FURUNO

SERVICE MANUAL

SSB RADIOTELEPHONE

MODEL FS-1503

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(KAOK) FS-1503

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Chapter 1 Configuration

1.1 Configuration

The basic FS-1503 consists of a transceiver unit (main unit) and antenna coupler (AT-1503), and covers the frequency range 1.6 to 27.5 MHz.

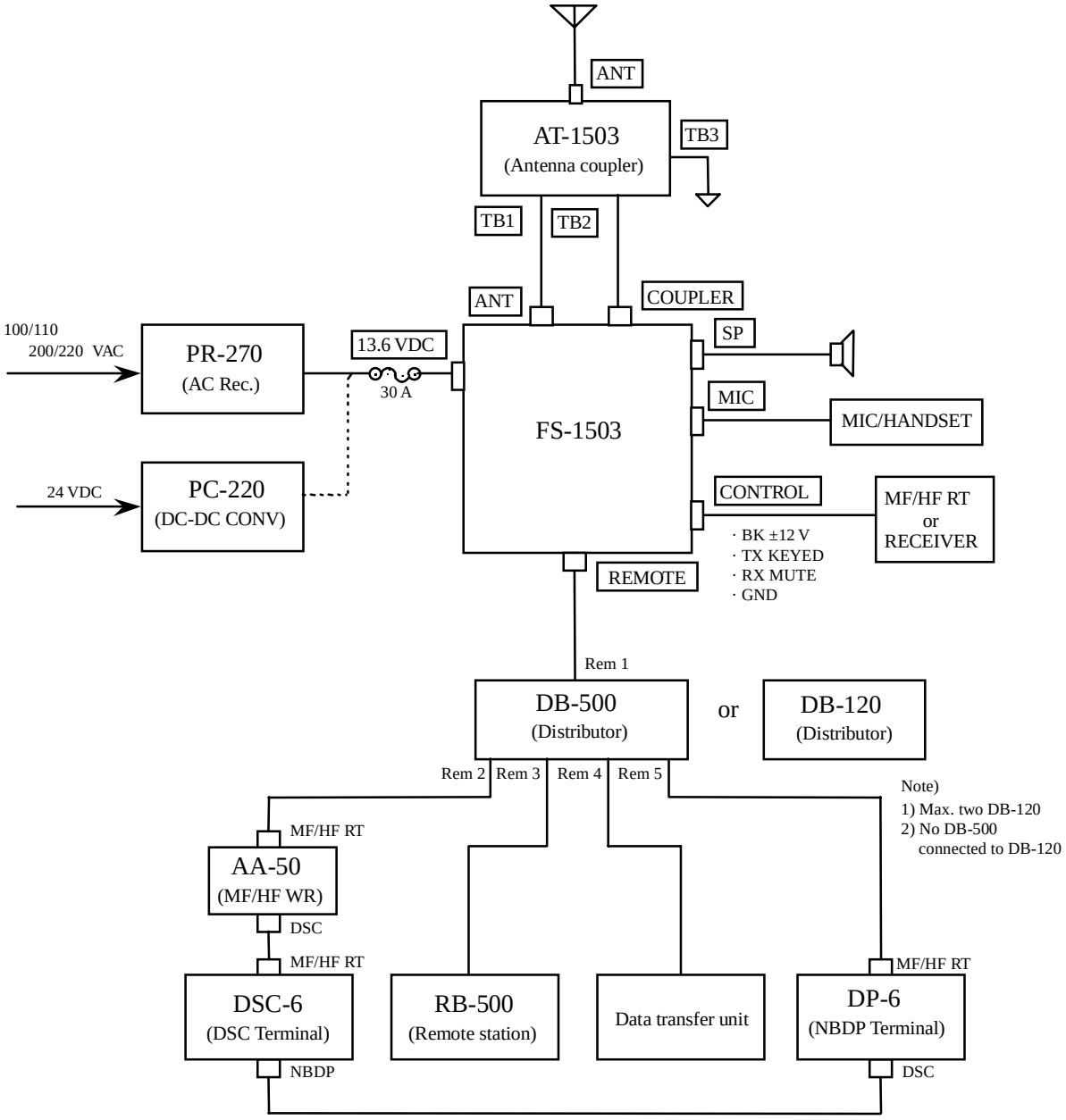


Figure 1-1 System Diagram

1. FS-1503 Standard Supply

There are four models depending on the selection of an antenna coupler and a handset.

Specification		Code No.	Model
Antenna Coupler	Handset		
Yes	Yes	000050900	FS-1503-01
Yes	No	000050901	FS-1503-02
No	Yes	000050902	FS-1503-03
No	No	000050903	FS-1503-04

The table below lists the complete set.

Standard Supply				
Name	Type	Q'ty	Code No.	Remarks
SSB Transceiver	FS-1503	1	000050905	
Antenna coupler	AT-1503	1	000050904	
Installation materials	CP05-07600	1	000050906	with coupler
	CP05-07610	1	000050907	without coupler
Accessories	FP05-05000	1	000050908	with handset
	FP05-05010	1	000050909	without handset
Document	OME-56140	1	000808223	Operator's Manual
	IME-56140	1	000808224	Installation Manual

2. FS-1503 Optional Supply

Optional Supply				
Name	Type	Q'Ty	Code No.	Remarks
AC Power Supply	PR-270	1	000113349	
DC Power Supply	PC-220	1	000113350	
Loudspeaker	MX910-X01	1	000138001	
REMOTE A Kit	0P05-82	1	005939810	05P0457 (RS-232C)
REMOTE B Kit	0P05-83	1	005939820	05P0458 (Current Loop)
CONTROL Board	0P05-41	1	005920330	05P0459
Filter (0.4 kHz)	SF0L04	1	000116693	For TLX
SW REG Board	0P05-84	1	005939830	For BATT floating ground
Handset	HS-6000FZ5	1	000112623	
Microphone	M112D 4509910	1	000116487	Noise canceling
Dummy load	0P05-85	1	005939840	05P0670
Copper band	04S0801 30x1200x0.3	1	000572187	
U-Bolt	0P05-12	1	005923680	For fixing antenna
Cable Assy	05S0949-0 L-20M	1	000130485	Control Cable between main unit and antenna coupler
	05S0949-0 L-30M	1	000130486	
	05S0949-0 L-40M	1	000130487	
	05S0949-0 L-50M	1	000130488	
Cable Assy	05S0462-1 L-20M	1	000113361	Coaxial Cable between main unit and antenna coupler
	05S0462-1 L-30M		000113362	
	05S0462-1 L-40M		000113363	
	05S0462-1 L-50M	1	000113364	
Distributor	DB-120	1	000057231	Two output, RB-500 not connectable
Distributor	DB-500-RS (E)	1	000056836	Five outputs
Remote Station	RB-500	1	000054514	
Whip antenna	FAW-6D	1	000572128	With insulator
	FAW-6R2	1	000572108	Welding mounting base (copper lug)
	FAW-6RP2	1	000572109	Welding mounting base (M-type connector)
	FAW-6R2A	1	000107921	Fixing to post (copper lug)
	FAW-6RP2A	1	000107920	Fixing to post (M-Type connector)

Optional Supply				
Name	Type	Q'ty	Code No.	Remarks
Antenna materials	E-22	1	000050632	Doublet Antenna Kit
	E-24	1	000050634	Single Wire Antenna Kit
	E-25	1	000050635	Doublet-span Antenna Kit
	E-26	1	000050636	Whip Antenna Lead-in Kit
	E-27	1	000050637	Whip Antenna Feeder Kit

Chapter 2 Circuit Description

2.1 General

The SSB transmitter/receiver (FS-1503) has been developed as an upgraded successor model of FS-1550 and FS-1502, which is used for pleasure boats and fishing boats. The specifications conform to the FCC regulations and the inspection standards of such countries as New Zealand, Australia, Russia, China, and southeastern Asian countries.

This model features that it uses DDS circuit for the local oscillator to reduce the frequency switching time and thus enables telex communication. It has a built-in two-tone alarm and is powered by a 13.6 V supply.

The transmitter works in 1.6 MHz to 23.0 MHz, 150 Wpep and in 23.0 MHz to 27.5 MHz, 75 Wpep with an automatic forced-air-cooling to PA section by FAN and the receiver works in 0.1 MHz to 29.9 MHz. The antenna coupler is automatically tuned to operating frequencies and does not need matching operation. An optional dummy antenna can be installed in the antenna coupler.

ITU channels are standard channels. In addition, there are 199 user-programmable channels and 65 station names among them can be displayed.

1. Interconnections

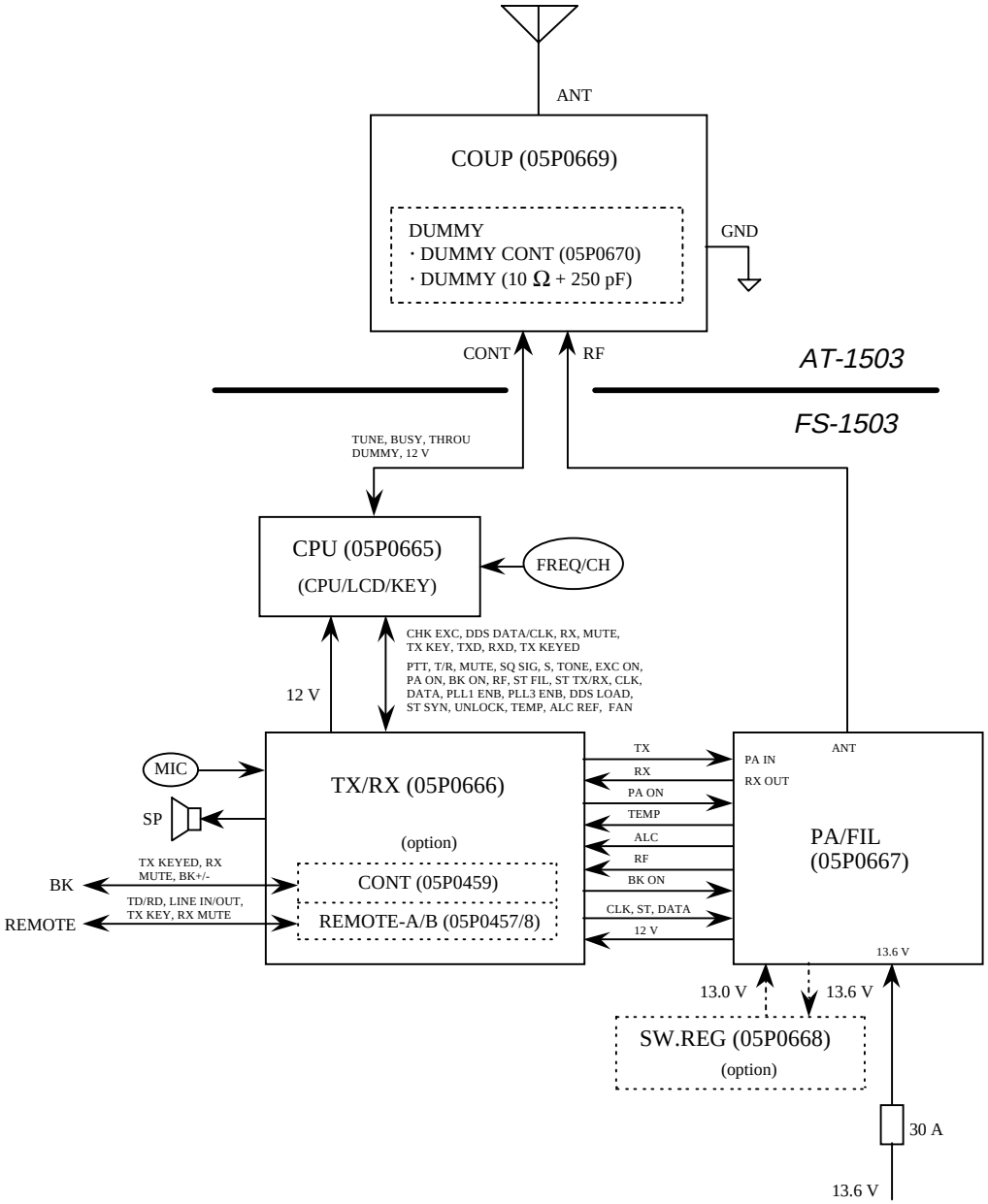


Figure 2-1 Interconnection Diagram

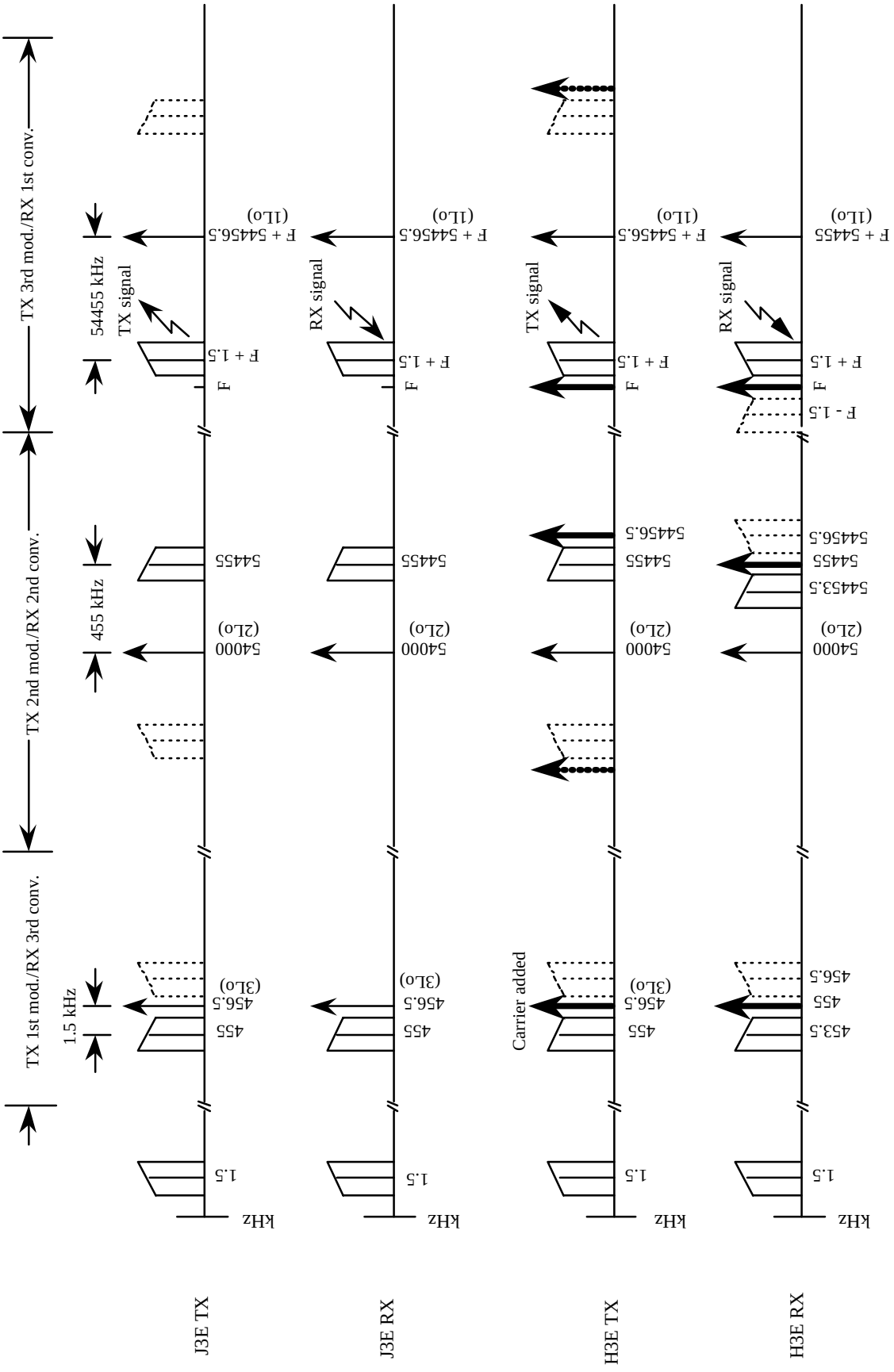
2. Function of PCB

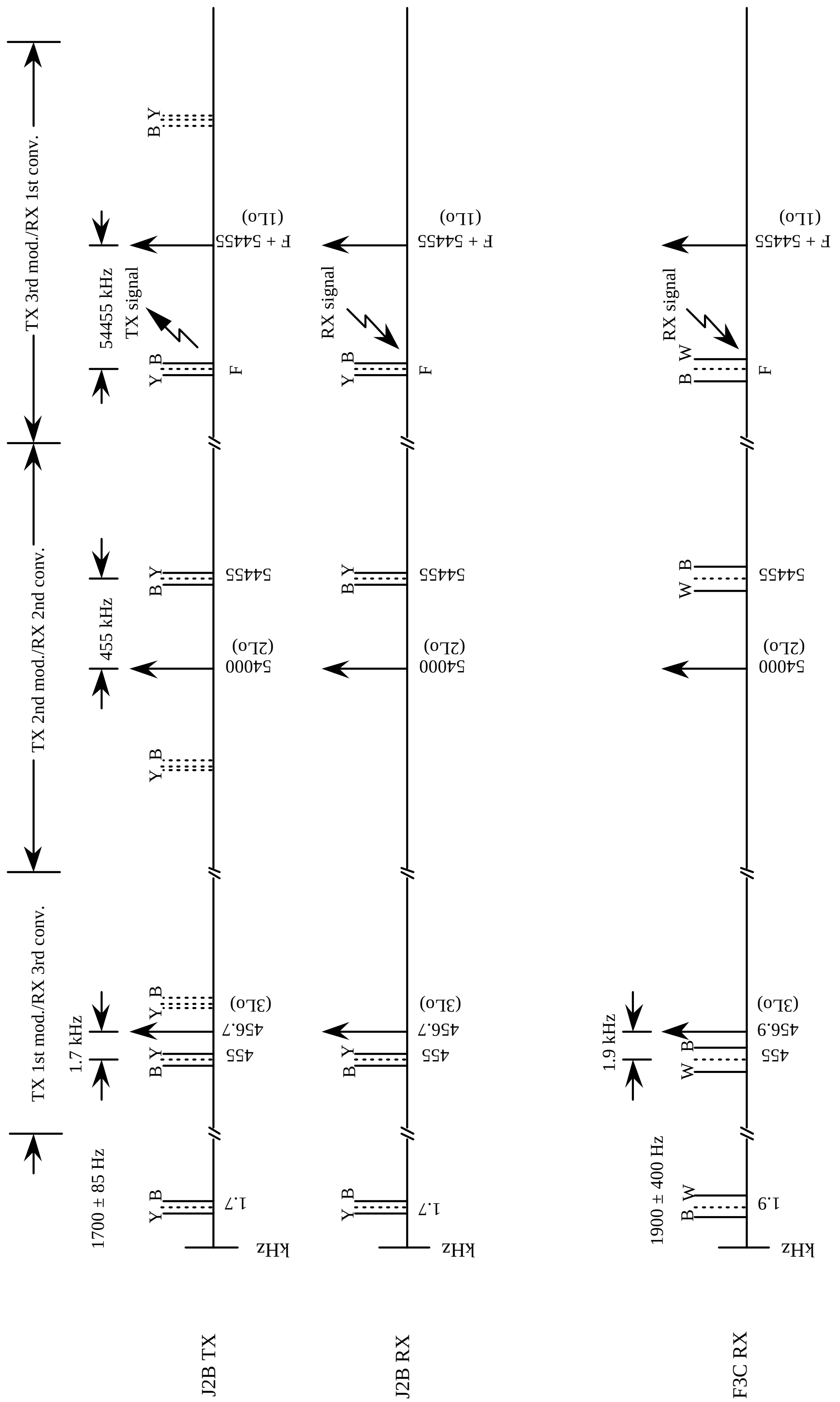
Table 2-1 Function of PCB

Board Name	Type	Description	Remarks
FS-1503			
CPU	05P0665	Scans the key switches, outputs signals to the LCD-panel display, and controls each circuit block (input/output control).	
TX/RX	05P0666	Comprises a modulator for microphone and LINE input signals, a transmitting RF amplifier, a receiving RF amplifier, low-frequency amplifiers, and a synthesizer (DDS) circuit.	TLX FIL (optional)
NB DET	05P0466	Includes a noise blanking control circuit.	
REMOTE (A)	05P0457	Equipped for remote control of DSC, RB-500, and NBDP.	OPTION (RS-232C)
REMOTE (B)	05P0458	Equipped for remote control of RB-500.	OPTION (Current Loop)
CONTROL	05P0459	Equipped when BK and MUTE signals are needed to interconnect receivers.	OPTION
PA/FIL	05P0667	Comprises the power input relay section, PA section, and TX-FIL section. The relay section contains a power ON/OFF circuit by a power input-line relay, and a protection circuit against over-voltage and over-current. The PA section includes a transmitting high-frequency power amplifier circuit and a temperature detecting circuit. The TX-FIL section contains transmitting LPF, ALC/reflection detecting circuit, and a transmitter/receiver switching circuit.	BC BAND FIL Setting
SW REG	05P0668	Equipped to change the grounding of the unit from negative ground to floating ground.	OPTION
AT-1503			
COUP	05P0669	The automatic tuning circuit in which CPU controls L/C matching network by detecting the phase, SWR, and frequency of the RF input signal from the main unit. The input/output signals are TUNE, BUSY, and THROU. The input impedance is 50 Ω and the maximum input power is 150 Wpep.	Selftest function with JP-1 set to "SELF TEST"
DUMMY CONT	05P0670	Controls ON/OFF of the dummy antenna of 10 Ω + 250 pF, 100 W.	OPTION

Note) *TX/RX board is equipped with CONTROL board (option), REMOTE-(A) or -(B) board (options), and NB-DET board. REMOTE-(A) or -(B) board is selected according to the used remote-control specification, RS-232C or current-loop, respectively.*

3. Spectrum


TX 3rd mod./RX 1st conv.
TX 2nd mod./RX 2nd conv.
TX 1st mod./RX 3rd conv.
54455 kHz
455 kHz
1.5 kHz
TX signal
RX signal
Carrier added
F + 54456.5 (1Lo)
F + 54455 (1Lo)
F + 1.5
F
F - 1.5
54000 (2Lo)
54455
54456.5
54453.5
456.5 (3Lo)
455
453.5
456.5
1.5
kHz
J3E TX
J3E RX
H3E TX
H3E RX



TX 3rd mod./RX 1st conv.
TX 2nd mod./RX 2nd conv.
TX 1st mod./RX 3rd conv.
54455 kHz
455 kHz
1.7 kHz
1700 ± 85 Hz
1.9 kHz
1900 ± 400 Hz
TX signal
RX signal
RX signal
F + 54455
(1Lo)
54455
54000
(2Lo)
455
456.7
456.9
(3Lo)
1.7
1.9
F
Y
B
W
kHz
J2B TX
J2B RX
F3C RX

2.2 CPU

1. General

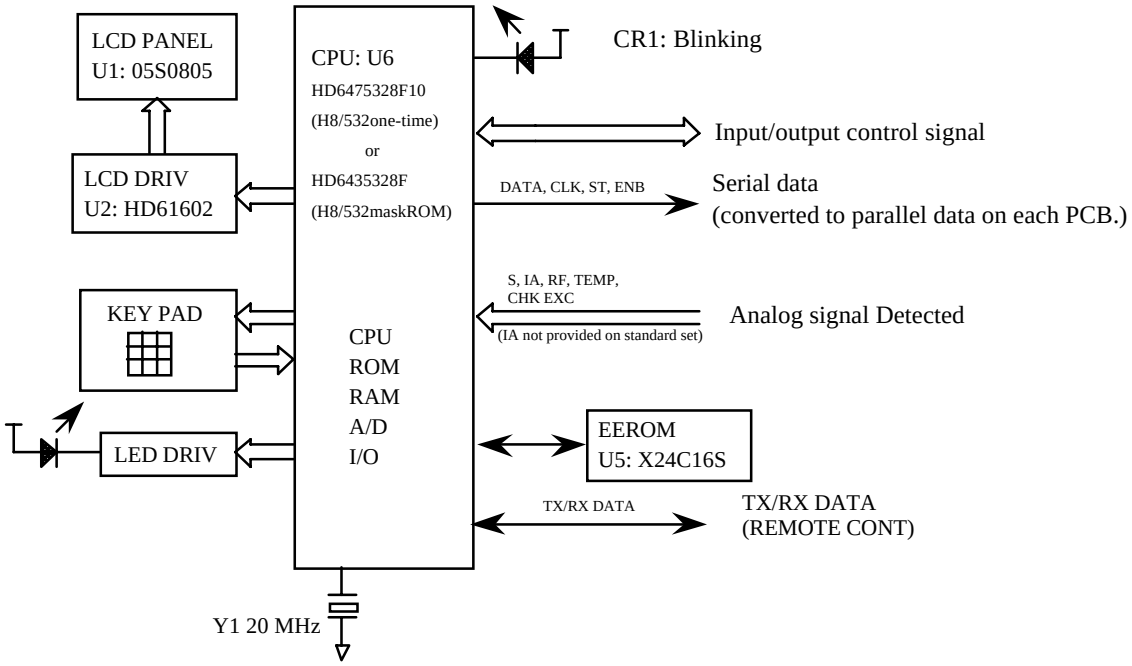


Figure 2-2 Block Diagram of CPU

U6: CPU is a 16-bit single-chip microcomputer with integrated peripheral functions such as RAM, ROM, timer, serial I/O, A/D converter, and I/O ports. The system program, ITU frequency table, system settings, initial values of power data, etc. are stored in the ROM of the CPU. EEROM U5: X24C16S (16 kB) stores set power data, user channels, system settings, and key settings.

