity. Rotate clockwise to increase sensitivity. However, if sensitivity is too high, the blanker may blank the target signal, deteriorating sound quality.

④⑧ (outer) PITCH

Adjusts the BFO pitch when receiving in CW mode. When receiving a signal at the center of the IF filter, the pitch is about 800Hz when the PITCH ring is in the center. Use the PITCH ring to select the desired pitch. Changing the setting of the PITCH ring also changes the side tone frequency.

④9 NB (noise blanker) switch

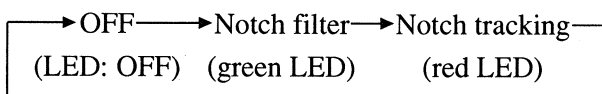
Rotates among OFF, NB1, and NB2. NB1 is effective for narrow pulse noises such as ignition. NB2 is best for wider noises.

⑤0 PHONES (headphones) connector

Connect headphones to this connector. When using headphones, internal and external speakers are disconnected.

⑤1 NOTCH filter switch

Switches the notch filter and notch tracking on and off. Press to turn ON the notch filter and light the green LED. Press again to turn ON notch tracking and light the red LED. Press once more to turn OFF the notch filter and notch tracking, and turn off the LEDs.



⑤2 (inner) NOTCH

The inner knob adjusts the notch filter frequency. Rotate NOTCH to minimize monotone interference from a continuous carrier or CW signal. Now press the NOTCH filter switch ⑤1 to start notch tracking; the notch filter will follow within a range of $\pm 10\text{kHz}$ even if the main tuning control is adjusted, thereby continuing to suppress the interference.

⑤2 (outer) SQ (squench)

The outer ring adjusts the squelch threshold level. Rotate SQ clockwise to increase the threshold, requiring a stronger signal to squelch. Rotate SQ fully counterclockwise to set the threshold to the minimum level; sound will be heard from the speaker under all conditions.

⑤3 SQ (squench) LED

Lights when the squelch is closed.
No sound will be heard when the squelch is closed.

NOTE

The squelch does not function when the AGC is OFF (except in FM mode).

⑤4 (inner) MIC gain

Adjusts microphone gain. Rotate clockwise to increase the gain.

In SSB and AM modes, adjust the MIC gain until the ALC meter flutters.

In FM mode, set the MIC gain to or below the center position.

⑤4 (outer) Po (power) control

Adjusts the transmitter output power. At full clockwise position, the transmitter output will be at rated power.

⑤5 TUNER (antenna tuner) switch

Controls operation of the automatic antenna tuner. Press the **TUNE** key to start tuning. The key LED blinks. The LED lights continuously when tuning is complete. This switch also starts tuning when the optional NFG-230 antenna tuner is installed. When using the built-in tuner, the green LED lights. When using an external tuner, the red LED lights. Press the **THRU** key to adjust the built-in antenna tuner to the equivalent of a $50\ \Omega$ load, bypassing the external tuner (by direct connection to the antenna). The **TUNE** key does not function on the standard JST-145, which is not equipped with an antenna tuner. It works only as a tuner switch for the NFG-230.

1-3 Numeric Keypad

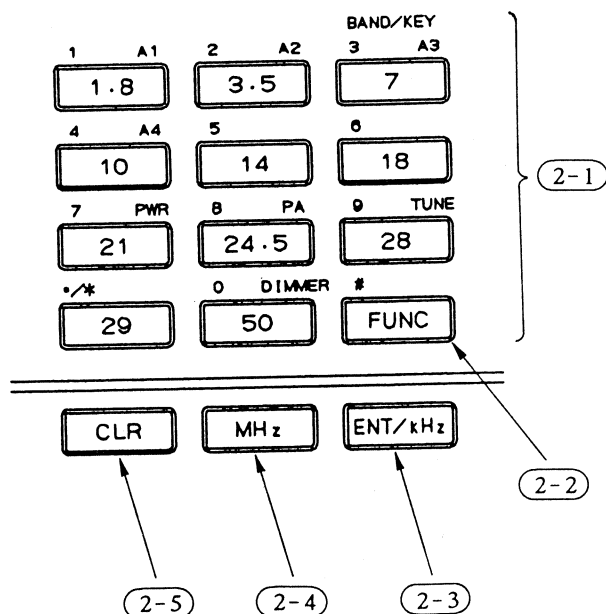


Figure 1.3 The Numeric Keypad

- (2-1) Normally functions as the band selector. Press a key to immediately select the band printed on the key face. These keys can be switched to function as frequency of function keys. Pressing a band key recalls the last settings (frequency, mode, IF filter, AGC, etc.) used in that band. Further, when moving from one band to another, the current settings are stored in band memory. However, the band's edge frequency is selected if you move bands after selecting a frequency outside the amateur band, then return to the last band. Note that the band keys are inoperative while transmitting.

- (2-2) **FUNCTION key**
Changes the keypad keys to function keys. Press the FUNCTION key to light the FUNCTION lamp ③②. Pressing any key with a set function turns OFF the FUNCTION lamp.

1 A1
FUNC 1.8
Selects the 1st antenna connected to linear amplifier JRL-2000F.

2 A2
FUNC 3.5
Selects the 2nd antenna connected to linear amplifier JRL-2000F.

3 A3
FUNC 7
Selects the 3rd antenna connected to linear amplifier JRL-2000F.

4 A4
FUNC 10
Selects the 4th antenna connected to linear amplifier JRL-2000F.

7 PWR
FUNC 21
Turns ON/OFF the power supply of linear amplifier JRL-2000F.

8 PA
FUNC 24.5
Turns ON/OFF the PA of linear amplifier JRL-2000F.

9 TUNE
FUNC 28
Instructs the tuner of linear amplifier JRL-2000F to start tuning operations.

0 DIMMER
FUNC 50
Dims display brightness.

- (2-3) **ENT/kHz (Enter/kHz) key**
Directly inputs a frequency.
Example: Press the following keys to specify a frequency of 14,225.3kHz.

ENT/kHz 1 A1 4 A4 2 A2 2 A2 5 /*
7 ENT/kHz
1.8 10 3.5 3.5 14 29

- (2-4) **MHz key**
Allows frequencies to be input in MHz.
Example: Press following keys to specify a frequency of 14.2253MHz.

ENT/kHz 1 A1 4 A4 /* 2 A2 2 A2 5
7 MHz
1.8 10 29 3.5 3.5 14

- (2-5) **CLR (clear) key**
Clears a key entry. Note, however, that you cannot clear an entry after pressing the ENT/kHz or MHz key after specifying a frequency.

1-4 Frequency Controls

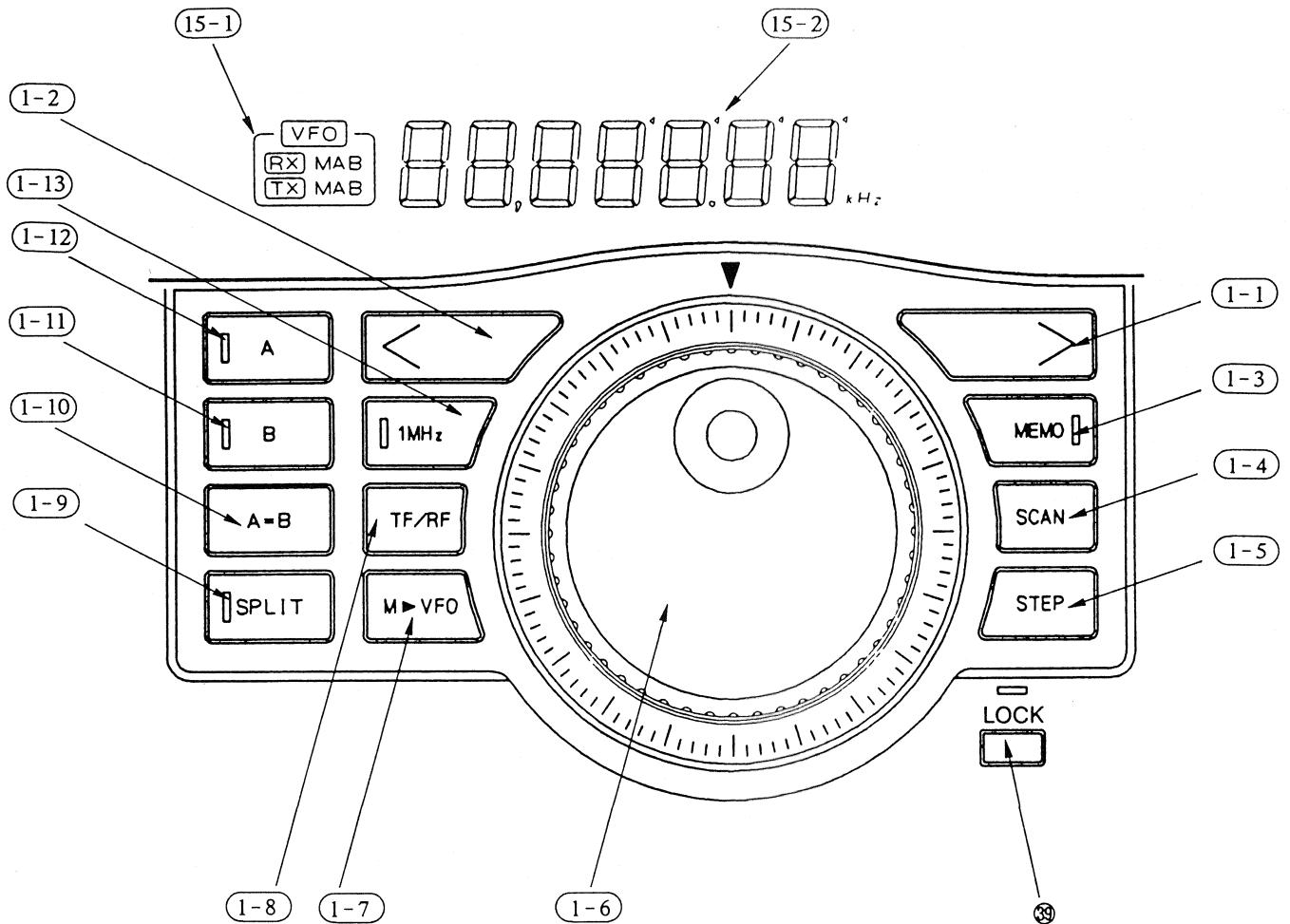


Figure 1.4 Frequency Controls

- (1-1) > Up key (< (1-2) Down key)**
 Press the up (>) key to continuously increase the displayed frequency. Similarly, press the down (<) key to continuously decrease the displayed frequency. Press the 1MHz key (1-13) then the up (>) or down (<) key to increase or decrease frequencies in 1MHz steps.
- (1-3) MEMO (memory) key**
 Recalls settings from memory. The LED lights when stored settings are recalled. Pressing the MEMO key in VFO mode displays a previously called memory channel number on the memory channel display (16) and simultaneously changes mode, frequency, and IF filter settings, etc., according to the contents of memory. Use the memory selector (37) to change memory channels.
- (1-4) SCAN key**
 Starts or stops scanning. The SCAN lamp (23) lights during the scanning operation.
- (1-5) STEP key**
 Changes the frequencies changed per step when using the main tuning control. There are two steps, 10Hz and 100Hz. The currently selected step is indicated by the marks to the top right of the numbers on the frequency display. You can also define an additional 1kHz step in FM mode and 2Hz step in other modes.
- (1-6) Main tuning control**
 Changes the frequency by 2,000 frequency steps per rotation. Use the STEP key (1-5) to select 10Hz or 100Hz steps.
- (1-7) M VFO (memory VFO) key**
 Sends information recalled from memory to the currently selected VFO.

(1-8) TF/RF (transmission frequency/reception frequency) key

Monitors the frequency of the unused VFO. For example, if you are using A-VFO for receiving or transmitting, press and hold the TF/RF key to display the frequency of the unused VFO (B-VFO). You can now use the main tuning control to change the B-VFO frequency. A-VFO frequency do not change during this operation.

(1-9) SPLIT key

Selects split operation between A-VFO and B-VFO. The SPLIT key's LED lights during split operation. When SPLIT is ON, the selected VFO (the VFO indicated by the lit LED) is used for reception. The VFO display (15-1) shows which VFO is used for reception and which for transmission.

(1-10) A = B (VFO equalization) key

Transfers the settings of the VFO currently in use to the other VFO.

As a result, both A-VFO and B-VFO have the same settings.

(1-11) B-VFO selector

Selects simplex operation using B-VFO.

(1-12) A-VFO selector

Selects simplex operation using A-VFO.

(1-13) 1MHz key

Sets the up (>) and down (<) keys to a 1MHz step.

(15-1) VFO display

Shows whether A-VFO, B-VFO, or memory is used for receiving or transmitting.

Reception: Memory Transmission: Memory
VFO

RXM

TXM

Reception: B-VFO Transmission: A-VFO
VFO

RX_{LL}B

TX_{LL}A_{LL}

(15-2) Smallest digit mark

Indicates the smallest digit that changes when using the main tuning control.

When not lit, the step is 2Hz.

1-5 Rear Panel

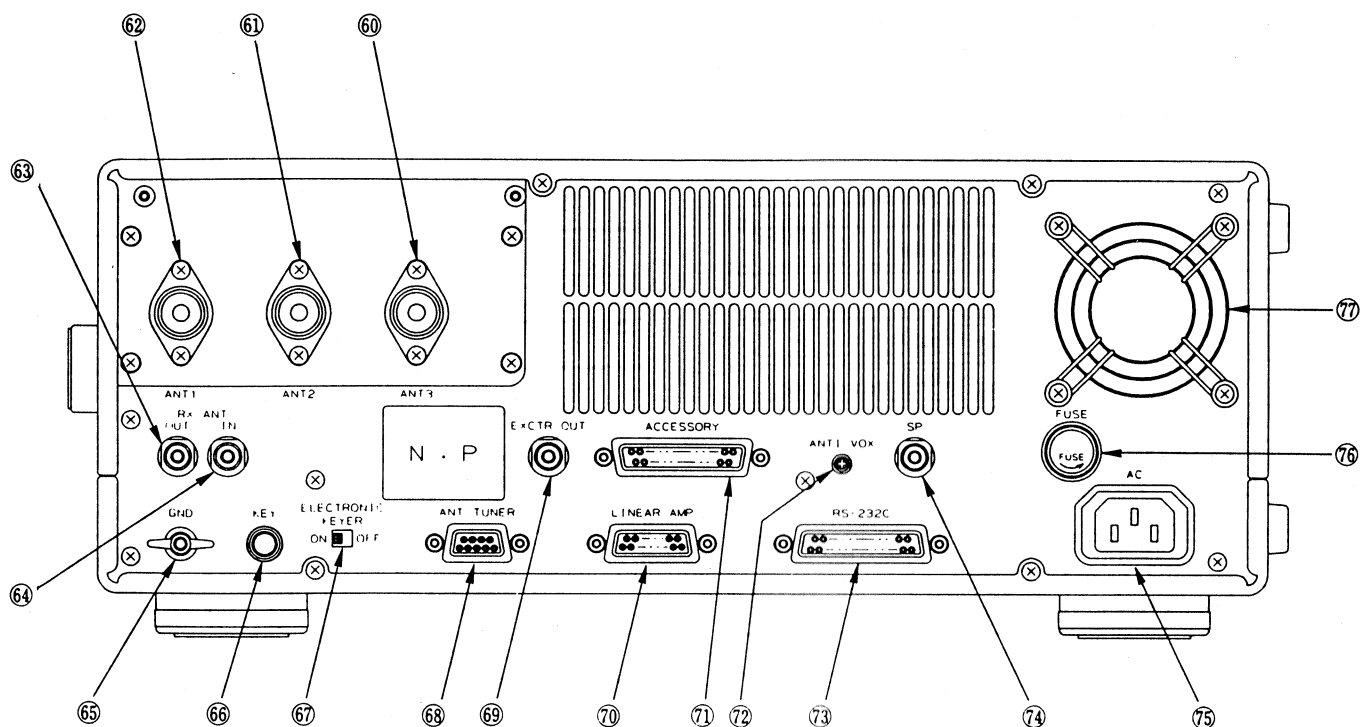


Figure 1.5 Rear Panel

60, 61, 62 ANT (antenna) connectors

Used for connection to 50 Ω antennas with UHF-type plugs.

63 RX ANT OUT (receiving antenna output)

Connected to 60, 61 or 62 when the set is receiving. Use this connector to connect another receiver.

64 RX ANT IN (receiving antenna input)

When using a receive-only antenna, connect it to this connector.

65 GND (ground)

Used for connection to an earth ground system. Use a short, thick copper wire as required.

66 KEY connector

For connecting a Morse key or manipulator.

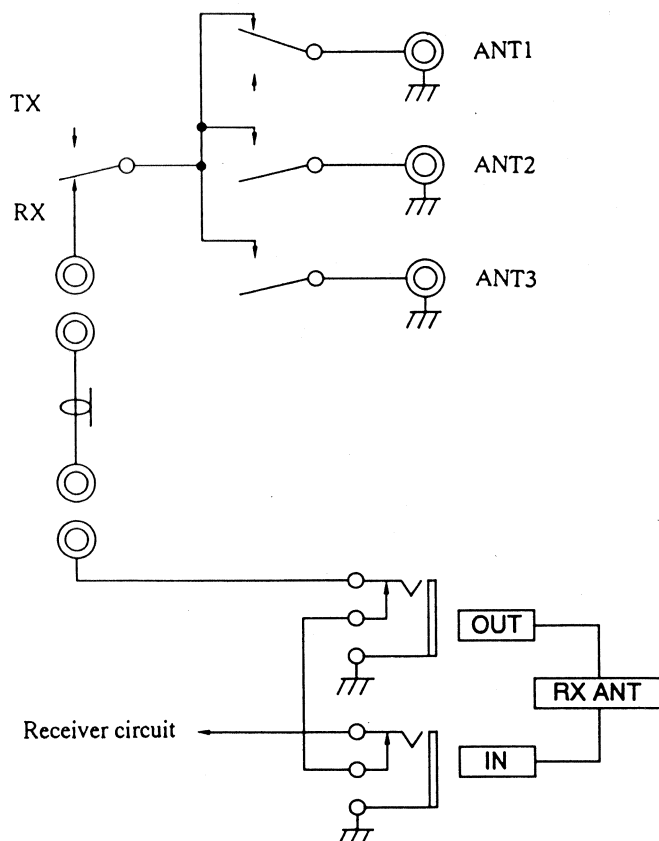


Figure 1.6 Internal Connection of Antenna Connectors

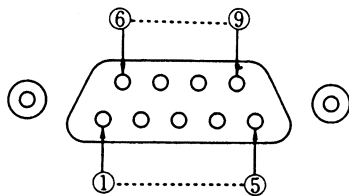
⑥⑦ ELECTRONIC KEYER ON/OFF switch

Switches the internal electronic keyer on and off.

⑥⑧ ANT TUNER (antenna tuner) connector

For connecting the control cable of the optional external NFG-230 antenna tuner.

Pin No.	Signal Nomenclature	Function
1	SHLD	Ground (shield)
2	ETD	Bus line output
3	ERD	Bus line input
4	—	—
5	—	—
6	13.8 V	13.8 V output
7	13.8 V	13.8 V output
8	E	Ground
9	E	Ground



(Pin configuration from the rear panel)

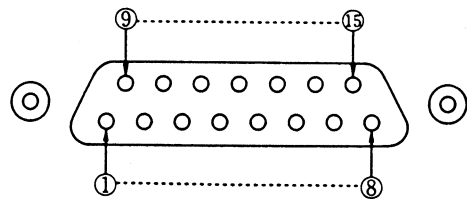
Figure 1.7 ANT TUNER Connector Pin Configuration

⑦⑩ LINEAR AMP connector

Used to connect a linear amplifier.

Use the supplied 15-pin plug or a commercially-available 15-pin Subminiature D connector (plug). Use JRC's CFQ-4794 cable to connect the JRL-2000F.

Pin No.	Signal Nomenclature	Function
1	E	Ground
2	TXD	Bus line output
3	RXD	Bus line input
4	—	—
5	ALC	ALC input
6	$\overline{RL}$	Should be grounded for operating a linear amp.
7	LACM	Standby relay contact output (common)
8	LAMK	Standby relay contact output (make)
9	E	Ground
10	—	—
11	—	—
12	TX13.8 V	Transmitting: 13.8 V
13	E	output
14	13.8 V	Ground
15	E	13.8 V output



(Pin configuration from the rear panel)

Figure 1.8 LINEAR AMP Connector Pin Configuration

⑥⑨ EXCTR OUT (exciter output)

For connecting transmission output when using a transverter, etc. The connector has a 50 Ω impedance and a maximum output voltage of 1 Vrms.

⑦① ACCESSORY connector

Various outputs, and inputs for control signals when using external devices.

Use the 25-pin plug supplied or a commercially-available 25-pin Subminiature D connector (plug).

Pin No.	Signal Nomenclature	Function
1	-BK	Standby input/output
2	RXBK	Muting input for the receiver
3	SEL BK	During grounded, the transmitter is set to transmission in AM mode.
4	-	-
5	E	Ground
6	XVT	Externally switches from transmitter output to transverter output
7, 8	-	-
9	LINE OUT	Reception line output (0 dBm: 600 Ω) (squench not operative on this output)
10	E	Ground
11, 12	-	-
13	MIC MUTE	Applying a voltage of 5 to 13.8 V mutes from signals microphone for transmitting. LINE IN is not muted.
14	13.8 V	13.8 V output Maximum current: 50 mA
15	E	Ground
16	LINE IN	External transmission modulation input (-40 dBm)
17, 18	-	-
19	BUSY	"L" when squench is closed. Maximum current: 10 mA
20	-	-
21	-	-
22-24	-	-
25	E	Ground

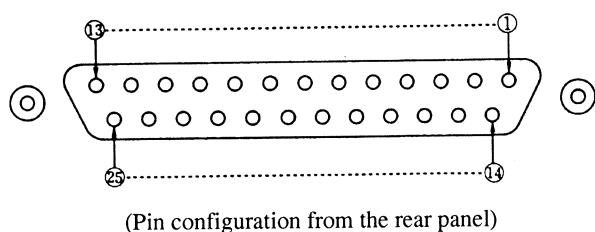


Figure 1.9 Accessory Connector Pin Configuration

⑦② ANTI VOX adjuster

When in VOX operation, set to the optimum position to prevent incorrect VOX operation due to sound from the speaker.

⑦③ RS-232C Interface connector

For connecting a PC, etc., for remote control.

Pin No.	Signal Nomenclature	Function
1	FG	Ground
2	SD	Send data
3	RD	Receive data
4	RS	Request to send
5	CS	Not used
6	-	-
7	SG	Ground
8	-	-
...	...	...
25	-	-

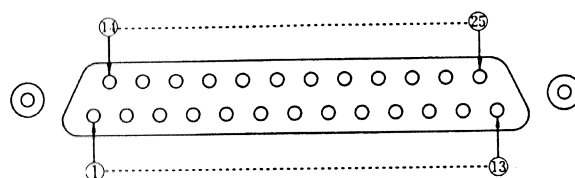


Figure 1.10 RS-232C Connector Pin Configuration

⑦④ SP (external speaker) connector

For connecting an optional external speaker.

⑦⑤ AC connector

For connecting the supplied AC cable.

⑦⑥ FUSE

The JST-145/245 uses a cartridge fuse. Be sure to replace with a fuse of the specified capacity.

⑦⑦ Power supply fan

For cooling the power supply.

1-6 Connecting Peripheral Equipment

1-6-1 Electronic Keyer

Connect a manipulator using a commercially-available 6.0mm-diameter plug, as shown in Figure 1-11. Then, turn on the ELECTRONIC KEYSER switch ⑥7.

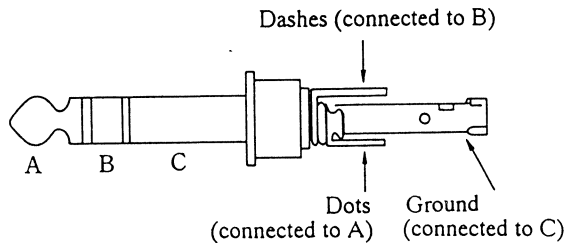


Figure 1-11 Connection of Electric Keyer

1-6-2 Linear Amp

Connect the optional CFQ-4794 control cable to the LINEAR AMP connector ⑦0 on the rear panel of the JST-145/245 to use JRC's JRL-2000F linear amp. See Figure 1-12 for how to connect a linear amp other than the JRL-2000F.

Use a commercially-available 15-pin Subminiature D connector (plug).

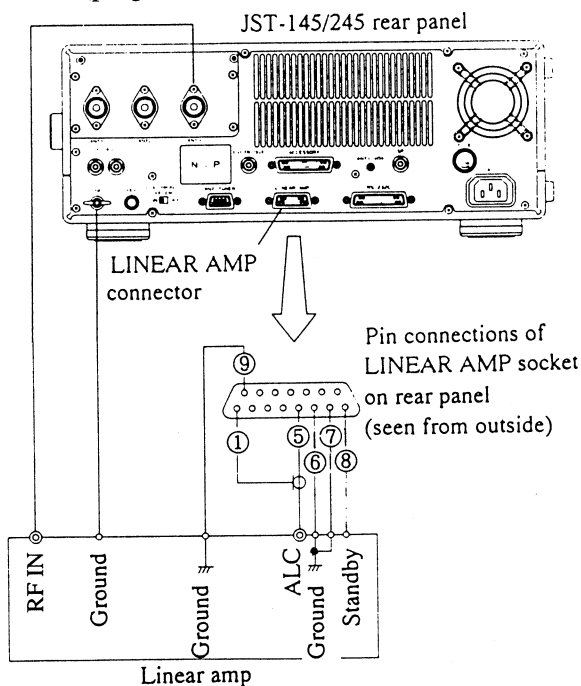


Figure 1-12 Connection of Linear Amp

1-6-3 Receiving Antenna and Separate Receiver

To receive using a special antenna other than those connected to the ANT connectors ⑥0, ⑥1, ⑥2 on the rear panel, connect the antenna to the RX ANT IN connector ⑥4 on the rear panel.

To receive using a separate receiver, connect the external receiver's antenna terminal to the RX ANT OUT connector ⑥3.

This disconnects the internal receiver from the antenna circuit.

Figure 1-6 shows the internal connections of the RX ANT IN and RX ANT OUT connectors.

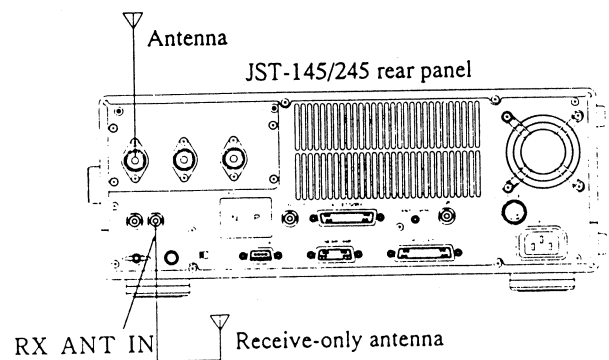


Figure 1-13 Connection of Receive-only Antenna

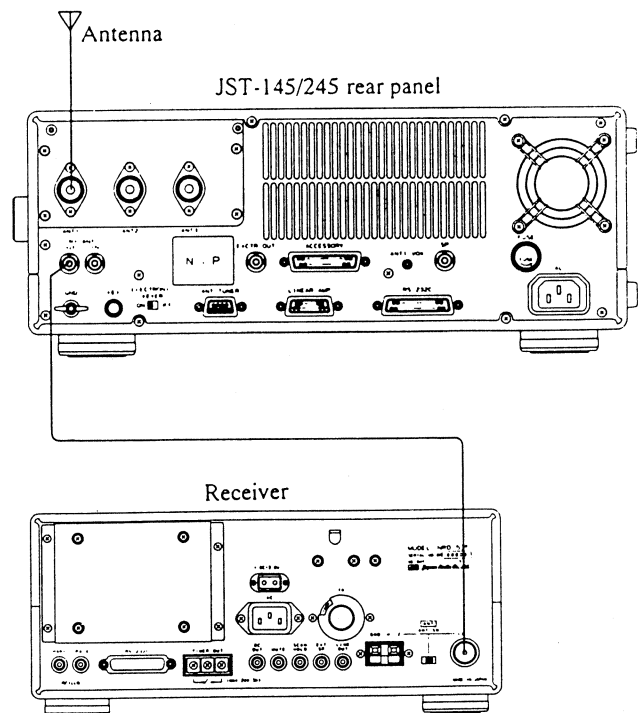
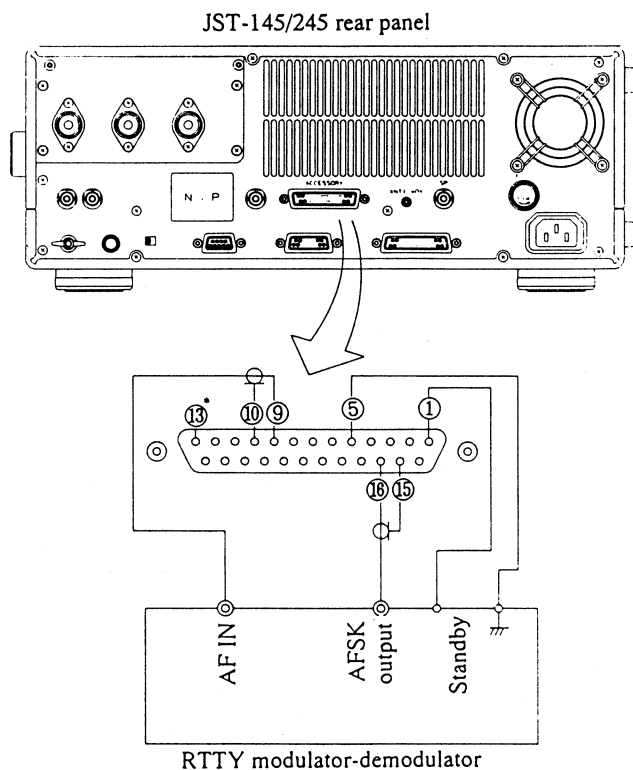


Figure 1-14 Connection of Separate Receiver

1-6-4 RTTY

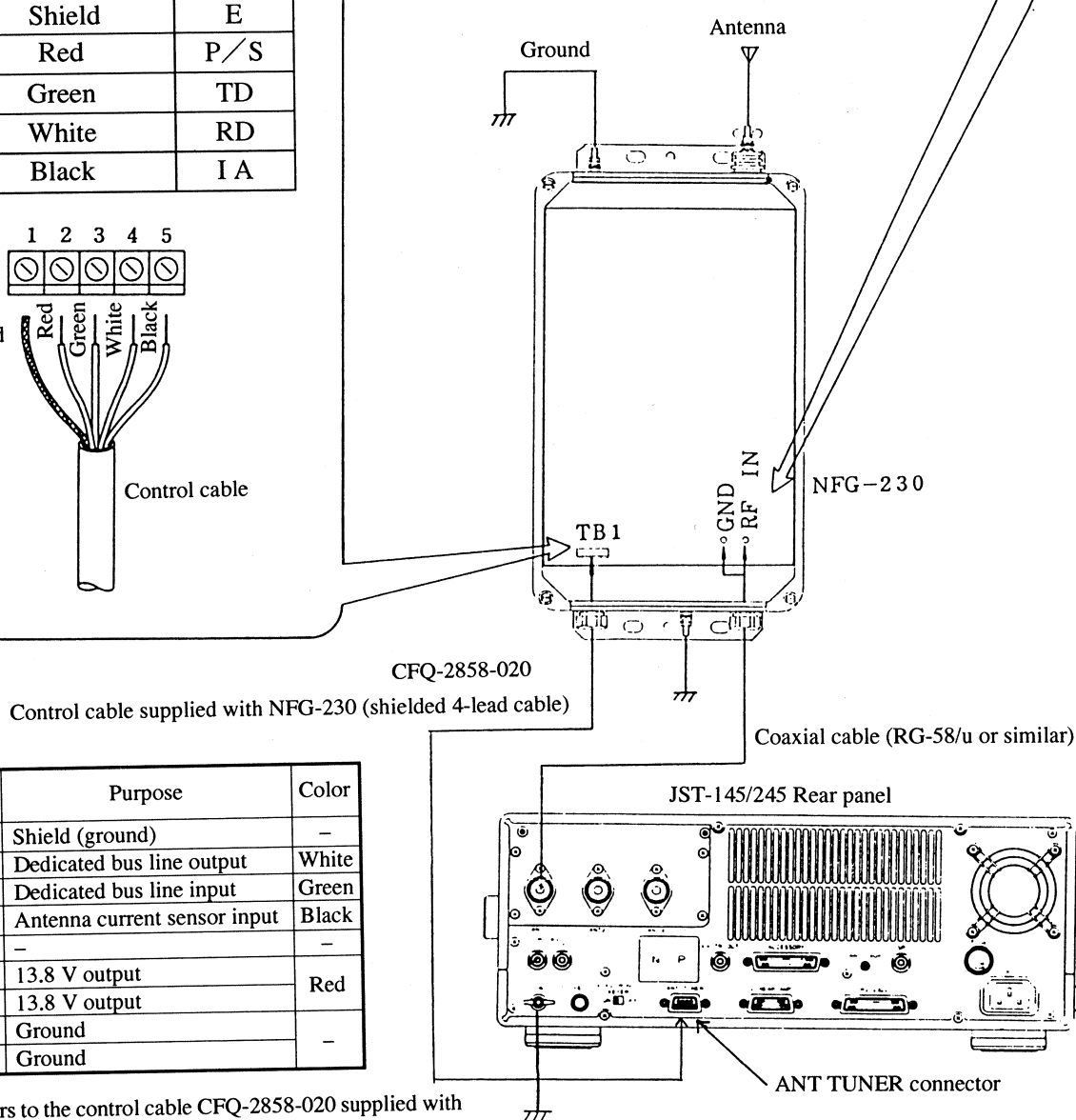
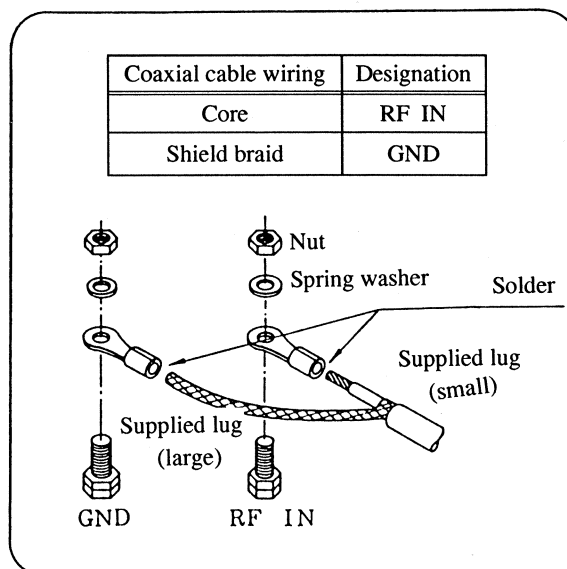
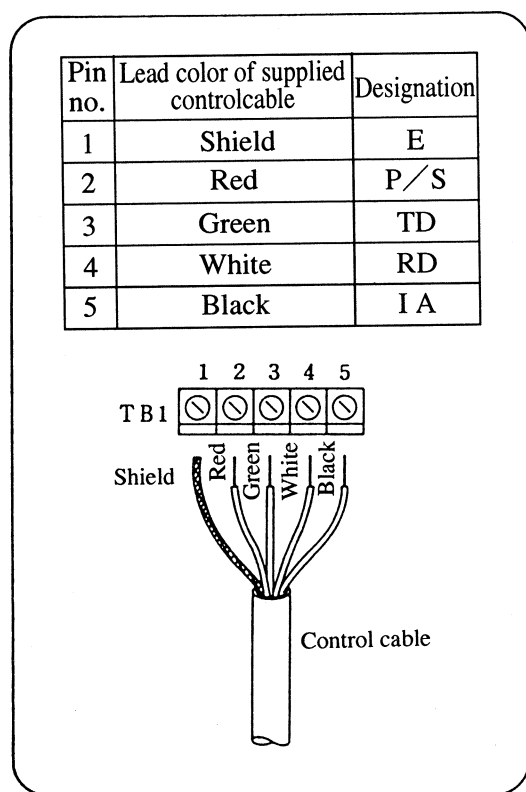
To operate the JST-145/245 in RTTY (AFSK) mode requires a special modulator-demodulator. Figure 1-15 shows how to connect the modulator-demodulator, but see the instruction manual of the modulator-demodulator for details.



**Figure 1-15 Example Connection of RTTY
Modulator-Demodulator**

1-6-5 External Antenna Tuner

To use the external antenna tuner NFG-230, connect it as shown in Figure 1-16, using the supplied control cable. The other end of the cable should be plugged into the **ANT TUNER** connector on the rear panel of the JST-145/JST-245.



Pin no.	Designation	Purpose	Color
1	SHLD	Shield (ground)	—
2	ETD	Dedicated bus line output	White
3	ERD	Dedicated bus line input	Green
4	IA	Antenna current sensor input	Black
5	—	—	—
6	13.8V	13.8 V output	Red
7	13.8V	13.8 V output	
8	E	Ground	—
9	E	Ground	

* The color refers to the control cable CFQ-2858-020 supplied with the NFG-230

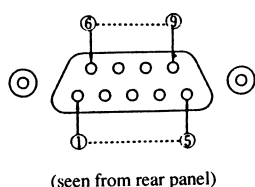


Figure 1.16 Connection of NFG-230

1-7 PC Control of the Transceiver

The JST-145/245 can be externally controlled by devices such as PCs via the RS-232C interface.

- Baud rate: 4800 bps
- Format: 1 start bit, 8 data bits, no parity bit, 1 stop bit (10 bits/character)
- Items under PC control:
 - Frequency, mode, bandwidth, AGC, PBS, BWC, tuner control, transmit or receive, channel settings, memory channel recall/storing, break-in method, antenna selection, squelch status, noise blanker, transceiver status requests, meter select, user definitions
- Output items: Frequency, mode, bandwidth, AGC, recalled contents of memory channel, metering, squelch status, and tuning status

1-7-1 Connection via RS-232C

Connect the RS-232C connector of the JST-145/245 to that of a PC using an RS-232C cable (commercially available crossed cable with 25-pin Subminiature D connectors at either end). You can also use JRC's optional 6ZCJD00350 RS-232C cable. See the table below for the signal names of the RS-232C pins.

Table 1-7 RS-232C Connector Signals and Connections

Signal	Pin		Pin	Signal
JST-145/245			Computer	
(FG)	1	—————	1	(FG)
(SD)	2	↗ ↘	2	(SD)
(RD)	3	← —→	3	(RD)
(RS)	4	↗ ↘	4	(RS)
—	—	← —→	5	(CS)
—	—	↗ ↘	6	(DR)
(SG)	7	—————	7	(SG)
—	—	↗ ↘	8	(CD)
(ER)	20	—————	20	(ER)

1-7-2 Control method

This sub-section shows the format of commands used to control the JST-145 or 245. See the instruction manual for details of commands.

Control ID, Control details, CR

The control ID is a single uppercase letter.

The length of the control details depend on the control ID, but they consist of numerals 0 to 9.

The CR (carriage return) is a delimiter.

The following details each of the items that can be controlled.

- "H" External control ON/OFF

Command	Content	Response
"H" CR	Control status request	"Hn" CR n: 0, 1
"H0" CR	Control OFF	
"H1" CR	Control ON	

When using a PC to control the JST-145/245, first turn the control ON.

When external control is turned ON, the REMOTE segment of the LCD and the LED on the LOCK switch ③⑨ light. Except for the power switch, ATT switch, AF and RF nob on the front panel, all controls and keys are electrically locked.

When external control is turned OFF, the REMOTE segment of the LCD and the LED on the LOCK switch ③⑨ turn OFF. You can then again use the controls on the panel. Note that external control is turned off if the power switch is turned off.

The following sample program is written in BASIC for the NEC PC-9800 Series of PCs. If using other PCs, be sure to set the baud rate, etc., of the RS-232C port.

```

10 OPEN "COM: N81NN" AS #1    Open RS-232C port
20 ,
30 PRINT #1, "H1"             Set remote control ON
40 PRINT #1, "F07050000A"     Set frequency to 7.05 MHz
                                in A-VFO
50 PRINT #1, "A1"             Select ANT1
60 PRINT #1, "D3"             Select LSB mode
70 PRINT #1, "G0"             Set AGC SLOW
80 PRINT #1, "H0"             Set remote control OFF
90 ,
100 CLOSE                     Close RS-232C port
110 END

```

Section 2 Specifications

2-1 General Specifications

- Transmission frequency range
 - 1.8 MHz band 1.8 to 2.0 MHz (160 m)
 - 3.5 MHz band 3.5 to 4.0 MHz (80 m)
 - 7 MHz band 7.0 to 7.3 MHz (40 m)
 - 10 MHz band 10.1 to 10.15 MHz (30 m)
 - 14 MHz band 14.0 to 14.35 MHz (20 m)
 - 18 MHz band 18.068 to 18.168 MHz (17 m)
 - 21 MHz band 21.0 to 21.45 MHz (15 m)
 - 24 MHz band 24.89 to 24.99 MHz (12 m)
 - 28 MHz band 28.0 to 29.7 MHz (10 m)
 - 50 MHz band 50.0 to 54.0 MHz (6 m)
(JST-245 only)
- Reception frequency range
 - 100 kHz to 30 MHz
 - 30 to 54 MHz (JST-245 only)
- Modes
 - SSB (LSB, USB)
 - CW
 - AM (A3H)
 - FM
 - AFSK
- Frequency stability
 - Better than ± 10 ppm 5 min. to 60 min. after switching ON
 - Thereafter, better than ± 2 ppm
- Minimum tuning increment
 - 2 Hz
- Memory capacity
 - 200 channels
- Antenna impedance
 - 50 Ω (unbalanced)
- Input voltage
 - JST-145DXU/245DXU
 - 85 to 132 VAC, 50/60 Hz single phase
 - JST-145DXG/245DXG
 - 170 to 264 VAC, 50/60 Hz single phase
- Power consumption
 - Receive (with no signal):
 - Approx. 90 VA
 - Transmit:
 - Approx. 900 VA (at 150 W output by JST-145DX/245DX)
- Dimensions
 - 350 mm (W) $\times$ 130 mm (H) $\times$ 305 mm (D)
 - (365 mm $\times$ 134 mm $\times$ 345 mm including projections)
- Weight
 - Approx. 12 kg

2-2 Transmitter

- Output power
 - JST-145DX and JST-245DX:
 - 15 to 150 W, continuously adjustable
- Modulation
 - SSB, AM (A3H), and AFSK:
 - Balanced modulation
 - FM: Reactance modulation
- Carrier suppression ratio
 - 50 dB or more
- Undesired sideband suppression ratio
 - 60 dB or more
- Spurious emission
 - 40 dB or less
- 3rd order intermodulation distortion
 - 38 dB or less
- Frequency response
 - 400 to 2600 Hz (within 6 dB, SSB)
- Maximum frequency deviation
 - ± 5 kHz
- Microphone impedance
 - 600 Ω

2-3 Receiver

- Receiving system
 - SSB, CW, AM, and AFSK: Quadruple superheterodyne
 - FM: Triple superheterodyne
- Intermediate frequencies
 - 1st IF: 70.445 MHz
 - 2nd IF: 9.455 MHz
 - 3rd IF: 455 kHz
 - 4th IF: 97 kHz
- Sensitivity

	SSB, CW, AFSK	AM	FM
0.1 to 0.5 MHz	14 dB μ	24 dB μ	–
0.5 to 1.6 MHz	6 dB μ	16 dB μ	–
1.6 to 30 MHz	–10 dB μ	6 dB μ	–6 dB μ
48 to 54 MHz	–10 dB μ	6 dB μ	–6 dB μ

(SSB, CW, AFSK, and AM at 10 dB S/N; FM at 12 dB SINAD)

- Image rejection: 70 dB or more
- IF rejection: 70 dB or more
- Selectivity

	–6 dB	–60 dB
SSB, CW (W), AFSK (INTER)	2.4 kHz or more	4.0 kHz or less
FM (WIDE)	12 kHz or more	–
AM (INTER)	6 kHz or more	18 kHz or less

RIT/XIT range: ± 9.99 kHz

PBS range: ± 2 kHz

Notch filter attenuation:

Approx. 40 dB

Maximum audio output:

1 W or more

(Ratings are standard values using the JAIA measuring methods.)

(Ratings and circuits subject to change without prior notice.)

Section 3 Circuit Description

3-1-1 JST-145 Signal Block Diagram

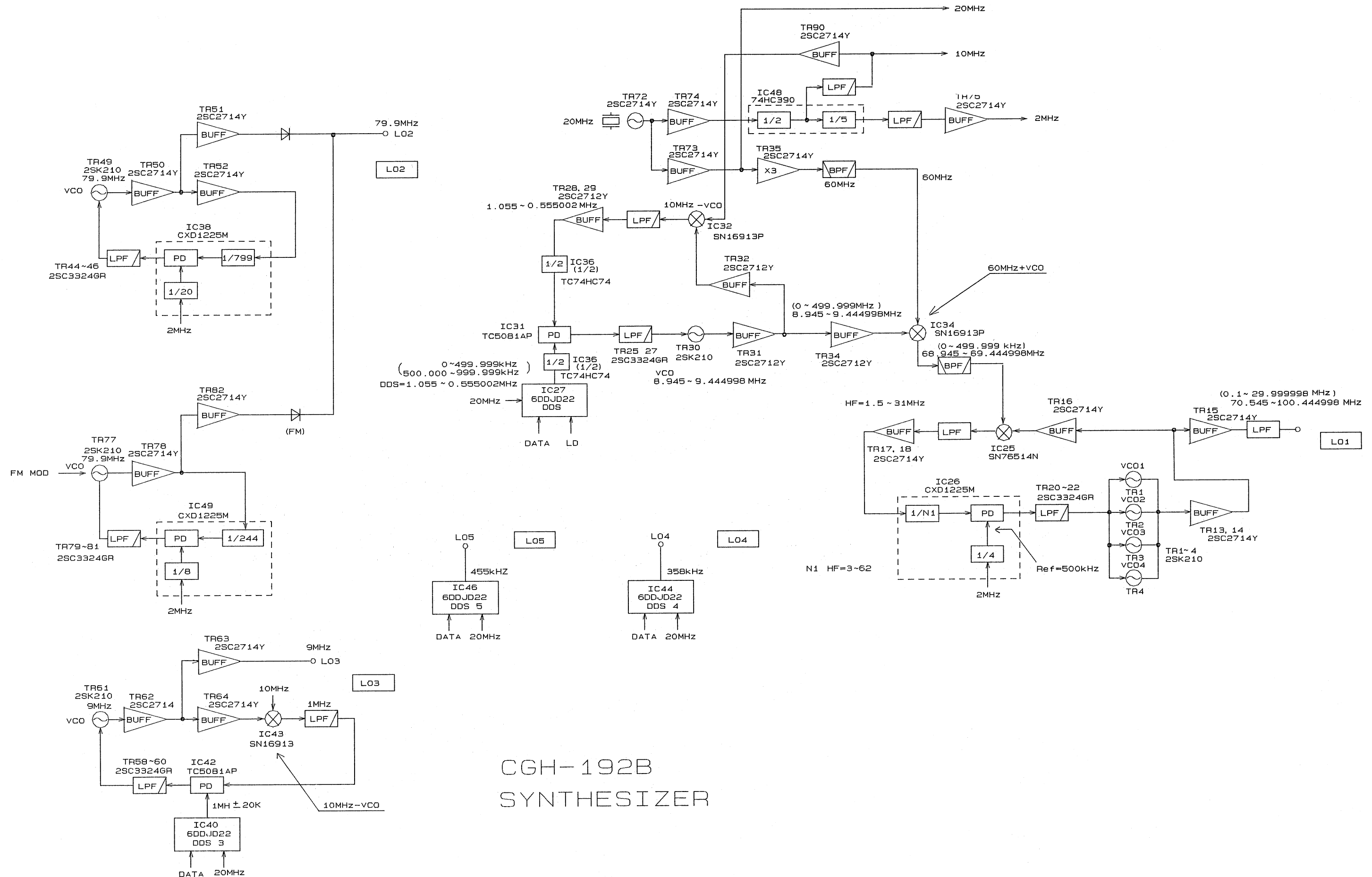
TX/RX



TX/RX

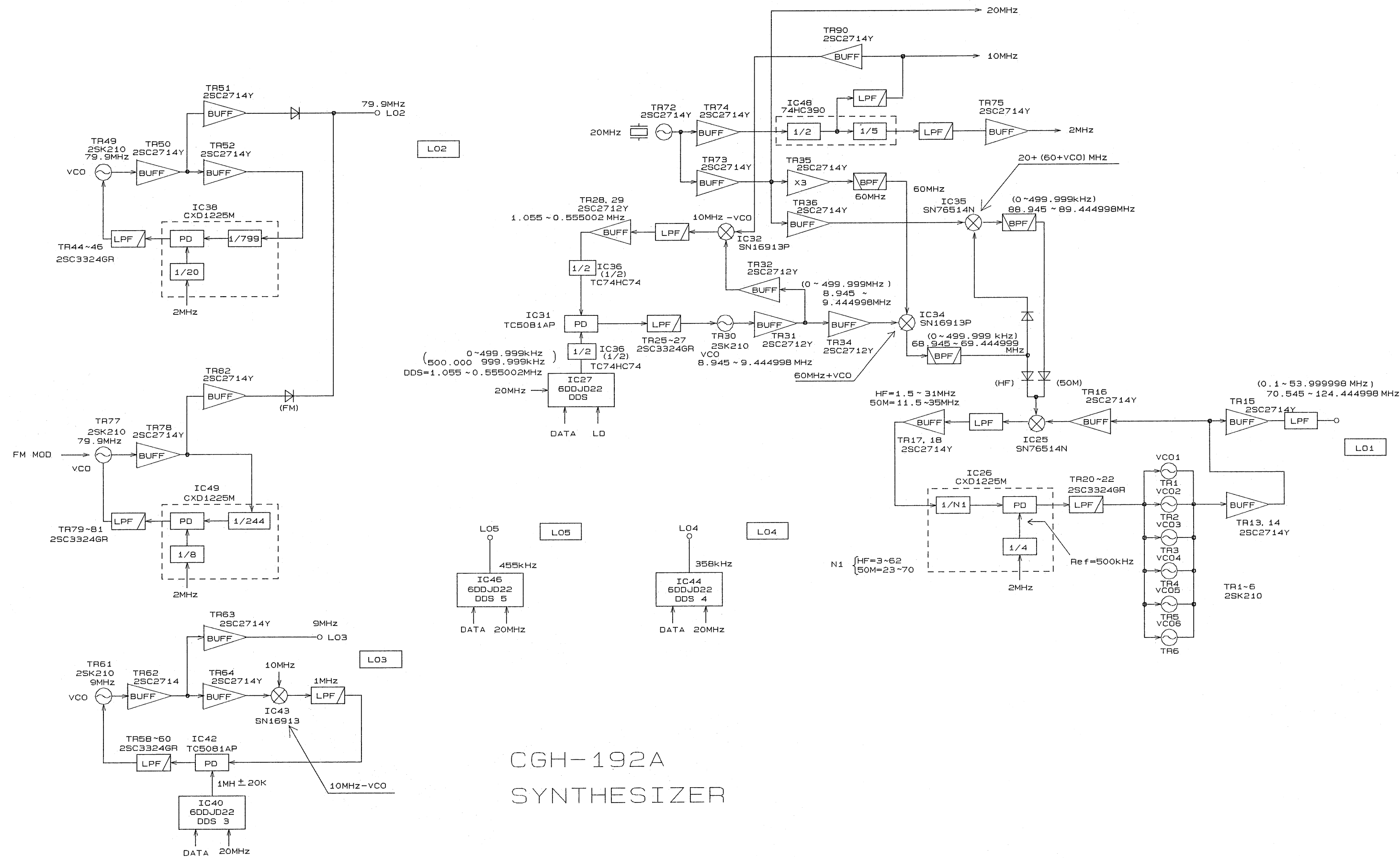


3-1-3 JST-145 Synthesizer Block Diagram



CGH-192B
SYNTHESIZER

3-1-4 JST-245 Synthesizer Block Diagram



3-2 General Circuit Description

3-2-1 Receiver

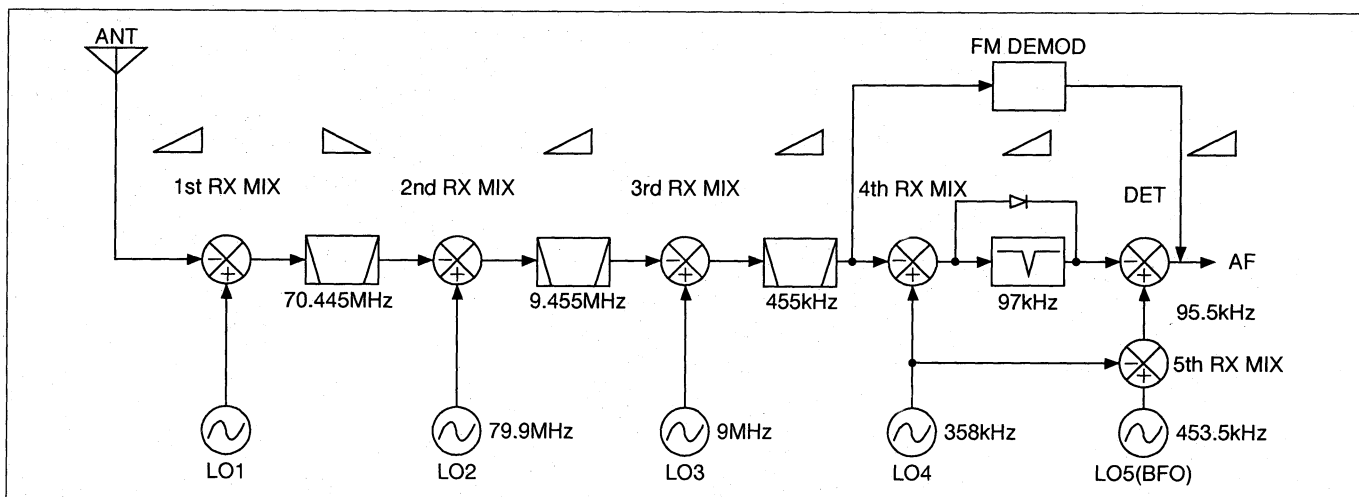


Fig.3.1 Block diagram of receiver section

The receiver employs a quadruple superheterodyne design comprising four IF stages: 1st RX IF (70.445 MHz), 2nd RX IF (9.455 MHz), 3rd RX IF (455 kHz), and 4th RX IF (97 kHz). However, at the only FM mode, the receiver operates as a triple superheterodyne using the 1st RX IF (70.445 MHz), 2nd RX IF (9.455 MHz), and 3rd RX IF (455 kHz).

The principle of the frequency conversion section is shown in the above diagram. The illustration shows the IF stages and the local oscillators (LO) under the upper sideband (USB) mode as an operation example.

The IF output from the mixer is the result from mixing the input frequency (f_{in}) with the local oscillator frequency (f_{osc}). Two calculations are performed to obtain the sum ($f_{in} + f_{osc}$) and the differential ($f_{in} - f_{osc}$), but normally the IF circuit is used as a bandpass filter to extract only one of these signals for amplification. If the frequency of the local oscillator is set to a higher value than the input signal frequency, the output will be found from the $f_{osc} - f_{in}$ signal. When an SSB signal is input to such a reverse heterodyne frequency converter, the USB mode signal is converted to the lower sideband (LSB) and the LSB mode signal is inverted to upper sideband (USB).

The reception signal input from the antenna is mixed with the 1st local oscillator frequency (LO1, dependent on reception frequency) at the 1st RX mixer and converted to the 1st RX IF signal (70.445 MHz). Since LO1 is set to a higher value than the reception frequency in this unit, the USB mode reception signal is inverted to the LSB signal at the 1st RX IF stage.

The signal at the 1st RX IF stage is mixed with the 2nd local oscillator frequency (LO2: 79.9 MHz) in the 2nd RX MIX for conversion into the 2nd RX IF signal (9.455 MHz). In that case, since LO2 is set to a higher value than the 1st RX IF signal, the LSB mode signal at the 1st RX IF stage is inverted to a USB signal.

The signal at 2nd RX IF stage is mixed with the 3rd local oscillator frequency (LO3: 9.0 MHz) in the 3rd RX MIX for conversion into the 3rd RX IF signal (455 kHz). Since LO3 is set to a lower value than the 2nd RX IF signal, no sideband inversion is carried out and the 3rd RX IF signal remains as a USB signal.

At the FM mode, the 3rd RX IF signal as it is supplied to the FM demodulator and sends it to the AF (audio frequency) amplifier.

In other modes, the 3rd RX IF signal is mixed with the 4th local oscillator frequency (LO4: 358 kHz) in the 4th RX mixer for conversion into the 4th RX IF signal (97 kHz). Since LO4 is set to a lower value than the 3rd RX IF signal, no sideband inversion is carried out and the 4th RX IF signal remains a USB signal.

In the SSB, CW, and RTTY modes, the 4th RX IF signal is product-detected using the signal from the 5th RX MIX and after changing to the voice then sent to the AF amplifier. The 5th RX MIX signal is the difference ($LO5 - LO4$) between the LO4 signal and the BFO (beat frequency oscillator) signal (LO5, dependent on mode).

In the AM mode, the 4th RX IF signal is sync detected at the 5th RX MIX then sent to the AF amplifier.

3-2-2 Transmitter

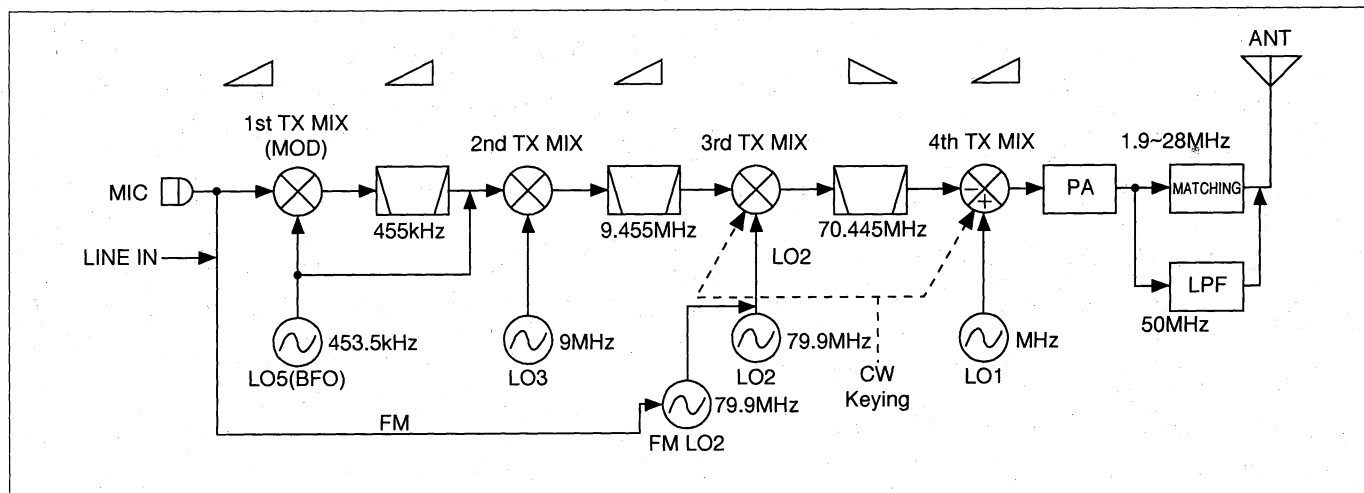


Fig.3.2 Block diagram of transmitter section

At the transmitter, the TX signals input from MIC are converted to the one of desired frequency as inverted against receiver systems, then amplified to the appointed power. However, for the transmission, the 97 kHz IF stage is not used, but four kinds of frequency are existed (1st TX IF (455 kHz), 2nd TX IF (9.455 MHz), 3rd TX IF (70.445 MHz) and a 4th desired transmit frequency).

The principle of the frequency section is shown in the above diagram. The illustration shows with the IF stages and the local oscillators (LO) under the upper sideband (USB) mode as an operation example.

At the SSB, AM and RTTY modes, the Audio Signal input from the MIC or LINE IN is mixed (modulated) with the BFO signal (LO5, dependent on mode) in the 1st TX MIX and converted to a 455 kHz double sideband (DSB) signal. By passing this signal through a 455 kHz filter, unwanted sideband components are removed, resulting in a USB or LSB as SSB signal. USB or LSB signal selection depends on the output frequency of LO5.

When at the CW, AM and FM mode, the LO5 also becomes the carrier signal. In the AM mode, a regular USB signal is generated, and then, at next stage, LO5 is added to this to obtain the AM signal (A3H).

The signal from the 1st TX IF stage is mixed with the 3rd local oscillator frequency (LO3: 9.0 MHz) in the 2nd TX MIX for conversion into the 2nd TX IF signal (9.455 MHz). LO3 is set to a lower value than the 2nd TX IF frequency. There fore, no sideband inversion at

TX IF is carried out and the 2nd TX IF signal remains as a USB signal.

The signal from the 2nd TX IF stage is mixed with the 2nd local oscillator frequency (LO2: 79.9 MHz) in the 3rd TX MIX for conversion into the 3rd TX IF signal (70.445 MHz). Since LO2 is set to a higher value than the 3rd TX IF frequency, the USB mode signal of the 2nd TX IF stage is inverted to an LSB signal.

At the FM mode, the audio signal from the microphone is sent to a dedicated LO2 (FM LO2) for frequency modulation.

The signal from the 3rd TX IF stage is mixed with the 1st local oscillator frequency (LO1) in the 4th TX MIX and converted to the transmission frequency. Since LO1 is set to a higher value than the transmission frequency, the LSB signal is inverted to a USB signal at the 3rd TX IF stage.

Unwanted frequency components caused from generating in the various conversion circuits are removed by means of bandpass filters in the IF stages.

After conversion to the transmission frequency, the signal is sent to the power amplifier for amplification to the appointed power.

In the JST-245, the signal passes a matching circuit if it is between 1.8 and 28 MHz before being output to the antenna. If the signal is in the 50 MHz band, a low-pass filter is used.

In the JST-145, the signal is routed only though the low-pass filter before being output to the antenna.

3-2-3 Control Circuits

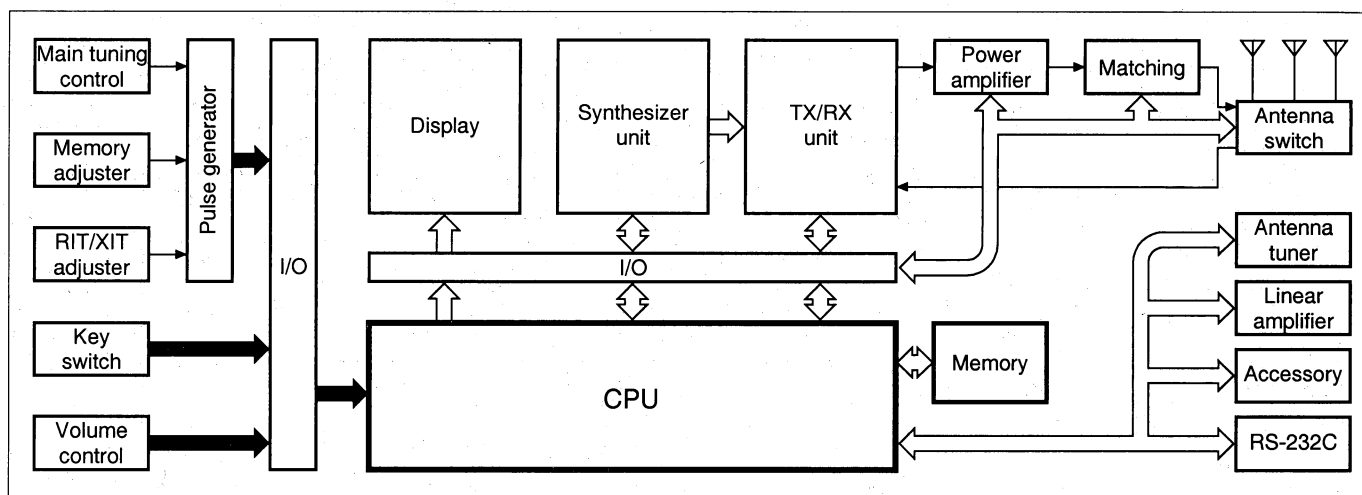


Fig.3.3 Block diagram of control system

All operations of this transceiver unit are controlled by a CPU. The CPU collects information from the switches and controls on the front panel and from external equipment connected to rear-panel connectors. After processing this information, the CPU controls the various internal units and outputs control data to external equipment.

Communication between the CPU and the internal units and external equipment is maintained continuously, and confirmation signals are returned which indicate execution status to the CPU. The CPU uses these signals to monitor the various units and activate protection circuits as required.

Control signals from the front panel can be divided into the following five categories:

- Main tuning control
- Memory adjuster
- RIT/XIT adjuster
- Key switches
- Volume control

These control signals are sent to the CPU via an I/O interface. The main tuning knob for frequency control, the MEMORY knob for selecting the memory channel, and the RIT/XIT knob for performing fine frequency adjustment use rotary encoders. The output signals from these rotary encoders are processed by a dedicated IC, then sent to the CPU.

Control information from the key switches comprises all pushbuttons and switches on the front panel, as well

as the setting of the PBS, BWC, NOTCH, PITCH DELAY, and SPEED controls.

External connectors are provided on the rear panel for making connection to the following external equipment. The following four types of external equipment can be used:

- Antenna tuner
- Linear amplifier
- Accessory equipment
- Personal computer (RS-232C)

The CPU controls each circuit via an interface (I/O), based on these control signal inputs. The CPU then sends control data to the various internal units via the I/O interface. Control data to external equipment are sent directly from the CPU.

The following types of control data are available:

- Display data
- Frequency control data and VCO (Note 1) for synthesizer unit
- Variable tuning data (Note 2) for TX/RX unit.
- Transmission section attenuator control voltage
- Antenna matching data
- Transmission/reception switching control for each unit
- External equipment control data

Notes

1. For information on the VCO, refer to "3-5 Synthesizer Unit".
2. For information on variable tuning, refer to "3-4 TX/RX Unit".

3-3 Panel Unit (CDE-783)

3-3-1 Panel Unit Circuit Description

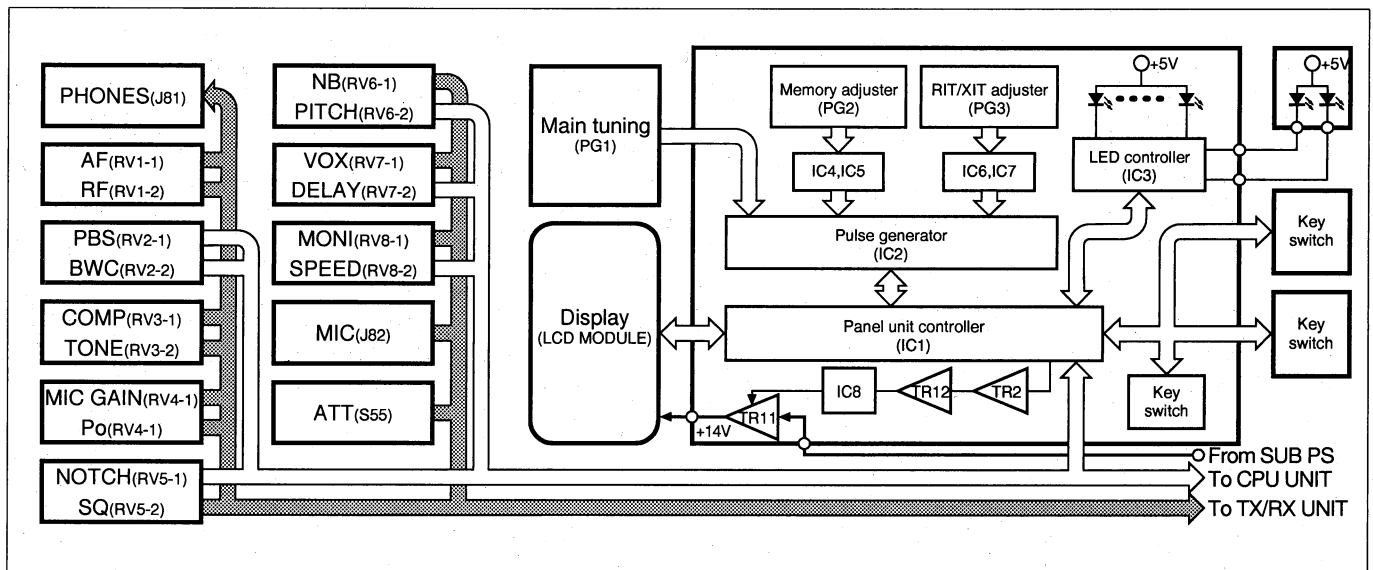


Fig.3.4 Block diagram of panel unit

The panel unit consists of the PCBs shown above which carry out the following seven types of control operations:

- Rotary encoder signal detection
- Key switch signal detection
- Data communication with CPU
- LED drive
- Display drive
- Output of gain and level adjustment values
- Other functions

[1] Rotary Encoder Signal Detection

The main tuning knob (PG1) as well as the memory tuning knob (PG2) and the RIT/XIT knob (PG3) are rotary encoders which output two kinds of pulses according to the rotation amount. Wave shaping of the pulse signals from PG2 and PG3 is done by IC4/IC5 and IC6/IC7.

The signals output from these rotary encoders are sent to a dedicated processing IC (IC2) which detects the rotation amount and rotation direction, then converts the signals into 8-bit parallel data and sends it to the panel unit controller (IC1).

IC2 detects the rotation direction and rotation amount of the rotary encoder and converts this information into an 8-bit parallel signal which is sent to the panel unit controller (IC1).

[2] Key switch signal detection

Key switches can be divided into three groups: numeric keypad, selectors (including transmitter, meter RF

amplifier, filter, and antenna control), and other functions including frequency setting.

The panel unit controller (IC1) detects the key switch signals by means of a matrix circuit with seven input and eight output lines. The output lines continuously provide eight different types of pulse signals, and the key switches are located on the matrix cross points. Pressing a key switch closes the matrix line, so that the specific pulse signal is supplied to the panel unit controller (IC1).

The panel unit controller (IC1) determines which switch was pressed from the type of input pulse and the signal line number.

[3] Data communication with CPU

Data communication takes place continuously between the panel unit controller (IC1) and the CPU unit.

Information from the rotary encoder processor (IC2) and the various switches is supplied to the panel unit controller (IC1) for conversion into a 8-bit parallel data which are output to the CPU. The CPU processes these data and other information to drive the LEDs and the display. This is achieved by returning another 8-bit parallel data signal to the front panel unit.

[4] LED drive

When the panel unit controller (IC1) receives LED control data from the CPU, it converts these data into a serial signal and sends it to the LED controller (IC3). The LEDs are connected to the ports of this controller.

LED on/off status is determined by the voltage level at these ports. At low level (0 V), a LED is on and at high level (+5 V), it is off.

[5] Display drive

The panel unit controller (IC1) converts the display control data from the CPU unit into 4-bit parallel data, and sends it to the display (LCD MODULE).

The LCD module interprets the data and displays frequency, memory channel, signal level and mode information.

The LCD module has an integrated light controller which uses the dimmer circuit consisting of TR11, TR12, and IC8 to control display brightness in two steps.

[6] Output of gain and level adjustment values

The panel unit contains eight dual-ganged variable resistors which serve for 16 different kinds of gain and level adjustments. The values from these VRs are not processed within the panel unit but sent directly to the CPU unit or the TX/RX unit.

☐ The following six VRs determine information for the CPU unit:

- Passband shift (PBS) RV2-1
- Bandwidth control (BWC) RV2-2
- Notch level (NOTCH) RV5-1
- BFO pitch (PITCH) RV6-2
- Transmission signal delay (DELAY) RV7-2
- Keying speed (SPEED) RV8-2

☐ The following ten VRs determine information for the TX/RX unit:

- AF gain (AF) RV1-1
- RF gain (RF) RV1-2
- Compressor level (COMP) RV3-1
- Tone level (TONE) RV3-2
- Microphone gain (MIC) RV4-1
- Power level (Po) RV4-2
- Squelch level (SQ) RV5-2
- Noise blanker sensitivity (NB) RV6-1
- VOX gain (VOX) RV7-1
- Monitor level (MONI) RV8-1

[7] Other functions

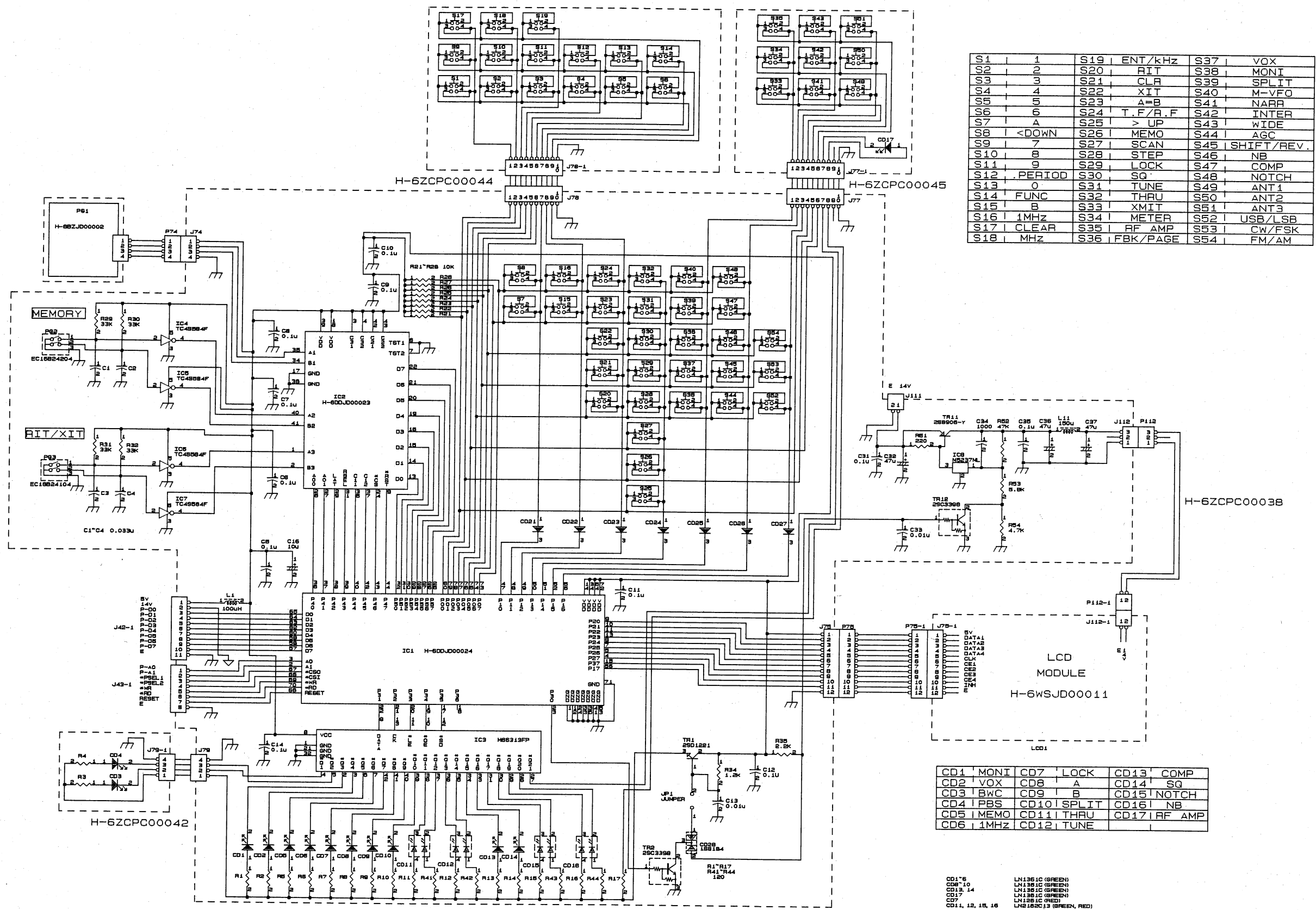
The panel unit also provides a headphone jack (J81), microphone connector (J82), and RF attenuator selector (S55).

The headphone jack (J81) is connected to the speaker output line of the TX/RX unit. When a plug is inserted into the jack, the internal speaker and external speaker are cut off.

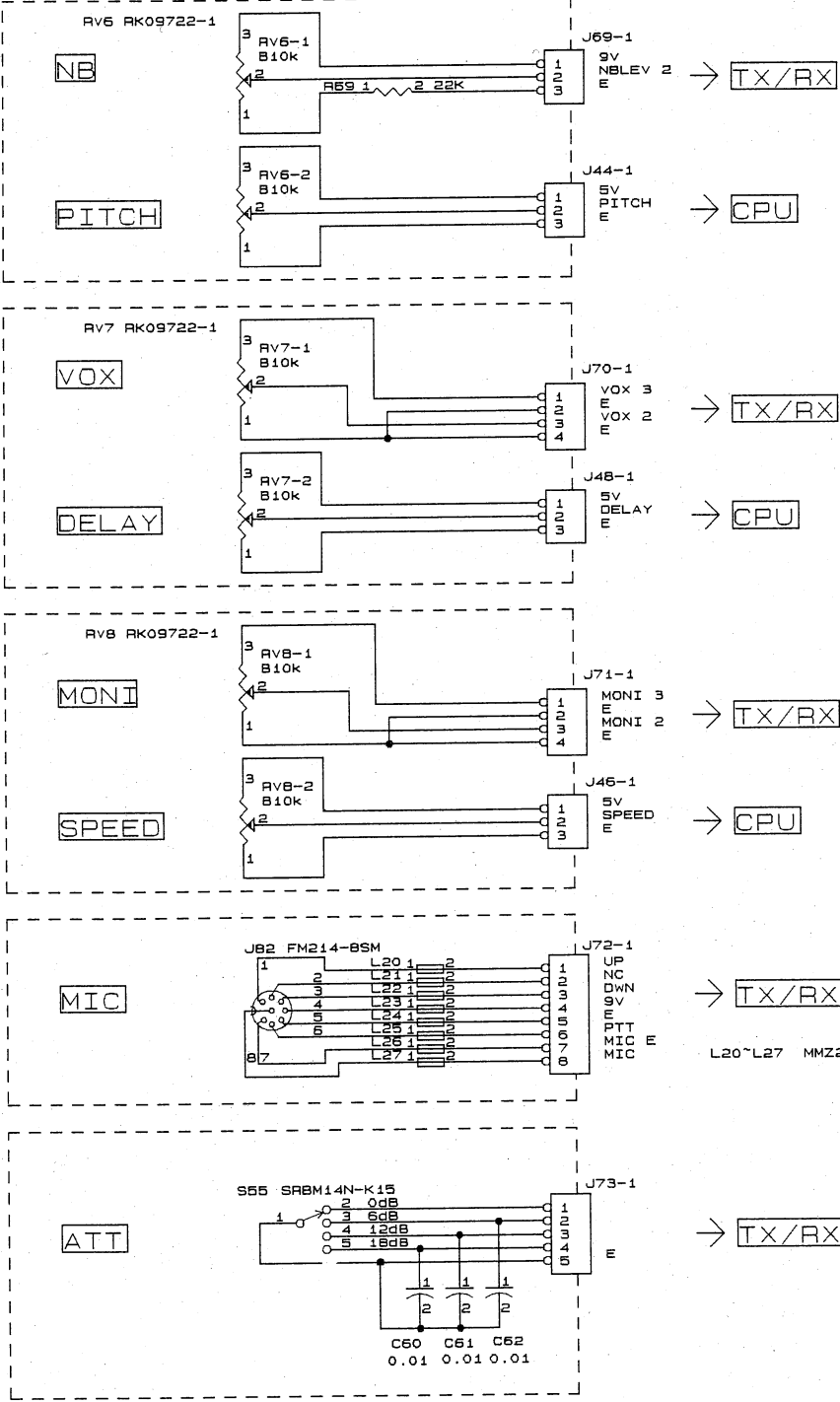
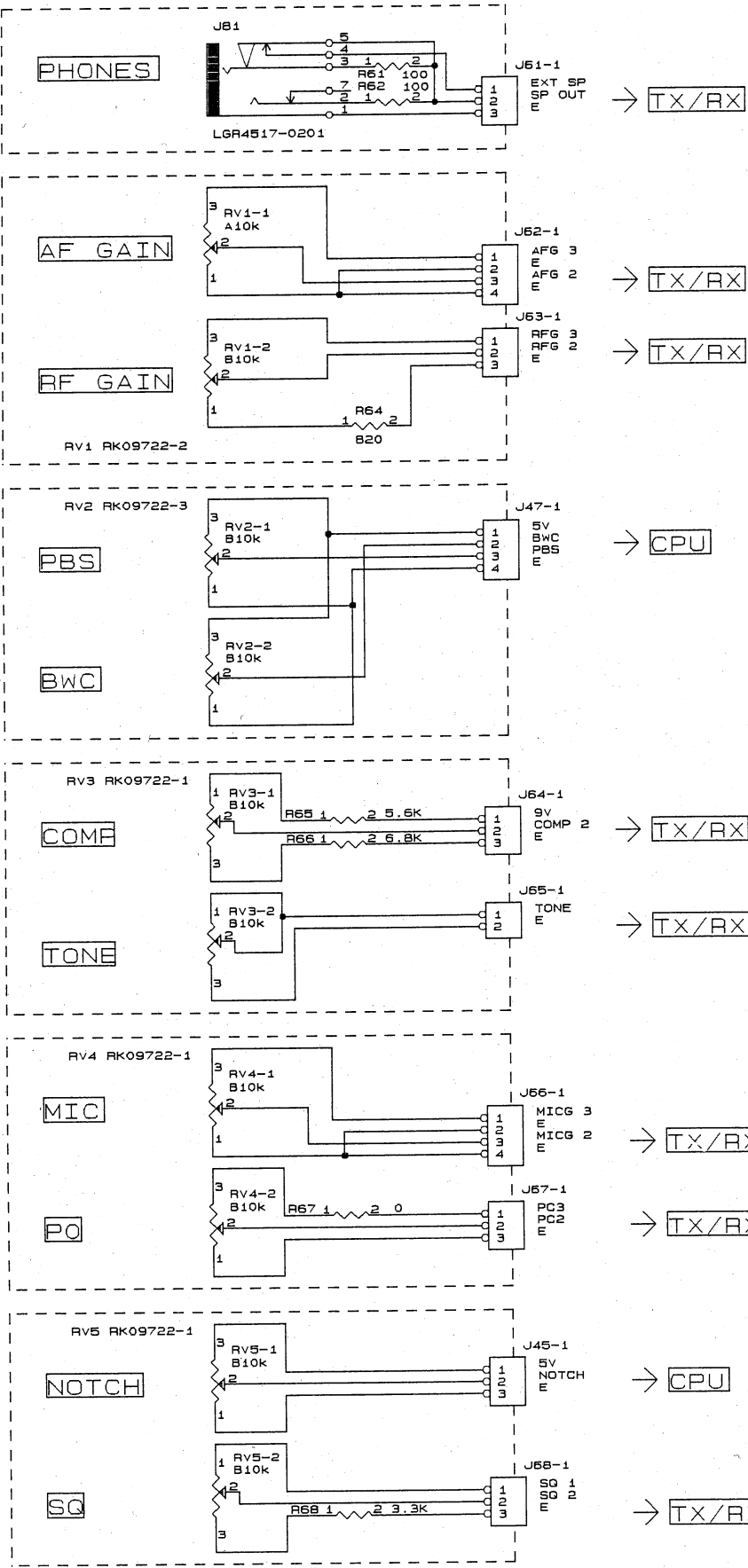
The microphone connector (J82) serves for input of the voice signal, the frequency up/down signal and the reception switching signal (PTT). These signals are supplied to the TX/RX unit. The microphone connector (J82) also carries a +9 V supply voltage provided by the TX/RX unit. This serves to electret condenser-type microphones.

The RF attenuator selector (S55) directly controls the attenuator setting of the TX/RX unit.

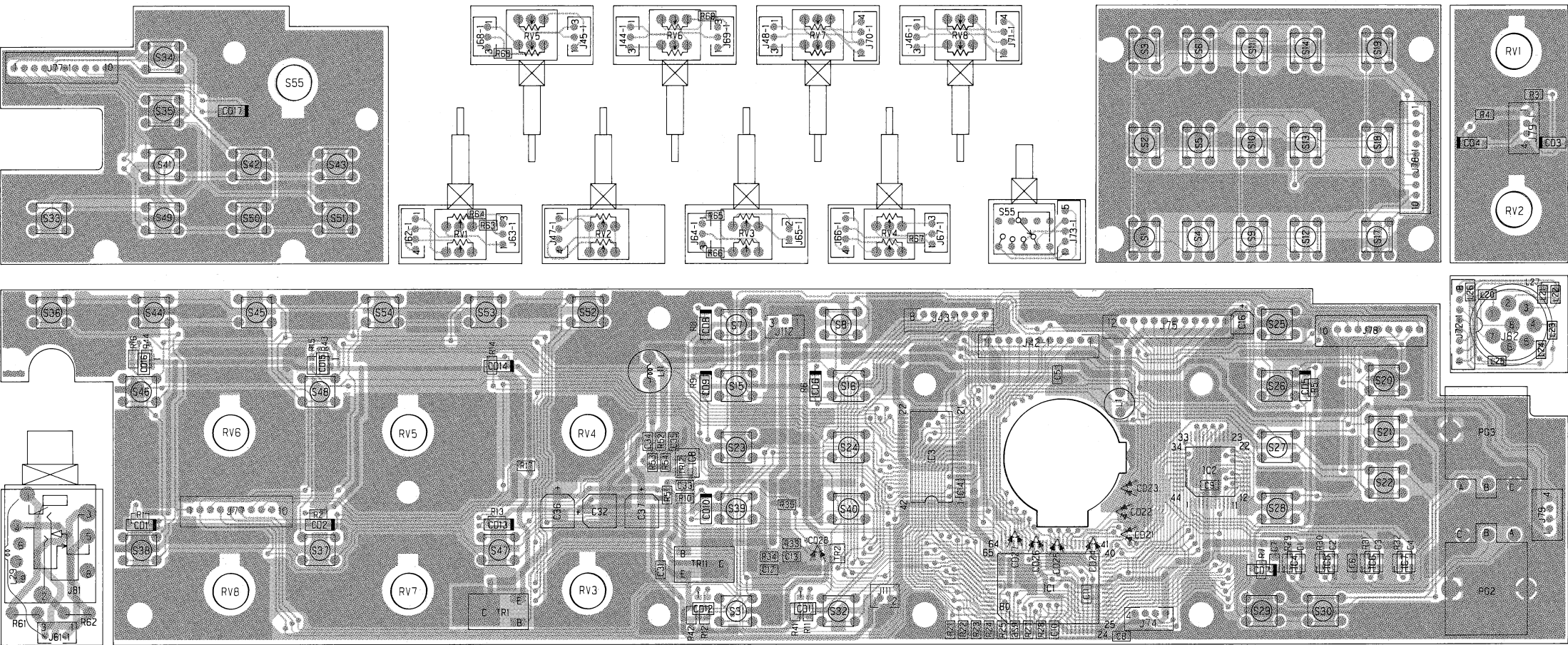
3-3-2 Panel Unit Circuit Diagram (1/2)



Panel Unit Circuit Diagram (2/2)



3-3-3 Panel Unit PCB Diagram (Component Side)



Parts No.	IC8			TR2			TR11			TR12		
Pin No.	1	2	3	1 (B)	2 (C)	3 (E)	B	E	C	1 (B)	2 (C)	3 (E)
Voltage	1.3V	GND	13.0V	0V	4.1V	GND	13.0V	13.6V	10.0V	4.2V	0V	GND
Remarks	Panel Control			Panel Control			Panel Control			Panel Control		

3-4 TX/RX Unit (CAF-412A/JST-245, B/JST-145)

3-4-1 TX/RX Unit Circuit Description

The transmission and reception sections of this transceiver use common filters for frequency conversion. The TX/RX unit therefore contains both the transmission and reception circuitry, to facilitate wiring layout. The filter points and main circuit blocks are shown in the diagram below.

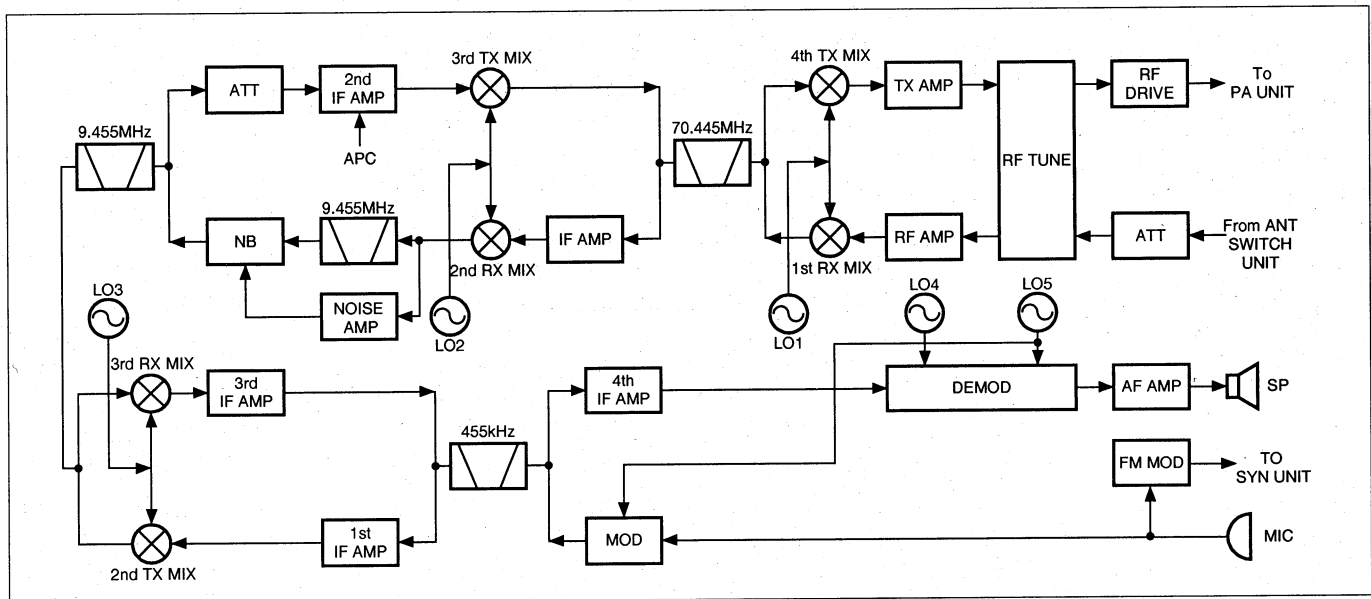


Fig.3.5 Block diagram of TX/RX unit

[1] Circuit from transmission/reception signal output/input to 70.445 MHz filter

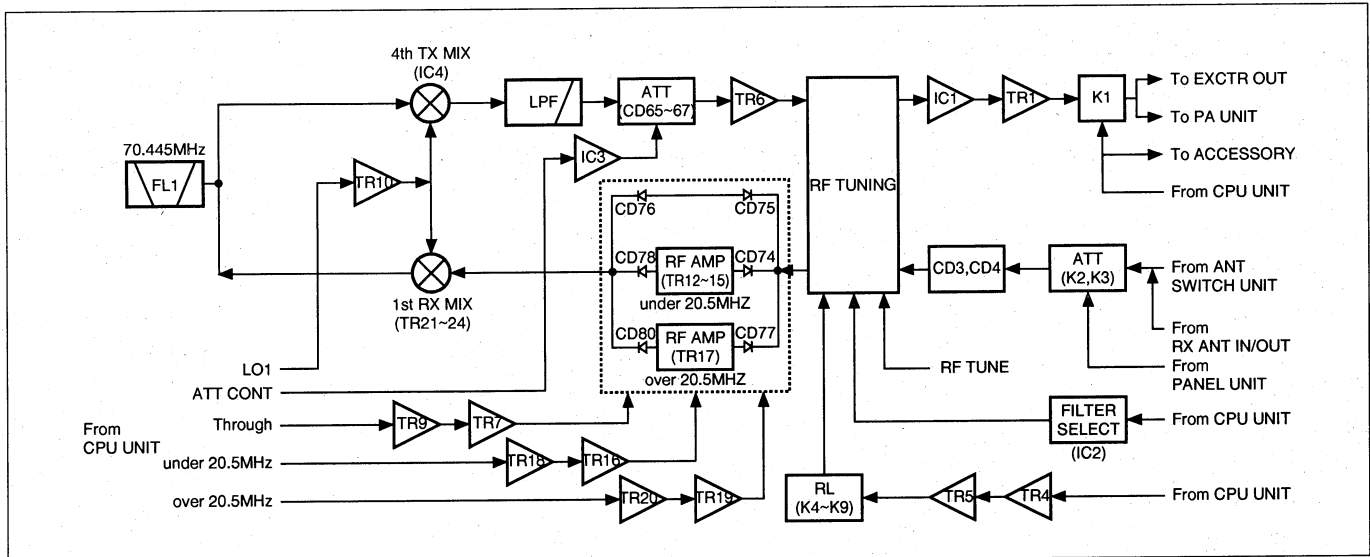


Fig.3.6 Block diagram of circuit from input/output of transmission and reception signals to 70.445 MHz filter

Receiver section

The reception signal from the antenna switch unit or the antenna input (RX ANT IN) is routed through the attenuator circuit (R10~R13) and the overload protection circuit (CD3, CD4) and is then sent to the RF tuning circuit.

The attenuator circuit comprises two relays (K2, K3). The relays are switched according to a control signal

from the panel unit, providing 4-step attenuation (0 dB, 6 dB, 12 dB, 18 dB).

The overload protection circuit routes the signal to ground if it exceeds the tolerance threshold, to protect the RF tuning circuit and other circuits.

Normally, the reception signal will be input from the antenna switch unit, but if a signal is connected to the

antenna input RCA-type jack on the rear panel, the signal from the antenna switch unit is cut off and the rear panel input signal is selected.

The reception signal supplied to the RF tuning circuit passes through various filters to remove unwanted signal components and is then sent to the RF amplifier.

The RF tuning circuit of the JST-245 comprises a total of nine filters. Eight filters are used to divide up the 100 kHz - 54 MHz range, and one filter is used for the 1.6 - 54 MHz range. The frequency division and filter types are shown in the table below. The JST-145 has seven filters, six for the 100 kHz - 30 MHz range and one for the 1.6 - 30 MHz range.

Frequency	Filter type
100kHz~0.4MHz	Low-pass filter
0.4MHz~1.6MHz	Variable tuning filter
1.6MHz~4.4MHz	
4.4MHz~12.3MHz	
12.3MHz~20.5MHz	
20.5MHz~30MHz	
30MHz~48MHz	Bandpass filter
48MHz~54MHz	Variable tuning filter
1.6MHz~54MHz	Bandpass filter

Table 3.1 Reception signals and filter type

The filters are selected by the output signal of the filter selector (IC2) and the relay (K4 - K9) drive signal which is output via TR4 and TR5. Switching is triggered by control signals from the CPU unit, according to the transmission/reception frequency.

The variable tuning filters use varicap diodes. When the applied voltage changes, the resonance frequency of the multi-tuned circuit also changes. This allows a more narrow passband width than with a conventional fixed bandpass filter, thus helping to reduce intermodulation problems. The applied voltage of the varicap diode is changed for every 100 kHz of transmission/reception frequency under control of the CPU unit.

For this reason, the RF tuning circuit is called a variable tuning circuit. The same circuit is also used for transmission.

From the RF tuning circuit, the signal reaches the RF amplifier. Here it can be divided into three routes, depending on the setting of the RF AMP ON/OFF

switch and whether the signal frequency is higher or lower than 20.5 MHz. The signal then goes to the 1st RX mixer.

A control signal from the CPU unit determines which of the three routes is used. If the RF AMP switch is OFF, the control signal passes TR9 and TR7 and turns the pass-through circuit switching diodes (CD75, CD76) on, so that the reception signal is routed to the 1st RX mixer without RF amplification.

If the RF AMP switch is ON, the amplification circuit is selected depending on whether the signal is higher or lower than 20.5 MHz. For reception signals below 20.5 MHz, the CPU unit sends a control signal via TR18 and TR19 to TR12 - TR15, which set the amplification circuit switching diodes (CD74, CD78) to ON. This RF amplification circuit is designed specifically to prevent cross modulation in the low band by means of gate grounding with four junction-type FETs.

For reception signals at 20.5 MHz and above, the CPU unit sends a control signal via TR20 and TR19 to TR17, which sets the amplification circuit switching diodes (CD77, CD80) to ON. This RF amplification circuit is designed specifically for high sensitivity in the high band, by means of a dual-gate MOS-FET.

The signal then enters the 1st RX MIX where it is mixed with the 1st local oscillator (LO1) signal from the synthesizer unit, resulting in the 1st RX IF signal (70.445 MHz).

The 1st RX MIX is a double-balanced mixer using four FETs (TR21 - TR24). The LO1 output frequency depends on the reception frequency. TR10 acts as a buffer amplifier for the LO1 signal. LO1 is also used for transmission.

The 70.445 MHz signal produced by the 1st RX MIX is sent to a monolithic filter (FL1) with a center frequency of 70.445 MHz for removal of unwanted frequency components. The monolithic filter (FL1) is also used for transmission.

■ Transmitter section

The 70.445 MHz 3rd TX IF signal from the monolithic filter (FL1) is mixed in the 4th TX MIX with the same 1st local oscillator (LO1) signal as used for reception, to produce the final transmission frequency signal. The 4th TX MIX is a double-balanced mixer circuit.

After being routed through a 54 MHz low-pass filter to remove unwanted frequency components, the converted transmission signal is sent to the attenuator circuit (ATT: CD65 - CD67). This attenuator circuit is intended to make the total gain flat over each band. It is controlled by the CPU. A control signal from the CPU is used to drive the voltage shifter IC3. After the attenuator circuit, the signal is buffered by TR6 and sent to the RF tuning circuit.

In the same way as for the reception signal, the RF tuning circuit uses various filters which are switched

according to the signal frequency. The filters block frequency components which could not be removed by the preceding low-pass filter.

After the RF tuning circuit, the transmission signal is amplified by IC1 and TR1 to the level required to drive the power amplifier unit. The amplified signal is then supplied to the power amplifier unit or to the EXCTR OUT connector on the rear panel. Which output is used depends on the status of the XVT pin of the accessory connector on the rear panel. This connector serves for use with a transverter or similar equipment.

[2] Circuit from 70.445 MHz filter to 9.455 MHz filter

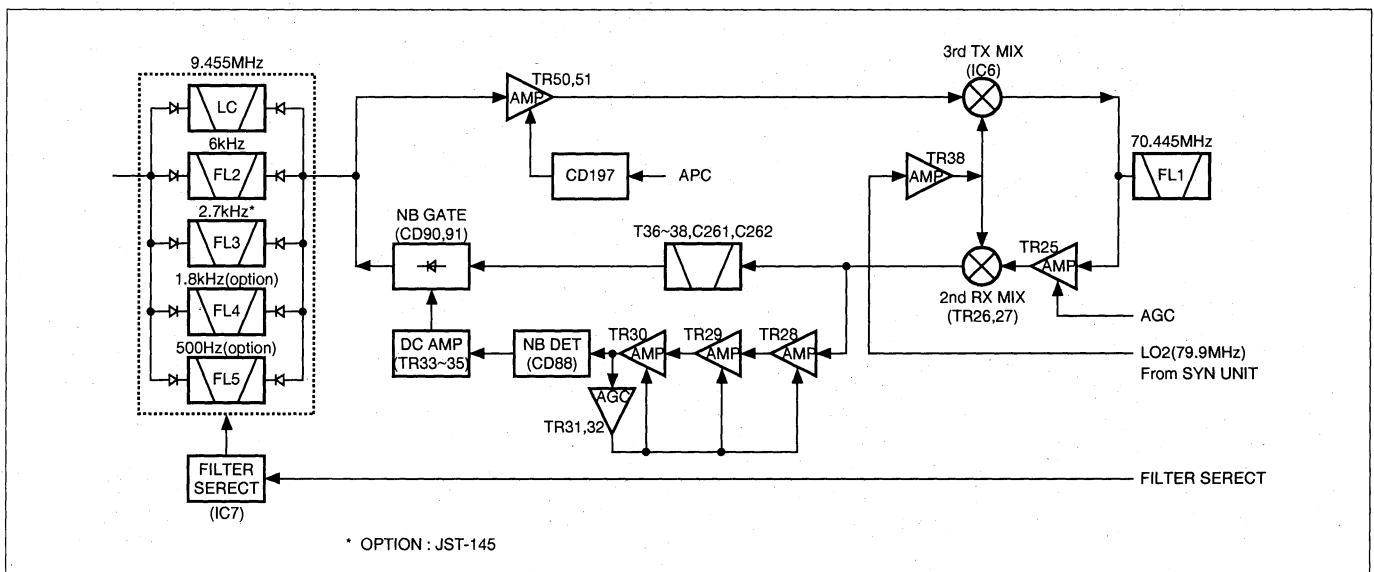


Fig.3.7 Block diagram of circuit from 70.445 MHz filter to 9.455 MHz filter

■ Receiver section

The 70.445 MHz 1st RX IF signal from the monolithic filter (FL1) is amplified in the 1st RX IF stage (TR25) and sent to the 2nd RX MIX. TR25 is a dual-gate MOSFET designed to apply auto-gain control (AGC). The AGC signal for TR25 is generated in the 4th RX IF stage, after the 4th RX MIX (TR64), and supplied to TR25 via IC19.

The 2nd RX MIX uses two FETs (TR26, TR27) in a balanced configuration. In this mixer, the 1st RX IF (70.445 MHz) signal is mixed with the 2nd local oscillator (LO2: 79.9 MHz) signal from the synthesizer unit, resulting in the 9.455 MHz 2nd RX IF signal. TR38 serves to buffer the LO2 signal before input to the 2nd RX MIX. This signal is also used for the 3rd TX MIX.

The converted 9.455 MHz 2nd RX IF signal is divided

into two lines, for the noise blanker detection circuit and the gate circuit.

In the noise blanker detection circuit, the 2nd RX IF signal is routed through a 3-stage noise amplifier (TR28 - TR30) and sent to TR31 and TR32 for AGC, so that the signal level is always constant. The signal then is sent to the noise detector (CD88).

Normally, there will be no output from the noise detector, but if the 2nd RX IF signal contains pulse noise, this is detected and the noise components only are sent to the noise amplifier (DC AMP: TR33 - TR35). This signal is amplified by a noise amplifier to a level sufficient to drive the gate circuit (NB GATE) of the noise blanker. The resulting signal is the gate drive signal.

The other branch of the 2nd RX IF signal is routed through an LC tuning circuit (T36 - T38, C261, C262) and then sent to the gate of the noise blanker. The gate

circuit is a balanced type with two diodes (CD90, CD91). Normally, the diodes are ON and the 2nd RX IF signal passes unchanged. If there is pulse noise in the signal, the gate drive signal from the abovementioned noise amplifier causes the gate to go OFF, blanking the signal.

After the gate, the 2nd RX IF signal is sent to the LC filter with a center frequency of 9.455 MHz or the crystal filters (FL2 - FL5) before being passed to the next stage.

Which IF filter is used depends on the filter selector (IC7). This IC operates according to a control signal from the CPU unit which in turn is based on the setting of the mode switches and filter selector on the front panel. These IF filters are also used for transmission.

■ Transmitter section

After passing the 9.455 MHz IF filters, the 2nd TX IF signal is routed through an attenuator and buffered by TR50 and TR51 before being supplied to the 3rd TX MIX. The circuit consisting of TR50 and TR51 receives an auto power control (APC) signal which varies the gain as required to keep the 9.455 MHz 2nd RX IF signal at the rated level.

The 3rd TX MIX is a double-balanced type consisting of a single IC (IC6). In this mixer, the 9.455 MHz 2nd RX IF signal is mixed with the 2nd local oscillator (LO2: 79.9 MHz) signal from the synthesizer unit, resulting in the 70.445 MHz 3rd RX IF signal. This signal is then sent to the monolithic filter (FL1). In FM mode, frequency conversion is applied to LO2.

[3] Circuit from 9.455 MHz filter to demodulator

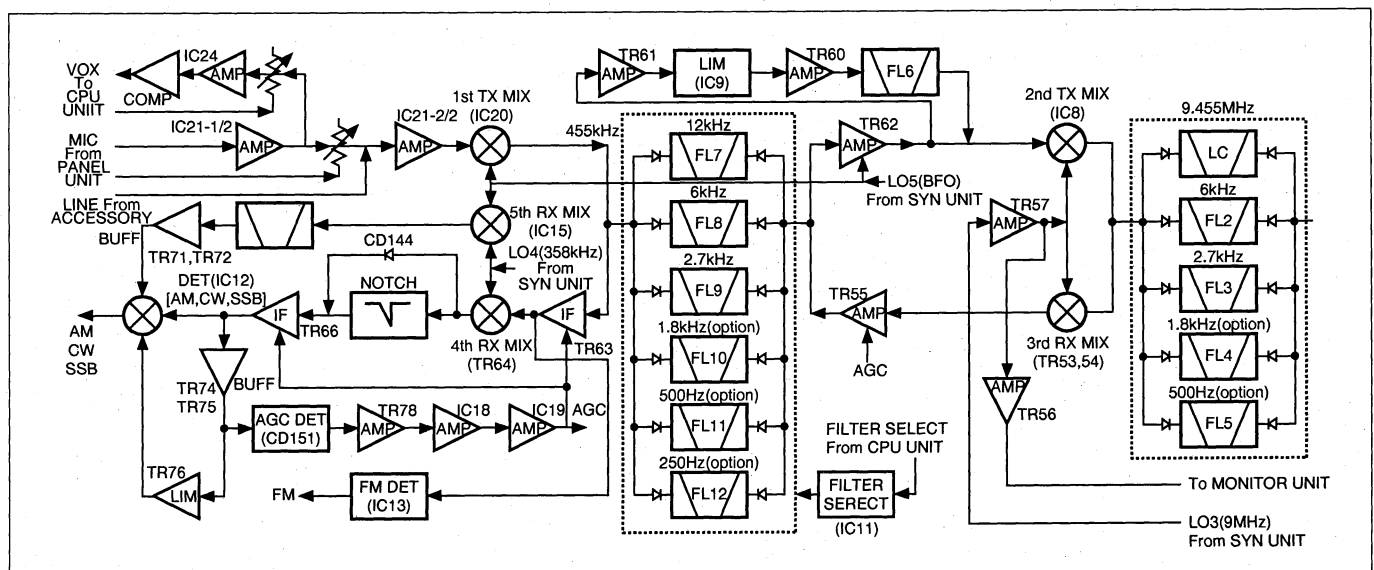


Fig.3.8 Block diagram of circuit from 9.455 MHz filter to modulator/demodulator

■ Receiver section

After passing the 9.455 MHz IF filters, the 2nd RX IF signal is sent to the 3rd RX MIX.

The 3rd RX MIX uses two FETs (TR53, TR54) in a balanced configuration. In this mixer, the 9.455 MHz 2nd RX IF signal is mixed with the 3rd local oscillator (LO3: 9 MHz) signal from the synthesizer unit, resulting in the 455 kHz 3rd RX IF signal. TR57 serves to buffer the LO3 signal before input to the 3rd RX MIX. This signal is also used for the 2nd TX mixer, and after being buffered by TR56, is output to the monitor unit.

The converted 455 kHz 3rd RX IF signal is buffered by TR55 and then sent to the crystal filters (FL7 - FL12) before being passed to the next stage.

Which IF filter is used depends on the filter selector (IC11). This IC operates according to a control signal from the CPU unit, which in turn is based on the setting of the mode switches and filter selector on the front panel. These IF filters are also used for transmission.

After passing the 455 kHz IF filters, the 3rd RX IF signal is amplified by TR63 and then divided into two lines for amplitude conversion or frequency conversion, depending on the mode.

The frequency converted 3rd RX IF signal is sent to the FM demodulator (IC13) and the demodulated audio signal is then sent to the audio amplifier.

The amplitude converted 3rd RX IF signal is sent to the 4th RX IF MIX where it is mixed with the 4th local oscillator (LO4: 358k Hz) signal from the synthesizer unit, resulting in the 4th RX IF signal (97 kHz). LO4 is also used as a carrier signal (BFO) for product detection.

The 97 kHz 4th RX IF signal is routed through the notch circuit and the IF amplifier (TR66) and sent to the double-balanced mixer (IC12) for detection and demodulation. The notch circuit uses a fixed frequency, but LO4 is variable, which in effect allows the notch point to be varied. When this circuit is OFF, CD144 acts as a pass-through circuit.

After passing TR66, the 4th RX IF signal is buffered by TR74 and TR75 and also sent to the AGC detector (CD151). The AGC signal produced here is amplified by TR78, IC18, and IC19 and applied to TR25, TR55, TR63 and TR66. This signal also serves as drive signal for the signal strength meter.

In the AM mode, the double-balanced mixer (IC12) operates as sync detector, and in other modes as product detector. The carrier signal required for sync detection is obtained by routing the 4th RX IF signal via the buffers TR74 and TR75 through a limiter circuit (TR76).

The carrier signal for product detection is obtained by mixing the LO4 signal and the LO5 signal in the 5th RX IF MIX (IC15). After filtering, this double-balanced mixer sends the converted carrier signal via buffers TR71 and TR72 to IC12. LO5 is also used as modulation carrier signal during transmission.

■ Transmitter section

In amplitude modulated modes, the audio signal from the microphone connector on the panel unit is amplified by IC21 (1/2). After level adjustment by the MIC gain control on the panel unit, the signal is further amplified by IC21 (1/2) and sent to the 1st TX MIX. The line signal from the accessory connector on the rear panel is handled like the microphone signal.

The 1st TX MIX (IC20) is a double-balanced circuit which mixes the audio signal with the carrier signal (BFO signal) from LO5. This balanced modulation results in the 455 kHz 1st TX IF signal.

The frequency of the local oscillator LO5 depends on the mode, as shown below.

Mode	LO5
LSB	456.5 kHz
USB	453.5 kHz
AM	453.5 kHz
AFSK	457.21 kHz

Table 3.2 LO5 frequency in various modes

The 1st TX IF signal is a double sideband signal (DSB) with lower and upper sidebands (LSB and USB). This signal is routed through the 455 kHz IF filters (FL7 - FL12) for removal of unwanted sideband components, leaving either an LSB or a USB signal. However, in CW, AM, and FM mode, a carrier signal is required. Therefore the signal is returned to the carrier adder circuit (TR62) after the IF filters, and LO5 is added again.

After passing TR62, the 1st TX IF signal is sent to the 2nd TX MIX. If the COMP (compressor) switch on the front panel is ON, the speech processor circuit (TR61, IC9, TR60, FL6) is inserted into the path before the signal enters the 2nd TX MIX.

The 2nd TX MIX (IC8) is a double-balanced circuit which mixes the 1st TX IF signal with the LO3 (9 MHz) signal, resulting in the 2nd TX IF signal. This signal is routed through the 9.455 MHz IF filters (FL1 - FL5) and sent to the next stage.