Refer to the next page for the functions of input/output control signals of the CPU.

Note) *U6 is soldered to the board.*

- *HD6475328F10 (H8/532: one-time)*
- *HD6435328F (H8/532: mask ROM) ----- for permanent use*

  ** Program number: 05501-91-00X*
  (This number can be confirmed by turning on power while depressing [ENT] key, and pressing any key.)

2. CPU Input/output Control Signals

Table 2-2 CPU Function List

U6: I/O Port	IN/OUT	Function (Signal name)	Description
P30	OUT	T/R	TX/RX selection, TX: H
P31	OUT	MUTE	MUTE ON: H
P32	OUT	EXC ON	TX/RX Exciter ON/OFF, TX:H
P33	OUT	PA ON	PA selection, TX: H
P34	OUT	TX KEYED	BK output, TX: H
P35	OUT	BK ON	ANT BK signal, TX: H
P36	OUT	VS EN	Not used
P37	OUT	THROU	Ant. Coupler "through" signal, H: ON/OFF
P40	OUT	DATA	Shift register serial data
P41	OUT	CLK	Shift register clock
P42	OUT	PLL1 ENB	1st osc. PLL IC shift register strobe signal
P43	OUT	PLL3 ENB	3rd osc. PLL IC shift register strobe signal
P44	OUT	DDS LOAD	DDS IC shift register strobe signal
P45	OUT	ST SYN	SYN shift register strobe signal
P46	OUT	ST TX/RX	TX/RX shift register strobe signal
P47	OUT	ST PA/FIL	TX FIL shift register strobe signal
P17	OUT	TUNE	Ant. Coupler tune signal
P24	OUT	FAN	Fan ON/OFF signal, ON: H
P76	OUT	TONE	Two-tone alarm and key beep output
P77	OUT	DUMMY	Dummy in ant. coupler ON/OFF, ON: H
P92	OUT	ALC REFF	ALC reference voltage, propertion to power data
P93	OUT	RF GAIN	RF GAIN voltage
P94	OUT	DA3	Not used
P97	OUT	RUN	CPU RUN signal, square wave
P80	IN	S	S-meter analog input
P81	IN	IA	IA-meter analog input
P82	IN	RF	RF-meter analog input
P83	IN	TEMP	Over temperature detector analog input
P84	IN	IC	IC meter analog input, not used
P85	IN	VC	VC meter analog input, not used
P86	IN	RF GAIN VR	RF GAIN Voltage
P87	IN	CHK EXC	TX/RX output check signal analog input

U6: I/O Port	IN/OUT	Function (Signal name)	Description
P15	IN	TX KEY	Remote terminal TX signal, TX: L
P16	IN	BUSY (TUNE OK)	Busy signal from ant. coupler
P12	IN	PTT	PTT signal, ON: L
P73	IN	RX MUTE	MUTE signal from CONTROL terminal
P74	IN	UNLOCK	PLL unlock, unlock: L
P75	IN	SQ SIG	Squelch ON/OFF signal
P90	OUT	DDS DATA	DDS shift register serial data
P91	OUT	DDS CLK	DDS shift register clock
P95	OUT	TXD	Data to remote terminal
P96	IN	RXD	Data from remote terminal
P10	IN	UP	Freq./channel up signal
P11	IN	DOWN	Freq./channel down signal
P50	OUT	D0	LCD data, key scan
P51	OUT	D1	LCD data, key scan
P52	OUT	D2	LCD data, key scan
P53	OUT	D3	LCD data, key scan
P54	OUT	D4	LCD data
P55	OUT	D5	LCD data
P56	OUT	D6	LCD data
P57	OUT	D7	LCD data
P60	IN	READY	LCD control
P61	OUT	CS	LCD control
P62	OUT	WE	LCD control
P63	OUT	SYNC	LCD control
P20	IN	S1 to S4	Scan input
P21	IN	S5 to S8	Scan input
P22	IN	S9 to S12	Scan input
P23	IN	S13 to S16	Scan input
P70	OUT	DIM	LCD, KEY illumination
P71	OUT	DIM	LCD, KEY illumination
P72	OUT	DIM	LCD, KEY illumination
P14	IN/OUT	S-DATA	Serial data input/output
P13	OUT	S-CLK	EE-ROM clock

3. Control Signals

There are two ways for the CPU to control the transmitting/receiving circuits. One is, the CPU directly sends signals to them, and the other is, the CPU sends serial data to each circuit board and there the data are converted to parallel data that controls each circuit.

The CPU controls TX/RX board and PA/FIL board by sending serial-data from P40: DATA, and DDS circuit in TX/RX from P90: DDS DATA.

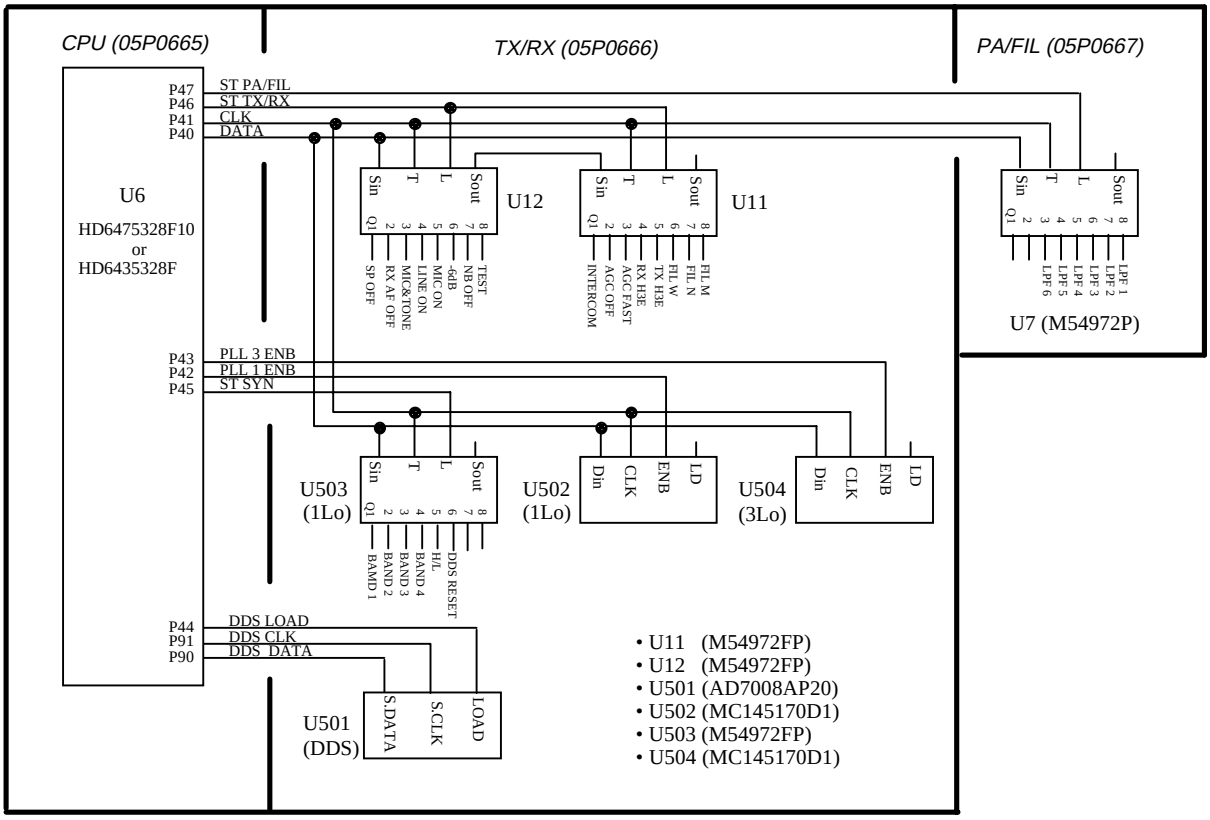
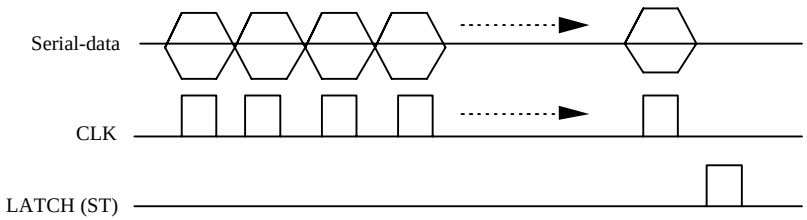


Figure 2-3 Serial Data Lines

Serial-data transmission has an advantage of smaller number of control lines than parallel-data transmission. However, the signals T/R, MUTE, EXC ON, PA ON, TX KEYED, and BK ON are directly sent as parallel data from CPU, because these signals need precisely matched timing with their object circuits.

Whereas DATA CLK for the serial-data is periodically sent from the CPU, ST (LATCH) signal is sent to control the circuit (M54972P) when the data are changed by key operations.

The transmission timing of the serial-data is shown in Figure 2-4 and the functions of the serial control signals are listed on Table 2-3.



While data and clock are sent from CPU, changed data is taken in by LATCH signal.

Figure 2-4 Transmission Timing

M54972P (8BIT SERIAL INPUT LATCHED DRIVER)

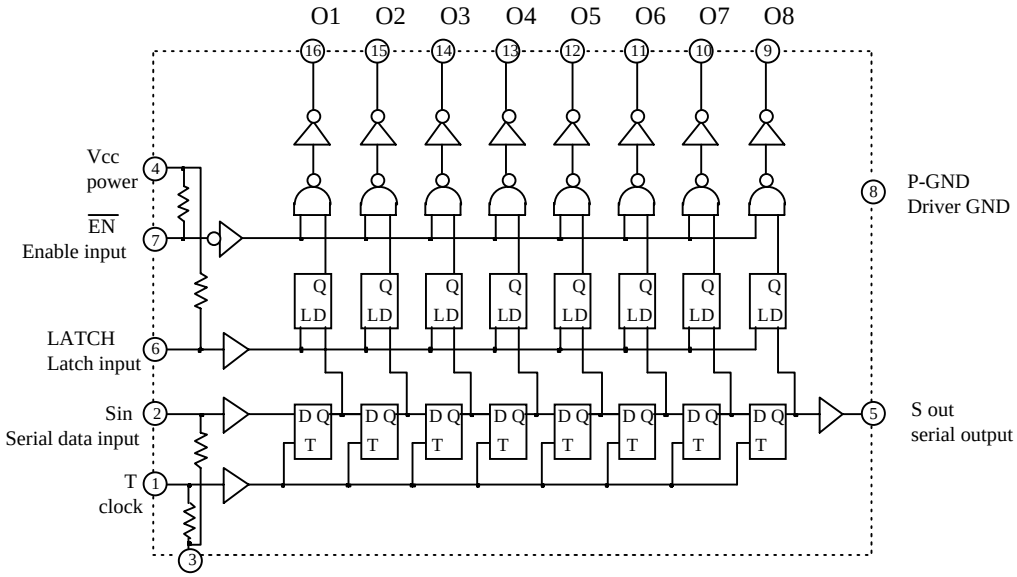


Figure 2-5 Block Diagram of M54972P

M54972P consists of 8 D-flip-flops and 8 latches connected to the outputs of the flip-flops. Serial-data signals input to the serial-data input (S-in) and clock pulses input to the clock input (T). Every time the clock changes from L to H, the input signal is taken in the internal shift register and the data in the shift register shifts successively.

The serial output (S-out) is connected to the serial input (S-in) of the next M54972P, when more than one M54972P are connected in series to increase bit number.

The data in the shift register output to the parallel output Q1 to Q8, when the latch input (LATCH) is H, the enable input for output control (EN) is L, and the clock changes from L to H.

IC	OUT	BIT	Function	Default	RX					MIC TX			Remote TX (TX KEY)				Tone/2-Tone ALM			Self test		Tune	Intercom	
				2182 kHz H3E	LSB	USB	H3E	TLX	FAX	LSB	USB	H3E	LSB	USB	H3E	TLX	LSB	USB	H3E	RX TLX	TX TLX	USB (1.5 kHz)	Response	Calling/ Busy
NC	NC	31 ↓	See note.																					
U11	Q8	15	FIL M	0	1	1	0	1 (0)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-	-
	Q7	14	FIL N	0	0	0	0	0 (1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-
	Q6	13	FIL W	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-
	Q5	12	TX H3E	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0
	Q4	11	RX H3E	1	0	0	1	0	0	1	1	1	1	1	1	1	1	1	1	0	1	1	-	-
	Q3	10	AGC FAST	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	-	-
	Q2	9	AGC OFF	0	-	-	-	-	-	1	1	1	1	1	1	1	1	1	1	0	1	1	-	-
	Q1	8	INTERCOM	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
U22	Q8	7	TEST	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1
	Q7	6	NB OFF	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-
	Q6	5	-6 dB	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0
	Q5	4	MIC ON	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	1	0
	Q4	3	LINE ON	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0
	Q3	2	MIC & TONE	0	0	0	0	0	0	1	1	1	0	0	0	0	1	1	1	0	1	1	0	0
	Q2	1	RX AF OFF	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	0
	Q1	0	SP OFF	1	-	-	-	-	-	0	0	0	0	0	0	0	1	1	1	1	1	-	1	-
CPU I/O: P31			MUTE	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON

(1: High, 0: Low)

Note) Bits 16 to 31 are not used.

Table 2-4 PA/FIL Serial Data List

IC	OUT	BIT	Functions	Status	
				TX	RX
U7	Q8	7	LPF1	0.1 to 2.4 MHz: "L"	
	Q7	6	LPF2	2.4 to 3.6 MHz: "L"	
	Q6	5	LPF3	3.6 to 6.0 MHz: "L"	
	Q5	4	LPF4	6.0 to 10.0 MHz: "L"	
	Q4	3	LPF5	10.0 to 18.0 MHz: "L"	
	Q3	2	LPF6	18.0 to 30.0 MHz: "L"	
	Q2	1	NOT USED		
	Q1	0	NOT USED		

2.3 Oscillator

Taking J3E as an example, the outline of the frequency conversion is shown in Figure 2-6 and the relation between the transmitting and receiving frequencies and local frequencies is shown in Table 2-6.

The frequency conversion circuit and the local oscillator circuit are included in TX/RX board.

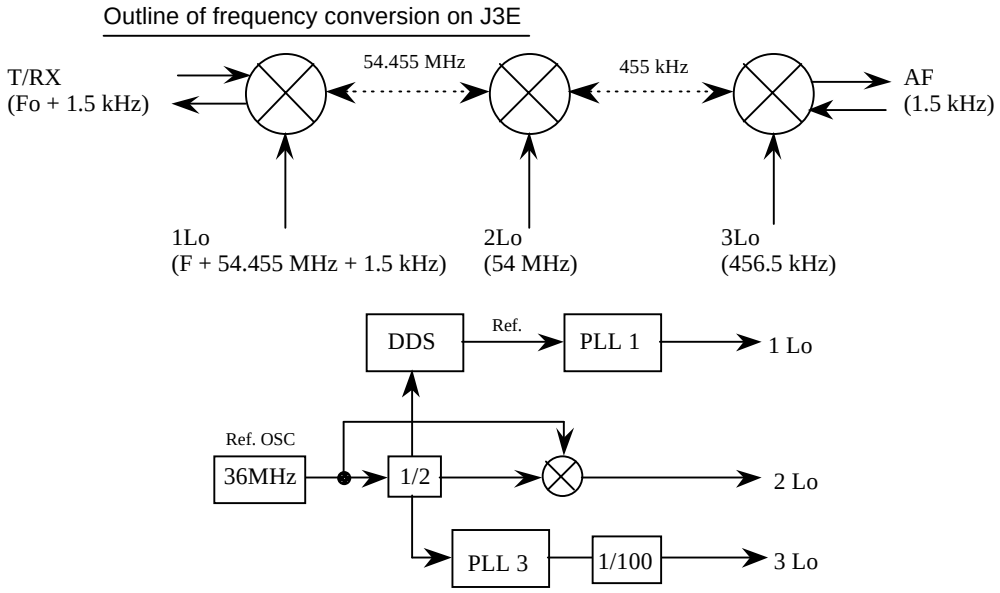


Figure 2-6 Frequency Conversion

Table 2-5 Frequency of Local oscillator

Mode	1st Local oscillator (1Lo)		2nd Local oscillator (2Lo)	3rd Local oscillator (3Lo)	
USB	F + 54.455 MHz + 1.5 kHz		54 MHz	456.5 kHz	
LSB	F + 54.455 MHz - 1.5 kHz		54 MHz	453.5 kHz	
H3E	TX	F + 54.455 MHz + 1.5 kHz	54 MHz	TX	456.5 kHz
	RX	F + 54.455 MHz ± 0 kHz	54 MHz	RX	455 kHz
TLX	F + 54.455 MHz ± 0 kHz		54 MHz	456.7 kHz	
FAX	F + 54.455 MHz ± 0 kHz		54 MHz	456.7 kHz	

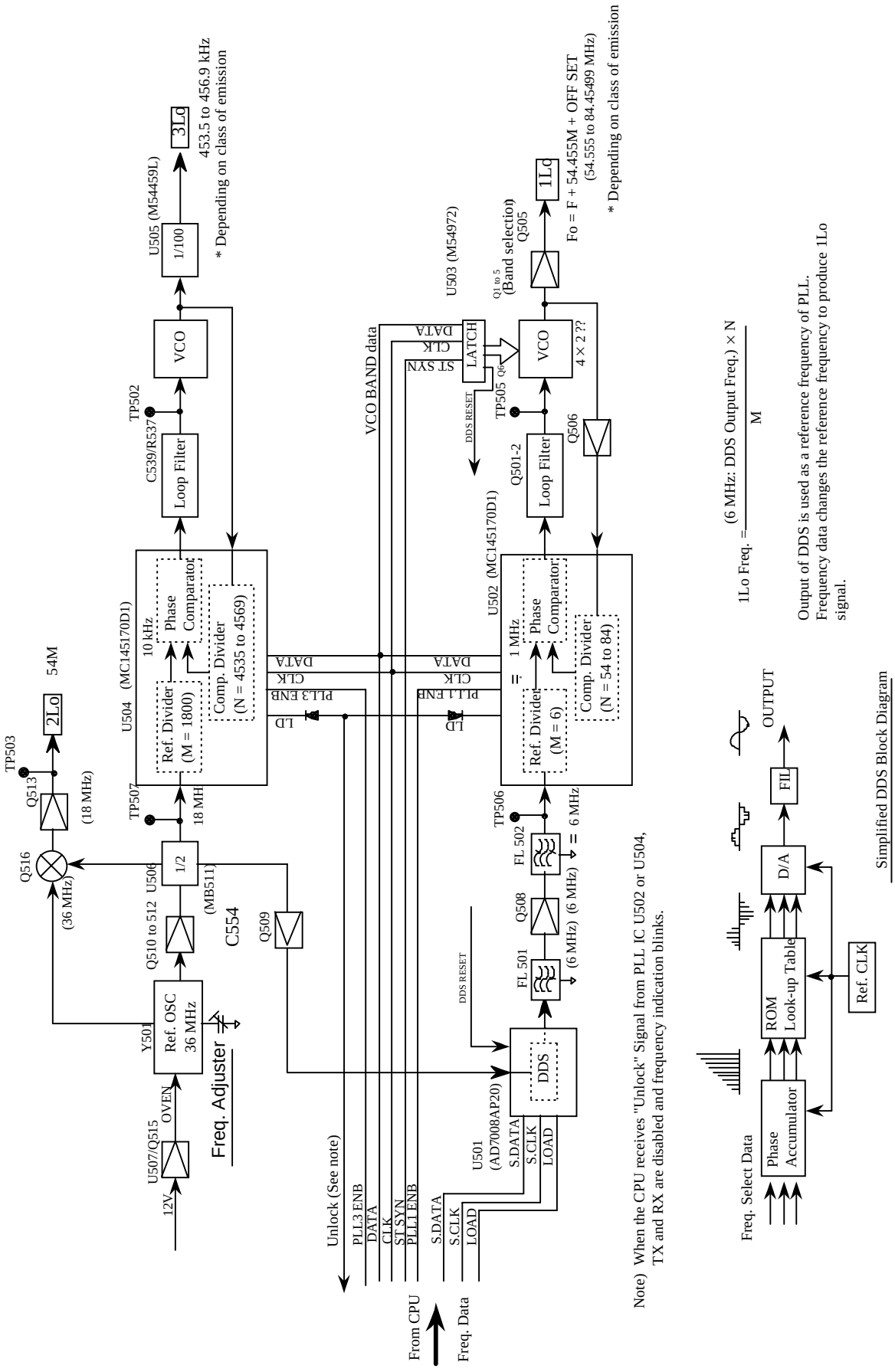


Figure 2-7 Block Diagram of Synthesizer Circuit

3rd Local Frequency (3Lo)

3Lo is generated by PLL3 (U504). The oscillating frequency varies in accordance with the class of emission. For example, 456.5 kHz is for J3E (USB) and 456.7 kHz for J2B (TLX).

2nd Local Frequency (2Lo)

2Lo, 54 MHz, is generated by mixing the output of a reference oscillator (Y501), 36 MHz, with one half of the frequency, 18 MHz.

1st Local Frequency (1Lo)

1Lo is generated by PLL (U502) and DDS (U501). The output frequency is "the set frequency + 54.455 MHz + the offset frequency".

The frequency is generated by varying the reference frequency and the frequency division ratio of PLL in accordance with the set value of the frequency — the reference frequency of PLL is the output frequency of DDS (Direct Digital Synthesizer). The relation between the output frequency of DDS and the oscillating frequency of PLL is as follows.

DDS output frequency, $fo = (K \times fc) \div 2^N$,

where fc is DDS clock frequency (18 MHz) $\rightarrow$ the reference frequency 36 MHz is divided into 1/2,

N is DDS phase accumulator bit number (32 bits), and

K is DDS phase data input (32 bits) $\rightarrow$ frequency data from CPU.

PLL oscillating frequency, 1Lo = (DDS output frequency, $fo \times N) \div M$,

Where N is the dividing value of the comparing frequency divider (54 to 84) $\rightarrow$ frequency data from CPU, and

M is the dividing value of the reference frequency divider (fixed to 6).

PLL (VCO) has to oscillate in 54.555 MHz to 84.45499 MHz with the set frequencies of 0.1 MHz to 29.99999 MHz. One VCO with a fixed inductance coil can not cover the wide frequency range of about 30 MHz. To cover the wide range, the VCO has four coils with different inductance and selects one corresponding to the set frequency from them. Further, the two capacitors are switched each other in combination with each coil inductance.

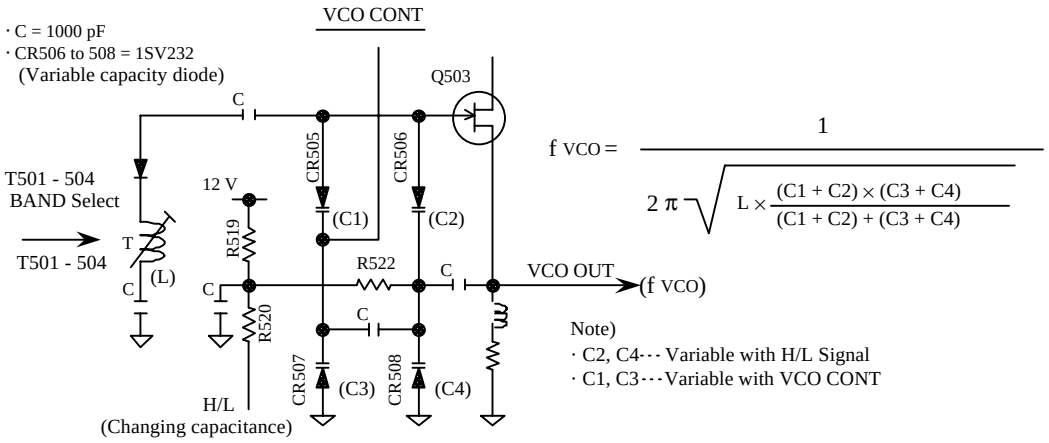


Figure 2-8 1Lo PLL VCO

Table 2-6 Oscillation Frequency on Each Band

Band	Set Frequency	VCO Output Frequency
1-L	0.1 to 2.99999 MHz	54.55500 to 57.45499 MHz
1-H	3.0 to 5.99999 MHz	57.45500 to 60.45499 MHz
2-L	6.0 to 9.49999 MHz	60.45500 to 63.95499 MHz
2-H	9.5 to 13.49999 MHz	63.95500 to 67.95499 MHz
3-L	13.5 to 17.49999 MHz	67.95500 to 71.95499 MHz
3-H	17.5 to 21.49999 MHz	71.95500 to 75.95499 MHz
4-L	21.5 to 25.49999 MHz	75.95500 to 79.95499 MHz
4-H	25.5 to 29.99999 MHz	79.95500 to 84.45499 MHz

Note) *The above table shows the VCO output frequency on TLX and FAX modes. Add an offset frequency for other modes.*

Reference) *PLL1, PLL3, DDS and BAND data are set in the following order every time set frequency and/or class of emission is changed.*

1) DDS data setting
2) PLL1 data setting
3) SYN shift register data setting (1Lo Band data)
4) PLL3 data setting

2.4 TX/RX circuit

TX/RX section (J3E)

The AF input signal from a dynamic microphone (600 Ω, rated input -46 dBm) is amplified by a compressor amplifier U14 (M51304L) to increase the average transmitting power and to suppress an over-input as well.

At the next stage U5 2/2, the AF signal gain is adjusted in accordance with the radio wave format J3E and H3E.

Further, after passing through R156 [TX GAIN], the signal is mixed with 3Lo (456.5 kHz) by a ring modulator CR22 (SMS3926-023) and converted to a signal of 456.5 kHz ± AF (1.5 kHz).

This signal passes through a crystal filter FL2 (2.4 kHz) and derives the first IF signal of 455 kHz.

Note) *The passing filter is changed according to the class of emission.*

FIL 2 (fB = 2.4 kHz)	*J3E, H3E*
FIL 3 (fB = 0.4 kHz)	*J2B (TLX) ---- option*
FIL 4 (fB = 6 kHz)	*H3E receiving*

With H3E, 3Lo signal (456.5 kHz) is added to the output signal from FL2 (2.4 kHz) through R101 [H3E CARR].

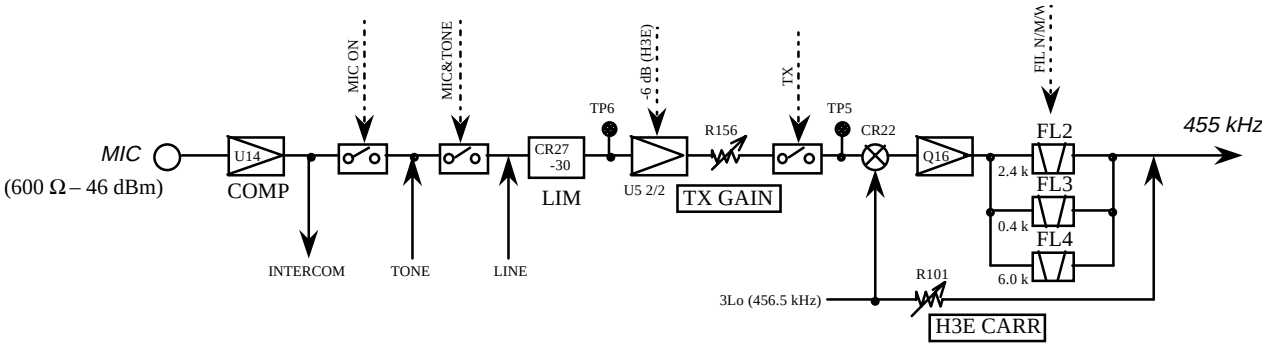


Figure 2-9 AF Amplifier thru 455 kHz Circuit

The signal of 455 kHz is mixed with 2Lo (54 MHz) by a ring modulator CR10 (SMS3926-023) and converted to a signal of 54 MHz ± 455 kHz. This signal is amplified by Q7, passed through a filter FL1 (54.455 MHz), and derives the second IF signal.

This signal of 54.455 MHz is mixed with a local oscillator signal 1Lo (F + 54.455 MHz + 1.5 kHz) by DBM CR5 (SBL-1C) and converted to a signal with frequency (F + 54.455 MHz + 1.5 kHz) ± 54.455 MHz. This signal further passes through 30 MHz L.P.F. and derives a transmitting signal with a frequency of F + 1.5 kHz.

Note) *The output impedance is matched to 50 Ω over the wide frequency range by incorporating the 30 MHz L.P.P and 60 MHz H.P.F. to the output of DBM CR5, reducing spurious signals generated in the DBM.*

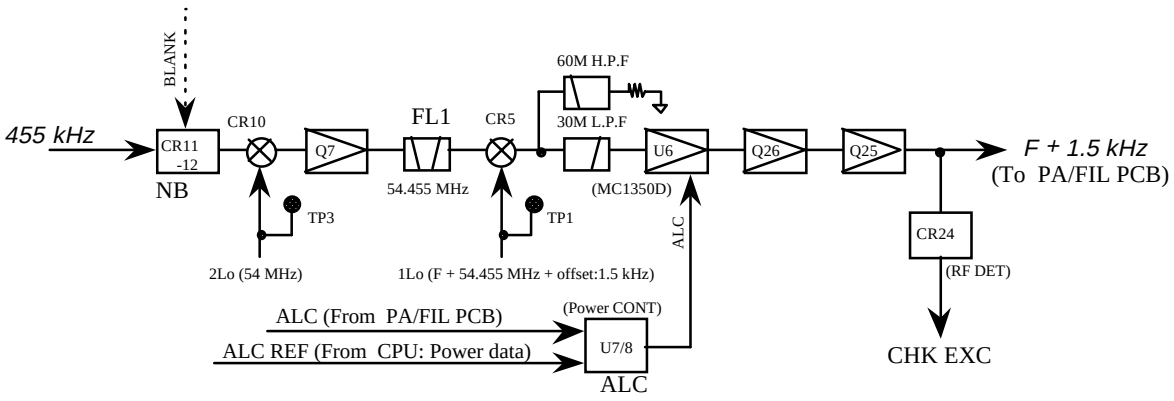


Figure 2-10 455 kHz Circuit thru Exciter

The power of this transmitting signal is adjusted in a gain-control IF amplifier U6 (MC1350D), which is controlled by the ALC circuit that consists of U7 and U8.

The input signals to the ALC circuit are the power data (ALC REF) at CPU board and a feedback signal of transmitting power detected at the output of the FIL section on PA/FIL board. That is, the transmitter output level of TX/RX board is automatically adjusted so as to derive the transmitting power set by the power data.

This transmitting signal outputs to PA/FIL board after passing through amplifiers Q26 and Q25.

The transmitting power signal of TX/RX board is detected by CR24, C103, and R112 (self-check signal) and input to CPU as CHK EXC signal.

The transmitting power is self-checked in a condition; 3 MHz, J2B, 1700-Hz tone signal and a power data of 255.

Reference) *When a transmitting power is 140 W to 150 W, CHK EXC level is 2.4 to 2.6 V.*

PA/FIL section

The transmitting output signal from TX/RX board (EXC OUT) inputs to PA/FIL board. It is passed through a π-type attenuater (-1.5 dB) that consists of R14 to R16, amplified by a two-stage push-pull amplifier, and sent to FIL section. The gain in the PA section is about 25 dB, and the loss in the FIL section is less than 0.5 dB.

In transmitting, the gain of the PA circuit is controlled by switching ON/OFF the bias voltage of the two-stage push-pull amplifier in accordance with PA ON signal from CPU. The bias voltage for Q4 and Q5 is 40 to 60 mV across R69.

For Q6 and Q7, the current flowing through FL3 is adjusted to 500 ± 50 mA by R39 [BIAS].

To protect the PA circuit, a thermister RT2 detects the temperature of PA transistors. If it detects a temperature of 90 to 100 °C, the power data is automatically decreased to a lower set value (LOW) and prevents PA transistors from being damaged. When it detects 45 °C, fan automatically air-cools the PA section.

The voltage at J1-7 (TEMP) is 1 V ± 0.1 V at the normal temperature of 25 °C, 1.85 V at 45 °C (FAN ON), and 4.1 V at 90 to 100 °C (LOW).

Note) *PA amplifier is high-frequency-grounded to -13.6 V line through capacitors C49 to C52.*

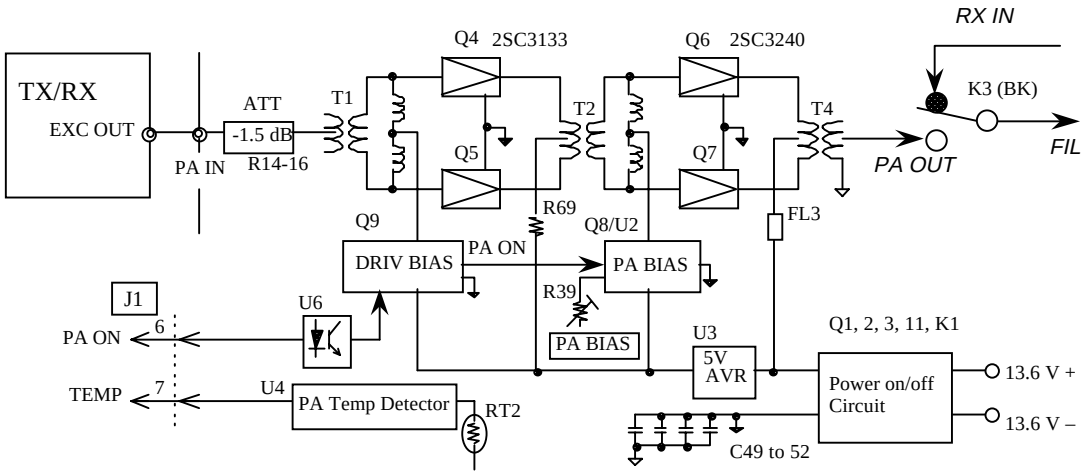


Figure 2-11 Block Diagram of PA

The PA output is supplied to L.P.F.'s B1 to B6 to reject spurious signal components. These filters are commonly used for transmitting and receiving. Their losses are less than 1 dB.

Relays are used to switch each filter ON/OFF. U8 drives the relays with the parallel data which is converted by U7 from the serial data signal sent from CPU in accordance with the set frequency.

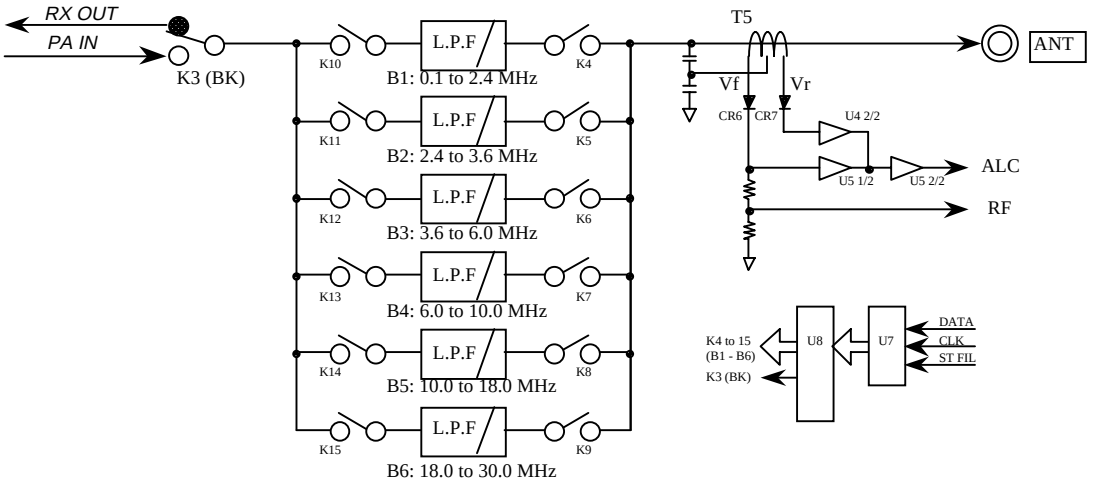


Figure 2-12 Block Diagram of FIL (TX)

T5 detects the traveling wave voltage (Vf) and reflecting wave voltage (Vr) on the output signal of the L.P.F. CPU receives the traveling wave voltage component and processes it for the RF meter indication.

U5 1/2 amplifies the detected traveling wave voltage component and U4 2/2 amplifies the reflecting component. Both voltage components are amplified by U5 2/2 and derives ALC control signal. The ALC signal inputs to U8 2/2 on TX/RX board and automatically controls the transmitting power on the basis of the set power data. The signal is also used to protect the PA when the power output is opened or short-circuited.

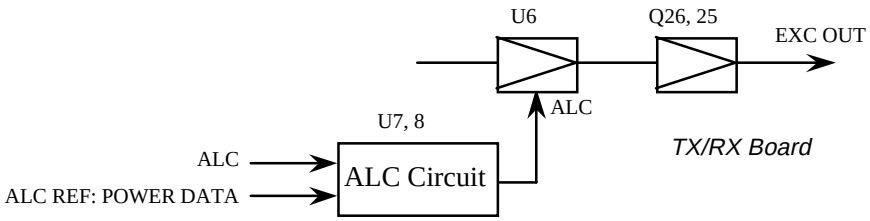


Figure 2-13 ALC Signal

2.5 Receiver Circuit

PA/FIL section

The RF signal received by the antenna inputs to PA/FIL board, passes through the common L.P.F.'s for transmitting/receiving and BC-band-rejection filter, and outputs to TX/RX board.

The BC-band-rejection filter is a 1.6 MHz H.P.F and switched ON/OFF with the jumper wire connections at J8 and J9. The factory default connection is OFF: 2. When a BC-band interference occurs in the receiving band higher than 1.6 MHz, the jumper wire is set to ON:1.

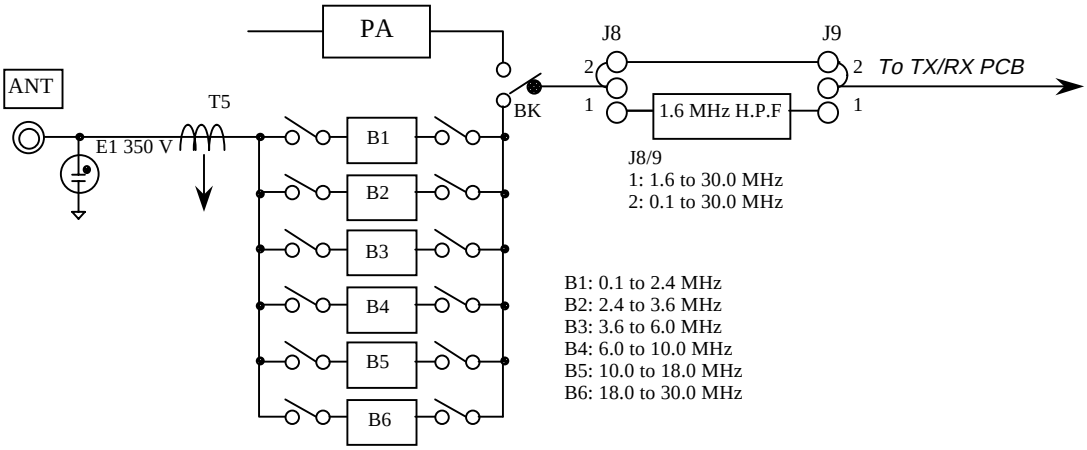


Figure 2-14 Block Diagram of FIL (RX)

TX/RX Section: Fo to NB (J3E)

The receiving signal (F + 1.5 kHz) from PA/FIL board is passed through a 30 MHz L.P.F. and amplified (G-G grounding amplification) by Q1/2. The gain is about 10 dB.

This signal is passed through 30 MHz L.P.F., mixed with a local oscillator signal 1Lo (F + 54.455 MHz + 1.5 kHz) by DBM CR5 (SBL-1C), converted to a signal with frequency (F + 54.455 MHz + 1.5 kHz) ± (F + 1.5 kHz), and derives the first intermediate frequency signal of 54.455 MHz with FL1.

The first IF signal is further amplified by U1, mixed with 2Lo (54 MHz) by a ring modulator CR10 (SMS3926-023), and derives the second intermediate frequency signal of 455 kHz.

The second IF signal is passed through a noise blanking circuit NB (CR11/12) and FL2 (455 kHz), and amplified by U2.

The gain of U1 and U2 (MC1350D) is controlled by AGC (forward AGC).

Note) *The DBM impedance is matched to 50 Ω over the wide frequency range by incorporating the 30 MHz L.P.P and 60 MHz H.P.F. to the input of DBM CR5, reducing spurious signals generated in the DBM.*

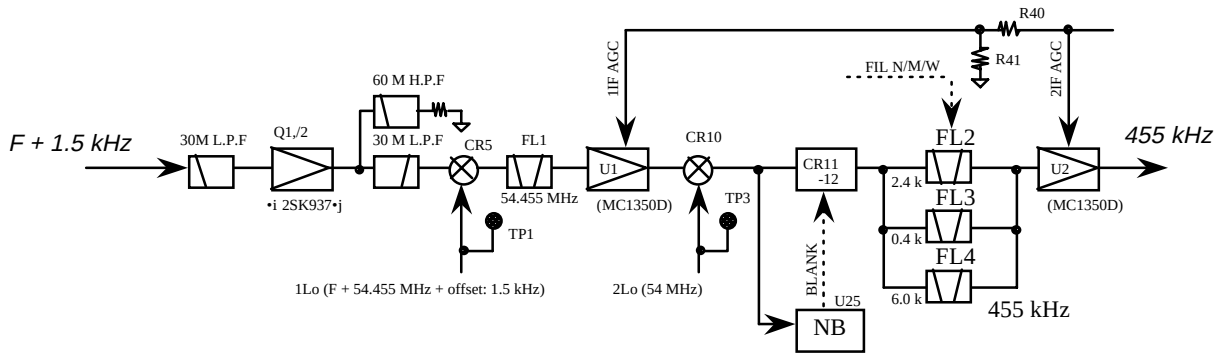


Figure 2-15 Receiver RF Circuit

Reference) Noise blanker (NB)

NB rejects pulse noise included in the receiving signal. U25 in NB detects pulse noise and outputs negative pulses to the output terminal (BLANK). The pulse signal turns off switching diodes CR11 and CR12 and blocks the receiving signal during the time the pulse noise occurs.

Changing the value of a resistor R35 can adjust the noise detection level of the NB.

In receiving TLX, the NB is not operated, because it cuts top portions of the signal pulses.

Note) *The transmitting signal of 455 kHz also passes CR11 and CR12, which are ON during transmitting.*

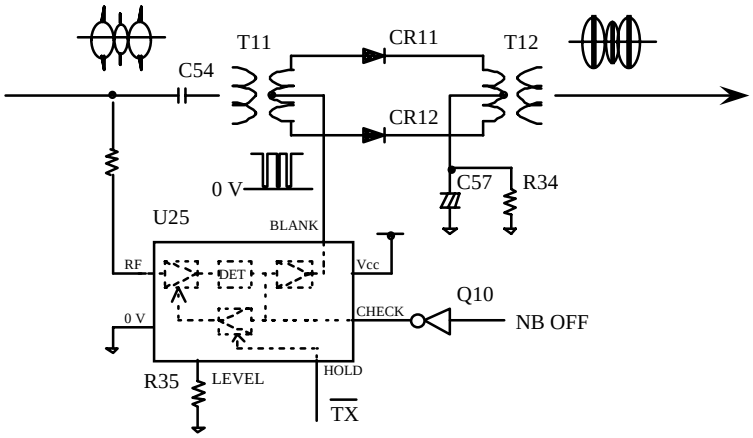


Figure 2-16 NB Circuit

TX/RX Section: NB to AF

The output signal from the NB passes through 455-kHz filters with bandwidth corresponding to the class of emission, which reject noise out of pass band. The filters are commonly used for both transmitting and receiving.