[4] Circuit from receiver section to audio frequency (AF) amplifier

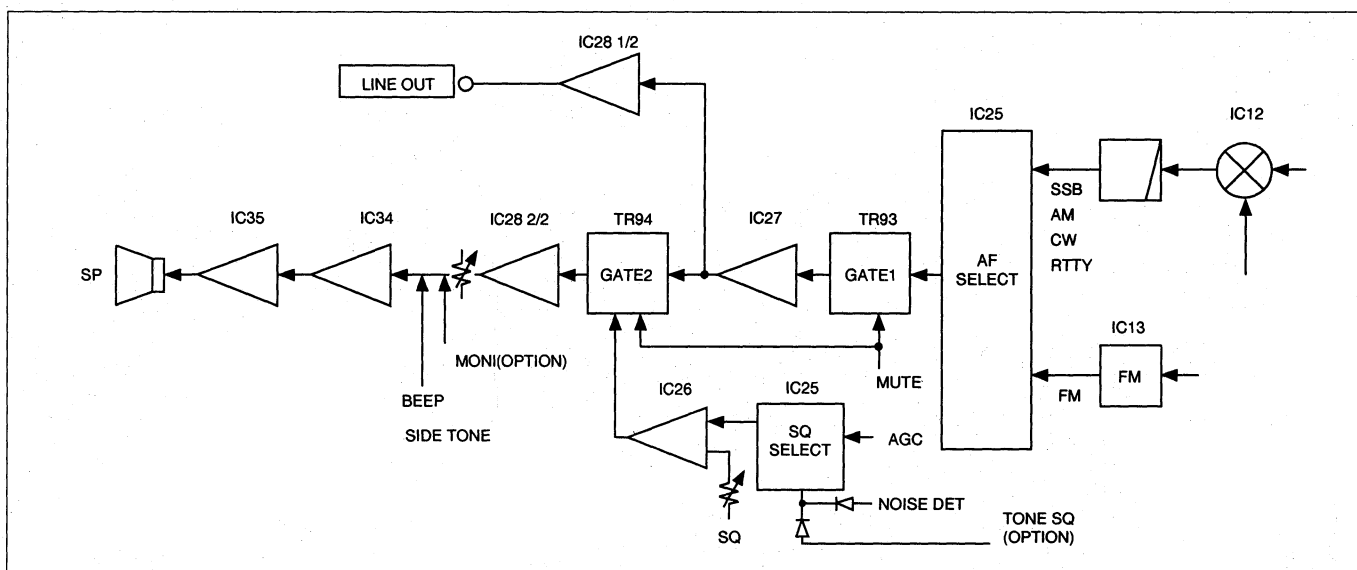


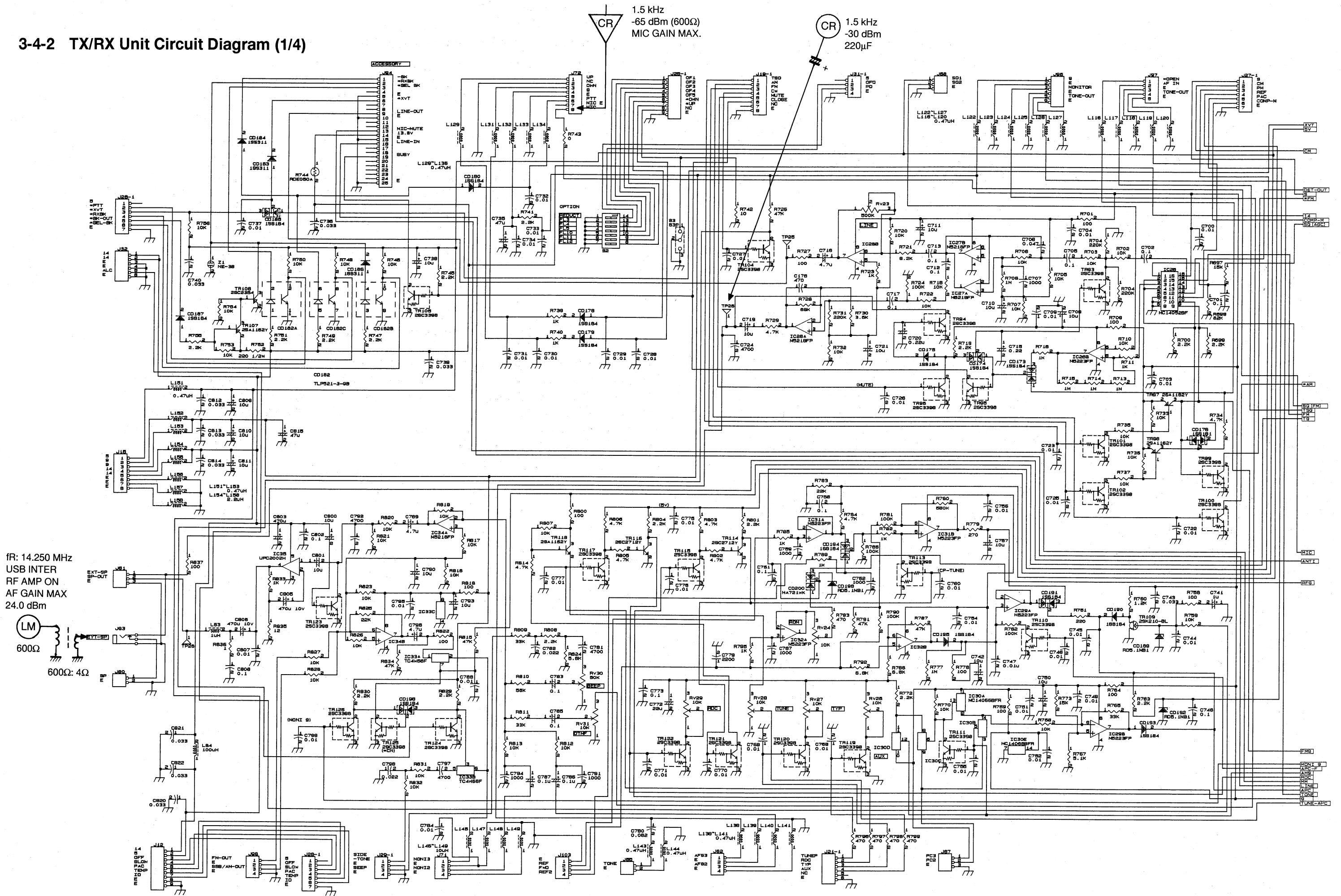
Fig.3.9 Block diagram of low frequency (AF) amplifier in receiving section

The output signals from the AM demodulator (IC12) and FM demodulator (IC13) are supplied to the AF signal selector (IC25) where the demodulator output is selected according to the reception mode. The demodulator output (AF signal) is then amplified by IC27 and split into two lines. One line goes to IC28 (2/

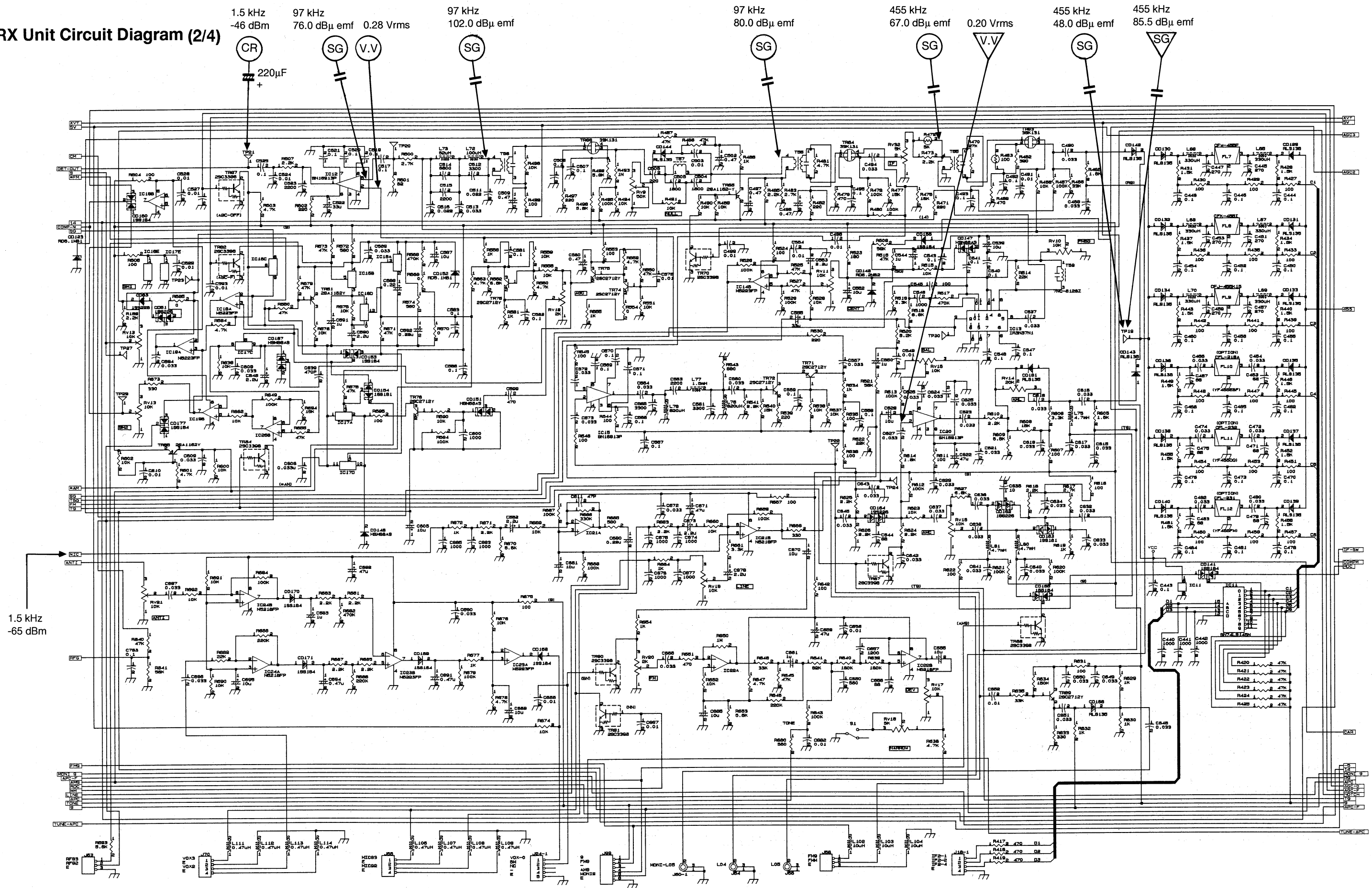
2), then to the AF gain control of the panel unit, and finally to IC34 and IC35 for further amplification before being used to drive the speaker.

The other line is amplified by IC28 (1/2) and supplied to the accessory connector on the rear panel as the LINE OUT signal.

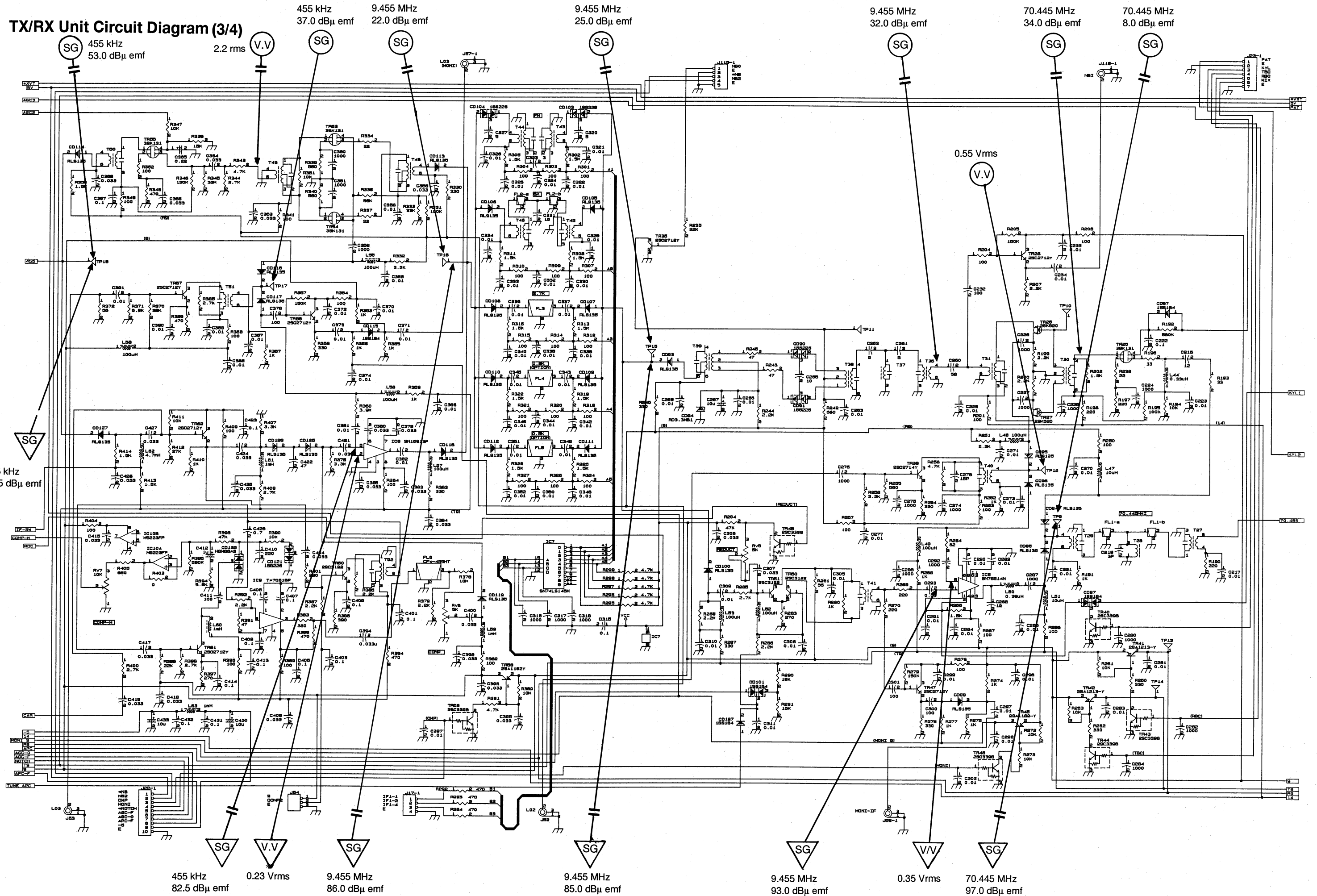
3-4-2 TX/RX Unit Circuit Diagram (1/4)



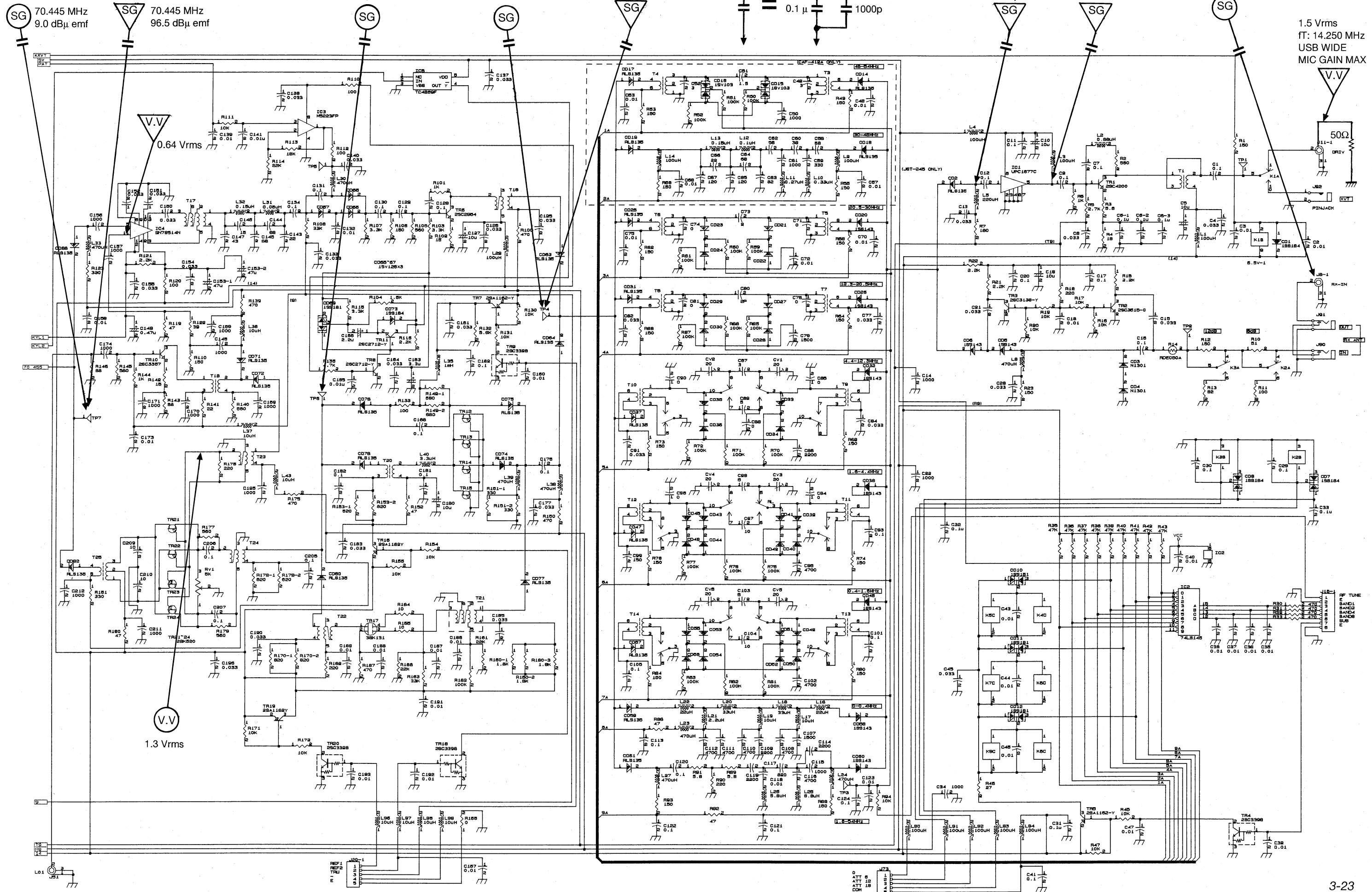
TX/RX Unit Circuit Diagram (2/4)



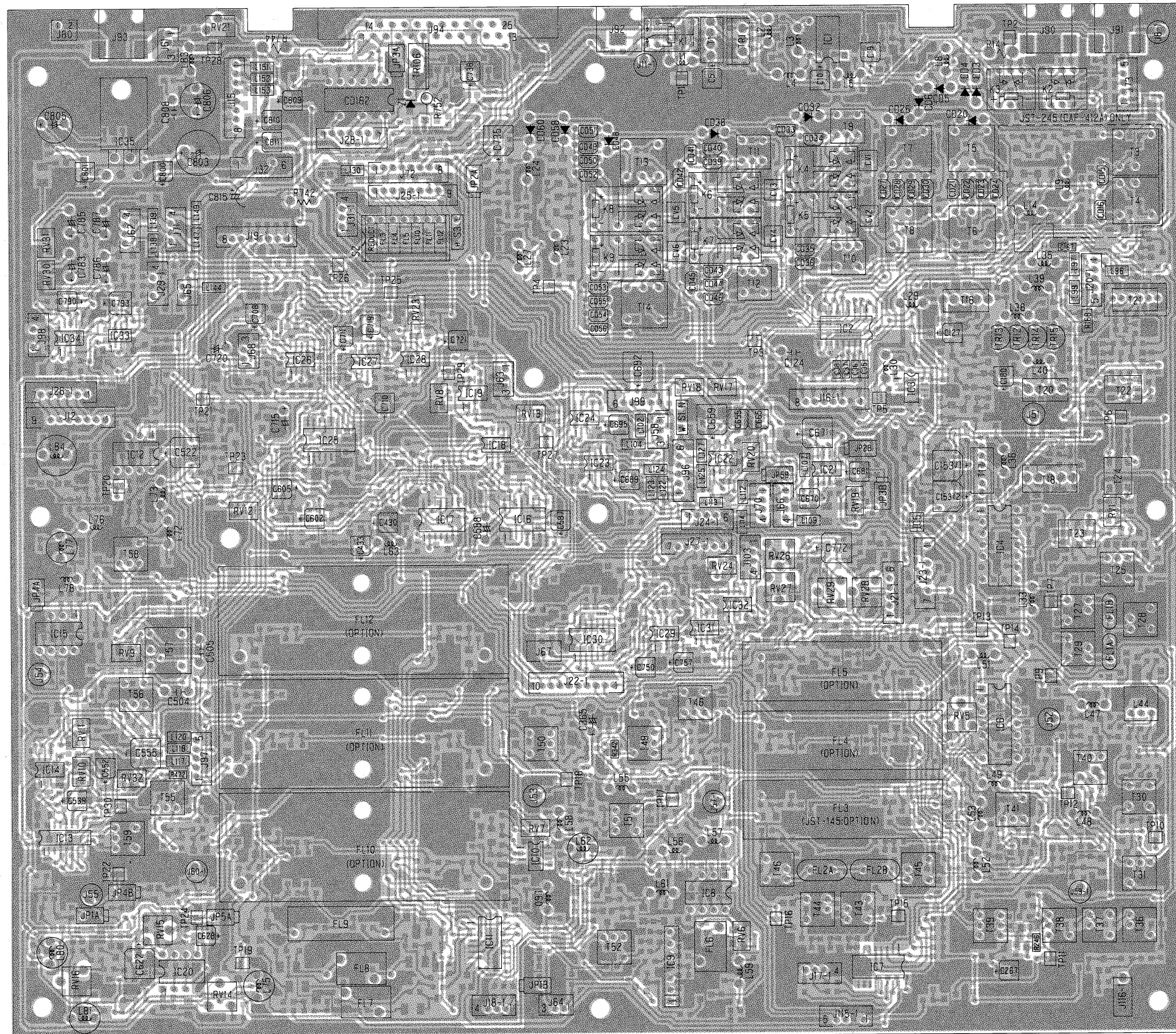
TX/RX Unit Circuit Diagram (3/4)



TX/RX Unit Circuit Diagram (4/4)



3-4-3 TX/RX Unit PCB Diagram (Component Side)



Parts No.	IC1								TR9				TR10				TR12				TR13			
Pin No.	1	2	3	4	5	6	7	8	1 (B)	2 (C)	3 (E)	RF AMP	1 (B)	2 (E)	3 (C)	D	S	G	D	S	G	D	S	G
Voltage	1.2V	GND	GND	GND	4.3V	GND	GND	4.5V	0V	8.9V	GND	ON	2.3V	3.0V	8.3V	3.0V	13.0V	GND	3.0V	13.0V	GND	3.0V	13.0V	GND
Remarks	TRANSMITTING								RECEIVING				RECEIVING				RECEIVING				RECEIVING			

Parts No.	TR14								TR15				TR17				TR21				TR22				TR24			
Pin No.	S	D	G	S	D	G	1 (S)	2 (D)	3 (G2)	4 (G1)	2 (S)	1 (D)	3 (G)	2 (S)	1 (D)	3 (G)	2 (S)	1 (D)	3 (G)	2 (S)	1 (D)	3 (G)	2 (S)	1 (D)	3 (G)	2 (S)	1 (D)	3 (G)
Voltage	3.0V	13.0V	GND	3.0V	13.0V	GND	0.3V	13.5V	0V	0V	5.0V	12.4V	0V	5.0V	12.4V	0V	5.0V	12.4V	0V	5.0V	12.4V	0V	5.0V	12.4V	0V	5.0V	12.4V	0V
Remarks	RECEIVING								RECEIVING				RECEIVING				RECEIVING				RECEIVING				RECEIVING			

Parts No.	IC3								IC4													
Pin No.	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Voltage	3.2V	1.7V	1.7V	GND	NC	NC	NC	13.4V	0V	12.2V	9.2V	8.7V	5.6V	GND	0V	0V	5.6V	8.7V	8.7V	8.7V	9.2V	0V
Remarks	TRANSMITTING								TRANSMITTING													

Parts No.	IC5								TR2				TR3				TR6				TR8				TR11			
Pin No.	1	2	3	4	5	1 (B)	2 (E)	3 (C)	1 (B)	2 (E)	3 (C)	1 (B)	2 (E)	3 (C)	1 (B)	2 (E)	3 (C)	1 (B)	2 (E)	3 (C)	1 (B)	2 (E)	3 (C)	1 (B)	2 (E)	3 (C)	1 (B)	2 (E)
Voltage	NC	4.9V	GND	0	4.9V	0.7V	GND	0V	0.7V	GND	0V	1.17V	0.5V	13.5V	0V	1.17V	0.5V	13.5V	0V	1.17V	0.5V	13.5V	0V	1.17V	0.5V	13.5V	0V	1.17V
Remarks	RECEIVING								RECEIVING				RECEIVING				RECEIVING				RECEIVING				RECEIVING			

Parts No.	IC2																J16-1
Pin No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	7
Voltage	H	L	H	H	H	H	H	GND	H	H	NC	L	L	L	H	5V	under 0.4MHz
	H	H	L	H	H	H	H	GND	H	H	NC	L	L	L	H	5V	0.4~0.799MHz
	H	H	L	H	H	H	H	GND	H	H	NC	L	L	L	H	5V	0.8~1.599MHz
	H	H	L	H	H	H	H	GND	H	H	NC	L	L	L	H	5V	1.6~2.649MHz
	H	H	H	L	H	H	H	GND	H	H	NC	L	L	L	H	5V	2.65~4.399MHz
	H	H	H	H	L	H	H	GND	H	H	NC	L	L	L	L	5V	4.4~7.399MHz
	H	H	H	H	L	H	H	GND	H	H	NC	L	L	L	L	5V	7.4~12.299MHz
	H	H	H	H	L	L	H	GND	H	H	NC	L	L	L	L	5V	12.3~20.499MHz
	H	H	H	H	H	H	L	GND	H	H	NC	L	L	L	L	5V	20.5~29.999MHz
	H	H	H	H	H	H	H	GND	L	H	NC	L	L	L	L	5V	30.0~47.999MHz
	H	H	H	H	H	H	H	GND	H	L	NC	L	L	L	L	5V	48.0~53.999MHz
	L	H	H	H	H	H	H	GND	H	H	NC	L	L	L	L	5V	1.6~53.999MHz
Remarks	Frequency Select																

H: 11.0V L: 0V

H: 5.0V L: 0V

Parts No.	TR4						TR5			TR7			
Pin No.	1 (B)	2 (C)	3 (E)	1 (B)	2 (E)	3 (C)	CONTROL			1 (B)	2 (E)	3 (C)	AGC
Voltage	4.9V	0V	GND	12.7V	13.5V	13.5V	SUB ON			8.8V	8.8V	0V	ON
Voltage	0V	13.5V	GND	13.5V	13.5V	0.2V	SUB OFF			8.0V	8.8V	8.7V	OFF
Remarks	RECEIVING							RECEIVING			RECEIVING		

Parts No.		TR16			TR18			TR19			TR20				
Pin No.		1 (B)	2 (E)	3 (C)	1 (B)	2 (C)	3 (E)	1 (B)	2 (E)	3 (C)	1 (B)	2 (C)	3 (E)	Frequency	
Voltage		12.8V	13.5V	13.5V	4.8V	0V	GND	13.5V	13.5V	0V	0V	13.5V	GND	20.5MHz max	
Voltage		13.5V	13.5V	0V	0V	13.5V	GND	12.8V	13.5V	13.5V	4.8V	0V	GND	20.5MHz min	

Parts No.	J73								ATT Select			
Pin No.	1	2	3	4	5	6	7	8	1	2	3	4
Voltage	H	L	L	L	L	L	L	L	L	L	L	L
Voltage	L	H	L	L	L	L	L	L	L	L	L	L
Voltage	L	L	L	L	L	L	L	L	L	L	L	L
Voltage	L	L	L	L	L	L	L	L	L	L	L	L
Remarks	ATT Select								ATT Select			

H: 13.0V L: 0V

Parts No.		IC6														IC8							
Pin No.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	1	2	3	4	5	6	7	8
Voltage		0V	8.2V	6.3V	6.3V	4.0V	GND	0V	0V	4.0V	6.3V	6.3V	6.3V	NC	0V	6.4V	3.8V	2.7V	GND	2.7V	3.8V	3.8V	7.7V
Remarks		TRANSMITTING														TRANSMITTING							

IC9														IC7																						
Parts No.		TR25							TR26							TR27							TR28							TR35						
Pin No.		1	2	3	4	5	6	7	S	D	G2	G1	D	S	G	D	S	G	1 (B)	2 (E)	3 (C)	1 (B)	2 (E)	3 (C)	1 (B)	2 (E)	3 (C)									
Voltage		1.9V	1.9V	7.1V	GND	8.0V	1.9V	1.9V	1.3V	12.3V	3.0V	1.1V	13.0V	5.3V	0V	13.0V	5.3V	0V	6.6V	6.0V	8.6V	0V	GND	8.6V	0V	GND	4.8V									
Remarks		TRANSMITTING (COMP)														RECEIVING							RECEIVING							RECEIVING						

IC9														IC7																					
Parts No.	TR38							TR40							TR41							TR42							TR43						
Pin No.	1 (B)	2 (E)	3 (C)	1 (B)	2 (C)	3 (E)	Remarks	1 (B)	2 (E)	3 (C)	Remarks	1 (B)	2 (E)	3 (C)	Remarks	1 (B)	2 (E)	3 (C)	Remarks	1 (B)	2 (C)	3 (E)	Remarks												
Voltage	1.6V	1.1V	7.7V	0V	8.6V	GND	TRANSMITTING	8.8V	8.8V	0V	TRANSMITTING	8V	8.8V	8.8V	TRANSMITTING	8.8V	8.8V	8.8V	TRANSMITTING	8.8V	8.8V	8.8V	TRANSMITTING												
Remarks	RECEIVING							4.8V	0V	GND	RECEIVING	8V	8.8V	8.8V	RECEIVING	8.8V	8.8V	0V	RECEIVING	4.9V	0V	GND	RECEIVING												

IC9														IC7																												
Parts No.	TR44							TR45							TR46							TR47							TR48							TR57						
Pin No.	1 (B)	2 (C)	3 (E)	Remarks				1 (B)	2 (E)	3 (C)	MONI knob at MAX	1 (B)	2 (C)	3 (E)	MONI knob at MAX	1 (B)	2 (E)	3 (C)	1 (B)	2 (C)	3 (E)	1 (B)	2 (C)	3 (E)	1 (B)	2 (C)	3 (E)	1 (B)	2 (E)	3 (C)												
Voltage	4.9V	0V	GND	TRANSMITTING				8V	8.8V	8.8V	ON	4.9V	0V	GND	ON	4.9V	0V	GND	0V	8.8V	8.8V	2V	8.2V	0V	8.8V	GND	1.9V	1.4V	8.6V													
Voltage	0V	8.8V	GND	RECEIVING				0V	8.8V	8.8V	OFF	0V	8.8V	GND	OFF	0V	8.8V	GND	OFF	TRANSMITTING							RECEIVING															

IC9														IC7								
Parts No.	TR50														TR51							
Pin No.	1 (B)	2 (E)	3 (C)	Remarks		1 (B)	2 (E)	3 (C)	Remarks		1 (B)	2 (E)	3 (C)	Remarks								
Voltage	2.8V	2.1V	8.4V	TRANSMITTING		2.8V	2.1V	8.4V	TRANSMITTING		2.8V	2.1V	8.4V	TRANSMITTING								
Voltage	0.2V	0V	8.8V	RECEIVING		0.2V	0V	8.8V	RECEIVING		0.2V	0V	8.8V	RECEIVING								

IC9														IC7							
Parts No.	TR53				TR54				TR55				TR56								
Pin No.	1 (S)	2 (D)	3 (G2)	4 (G1)	1 (S)	2 (D)	3 (G2)	4 (G1)	1 (S)	2 (D)	3 (G2)	4 (G1)	1 (B)	2 (E)	3 (C)						
Voltage	2.2V	8.0V	2.2V	2.2V	2.2V	8.0V	2.2V	2.2V	2.0V	8.4V	3 (G2)	1.8 (G1)	2.6V	2.0V	8.2V						
Remarks	Rx				Rx				Rx				RECEIVING								

IC9														IC7																	
Parts No.		TR58						TR59						TR60						TR61						TR62					
Pin No.		1 (B)	2 (E)	3 (C)	COMP	1 (B)	2 (C)	3 (E)	COMP	1 (B)	2 (E)	3 (C)	COMP	1 (B)	2 (E)	3 (C)	COMP	1 (B)	2 (E)	3 (C)	COMP	1 (B)	2 (E)	3 (C)	COMP	1 (B)	2 (E)	3 (C)	COMP		
Voltage		8.0V	8.8V	8.8V	ON	4.8V	0V	GND	ON	2.4V	1.6V	6.8V	ON	0V	0V	8.8V	OFF	0V	0V	8.8V	OFF	0V	0V	8.8V	OFF	0V	0V	8.8V	OFF		
Remarks		TRANSMITTING						TRANSMITTING						TRANSMITTING						TRANSMITTING						RECEIVING					
		COMP knob at MAX						COMP knob at MAX						COMP knob at MAX						COMP knob at MAX											

Parts No.		IC7																
Pin No.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Filter
Voltage		L	H	H	H	H	NC	NC	GND	NC	NC	NC	GND	L	L	L	5V	FL1 (LC)
		H	L	H	H	H	NC	NC	GND	NC	NC	NC	GND	L	L	H	5V	FL2 (6kHz)
		H	H	L	H	H	NC	NC	GND	NC	NC	NC	GND	L	H	L	5V	FL3 (2.7kHz)
		H	H	H	L	H	NC	NC	GND	NC	NC	NC	GND	L	H	H	5V	FL4 (1.8kHz)
		H	H	H	H	L	NC	NC	GND	NC	NC	NC	GND	H	L	L	5V	FL5 (500Hz)
Remarks		9.455MHz IF Filter Select																

Parts No.		IC12								IC13															
Pin No.	1	2	3	4	5	6	7	8		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Voltage	5.7V	3.4V	2.4V	GND	2.4V	3.4V	3.4V	6.9V		4.5V	3.8V	4.2V	4.5V	3.4V	3.4V	3.4V	4.5V	2.2V	0.8V	1.2V	4.5V	0V	0V	GND	GND
Remarks																									
	RECEIVING									RECEIVING															

Parts No.		IC14						
Pin No.	1	2	3	4	5	6	7	8
Voltage	NC	NC	NC	GND	2.3V	2.3V	2.0V	8.8V
Remarks	RECEIVING							

Parts No.		IC15							
Pin No.		1	2	3	4	5	6	7	8
Voltage		5.6V	3.0V	2.4V	GND	2.3V	3.3V	3.3V	6.7V
Remarks		RECEIVING (MIX)							

[illegible]

Parts No.		IC18										IC19									
Pin No.		1	2	3	4	5	6	7	8	Remarks		1	2	3	4	5	6	7	8	Remarks	
Voltage		4.9V	4.9V	4.9V	GND	NC	NC	NC	8.5V	TRANSMITTING		0.6V	0.6V	0.6V	GND	0V	0V	0V	8.5V	TRANSMITTING	
		4.9V	4.9V	4.7V	GND	NC	NC	NC	8.5V	RECEIVING		4.9V	4.9V	4.9V	GND	0V	0V	0V	8.5V	RECEIVING	

Parts No.		IC20								IC21								IC22							
Pin No.		1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Voltage		6.4V	3.8V	2.7V	GND	2.7V	3.8V	3.8V	7.7V	4.3V	4.3V	4.3V	4.3V	GND	4.3V	4.3V	8.6V	4.6V	4.6V	4.6V	4.6V	GND	4.3V	4.5V	8.6V
Remarks		TRANSMITTING								TRANSMITTING								TRANSMITTING							

Parts No.	When VOX is ON and a signal is input								IC24							
Pin No.	1	2	3	4	5	6	7	8								
Voltage	7V	2.7V	6V	GND	3.8V	3.8V	7V	8.5V	1	2	3	4	5	6	7	8
Remarks	TRANSMITTING								TRANSMITTING							

Parts No.		IC26 FM only															
Pin No.		1	2	3			4		5		6		7		8		Remarks
				FM	FSK	Others											
Voltage		4.9V	4.9V	5.4V	4.1V	0V	TRANSMITTING	GND	NC	NC	NC	NC	NC	NC	NC	8.4V	TRANSMITTING
		4.9V	4.9V	4.1V	4.1V	4.1V	RECEIVING	GND	NC	NC	NC	NC	NC	NC	NC	8.4V	RECEIVING

Parts No.	TR63					TR64					TR65				TR66					TR67			
	S	D	G2	G1	Remarks	S	D	G2	G1	Remarks	1 (B)	2 (E)	3 (C)	NOTCH	S	D	G2	G1	Remarks	1 (B)	2 (C)	3 (E)	Remarks
Voltage	3.2V	12.2V	5V	3V	TRANSMITTING	1.7V	12.6V	2.0V	1.7V	TRANSMITTING	13.5V	13.5V	-5V	ON	0.4V	4.7V	0.3V	1.1V	TRANSMITTING	4.9V	0V	GND	TRANSMITTING
	0.8V	13.1V	0.6V	3.2V	RECEIVING	1.7V	12.6V	2.0V	1.7V	RECEIVING	12.8V	13.5V	13.5V	OFF	1.3V	4.2V	2.5V	1.1V	RECEIVING	0V	8.8V	GND	RECEIVING

[illegible]

Parts No.		TR82				TR84				TR85				TR87								
Pin No.	1 (B)	2 (C)	3 (E)	AGC	1 (B)		2 (C)		3 (E)		1 (B)		2 (E)		3 (C)		1 (B)		2 (C)		3 (E)	
Voltage	4.9V	0V	GND	FAST,OFF	Tx	Rx	Rx	Tx	Rx		AM only	Others			AM only	Others	Tx	Rx	Tx	Rx		
Remarks	0V	8.8V	GND	SLOW	8.8V	0V	0V	5.5V	GND	8V	8.8V	8.9V	8V	8.9V	8V	0V	8.8V	0V	0V	8.7V	GND	

Parts No.	TR88			TR89			TR90			TR91			
Pin No.	1 (B)		2 (C)	3 (E)	1 (B)	2 (E)	3 (C)	1 (B)	2 (C)	3 (E)	1 (B)	2 (E)	3 (C)
Voltage	AM	Others	AM	Others	2.6V	1.9V	8.2V	0V	0V	GND	0V	0V	GND
Remarks	8.8V	0V	0V	8.5V	GND	TRANSMITTING		TRANSMITTING		TRANSMITTING		TRANSMITTING	

Parts No.	IC11																Filter
Ptn No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
	L	H	H	H	H	H	H	GND	NC	NC	NC	GND	L	L	L	4.9V	FL7 (12kHz)
	H	L	H	H	H	H	H	GND	NC	NC	NC	GND	L	L	H	4.9V	FL8 (6kHz)
	H	H	L	H	H	H	H	GND	NC	NC	NC	GND	L	H	L	4.9V	FL9 (2.4kHz)
	H	H	H	H	H	H	H	GND	NC	NC	NC	GND	L	H	H	4.9V	FL10 (1.8kHz)
	H	H	H	H	L	H	H	GND	NC	NC	NC	GND	H	L	L	4.9V	FL11 (500Hz)
	H	H	H	H	H	L	H	GND	NC	NC	NC	GND	H	L	H	4.9V	FL12 (300Hz)
Remarks	455KHz IF Filter Select																

H: 7.0V
L: 0V

Parts No.		TR70			
Pin No.	1 (B)	2 (C)	3 (E)	NOTCH	
Voltage	0V	13.5V	GND	ON	
Voltage	4.9V	0V	GND	OFF	
Remarks	RECEIVING				

H: 5V
L: 0V

When TSQ of IC 25 is ON										
Pin No.	1	2	3	4	5	6	7	8	9	10
Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx	Rx
FM	4.2V	4.2V	4.1V	5.4V	4.1V	NC	GND	GND	8.8V	8.8V
FSK	4.2V	4.2V	4.1V	5.4V	2.8V	NC	GND	GND	0V	0V
AM	0V	4.2V	5.4V	4.1V	0V	NC	GND	GND	0V	0V
CW	0V	4.2V	5.4V	2.9V	0V	NC	GND	GND	0V	0V
SSB	0V	4.2V	5.4V	2.7V	0V	NC	GND	GND	0V	0V

When TSQ of IC 25 is ON										
Pin No.	11	12	13	14	15	16				
Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx			
FM	0V	0V	0V	NC	NC	0V	8.9V	8.9V		
FSK	0V	0V	0V	NC	NC	0V	8.9V	8.9V		
AM	0V	0V	0V	NC	NC	0V	8.9V	8.9V		
CW	0V	0V	0V	NC	NC	0V	8.9V	8.9V		
SSB	0V	0V	0V	NC	NC	0V	8.9V	8.9V		

IC27										
Pin No.	1	2	3	4	5	6	7	8	IC29	
Voltage	4.3V	3.9V	GND	NC	NC	8.4V	4.6V	4.2V	4.0V	GND
Remarks	RECEIVING									

IC30										
Pin No.	1	2	3	4	5	6	7	8	IC33	
Voltage	8.8V	0V	0V	8.8V	74.5mV	8.8V	0V	0V	0V	0V
AM	8.4V	8.1V	5.7V	8.8V	5V	8.4V	5.7V	8.1V	0V	8.8V
その他	8.6V	3.9V	4.0V	8.6V	0V	8.6V	0V	0V	8.8V	0V
Remarks	RECEIVING (AUX)									

IC31										
Pin No.	1	2	3	4	5	6	7	8	IC34	
Voltage	0V	0V	0V	GND	0V	0V	0V	8.7V	4.3V	4.3V
Remarks	RECEIVING									

IC32										
Pin No.	1	2	3	4	5	6	7	8	IC35	
Voltage	0V	0V	0V	GND	0V	0V	0V	8.7V	4.3V	4.3V
Remarks	RECEIVING									

IC33										
Pin No.	1	2	3	4	5	6	7	8	IC36	
Voltage	0V	0V	0V	GND	0V	0V	0V	8.7V	4.3V	4.3V
Remarks	RECEIVING									

IC37										
Pin No.	1	2	3	4	5	6	7	8	IC38	
Voltage	0V	0V	0V	GND	0V	0V	0V	8.7V	4.3V	4.3V
Remarks	RECEIVING									

IC39										
Pin No.	1	2	3	4	5	6	7	8	IC40	
Voltage	0V	0V	0V	GND	0V	0V	0V	8.7V	4.3V	4.3V
Remarks	RECEIVING									

Parts No.	TR105			TR109			TR110			TR120			TR123			IC26							
Pin No.	1 (B)	2 (C)	3 (E)	D	S	G	1 (B)	2 (C)	3 (E)	1 (B)	2 (C)	3 (E)	1 (B)	2 (C)	3 (E)	1	2	3	4	5	6	7	8
Voltage	4.2V	0V	GND	0V	GND	0V	0V	0V	GND	4.7V	0V	GND	0V	0V	GND	0V	4.9V	0V	GND	0V	0V	0V	8.8V
Remarks	RECEIVING			RECEIVING			RECEIVING			Tx			RECEIVING			TRANSMITTING							

H: 5.0V
L: 0V

Parts No.	S2														Option Filter Select							
Pin No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Filter							
Voltage	GND	GND	GND	GND	GND	GND	GND	GND	H	H	H	H	H	L	REDUCT	FL3	FL4	FL5	FL10	FL11	FL12	
Remarks	Option Filter Select																					

TR95										TR96									
1 (B)			3 (E)			2 (C)				1 (B)			3 (E)			2 (C)			
FM	6.2V	0V	GND	GND	GND	0V	4.3V			0V	4.9V	GND	GND	GND	6.4V	0V			
AM	0V	0V	GND	GND	GND	4.3V	4.3V			0V	4.9V	GND	GND	GND	6.4V	0V			
CW	0V	0V	GND	GND	GND	4.3V	4.3V			0V	4.9V	GND	GND	GND	6.4V	0V			
FSK	0V	0V	GND	GND	GND	4.3V	4.3V			0V	4.9V	GND	GND	GND	6.4V	0V			
SSB	0V	0V	GND	GND	GND	4.3V	4.3V			0V	4.9V	GND	GND	GND	6.4V	0V			
	Tx	Rx	Tx	Rx	Rx	Tx	Rx			Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx		
	FM									FM	FM	FM	FM	FM	FM	FM	FM		
	TSQ	TSQ					TSQ			CSQ					TSQ	CSQ			
	6.5V	4.7V					0V			0V					6.6V	6.4V			
	CSQ																		
	6.2V																		

3-5 Synthesizer Unit (CGH-192A/JST-245, B/JST-145)

3-5-1 Synthesizer Unit Circuit Description

[1] Reference oscillator

All frequencies in the synthesizer unit of the JST-145/JST-245 are generated by a single oscillator. This reference oscillator consists of a crystal oscillator, frequency divider, filter circuits and buffer circuits. It

provides the 20 MHz, 10 MHz and 2 MHz frequency components used internally by the unit.

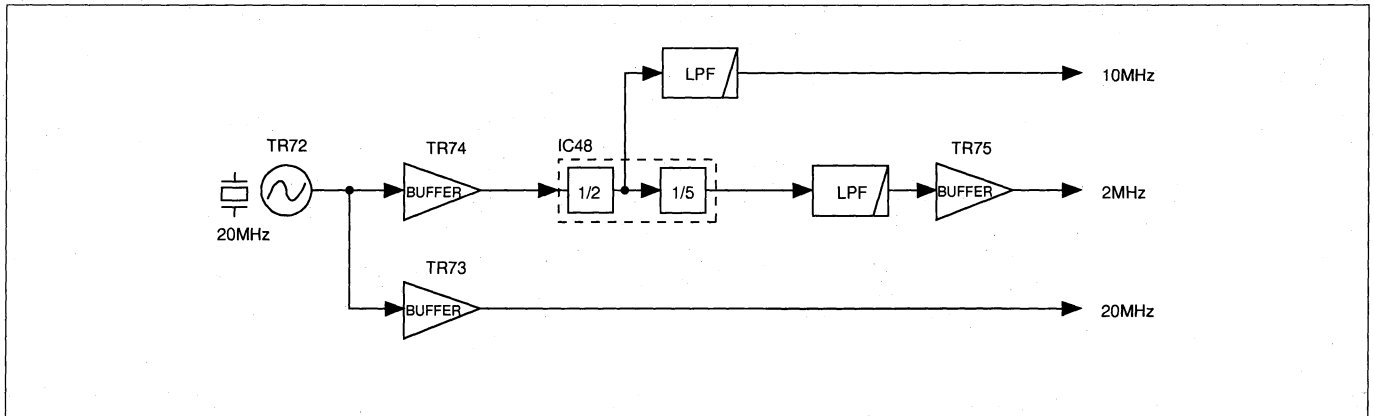


Fig.3.10 Reference Oscillator Block Diagram

TR72 is used for the 20 MHz reference signal. The output is buffered by TR73 and supplied to the other circuits. It is also buffered by TR74 and sent to the frequency divider IC48, which divides it first by 2 and then by 5. The 10 MHz signal obtained by the 1/2

division is routed through a low-pass filter. The 2 MHz signal obtained by the 1/5 division is also routed through a low-pass filter, buffered by TR75 and supplied to the respective circuits.

[2] 1st local oscillator (LO1)

In the 1st local oscillator, a direct digital synthesizer (DDS), phase-locked loop (PLL) and mixer circuit are used to generate a signal with a frequency range of 70.545 to 124.444998 MHz in 2-Hz steps, which serves as LO1 signal.

[2-1] DDS section (1055.000 - 555.002 kHz)

First, the main IC of the DDS section, IC27 generates a signal with a range of 1055.000 to 555.002 kHz in 2-Hz steps. The DDS consists of IC27, D/A converters RA4 and RA5, constant-current circuit IC29, TR23, TR24, and comparator IC30.

To write frequency data to IC27, the CPU sends 8-bit parallel data. IC27 directly synthesizes the required signal from these data.

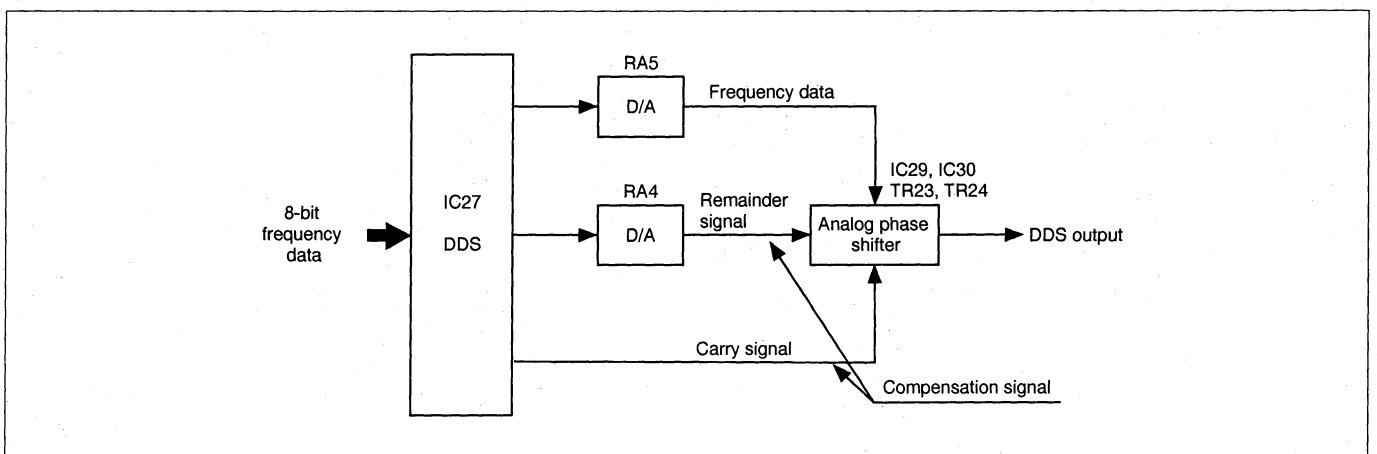


Fig.3.11 DDS Circuit Block Diagram

The frequency data output of IC27 is converted into analog form by the ladder-type converter RA4 and then sent to IC30. Since this output still contains jitter components, two types of compensation signals are supplied by IC27. One of these signals is the remainder signal produced by the ladder type D/A converter, RA5, and the other is the carry signal. These signals are supplied to the analog phase shifter consisting of IC30, IC29, TR23, and TR24. This circuit cancels the jitter components in the frequency data output, resulting in a signal with low phase jitter over the range of 1055.000 to 555.002 kHz.

[2-2] PLL (8.945 - 9.444998 MHz)

The 1055.000 - 555.002 kHz DDS output is divided by 2 in IC36 and sent as reference signal to IC31 which is part of the PLL circuit consisting of IC31, IC32, IC36 etc.

TR30 is a VCO with a frequency range of 8.945 to 9.444998 MHz. The VCO output is divided into two components, one for use within the loop and the next for use as offset signal in the next loop. The first component is buffered and then mixed with the 10 MHz signal from the reference oscillator in the mixer IC32, resulting in the differential signal (1.055 - 0.555002 MHz). IC36 divides this signal by 2 and then supplies it to IC31 in the next stage, where phase comparison with the DDS output signal (1.055 - 0.555002 MHz) is carried out. The signal then is routed through the active filter formed by TR25 - TR27.

VCO	Oscillation frequency	Transmission/reception frequency
VCO1	70.545-77.944998MHz	0.1-7.499998MHz
VCO2	77.955-84.944998MHz	7.5-14.499998MHz
VCO3	84.955-91.944998MHz	14.5-21.499998MHz
VCO4	91.955-100.444998MHz	21.5-29.999998MHz
VCO5	100.455-115.444998MHz	30.0-44.999998MHz
VCO6	115.455-124.444998MHz	45.0-53.999998MHz

Note: VCO5 and 6 are used in the CGH-192A (JST-245) only.

Table 3.3 VCO frequencies in final loop

The VCO output is buffered by TR13 and TR14 and routed through a low-pass filter before being supplied to the local amplifier TR15 and TR16. The output of TR15 is supplied to the TX/RX unit as 1st local oscillator signal (LO1, 70.545 - 124.444998 MHz).

The output from TR16 is used for the PLL and converted to 1.5 - 35 MHz in the subsequent mixer stage (IC25). This signal then is routed through a low-pass filter and buffered by TR17 and TR18 before being supplied to the PLL (IC26). This IC contains a sub divider, main divider, and phase comparator. The sub divider divides the 2 MHz signal from the reference generator by 4 to create the 500 kHz reference signal. The phase comparator compares this to the 500 kHz reference and controls the VCO via an active filter formed by TR20 - TR22.

[3] 2nd local oscillator (LO2)

The 2nd local oscillator generates a 79.9 MHz signal with a main synthesizer and a second synthesizer which is used only for the FM mode. The main PLL synthesizer consists of a VCO (TR77) and the PLL IC (IC49). The TR77 VCO operates at 77.9 MHz and TR78 serves as buffer before the signal is supplied to the PLL IC IC38. This IC divides the 79.9 MHz signal by 799. It also divides the 2 MHz reference signal by 20 and performs phase comparison of the 100 kHz components. The output of the phase comparator controls the VCO via an active filter formed by TR44 - TR46.

The LO2 also incorporates another PLL synthesizer for use in the FM mode. Operation is almost identical as for the main synthesizer, but the VCO is modulated directly for FM transmission.

The VCO output is buffered by TR51 and TR82, switched by the diode switches CD37 and CD38, and then supplied to the TX/RX unit as 2nd local oscillator signal (LO2).

[4] 3rd local oscillator (LO3)

The 3rd local oscillator consists of a DDS, VCO, mixer, and phase comparator.

The VCO (TR61) output signal (9 MHz) is buffered by TR62, again buffered by TR63 and then sent to the TX/RX unit as the 3rd local oscillator (LO3) signal. It is also buffered by TR64 and supplied to the mixer IC43. This IC mixes the 9 MHz VCO signal and the 10 MHz reference signal, to obtain the differential signal (1 MHz). This is supplied to the phase comparator (IC42). Here the phase is compared to the output of DDS3 (IC40). The phase comparator output passes the active filter consisting of TR58 - TR60 and controls the VCO.

[5] 4th local oscillator (LO4)

The DDS (IC44) generates a 358 kHz signal which is routed through a bandpass filter and supplied to the TX/RX unit as a sine wave signal. The operation principle is the same as for the DDS of LO1.

[6] 5th local oscillator (LO5)

The DDS (IC46) generates a BFO signal according to the mode as shown below. This signal is routed through a bandpass filter and supplied to the TX/RX unit as a sine wave signal. The operation principle is the same as for the DDS of LO1.