Note) *The passing filter is changed according to the class of emission.*

FIL 2 (fB = 2.4 kHz)	*J3E*
FIL 3 (fB = 0.4 kHz)	*J2B (TLX) ---- option*
FIL 4 (fB = 6 kHz)	*H3E receiving*

R210 connected to Q39 (RX GAIN) adjusts the receiving gain according to AGC level. In J3E (4 MHz), the R210 is adjusted so that the S-meter starts to deflect when the gain volume is at maximum and an antenna input (SSG level) is +10 dBμV. A thermister RT4 compensates the temperature characteristic of the overall receiving gain.

The signal output from Q39 passes through FL5 (455 kHz), and enters AGC circuit and AM and SSB demodulators (commonly used for transmitting and receiving).

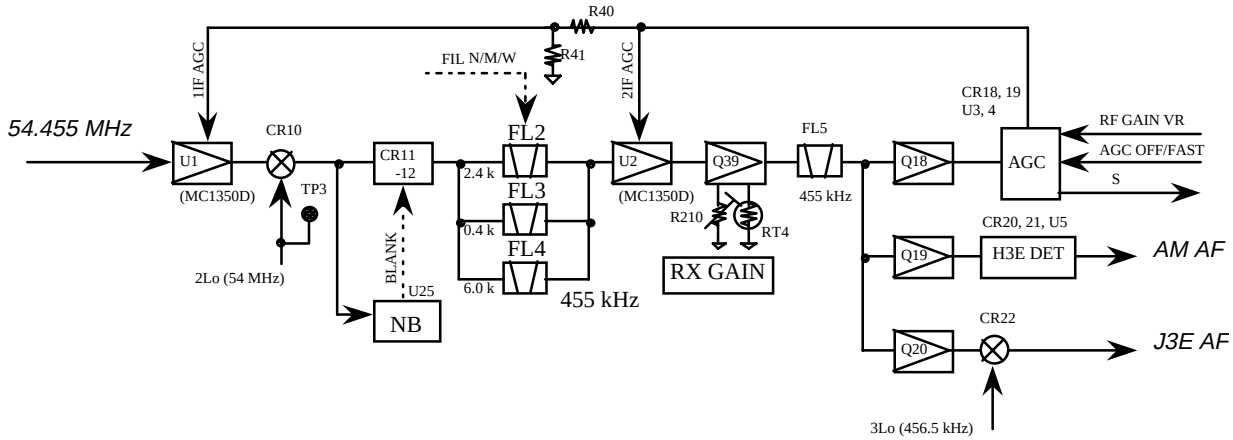


Figure 2-17 455 kHz Circuit

TX/RX Section: AGC, AF

In the AGC circuit, the receiving signal (455 kHz) is amplified by Q18, and detected by CR18 and CR19. C77, R60, and R62 determine the AGC time constant.

C77 and R60 determines the AGC attack-time to be about 10 msec. R61 and R62 determines AGC decay-time in AGC-FAST to be about 100 msec and R62 determines that in AGC-SLOW about 3 sec. U21 switches R61ON and OFF according to AGC-FAST and SLOW, respectively.

U4-1/2, U3-1/2, and U3-2/2 are AGC signal amplifiers. The control signal from the gain volume* is supplied to the AGC circuit to control the gains of U1 (MC1350D) of the first IF amplifier and U2 (MC1350D) of the second IF amplifier. The controlling method is forward AGC.

U4-2/2 amplifies the AGC voltage and detects the receiving signal strength "S". This signal not only deflects S-meter, but controls the scanning, sweeping, and squelching of the receiving signal.

In the scanning and sweeping, the AGC is automatically turned ON.

***:** The voltage from the gain volume (RF GAIN VR) is read by the CPU, A/D-converted, and then processed for the volume curve. RF GAIN can also be adjusted by RFxx of MIF command from a remote terminal. Operation of the RF gain volume cancels the MIF command.*

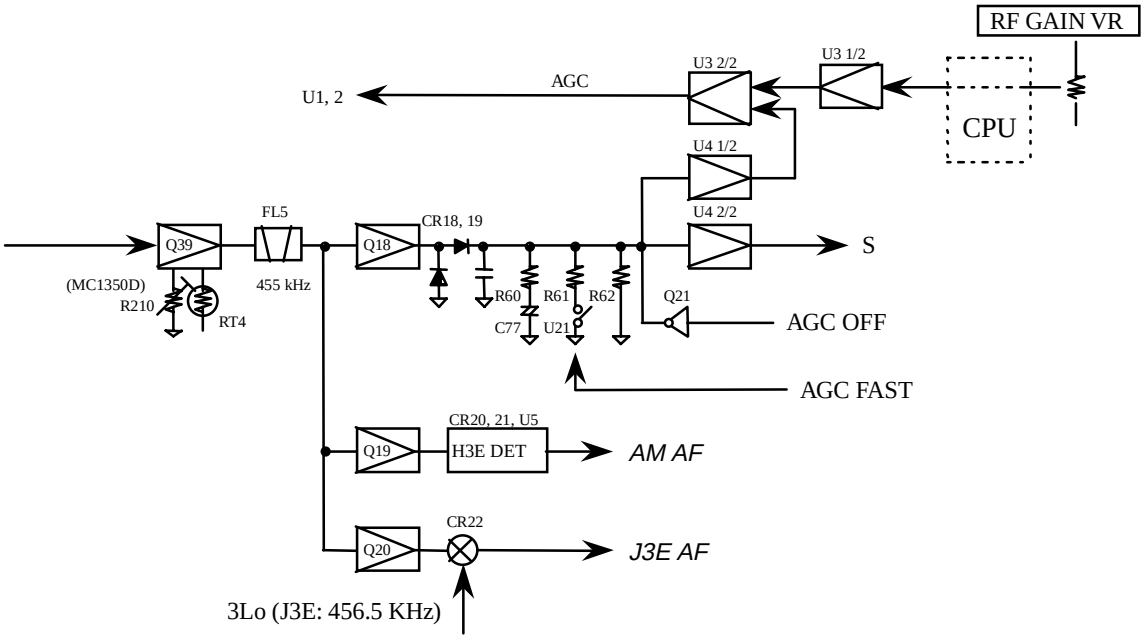


Figure 2-18 AGC and Demodulator Circuits

In the AM demodulating circuit, the receiving signal (455 kHz) is amplified by Q19, detected by CR21/22, and derives audio signal.

In the SSB demodulating circuit (including TLX), the receiving signal (455 kHz) is amplified by Q20, mixed with 3Lo (456.5 kHz) by CR22 (demodulation), and derives audio signal.

Note) *The CPU reads RF gain voltage, converts from analog signal to digital signal, and processes the signal for an adequate curve to control the AGC circuit. RF gain can be changed by MIF command RF xx output from an external unit. Rotating RF GAIN volume cancels the MIF command.*

TX/RX Section AF

The received AF signal is distributed through each analog switch to LINE OUT, SQ SIG (for audio squelch signal detection), SPEAKER output, and PHONE output circuit.

SQ SIG detecting circuit U10 outputs "SQ SIG" to CPU. CPU analyses the frequency components of this signal, outputs RX AF OFF signal through U12, and controls U20-5 and -13 lines for squelch control. While intercom is used and self-testing, the RX AF OFF signal switches the U20 lines (RX line) OFF.

MUTE signal from CPU directly switches OFF U20-5 and 13 lines when transmitting from MIC, and remote terminal, tow-tone alarming, tuning antenna coupler, using intercom, and self-testing.

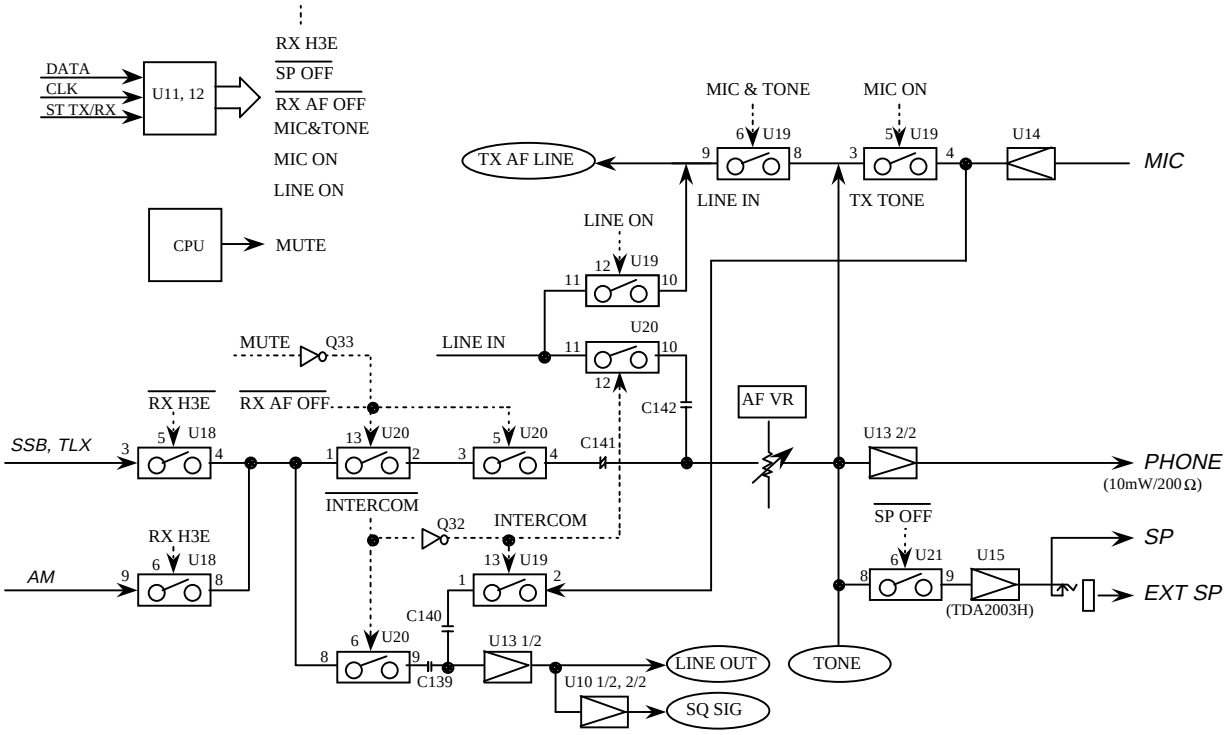


Figure 2-19 RX AF Circuit

2.6 Power Supply SW Circuit

Power supply SW circuit is included in PA/FIL board.

When the power switch is turned on, a relay K1 is made ON by Q1 and power is supplied to circuits. To protect the contact of K1 against the rush current at power on, a delay circuit is provided. That is, C10 is charged through Q11 which is switched on by Q3 at power on, and then K1 is turned on. When K1 is ON, Q11 is switched OFF, and power is supplied through K1. Turn-on of K1 is delayed until C9 is charged.

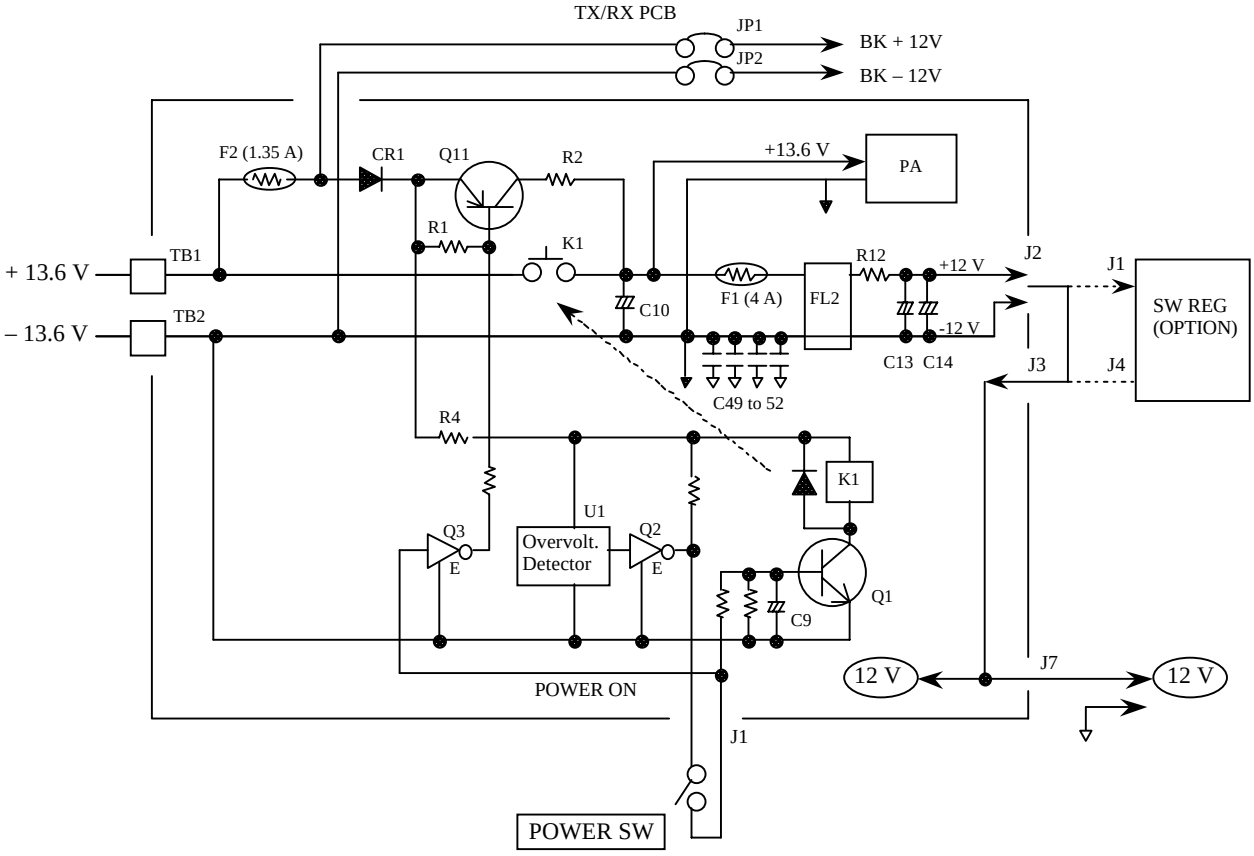


Figure 2-20 Power Supply Circuit

The allowable input voltage of power supply is from about +8 V to +17 V. (Rating voltage: 13.6 V ± 15 %) The upper limit +17V is determined by a over-voltage detector U1 and a switch Q2 and the lower limit +8 V is determined by the drive voltage of the relay K1. F1 and F2 are poly-switches. The poly-switch works as a fuse that cuts off (trip) circuit with a Joule heat generated by the current flowing through it. Once the switch becomes off, it does not recover until it cools down while power supply is off.

Note) *The negative line of the power supply and the negative ground of the circuit boards (chassis) shares a common earth. When a floating ground that separates the negative line and the negative ground is needed, an optional SW REG board is to be added.*

2.7 SW REG Board (option)

The negative line of the power supply and the negative ground of the circuit boards (chassis) shares a common earth. When a floating ground that separates the negative line and the negative ground is needed, SW REG board is to be added.

PA/FIL board and SW REG board are connected by connectors as follows. The necessary connector assembly comes with to the SW REG board.

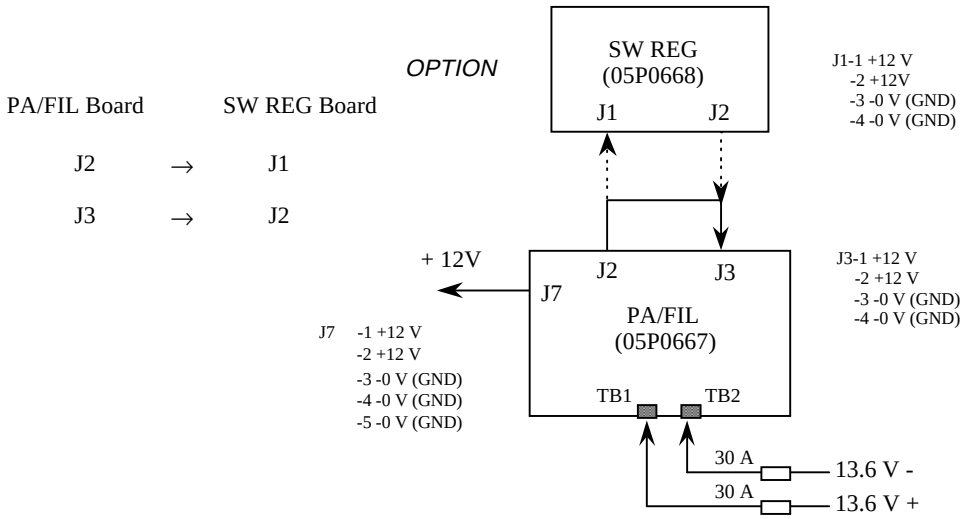


Figure 2-21 Connection of SW REG Board

The block diagram of the SW REG board is shown in Figure 2-22. The power supply voltage for the board is +13.6 V and the switching regulator outputs +13.0 mV. R15 (AVR) adjusts the output voltage. The oscillating frequency of the switching regulator, measurable between TP1 and TP2, is 170 kHz ± 20 kHz, which is determined by R9 and C10 connected to U1.

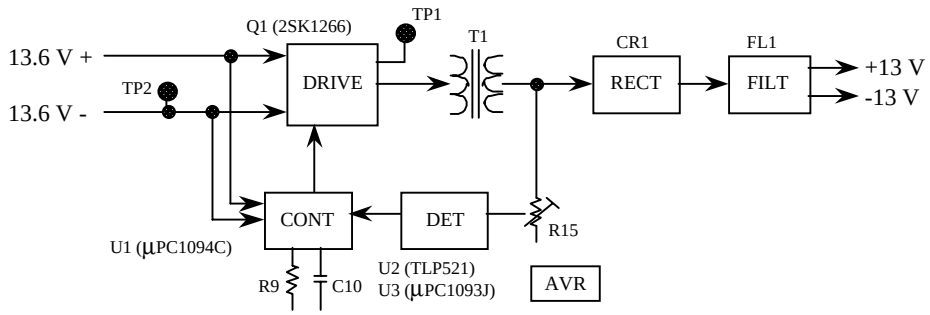


Figure 2-22 Block Diagram of SW REG Circuit

2.8 ANT COUP (Antenna Coupler)

1. General

AT-1503 is tunable to an antenna length from 6 m to 15 m in a frequency range of 1.6 MHz to 27.5 MHz. U8 (MPU) starts the automatic tuning (matching) with "TUNE" signal from the main unit and the result of the matching is sent to the CPU in the main unit by H and L levels of BUSY signal.

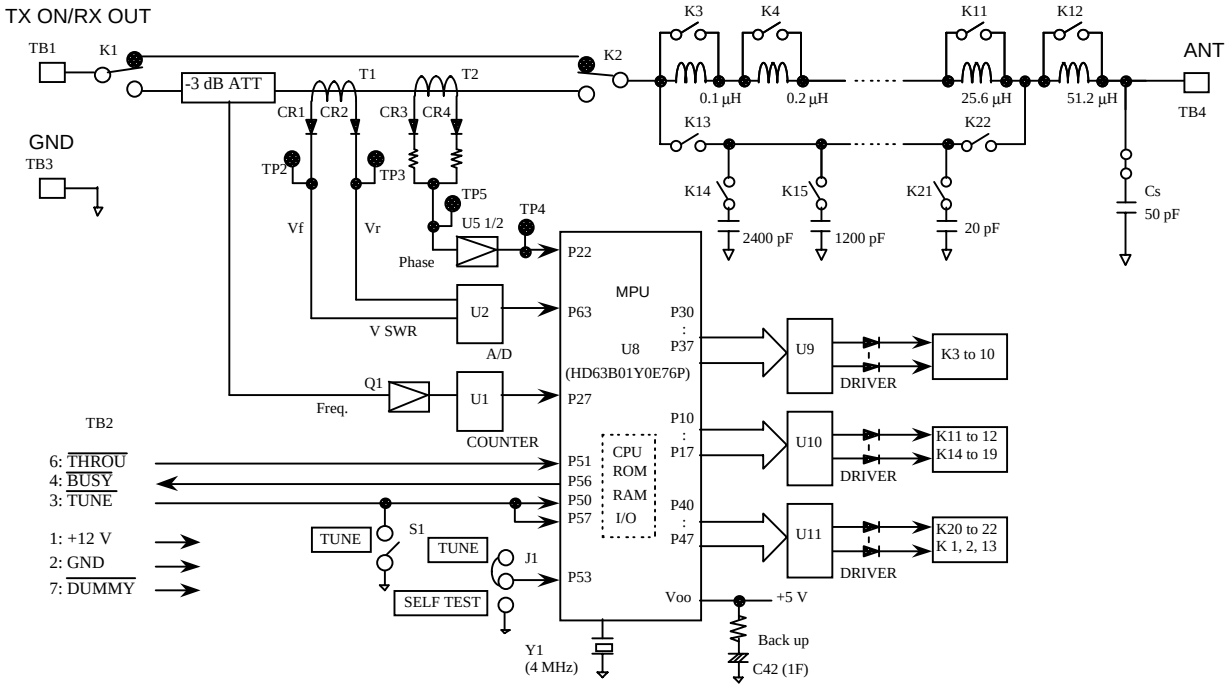
The matching is practiced by a L-type matching circuit and SWR in the matched condition is less than 2.0 (input impedance: 50 Ω).

When the SWR has been adjusted to less than 1.5 in a frequency band, the matching data is stored in the internal RAM of U8. The data is referred when the matching in the frequency band is executed again, thus leading to a quicker matching operation (maximum time: 15 sec). The matching data is held for about a week by a backup capacitor C42 (1F).

When SWR is larger than 2.0 or it takes longer than 15 sec for a matching, a signal TUNE ERROR turns ON relays K3 to K12 that bypass the matching coils, thus preventing the coils to be burnt out.

An optional dummy antenna (10 Ω + 250 pF, 100 W) can be built in for the purpose of maintenance work.

AT-1503 itself is provided with self-check function. Connect J1 to "SELF TEST" and depress S1 "TUNE", then the self-check automatically starts (see chapter 5).



Capacitance and Reactance in matching circuit (Matching Data)
Coil: 0.1, 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, 12.8, 25.6, 51.2 μH
Capacitor: 2400, 1200, 600, 300, 150, 75, 41, 22 pF
Antenna Shunted Capacitor: fixed to 50 pF

Figure 2-23 Block Diagram of AT-1503

2. Matching Process (TUNE/BUSY Signals)

1. When PTT switch is depressed or TX KEY is turned ON by an external device after the frequency change, or when TUNE switch is depressed, "TUNE" is displayed on the main unit and "TUNE" signal inputs to the antenna coupler.

2. The relays K1 and K2 are turned ON, and the detector circuits are switched ON. That is, RF input frequency detected by ATT, Vf/Vr (V SWR) detected by T1, and the phase detected by T2 input to U8 (MPU).

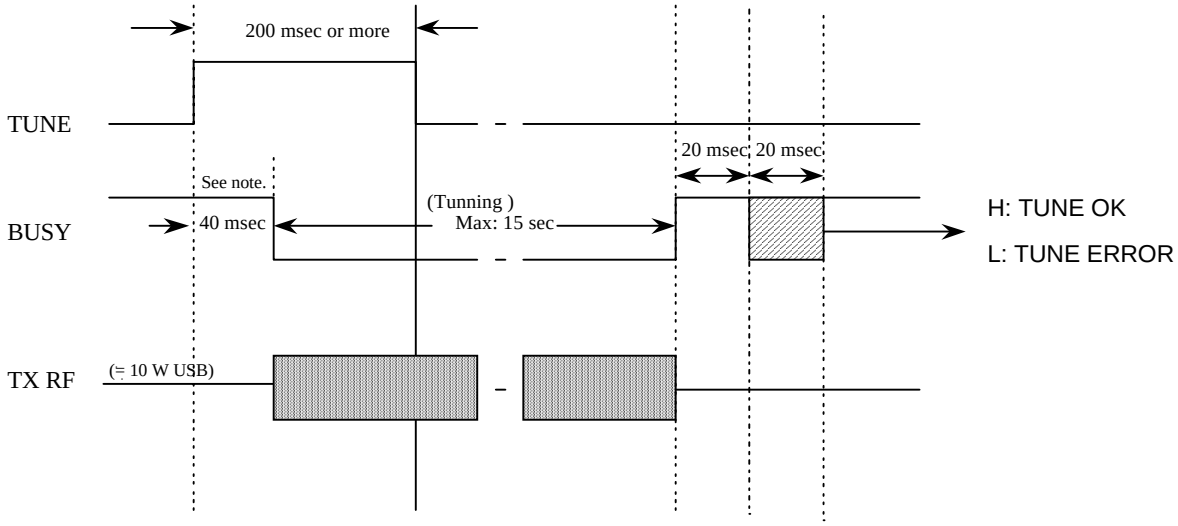
3. During matching, an about 10 W signal with a selected frequency is input to RF circuit in USB mode (Tone: 1500 Hz).

4. MPU drives the relays K3 to K22 in accordance with the data from the detector circuit and changes the constants of L/C in L-type matching circuit.

5. If SWR is less than 1.5, the matching data is stored in the internal RAM of U8. If SWR is more than 2.0 or it takes longer than 15 seconds for matching (time out), the matching circuit is bypassed.

6. The matching results are informed to CPU of the main unit by H and L levels of BUSY signal.

7. RF signal is stopped, the matching results are displayed, and the condition of the main unit is returned to that when the matching was started. If SWR is less than 2.0, TUNE OK appears, and if it is 2.0 or more, error sounds (three beeps) occur with the indication TUNE ERROR.



Note) *If the level remains "H" for one second, TUNE ERROR is to result.*

Figure 2-24 TONE Operation Timing Chart

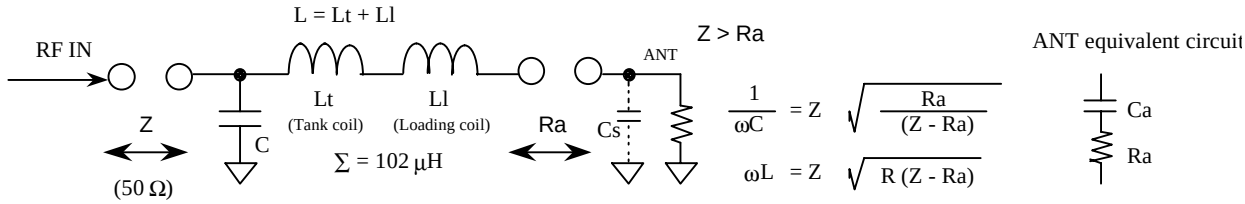
3. Matching Circuit

AT-1503 uses two L-type matching circuits with a nominal input impedance Z of 50 Ω as shown below. Refer to Figure 2-25 for the variation of the input impedance with frequency.

The matching circuit in the MF band is shown below, where the antenna length is less than one quarter of the wavelength. The antenna impedance includes not only a resistance but a capacitive reactance (-jXCa). In addition to matching Z to Ra, an inductance L1 (loading coil) is needed to cancel an antenna capacitance Ca.

At the output side of the matching circuit, a shunt capacitor Cs is included, which equivalently increases Ca to make it possible to match to an antenna with small Ca.

Reference) *When a 6 m whip antenna is hoisted, the Ca is about 80 pF in 1.6 MHz. In this case LI is 120 μH that is too high. Adding Cs (50 pF) increases the equivalent value of Ca to about 130 pF and leads to the necessary value of LI 75 μH that is within a matching range.*



The matching circuit for the antenna length of longer than a quarter of the wavelength is shown below. The actual antenna has not only a resistance Ra but also a capacitance, or an inductive reactance in an antenna length range. In addition to matching Z to Ra, a coupling capacitor Cc is needed to cancel the antenna reactance

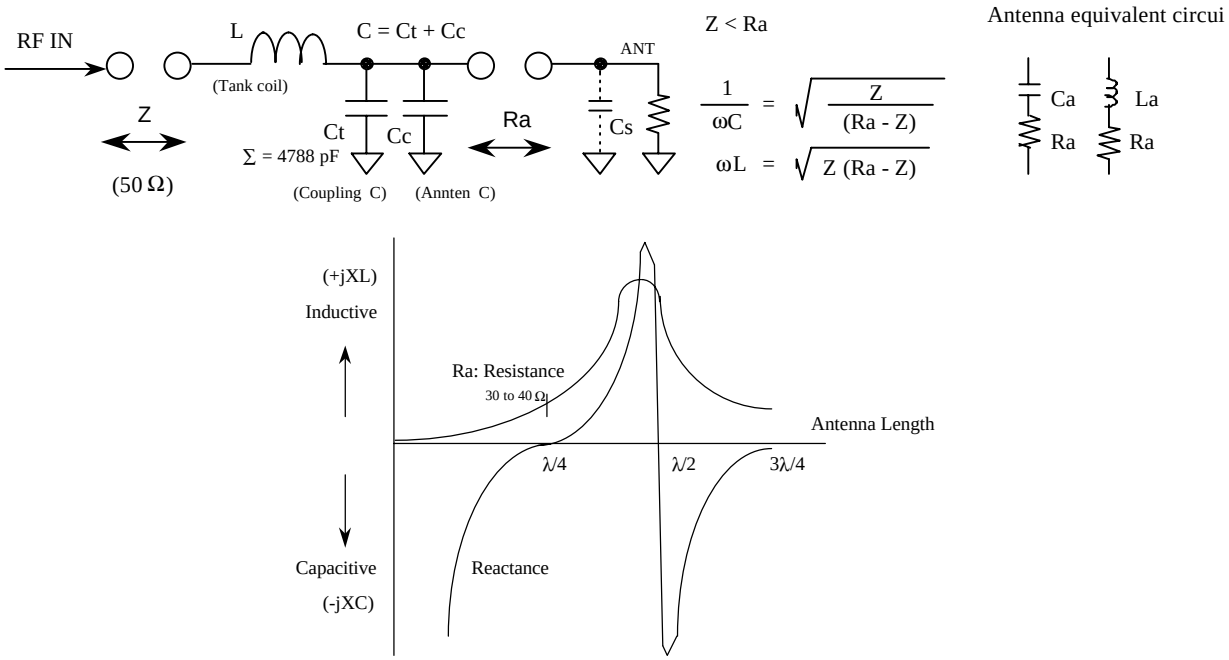


Figure 2-25 Change of Antenna Impedance

Matching Flow Chart

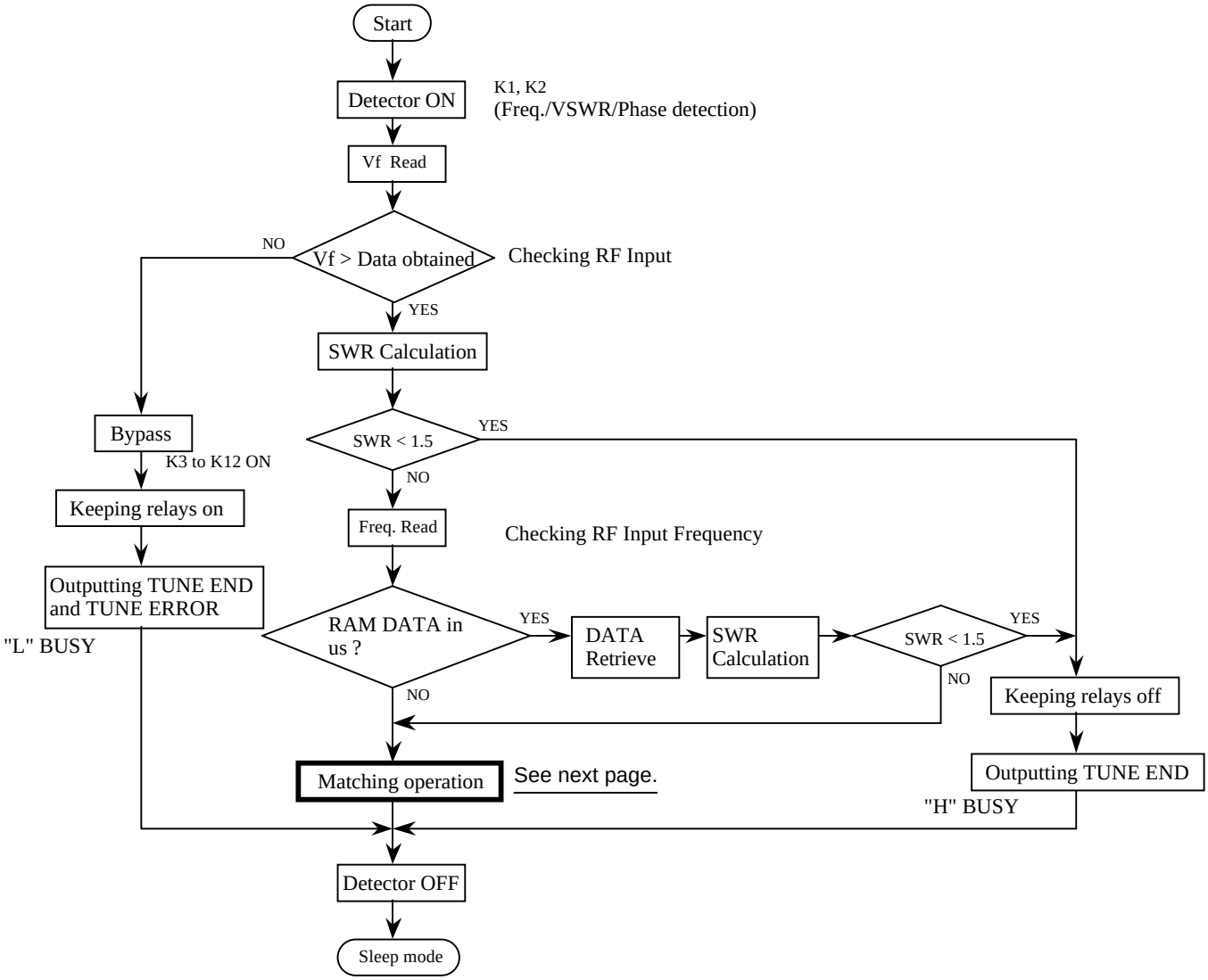
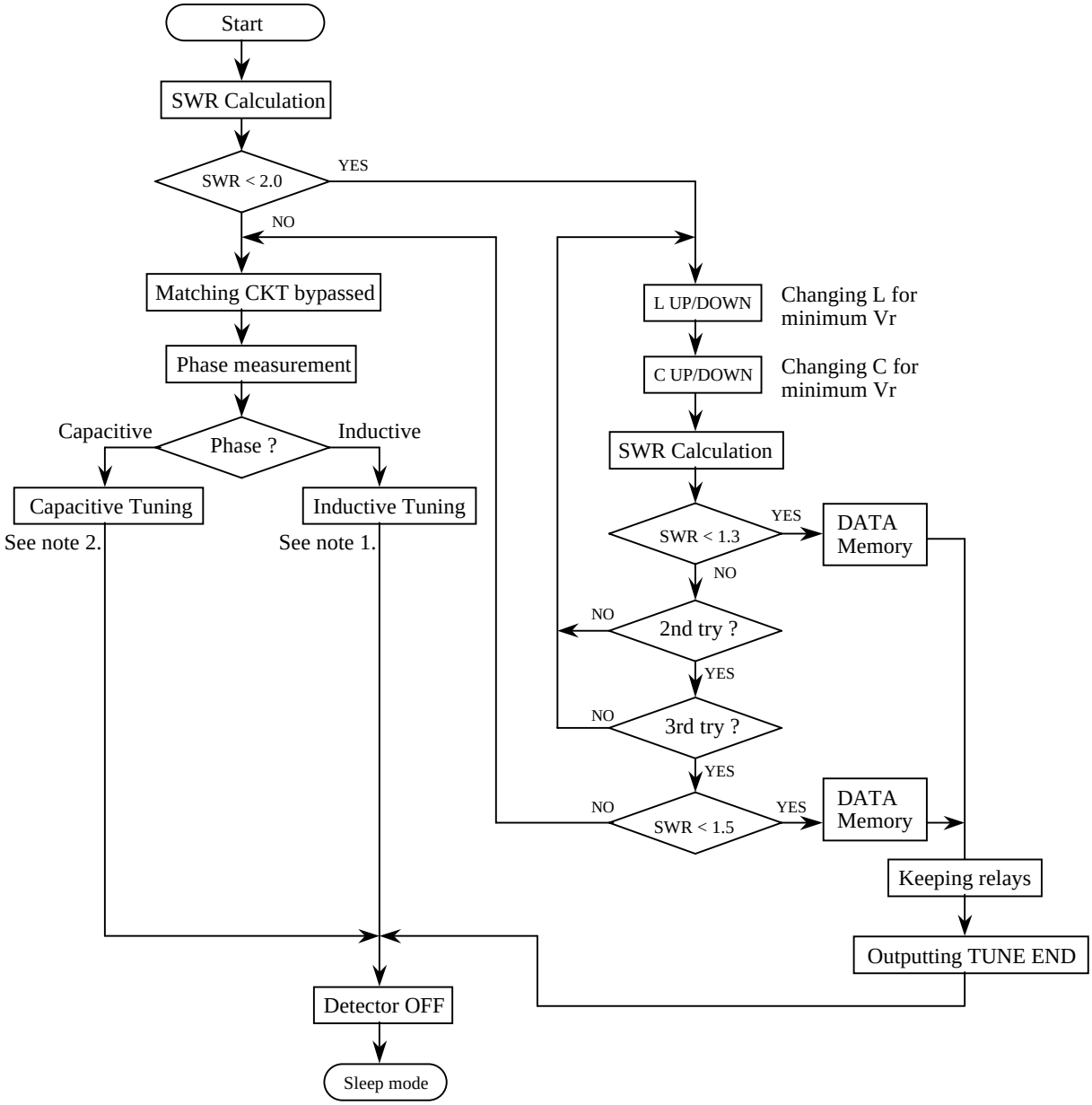


Figure 2-26 Matching Flow Chart

Matching Operation



Note 1) *Inductive tuning*

At first a dip-point of the reflection voltage Vr is sought by varying the capacitor of the matching circuit. Then, the smallest SWR is sought by varying the C and L.

Note 2) *Capacitive tuning*

At first a dip-point of the reflection voltage Vr is sought by varying the coil inductance of the matching circuit. Then, the smallest SWR is sought by varying the C and L.

Figure 2-27 Matching Operation

4. THROUGH Signal

The antenna coupler control depends on the system setting 9921 ("through"-signal of antenna coupler). The through-signal brings the characteristics of the matching circuit to a through condition, and is not a static H or L signal but pulse signal.

The through-signal turns OFF the relay for controlling the coils K3, K7, and K10, turns ON the relay for other coils, turns OFF the relays K13 to K22 for controlling the capacitors, and makes the frequency characteristics of the antenna coupler flat by adding L1, L5, and L8 in the line between TX IN/RX OUT and the antenna terminal.

System setting: 9921

0: sets to "through" in the following receiving conditions. (THRU not always)

1. MF: frequencies in transmitting and receiving are different.
2. HF: bands in transmitting and receiving are different. (1.2 MHz or more)
3. Receiving in scanning and sweeping modes.
4. Receiving frequency is less than 1605 kHz.

1: always sets to "through". (THRU always)

Table 2-7 "Through" Operation

System Setting 9921	Condition		THROU Signal	Remarks
THRU not always	At power on	Same TX/RX frequencies.	No	
		Different TX/RX frequencies.	Yes	1
	Changing RX frequency	Switched to different frequencies.	Yes	1
	TX/RX under non-thru condition	In TUNE mode, switching between TX and RX.	No	2
	TX/RX under thru condition	End of TUNE	Yes	2
		After TUNE, start and end of TX.		1
	Under TUNE ERROR	End of TUNE ERROR	No	
		After TUNE ERROR, start and end of TX.		
THRU always	At power on	Same TX/RX frequencies.	Yes	1
		Different TX/RX frequencies.		1
	Changing RX frequency		No	1
	TX/RX under thru condition	End of TUNE	Yes	2
		After TUNE, start and end of TX.		2
	Under TUNE ERROR	End of TUNE ERROR	No	
		After TUNE ERROR, start and end of TX.		

Remark)

1) The different frequencies mean the transmitting and receiving frequencies in the "through" condition "0" of the system setting 9921.

2) Refer to above system setting: 9921.

2.9 Interface

1. REMOTE (A), (B)

An optional REMOTE board is needed to connect DSC, NBDP terminal, remote station (RB-500), and distributor (DB-500, DB-120).

One of two types of REMOTE boards is selected according to the connecting device, (A): 05P0457 for RS-232C and (B): 05P0458 for current loop.

· Devices with RS-232-C: DSC-5/6, DP-5/6, DB-120, DB-500

· Devices with current loop: RB-500, DB-500

Note) *DB-500 is applicable to both types with modifications in the REMOTE boards.*

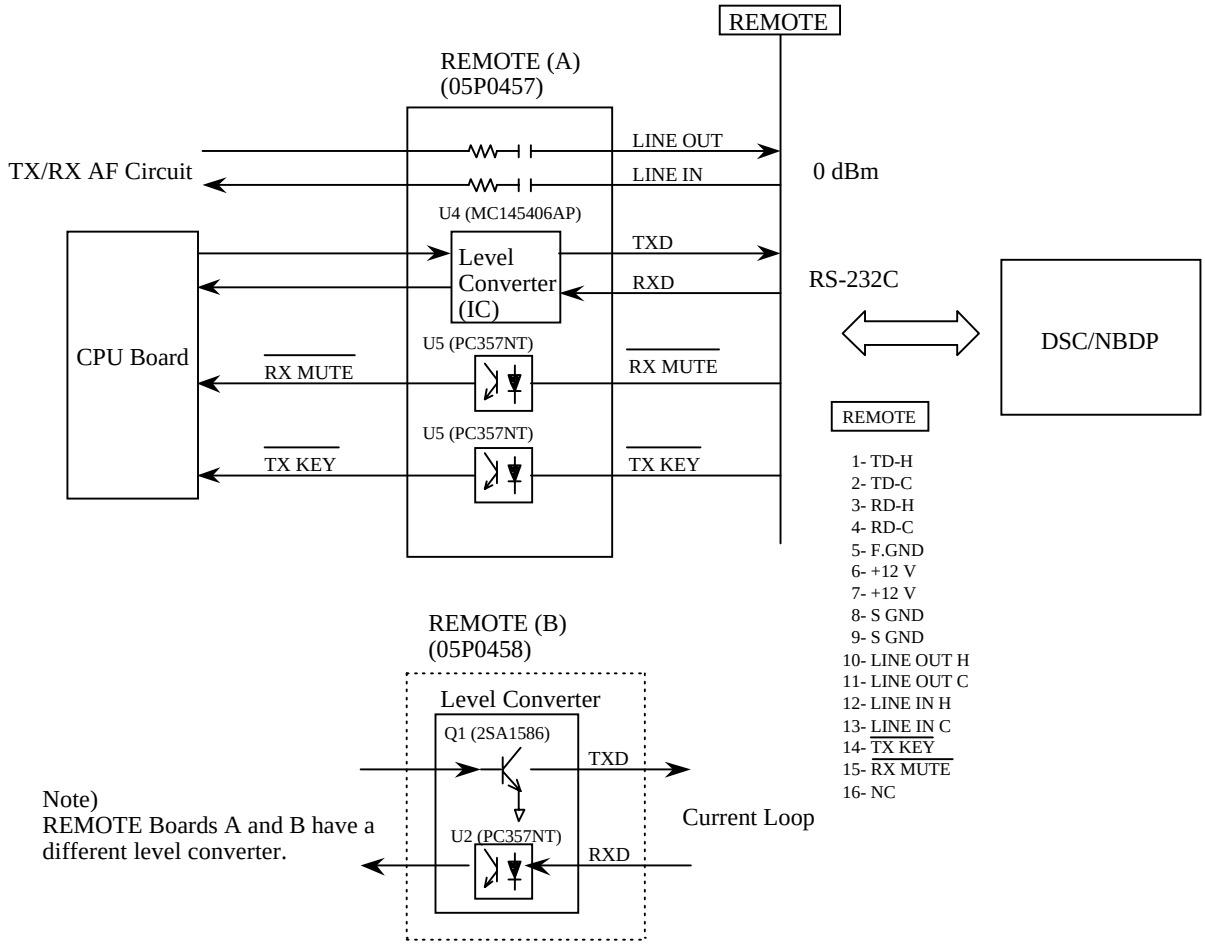


Figure 2-28 Remote Terminal Connection

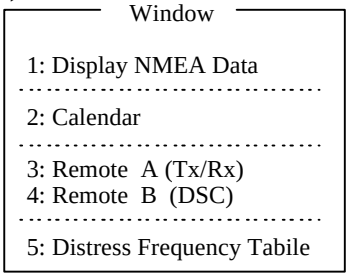
Operation with MIF Command

The FS-1503 can be controlled by MIF commands from Furuno's NBDP, DSC and remote station.

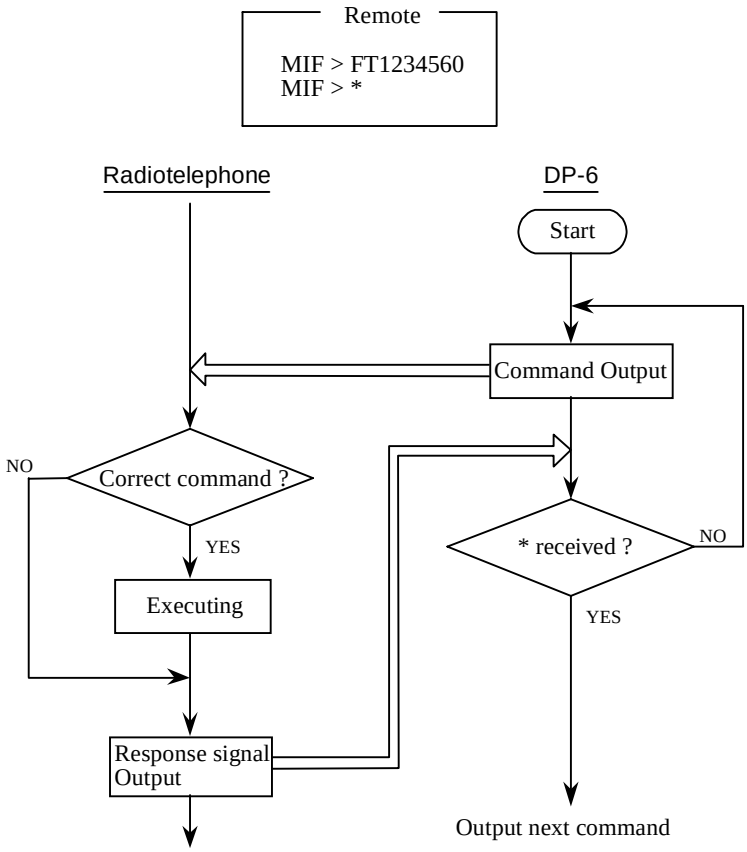
The following explains how MIF command from the DP-6 controls the FS-1503.