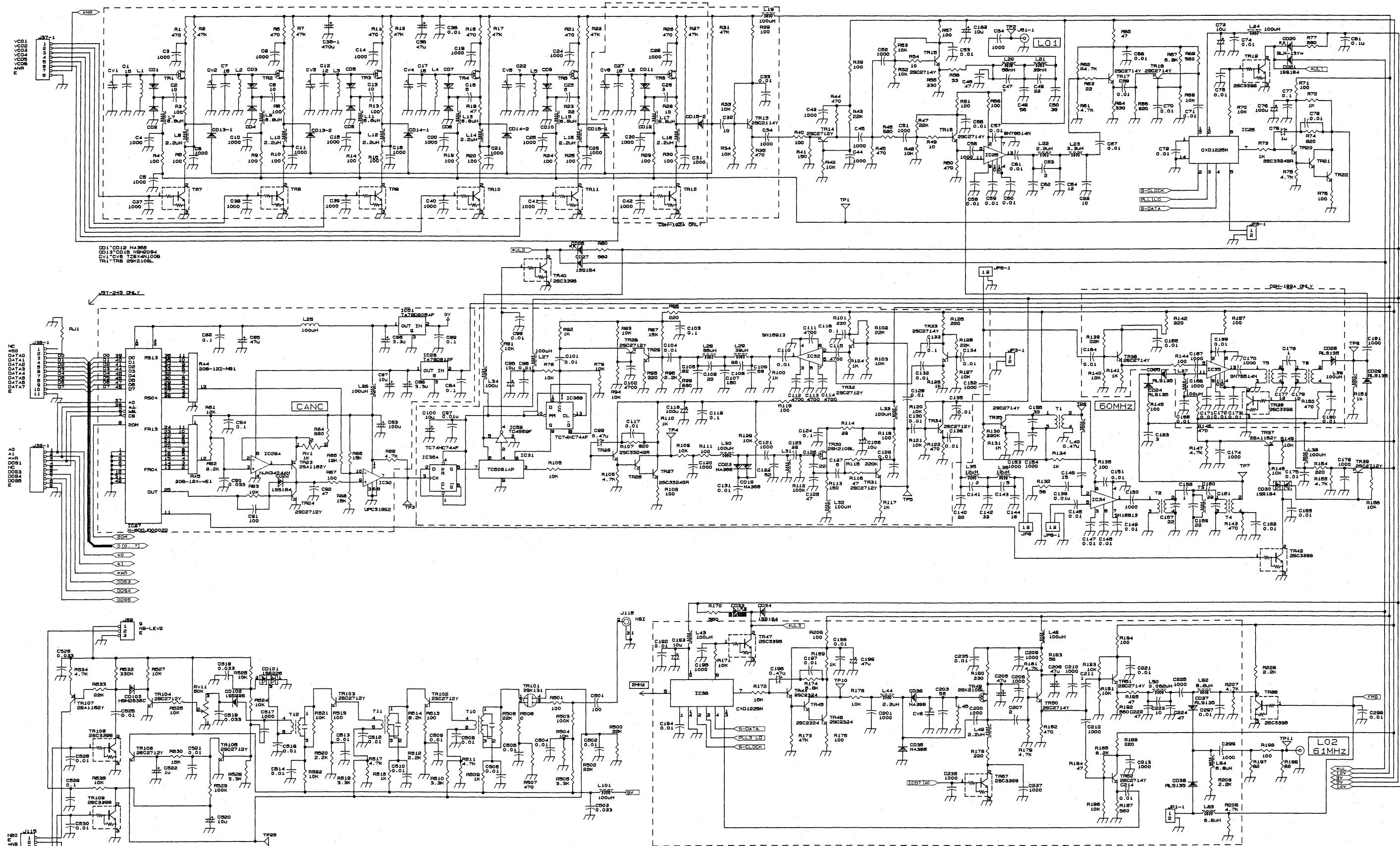
Mode	Transmission	Reception
LSB	456.5kHz	456.5kHz
USB	453.5kHz	453.5kHz
AM(AME)	453.5kHz	—
AFSK	457.21kHz	457.21kHz
CW	455.0kHz	455.0kHz
FM	455.0kHz	—

Table 3.4 LO5 frequency in various modes

[7] External equipment interface

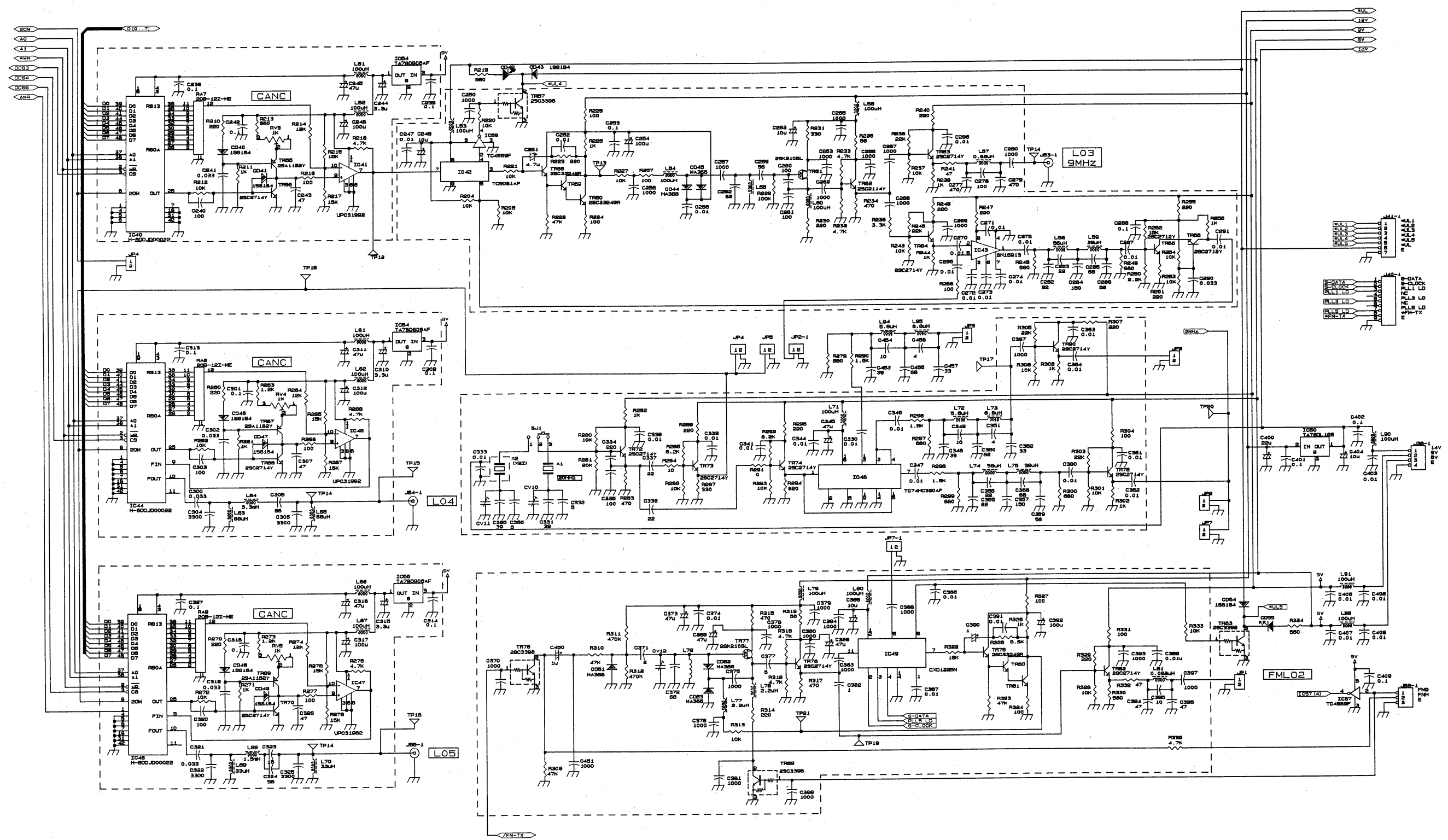
This block comprises the CPU unit and external equipment interface for the CW key, linear amplifier, auto tuner (NFG-230) and RS-232C interface. The CW key line is a direct output which incorporates the diodes CD67 and CD68 for reverse-flow prevention. The linear amplifier and auto tuner connectors provide the required data lines. The photocoupler CD66 provides isolation. The data lines are designed exclusively for the linear amplifier JRL-2000F and the auto tuner NFG-230. IC56 is the interface IC which contains the 5V circuitry and the line driver/receiver for the RS-232C interface.

3-5-2 Synthesizer Unit Circuit Diagram (1/3)

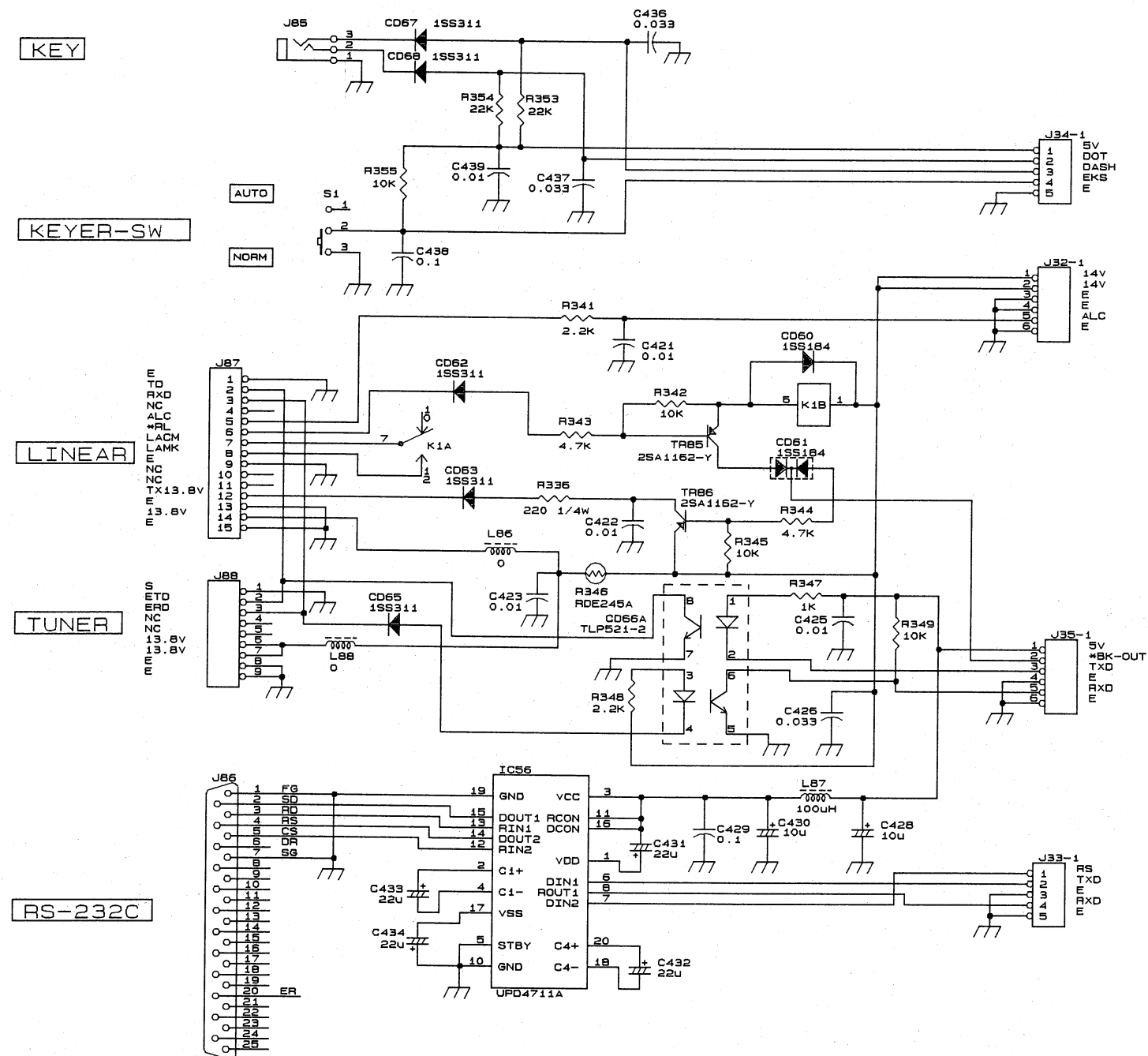


CGH-192A/B SYNTHESIZER UNIT (1/3)

Synthesizer Unit Circuit Diagram (2/3)

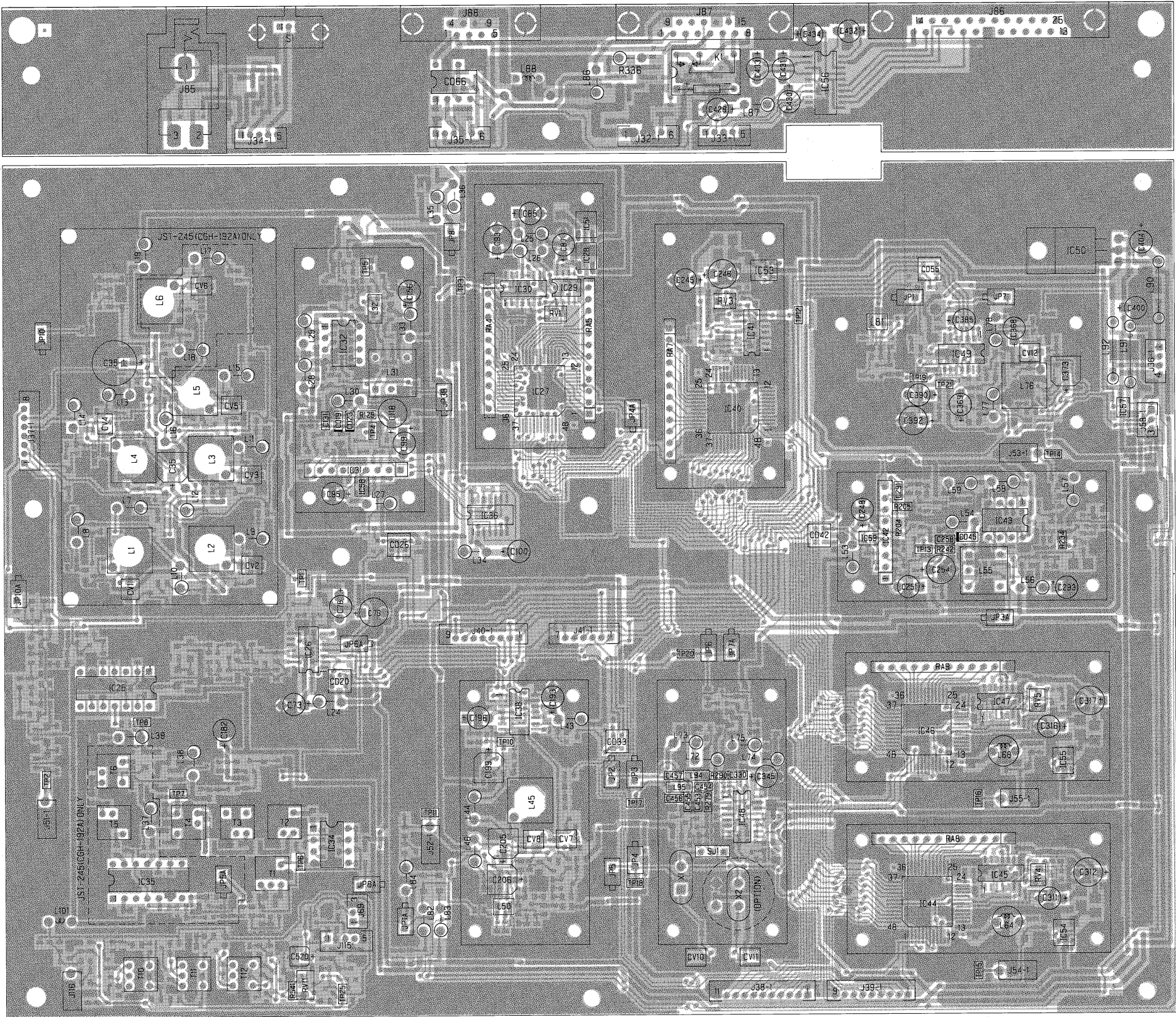


Synthesizer Unit Circuit Diagram (3/3)



CGH-192A/B SYNTHESIZER UNIT (3/3)

3-5-3 Synthesizer Unit PCB Diagram (Component Side)



3-39

Parts No.	TR1						TR2			TR3			TR4			TR5			TR6		
	1 (G)	2 (D)	3 (S)	Frequency			1 (G)	2 (D)	3 (S)	1 (G)	2 (D)	3 (S)	1 (G)	2 (D)	3 (S)	1 (G)	2 (D)	3 (S)	1 (G)	2 (D)	3 (S)
Pin No.																					
Voltage	0V	7.5V	1.9V	0.1~7.4999 MHz			0V	11.6V	5.0V	0V	11.6V	5.0V	0V	11.6V	5.0V	0V	11.6V	5.0V	0V	11.6V	5.0V
Voltage	0V	11.6V	5.0V	7.5~14.4999 MHz			0V	7.5V	1.9V	0V	11.6V	5.0V	0V	11.6V	5.0V	0V	11.6V	5.0V	0V	11.6V	5.0V
Voltage	0V	11.6V	5.0V	14.5~21.4999 MHz			0V	11.6V	5.0V	0V	7.5V	1.9V	0V	11.6V	5.0V	0V	11.6V	5.0V	0V	11.6V	5.0V
Voltage	0V	11.6V	5.0V	21.5~29.9999 MHz			0V	11.6V	5.0V	0V	11.6V	5.0V	0V	7.5V	1.9V	0V	11.6V	5.0V	0V	11.6V	5.0V
Voltage	0V	11.6V	5.0V	30~44.9999 MHz			0V	11.6V	5.0V	0V	11.6V	5.0V	0V	11.6V	5.0V	0V	7.5V	1.9V	0V	11.6V	5.0V
Voltage	0V	11.6V	5.0V	45~53.9999 MHz			0V	11.6V	5.0V	0V	11.6V	5.0V	0V	11.6V	5.0V	0V	11.6V	5.0V	0V	7.5V	1.9V

Parts No.	TR7						TR8			TR9			TR10			TR11			TR12		
	1 (B)	2 (C)	3 (E)	Frequency			1 (B)	2 (C)	3 (E)	1 (B)	2 (C)	3 (E)	1 (B)	2 (C)	3 (E)	1 (B)	2 (C)	3 (E)	1 (B)	2 (C)	3 (E)
Pin No.																					
Voltage	4.5V	0V	GND	0.1~7.4999 MHz			0V	5.0V	GND	0V	5.0V	GND	0V	5.0V	GND	0V	5.0V	GND	0V	5.0V	GND
Voltage	0V	5.0V	GND	7.5~14.4999 MHz			4.5V	0V	GND	0V	5.0V	GND	0V	5.0V	GND	0V	5.0V	GND	0V	5.0V	GND
Voltage	0V	5.0V	GND	14.5~21.4999 MHz			0V	5.0V	GND	0V	5.0V	GND	0V	5.0V	GND	0V	5.0V	GND	0V	5.0V	GND
Voltage	0V	5.0V	GND	21.5~29.9999 MHz			0V	5.0V	GND	0V	5.0V	GND	0V	5.0V	GND	0V	5.0V	GND	0V	5.0V	GND
Voltage	0V	5.0V	GND	30~44.9999 MHz			0V	5.0V	GND	0V	5.0V	GND	0V	5.0V	GND	0V	5.0V	GND	0V	5.0V	GND
Voltage	0V	5.0V	GND	45~53.9999 MHz			0V	5.0V	GND	0V	5.0V	GND	0V	5.0V	GND	0V	5.0V	GND	0V	5.0V	GND

Parts No.	TR13				TR20				TR21				TR22				TR25				TR26				TR27			
	1 (B)	2 (C)	3 (E)		1 (B)	2 (C)	3 (E)		1 (B)	2 (C)	3 (E)		1 (B)	2 (C)	3 (E)		1 (B)	2 (C)	3 (E)		1 (B)	2 (C)	3 (E)		1 (B)	2 (C)	3 (E)	
Pin No.																												
Voltage	4.9V	10.7V	4.2V		1.7V	11.5V	1.2V		1.2V	10.3V	0.7V		0.7V	10.3V	0.1V		2.2V	11.2V	1.6V		1.6V	6.1V	1.2V		1.2V	6.1V	0.5V	

Parts No.	TR44				TR45				TR46			
	1 (B)	2 (C)	3 (E)		1 (B)	2 (C)	3 (E)		1 (B)	2 (C)	3 (E)	
Pin No.												
Voltage	1.9V	11.4V	1.4V		1.4V	8.0V	1.0V		1.0V	8.0V	0.3V	

Parts No.	TR19				TR40				TR47				IC58				
	1 (B)	2 (C)	3 (E)		1 (B)	2 (C)	3 (E)		1 (B)	2 (C)	3 (E)		1	2	3 (E)	4	5
Pin No.																	
Voltage	2.1V	0V	GND		2.7V	0V	GND		2.1V	0V	GND		NC	0V	GND	4.7V	4.8V
Voltage	0V	3.5V	GND		0.3V	3.5V	GND		0V	3.5V	GND		NC	4.4V	GND	0.3V	4.8V
																	LOOK

Parts No.	TR37				TR38				TR39				TR42			
	1 (B)	2 (C)	3 (E)		1 (B)	2 (C)	3 (E)		1 (B)	2 (C)	3 (E)		1 (B)	2 (C)	3 (E)	
Pin No.																
Voltage	8.6V	0V	8.6V		4.8V	0V	GND		7.9V	8.6V	7.2V		0V	8.3V	GND	frequency
Voltage	7.8V	8.5V	8.6V		0V	4.2V	GND		0.6V	8.6V	0V		4.8V	0V	GND	30MHz max
																30MHz min

Parts No.	TR87				TR88			
	1 (B)	2 (C)	3 (E)		1 (B)	2 (C)	3 (E)	Mode
Pin No.								
Voltage	0V	3.5V	GND		8.8V	0V	GND	FM
Voltage	8.4V	0V	GND		0V	3.8V	GND	Others

Parts No.		IC41														IC42								
Pin No.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	1	2	3	4	5	6	7	8	9
Voltage		NC	NC	GND	NC	NC	GND	1.1V	GND	1.6V	2.9V	5.0V	NC	NC	NC	NC	NC	1.9V	3.9V	4.8V	NC	1.0V	2.4V	GND
Remarks		RECEIVING														RECEIVING								

IC43														IC45									
Parts No.	Pin No.	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Voltage		5.5V	3.3V	2.4V	GND	2.3V	3.3V	3.3V	6.6V	NC	NC	NC	GND	NC	GND	1.6V	GND	1.8V	2.9V	5.0V	NC	NC	NC
Remarks		RECEIVING														RECEIVING							

IC47														IC53							
Parts No.	Pin No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	1	2	3	1	2	3
Voltage		NC	NC	GND	NC	NC	GND	1.2V	GND	1.5V	2.8V	5.0V	NC	NC	NC	13.5V	11.9V	GND	5.0V	GND	8.7V
Remarks		RECEIVING														RECEIVING					

IC48														IC55							
Parts No.	Pin No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	1	2	3	1	2	3
Voltage		2.4V	GND	2.3V	2.3V	NC	NC	0.9V	GND	NC	NC	NC	GND	NC	GND	5.0V	GND	8.7V	5.0V	GND	8.7V
Remarks		RECEIVING														RECEIVING					

IC49															
Parts No.															
Pin No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Voltage	-2.6V	4.9V	0V	0V	2.0V	NC	0V	3.6V	NC	NC	0.5V	4.7V	NC	GND	
Remarks	RECEIVING														

Parts No.		TR55						TR56						TR61						TR62						TR63						TR64						TR65						TR66					
Pin No.		B	E	C	B	E	C	B	E	C	D	S	G	B	E	C	B	E	C	B	E	C	B	E	C	B	E	C	B	E	C	B	E	C															
Voltage		3.6V	4.2V	1.6V	-0.9V	GND	1.6V	9.7V	1.4V	0V	5.3V	4.7V	11.1V	2.4V	2.8V	8.0V	2.5V	2.3V	8.2V	1.0V	0.4V	3.4V	4.0V	3.4V	6.2V																								
Remarks		RECEIVING						RECEIVING						RECEIVING						RECEIVING						RECEIVING						RECEIVING						RECEIVING											

Parts No.		TR67			TR68			TR69			TR70			TR72			TR73			TR74			TR75		
Pin No.		B	E	C	B	E	C	B	E	C	B	E	C	B	E	C	B	E	C	B	E	C	B	E	C
Voltage		3.6V	4.2V	1.8V	-1.0V	GND	1.8V	3.6V	4.2V	1.5V	-1.0V	GND	1.5V	2.6V	2.0V	4.3V	2.1V	1.7V	3.6V	2.1V	2.5V	4.2V	1.4V	0.8V	4.7V
Remarks		RECEIVING			RECEIVING			RECEIVING			RECEIVING			RECEIVING			RECEIVING			RECEIVING			RECEIVING		

Parts No.		TR77						TR82						TR89						TR90						TR57						TR83																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
Pin No.		D	S	G	B	E	C	B	E	C	1 (B)	2 (C)	3 (E)	B	E	C	1 (B)	2 (C)	3 (E)	1 (B)	2 (C)	3 (E)	1 (B)	2 (C)	3 (E)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		

Parts No.		IC59					TR76					IC57					TR89			
Pin No.		1	2	3	4	5	PULL	1 (B)	2 (C)	3 (E)	FM	1	2	3	4	5	1 (B)	2 (C)	3 (E)	Mode
Voltage		NC	3.8V	GND	0.8V	4.8V	LOCK	0V	0V	GND	TRANSMITTING	NC	8.8V	GND	0V	8.6V	8.8V	0V	GND	FM
Remarks		NC	0V	GND	4.7V	4.8V	UNLOCK	4.7V	0V	GND	RECEIVING	NC	0V	GND	8.4V	8.6V	0V	3.7V	GND	Others

Parts No.		TR58			TR59			TR60		
Pin No.		1 (B)	2 (C)	3 (E)	1 (B)	2 (C)	3 (E)	1 (B)	2 (C)	3 (E)
Voltage		1.9V	11.4V	1.4V	1.4V	7.9V	1.0V	1.0V	7.9V	0.3V

Parts No.		TR79			TR80			TR81			
Pin No.		1 (B)	2 (C)	3 (E)	1 (B)	2 (C)	3 (E)	1 (B)	2 (C)	3 (E)	
Voltage		1.9V	11.4V	1.4V	1.4V	8.0V	0.9V	0.9V	8.0V	0.3V	FM mode

Parts No.	IC56																			
Pin No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Voltage	9.7V	7.3V	4.9V	2.5V	0V	4.9V	0V	4.9V	4.9V	GND	4.9V	0V	0V	9.7V	-9.6V	4.9V	-9.6V	-4.8V	0V	4.8V
Remarks	RECEIVING																			

Parts No.	TR85			TR86		
Pin No.	B	E	C	B	E	C
Voltage	13.6V	13.6V	0V	13.6V	13.6V	0V
Remarks	RECEIVING			RECEIVING		

3-6 PA Unit (CAH-449-2)

3-6-1 PA Unit Circuit Description

The power amplifier (PA) unit serves to amplify the exciter signal to the rated power for transmission. It consists of the power amplifier circuitry, bias control circuit, final stage drain current detector circuit and cooling fan control circuit.

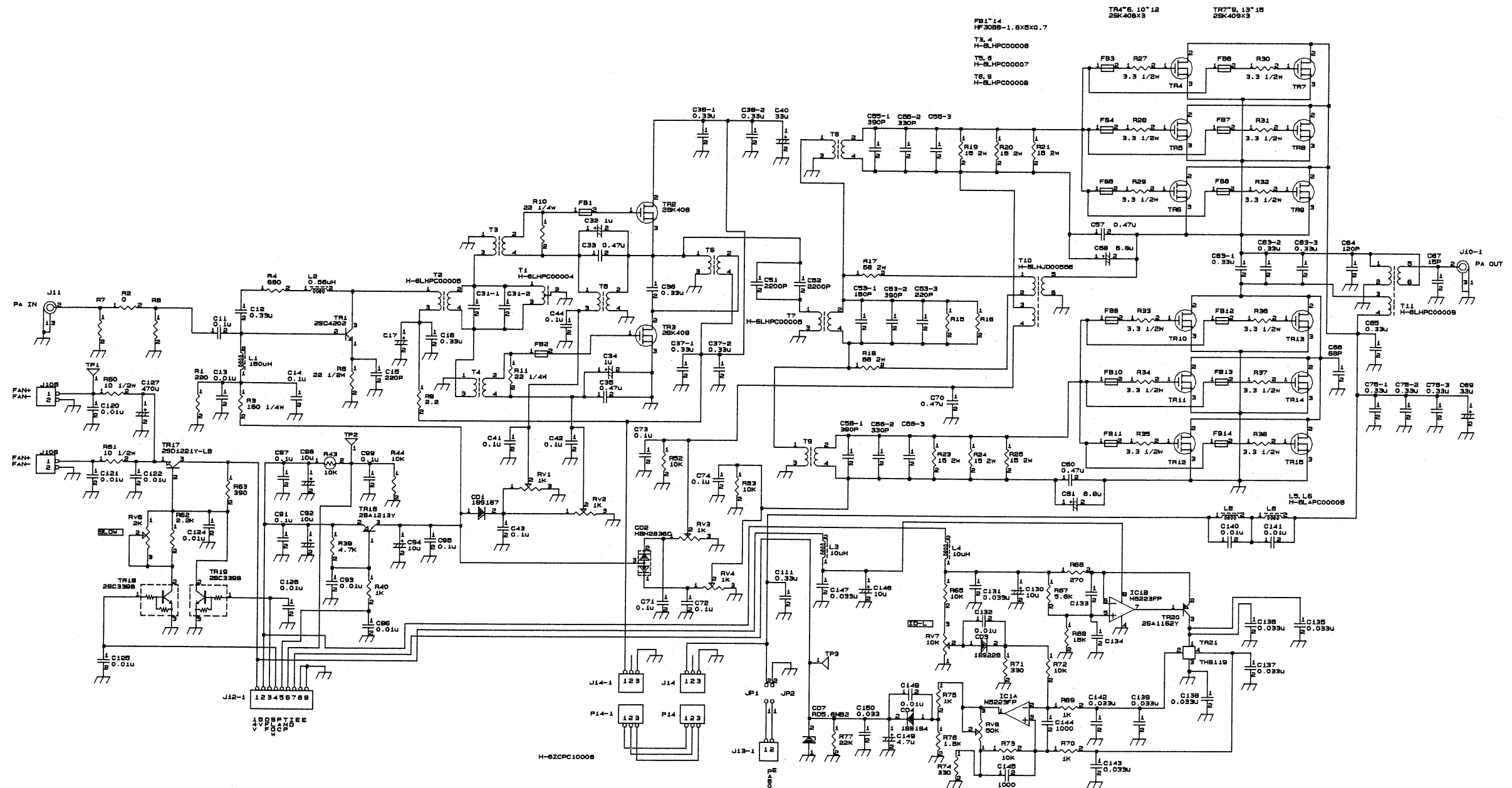
The power amplifier is configured as a three-stage wide-band amplifier. The first stage is a class A amplifier using a single bipolar transistor, and the driver stage is a single-ended push-pull (SEPP) circuit using power MOS-FETs for VHF applications. Unlike conventional push-pull circuits, this current matching circuit employs no coupling transformer. This keeps distortion to a very low level. The final stage uses 12 of the same MOS-FETs as the driver stage in a SEPP configuration, to produce the rated output. The use of 12 devices assures efficient thermal dissipation due to distributed processing. Heat concentration is avoided, and the use of a specially designed heat sink with low thermal resistance further improves dissipation efficiency and stability.

The bias control circuit (TR16) is governed by a control signal from the CPU to optimize the bias amount in each stage.

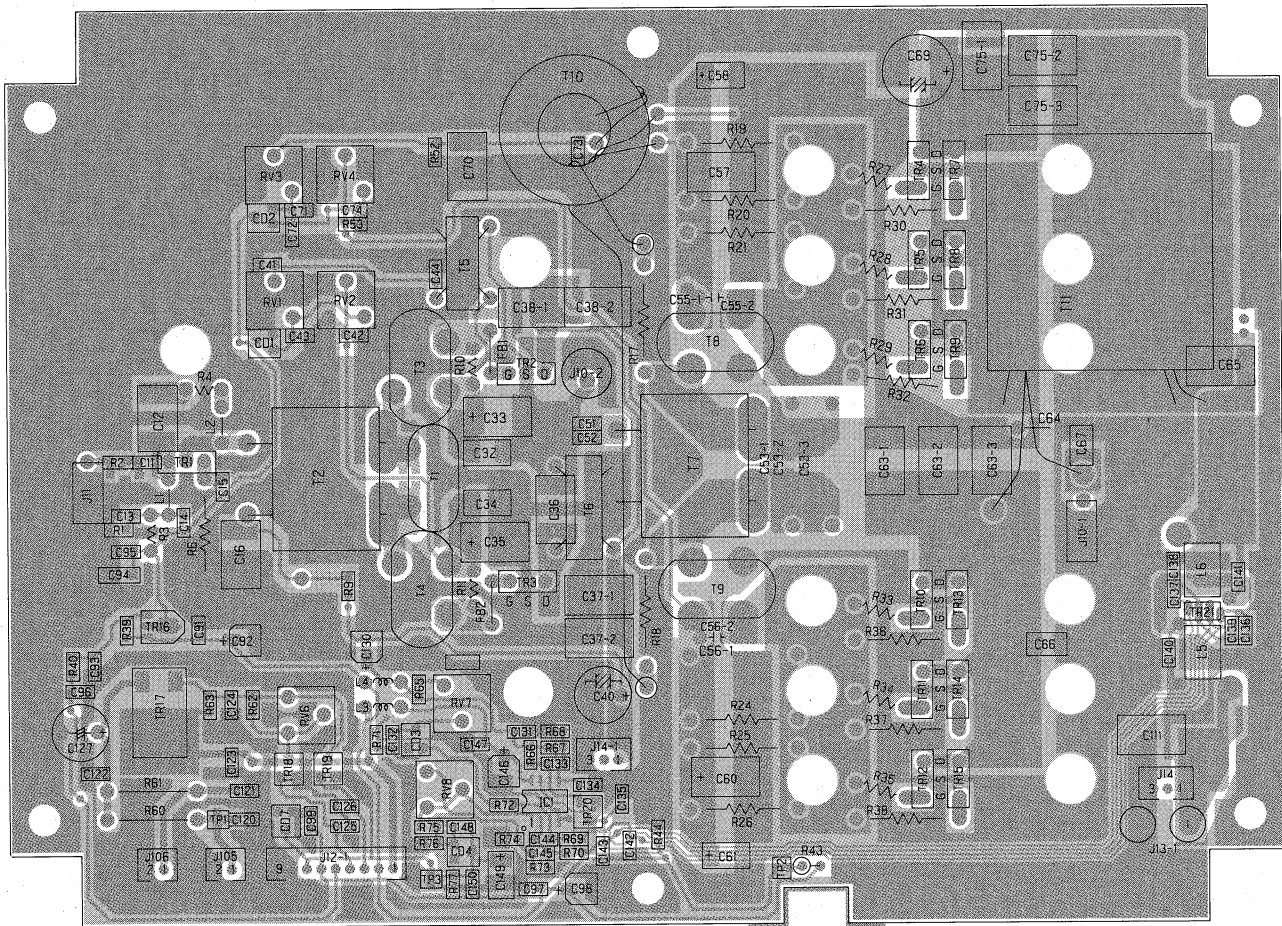
The final stage drain current detector circuit (IC1, TR21) uses current detector coils (L5, L6) in the final stage drain line. The Hall sensor (TR21) converts the magnetic energy generated by the drain current into an electrical signal which is supplied to the meter A/D converter in the CPU unit, for ID metering. IC1B supplies a constant current to drive the Hall sensor (TR21), and IC1A serves to amplify the Hall sensor output.

The cooling fan control circuit detects the heat sink temperature by means of a thermo-sensor (R43). The result is processed by the CPU which issues a three-step control signal (OFF, SLOW, FAST) to adjust the cooling fan speed.

3-6-2 PA Unit Circuit Diagram



3-6-3 PA Unit PCB Diagram (Component Side)



Parts No.	IC1								TR1			TR2,TR3		
Pin No.	1	2	3	4	5	6	7	8	1 (E)	2 (B)	3 (C)	1 (G)	2 (D)	3 (S)
Voltage	2.4V	1.4V	1.4V	GND	3.5V	3.5V	2.8V	13.5V	1.76V	2.53V	60.0V	2.25V	60.0V	GND
Remarks	TRANSMITTING								TRANSMITTING			TRANSMITTING		

Parts No.	TR4~TR9			TR10~TR15			TR16			TR17			TR18		
Pin No.	1 (G)	2 (D)	3 (S)	1 (G)	2 (D)	3 (S)	1 (B)	2 (E)	3 (C)	1 (E)	2 (B)	3 (C)	1 (B)	2 (C)	3 (E)
Voltage	2.25V	60.0V	GND	2.25V	60.0V	GND	4.1V	5.0V	4.9V	0V	0.1V	13.5V	0V	0.1V	GND
Remarks	TRANSMITTING			TRANSMITTING			TRANSMITTING			TRANSMITTING			TRANSMITTING		

Parts No.	TR19			TR20			TR21				TEST POINT		
Pin No.	1 (B)	2 (C)	3 (E)	1 (B)	2 (E)	3 (C)	1	2	3	4	TP1	TP2	TP3
Voltage	4.9V	0.1V	GND	2.8V	3.5V	3.1V	3.1V	1.5V	GND	1.5V	0V	2.6V	0.9V
Remarks	TRANSMITTING			TRANSMITTING			TRANSMITTING				TRANSMITTING		

f=14.250MHz
 MODE=USB (no modulation)
 FAN=OFF
 TX

3-7 Matching Unit (CFG-127)

The JST-245 incorporates an auto tuner unit consisting of three subassemblies: the matching unit (CFG-127), RL control unit (CCB-424), and sensor unit (CCC-

284A). The auto tuner unit operates only in the HF band from 1.6 to 30 MHz, not in the 50 MHz band. For the JST-145, the auto tuner unit can be installed as an option.

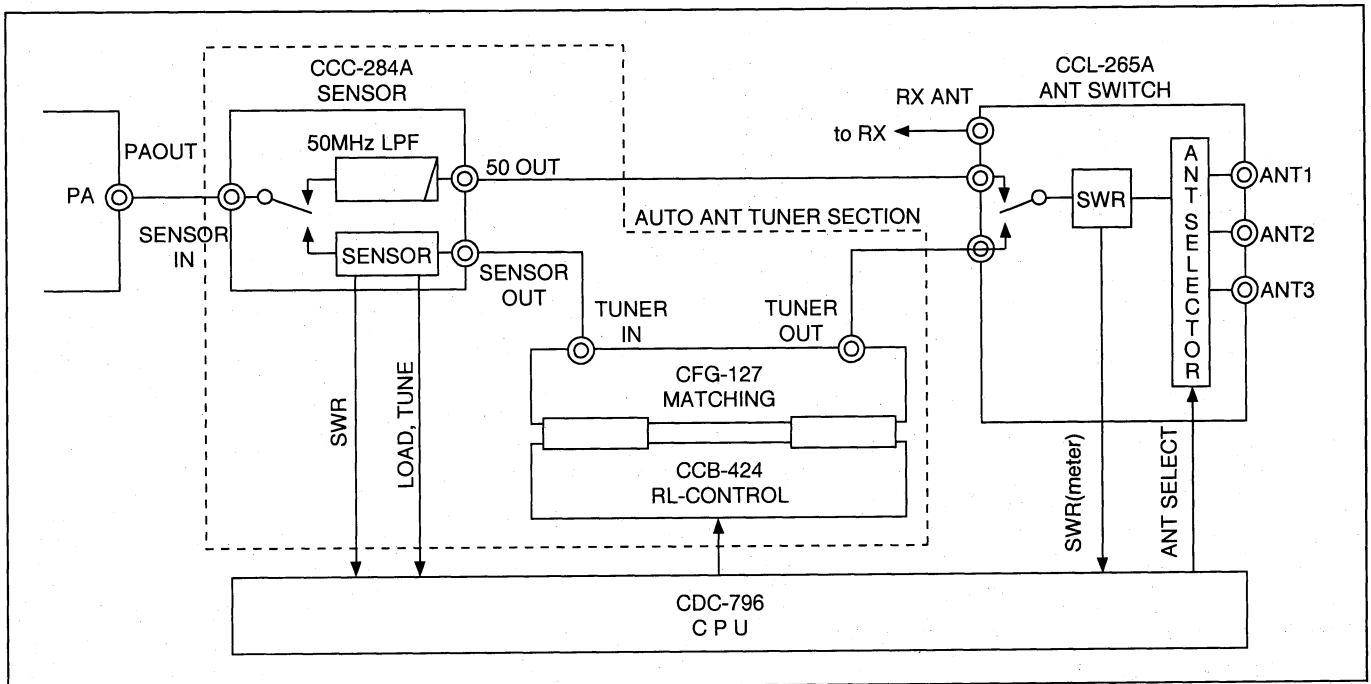


Fig.3.12 Block diagram of matching unit

3-7-1 Matching Unit Circuit Description

The matching unit serves to match the output impedance of the PA unit to the antenna impedance (up to SWR of 3.0). The unit uses a L- π -L type circuit

which not only serves to match the impedance but also filters out harmonics of the transmission frequency.

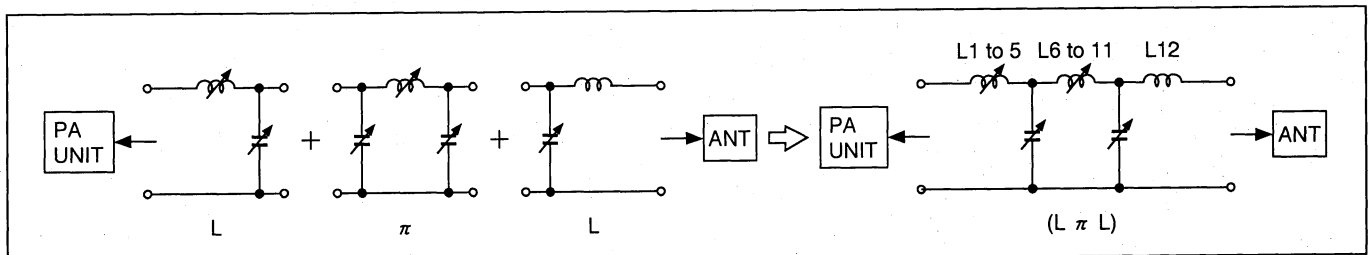


Fig.3.13 Basic circuit configuration of matching unit

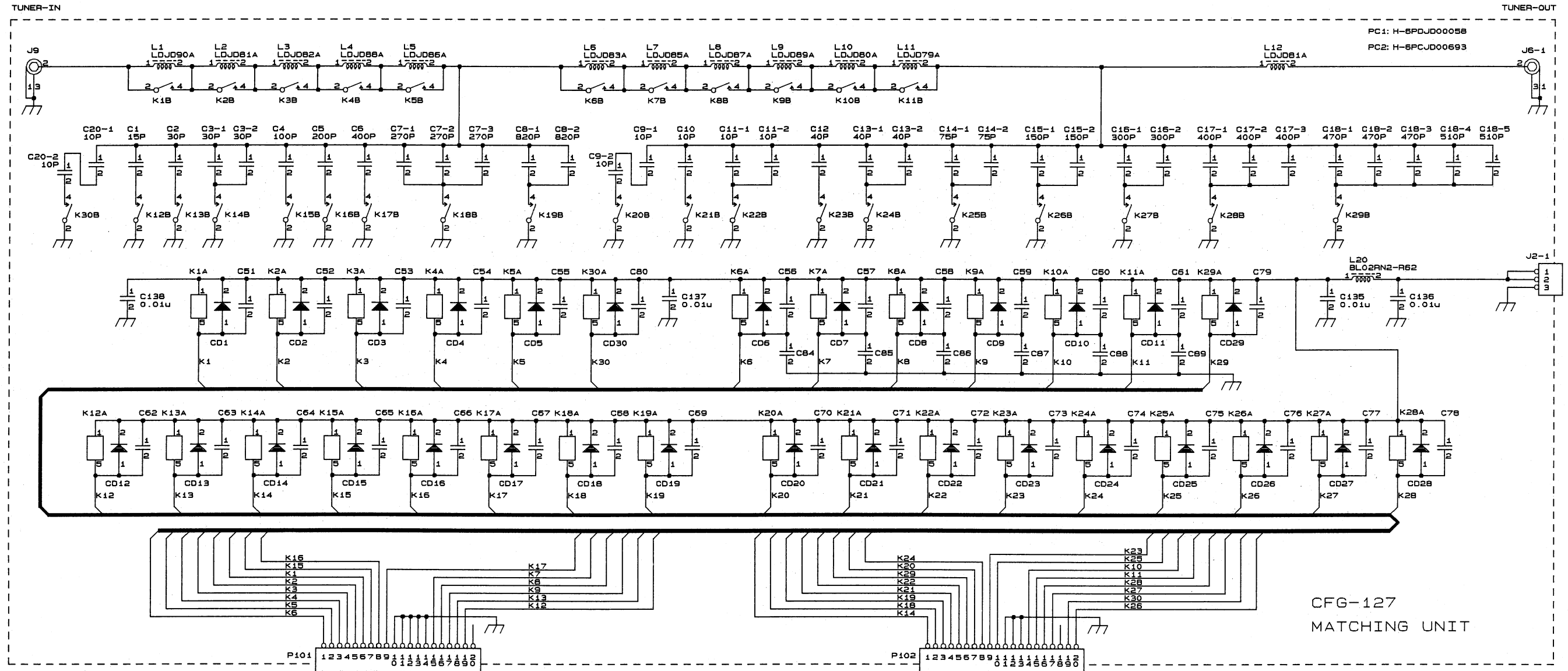
The values of the capacitors and coils in the matching unit are chosen according to binary combinations and are switched by relays which allow very fast switching. This allows fast selection of memorized data.

The matching unit data can be memorized separately for ANT1 to ANT3. Also, the default data is memorized in advance for an antenna impedance of 50 Ω (SWR = 1.0), for each frequency.

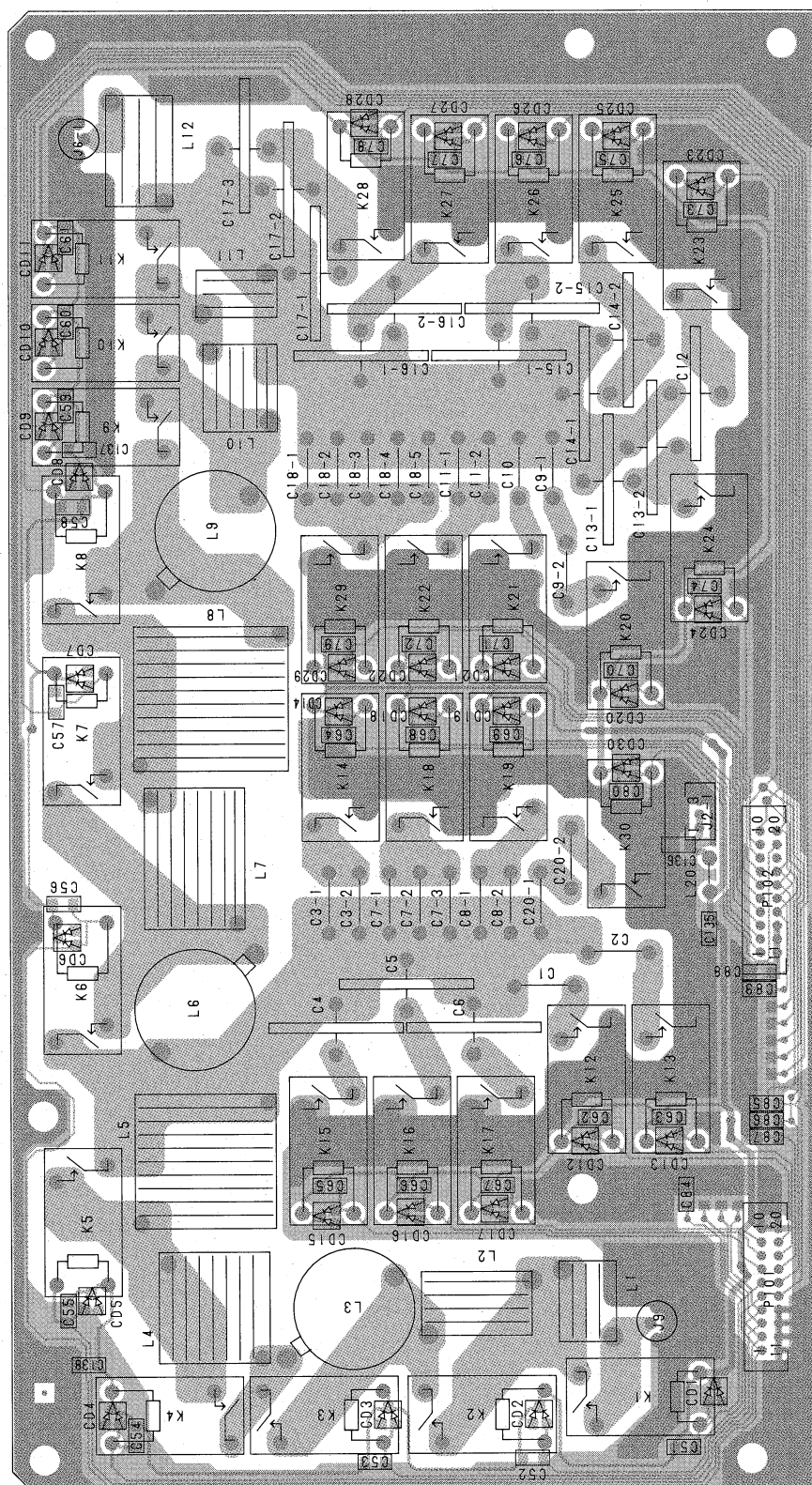
BAND (MHz)	FREQ. (kHz)	STEP (kHz)
1.8	1,800 }	10
	2,000	
3.5	3,500 }	20
	3,840 }	30
	4,020	
7	6,960 }	50
	7,310	
10.1	9,950 }	70
	10,160	
14	13,940 }	100
	14,140 }	110
	14,360	
18.1	17,960 }	140
	18,240	
21	20,890 }	160
	21,530	
24.9	24,870 }	190
	25,060	
28	27,870 }	210
	28,290 }	220
	29,610	
	}	230
	29,840	

Table 3.5 Memory frequencies of matching unit (CFG-127)

3-7-2 Matching Unit Circuit Diagram



3-7-3 Matching Unit PCB Diagram (Component Side)



3-8 RL Control Unit (CCB-424)

3-8-1 RL Control Unit Circuit Description

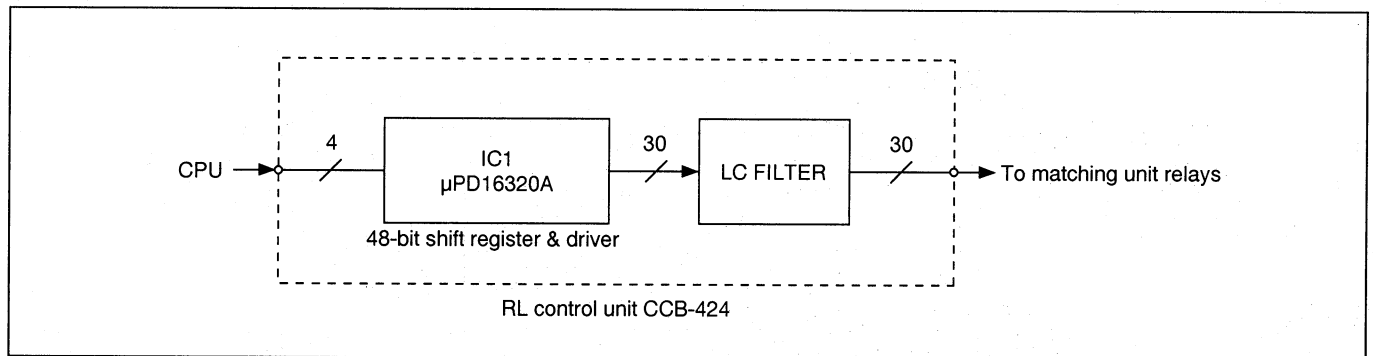
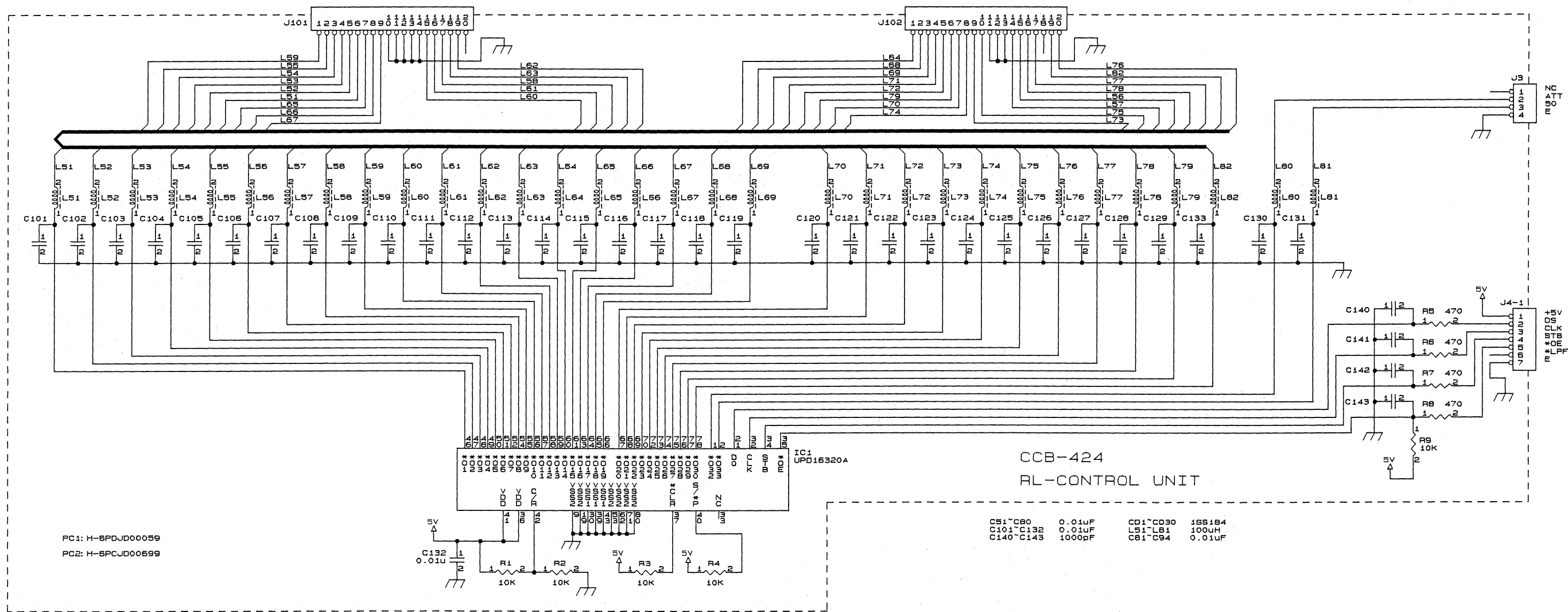


Fig.3.14 RL Control Unit Block Diagram

The RL (relay) control unit operates the relays of the matching unit according to signals sent from the CPU. The unit contains a serial-to-parallel converter (IC1) and an LC filter. IC1 converts the 1-bit serial input into a 48-bit parallel output. It also contains the driver circuitry.