Operation on DP-6

1. Press [F4] (window).
2. Select "3: Remote A (TX/RX).



3. Enter a command and a parameter. For example, type FT1234560 and press [Enter] to set TX freq. to 12345.60 KHz.
4. If the entered command is executed, * appears. If not, ? appears.



Response Signal

- *CR (LF) --- When a command is executed correctly.
- ?CR (LF) --- When a command is incorrect or an error occurs during the execution.

MIF Command List

Command	Description
DRS	Keylock setting, getting highest priority. (DISTRESS)
DRR	Releasing keylock, (DISTRESS)
FZS	Keylock setting, Highest priority to 2182 KHz from main unit (FREEZE)
FZR	Releasing keylock, (FREEZE)
EM*	[*; 0: LSB, 1: J3E, 2: H3E, 5: TLX, 6: FAX]
FT*******	TX freq. setting, *: 1234560 for 12,345.60 KHz, for example
FR*******	RX freq. setting, *: 1234560 for 12,345.60 KHz, for example
ST****	Registeration of class of emission and TX/RX frequency onto user channel
CH****	User channel setting, *: band + channel
RC****	User channel setting (Recall)
CHI*****	ITU Channel setting
RCI*****	ITU channel setting (Recall)
AGS	AGC on setting
AGR	AGC off setting
RF**	RF Gain setting, [*; FF: RF GAIN MAX to 00: RF GAIN MIN]
SQS	Squelch on setting
SQR	Squelch off setting
SCS	start scanning
SCR	stop scanning
PO*	TX power setting, [*; 0, 1, 2: LOW, 3: HIGH]
TU	TUNE OK; [*], TUNE ERROR; [?] Tuning,
IC*S	Intercom calling, *: Call number
IC*R	Intercom call termination, *: Call number
CAID	Confirmation of model name, [#IDFS1503] responded
CAEM	Confirmation of class of emission, [#EM*] responded
CAFT	Confirmation of TX frequency, [#FT*******]
CAFR	Confirmation of RX frequency, [#FR*******]
CACH	Confirmation of channel setting, [#CH****], [#CHI*****] responded
CARC	Confirmation of, [#RC****], [#RCI*****] responded
CAAG	Confirmation of AGC setting, [#AGS (AGC ON)], [#AGR (AGC OFF)] responded
CARF	Confirmation of RF gain setting, [#RF**] responded,*; 00 to FF
CASL	Confirmation of S level, [#SL**] responded,*; 00 to FF
CASQ	Confirmation of squelch setting, [#SQS (SQ ON), #SQR (SQ OFF)] responded
CAPO	Confirmation of TX power, [#PO*] responded

2. CONTROL

Providing a BK line requires an optional CONTROL board. Current capacity of CR1,Vobc) in the BK line is 1A.

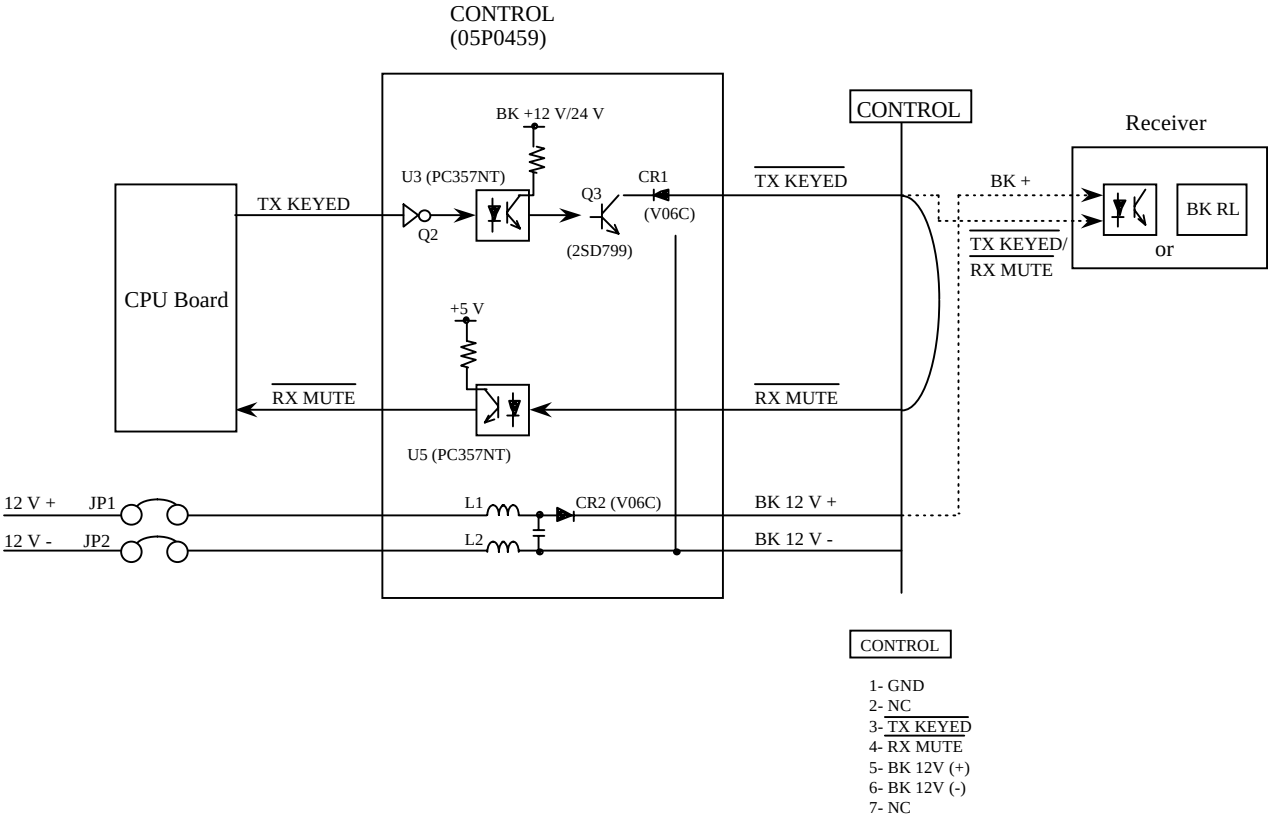
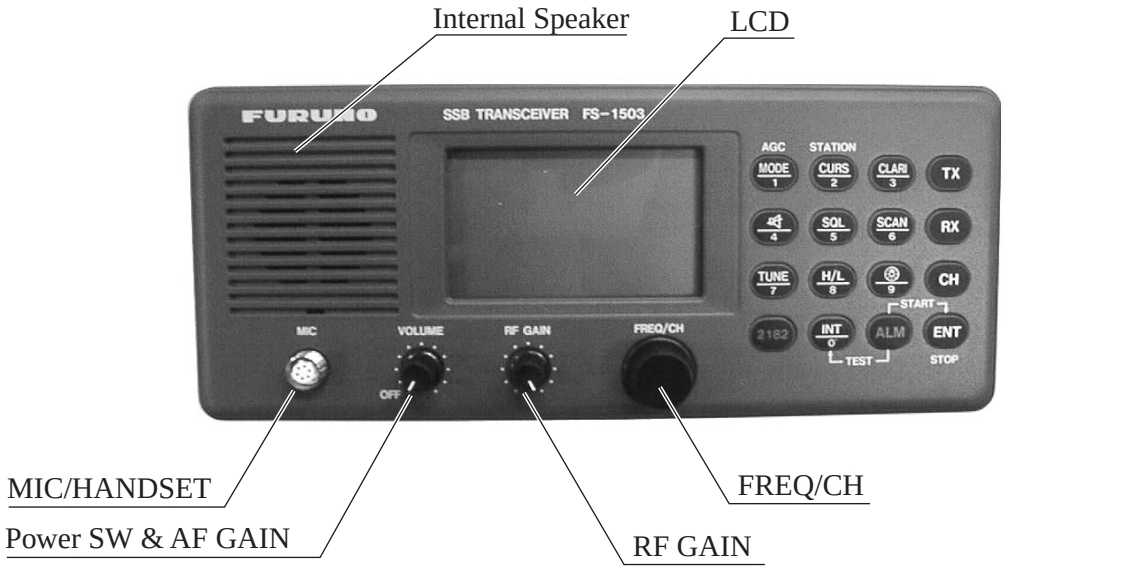


Figure 2-29 CONTROL Board

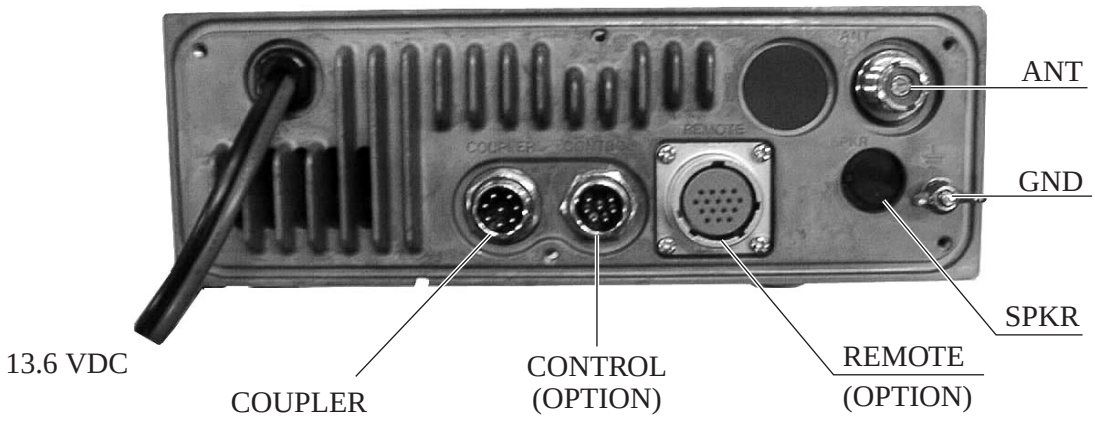
Chapter 3 Location of Parts

3.1 Main Unit

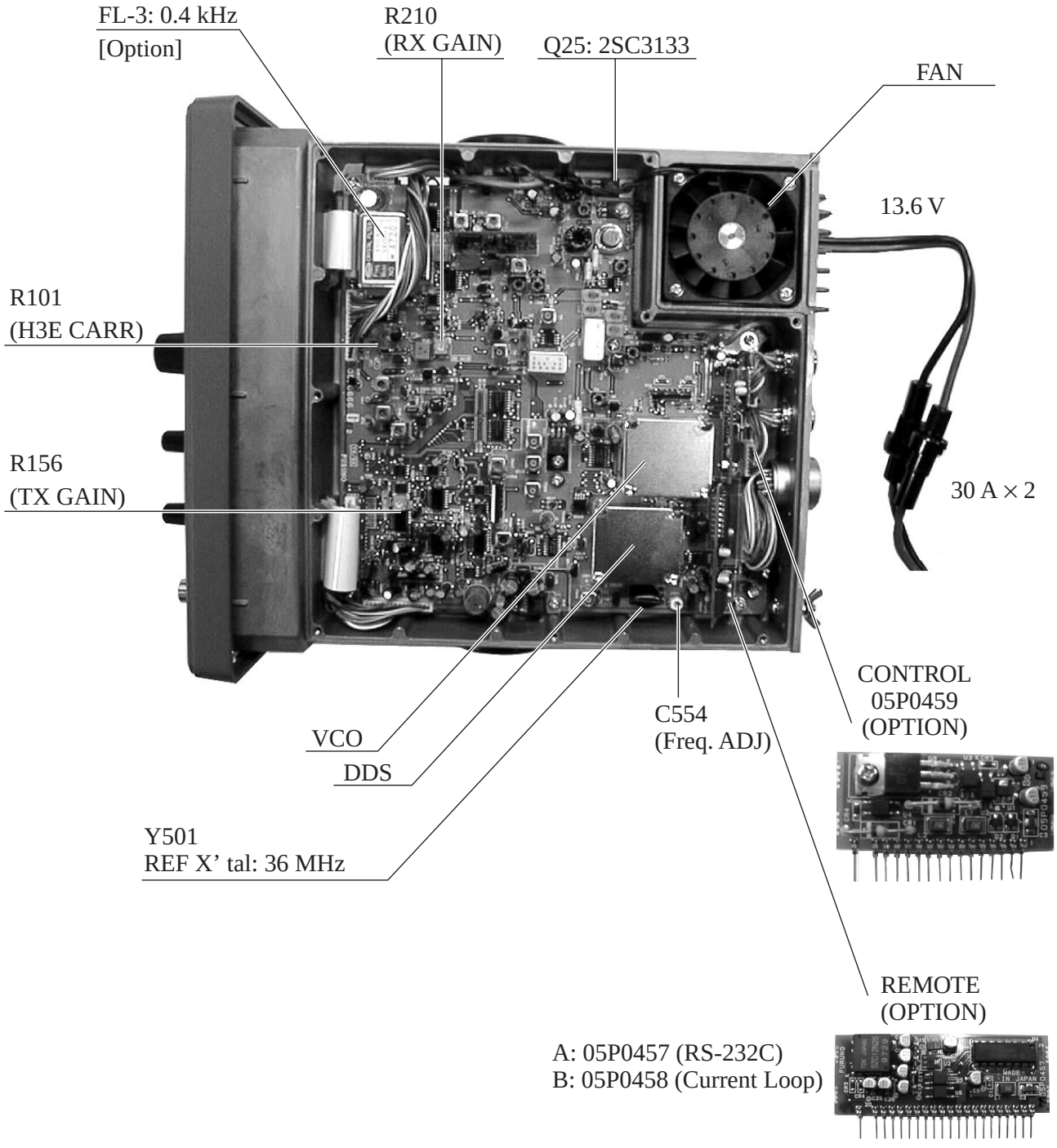
1. FS-1503 Front Panel



2. FS-1503 Rear Panel

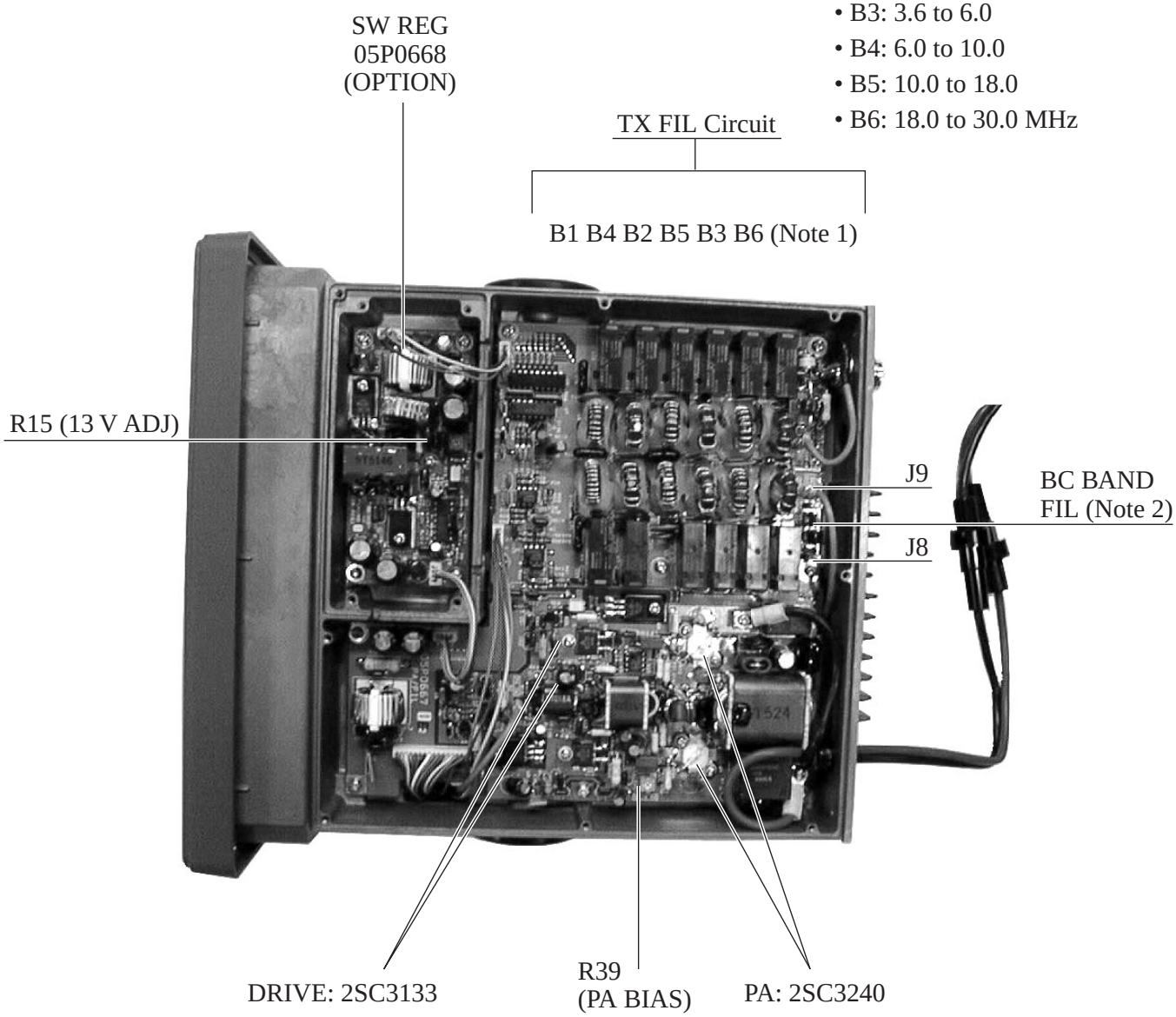


3. TX/RX Board


FL-3: 0.4 kHz
[Option]
R210
(RX GAIN)
Q25: 2SC3133
FAN
13.6 V
R101
(H3E CARR)
R156
(TX GAIN)
30 A × 2
CONTROL
05P0459
(OPTION)
VCO
DDS
C554
(Freq. ADJ)
Y501
REF X' tal: 36 MHz
REMOTE
(OPTION)
A: 05P0457 (RS-232C)
B: 05P0458 (Current Loop)

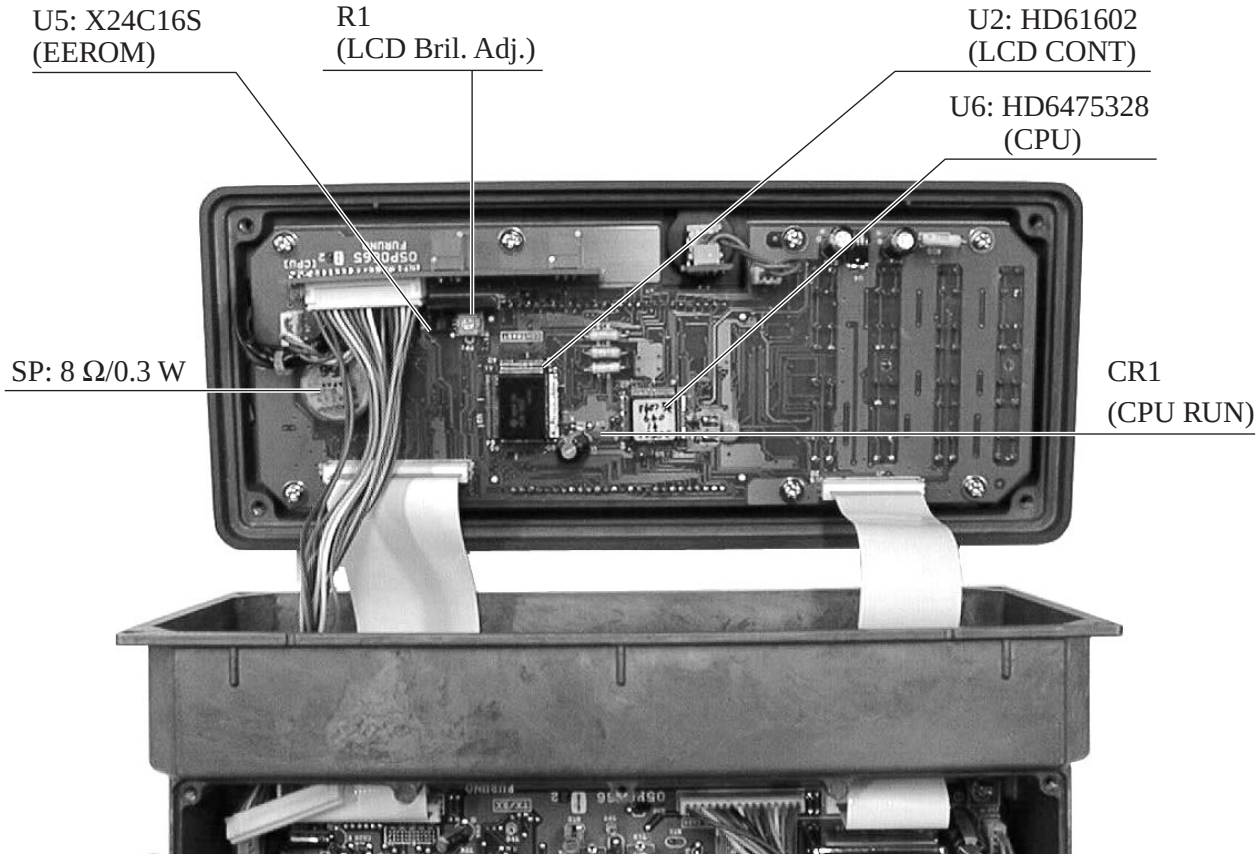
4. PA/FIL Board (05P0667)/SW REG Board (05P0668)

Note 1) TX FIL ranges
- B1: 0.1 to 2.4
- B2: 2.4 to 3.6
- B3: 3.6 to 6.0
- B4: 6.0 to 10.0
- B5: 10.0 to 18.0
- B6: 18.0 to 30.0 MHz



Note 2) BC BAND FIL Setting
- J9, 8 ------- ①: 1.6 to 30.0 MHz
- J8, 9 ------- ②: 0.1 to 30.0 MHz (Default)

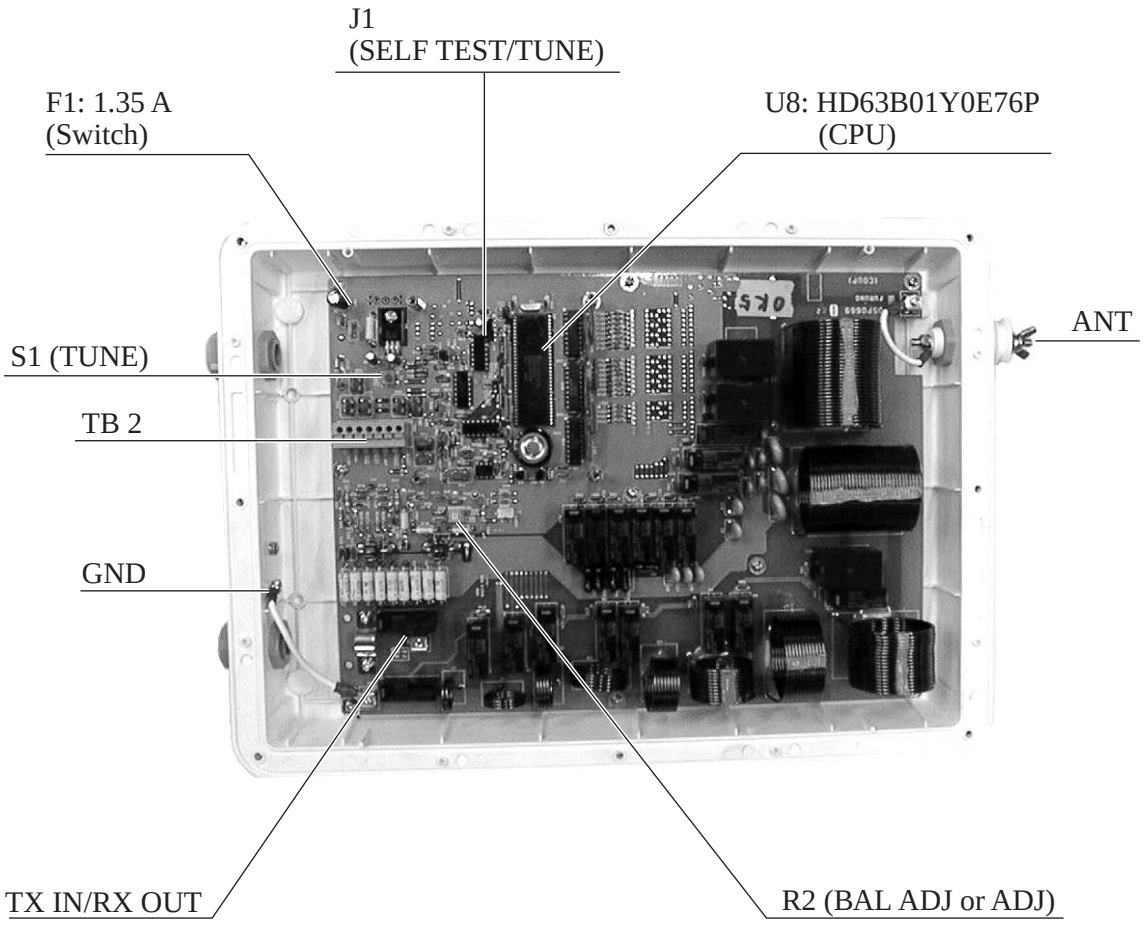
5. CPU Board (05P0665)



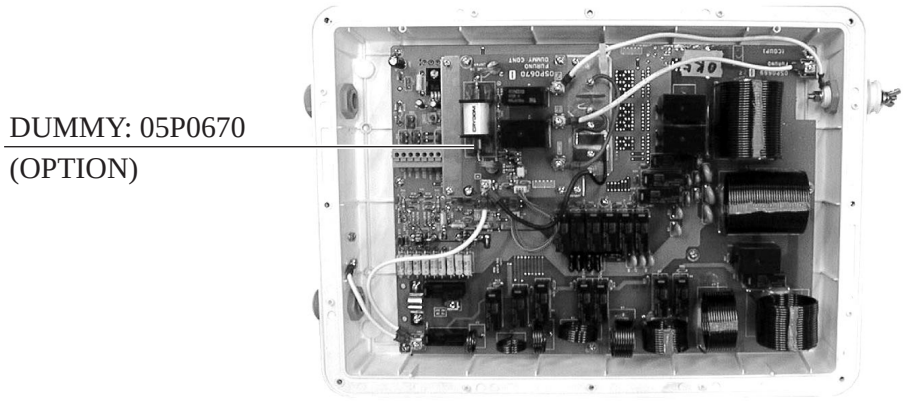
3.2 AT-1503

1. AT-1503 (05P0669)

(Standard type)

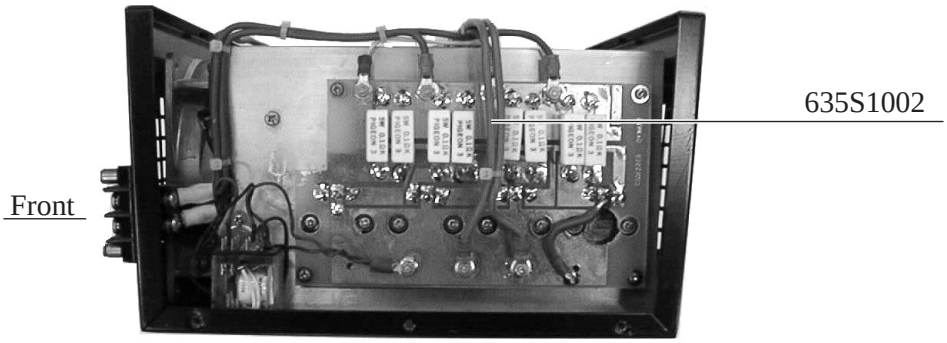


(Built-in dummy type: optional)

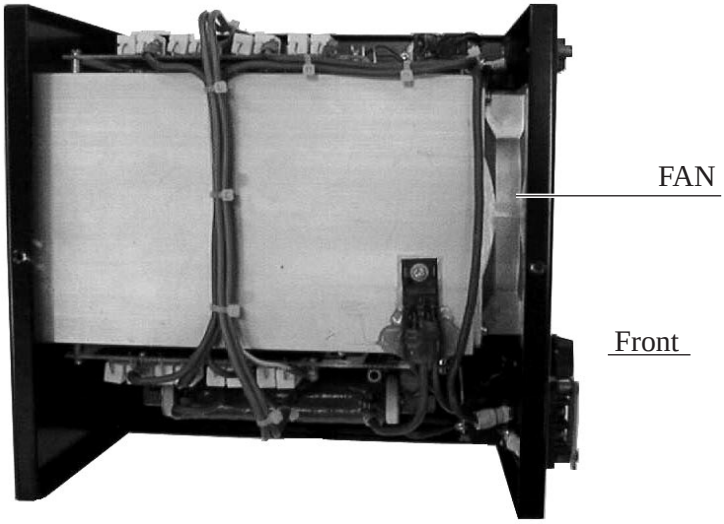


3.3 Power Supply Unit

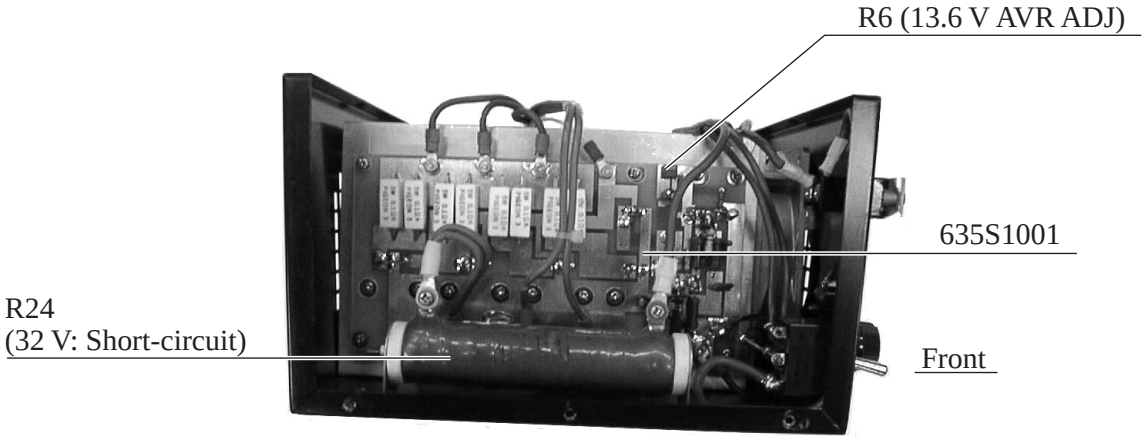
1. PR-200



Right-hand Side View

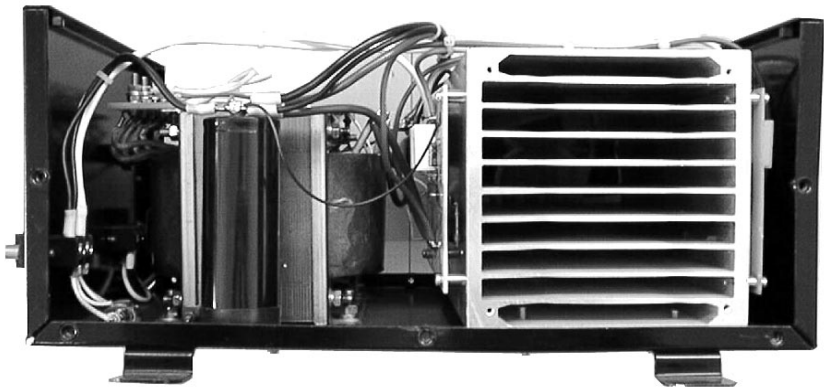


Top View

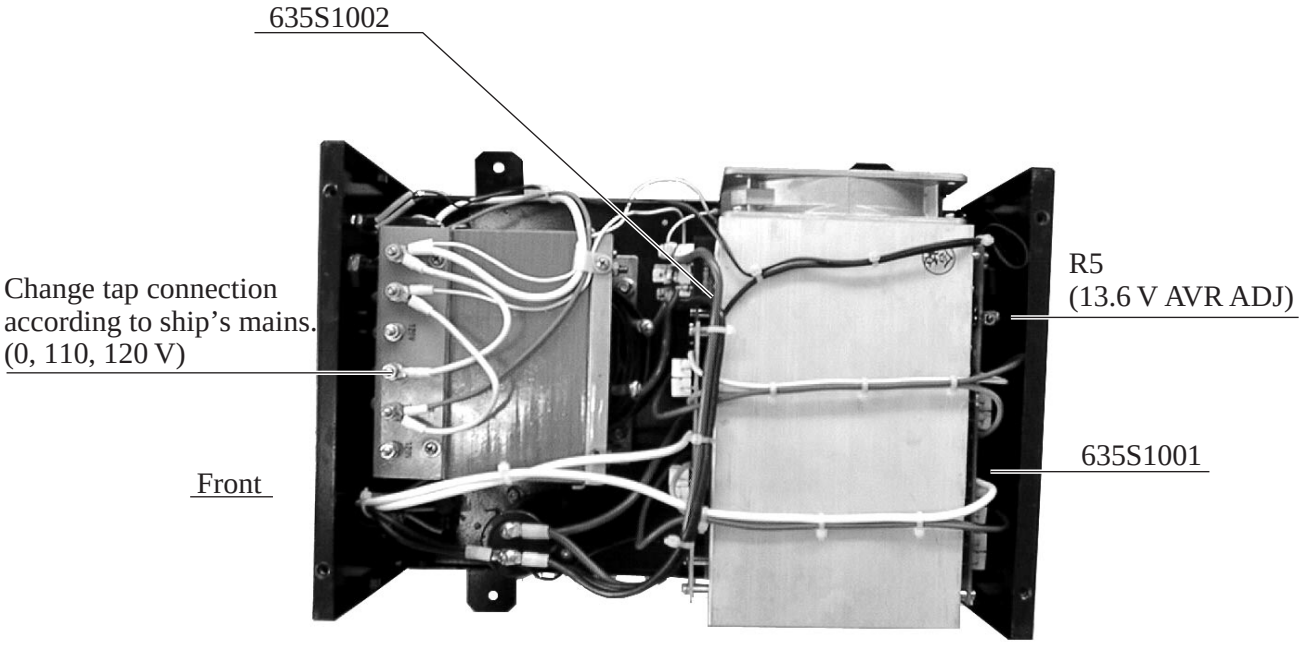


Left-hand Side View

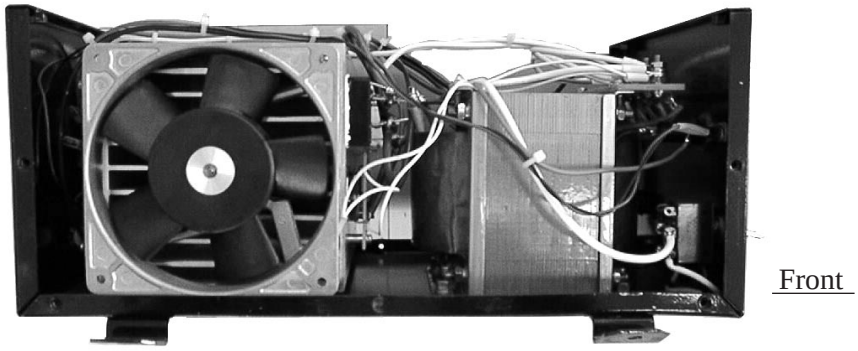
2. PR-270



Right-hand Side View



Top View

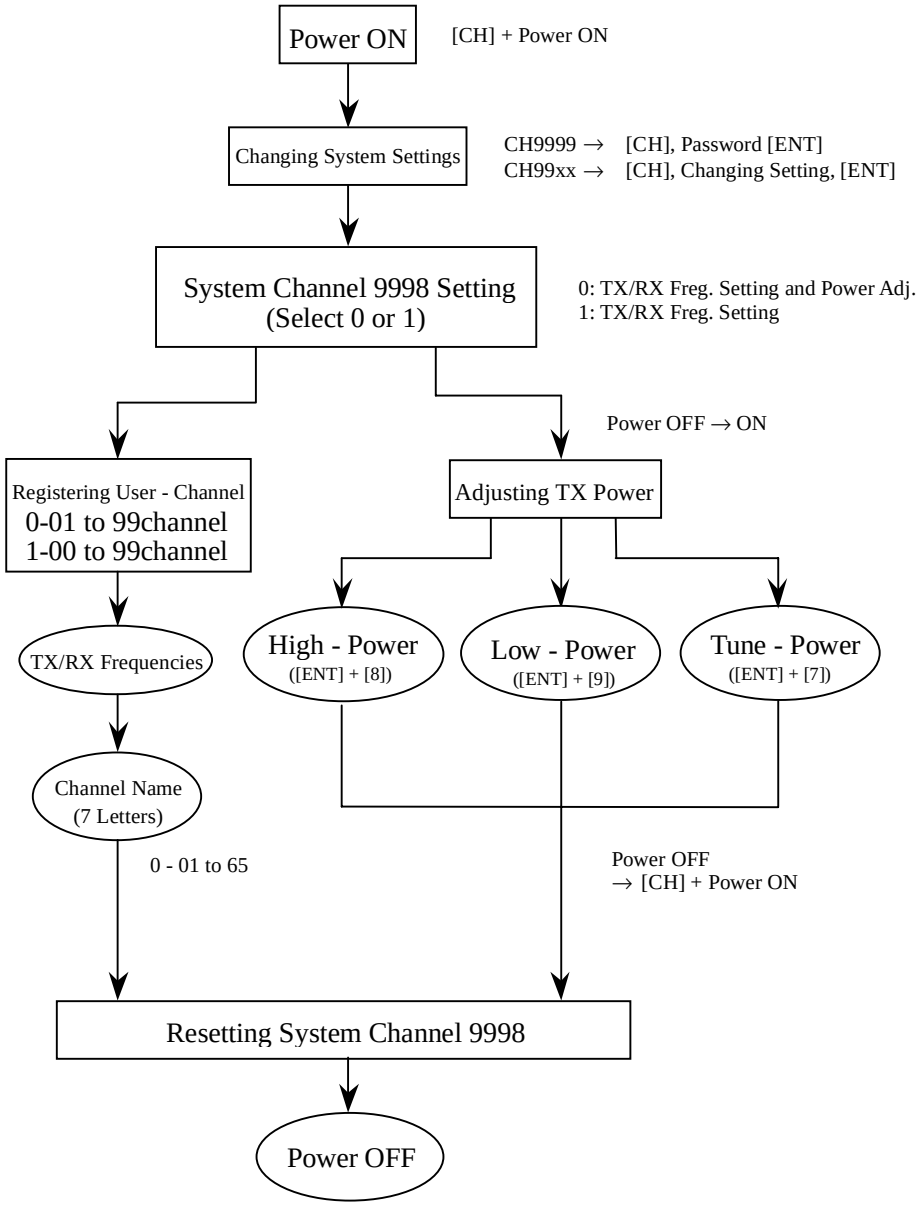


Left-hand Side View

Chapter 4 System Settings

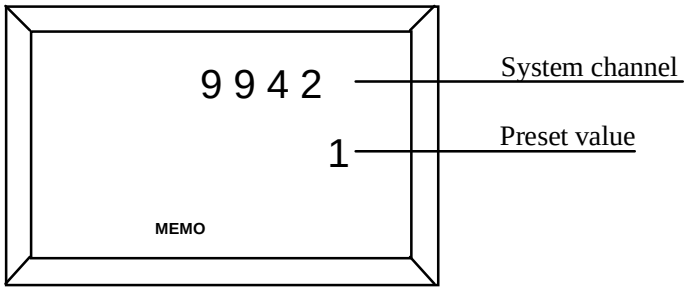
The system channels list is shown on the next page. The system channels marked * can only be set by a Furuno service agent or dealer. These channels can be recalled by entering the password. The procedure for changing user settable system settings appears in the Operator's Manual.

The figure below shows the setting-up procedure of the FS-1503.



4.1 Changing System Settings

1. While pressing and holding down [CH], turn the power on. System channel 9942, setting number 1, and MEMO appear on the screen.



2. Select the system channel 9999 by rotating the FREQ/CH knob.
3. Enter a password. (Press [CH], type password, and then press [ENT].)
4. Select a channel to be changed its setting by rotating the FREQ/CH knob.
5. Change the setting. (Press [CH], enter setting number, and then press [ENT].)
6. To change another channel, repeat steps 4 and 5.
7. Turn the power off and on again to store the settings.

4.2 System Channels List

Note that channels marked by * can be recalled by entering the password on system channel 9999.

CH No.	Function	Setting					Default		
		0	1	2	3	4	Std	USA	Thai.
9900	* Country	Standard	USA	Thai.			0	1	2
9901	* User Channel Clear	[CH] [1] [ENT]							
9902	* TX PWR Data Clear	[CH] [1] [ENT]					150 W	150 W	100 W
9903	* TX Frequency	Free	ITU/ ROM	ROM	Marine Free		1	1	2
9904	* RX Frequency	Free	ITU/ ROM	ROM	Marine Free		0	0	2
9905	* ITU Channel	Standard	USA	Standard + MF			0	1	0
9906	* CH/Freq. Indication	CH/Freq.	Freq.	CH			0	0	0
9908	* TLX (Telex) Usage	TX/RX	RX	Disable			2	2	2
9909	* TLX RX Bandwidth	Wide (2.4 k)	Narrow (0.4 k)				0	0	0
9910	* System Delay	5 to 50 ms					10	10	10
9911	* H3E (AM) Usage	TX/RX	RX	Disable	2182	1 + 3	4	4	3
9912	* 2182 kHz Class of Emission	H3E	J3E	H3E Fixed			0	0	0
9914	* LSB Usage	TX/RX	RX	Disable			2	2	2
9915	* FAX (Weather Facsimile) Usage	TX/RX	RX	Disable			1	1	2
9917	* 2-tone TX, Test TX	2-tone: Enable Test: Disable	Both Enable			Both Disable	0	0	0
9918	* Test Alarm TX Frequency	1605.00 to 29999.9 kHz					2191 kHz		
9919	* Squelch during RX of 2-tone	Not Open	Open				1	1	1
9920	* TX TUNE	Enable	Disable	Auto			0	0	0
9921	* THRU Signal	Limited	RX				0	0	0
9922	* Meter Indication	IA	RF				1	1	1
9924	* Remote Signal Format	MIF	TBUS				0	0	0
9942	Key Response Tone	OFF	ON				1	1	1
9943	Noise Blanker	OFF	ON				1	1	1
9951	Scan Stop Signal Level	SQ Level	S: 1 to 10				3	3	3
9952	Scan Dwell Time	RX	1 to 99 sec				2	2	2
9953	Sweep Width	0.01 to 30000.00 kHz					100.0 kHz		
9954	Sweep Step Frequency	0.01 to 30000.00 kHz					1.00 kHz		
9955	Squelch Activation	Freq.	Level	AND	OR		3	3	3
9956	Squelch Level	S: 0 to 10					5	5	5
9957	Squelch Decay Time	500 to 4000 msec					1000 msec		
9958	Squelch Activating Frequency	500 to 2000 Hz					1000 Hz		
9998	* User Channel Memory/Power Adj.	Enable	TX/RX	RX	Disable		2	2	3
9999	Password	[CH] (Password) [ENT] to access asterisk-marked channels.							

Description of System Channel

1. 9900 (Country)
   System settings 9903 and above are preset to default values depending on local rules and regulations.

2. 9902 (TX power data clear)
   Power data is changed to default settings as below.
   · Standard, USA HIGH: 220 (150 W) LOW: 140 TUNE: 40
   · Thai HIGH: 170 (100 W) LOW: 140 TUNE: 40

3. 9903 (TX frequency)
   · 0: Free: Frequencies can be selected in the range of 1.6065 MHz to 29.9999 MHz. ITU and User channels are also available.
   · 1: ITU/ROM: ITU and User channels are available.
   · 2: ROM: User channel only
   · 3: Marine Free: Frequencies can be selected in the following range. ITU and User channels are also available.
   1606.5 – 4438; 6200 – 6525; 8100 – 8815; 12230 – 13200;
   16360 – 17410; 18780 – 19800; 22000 – 22855; 25070 – 26175 kHz

4. 9904 (RX frequency)
   · 0: Free: Frequencies can be selected in the range of 0.1000 MHz to 29.9999 MHz. ITU and User channels are also available.
   · 1: ITU/ROM: ITU and User channels are available.
   · 2: ROM: User channel only
   · 3: Marine Free: Frequencies can be selected in the following range. ITU and User channels are also available.
   1606.5 – 4438; 6200 – 6525; 8100 – 8815; 12230 – 13200;
   16360 – 17410; 18780 – 19800; 22000 – 22855; 25070 – 26175 kHz

5. 9905 (ITU channel)
   Refer to appendix 2 for ITU channel list.

6. 9906 (Channel/Frequency Indication)
   · 0: CH/Freq: The selected RX channel and frequency are displayed on the upper and lower rows respectively. The selected TX channel and frequency are indicated when the PTT switch is depressed.
   Both TX and RX frequency can be momentarily displayed on the upper and lower rows respectively by pressing [ENT].
   While pressing and holding down [ENT], press [CUSR] for momentary call of channel name or station name.

   · 1: FREQ: TX and RX frequencies are indicated on upper and lower rows respectively. The channel number are displayed momentarily when [ENT] is pressed.

   · 2: CH: TX and RX channels are indicated on upper and lower rows respectively. However, if a channel is preset by a frequency, instead of channel number, the frequency is displayed.
   Pressing [ENT] changes the display from "channel" to "frequency" momentarily.

7. 9909 (TLX RX Bandwidth)
   · 1: Narrow (0.4 kHz) requires an optional filter, SF0L04.

8. 9910 (TLX System Delay)
   Set to "10 msec" normally.

9. 9912 (2182 kHz Class of Emission)
   Selects class of emission for 2182 kHz signal when [2182] is pressed.
   [MODE] is inoperative if 2:H3E fix is selected.