3-8-2 RL Control Unit Circuit Diagram



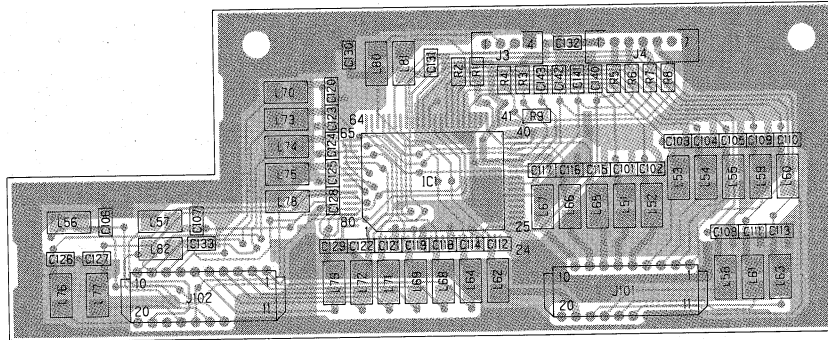
Parts No.	IC1																							
Pin No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Voltage	13.6V	13.6V	0V	0V	0V	0V	0V	0V	GND	0V	0V	0V	0V	0V	0V	0V	0V	0V	GND	0V	0V	0V	0V	0V
Note																								
Remarks	RL Control																							

Parts No.	IC1																							
Pin No.	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
Voltage	0V	0V	0V	0V	0V	GND	0V	0V	NC	0V	0.3V	4.9V	4.9V	0V	GND	4.9V	4.9V	2.5V	GND	0V	0V	70mV	13.6V	13.6V
Note																								
Remarks	RL Control																							

Parts No.	IC1																							
Pin No.	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72
Voltage	13.6V	13.6V	13.6V	13.6V	GND	13.6V	13.6V	13.6V	13.6V	13.6V	13.6V	13.6V	13.6V	GND	13.6V	13.6V	13.6V	13.6V	13.6V	13.6V	13.6V	13.6V	GND	13.6V
Note																								
Remarks	RL Control																							

Parts No.	IC1							
Pin No.	73	74	75	76	77	78	79	80
Voltage	13.6V	13.6V	13.6V	13.6V	13.6V	13.6V	0V	GND
Note								
Remarks	RL Control							

3-8-3 RL Control Unit PCB Diagram



3-9 Sensor Unit (CCC-284A/JST-245,B/JST-145)

3-9-1 Sensor Unit Circuit Description

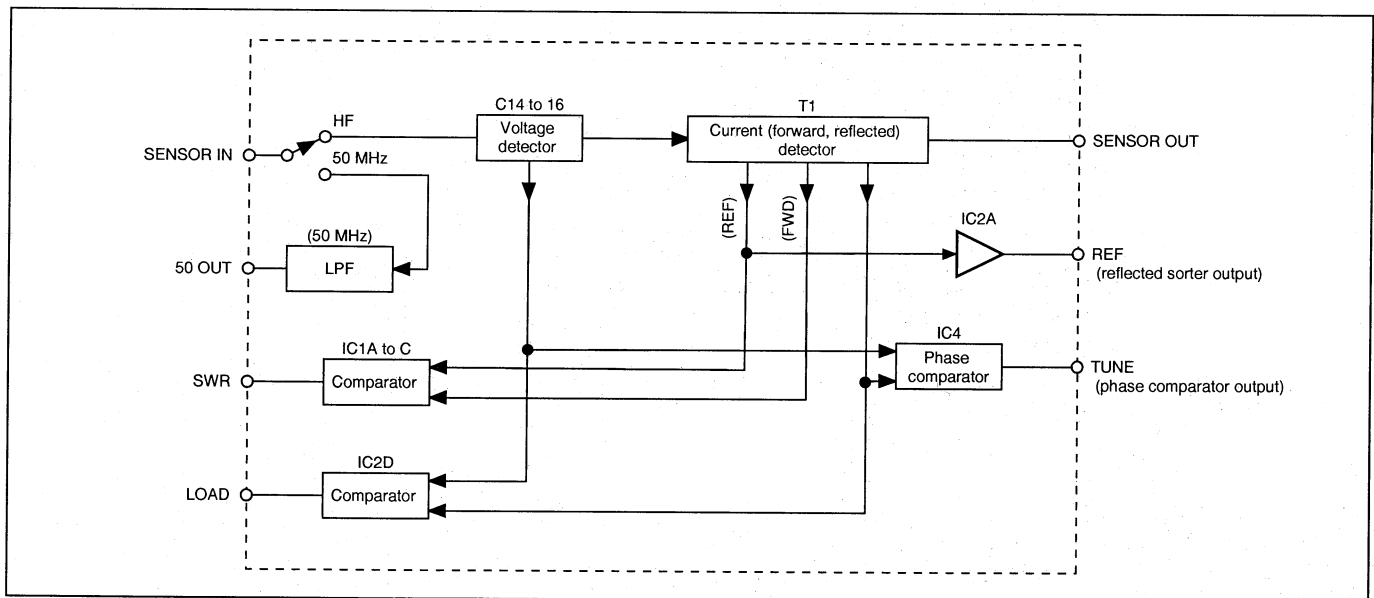


Fig.3.15 Sensor Unit Block Diagram

The sensor unit is located between the PA unit and the matching unit of the JST-245. It contains detection circuitry for SWR, impedance (referenced to 50 ohms), and phase. The sensor unit detects the matching condition between the PA unit and matching unit and conveys the information to the CPU. The sensor unit also incorporates a low-pass filter for use during transmission in the 50 MHz band.

The A - C sections of IC1 are comparators for SWR detection. By comparing the forward wave and reflected wave, the SWR 1.2, 1.5 and 2.0 points are determined. The A - D sections of IC3 amplify the current component detected at T1 and the voltage component split off by capacitors C14 - C16. The phase comparator IC4 detects the load impedance phase. Section D of IC2 compares the compares the current

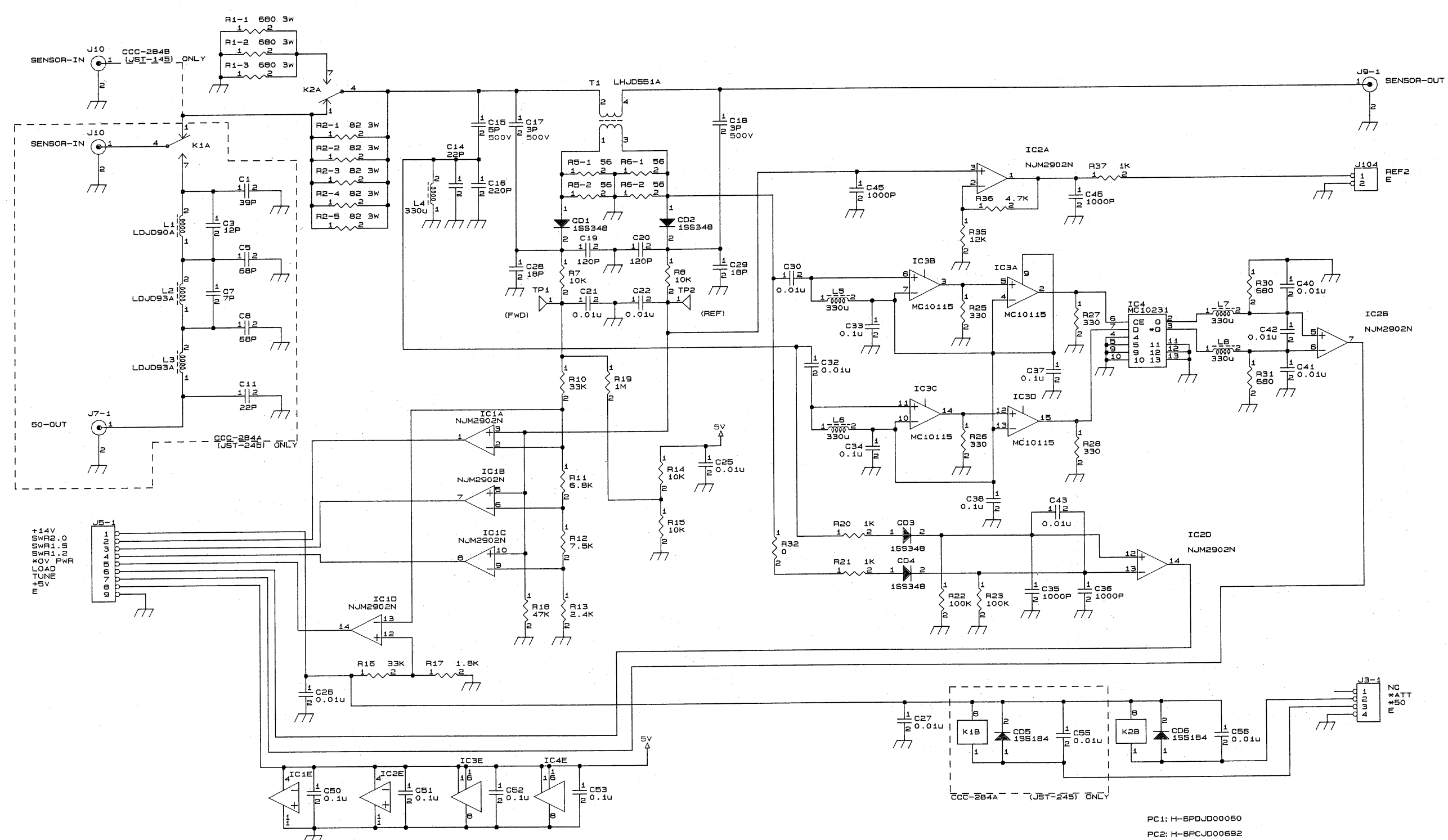
component from T1 and the voltage component from capacitors C14 - C16 to determine whether the load impedance is higher or lower than 50 ohms.

The attenuator circuit consisting of R1 and R2 acts as a buffer which prevents load fluctuations of the matching unit from affecting operation stability of the PA unit.

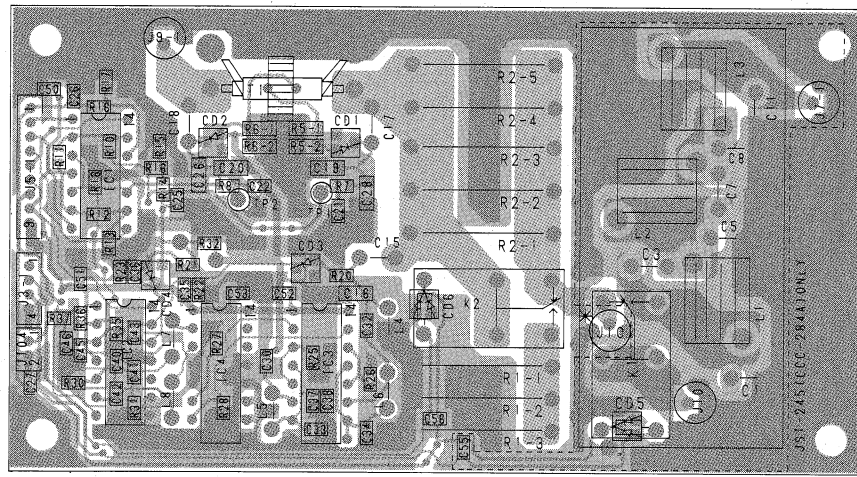
During operation in the 50 MHz band, the matching unit is inactive, but a filtering circuit for harmonics during transmission and the power low-pass filter circuits are incorporated in the sensor unit.

The CCC-284B is intended for the option tuner of the JST-145, hence it is not included in this 50 MHz LPF circuit.

3-9-2 Sensor Unit Circuit Diagram



3-9-3 Sensor Unit PCB Diagram (Component Side)



*JST-145(CCC-284B) ONLY

Parts No.	IC1														Remarks
Pin No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Voltage	0.7V	1.0V	0V	4.8V	0V	0.6V	0.7V	0.7V	0.1V	0V	GND	0.7V	1.0V	0.7V	TRANSMITTING
Voltage	0.7V	0.2V	0V	4.8V	0V	0.1V	0.7V	0.7V	0V	0V	GND	0.7V	0.2V	4.7V	RECEIVING
Remarks	Antennas Matching Detection														

Parts No.	IC2														Remarks
Pin No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Voltage	0V	0V	0V	4.8V	NC	NC	NC	NC	NC	NC	GND	0.4V	0.4V	0.7V	TRANSMITTING
Voltage	0V	0V	0V	4.8V	NC	NC	NC	NC	NC	NC	GND	0V	0V	0.7V	RECEIVING
Remarks	Antennas Matching Detection														

Parts No.	IC3																Remarks
Pin No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
Voltage	4.8V	3.6V	3.6V	3.6V	3.6V	3.6V	3.6V	GND	3.6V	3.6V	3.6V	3.6V	0V	3.6V	3.6V	4.8V	TRANSMITTING
Voltage	4.8V	3.4V	3.6V	3.6V	3.6V	3.6V	3.6V	GND	3.6V	3.6V	3.6V	3.6V	0V	3.6V	3.5V	4.8V	RECEIVING
Remarks	Antennas Matching Detection																

Parts No.	IC4																Remarks
Pin No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
Voltage	4.8V	4.1V	3.2V	GND	GND	3.6V	3.6V	GND	GND	GND	GND	GND	GND	4.4V	3.6V	4.8V	TRANSMITTING
Voltage	4.8V	3.2V	4.1V	GND	GND	3.5V	3.5V	GND	GND	GND	GND	GND	GND	4.3V	3.5V	4.8V	RECEIVING
Remarks	Antennas Matching Detection																

f=14.250MHz
MODE=FM

3-10 LPF Unit (CFJ-157B)

The JST-145 does not have an auto tuner section (NFG-183: matching unit, RL control unit, sensor unit). Instead it has a low-pass filter unit (CFJ-157B). If the Auto tuner NFG-183 is installed as an option, the LPF unit must be removed.

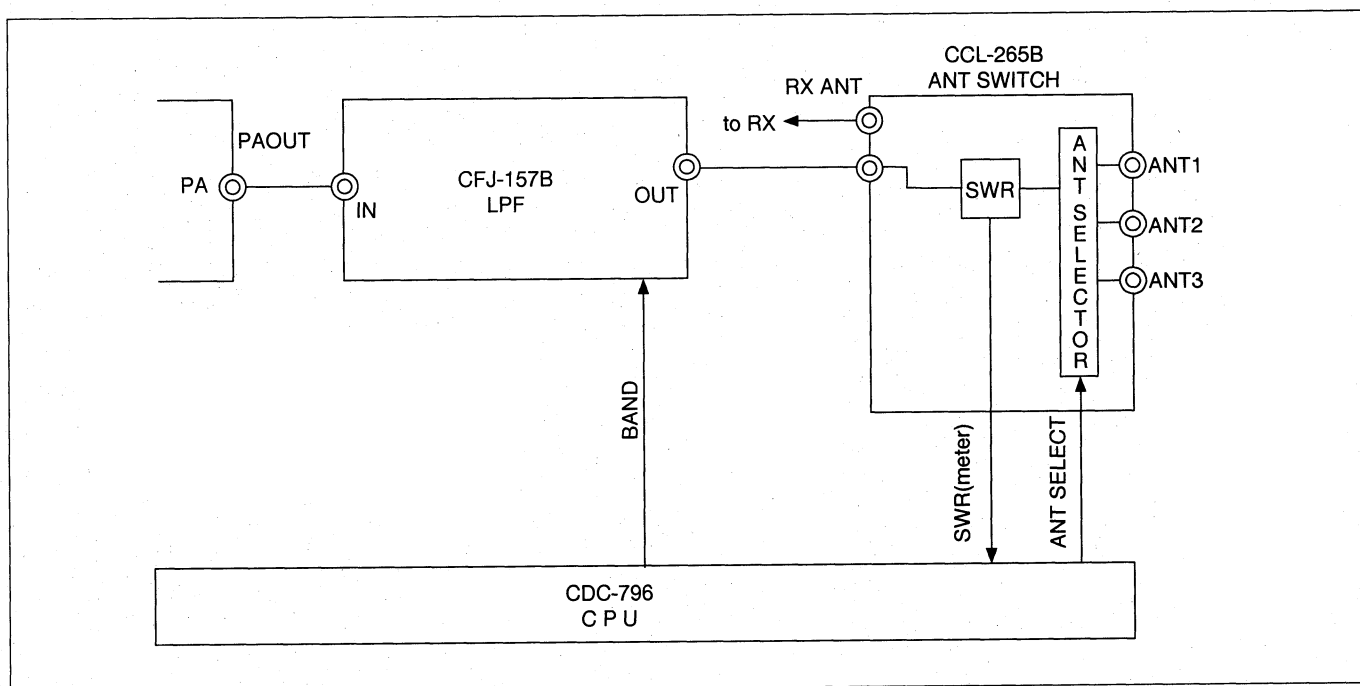


Fig.3.16 Block diagram of LPF unit

3-10-1 LPF Unit Circuit Description

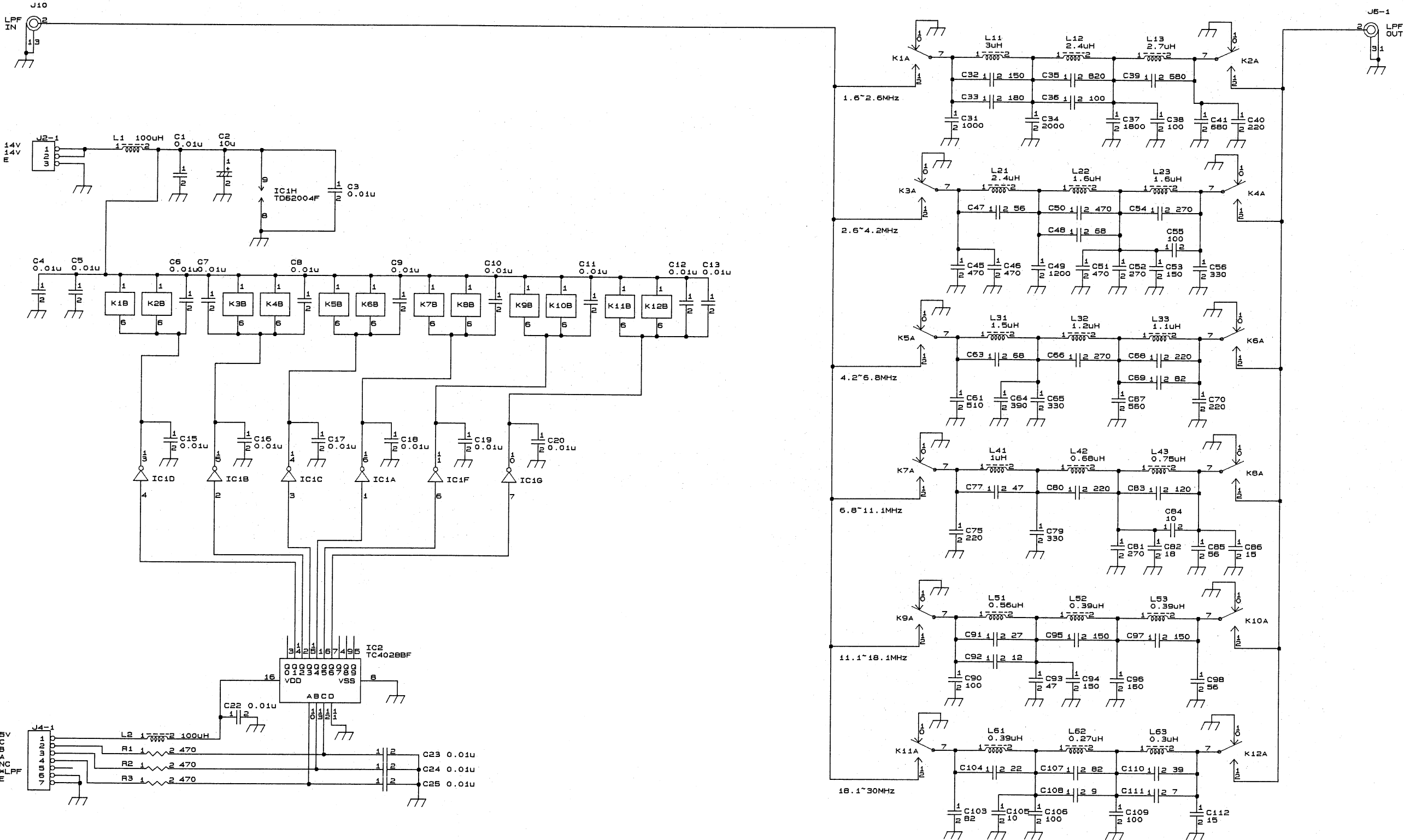
The LPF unit is configured as a power low-pass filter which keeps the transmission signal output by the PA unit at the rated spurious level. The unit is designed for the JST-145 only.

The unit incorporates six filter circuits, a decoder for frequency data from the CPU, and a drive circuit for the filter section relays.

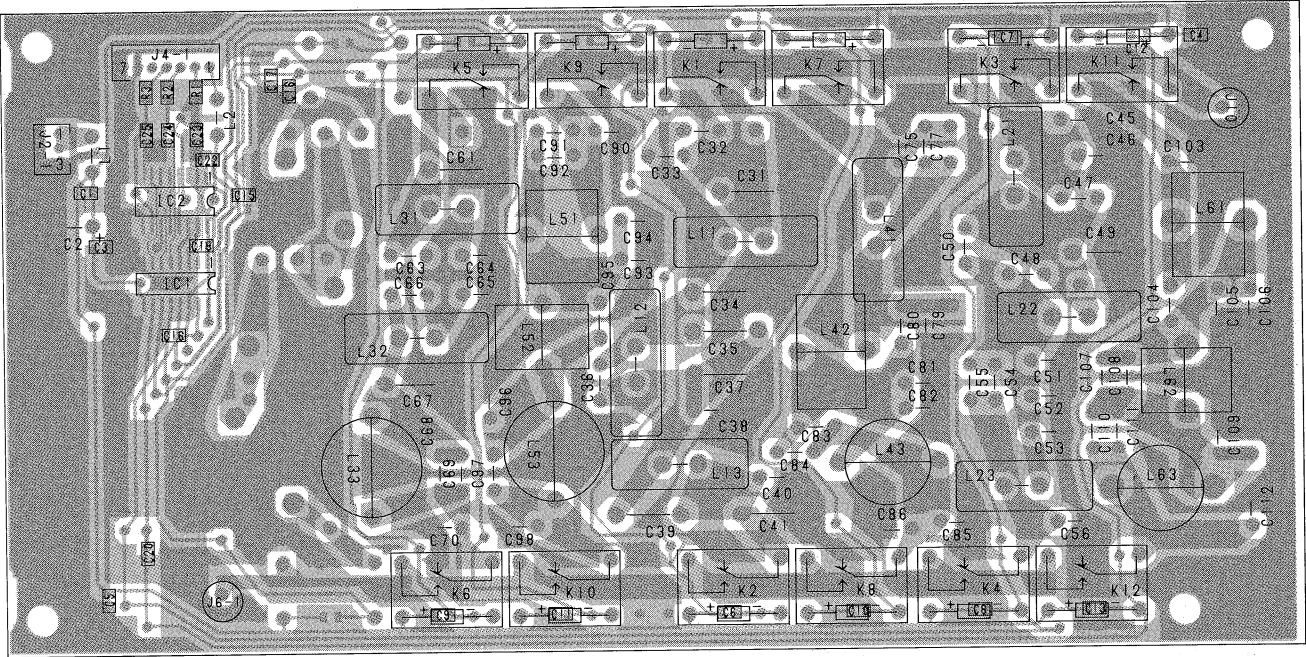
To achieve the desired attenuation characteristics, the filter circuits are configured as 7th order Chebyshev type low-pass filters. Separate filter circuits are provided for six ranges from 1.6 to 30 MHz. All filter circuits employ the same circuit configuration.

The decoder (IC2) converts the frequency data sent as BCD codes from the CPU into decimal codes. Out of the six output lines, the selected line is High. IC1 uses the decoder output signal to drive the relays of the LPF circuits. The IC is a Darlington transistor array.

3-10-2 LPF Unit Circuit Diagram



3-10-3 LPF Unit PCB Diagram (Component Side)



Parts No.	IC1																LPF
Pin No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
Voltage	L	L	L	H	NC	L	L	GND	VCC	H	H	NC	L	H	H	H	1.6~2.6MHz
	L	H	L	L	NC	L	L	GND	VCC	H	H	NC	H	H	L	H	2.6~4.2MHz
	L	L	L	H	L	NC	L	L	GND	VCC	H	H	NC	H	L	H	4.2~6.8MHz
	H	L	L	L	L	NC	L	L	GND	VCC	H	H	NC	H	H	L	6.8~11.1MHz
	L	L	L	L	NC	H	L	L	GND	VCC	H	L	NC	H	H	H	11.1~18.1MHz
Remarks	LPF Control																18.1~30MHz

H:5.0V

L:0V

H:13.0V

L:0V

Parts No.	IC2																LPF
Pin No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
Voltage	L	L	NC	NC	NC	L	L	GND	NC	H	GND	L	L	H	L	VCC	1.6~2.6MHz
	L	H	NC	NC	NC	L	L	GND	NC	L	GND	L	H	L	L	VCC	2.6~4.2MHz
	L	L	NC	NC	NC	L	L	GND	NC	H	GND	L	H	L	H	VCC	4.2~6.8MHz
	H	L	NC	NC	NC	L	L	GND	NC	L	GND	H	L	L	L	VCC	6.8~11.1MHz
	L	L	NC	NC	NC	H	L	GND	NC	H	GND	H	L	L	L	VCC	11.1~18.1MHz
Remarks	LPF Control																18.1~30MHz

H:5.0V
L:0V

3-11 ANT Switch Unit (CCL-265A/JST-245,B/JST-145)

3-11-1 ANT Switch Unit Circuit Description

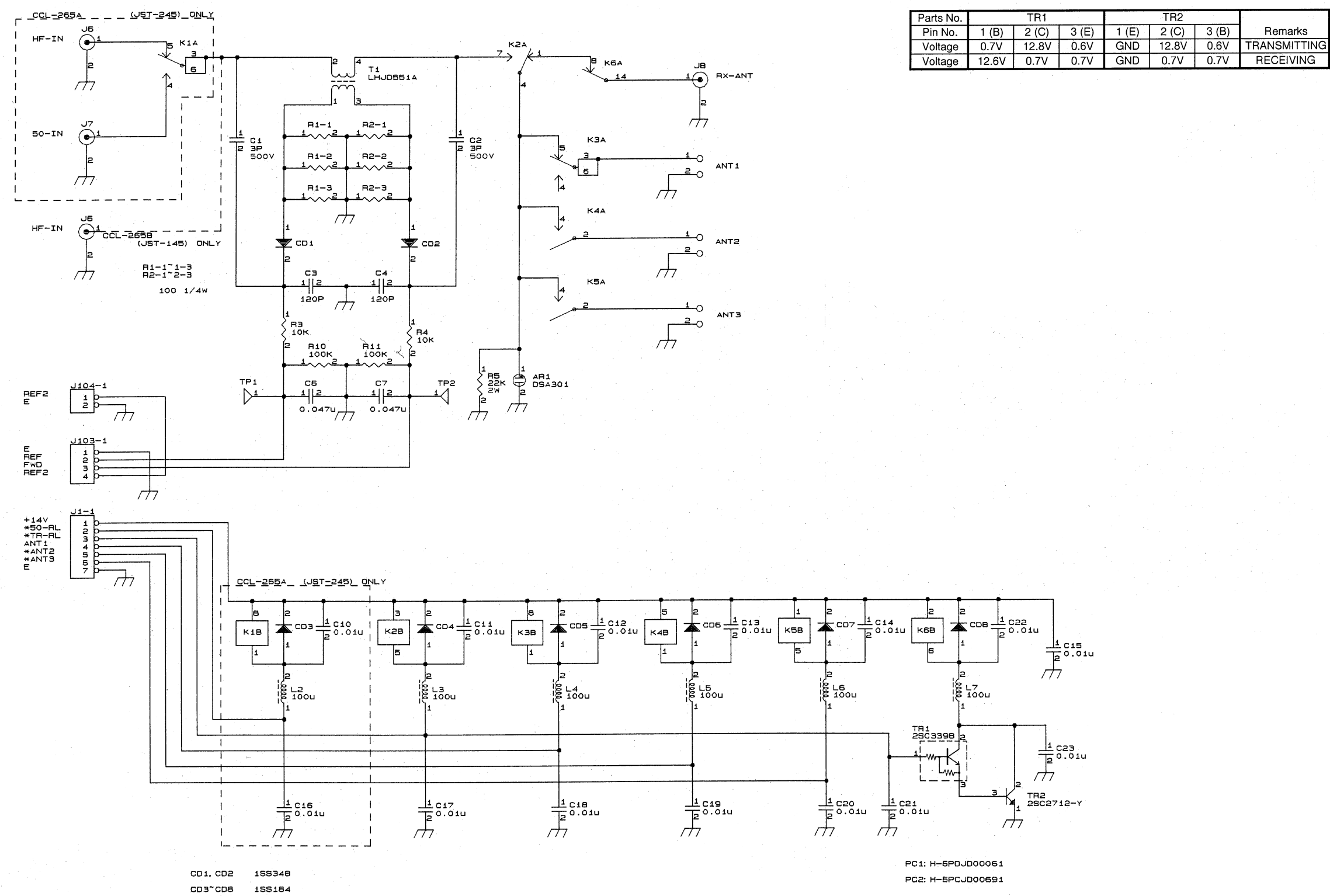
The antenna switch unit serves to select the antenna connector for transmission and reception. It consists of the selector circuitry for ANT1 - ANT3, the transmission/reception selector circuit, and a control circuit.

In the JST-245, during operation in the 1.9 - 29 MHz HF band, K1A is switched to the J5 side to receive the transmission signal input from the matching unit. During operation in the 50 MHz band, K1A is switched to the J6 side to receive the signal from the 50 MHz low-pass filter in the sensor unit. In the JST-145, K1A is absent and the transmission signal from the LPF unit is input to J5.

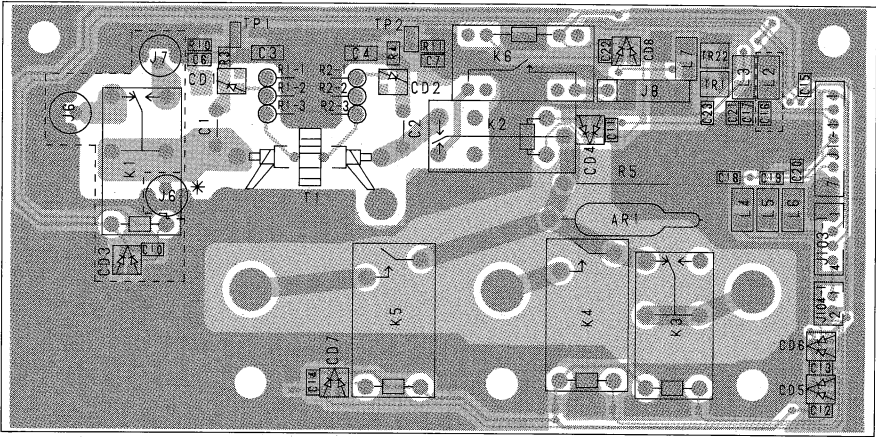
The transformer T1 serves to detect the forward wave and reflected wave power during transmission. The output voltage is sent as Po, REF and SWR meter signal to the A/D converter in the CPU. K2A is a high-speed relay which allows fast switching of the antenna transmission and reception status. During transmission, the output signal is supplied to ANT1 - ANT3, and during reception, the signal from ANT1 - ANT3 is supplied to the reception circuitry. K6A is linked to K2A. During transmission, it is in the open condition, to isolate the transmission signal from the reception circuitry.

K3A, K4A, and K5A are relays which connect ANT1 - ANT3 to the transmission/reception circuitry, depending on the antenna selector switch setting.

3-11-2 ANT Switch Unit Circuit Diagram



3-11-3 ANT Switch Unit PCB Diagram (Component Side)



[---] JST-245 (CCL-265A) ONLY

* JST-145 (CCL-265B) ONLY

3-12 CPU Unit (CDC-796)

3-12-1 CPU Unit Circuit Description

The CPU unit controls the entire operation of the JST-145/JST-245. It consists mainly of the 8-bit single-chip CPU, augmented by the ROM, RAM and I/O interface IC.

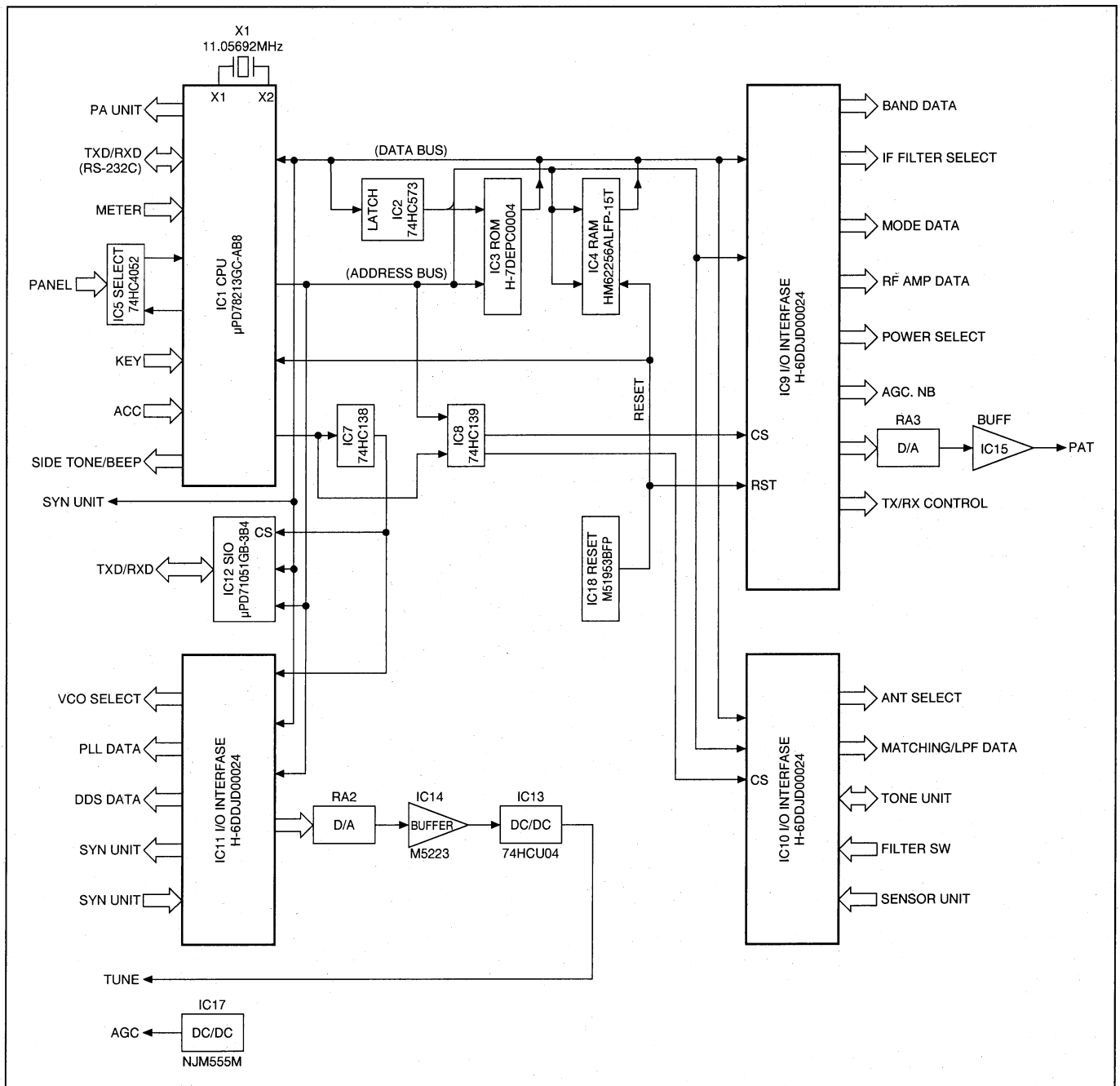


Fig.3.17 CDC-796 CPU Unit Block Diagram

IC1 (μ PD78213GC-AB8) is an 8-bit single-chip CPU with 14 inputs, 12 outputs, and 10 input/output lines. Since it is a type designed for external RAM and ROM, IC3 (H-7DEPC0004) is provided as 64K ROM, and IC4 (HM62256ALFP) as 32K RAM. IC9 - IC11 (H-6DDJD00024) are I/O interface ICs with 8 bit $\times$ 6 ports = 48 bit I/O ports.

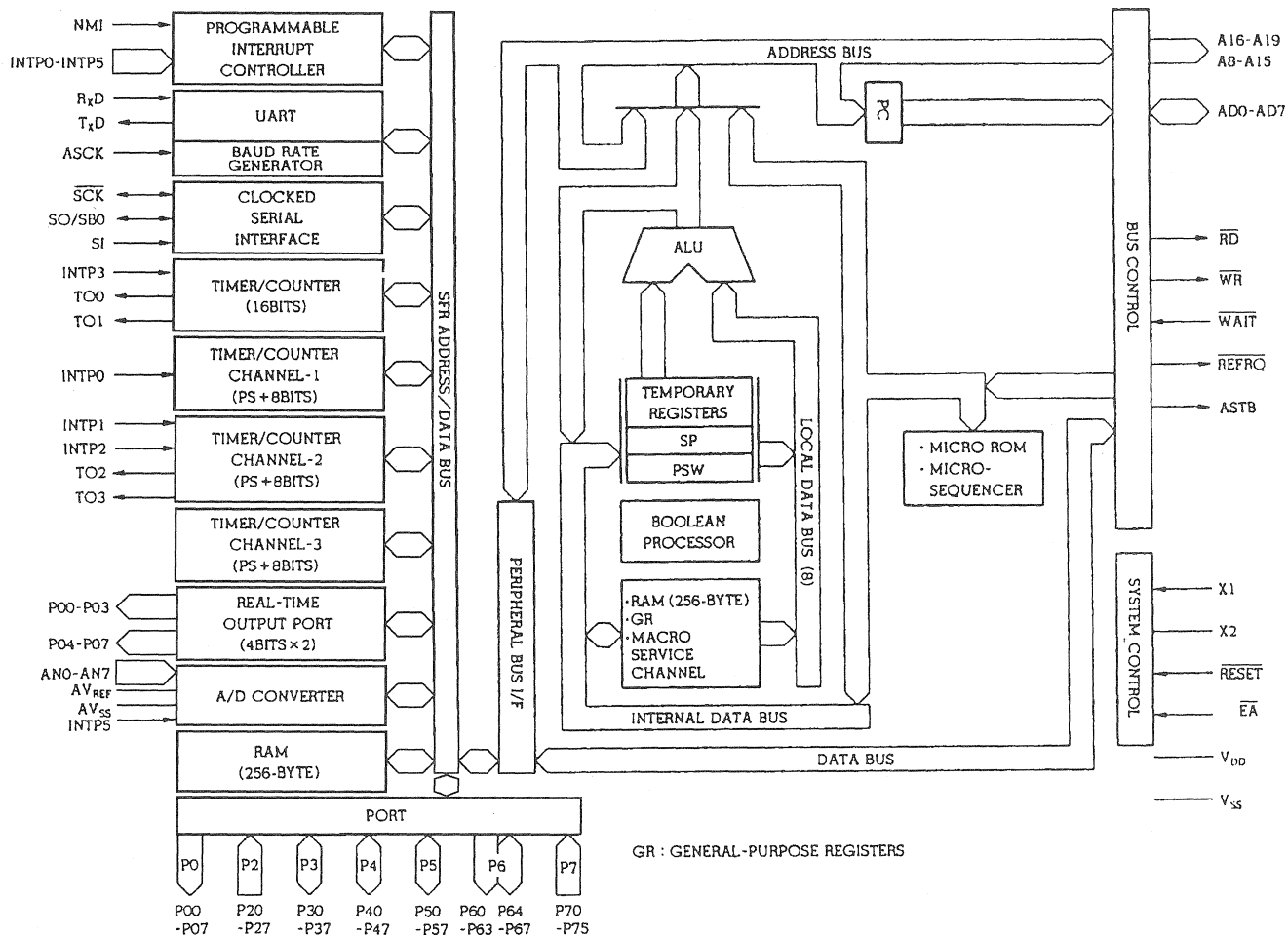


Fig.3.18 CPU (μPD78213GC-AB8) Block Diagram

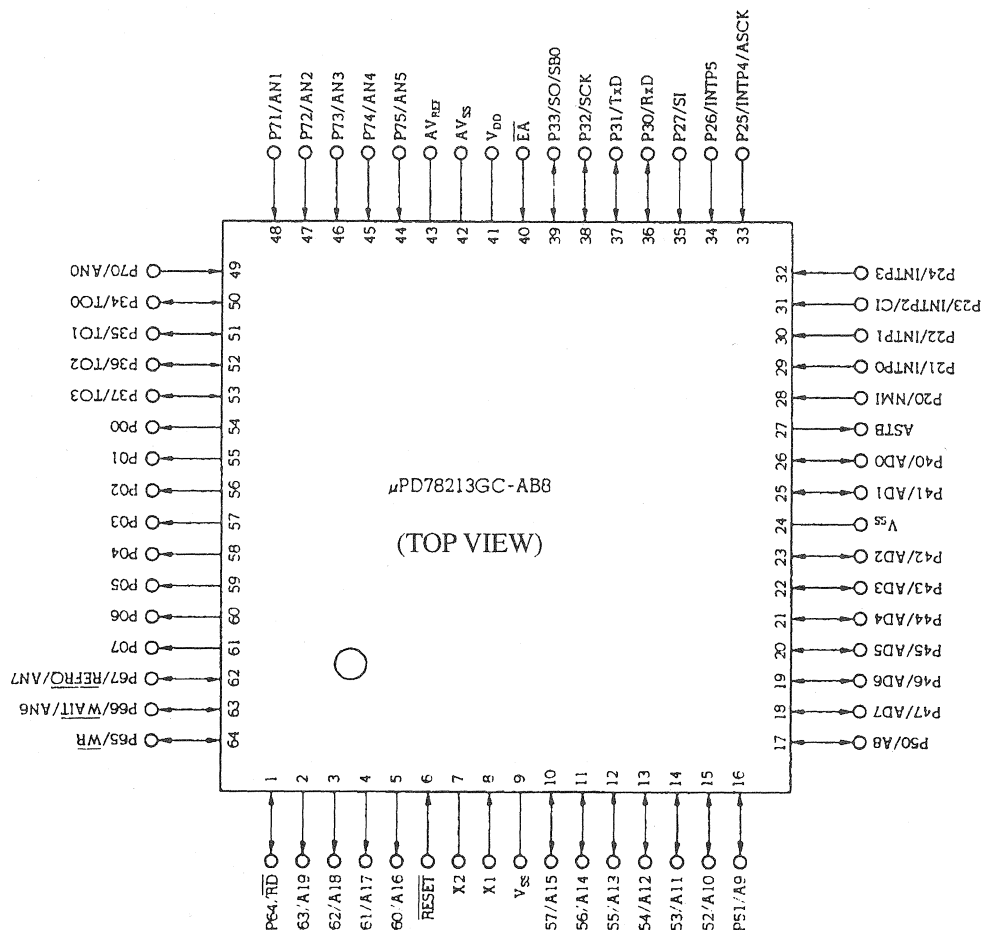


Fig.3.19 CPU (μPD78213GC-AB8) Terminal Connection

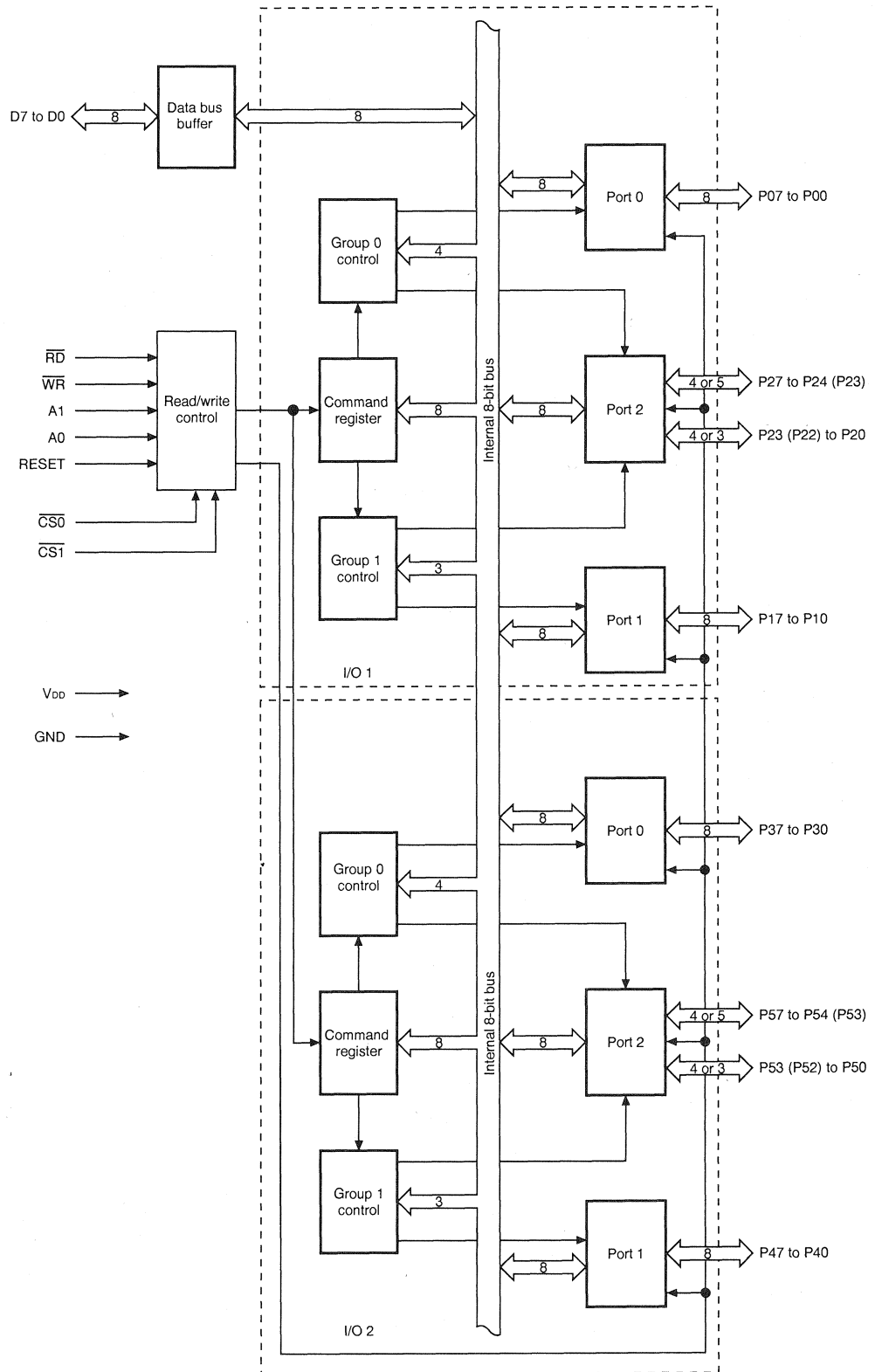


Fig.3.20 I/O INTERFACE (H-6DDJD00024)Block Diagram

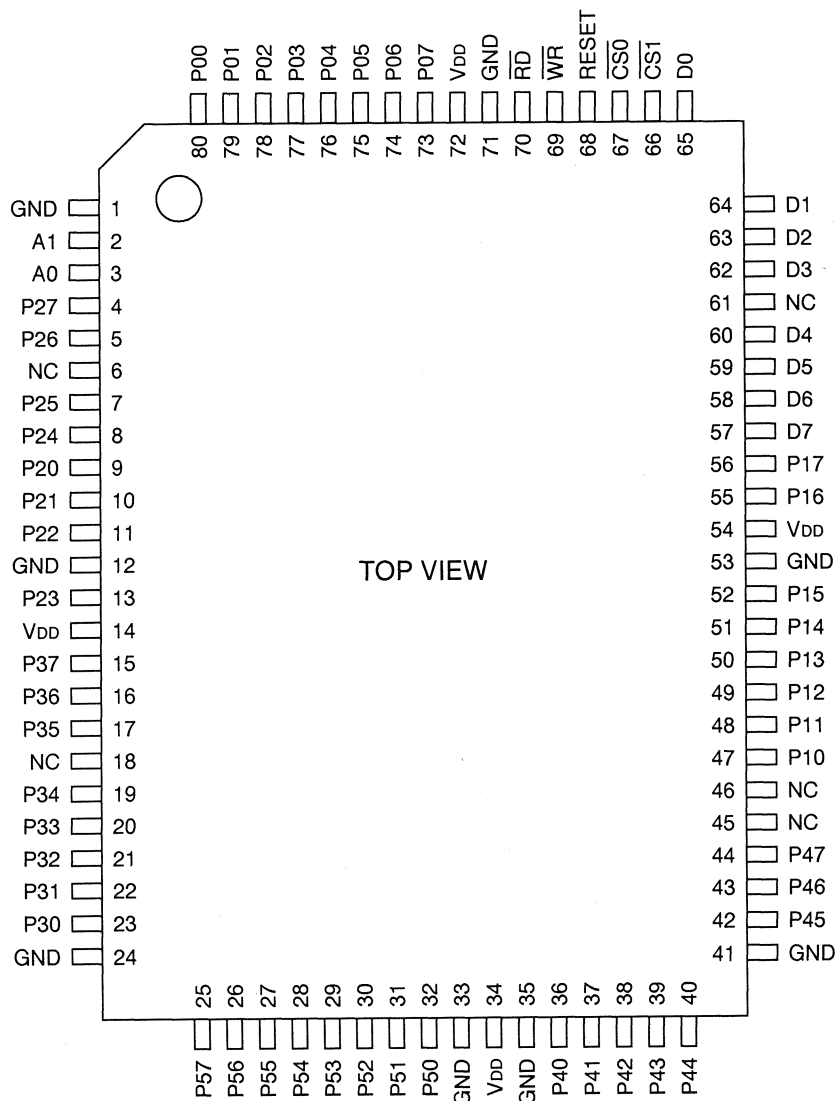


Fig.3.21 I/O INTERFACE (H-6DDJD00024) Terminal Connection

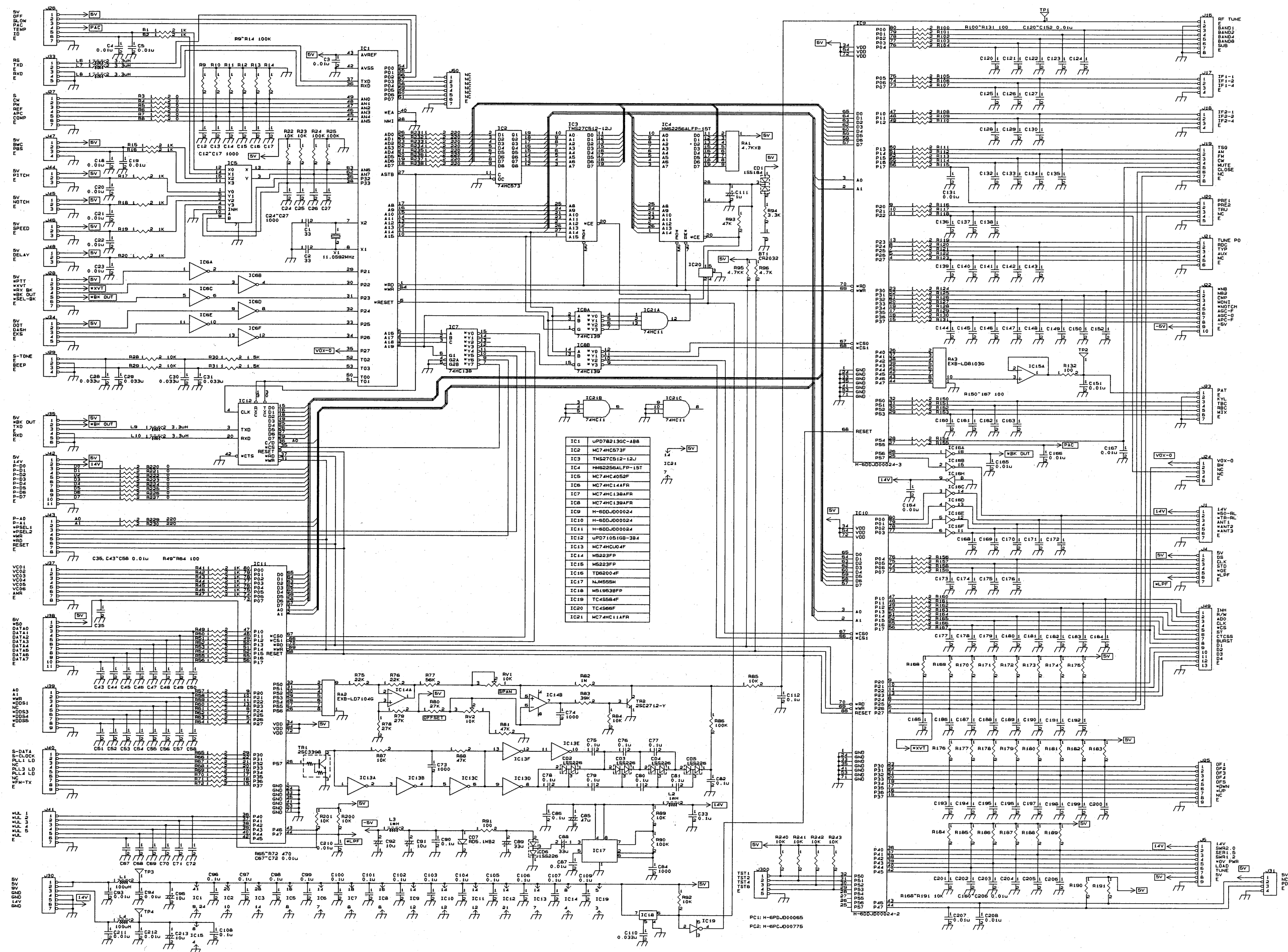
The I/O ports of IC9 - IC11 (H-6DDJD00024) are used mainly for internal control of the SYN unit, TX/RX unit, and display unit. RA3 and IC15 (M5223FP) connected to P40 - P47 of IC9 (H-6DDJD00024) is a D/A converter which generates a control voltage for the pin diode attenuator inserted in the transmission circuitry of the TX/RX unit. RA2, IC13 (74HCUD4F) and IC14 (M5223FP) connected to P50 - P56 of IC9 (H-6DDJD00024) is a circuit which generates a varicap control voltage for the variable tuning circuit in the TX/RX unit. Depending on the operating frequency, the voltage is a value between 5.7 and 20 V.

The main purpose of IC9 - IC11 (H-6DDJD00024) is to serve as interface for H/L digital signals. The analog signal detection input is directly connected to the A/D converter integrated in the 8-bit single-chip CPU (μ PD78213GC-AB8). Analog signals comprise sorter

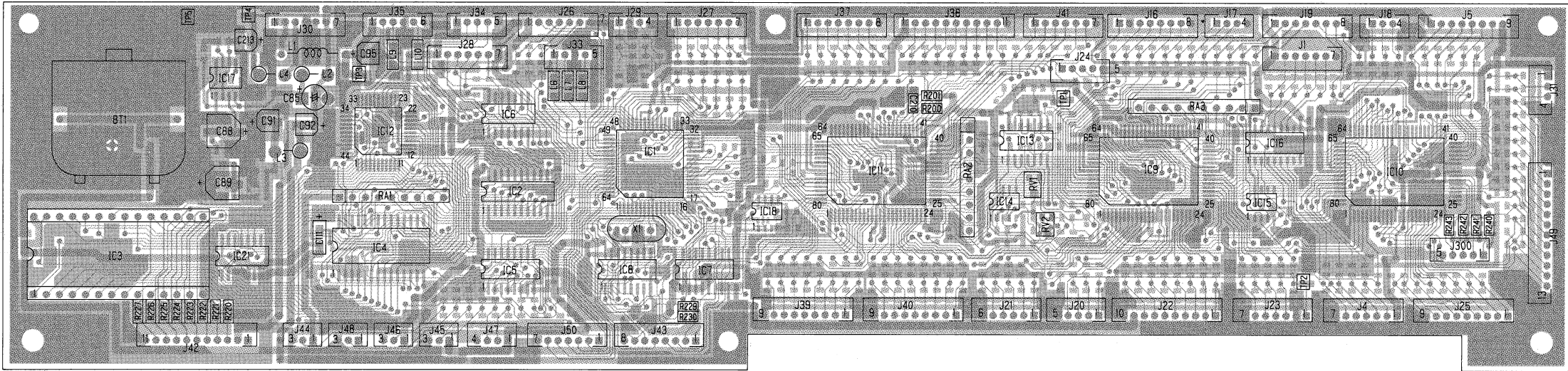
signals such as the signal meter and power meter signals. These are input to AN0 - AN5 of IC1 (μ PD78213GC-AB8). Besides these, the signals from the front panel PBS and BWC controls etc. are routed through the 4-channel multiplexer 74HC4052 and input to AN6 and AN7.

IC12 (μ PD71051GB-3B4) provides a serial data channel for external equipment (linear amplifier JRL-2000F, auto tuner NFG-230). It is connected to the external equipment via the photocoupler in the SYN unit. IC17 (NJM555M) is a DC/DC converter which supplies a -5V voltage to the reception AGC and switching circuits in the TX/RX unit.

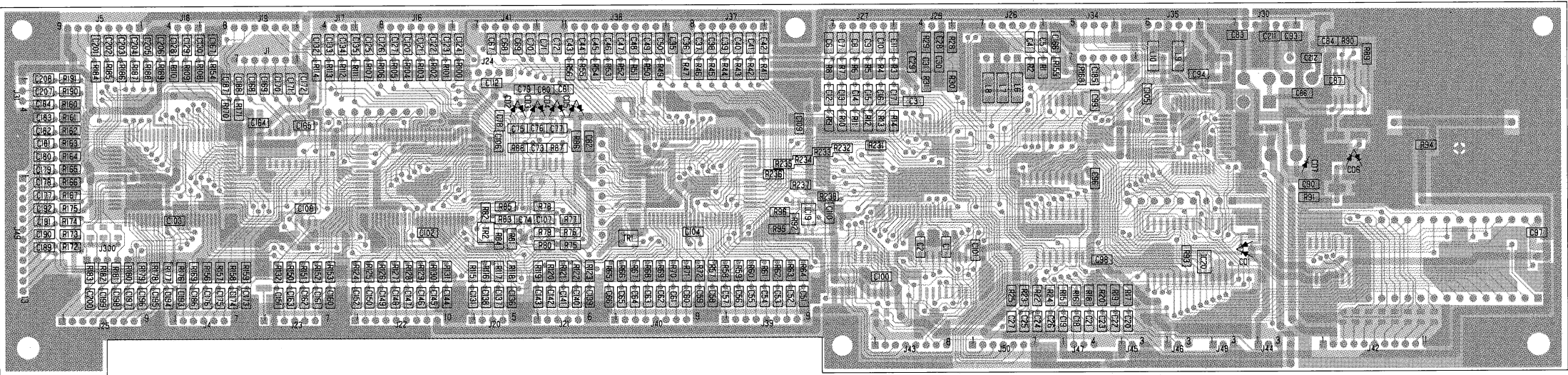
3-12-2 CPU Unit Circuit Diagram



3-12-3 CPU Unit PCB Diagram



(Component Side)



(Pattern Side)

Parts No.	IC5																TR1			TR2		
Pin No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	1 (B)	2 (C)	3 (E)	1 (E)	2 (C)	3 (B)
Voltage	0V	0V	0V	0V	0V	GND	GND	GND	1.0V	1.0V	0V	2.1V	1.2V	0.6V	0V	4.9V	0V	2.5V	GND	GND	13.2V	0.6V
Remarks	System Control																System Control			System Control		

Parts No.	IC6													
Pin No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Voltage	4.9V	0V	4.9V	0V	4.9V	0V	GND	0V	4.9V	0V	4.9V	4.9V	0V	4.9V
Remarks	System Control													

Parts No.	IC12																							
Pin No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Voltage	0V	0V	4.9V	0.4V	0V	0V	0V	4.9V	0V	0V	0V	0V	2.5V	4.9V	2.4V	0V	0V	2.4V	2.4V	4.9V	0V	0V	0V	0V
Note																								
Remarks	System Control																							

Parts No.	IC12																			
Pin No.	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
Voltage	4.9V	4.9V	4.9V	0V	4.9V	2.5V	4.9V	0V	0V	0V	4.9V	2.5V	2.3V	0V	0V	4.9V	0V	GND	4.9V	0V
Note																				
Remarks	System Control																			

Parts No.	IC13														IC14							
Pin No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	1	2	3	4	5	6	7	8
Voltage	2.5V	2.5V	2.5V	2.4V	2.4V	2.6V	GND	2.3V	2.6V	2.6V	2.4V	2.4V	2.6V	4.9V	2.4V	2.5V	2.5V	0V	3.1V	3.1V	2.7V	4.9V
Remarks	System Control														System Control							

Parts No.	IC15								IC16															
Pin No.	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Voltage	1.7V	1.7V	1.7V	GND	NC	NC	NC	9.0V	0V	0V	0V	0V	0V	0V	0V	0V	13.6V	0V	13.6V	13.6V	13.6V	12.6V	13.6V	13.6V
Remarks	System Control								System Control															

Parts No.	IC17								IC18								IC19				
Pin No.	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5
Voltage	GND	6.2V	6.2V	12.5V	8.3V	6.2V	6.2V	12.5V	NC	NC	NC	GND	1.2V	4.9V	4.9V	0V	0V	4.9V	GND	0V	4.9V
Remarks	System Control								System Control								System Control				

3-13 Power Supply Unit (CBD-1197/CBG-87)

3-13-1 Power Supply Unit Circuit Description

The power supply consists of the main power supply unit (CBD-1197) and the sub power supply unit (CBG-87), both of which are switching type power supplies.

The AC input is routed to the main power supply for AC isolation and conversion to the VPA voltage (60 V DC). The VPA voltage is fed to the power amplifier unit and to the sub power supply. The sub power supply converts this voltage into 13.8 V, 9 V, and 5 V DC which are used by all units.

The main power supply uses a principle called PMPT (Phase Modulated PWM Topology). This method, which is also referred to as zero volt switching, is a kind of partial resonance arrangement. By combining aspects of a conventional PWM circuit and a resonance-type circuit, the power supply achieves high efficiency and low noise.

The sub power supply employs the RCC principle and is configured as a conventional ringing choke converter.

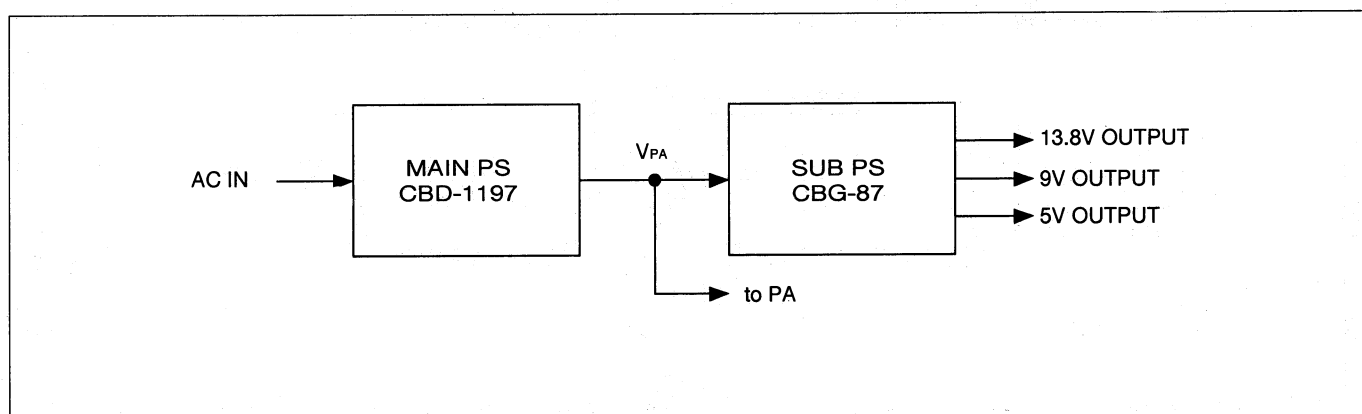


Fig.3.22 Block diagram of power supply unit

[1] Main power supply (CBD-1197)

The AC voltage is routed through the noise filter L1/C1 and the surge protector R1/K1 before being converted into a DC voltage by the rectifying circuit (CD2, C4, C5). The rectifier is a conventional capacitor-input type with a surge protector to prevent overload at power-on. By switching the AC voltage input tap, the unit can handle either 100 or 200 V AC line voltages, but the operation of the rectifying circuit differs depending on the input voltage. When the input is 100 V AC, the circuit functions as a double-voltage rectifier, and with 200 V AC as a full-wave rectifier.

The voltage is then supplied to the fully bridged switching circuit (TR1 - TR4) for conversion into a high-frequency signal of about 150 Hz. This circuit is a zero volt switching type designed to minimize noise. The signal then goes to the main transformer (T1) for isolation and conversion to the required voltage.

The output of the main transformer is sent to the rectifier consisting of CD3, L2, and C11, for rectification and smoothing. After passing the noise filter L3 and C12, the DC output is available.

A part of the DC output is used for feedback, by being routed via the photocoupler CD6 to the control IC (IC1). This IC governs the output pulse width of the main switching circuit (TR1 - TR4) in order to keep the output voltage constant, regardless of input and load fluctuations. The control is achieved indirectly, by adjusting the drive signal timing to each transistor. This results in a phase difference which is used to achieve uniform output. The power supply therefore remains stable also within a narrow pulse range, regardless of load fluctuations.

TR17 and CD22 form an overload protection circuit. Output overload is detected by means of R5. If two consecutive overload cycles are detected, the output of the power supply is shut down. CD9 functions as overvoltage protection. If for some reason the output voltage is abnormally high, the output of the power supply is shut down. Both of these conditions can be reset by turning the power supply off. After removing the cause, turning the power supply on again will restore normal operation.

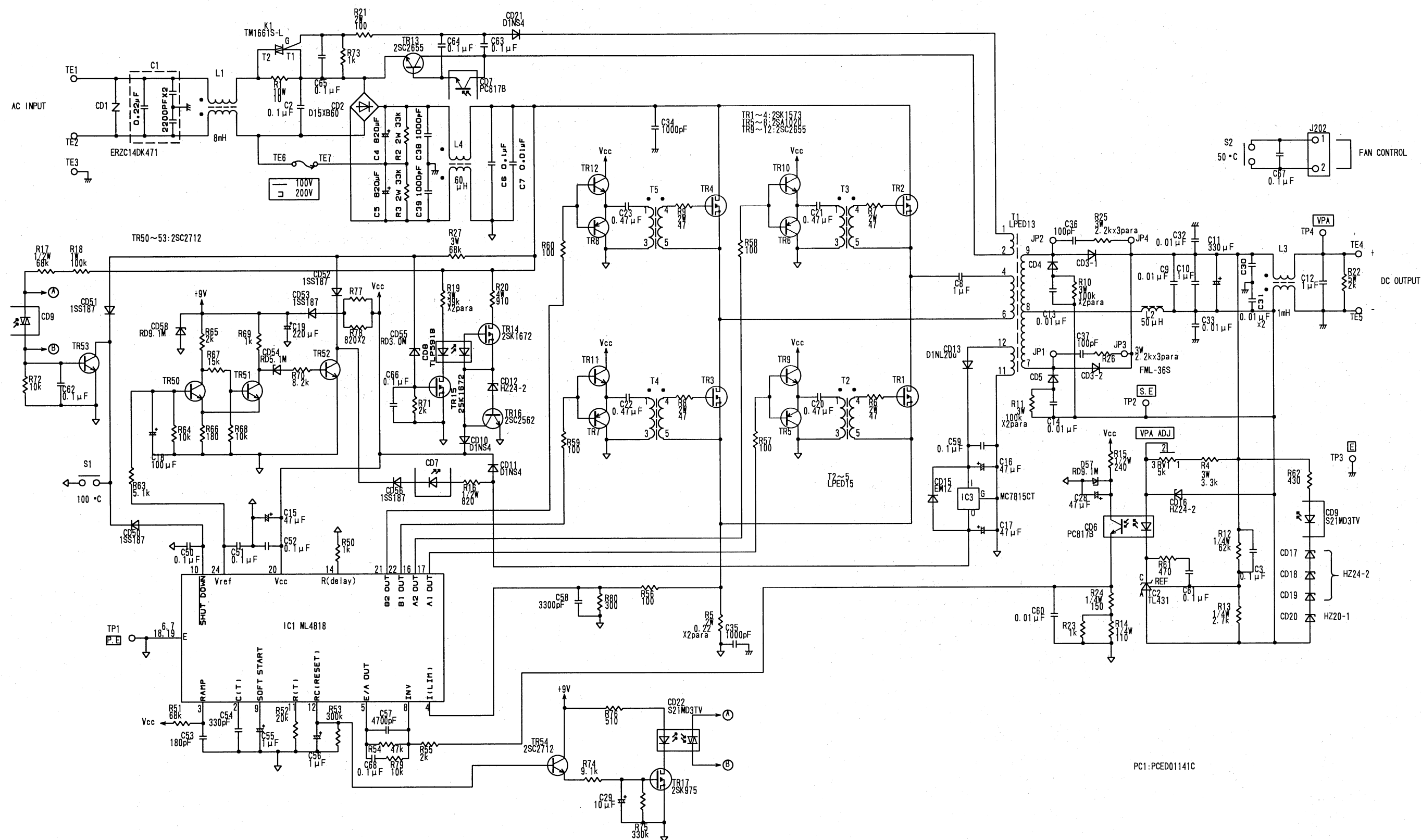
[2] Sub power supply (CBG-87)

The DC input voltage from the main power supply is routed through the noise filter L1/C1 to the RCC type switching circuit (IC1) which generates a high-frequency signal of about 20 - 100 kHz. Since this circuit is self-oscillating, a control voltage for the IC is not required.

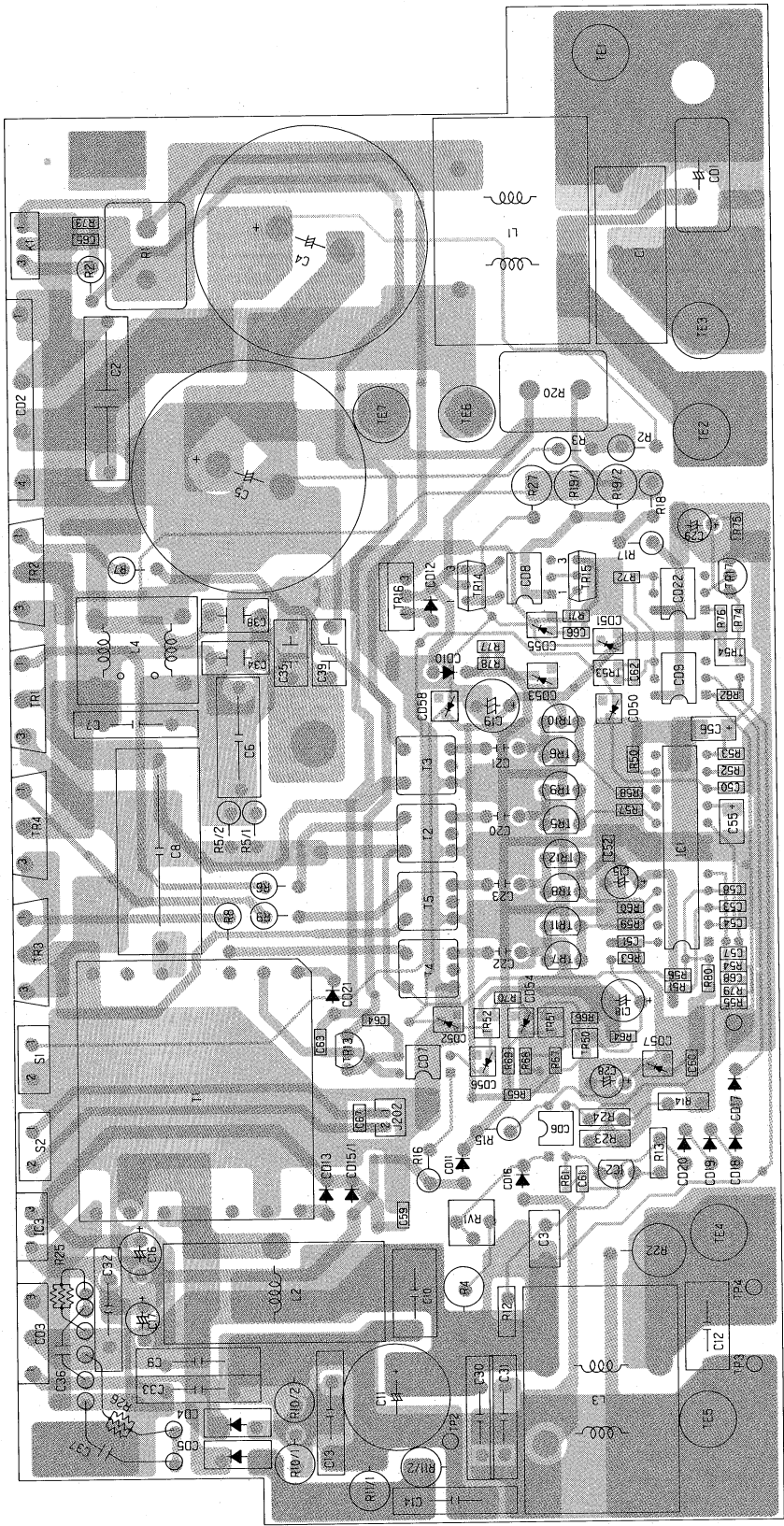
The high-frequency signal is sent to the transformer T1 for step-down conversion into the required three voltages. These are then rectified by CD2/CD6, CD3/CD8, and CD5/CD10, respectively. The 5 V and 9 V DC voltages are further stabilized by dedicated three-terminal regulator ICs (IC3 and IC4). A part of the 13.8 V DC voltage is used for feedback, by being routed via the photocoupler CD1 to the switching IC (IC1), to keep the output voltage constant.

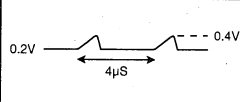
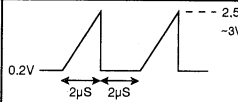
CD7 and TR1 function as overvoltage protection. If for some reason the nominal 13.8 V DC output voltage becomes abnormally high, the output of the power supply is shut down. This condition can be reset by turning the power supply off. After removing the cause, turning the power supply on again will restore normal operation.

3-13-2 Power Supply Unit (CBD-1197) Circuit Diagram



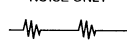
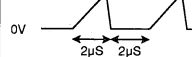
3-13-3 Power Supply Unit (CBD-1197) PCB Diagram (Component Side)

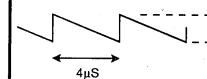
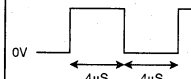
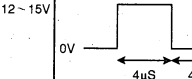


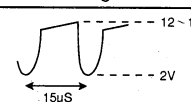
Parts No.	IC1			
Reference GND	TP1.			
Pin No.	1	2	3	
Voltage	0V			
Remarks			I _o =0A	I _o =6A

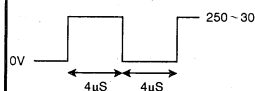
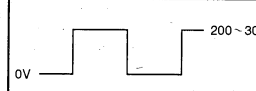
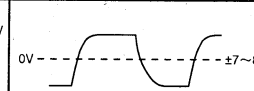
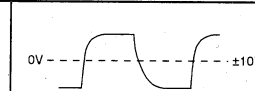
Caution

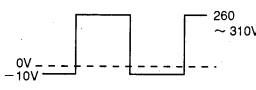
TP1 (PE) is connected to the AC line. To prevent the danger of electric shock and short-circuiting when using this terminal, insert an isolation transformer in the AC line.

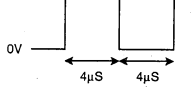
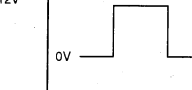
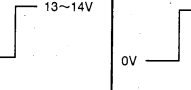
Parts No.	IC1									
Reference GND	TP1.									
Pin No.	4		5	6, 7	8	9	10	11	12	
Voltage	0V NOISE ONLY 			1V	3V	0V	5V	5.5~6V	8.5V	5~5.5V
Remarks	I _o =0A		I _o =6A	I _o =0A	I _o =6A					

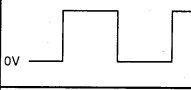
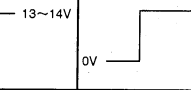
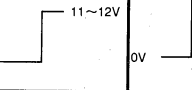
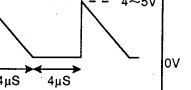
Parts No.	IC1									
Reference GND	TP1.									
Pin No.	13	14	15	16		17		18, 19		
Voltage		4~4.5V	0V			Same as pin 16 (A2 OUT)		0V		
Remarks				I _o =0A	I _o =6A					

Parts No.	IC1					IC2			IC3				
Reference GND	TP1.					IC2 A			TP1.				
Pin No.	20		21, 22	23	24	A	REF	C	IN		G	OUT	
Voltage	12~15V	14~15V	Same as pin 16 (A2 OUT)	0V	5V	0V	2.5V		18~20V	20~23V	0V	13~15V	14~15V
Remarks	I _o =0A	I _o =6A							I _o =0A	I _o =6A		I _o =0A	I _o =6A

Parts No.	TR1, TR3			
Reference GND	TP1.			
Pin No.	D		G	
Voltage				
Remarks	I _o =0A		I _o =6A	

Parts No.	TR2, TR4			
Reference GND	TP1.			
Pin No.	D		S	
Voltage	250~300V	200~300V		
Remarks	I _o =0A	I _o =6A	I _o =0A	I _o =6A

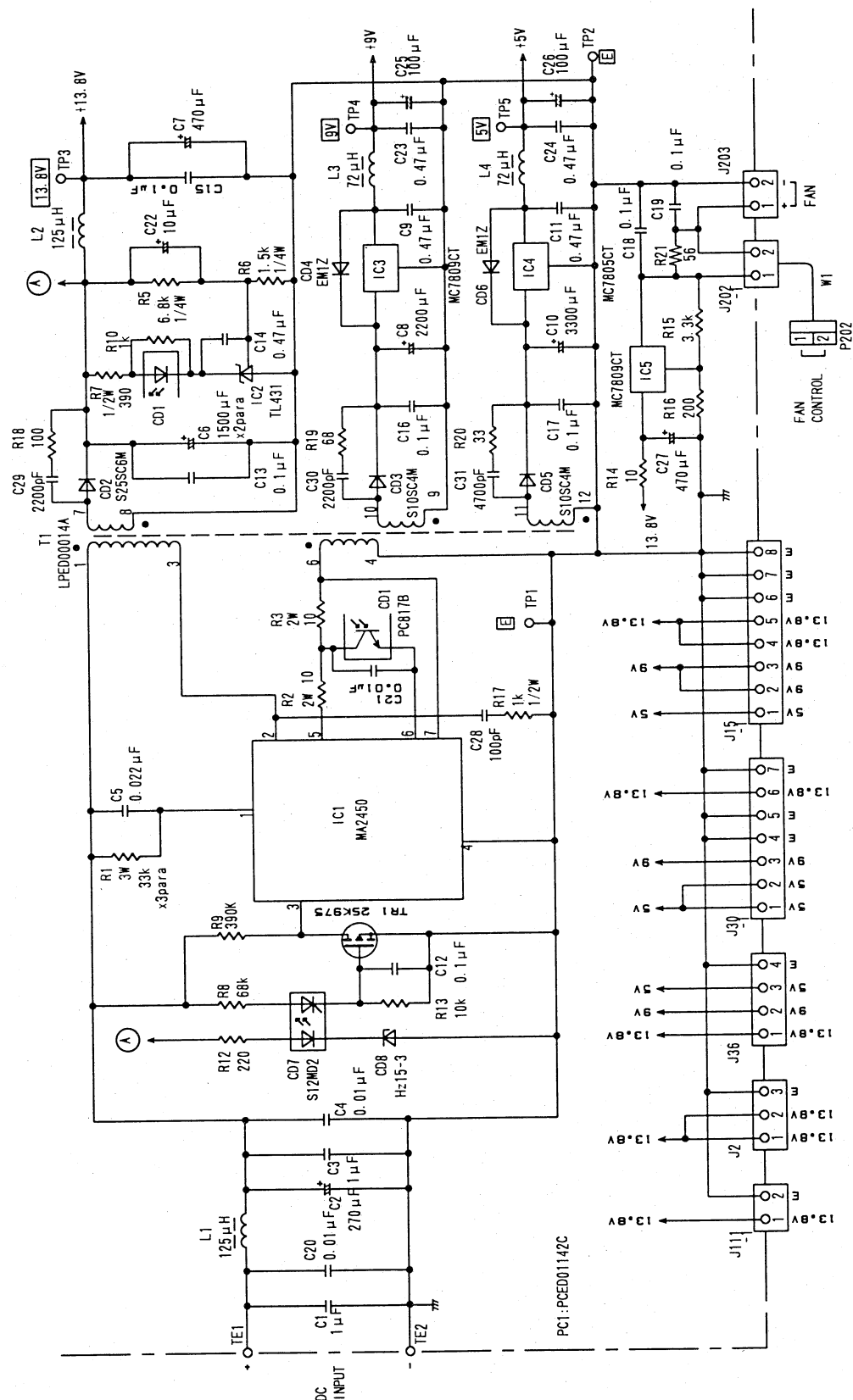
Parts No.	TR5~TR8				TR9~TR12	
Reference GND	TP1.				TP1.	
Pin No.	C	B		E	C	
Voltage	0V				12V	14~15V
Remarks		I _o =0A	I _o =6A		I _o =0A	I _o =6A

Parts No.	TR9~TR12			TR13	
Reference GND	TP1.			TP1.	
Pin No.	B		E	C	
Voltage					
Remarks	I _o =0A	I _o =6A		I _o =0A	I _o =6A

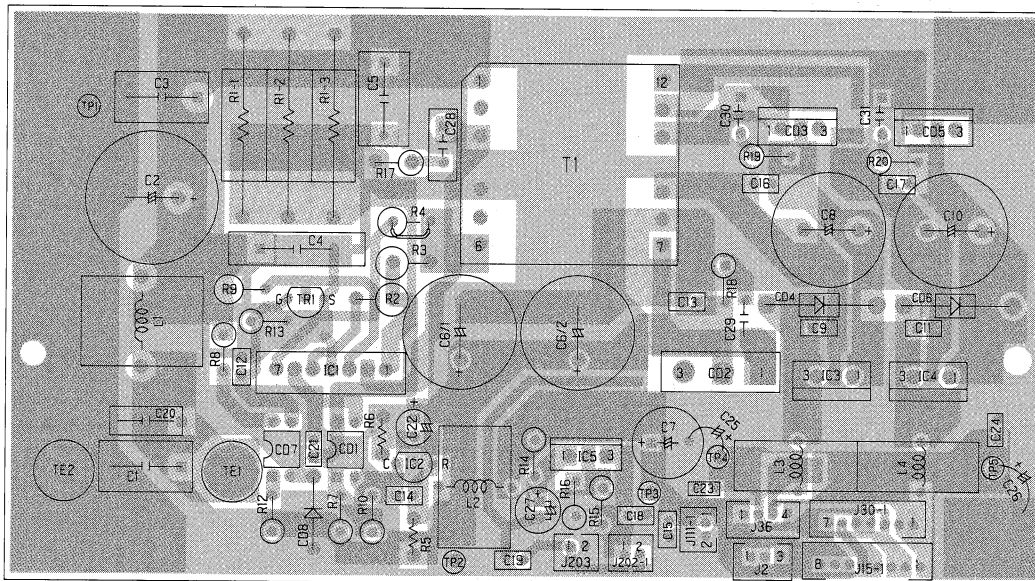
Parts No.	TR13		TR14				TR15				TR16			TR17		
Reference GND	TP1. E		TP1.													
Pin No.	B	E	D		G	S	D		G	S	C	B	E	D	G	S
Voltage	0.6~0.8V	0V	250~300V	200~300V	1~3V	1~3V	250~300V	200~300V	0V	0V	1~3V	0V	0V	8~9V	0V	0V
Remarks			Io=0A	Io=6A			Io=0A	Io=6A								

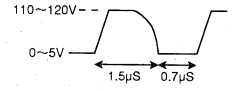
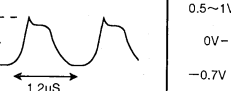
Parts No.	TR50			TR51			TR52			TR53			TR54		
Reference GND	TP1.			TP1.			TP1.			TP1.			TP1.		
Pin No.	C	B	E	C	B	E	C	B	E	C	B	E	C	B	E
Voltage	0.8~1V	1.5V	0.8V	8~9V	0.2~0.4V	0.8V	0.1V	0.6~0.8V	0V	8~10V	0V	0V	9V	0V	0.5~0.6V
Remarks															I _o =0A

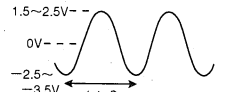
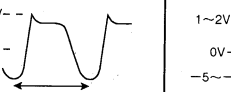
3-13-4 Power Supply Unit Circuit Diagram

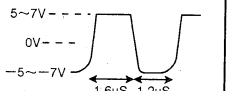


3-13-5 Power Supply Unit (CBG-87) PCB Diagram (Component Side)



Parts No.	IC1					
Pin No.	1		2		3	
Voltage	100~130V	120~150V				
Remarks	I _o =0A	RECEIVING	I _o =0A	RECEIVING	I _o =0A	RECEIVING

Parts No.	IC1					
Pin No.	4		5		6	
Voltage	0V	0V				
Remarks	I _o =0A	RECEIVING	I _o =0A	RECEIVING	I _o =0A	RECEIVING

Parts No.	IC1		IC2		IC3		IC4	
Pin No.	7		A	REF	C	IN	GND	OUT
Voltage			0V	2.5V	9~10V	11~13V	0V	8.6~9.4V
Remarks	I _o =0A	RECEIVING						

Parts No.	IC5						TR1		
Pin No.	IN		GND		OUT		D	G	S
Voltage	13~15V	12~15V	1.6V	1.5V	10.5~11.5V	9.5~10.5V	Same as pin 3 of IC1	0V	0V
Remarks	I _o =0A	RECEIVING	I _o =0A	RECEIVING	I _o =0A	RECEIVING			

3-14 Tone Unit (CCL-267, Option)

This unit is required for tone squelch, code squelch and paging in FM mode. It is available as an option for the JST-145 and JST-245.

3-14-1 Tone Unit Circuit Description

The tone unit incorporates an IC which serves as tone squelch encoder and decoder, and an IC which serves as code squelch and DTMF encoder and decoder for paging. IC2 (S-7119BF) is a one-chip IC using the CTCSS principle for tone squelch encoding and

decoding. The IC sets the tone frequency and other parameters according to serial data from the CPU. The frequency setting range is 67 - 250.3 Hz, with 38 available settings.

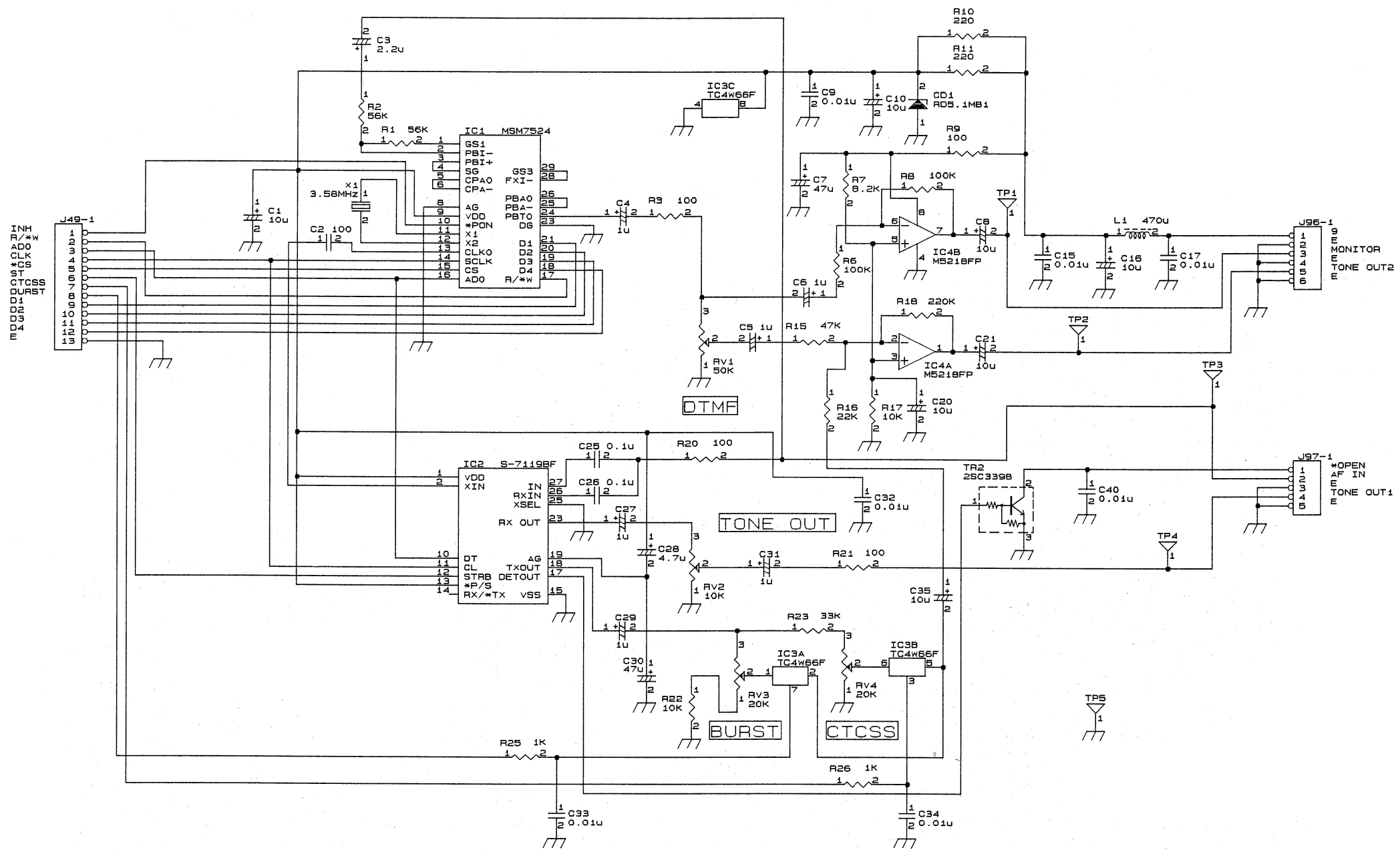
#	Frequency (Hz)	#	Frequency (Hz)	#	Frequency (Hz)	#	Frequency (Hz)
1	67.0	11	97.4	21	136.5	31	192.8
2	71.9	12	100.0	22	141.3	32	203.5
3	74.4	13	103.5	23	146.2	33	210.7
4	77.0	14	107.2	24	151.4	34	218.1
5	79.7	15	110.9	25	156.7	35	225.7
6	82.5	16	114.8	26	162.2	36	233.6
7	85.4	17	118.8	27	167.9	37	241.8
8	88.5	18	123.0	28	173.8	38	250.3
9	91.5	19	127.3	29	179.9		
10	94.8	20	131.8	30	186.2		

Table 3.6 Tone frequencies available with IC2 (S-7119BF)

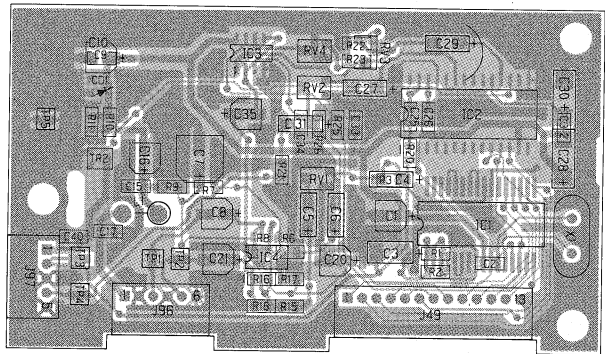
IC1 (MSM7524) is a one-chip encoder and decoder IC handling the DTMF signal for code squelch and paging. Its entire operation is controlled by serial data from the CPU.

IC4A (M5218FP) is a buffer/mixer for the tone and DTMF output which is supplied to the MIC-AMP circuit in the TX/RX unit. IC4B (M5218FP) is a buffer for the monitor output of the DTMF signal which is supplied to the AF-AMP circuit in the TX/RX unit.

3-14-2 Tone Unit Circuit Diagram



3-14-3 Tone Unit PCB Diagram (Component Side)



Parts No.	IC1																
Pin No.	1	2	3,4	5,6	8	9	10	11	12	13	14~16	17	18~21	23	24	25,26	28,29
Voltage	2.6V	2.6V	2.6V	2.6V	GND	5.2V	0V	2.5V	2.4V	2.4V	—	4.8V	—	GND	2.6V	2.6V	2.6V
Remarks	Tone Control																

Parts No.	IC2													
Pin No.	1	2	10	11	12	13	15	17	18	19	23	25	26	27
Voltage	0V	1.9V	—	—	—	5.2V	GND	0V	2.6V	2.6V	2.6V	GND	2.4V	2.4V
Remarks	Tone Control													

Parts No.	IC3								IC4								TR2		
Pin No.	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1 (B)	2 (C)	3 (E)
Voltage	0V	0V	0V	GND	0V	0V	0V	5.1V	4.3V	4.3V	4.3V	GND	4.3V	4.3V	4.3V	7.9V	0V	6.6V	GND
Remarks	Tone Control								Tone Control								Tone Control		

f=14.250MHz
MODE=FM
TSQ=ON
RECEIVING
(NO SIGNAL)

3-15 Monitor Unit (CMF-144, Option)

This unit is required to perform transmission IF monitoring in the SSB and AM modes. It is available as an option for the JST-145 and JST-245.

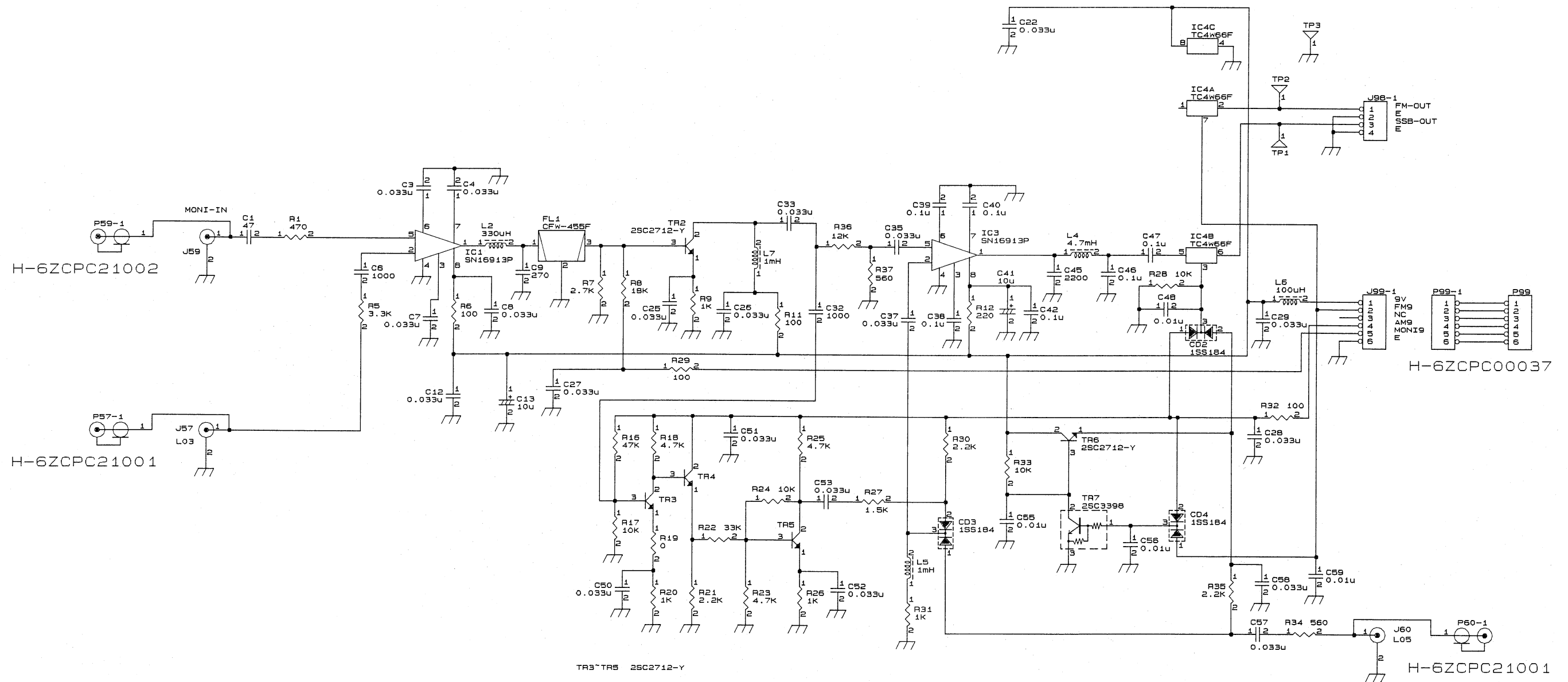
3-15-1 Monitor Unit Circuit Description

The monitor unit incorporates a circuit which converts the transmission IF of 9.455 MHz into 455 kHz and performs detection of this signal.

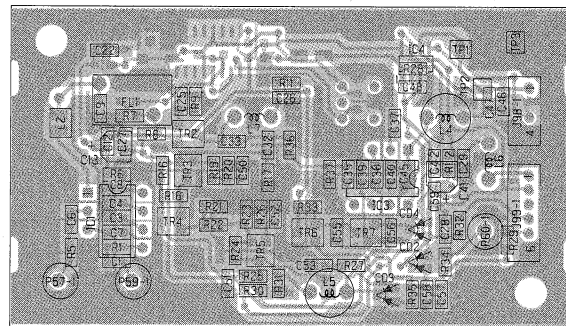
IC2 mixes the 9.455 MHz transmission IF signal from the TX/RX unit with the 9 MHz local oscillator signal LO3 and converts it into a 455 kHz signal. After conversion, the 455 kHz signal is filtered by FL1 and amplified by TR2, and then divided into two lines. One

line goes to the detector circuit (IC3) and the other to the carrier generator required for monitoring in the AM mode. In the SSB mode, IC3 operates as product detector, and in the AM mode as sync detector using the signal from the carrier generator. After detection, the audio signal is filtered by an LC filter and becomes the monitor signal which is adjusted by the MONITOR control RV8-1 on the front panel and supplied to the AF-AMP circuit in the TX/RX unit.

3-15-2 Monitor Unit Circuit Diagram



3-15-3 Monitor Unit PCB Diagram (Component Side)



Parts No.	IC1								IC3							
Pin No.	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
Voltage	6.4V	3.8V	2.7V	GND	2.7V	3.8V	3.8V	7.6V	5.6V	3.3V	2.4V	GND	2.4V	3.3V	3.3V	6.7V
Remarks	TX Monitor								TX Monitor							

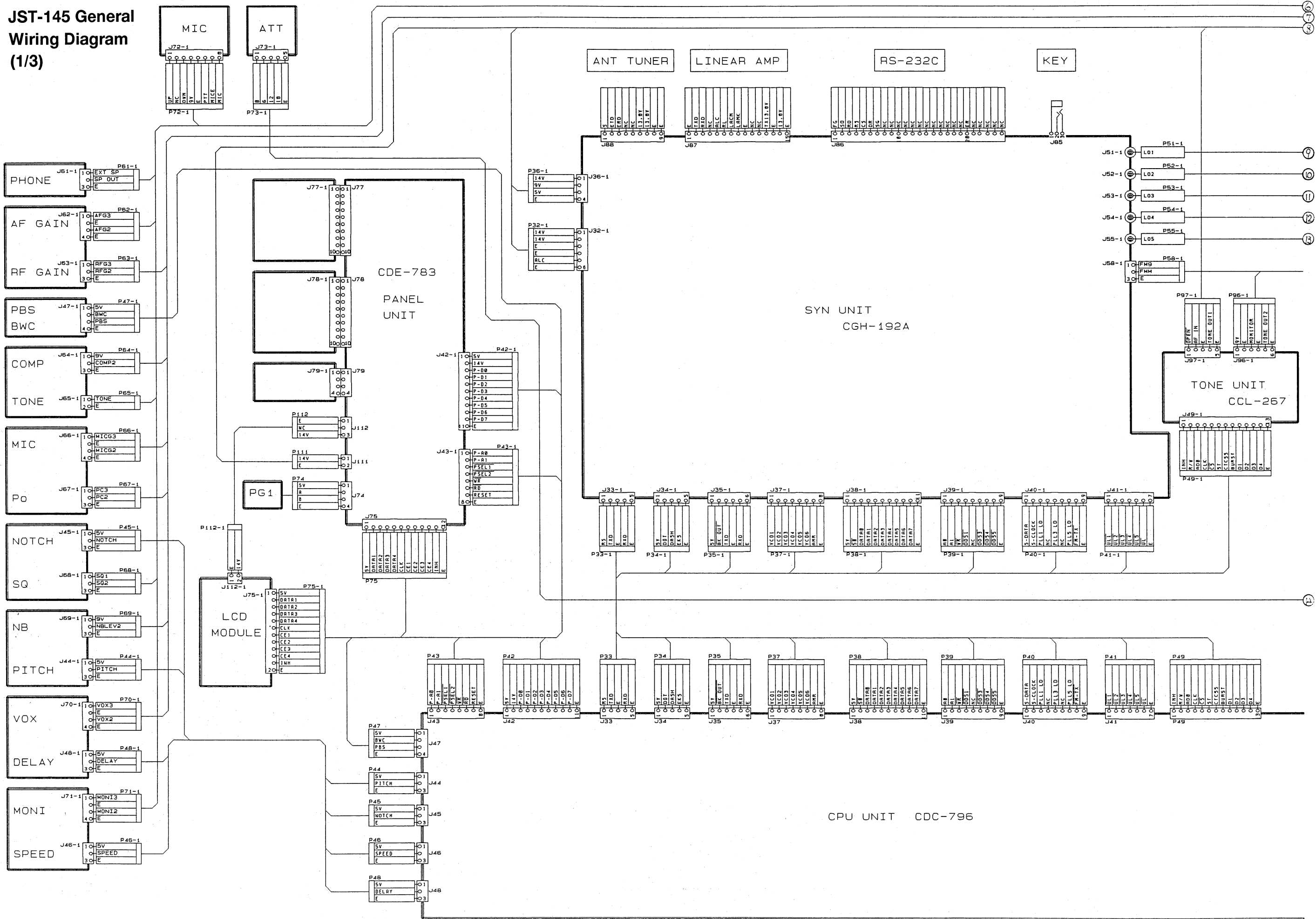
Parts No.	TR2			TR3			IC4								TR4		
Pin No.	1 (E)	2 (C)	3 (B)	1 (E)	2 (C)	3 (B)	1	2	3	4	5	6	7	8	1 (E)	2 (C)	3 (B)
Voltage	0.5V	3.6V	1.2V	0.9V	3.2V	1.0V	NC	4.2V	7.5V	GND	4.2V	4.2V	0V	8.7V	3.2V	8.0V	3.2V
Remarks	TX Monitor			TX Monitor			TX Monitor								TX Monitor		

Parts No.	TR5			TR6			TR7		
Pin No.	1 (E)	2 (C)	3 (B)	1 (E)	2 (C)	3 (B)	1 (B)	2 (C)	3 (E)
Voltage	0.7V	3.6V	1.3V	0V	8.7V	0V	7.5V	0V	GND
Remarks	TX Monitor			TX Monitor			TX Monitor		

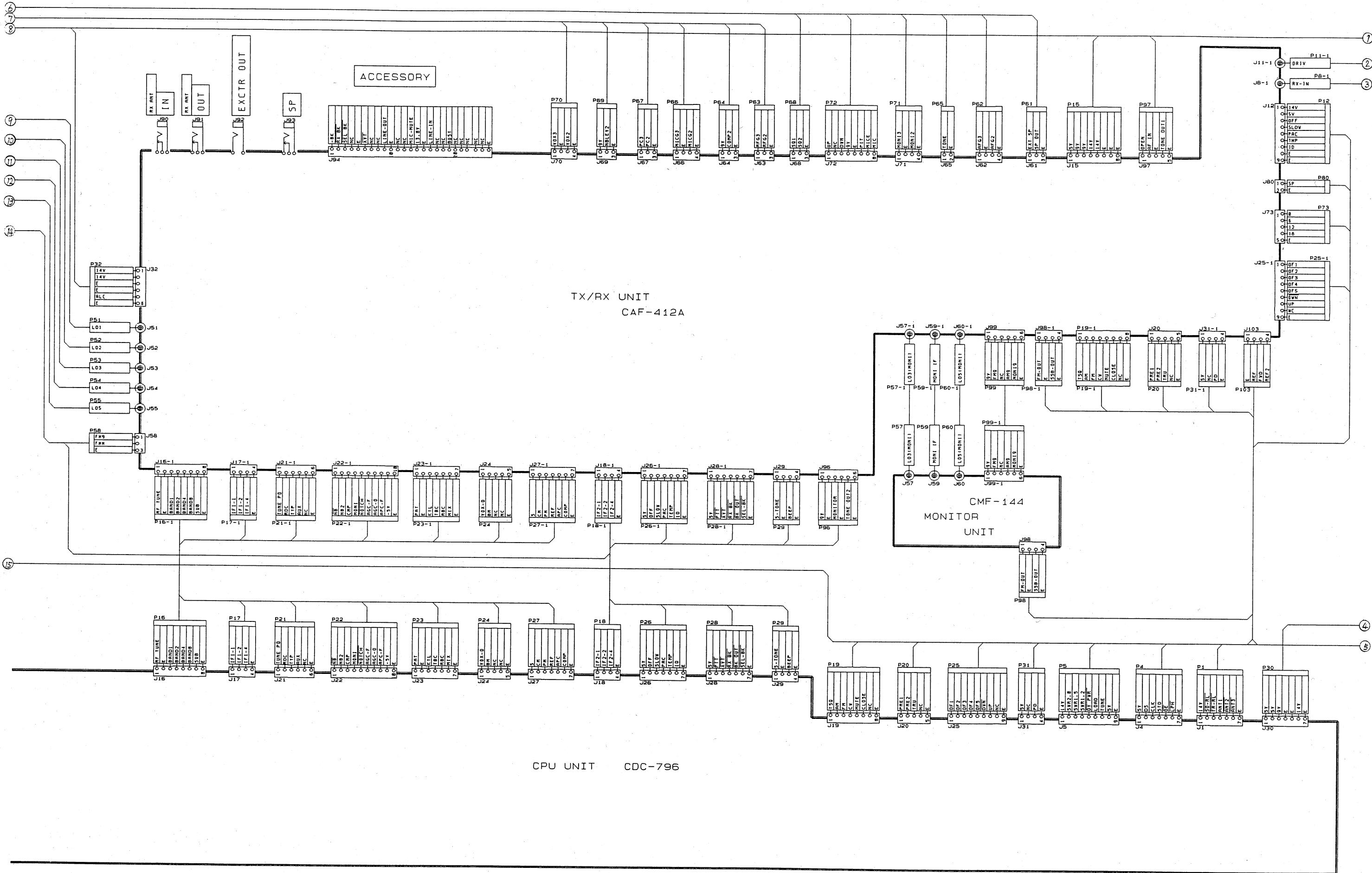
f=14.250MHz
MODE=AM
MONI=ON
Tx

3-16 General Wiring Diagram (CHASSIS)

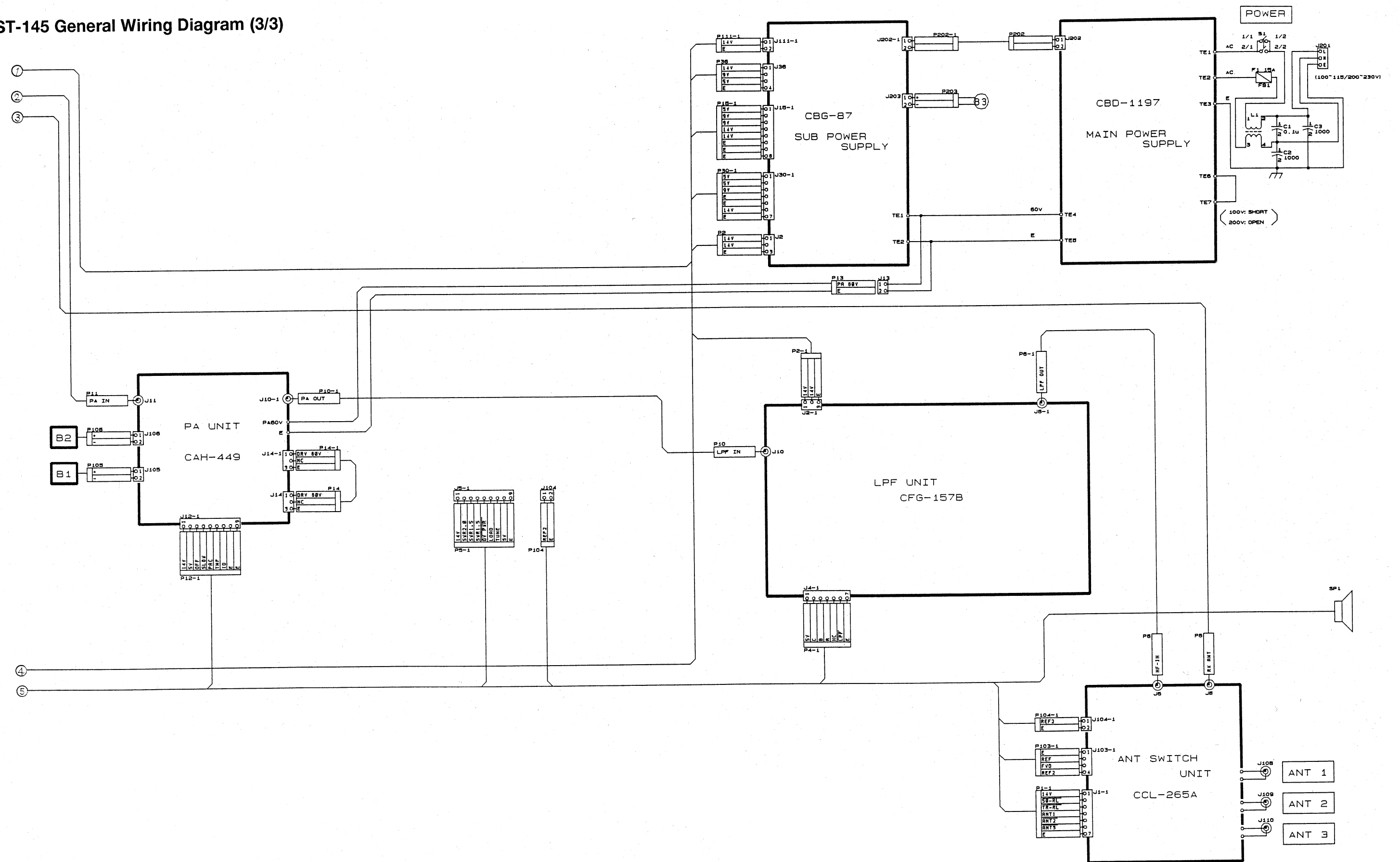
3-16-1 JST-145 General Wiring Diagram (1/3)



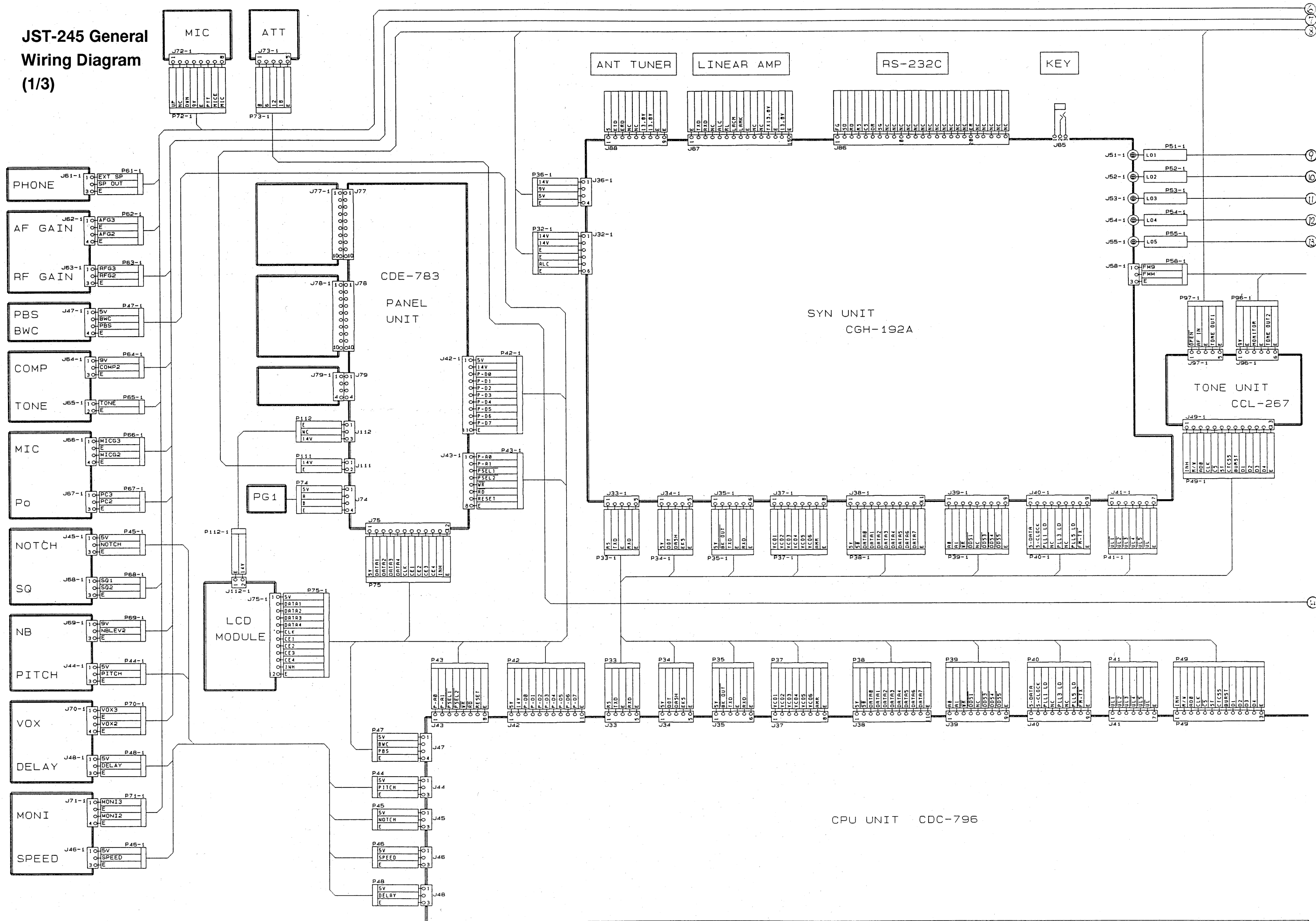
JST-145 General Wiring Diagram (2/3)



JST-145 General Wiring Diagram (3/3)

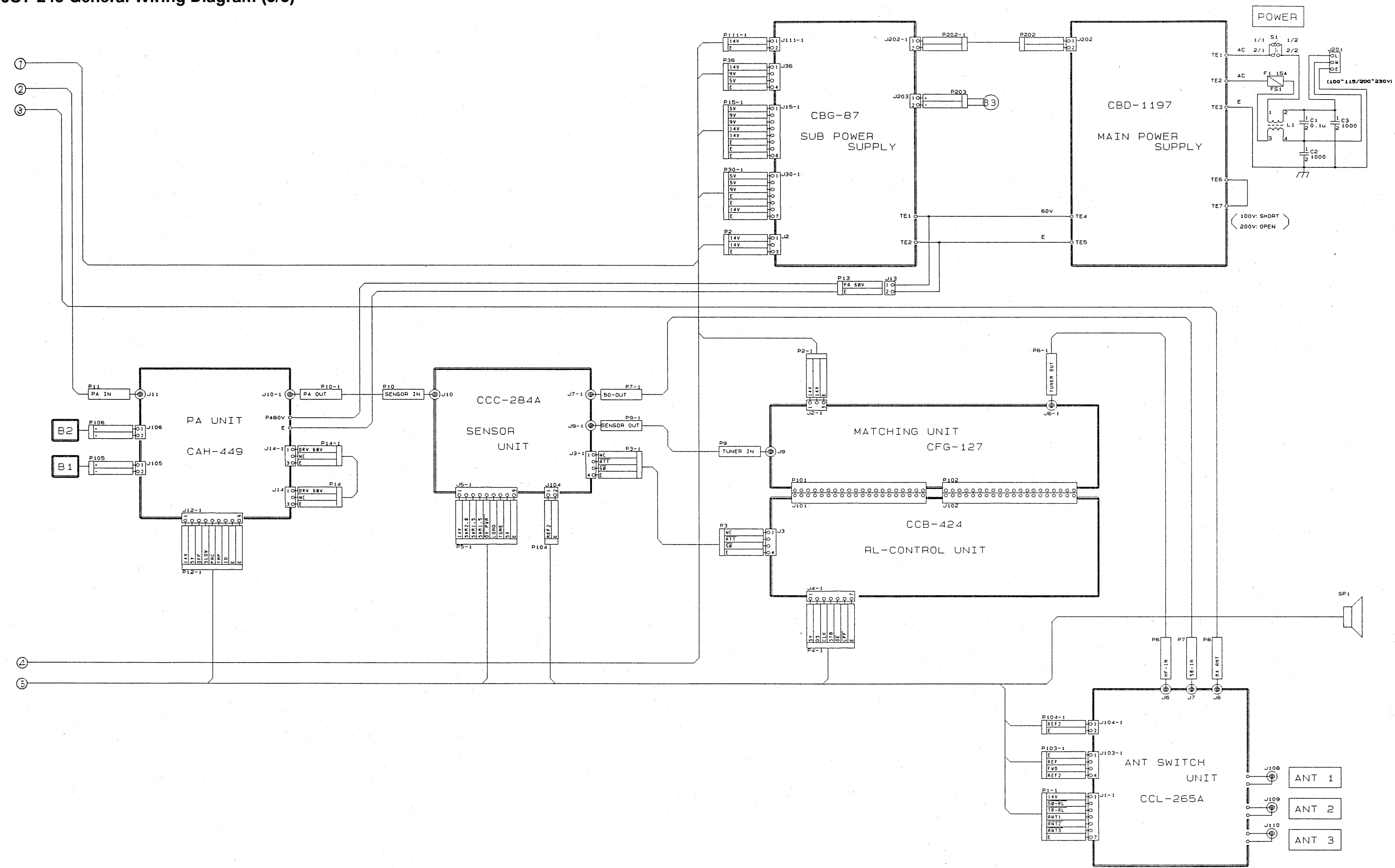


3-16-2 JST-245 General
Wiring Diagram
(1/3)



[illegible]

JST-245 General Wiring Diagram (3/3)



Section 4 Disassembly and Assembly

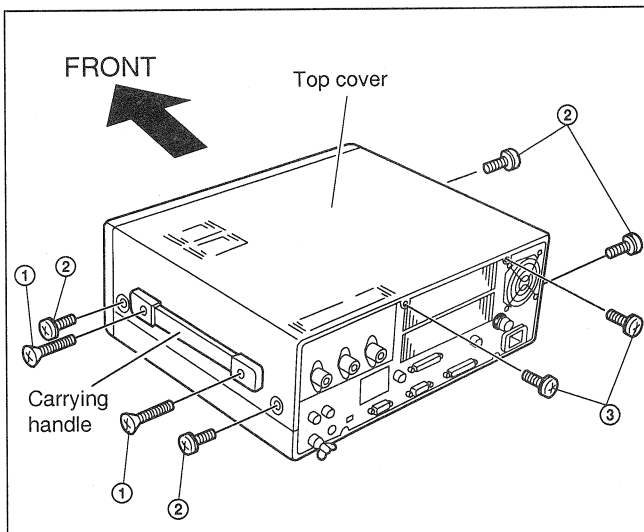
4-1 Removing the Cover

[1] Removing and attaching the top cover

Caution

Before removing the top cover, be sure to set the POWER switch to OFF and disconnect the power cable, to prevent the danger of electric shock.

- 1) Loosen screws ① (2 pcs.) and remove the carrying handle.
- 2) Remove screws ② (2 pcs. each) on both sides of the top cover and screws ③ (2 pcs.) on the rear panel, and take the top cover off.



- 3) Assemble by reversing the above steps.
* Start with the screws ③ on the rear panel for easy assembly.

Caution

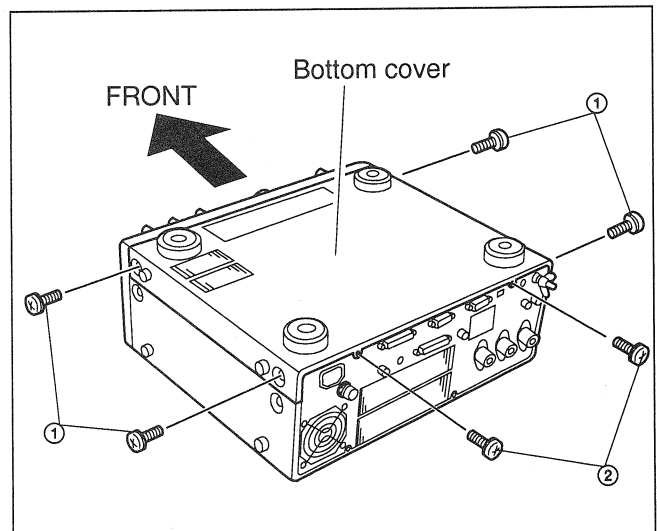
When the top cover is removed, the heat sink of the power amplifier unit is exposed. This heat sink uses a high number of very thin fins for efficient heat dissipation. Take care not to cut your hand or fingers on the fins.

[2] Removing and attaching the bottom cover

Caution

Before removing the bottom cover, be sure to set the POWER switch to OFF and disconnect the power cable, to prevent the danger of electric shock.

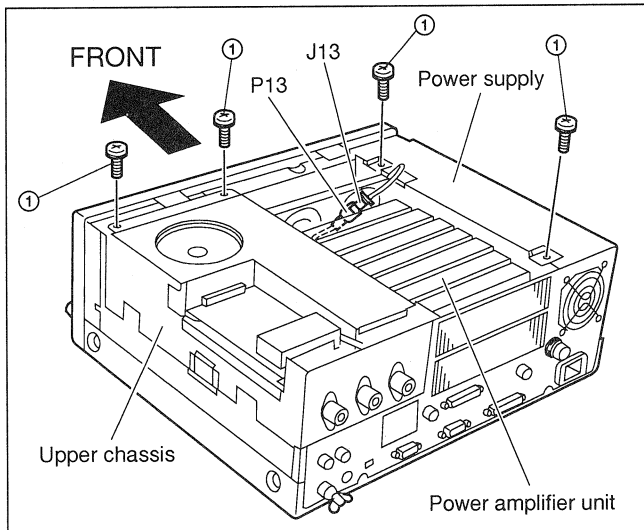
- 1) Turn the unit upside down.
- 2) Remove screws ① (2 pcs. each) on both sides of the bottom cover and screws ② (2 pcs.) on the rear panel, and take the bottom cover off.



- 3) Assemble by reversing the above steps.
* Start with the screws ② on the rear panel for easy assembly.

4-2 TX/RX Unit (CAF-412A/JST-245, B/JST-145)

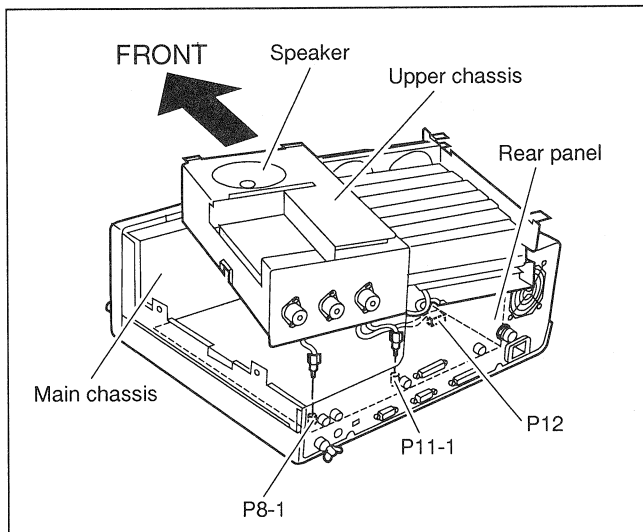
- 1) Remove the top cover, as described in section 4-1.
- 2) Remove the power connector (J13) (connected to the power amplifier unit) from the power supply.
- 3) Remove screws ① (4 pcs.) fastening the upper chassis.



Caution

Take care not to cut your hand or fingers on the fins of the heat sink of the power amplifier unit.

- 4) Carefully lift the upper chassis out and place it on the main chassis and the rear panel. Secure the chassis with one hand, to prevent it from falling.

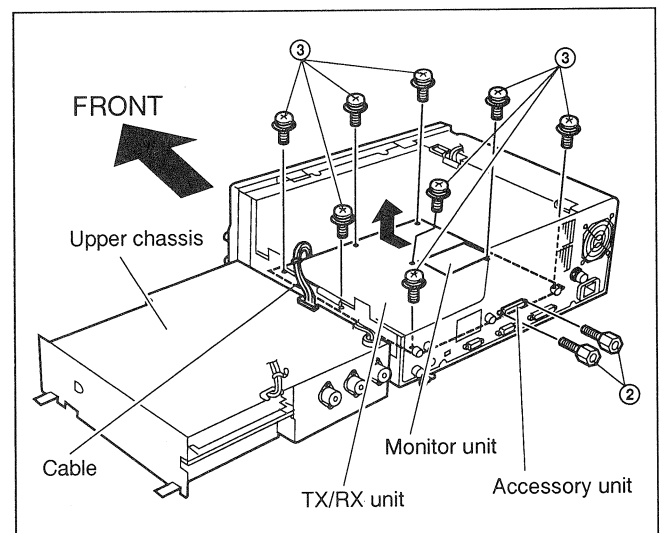


- 5) Remove the two coaxial connectors (P8-1, P11-1) (connected to the TX/RX unit) from the upper chassis.
- 6) Lift the upper chassis and remove connector P12, then turn the chassis over so that the speaker faces down.

Caution

Some cables are still connected to the upper chassis. Take care not to damage these cables.

- 7) Remove the monitor unit, as described in section 4-12.
* Skip this step if no monitor unit is installed.
- 8) Remove all connectors from the TX/RX unit (6 coaxial connectors, 35 regular connectors).
- 9) Remove support screws ② (2 pcs.) fastening the accessory connector on the rear panel.
- 10) Remove screws ③ (8 pcs.) fastening the TX/RX unit.
- 11) Slide the TX/RX unit to the front and then lift it out.

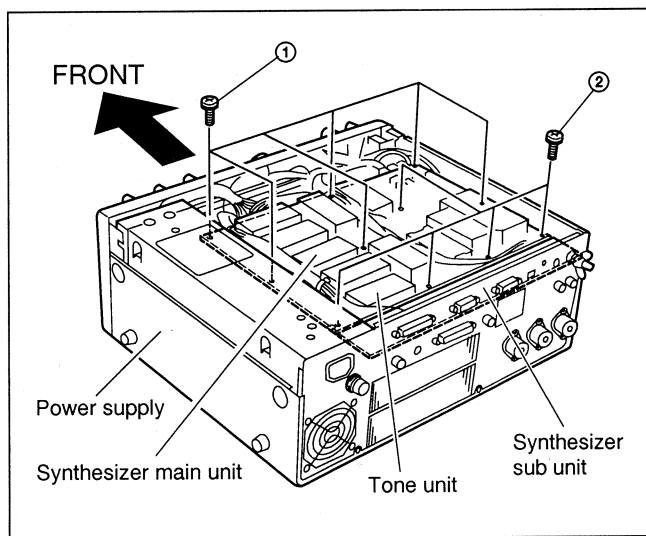


- 12) Assemble by reversing the above steps.

4-3 Synthesizer Unit (CGH-192A/JST-245, B/JST-145)

[1] Disassembly and assembly of main unit

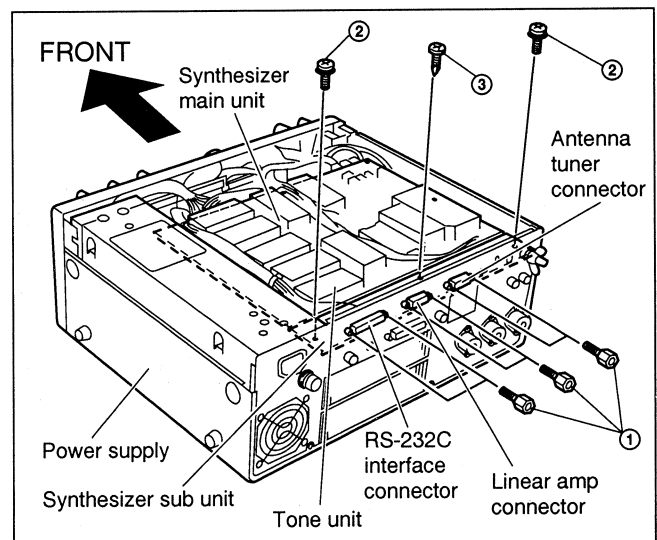
- 1) Remove the bottom cover, as described in section 4-1.
- 2) Remove the tone unit, as described in section 4-11.
* Skip this step if no tone unit is installed.
- 3) Remove all connectors from the synthesizer main unit (6 coaxial connectors, 9 regular connectors).
- 4) Remove all connectors from the synthesizer sub unit (4 connectors).
- 5) Remove screws ① (6 pcs.) and tapping screws ② (5 pcs.), and remove the synthesizer main unit.



- 6) Assemble by reversing the above steps.
* Take care not to mix up the positions of screws (1) [6 pcs.] and tapping screws (2) [5 pcs.].

[2] Disassembly and assembly of sub unit

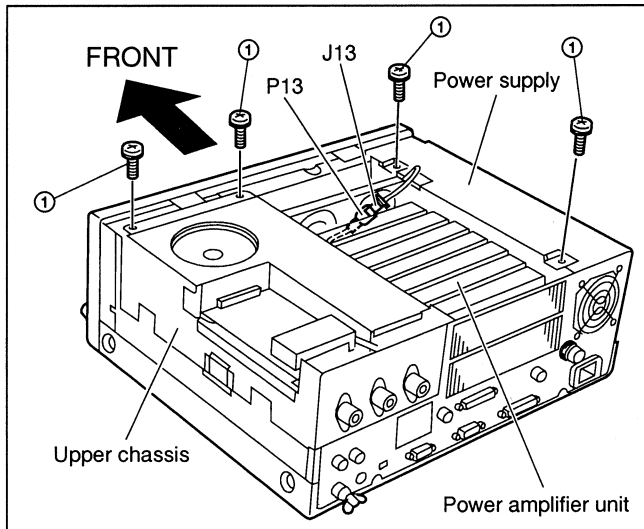
- 1) Remove the bottom cover, as described in section 4-1.
- 2) Remove the tone unit, as described in section 4-11.
- 3) Remove all connectors from the synthesizer sub unit (4 connectors).
- 4) Remove support screws ① (2 pcs. each) fastening the antenna tuner connector, linear amp connector, and RS-232C interface connector on the rear panel.
- 5) Remove screws ② (2 pcs.) and tapping screws ③ (1 pc.), and remove the synthesizer sub unit.



- 6) Assemble by reversing the above steps.
* Take care not to mix up the positions of screws (2) [2 pcs.] and tapping screw (3) [1 pc.].

4-4 PA Unit (CAH-449-2)

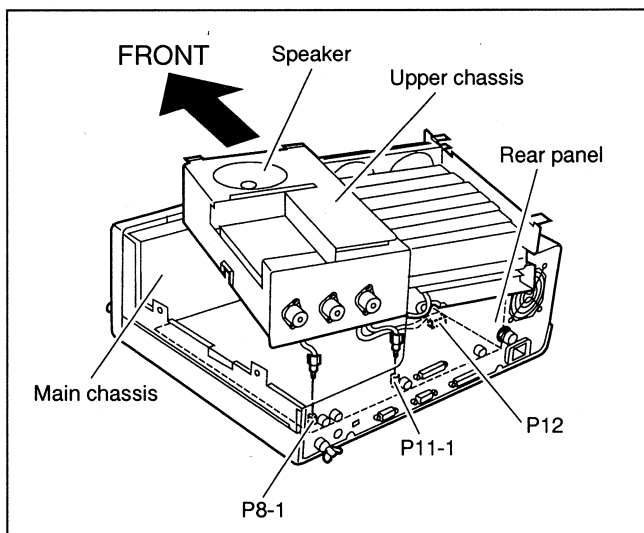
- 1) Remove the top cover, as described in section 4-1.
- 2) Remove the power connector (J13) (connected to the power amplifier unit) from the power supply.
- 3) Remove screws ① [4 pcs.] fastening the upper chassis.



Caution

Take care not to cut your hand or fingers on the fins of the heat sink of the power amplifier unit.

- 4) Carefully lift the upper chassis out and place it on the main chassis and the rear panel. Secure the chassis with one hand, to prevent it from falling.

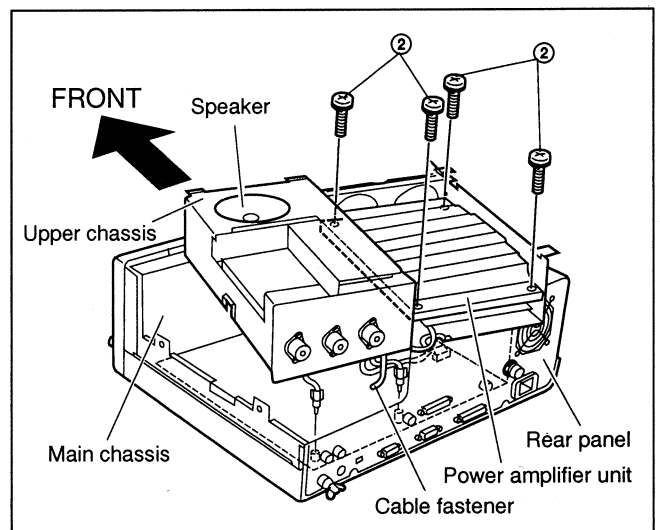


- 5) Remove the two coaxial connectors (P8-1, P11-1) (connected to the TX/RX unit) from the upper chassis.

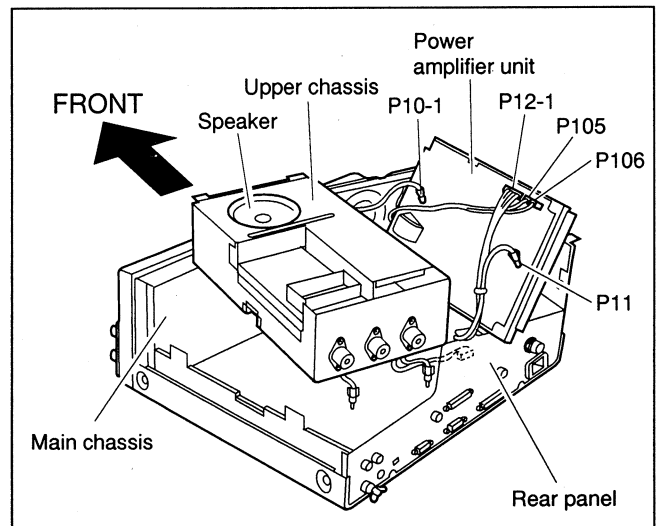
Caution

Some cables are still connected to the upper chassis. Take care not to damage these cables.

- 6) Carefully untie the cable fastener on the rear of the upper chassis so that the cables are free.
- 7) Remove screws ② (4 pcs.) fastening the power amplifier unit.



- 8) Move the power amplifier unit into an upright position and remove the 2 coaxial connectors (P10-1, P11) and 3 regular connectors (P12-1, P105, P106). Then remove the power amplifier unit together with the heat sink.

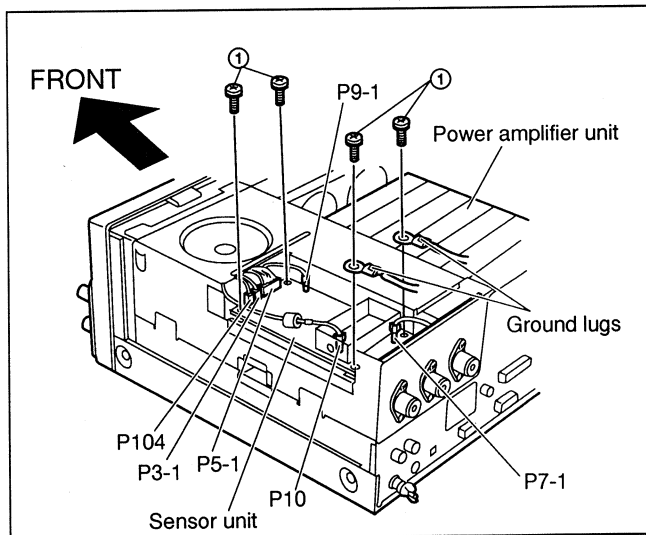


- 9) Assemble by reversing the above steps.

4-5 Sensor Unit (CCC-284A/JST-245, B/JST-145)

■ JST-245 only

- 1) Remove the top cover, as described in section 4-1.
- 2) Remove the 3 coaxial connectors (P7-1, P9-1, P10) and 3 regular connectors (P3-1, P5-1, P104) from the sensor unit.



- 3) Remove tapping screws ① (4 pcs.) and remove the sensor unit.
- 4) Assemble by reversing the above steps.

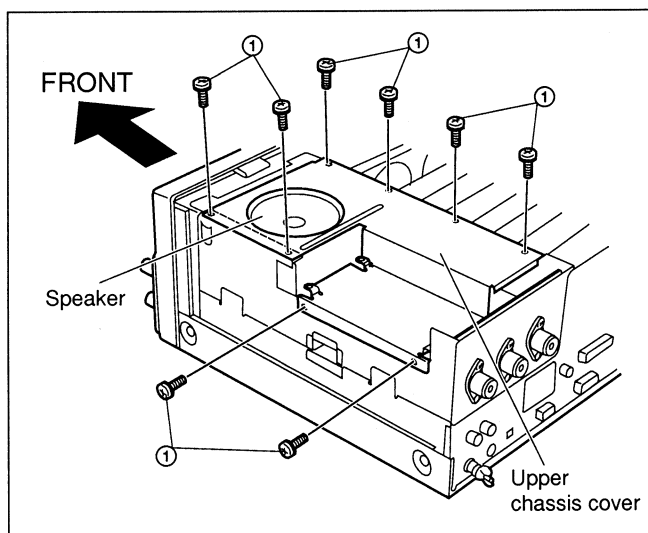
Caution

When installing the sensor unit, do not forget to fasten the two ground lugs.

4-6 LPF Unit (CFJ-157B)

■ JST-145 only

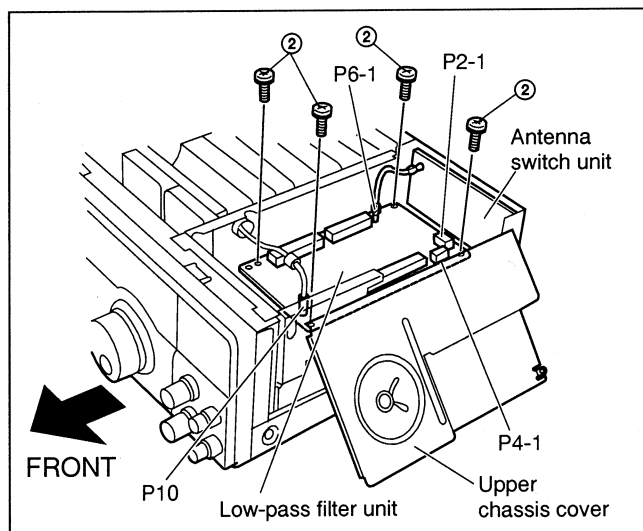
- 1) Remove the top cover, as described in section 4-1.
- 2) Remove tapping screws ① (8 pcs.) fastening the upper chassis cover.



Caution

The speaker is mounted to the upper chassis cover from the inside, and the speaker cable is still connected. Take care not to damage the cable.

- 3) After removing the upper chassis cover, lean it to the side of the unit, paying attention to the cables.
- 4) Remove the 2 coaxial connectors (P6-1, P10) and 2 regular connectors (P2-1, P4-1) from the sensor unit.
- 5) Remove screws ② (4 pcs.) and remove the low-pass filter unit.

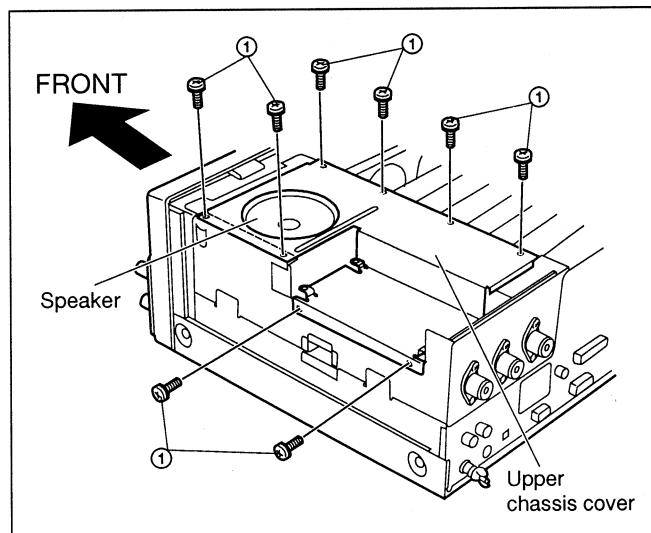


- 6) Assemble by reversing the above steps.

4-7 Matching Unit (CFG-127)/RL Control Unit (CCB-424)

■ JST-245 only

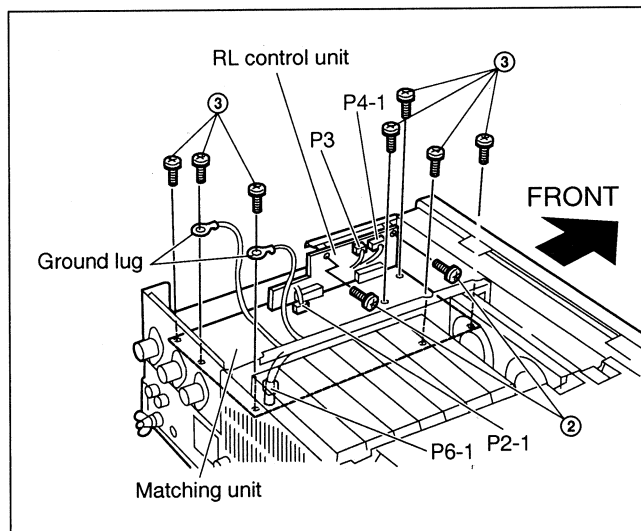
- 1) Remove the sensor unit, as described in section 4-5.
- 2) Remove tapping screws ① (8 pcs.) fastening the upper chassis cover.



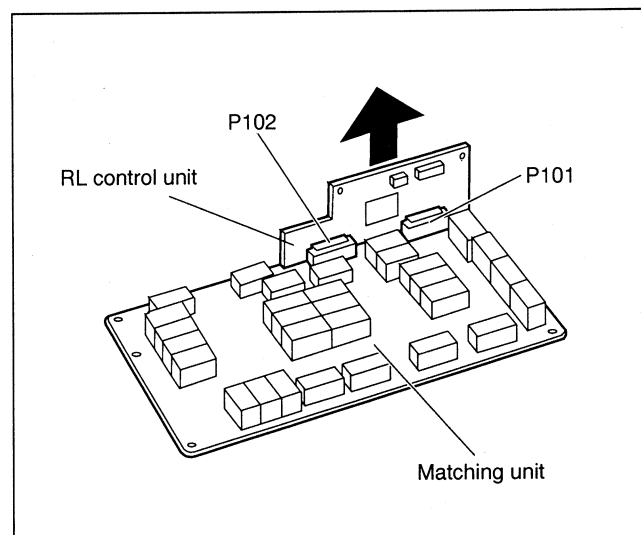
Caution

The speaker is mounted to the upper chassis cover from the inside, and the speaker cable is still connected. Take care not to damage the cable.

- 3) After removing the upper chassis cover, lean it to the side of the unit, paying attention to the cables.
- 4) Remove the 2 connectors (P3, P4-1) from the RL control unit.
- 5) Remove the 2 coaxial connectors (P6-1, P9) and 1 regular connector (P2-1) from the matching unit.
- 6) Remove tapping screws ② (2 pcs.) fastening the RL control unit and screws ③ (7 pcs.) fastening the matching unit.



- 7) Pull up the matching unit to remove it, with the RL control unit still attached.
- 8) Pull the RL control unit off the matching unit.



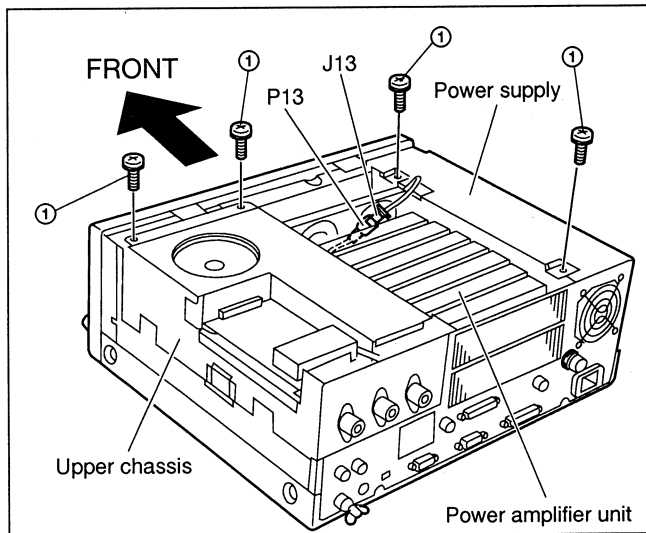
- 9) Assemble by reversing the above steps.

Caution

When installing the matching unit, do not forget to fasten the two ground lugs.

4-8 ANT Switch Unit (CCL-265A/JST-245, B/JST-145)

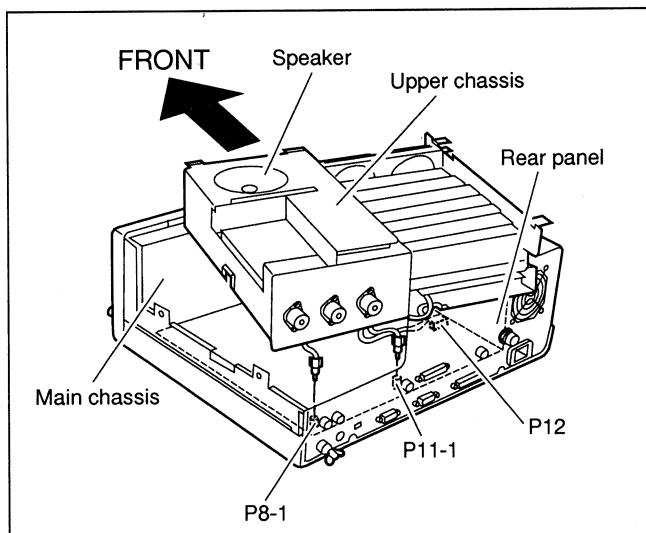
- 1) Remove the top cover, as described in section 4-1.
- 2) Remove the power connector (J13) (connected to the power amplifier unit) from the power supply.
- 3) Remove screws ① (4 pcs.) fastening the upper chassis.



Caution

Take care not to cut your hand or fingers on the fins of the heat sink of the power amplifier unit.

- 4) Carefully lift the upper chassis out and place it on the main chassis and the rear panel. Secure the chassis with one hand, to prevent it from falling.

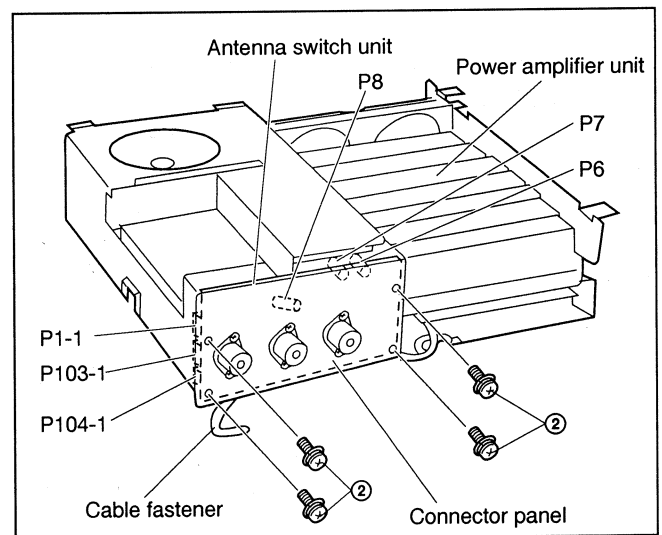


- 5) Remove the two coaxial connectors (P8-1, P11-1) (connected to the TX/RX unit) from the upper chassis.

Caution

Some cables are still connected to the upper chassis. Take care not to damage these cables.

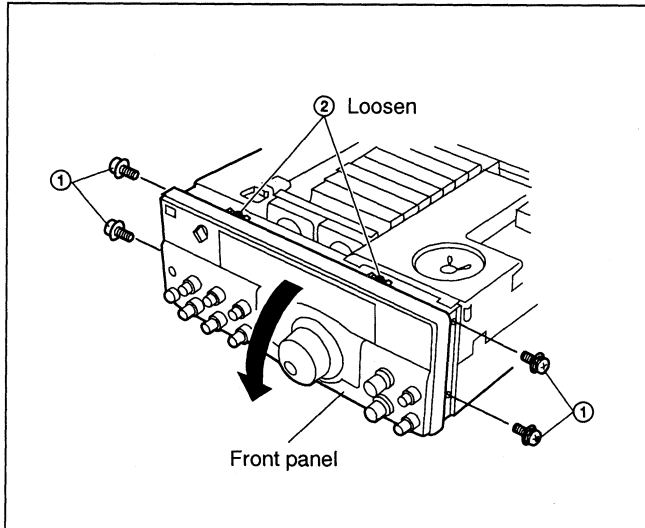
- 6) Remove screws ② (4 pcs.) fastening the connector panel.



- 7) Pull the connector panel up and disconnect the 3 coaxial connectors (P6, P7, P8) and 3 regular connectors (P1-1, P103-1, P104-1).
- 8) When the connector panel has been pulled about halfway up, the cable fastener will prevent further removal. Carefully untie the cable fastener, and then remove the connector panel together with the antenna switch unit.
- 9) Assemble by reversing the above steps.

4-9 CPU Unit (CDC-796)

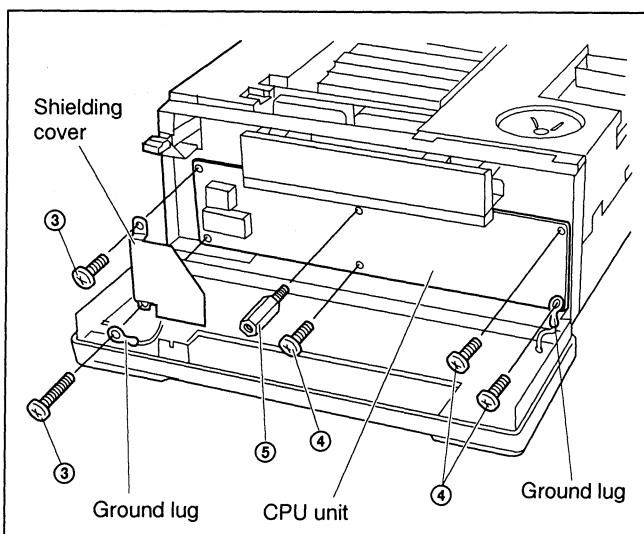
- 1) Remove the top cover and bottom cover, as described in section 4-1.
- 2) Remove screws ① (2 pcs. each) on both sides of the front panel.



Caution

Many cables are connected inside the front panel. Take care not to damage these cables.

- 3) Loosen screws ② (2 pcs.) on top of the front panel and flip the front panel down.
- 4) Remove tapping screws ③ (2 pcs.) and remove the shielding cover.



- 5) Remove all connectors from the front panel (35 connectors).

Caution

When removing the connectors, support the pin headers and take care not to place undue stress on the PCB.

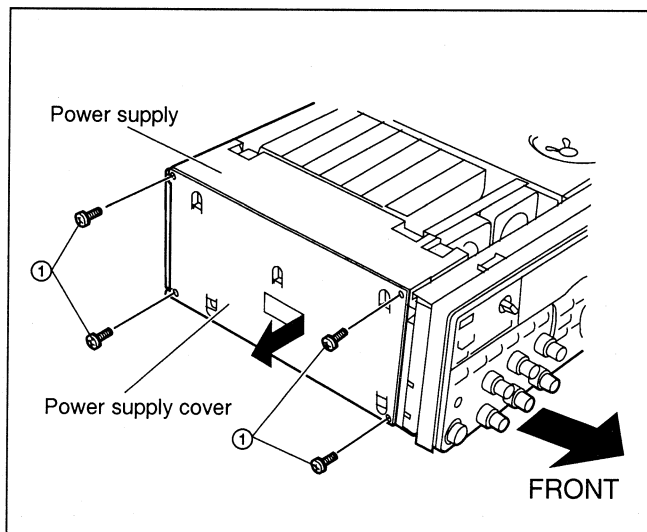
- 6) Remove tapping screws ④ [3 pcs.] and support ⑤, and remove the CPU unit.
- 7) Assemble by reversing the above steps.

Caution

When installing the CPU unit, do not forget to fasten the two ground lugs.

4-10 Power Supply Unit (CBD-1197/CBG-87)

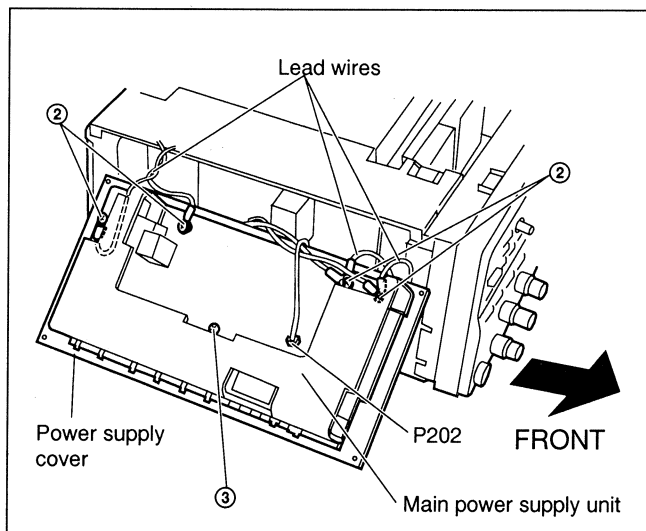
- 1) Remove the top cover and bottom cover, as described in section 4-1.
- 2) Remove screws ① (4 pcs.) fastening the power supply cover.



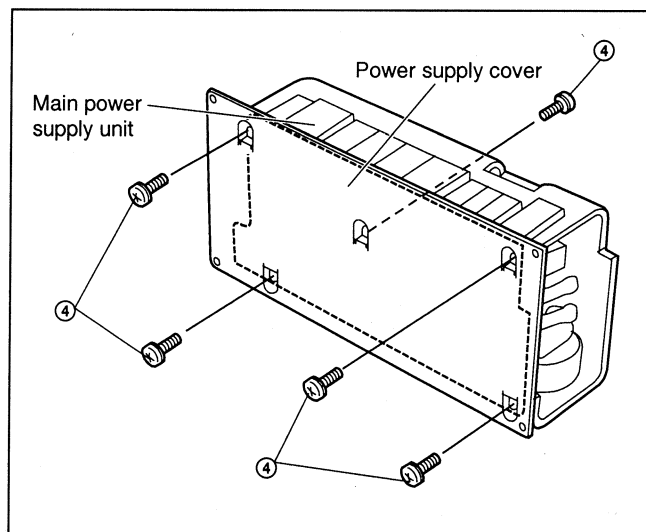
Caution

The main power supply unit is mounted to the inside of the power supply cover, and cables are still connected. Take care not to damage these cables.

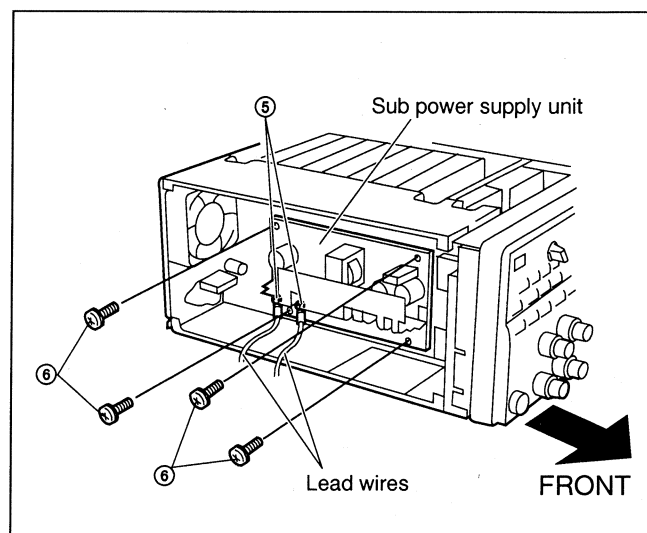
- 3) While keeping it in contact with the main chassis, the power supply cover to the front and then flip it down.
- 4) Remove screws ② (4 pcs.) fastening the lead wires, and remove the lead wires.



- 5) Remove the connector (P202) from the main power supply unit and remove screw ③ (1 pc.) from the center of the PCB.
- 6) Turn the power supply cover upside down, remove screw ④ (4 pcs.), and remove the main power supply unit.



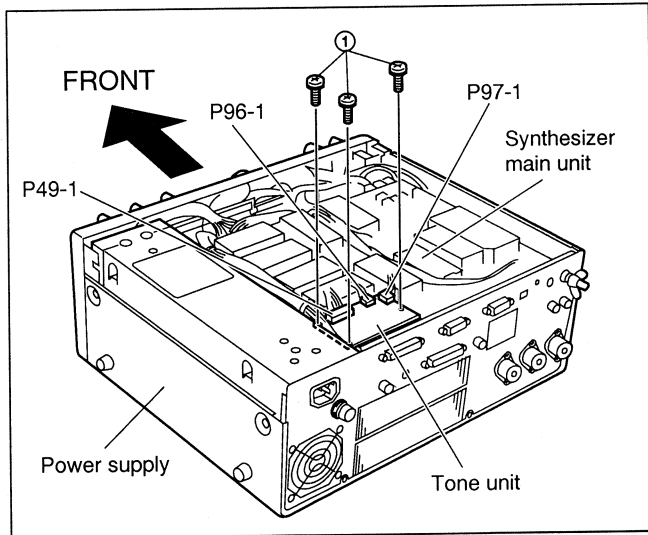
- 7) Remove screws ⑤ (2 pcs.) fastening the lead wires to the sub power supply unit, and remove the lead wires.



- 8) Remove all connectors (7 connectors) from the sub power supply unit.
- 9) Remove screws ⑥ (4 pcs.), and remove the sub power supply unit.
- 10) Assemble by reversing the above steps.

4-11 Tone Unit (CCL-267, Option)

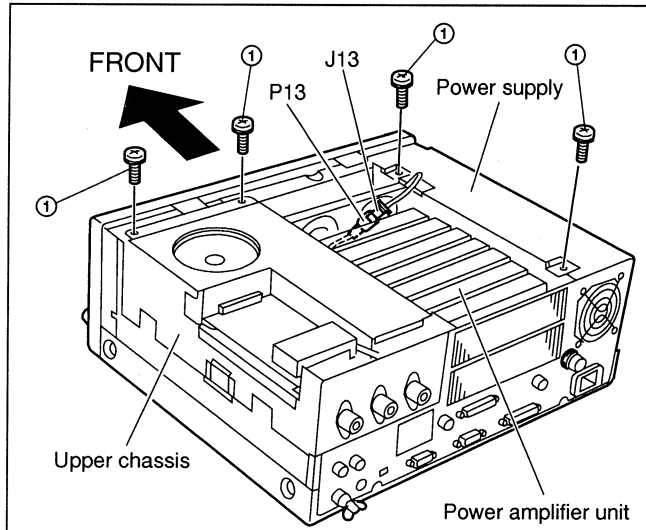
- 1) Remove the bottom cover, as described in section 4-1.
- 2) Remove all connectors (3 connectors) from the tone unit.
- 3) Remove tapping screws ① (3 pcs.) and remove the tone unit.



- 4) Assemble by reversing the above steps.

4-12 Monitor Unit (CMF-144, Option)

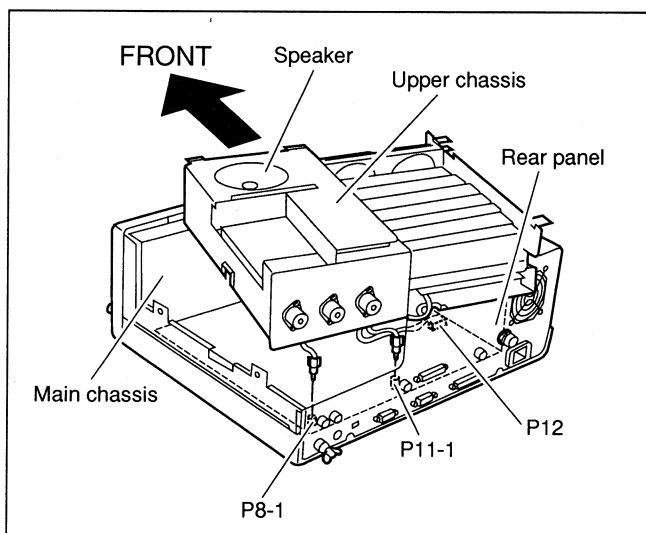
- 1) Remove the top cover, as described in section 4-1.
- 2) Remove the power connector (J13) (connected to the power amplifier unit) from the power supply.
- 3) Remove screws ① (4 pcs.) fastening the upper chassis.



Caution

Take care not to cut your hand or fingers on the fins of the heat sink of the power amplifier unit.

- 4) Carefully lift the upper chassis out and place it on the main chassis and the rear panel. Secure the chassis with one hand, to prevent it from falling.

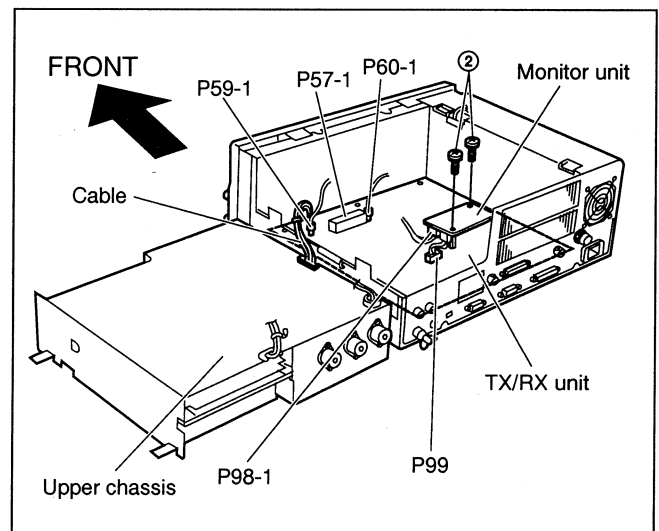


- 5) Remove the two coaxial connectors (P8-1, P11-1) (connected to the TX/RX unit) from the upper chassis.
- 6) Lift the upper chassis and remove connector P12, then turn the chassis over so that the speaker faces down.

Caution

Some cables are still connected to the upper chassis. Take care not to damage these cables.

- 7) Remove the 3 coaxial connectors (P57-1, P59-1, P60-1) (connected to the TX/RX unit) from the monitor unit.



- 8) Remove screws ② (2 pcs.) and lift the monitor unit up. Remove 1 connector (P98-1).
- 9) Assemble by reversing the above steps.

Section 5 Adjustments

1. Preparations
2. Power Supply Unit (CBD-1197, CBG-87)
3. PA Unit (CAH-449-2)
4. Matching Unit (CFG-127)
5. LPF Unit (CFJ-157B)
6. CPU Unit (CDC-796)
7. Synthesizer Unit (CGH-192A/B)
8. TX/RX Unit (CAF-412A/B) Receiver Section
9. TX/RX Unit (CAF-412A/B) Transmitter Section
10. General Adjustments (Transmission)
11. Optional Tone Unit (CCL-267) Adjustment
12. Optional Monitor Unit (CMF-144) Adjustment

5-1 Preparations

Before starting, set all switches and controls as shown below, to prevent operation errors. After adjustment, return the switches and controls to these positions.

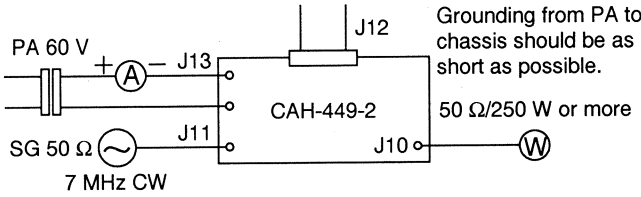
LOCK switch	OFF
RF GAIN	Maximum
AF control	Minimum
NOTCH switch	OFF
SQUELCH control	Fully counterclockwise
PBS control	Center
BWC control	Fully counterclockwise
NB switch	OFF
ATT switch	OFF
VOX switch	OFF
COMP switch	OFF
DELAY control	Fully counterclockwise
Po control	Minimum (shipping default: maximum)
MIC control	Minimum (shipping default: minimum)
PITCH control	Center
NB control	Center
TONE control	Fully counterclockwise
MONITOR control	Fully counterclockwise
SPEED control	Fully counterclockwise
RIT switch	OFF
XIT switch	OFF
ELECTRONIC KEYSER switch	OFF
SPLIT switch	OFF
MONITOR switch	OFF
MEMO switch	OFF

5-2 Power supply unit (CBD-1197, CBG-87)

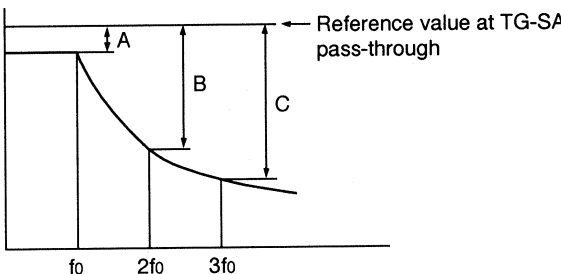
No.	Item	Adjustment procedure	Specification (reference value)
1	Power supply check	① Connect an AC power source and verify that the following voltages exist. • J111-1, pin ① 14V • J36-1, pin ① 14V - pin ② 9V - pin ③ 5V • J15-1, pin ① 5V - pin ② 9V - pin ③ 9V - pin ④ 14V - pin ⑤ 14V • J30-1, pin ① 5V - pin ② 5V - pin ③ 14V • J2, pin ① 14V - pin ② 14V • P13, pin ① 60V Note: Do not disconnect the wiring between main power supply and sub power supply.	

5-3 PA unit (CAH-449-2)

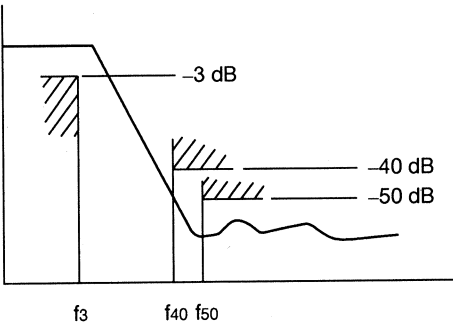
No.	Item	Adjustment procedure	Specification (reference value)										
1	Idling current adjustment	① Turn variable resistors RV1, RV2 (DRV BIAS), RV3, RV4 (PA BIAS) fully counterclockwise. ② Connect a power supply and current meter as shown below, ③ Connect pin ⑤ of J12-1 (PAC) to ground (transmission mode) and verify that the current meter reads approx. 90 mA. ④ After verifying the above condition, adjust RV1 and RV2 so that the value increases by 100 mA each. Then adjust RV3 and RV4 so that the value increases by 600 mA each. Note: Before performing the above adjustment, the unit should have been switched on at room temperature for at least 5 minutes. <table><tr><td>RV1</td><td>100 mA</td></tr><tr><td>RV2</td><td>100 mA</td></tr><tr><td>RV3</td><td>600 mA</td></tr><tr><td>RV4</td><td>600 mA</td></tr><tr><td>Total: Current meter reading:</td><td>1400 mA + approx. 90 mA ± 20 mA</td></tr></table>	RV1	100 mA	RV2	100 mA	RV3	600 mA	RV4	600 mA	Total: Current meter reading:	1400 mA + approx. 90 mA ± 20 mA	
RV1	100 mA												
RV2	100 mA												
RV3	600 mA												
RV4	600 mA												
Total: Current meter reading:	1400 mA + approx. 90 mA ± 20 mA												

No.	Item	Adjustment procedure	Specification (reference value)
2	ID meter adjustment	 ① Set the power amplifier (PA) to transmission mode and gradually increase SG output, so that the current at PA 60 V is 6.4 A. Adjust RV8 ID-H so that the front panel ID meter reading is 6 A ± 1 digit. (Pay attention to transmission power: 225 W at 6 A) (J12, #7: 3.3 V) ② With the power amplifier still in transmission mode, turn SG output off and adjust RV7 ID-L so that the front panel ID meter reading is 1.2 A ± 1 digit. (J12, #7: 1.0 V) ③ Repeat steps ① and ② about 2 to 3 times. Note: The current value in step ① is the value that is obtained by subtracting the current at J14.	
3	FAN SLOW adjustment FAN-OFF check	① Apply 14 V to pin ① of J12-1. ② Apply 5 V to pin ④ of J12-1, and adjust RV8 so that the voltage at pin ① of J105 or pin ① of J106 becomes 8 V. ③ Apply 5 V to pin ③ of J12-1, and verify that that the voltage at pin ① of J105 or pin ① of J106 is 0 V.	8V ± 0.5V

5-4 Matching Unit (CFG-127)

No.	Item	Adjustment procedure	Specification (reference value)																																								
1	Tuner default value check (JST-245) (CPU unit (CDC-796) and panel (CDE-783) are required.)	① Connect a spectrum analyzer to ANT1 and connect a tracking generator to J10 SENSOR IN of the sensor unit. ② Switch bands and press the XMIT key to activate transmission mode. Then check the filter characteristics.  <table><tr><th>TUNER f_0</th><th>A</th><th>B</th><th>C</th></tr><tr><td>1.8 MHz</td><td>3 dB or less</td><td>25 dB or more</td><td>35 dB or more</td></tr><tr><td>3.5 MHz</td><td>3 dB or less</td><td>25 dB or more</td><td>40 dB or more</td></tr><tr><td>7 MHz</td><td>3 dB or less</td><td>25 dB or more</td><td>40 dB or more</td></tr><tr><td>14.25 MHz</td><td>3 dB or less</td><td>25 dB or more</td><td>40 dB or more</td></tr><tr><td>21 MHz</td><td>3 dB or less</td><td>25 dB or more</td><td>40 dB or more</td></tr><tr><td>28 MHz</td><td>3 dB or less</td><td>25 dB or more</td><td>40 dB or more</td></tr></table> LPF <table><tr><th></th><th>3dBdown</th><th>40dBdown</th><th>50dBdown</th><th>150MHz</th><th>250MHz</th></tr><tr><td>30~54 MHz</td><td>65 MHz or more</td><td>94 MHz or less</td><td>102 MHz or less</td><td>60 dB or less</td><td>60 dB or less</td></tr></table> ③ Passband ripple Note: The power amplifier should not be installed or J13-1 (60 V DC) should be disconnected.	TUNER f_0	A	B	C	1.8 MHz	3 dB or less	25 dB or more	35 dB or more	3.5 MHz	3 dB or less	25 dB or more	40 dB or more	7 MHz	3 dB or less	25 dB or more	40 dB or more	14.25 MHz	3 dB or less	25 dB or more	40 dB or more	21 MHz	3 dB or less	25 dB or more	40 dB or more	28 MHz	3 dB or less	25 dB or more	40 dB or more		3dBdown	40dBdown	50dBdown	150MHz	250MHz	30~54 MHz	65 MHz or more	94 MHz or less	102 MHz or less	60 dB or less	60 dB or less	Within 3 dB
TUNER f_0	A	B	C																																								
1.8 MHz	3 dB or less	25 dB or more	35 dB or more																																								
3.5 MHz	3 dB or less	25 dB or more	40 dB or more																																								
7 MHz	3 dB or less	25 dB or more	40 dB or more																																								
14.25 MHz	3 dB or less	25 dB or more	40 dB or more																																								
21 MHz	3 dB or less	25 dB or more	40 dB or more																																								
28 MHz	3 dB or less	25 dB or more	40 dB or more																																								
	3dBdown	40dBdown	50dBdown	150MHz	250MHz																																						
30~54 MHz	65 MHz or more	94 MHz or less	102 MHz or less	60 dB or less	60 dB or less																																						

5-5 LPF Unit (CFJ-157B)

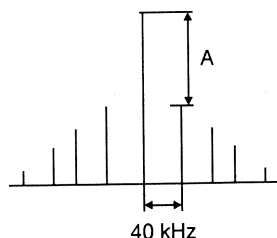
No.	Item	Adjustment procedure	Specification (reference value)																												
1	Filter characteristics (JST-145) (CPU unit (CDC-796) and panel (CDE-783) are required.)	① Connect a spectrum analyzer to ANT1 and connect a tracking generator to J10 [LPF IN]. ② Switch bands and press the [XMIT] key to activate transmission mode. Then check the filter characteristics.  <table><tr><th>LPF</th><th>f3</th><th>f40</th><th>f50</th></tr><tr><td>1.6 ~ 2.6MHz</td><td>2.7MHz or more</td><td>—</td><td>4MHz or less</td></tr><tr><td>2.6 ~ 4.2MHz</td><td>4.3MHz or more</td><td>6MHz or less</td><td>—</td></tr><tr><td>4.2 ~ 6.8MHz</td><td>7MHz or more</td><td>—</td><td>10MHz or less</td></tr><tr><td>6.8 ~ 11.1MHz</td><td>12MHz or more</td><td>—</td><td>20MHz or less</td></tr><tr><td>11.1 ~ 18.1MHz</td><td>19MHz or more</td><td>27MHz or less</td><td>—</td></tr><tr><td>18.1 ~ 30MHz</td><td>32MHz or more</td><td>48MHz or less</td><td>—</td></tr></table> ③ Passband ripple Note: The power amplifier should not be installed or J13-1 (60 V DC) should be disconnected.	LPF	f3	f40	f50	1.6 ~ 2.6MHz	2.7MHz or more	—	4MHz or less	2.6 ~ 4.2MHz	4.3MHz or more	6MHz or less	—	4.2 ~ 6.8MHz	7MHz or more	—	10MHz or less	6.8 ~ 11.1MHz	12MHz or more	—	20MHz or less	11.1 ~ 18.1MHz	19MHz or more	27MHz or less	—	18.1 ~ 30MHz	32MHz or more	48MHz or less	—	Within 3 dB
LPF	f3	f40	f50																												
1.6 ~ 2.6MHz	2.7MHz or more	—	4MHz or less																												
2.6 ~ 4.2MHz	4.3MHz or more	6MHz or less	—																												
4.2 ~ 6.8MHz	7MHz or more	—	10MHz or less																												
6.8 ~ 11.1MHz	12MHz or more	—	20MHz or less																												
11.1 ~ 18.1MHz	19MHz or more	27MHz or less	—																												
18.1 ~ 30MHz	32MHz or more	48MHz or less	—																												

5-6 CPU Unit (CDC-796)

No.	Item	Adjustment procedure	Specification (reference value)
1	Battery voltage check	① Check the BT1 battery voltage with a digital voltmeter (between battery holder + and ground)	3.0V or more
2	Tune voltage adjustment	① Connect a digital voltmeter to TP1. ② Set the displayed frequency to 400 kHz and adjust RV2 OFFSET for a voltage of 5.74 V. ③ Set the displayed frequency to 799.9 kHz and adjust RV1 SPAN for a voltage of 20 V. ④ Repeat steps ② and ③ until both conditions are fulfilled. * If offset does not rise to 5.74 V, adjust R80 and R79.	5.72 - 5.76 V 19.8 - 20.2 V
3	-5 V power supply check	① Connect a digital voltmeter to pin ⑨ of J22 and check the voltage.	-5 to -5.5 V

5-7 Synthesizer Unit (CGH-192A/B)

No.	Item	Adjustment procedure	Specification (reference value)
1	VCO power supply voltage check	① Connect a digital voltmeter to pin ② of IC50 and check the voltage.	$12V \pm 0.5V$
2	DDS power supply voltage check	① Connect a digital voltmeter to pin ① of IC51 and check the voltage. ② Check pins ① of IC53~IC55 in the same way. ③ Connect a digital voltmeter to pin ① of IC28 and check the voltage.	$5V \pm 0.2V$ $12V \pm 0.5V$
3	60 MHz adjustment	① Connect a RF voltmeter to TP6. ② Adjust T1 so that the RF voltmeter reading is maximum.	$0.3 V_{rms}$ or more
4	69 MHz adjustment	① Connect a RF voltmeter to TP8. ② Adjust T2~T4 so that the RF voltmeter reading is maximum.	$0.015 V_{rms}$ or more
	89 MHz adjustment (JST- 245 only)	③ Press the 50 MHz band key and set the displayed frequency to 30.0 MHz or more. ④ Adjust T5 and T6 so that the RF voltmeter reading is maximum.	$0.015 V_{rms}$ or more
5	DDS cancel adjustment DDS1 section	① Set the displayed frequency to 1.00903 MHz (USB mode). ② Connect a spectrum analyzer to pin ⑤ of IC36 (FF output). f-center: 520 kHz Span: 100 kHz (RBW = 100 Hz) ③ Adjust RV1 so that sideband spurious components are minimum.	$A = 60 \text{ dB}$ or more
	DDS3 section	① Connect a spectrum analyzer to TP14. f-center: 9 MHz Span: 50 kHz ② Set mode to USB and filter to INTER, and turn the BWC control to activate BWC. Then turn the control to the minimum (counterclockwise) position and turn it up by two scale points. ③ Set the span of the spectrum analyzer to 10 kHz (RBW 100 Hz) and adjust RV3 so that sideband spurious components are minimum.	



No.	Item	Adjustment procedure	Specification (reference value)
6	DDS4 section	① Connect a spectrum analyzer to TP15. f-center: 357 kHz Span: 50 kHz ② Set mode to USB. Turn the BWC control to the 6th scale point and the NOTCH control to the 5th scale point. ③ Adjust RV4 so that sideband spurious components are minimum. ④ Connect a RF voltmeter to TP15 and check the voltage.	0.4 Vrms or more
	DDS5 section	① Connect a spectrum analyzer to TP16. f-center: 455 kHz Span: 20 kHz ② Set mode to CW and the filter to WIDE. ③ Set the BWC control to the center and the PBS control to the 7th scale point. ④ Adjust RV5 so that sideband spurious components are minimum. ⑤ Connect a RF voltmeter to TP16 and check the voltage.	1.0 Vrms or more
	PLL section adjustment	① Set the displayed frequency to 1.000 MHz and the mode to AM (other than USB or LSB). ② Connect a digital voltmeter to TP4 (in shielded case beside VCO). ③ Adjust L31 for a digital voltmeter reading of 8 V. CD26 should be out at this time. ④ Set the displayed frequency to 1.49999 MHz and verify that the voltage at TP4 is 4 V.	8V $\pm$ 0.1V 4V $\pm$ 0.2V
	LO3 section adjustment	① Connect a digital voltmeter to TP13. (BWC control should be turned fully counterclockwise.) ② Adjust L55 for the digital voltmeter reading of 8 V. CD42 should be out at this time and should stay out also if the BWC control is turned. ③ Connect a RF voltmeter to TP14 and check the voltage.	8V $\pm$ 0.1V 0.1 Vrms or more
8	LO2 section adjustment	① Select AM mode (any other mode except FM). ② Connect a digital voltmeter to TP10. ③ Adjust CV8 for a digital voltmeter reading of 8 V. CD33 should be out at this time. ④ Connect a RF voltmeter to TP11 and check the voltage.	8V $\pm$ 0.1V 0.025 Vrms or more

No.	Item	Adjustment procedure	Specification (reference value)																																																	
9	20 MHz reference oscillator adjustment	① Set the displayed frequency to 100 kHz and the mode to AM (other than USB or LSB). ② Connect a frequency counter to TP2 or J51-1. ③ Adjust CV10 so that the frequency becomes 70.545 MHz. Note: Before performing the above adjustment, the unit should have been switched on for at least 10 minutes.	70.545 MHz ± 70 Hz																																																	
10	VCO section adjustment	① Connect a digital voltmeter to TP1. ② Adjust for the voltages listed below. <table><tr><th>Displayed frequency</th><th></th><th>Adjustment point</th><th>Voltage</th></tr><tr><td>7.49999 MHz</td><td>VCO1</td><td>CV1</td><td>10 V ± 0.1 V</td></tr><tr><td>14.49999 MHz</td><td>VCO2</td><td>CV2</td><td>10 V ± 0.1 V</td></tr><tr><td>21.49999 MHz</td><td>VCO3</td><td>CV3</td><td>10 V ± 0.1 V</td></tr><tr><td>29.99999 MHz</td><td>VCO4</td><td>CV4</td><td>10 V ± 0.1 V</td></tr><tr><td>44.99999 MHz</td><td>VCO5</td><td>CV5</td><td>10 V ± 0.1 V</td></tr><tr><td>53.99999 MHz</td><td>VCO6</td><td>CV6</td><td>10 V ± 0.1 V</td></tr></table> ③ Check the voltage at the lower frequency limit of each VCO. <table><tr><th>Displayed frequency</th><th></th><th>Voltage</th></tr><tr><td>100 kHz</td><td>VCO1</td><td>3.0 V or more</td></tr><tr><td>7.5 MHz</td><td>VCO2</td><td>3.0 V or more</td></tr><tr><td>14.5 MHz</td><td>VCO3</td><td>3.0 V or more</td></tr><tr><td>21.5 MHz</td><td>VCO4</td><td>3.0 V or more</td></tr><tr><td>30 MHz</td><td>VCO5</td><td>2.5 V or more</td></tr><tr><td>45 MHz</td><td>VCO6</td><td>3.0 V or more</td></tr></table> ④ Verify that no out-of-lock condition occurs over the displayed frequency range of 100 kHz ~ 53.99999 MHz (JST-145: 100 kHz ~ 29.99999 MHz). ⑤ Verify that CD26 briefly lights up and then goes out, due to brief unlocked condition at the frequency changeover points.	Displayed frequency		Adjustment point	Voltage	7.49999 MHz	VCO1	CV1	10 V ± 0.1 V	14.49999 MHz	VCO2	CV2	10 V ± 0.1 V	21.49999 MHz	VCO3	CV3	10 V ± 0.1 V	29.99999 MHz	VCO4	CV4	10 V ± 0.1 V	44.99999 MHz	VCO5	CV5	10 V ± 0.1 V	53.99999 MHz	VCO6	CV6	10 V ± 0.1 V	Displayed frequency		Voltage	100 kHz	VCO1	3.0 V or more	7.5 MHz	VCO2	3.0 V or more	14.5 MHz	VCO3	3.0 V or more	21.5 MHz	VCO4	3.0 V or more	30 MHz	VCO5	2.5 V or more	45 MHz	VCO6	3.0 V or more	JST-245 only {
Displayed frequency		Adjustment point	Voltage																																																	
7.49999 MHz	VCO1	CV1	10 V ± 0.1 V																																																	
14.49999 MHz	VCO2	CV2	10 V ± 0.1 V																																																	
21.49999 MHz	VCO3	CV3	10 V ± 0.1 V																																																	
29.99999 MHz	VCO4	CV4	10 V ± 0.1 V																																																	
44.99999 MHz	VCO5	CV5	10 V ± 0.1 V																																																	
53.99999 MHz	VCO6	CV6	10 V ± 0.1 V																																																	
Displayed frequency		Voltage																																																		
100 kHz	VCO1	3.0 V or more																																																		
7.5 MHz	VCO2	3.0 V or more																																																		
14.5 MHz	VCO3	3.0 V or more																																																		
21.5 MHz	VCO4	3.0 V or more																																																		
30 MHz	VCO5	2.5 V or more																																																		
45 MHz	VCO6	3.0 V or more																																																		

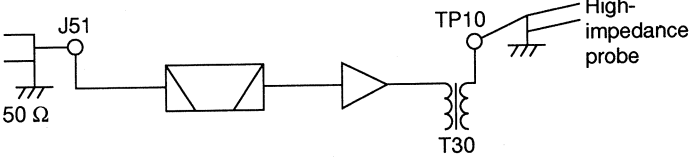
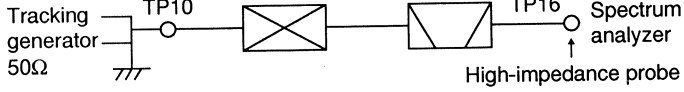
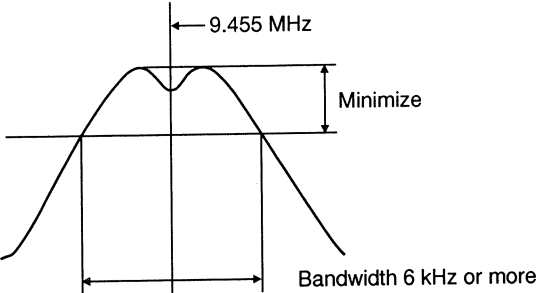
No.	Item	Adjustment procedure	Specification (reference value)
12	NB circuit adjustment NOISE-AMP adjustment Sensitivity adjustment	① Connect a signal generator to J116 and set it to 9.455 MHz, 40 dB μ emf. ② Set NB to ON and turn the NB control fully counterclockwise. ③ Connect a digital voltmeter or oscilloscope to TP25 and adjust T10, T11, T12 for minimum voltage. ④ Connect an oscilloscope to pin ② of RV11 and adjust RV11 for maximum waveform height.	

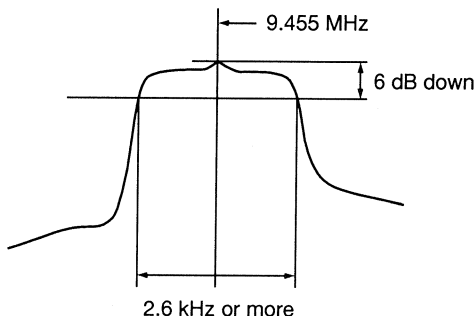
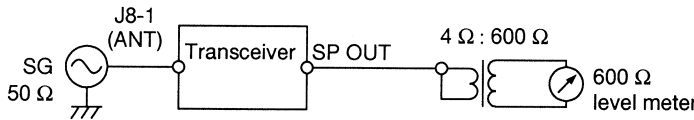
5-8 TX/RX Unit (CAF-412A/B) Receiver Section

No.	Item	Adjustment procedure				Specification (reference value)	
1	RF TUNE adjustment	Note: Before starting the adjustment, connect a digital voltmeter to TP3 and check the voltage at a displayed frequency of 400 kHz and 799.9 kHz (refer to step 2 of CPU unit adjustment). ① Connect a spectrum analyzer to TP6 and connect a tracking generator to J8-1 (RX-IN). ② Perform the following adjustments.					
		TUNE type		Displayed frequency	Adjustment location		
		400 kHz low-pass filter		0.4 MHz or less		300 kHz reference Attenuation 400 kHz: 3 dB or less 600 kHz: 30 dB or more	
		0.4~1.6 MHz	SUB 0.8~1.599 MHz	0.8 MHz 1.599 MHz	T13, 14 —	TUNE shift 3 dB or less	
			MAIN 0.4~0.799 MHz	0.799 MHz 0.4 MHz	CV5, 6 —		
			1.6~4.4 MHz	SUB 2.65~4.399 MHz	2.65 MHz 4.399 MHz		T11, 12 —
		MAIN 1.6~2.649 MHz		2.649 MHz 1.6 MHz	CV3, 4 —		
		4.4~12.3 MHz		SUB 7.4~12.999 MHz	7.4 MHz 12.299 MHz		T9, 10 —
			MAIN 4.4~7.399 MHz	7.399 MHz 4.4 MHz	CV1, 2 —		
			12.3~20.5 MHz		12.3 MHz 20.499 MHz		T7, 8 —
		20.5~30 MHz		20.5 MHz 29.999 MHz	T5, 6 —		
		30~48 MHz BPF		30 MHz~ 47.999 MHz			40 MHz reference Attenuation 30 MHz, 48 MHz: 3 dB or less 20 MHz, 60 MHz: 30 dB or more
		48~54 MHz		48 MHz 53.999 MHz	T3, 4 —		TUNE shift 3 dB or less

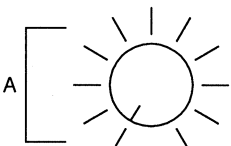
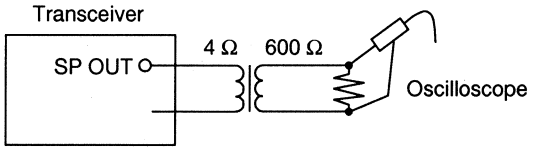
JST-245 only

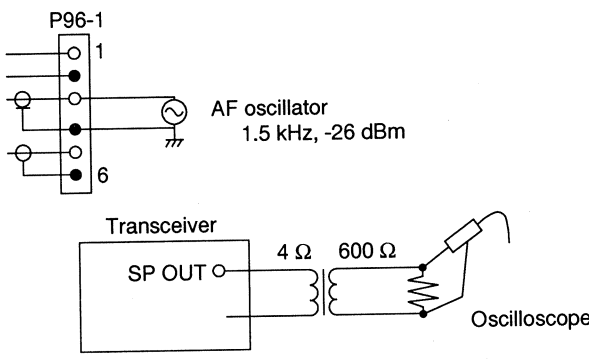
No.	Item	Adjustment procedure	Specification (reference value)
2	Local oscillator injection level	① Connect a RF voltmeter to the output of T18 (on the cathode side of CD71, CD72) (left lead of T18 on parts side, close to L36).	
	1. 1st local oscillator injection level	② Check the level over the displayed frequency range of 100 kHz ~ 53.999 MHz (JST-145: 100 kHz ~ 29.999 MHz) in 1MHz steps.	0.8 Vrms or more
	2. 2nd local oscillator injection level (79.9 MHz)	③ Connect the RF voltmeter to TP12. ④ Adjust T40 so that the RF voltmeter reading is maximum.	0.55 Vrms or more
3	3. 3rd local oscillator injection level (9 MHz)	⑤ Connect the RF voltmeter to TP17. ⑥ Adjust T51 so that the RF voltmeter reading is maximum.	1.5 Vrms or more
	Receiver section tuning	① Establish the following settings. Displayed frequency: 7.1 MHz Mode: USB Filter: WIDE AGC: OFF RF AMP: ON ATT: OFF	
	1st mixer tuning	② Connect a signal generator to J8-1 (ANT) and set it to 7.1015 MHz, 10 dB μ emf.	
		③ Connect a RF voltmeter to TP20.	
		④ Set RV1 to the center position and adjust T25 so that the RF voltmeter reading is maximum.	
		⑤ Verify that the RF voltmeter reading changes when the RF-AMP is set to ON/OFF.	
	2nd mixer filter tuning	⑥ Set the displayed frequency to 29 MHz and the signal generator to 29.0015 MHz. Verify that the voltmeter reading changes when the RF-AMP is set to ON/OFF.	
		⑦ Adjust L44, T30, T31, T36 ~ T39 so that the RF voltmeter reading is maximum.	
	3rd mixer amp tuning	Note: When adjusting T39, select a 9.455 MHz filter other than FL2 .	
		⑧ Adjust T48 ~ T50 so that the RF voltmeter reading is maximum.	
	IF 455 kHz AMP tuning	⑨ Adjust T55, T56, T58 so that the RF voltmeter reading is maximum.	

No.	Item	Adjustment procedure	Specification (reference value)
4	70.445 MHz MCF adjustment	① Connect a spectrum analyzer to TP10 and connect the TG output of a tracking generator to J51.  Note: Keep the ground connection as short as possible. ② Adjust T25 for maximum output at 70.455 MHz. ③ Adjust L44 for maximum output at 70.455 MHz. ④ Adjust T27 ~ T29 so that the 6 dB bandwidth is ± 7.5 kHz. (Use T27 and T29 to achieve flat response within the band and use T28 to adjust bandwidth.) ⑤ Repeat the adjustment of T25 and L44 for maximum output. ⑥ Perform fine adjustment of passband width using T27, T28, T29 and T25, L44.	
5	9.455 MHz filter adjustment	JST-245: Set FL3 of S2 (filter installation switch) to ON. All other switches of S2 should be OFF. JST-145: Set all six switches of S2 FL3 ~ FL12 to OFF. ① Connect a spectrum analyzer to TP16 and connect the TG output of a tracking generator to TP10.  ② Set the spectrum analyzer as follows. f-center: 9.455 MHz Span: 20 kHz ③ Set mode to AM and the filter to INTER. ④ Adjust T45 and T46 for minimum ripple within the 6kHz bandwidth.  ⑤ Set the mode to FM and the spectrum analyzer span to 2 MHz. ⑥ Adjust T43 and T44 so that the passband center is 9.455 MHz.	9.455 MHz filter

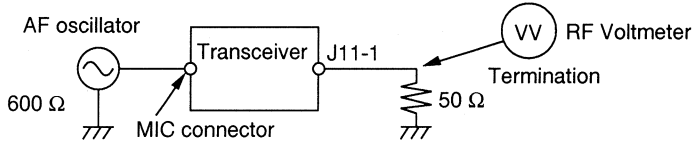
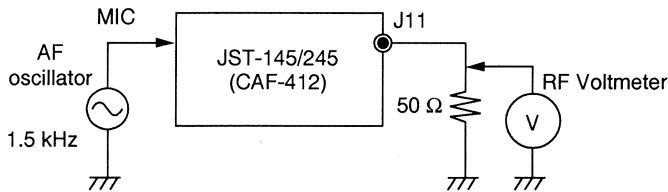
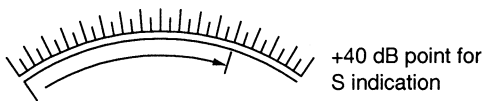
No.	Item	Adjustment procedure	Specification (reference value)									
	2.6 kHz filter (JST-245)	⑦ Set mode to LSB and the filter to INTER. Set the spectrum analyzer to a center frequency of 9.455 MHz and a span of 10 kHz, and verify the FL3 characteristics.  ⑧ The reference values of the optional filters are shown below. <table border="1"><thead><tr><th></th><th>6 dB</th><th>60 dB</th></tr></thead><tbody><tr><td>FL4</td><td>1.7 kHz or more</td><td>± 1.75 kHz or more</td></tr><tr><td>FL5</td><td>500 Hz or more</td><td>± 900 Hz or less</td></tr></tbody></table> ⑨ If passband ripple is too high, adjust T39. ⑩ In LSB mode, difference in AF output between the INTER and WIDE filter settings should be as shown at right. If the difference is too high, repeat item 5 (FL2 adjustment).		6 dB	60 dB	FL4	1.7 kHz or more	± 1.75 kHz or more	FL5	500 Hz or more	± 900 Hz or less	
		6 dB	60 dB									
FL4	1.7 kHz or more	± 1.75 kHz or more										
FL5	500 Hz or more	± 900 Hz or less										
6	Notch adjustment	① Establish the following settings. Displayed frequency: 7.1 MHz Mode: USB Filter: WIDE AGC: OFF RF-GAIN: MAX RF-AMP: ON ② Connect a signal generator to J8-1 (ANT) and set it to 7.1015 MHz, 20 dB μ emf. ③ Set NOTCH to ON and set the NOTCH control to the center position. ④ Adjust T57 and RV9 for minimum AF output.	within 4 dB									
7	AGC adjustment	① Establish the following settings. Displayed frequency: 7.1 MHz Mode: USB Filter: WIDE AGC: FAST NOTCH: OFF RF-AMP: ON ② Prepare the measurement setup as shown below.  ③ Connect a RF voltmeter to TP20. ④ Set the signal generator to 7.1015 MHz, 40 dB μ emf. ⑤ Adjust AGC so that the voltmeter reading becomes 0.01 Vrms. ⑥ Set the mode to AM and the signal generator to 1kHz, 30% modulation. Then verify the RF voltmeter reading. * Adjustment resistor: R588	0.009~0.011Vrms 0.009~0.011Vrms									

No.	Item	Adjustment procedure	Specification (reference value)
8	Full gain adjustment	① Establish the following settings. Displayed frequency: 7.1 MHz Mode: USB Filter: WIDE AF control: maximum ② Connect a signal generator to J8-1 (ANT) and set it to 7.1015 MHz, -2 dB μ emf. ③ Adjust RV32 [IF] so that the AF output becomes 24 dBm.	
9	Signal meter adjustment	① Establish the following settings. Displayed frequency: 7.1 MHz Mode: LSB Filter: WIDE AGC: FAST RF-AMP: ON ② Set the signal generator to 7.0985 MHz, 30 dB μ emf, non-modulated output. ③ [SM1] adjustment Adjust RV13 [SM1] so that the signal meter indication becomes "9". (Voltage at pin ⑥ of J27-1 should be 3.0 V.) ④ [SM2] adjustment Set the signal generator to 10 dB μemf and adjust RV8 [SM2] so that the signal meter indication becomes "S1". (Voltage at pin ⑥ of J27-1 should be 3.0 V.) ⑤ Set the signal generator to OFF and verify that the signal meter does not register. The voltage at pin ① of J27-1 should be 4.00 V or more. If it is less, readjust [SM1] as described below. • With the signal generator set to OFF, adjust [SM1] so that the voltage at pin ① of J27-1 becomes 4.00 V or more. • Then turn the signal generator on and set it to 30~35 dB μ emf. Verify that the signal meter reading becomes "S9".	
10	Detector circuit carrier level	① Establish the following settings. Displayed frequency: 7.1 MHz Mode: AM Filter: WIDE AGC: FAST RF-AMP: ON ② Set the signal generator to 7.1 MHz with 1kHz, 30% modulation and 20 dB μ emf. ③ Connect a voltmeter to pin ② of IC12. ④ Verify the voltmeter readings in the AM and LSB mode. AM, LSB: 0.15 Vrms or more * Adjustment resistors: R556 (AM), R530 (LSB)	
11	LINE OUT adjustment	① Establish the following settings. Displayed frequency: 7.1 MHz Mode: LSB Filter: WIDE AGC: FAST RF-AMP: ON ② Set the signal generator to 7.0985 MHz and 30 dB μ emf. ③ Connect a level meter (600 ohms) to TP25. ④ Adjust RV23 [LINE] so that the level meter reads -2 dBm.	-5~0 dBm

No.	Item	Adjustment procedure	Specification (reference value)
12	FM reception circuit Discriminator adjustment Center meter adjustment	① Establish the following settings. Displayed frequency: 7.1 MHz Mode: FM Filter: WIDE RF-AMP: ON AF GAIN: Center ② Leave the ANT connector open or terminate it with 50 Ω . ③ Connect a digital voltmeter to pin ⑨ of IC13. ④ Adjust T59 so that the voltage becomes 2.25 V. ⑤ Press the METER key to select the center meter mode. ⑥ Adjust RV11 CENT so that the meter is at center ("S9" position).	Center ± 1 scale point
13	Squelch adjustment	① Set AGC to FAST and RF GAIN to maximum, and leave the ANT connector open. ② Set the mode to LSB and turn the squelch control. Verify that the squelch on/off point falls in the range shown below. * Adjustment resistor: R697 ③ Set the mode to FM. Turn the squelch control and adjust RV10 FM SQ so that the squelch on/off point is the same as for the LSB mode. If the SQ LED has lit, turn FM SQ back a bit until it goes out. 	Squelch on/off point in LSB mode: ± 0.5 scale points
14	1st mixer balance	① Establish the following settings Displayed frequency: 100 kHz Mode: CW Filter: WIDE ② Connect a level meter to the speaker terminals and adjust AF GAIN so that the meter shows an indication (ANT: open) ③ Adjust RV1 so that the level reading becomes minimum.	
15	Beep tone adjustment	① Set user definition no. 7 to 1 (ON). ② Verify that the beep tone is heard from the speaker when a panel key is pressed. ③ Adjust RV30 BEEP so that the AF output becomes 2 Vpp/600 Ω . 	2 Vpp ± 0.2 V

No.	Item	Adjustment procedure	Specification (reference value)
16	DTMF volume adjustment	① Set the AF control to minimum and connect an audio frequency oscillator (1.5 kHz, -26 dBm) to pins ③ and ④ of P96-1. Then adjust RV31 DTMF so that the AF output becomes 3 Vpp/600 Ω. 	3 Vpp ±0.3 V

5-9 TX/RX Unit (CAF-412A/B) Transmitter Section

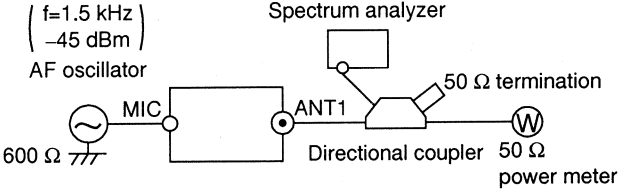
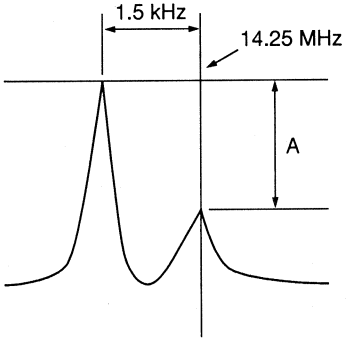
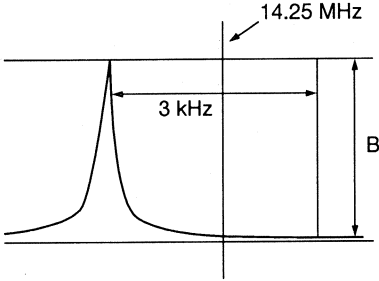
No.	Item	Adjustment procedure	Specification (reference value)
1	Output level adjustment	① Prepare the measurement setup as shown below.  ② Establish the following settings Displayed frequency: 14.25 MHz Mode: FM Filter: WIDE MIC GAIN: Minimum AF oscillator: 1.5 kHz ③ Adjust T41 for maximum RF voltmeter reading. Note: If the level is insufficient, perform fine adjustment with T43 and T44, while taking care not to impair the filter characteristics.	1.25 Vrms or more
	COMP level adjustment	④ Prepare the measurement setup as shown below.  ⑤ Set MIC GAIN to maximum and set the transceiver to transmission mode (COMP should be OFF). ⑥ Adjust the AF oscillator output so that the RF voltmeter reading becomes 1.5 Vrms (output should be about -60 to -65 dBm). ⑦ Set the COMP control to maximum and set COMP to ON. Adjust T52 for maximum RF voltmeter reading. Adjust RV6 COMP so that the RF voltmeter indication becomes maximum.	
	COMP meter adjustment	⑧ Switch the meter to COMP indication and adjust RV7 COMP-M so that the meter reading is as shown below.  ⑨ Turn the COMP control fully counterclockwise and verify that the meter does not register. ⑩ Turn the COMP control fully to maximum and adjust the AF oscillator output level so that the RF voltmeter reading is 1.0 Vrms (this level is taken as "A"). ⑪ Increase the AF oscillator output so that the RF voltmeter indication becomes 1.0 Vrms when COMP is set to OFF. Verify that this level is at least 20 dB higher than "A".	

No.	Item	Adjustment procedure	Specification (reference value)
2	FM modulation adjustment	① Establish the following settings Displayed frequency: 14.25 MHz Mode: FM Filter: WIDE Connect a 600 Ω AF oscillator to the MIC connector. ② Connect an FM linear detector (2nd LO = 79.9 MHz) to P52 of the synthesizer unit (CGH-192) and set the unit to the transmission mode. ③ Set the AF oscillator to 1.5 kHz -40 dBm, and set the MIC control to maximum. With the jumper switch S1 of the TX/RX unit CAF-412 set to the "W" side, adjust RV17 DEV so that the FM linear detector reads 4.2 kHz. With the jumper switch set to the "N" side, adjust RV18 NARROW so that the FM linear detector reads 2.1 kHz. After adjustment, return the switch to the "W" position. ④ Set the AF oscillator to 1.5 kHz, -65 dBm, and set the MIC control to center. Adjust RV20 FM so that the FM linear detector reads 3.5 kHz.	
	Maximum modulation		4.2 $\pm$ 0.2 kHz 2.1 $\pm$ 0.2 kHz
	Standard modulation		3.5 kHz $\pm$ 0.15 kHz
3	FM demodulator frequency response	① Connect a level meter (10 kΩ) to pin ② of J58. ② Connect an AF oscillator (600 Ω) to the MIC connector and set it to 1.5 kHz, -62 dBm. ③ Set COMP to OFF and the MIC control to center. Check the level meter indication at this point. ④ Vary the frequency of the AF oscillator and check the frequency response. Adjust the AF oscillator output so that the level meter reading becomes -20 dBm when the AF oscillator is set to 1 kHz. Using this as reference, verify that the level deviation is as shown below. 300 Hz: -7 to -15 dB 3 kHz: +5 to 10 dB 5 kHz: -5 dB or less Relative level (dB) Reference characteristics	-20 dBm $\pm$ 3 dB

5-10 General Adjustments (Transmission)

No.	Item	Adjustment procedure	Specification (reference value)
1	APC adjustment	① Set RV26 AUX, RV27 TYP, RV28 TUNE, and RV29 RDC fully counterclockwise. ② Connect a 50 Ω dummy load to the ANT1 connector. ③ Set the displayed frequency to 14.25 MHz and the mode to FM. Set the Po control to maximum. ④ Activate the transmission mode. Adjust RV27 TYP so that power at the 50 Ω dummy load is 150 W.	135 ~ 150 W
2	Transmission output power check	① Use the HF band key to switch all bands in the above condition, and check the output (mode: FM, Po control: maximum).	135 ~ 150 W
3	RDC adjustment	① Set the power DIP switch (S2) REDUCT to ON. ② Set the displayed frequency to 14.25 MHz and the mode to FM. Set the Po control to maximum. ③ Activate the transmission mode and adjust RV29 RDC so that the power meter reads 50 W. ④ After adjustment, return the power DIP switch (S2) REDUCT to OFF.	45 ~ 57 W
4	AUX adjustment (JST-245 only)	① Set the displayed frequency to 50.0 MHz and the mode to FM. Set the Po control to maximum. ② Adjust RV26 AUX so that power at the 50 Ω dummy load is 150 W.	135 ~ 150 W
5	AM carrier level	① Prepare the measurement setup as shown below. ② Establish the following settings Displayed frequency: 14.25 MHz Mode: AM Filter: INTER Po control: Maximum MIC GAIN control: Minimum ③ Press the FUNC key and then the FM/AM key. Set the unit to the transmission mode, and turn the MEMORY control until "90" is shown on the XIT display.	

No.	Item	Adjustment procedure	Specification (reference value)
6	TUNE power adjustment (JST- 245)	④ Set the unit to the transmission mode and adjust RV16 [AMC] so that power is 25 W. ⑤ Set the displayed frequency to 1.6 MHz and keep the [XMIT] key depressed. (AM carrier level is automatically adjusted.) Note 1: Wait until automatic adjustment of AM carrier level is completed. Note 2: For this adjustment, you should cover the power amplifier unit and make sure that the heat sink is properly cooled by the cooling fan. ⑥ After the cooling fan has stopped, perform automatic AM carrier adjustment again. ⑦ Set the unit to the same condition as in step ② and adjust RV16 [AMC] so that power is 37.5 W. ⑧ Set DIP switch (S2) [REDUCT] to ON. Set the displayed frequency to 14.25 MHz and activate the transmission mode. Adjust RV5 so that power becomes 17 W. After adjustment, return the [REDUCT] DIP switch to OFF. ⑨ Check AM carrier power in all bands.	25 ~ 52 W 13 ~ 25 W 25 ~ 52 W
	(JST-145)	① Set the displayed frequency to 29.0 MHz and the mode to FM. Set the Po control to maximum. ② Press the [FUNC] key and the [XMIT] key. ③ Adjust RV28 [TUNE] so that power is 25 W.	22 ~ 28 W
		① Set the displayed frequency to 29.0 MHz and the mode to FM. Set the Po control to maximum, and turn RV28 [TUNE] fully clockwise. ② Press the [FUNC] key and then the [XMIT] key to activate the transmission mode. ③ Adjust RV26 [AUX] so that power is 30 W. ④ Adjust RV28 [TUNE] so that power is 25 W.	25 ~ 30 W 22 ~ 28 W
7	Power meter adjustment	① Set the displayed frequency to 14.25 MHz and the mode to FM. Activate the transmission mode and verify that output power is 100 W. ② Select the power [Po] mode of the meter and adjust RV24 [POM] so that the meter reading is 100 W.	±1 scale point
8	AM modulation	① Set the AF oscillator to 1.5 kHz, -55 dBm, and the MIC GAIN control to the center position. ② Set the frequency to 14.25 MHz and activate the AM transmission mode. ③ Adjust RV14 [AML] so that the oscilloscope shows 100% modulation.	

No.	Item	Adjustment procedure	Specification (reference value)
9	LINE IN adjustment	① Connect an AF oscillator (600 Ω) to pin ⑩ of the J94 (ACCESSORY) connector on the rear panel. Set the AF oscillator to 1.5 kHz, -50 dBm. ② Establish the following settings Displayed frequency: 14.25 MHz Mode: USB Filter: WIDE Po control: Maximum ③ Activate the transmission mode and adjust RV19 LINE so that power becomes 50 W.	40 ~ 50 W
10	SSB transmission check	① Prepare the measurement setup as shown below.  ② Establish the following settings. Displayed frequency: 14.25 MHz Mode: LSB Filter: WIDE COMP: OFF MIC GAIN control: Maximum Po control: Maximum ③ Activate the transmission mode and check the power. ④ Set the spectrum analyzer to a center frequency of 14.25 MHz and a span of 10 kHz, and adjust RV15 BAL so that the carrier becomes minimum.  ⑤ In the above condition, verify that sideband suppression is 60 dB or more. 	140 ~ 150 W A = 40 dB or more B = 60 dB or more
	Carrier leak adjustment		
	Sideband suppression ratio		

5-11 Optional Tone Unit (CCL-267) Adjustment

NO.	Item	Adjustment procedure	Specification (reference value)
1	CTSS modulation adjustment	① Connect the optional unit to the transceiver. ② Set the displayed frequency to 29.5 MHz, the mode to FM, and the filter to WIDE. ③ Set TSQ to ON (with the [SQ-SEL] key). ④ Set user definition no. 24 to 88.5 Hz ⑤ Connect an FM linear detector to TX/RX OUT (J11) or the ANT connector (via a dummy resistor when using the ANT connector). ⑥ Press the [XMIT] key and adjust RV4 [CTCSS] for a frequency deviation of 0.5 kHz.	
2	Burst modulation adjustment	⑦ Press the [FUNC] key and then the [SQ-SEL] key to display the user definition no. 159. Select "1" with the RIT/XIT control. After making the setting, press the [CLR] key to return to normal operation mode. ⑧ Press the [XMIT] key and adjust RV3 [BURST] for a frequency deviation of 3.5 kHz. ⑨ After the RV3 adjustment is completed, display the user definition no. 159 again and return the setting to "0" with the RIT/XIT control. Press the [CLR] key to return to normal operation mode.	
3	DTMF modulation adjustment	⑩ With [TSQ] turned OFF, press any key on the numeric keypad to send a DTMF tone. Adjust RV1 [DTMF] for a frequency deviation of 3.5 kHz.	
4	CTCSS demodulation level adjustment	⑪ With [TSQ] turned OFF, connect a signal generator to the ANT connector. Set it to a frequency of 29.5 MHz and output of 30 dB μ emf., FM modulation with 1 kHz and 3.5 kHz deviation. ⑫ Connect the speaker output to a VU meter and adjust the AF control so that the output becomes 24 dBm. ⑬ Add a second modulation component of 88.5 Hz with 0.5 kHz deviation to the signal generator. ⑭ Set [TSQ] of the JST-245 to ON and adjust RV2 [TONE OUT] so that the speaker output is at the level set in step ⑫ (24 dBm).	
5	Operation check	After adjusting the volume, install the tone unit in two transceivers. Connect a dummy load to the ANT connector of one transceiver and activate the FM transmission mode. Verify that the DTMF tones are heard from the speaker when keys of the numeric keypad are pressed. Verify that the DTMF tones are demodulated properly by the receiving transceiver. Next, set both transceivers to the same frequency, FM, and CSQ (with [SQ-SEL]). Send with one unit and receive with the other. Verify that squelch is released and the tones are heard from the speaker. Repeat the check in the reverse direction.	

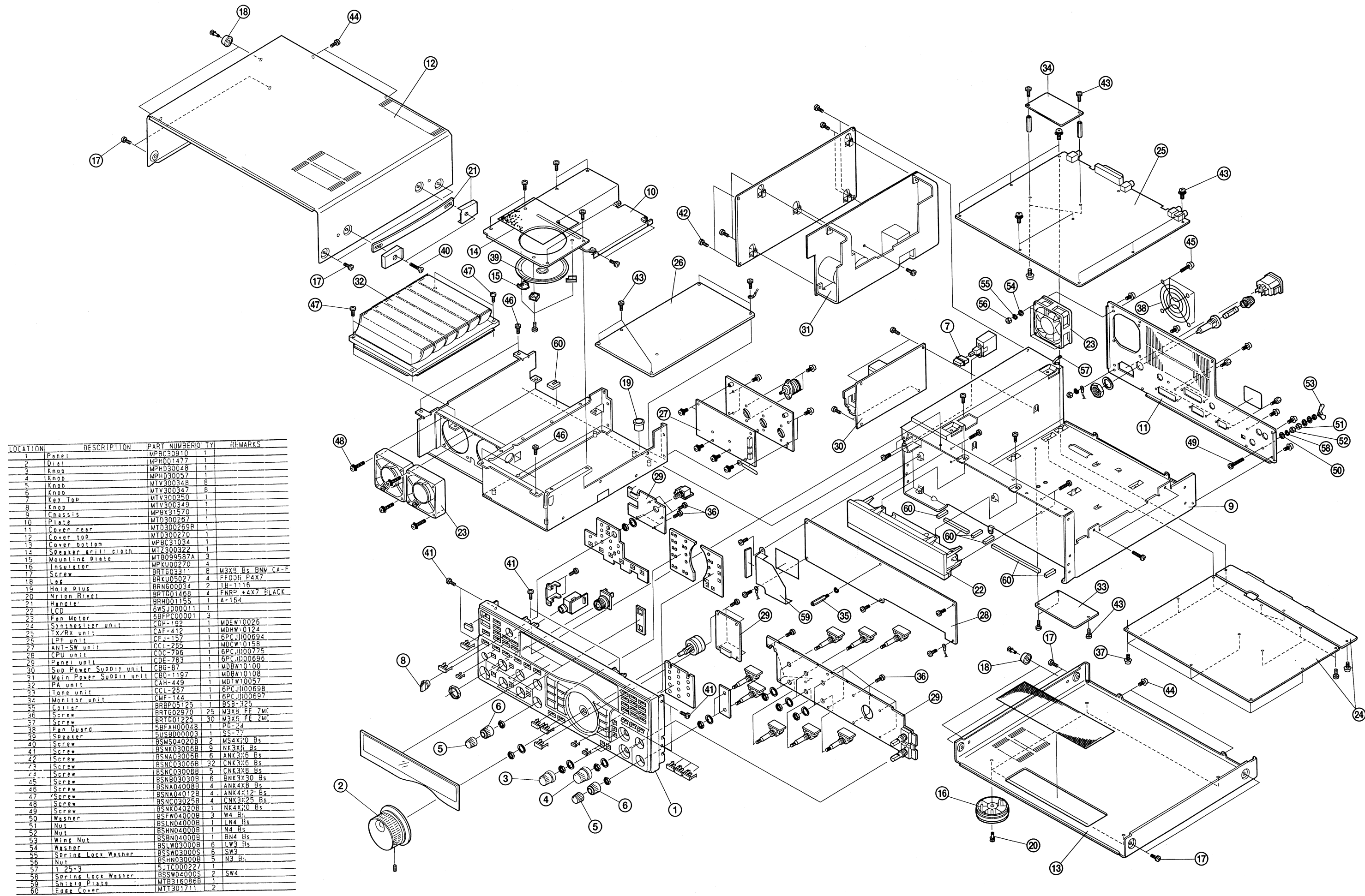
5-12 Optional Monitor Unit (CMF-144) Adjustment

No.	Item	Adjustment procedure	Specification (reference value)
1	Operation check	① Install the monitor unit in the transceiver, connect a microphone, and activate the USB transmission mode. Verify that the modulation can be heard from the speaker when the MONI (Monitor) switch on the panel is set to ON. Verify also that the level can be adjusted with the MONI control.	

Section 6 Parts List

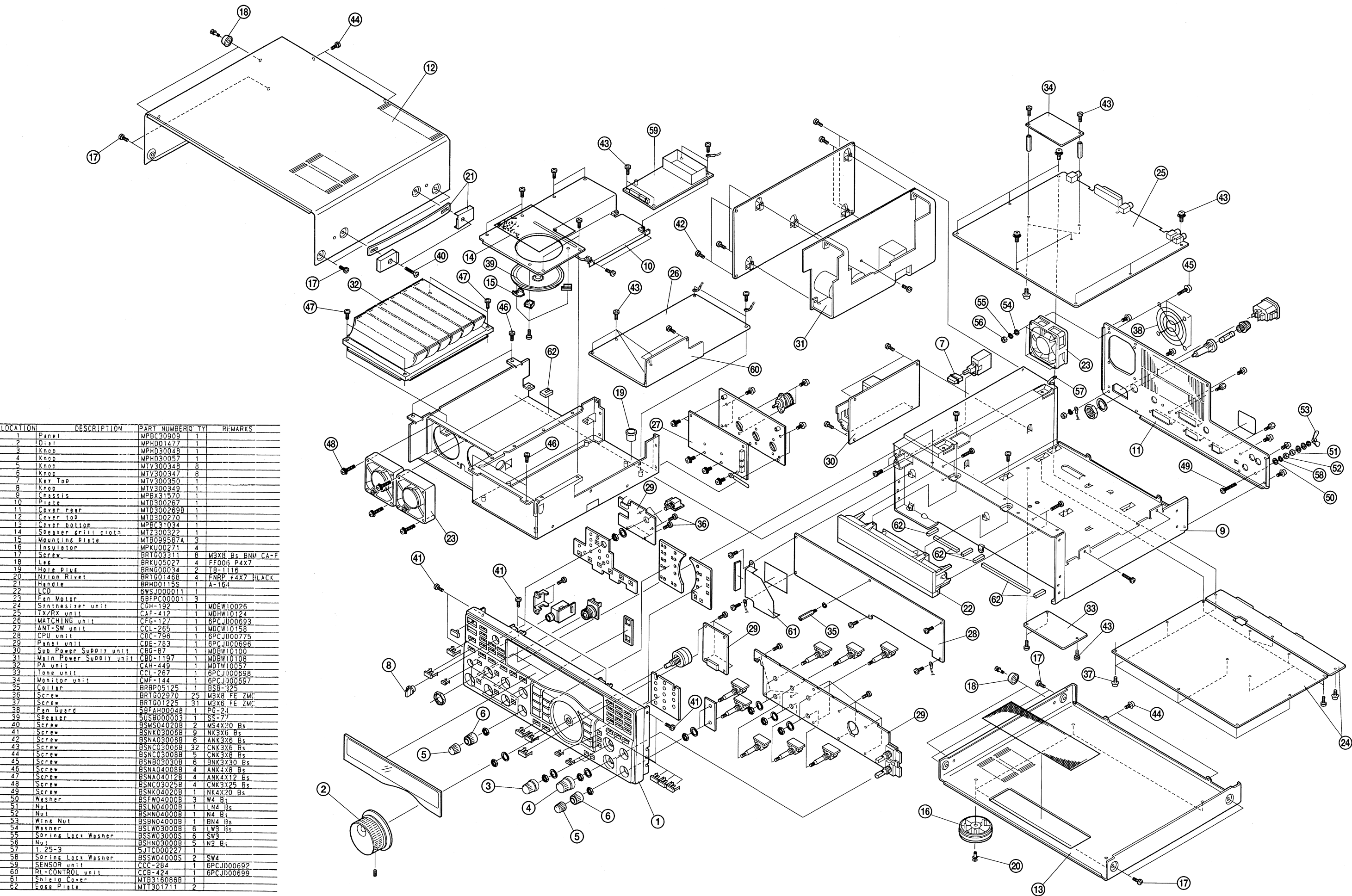
6-1 Structural Parts

6-1-1 JST-145 Exploded View



LOCATION	DESCRIPTION	PART NUMBER	QTY	REMARKS
1	Panel	MPBC30910	1	
2	Dial	MPHD01477	1	
3	Knob	MPHD30048	1	
4	Knob	MPHD30057	1	
5	Knob	MTV300348	8	
6	Knob	MTV300347	8	
7	Key Top	MTV300350	1	
8	Knob	MTV300349	1	
9	Chassis	MPBX31570	1	
10	Plate	MTD300267	1	
11	Plate rear	MTD300269B	1	
12	Cover top	MTD300270	1	
13	Cover bottom	MPBC31034	1	
14	Speaker grill cloth	MTZ300322	1	
15	Mounting plate	MTB099587A	3	
16	Insulator	MPKU00270	4	
17	Screw	BRTG03311	8	M3X8 Bz BNM CA-F
18	Leg	BRKU05027	4	FF006 P4X7
19	Hole plug	BRNG00034	2	TB-116
20	Nylon Rivet	BRTG01468	4	FNR2 #4X7 BLACK
21	Handle	BRHD01155	1	A-154
22	LCD	6WSJ00011	1	
23	Fan Motor	6GFC00001	3	
24	Synthesizer unit	CGH-192	1	MDHW10026
25	TX/RX unit	CAF-412	1	MDHW10124
26	LPF unit	CFJ-157	1	6PCJ000694
27	Ant-SW unit	CCL-265	1	MDCW10158
28	CPU unit	CDC-796	1	6PCJ000775
29	Panel unit	CDE-783	1	6PCJ000696
30	Sup Power Supply unit	CBG-87	1	MDBW10100
31	Main Power Supply unit	CBG-1197	1	MDBW10108
32	PA unit	CAH-449	1	MDTW10057
33	Tone unit	CCL-267	1	6PCJ000698
34	Monitor unit	CMF-144	1	6PCJ000697
35	Collar	BRBP05125	1	BSR-325
36	Screw	BRTG02970	25	M3X8 FE ZMC
37	Screw	BRTG01225	30	M3X8 FE ZMC
38	Fan Guard	SRFAH00048	1	PG-24
39	Speaker	BSSBD00203	1	SS-24
40	Screw	BSNA04020B	2	MS4X20 Bz
41	Screw	BSNA03006B	9	NK3X6 Bz
42	Screw	BSNA03006B	6	ANK3X6 Bz
43	Screw	BSNC03006B	32	CNK3X6 Bz
44	Screw	BSNC03008B	5	CNK3X8 Bz
45	Screw	BSNB03030B	6	BNK3X30 Bz
46	Screw	BSNA04008B	4	ANK4X8 Bz
47	Screw	BSNA04012B	4	ANK4X12 Bz
48	Screw	BSNC03025B	4	CNK3X25 Bz
49	Screw	BSNA04020B	1	NK4X20 Bz
50	Washer	BSFW04000B	3	W4 Bz
51	Nut	BSLN04000B	1	LN4 Bz
52	Nut	BSHN04000B	1	N4 Bz
53	Wing Nut	BSBN04000B	1	BN4 Bz
54	Washer	BSLW03000B	6	LW3 Bz
55	Spring Lock Washer	BSSW03000S	6	SW3
56	Nut	BSHN03000B	5	N3 Bz
57	1 25-3	6TTC00022	1	
58	Spring Lock Washer	BSSW04000S	2	SW4
59	Shield Plate	MTB316086B	1	
60	Edge Cover	MTT901711	2	

6-1-2 JST-245 Exploded View



For further information, contact :



Since 1915

Japan Radio Co., Ltd.

Main Office : Akasaka Twin Tower(main),
17-22, Akasaka 2-chome,
Minato-ku, Tokyo 107, JAPAN
Phone : 03-3584-8837
FAX : 03-3584-8879

Overseas Branches : London, New York
Liaison Offices : Jakarta, Bangkok, Manila, New Delhi,
Manchester, Rio de Janeiro, Portsmouth,
Rotterdam, Las Palmas