10. 9917 (2-tone TX, Test TX)
   · 0: Pressing [2182], and then [ALM] and [ENT] together emits 2-tone alarm signal for 45 seconds. 9912 must be set to 0 or 2. The alarm TX frequency is selected on 9918.
   · 1: In addition to 2-tone alarm TX, test transmission is available if an optional dummy load 05P0670 is fitted. Press [ALM] and [INT] together, and test signal on the frequency selected on 9918 is transmitted for 45 seconds into the dummy.

11. 9919 (Squelch during 2-tone alarm reception)
   · 0: (Not open): 2182 kHz squelch frequency is set on 9958.
   · 1: (Open): 1300 Hz signal of 2-tone alarm opens squelch.

12. 9920 (TX TUNE)
   · 0: (Enable): Tuning is made when the PTT switch or [TX TUNE] is depressed.
   · 1: (Disable): No tuning function
   · 2: (Auto): Tuning is made when the TX frequency is changed.

13. 9921 (THRU signal)
    - 0: Limited: RX signal does not pass through tuning circuit:
      1) When TX and RX frequencies on MF are different.
      2) When TX and RX band on HF are different.(frequency separation of more than 1.2 MHz)
      3) At scan/sweep reception
    - 1: RX: RX signal does not passe through tuning circuit during reception.

14. 9922 (Meter Indication)
    - 0: IA: The meter indicates antenna current (IA).
      (The IA cannot be selected on the standard type.)
    - 1: RF: The meter indicates RF output level.

15. 9924 (Remote Signal Format)
    - 0: MIF: Furuno radio interface. Selected when Furuno DSC or NBDP terminal is connected.
    - 1: TBUS: For equipment made by "Thrane & Thrane A/S" of Denmark.

16. 9951 (Scan Stop Signal Level)
    - 0: SQ Level: Scan stops when the squelch opens.
    - 1 to 9: Scan stops when receiving signal level is higher than the preset level.

17. 9955 (Squelch Activation)
    - 0: Freq.: The squelch opens when the receiving signal is lower than the preset value (9958).
    - 1: Level: The squelch opens when the S-meter is higher than the preset value (9956).
    - 2: AND: The squelch opens when both frequency and level are satisfied.
    - 3: OR: The squelch opens when either frequency or level is satisfied.

18. 9958 (Squelch Activating Frequency)
    If a detected signal is lower than the preset one, it is recognized as audio signal, if higher, it is noise.

19. 9998 (User Channel Memory/Power Adjustment)
    - · 0: Enable: Enabling to write TX and RX frequencies and adjust TX power on user channels.
    - · 1: TX/RX: Enabling to write TX and RX frequencies on user channels.
    - · 2: RX: Enabling to write RX frequencies on user channel.
    - · 3: Disable: Disabling to write frequencies and adjust TX power on user channel.

20. 9999 (Password)
    While pressing and holding down [CH], turn on the unit. Press [CH], enter a password, and then press [ENT]. All system settings can be changed.

4.3 Channel Programming

199 user channels are divided into two bands; 0 and 1. Further channels are divided into ten scan groups which are able to be scanned as a group.
TX and RX frequencies and class of emission can be preset on each user channel.

In addition, a user channel name can be entered on 65 channels, 0-01 to 0-065.

Band	Channel	Scan Group	Remarks	Band	Channel	Scan Group	Remarks
0	1 to 99	01 to 09		1	0 to 99	00 to 09	
		10 to 19				10 to 19	
		20 to 29				20 to 29	
		30 to 39				30 to 39	
		40 to 49				40 to 49	
		50 to 59				50 to 59	
		60 to 69				60 to 69	
		70 to 79				70 to 79	
		80 to 89				80 to 89	
		90 to 99				90 to 99	

How to program user channel

1. While pressing and holding down [CH], turn the power on.

2. Select system channel 9999 by rotating the FREQ/CH knob.

3. Enter a password. (Press [CH], type password, and then press [ENT].)

4. Select channel 9998 by rotating the FREQ/CH knob.

5. Press [CH], [1], and [ENT] in this order to enable channel programming.
   If [CH], [0], and [ENT] are pressed, not only channel programming but also power adjustment can be made.

6. Select an RX channel to be programmed by rotating the FREQ/CH knob. The display changes as follows when the knob is rotated: RX frequency, TX frequency, and channel name can be preset on a channel in this order. Note that the channel name cannot be entered on channel 66 and above.
   [0-01·R] → [0-01·T] → [0-01·-----] → [0-02·R] → [0-02·T] → [0-02·-----] → ·····[1-00·R] → [1-00·T] → [1-01·R] → ----------

7. Select the emission mode by pressing [MODE]: J3E for SSB radiotelephone and TLX for DSC and NBDP.

8. Enter a receiving frequency(R): Press [CH], enter a frequency with numeric keys, and then press [ENT]. Reenter a frequency after pressing [CH] if necessary.

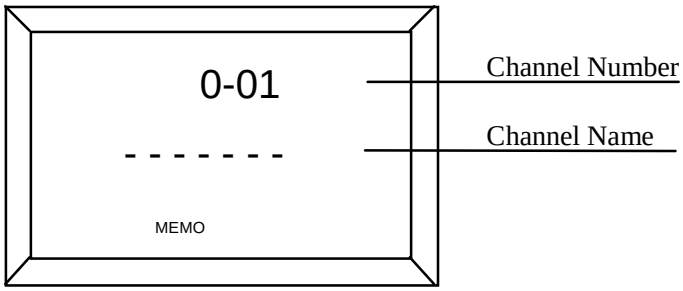
9. Rotate the FREQ/CH knob cw by one click to select the TX frequency(T) on the same channel.

10. Enter a transmitting frequency: Press [CH], enter a frequency with numeric keys, and then press [ENT]. If the transmitting frequency is the same as the receiving frequency, press [ENT] without typing the frequency.

If you do not need to register a channel name, skip steps 11 through 14.

How to register channel name

11. Rotate the FREQ/CH knob cw by one click, the following display will appear.



12. Press [CH], and select a desired number or alphabet by rotating the FREQ/CH knob. And then press [ENT].

13. Rotate the FREQ/CH knob to select a desired alphanumeric for the next character, and press [ENT].

14. Do the same to complete a channel name (max.7 characters). After entering the last character, cursor disappears automatically and the channel name is registered.

15. Rotae the FREQ/CH knob cw by one click to register the RX frequency on another channel. Or, set the system channel 9998 to the default value (2 or 3) to terminate the setting.

16. Turn off the power to store programmed channels.

The following pages describes how to delete a frequency and how to erase/change a channel name.
Now that system channel 9906 must be set to “0” for displaying a channel name.

How to erase programmed frequency

1. Follow steps 1 to 5 described in “How to program user channel” on page 4-8.

2. Select an RX channel to be erased by rotating the FREQ/CH knob.
   (For example, 0-010R)

3. Press [CH], [0], and [ENT] in this order.

4. Rotate the FREQ/CH knob cw by one click to select the TX channel.
   (For example, 0-01T)

5. Press [CH], [0], and [ENT] in this order.

To erase another user channel, repeat steps 2 to 5. All user channels can be erased at a time: On system channel 9901 press [CH], [1], and [ENT] in this order.

How to erase channel name

1. Select a channel name to be erased. (Carry out steps 1 to 5 on page 4-8, and select the channel name by rotating [FREQ/CH] knob.)

2. Press [CH], [0], and [ENT] in this order.

How to change channel name

1. Select a channel name to be changed. (Carry out steps 1 to 5 on page 4-8, and select the channel name by rotating [FREQ/CH] knob.)

2. Press [CH], and then press [ENT] several times until the cursor moves onto the character to be changed.

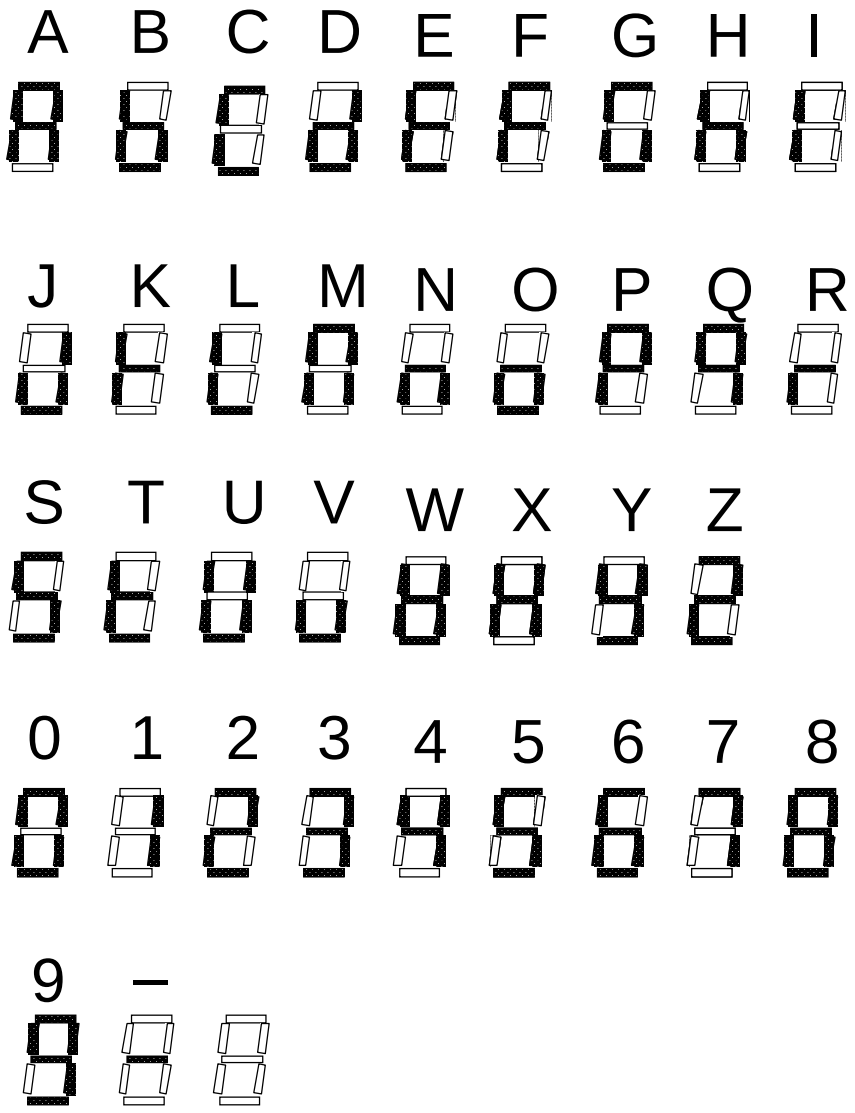
3. Rotate [FREQ/CH] knob to select a new character, and press [ENT].

4. Repeat steps 2 to 3.

5. Move the cursor onto the 7th character and press [ENT].

Symbols for Channel Name

The radiotelephone employs symbols to indicate channel names. The symbols and their corresponding letter are shown below.



Note) *To indicate the channel name, system channel 9906 must be set to "0:CH/FRQ". The channel name appears every time [CURS] is pressed while pressing and holding down [ENT].*

4.4 Power Data Setting

The output power can be set by changing power data through the keyboard. Adjustment of any potentiometers inside the unit is not necessary. Frequency ranges in which power data is effective are tabled on the next page.

System channel 9998 must be set to “0” for power adjustment. After the adjustment, system channel is set back to the previous value.

HI (normal) power

· Power data for each user channel and 2182 kHz is set individually.

· Where manually entered frequency or ITU channel is permitted, the data is set on each band and each class of emission.

· J3E power data is also used for LSB power data.

LOW (reduced) power

· Power data for 1.6 to 3.9999 MHz is set in each class of emission.

· Where manually entered frequency or ITU channel is permitted, the data is set on each band and each class of emission.

· J3E power data is also used for LSB power data.

TUNE power (Factory-adjusted)

· Normally the TUNE power adjustment is not necessary. Power data set on a channel is used on all channels.

Frequency Ranges for Power Adjustment

Power data can be set on following frequency ranges and classes of emission,
(Marked by "•"). Power data for user channel is entered for all classes of emission.

<table>
<tr><td rowspan="2"></td><td colspan="3">HI Power</td><td colspan="3">LOW Power</td></tr>
<tr><td>J3E</td><td>H3E</td><td>TLX</td><td>J3E</td><td>H3E</td><td>TLX</td></tr>
<tr><td colspan="7">BAND</td></tr>
<tr><td>1.6 - 1.9999</td><td>•</td><td>•</td><td>•</td><td rowspan="5">•</td><td rowspan="5">•</td><td rowspan="5">•</td></tr>
<tr><td>2.0 - 2.4999</td><td>•</td><td>•</td><td>•</td></tr>
<tr><td>2.5 - 2.9999</td><td>•</td><td>•</td><td>•</td></tr>
<tr><td>3.0 - 3.4999</td><td>•</td><td>•</td><td>•</td></tr>
<tr><td>3.5 - 3.9999</td><td>•</td><td>•</td><td>•</td></tr>
<tr><td>4.0 - 5.9999</td><td>•</td><td>•</td><td>•</td><td>•</td><td>•</td><td>•</td></tr>
<tr><td>6.0 - 7.9999</td><td>•</td><td>•</td><td>•</td><td>•</td><td>•</td><td>•</td></tr>
<tr><td>8.0 - 11.9999</td><td>•</td><td>•</td><td>•</td><td>•</td><td>•</td><td>•</td></tr>
<tr><td>12.0 - 15.9999</td><td>•</td><td>•</td><td>•</td><td>•</td><td>•</td><td>•</td></tr>
<tr><td>16.0 - 17.9999</td><td>•</td><td>•</td><td>•</td><td>•</td><td>•</td><td>•</td></tr>
<tr><td>18.0 - 21.9999</td><td>•</td><td>•</td><td>•</td><td>•</td><td>•</td><td>•</td></tr>
<tr><td>22.0 - 24.9999</td><td>•</td><td>•</td><td>•</td><td>•</td><td>•</td><td>•</td></tr>
<tr><td>25.0 - 29.9999</td><td>•</td><td>•</td><td>•</td><td>•</td><td>•</td><td>•</td></tr>
<tr><td colspan="7">ITU Channel</td></tr>
<tr><td></td><td colspan="6">Using above data for each frequency range and in each emission modes.</td></tr>
<tr><td colspan="7">User Channel</td></tr>
<tr><td>0 - 01 to 99</td><td colspan="3" rowspan="2">Power data is set on each channel.</td><td colspan="3" rowspan="2">Using above data for each frequency range and in each mode.</td></tr>
<tr><td>1 - 00 to 99</td></tr>
<tr><td colspan="7">[2182] key</td></tr>
<tr><td></td><td colspan="3">•</td><td colspan="3">Power data entered for 1.6 - 3.9999 MHz.</td></tr>
</table>

Default setting of power data

· Standard and USA (150 W): 220

· Thai (100 W): 170

· LOW (60 to 70 W): 140

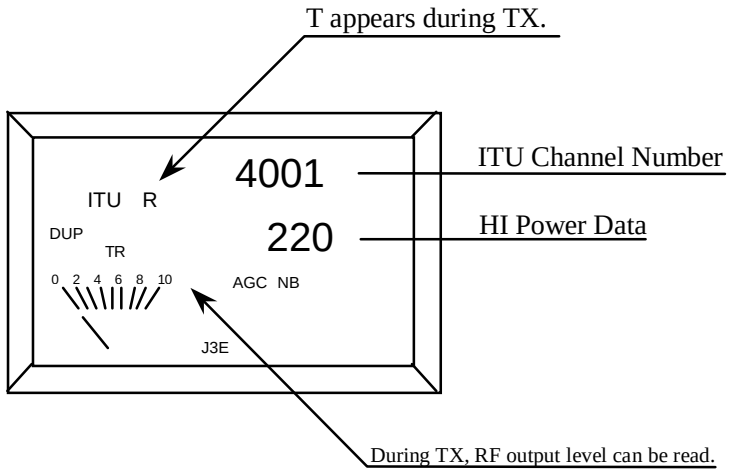
· TUNE (10 W): 40

How to adjust HI power

1. Select a TX channel. For example, select the ITU channel 401.

2. Press [TUNE/7].
   TUNE appears on the display and the coupler starts tuning. When the tuning is completed successfully, TUNE OK appears.

3. While pressing and holding down [ENT], press [8], and HI power data appears.



4. Set power data by rotating the FREQ/CH knob.
   The data can be set to from low power data plus 1 to 255. Read the power meter, if connected, while pressing the PTT switch and whistling or speaking into the handset.

5. Press [ENT] to register the power data.

6. Repeat steps 1 to 5 to set another power data.

Power Data vs. Output Power (50 ohm dummy load connected)

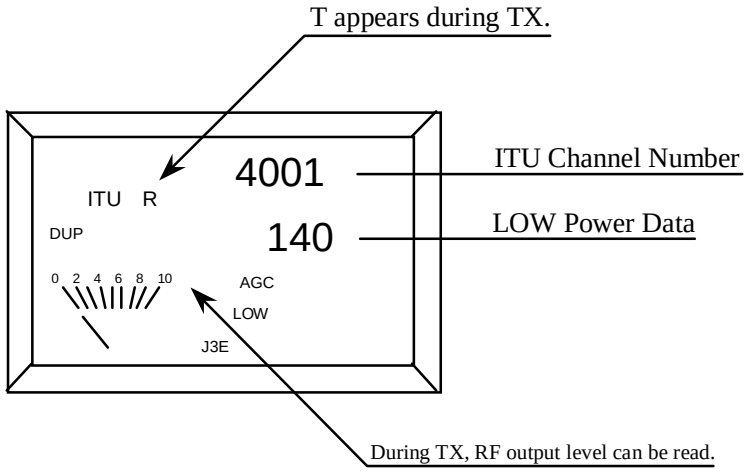
Power Data	255	240	220	200	180	160	140	120	100	80	60	40	20	10	0
Output (Wpep)	160	158	150	130	110	90	72	58	45	34	24	16	8	5	3

How to adjust LOW power

1. Select a TX channel. For example, select the ITU channel 401.

2. Press [TUNE/7].
   TUNE appears on the display and the coupler starts tuning. When the tuning is completed successfully, TUNE OK appears.

3. While pressing and holding down [ENT], press [9], and LOW power data appears.



4. Set power data by rotating the FREQ/CH knob. The data can be set to from 0 to HI power data minus 1. Read the power meter, if connected, while pressing the PTT switch and whistling or speaking into the handset.

5. Press [ENT] to register the power data.

6. Repeat steps 1 to 5 to set another power data.

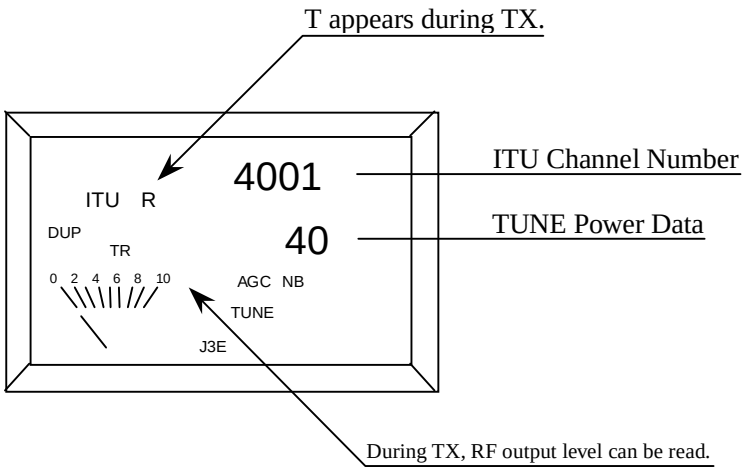
How to adjust TUNE power

Tune power data is factory-adjusted to 40. Do not change this setting unless Furuno asks you to change this setting. Too high setting may cause the antenna coupler to burn out.

1. Select a TX channel. For example, select the ITU channel 401.

2. Press [TUNE/7].
   TUNE appears on the display and the coupler starts tuning. When the tuning is completed successfully, TUNE OK appears.

3. While pressing and holding down [ENT], press [TUNE/7], and TUNE power data appears.



4. Set power data by rotating the FREQ/CH knob.
   The data can be set to from 0 to 60.

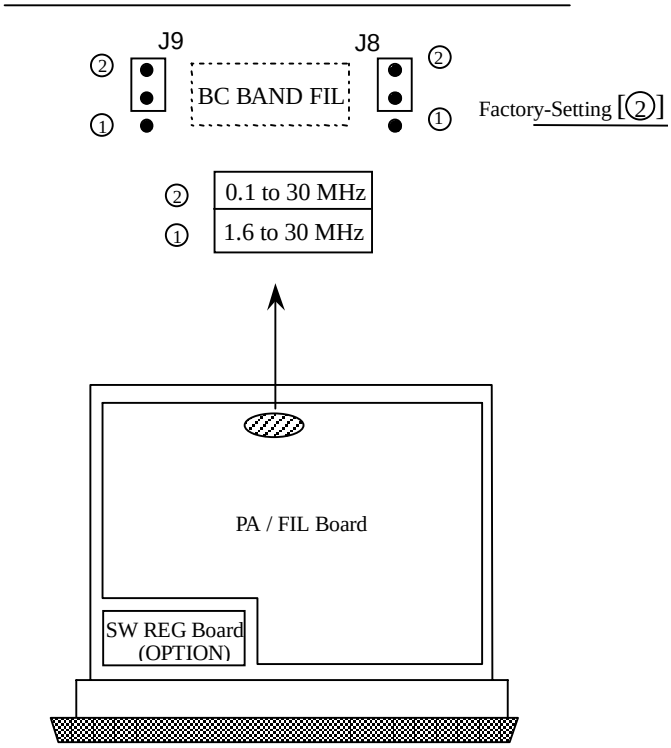
5. Press [ENT] to register the power data.

4.5 BC Band Filter Setting

If MF/HF band is interfered with broadcast(BC) band, change jumper settings J8 and J9 from "2" to "1."

Position "1": Receiving frequency range from 1.6 MHz to 30 MHz

Position "2": Receiving frequency range from 0.1 MHz to 30 MHz



1.6 MHz HPF (High Pass Filter) is added on the receiving line with jumpers 8 and 9 set to "2".

4.6 Setting for NBDP (DP-6)

When the NBDP DP-6 is connected to the radiotelephone, the following setting must be carried out.

Setting on DP-6

1. On the DP-6, press [F6], and enter the password for system setting. The setting must be as below.

- Slave Delay 5 msec
- BK Timing Pre Tone 10 msec
- Post Tone 0 msec
- Mute Timing Pre BK 0 msec
- Post BK 0 msec
- Modem Output Lervel 0 dBm
- MIF Tune ON
- Freeze ON or OFF
- AGC ON
- Emission ON

[F6] System Setup Menu

System

	Set up	Lock	Change	Default
*	Slave Delay	5	msec (0 - 50msec)	
*	BK Timing Pre Tone	10	msec (0 - 100msec)	
*	Post Tone	0	msec (0 - 20msec)	
*	Mute Timing Pre BK	0	msec (0 - 20msec)	
*	Post BK	0	msec (0 - 20msec)	
*	Mdem Output Level	0	dBm (-30 - +10 dBm)	
*	MIF Tune	OFF	ON	
*	Freeze	OFF	ON	
*	AGC	OFF	ON	
*	Emission	OFF	ON	
	TX/RX MSG Save	OFF	ON	
	Edit Before Sending	OFF	ON	
	Timer System	OFF	UTC STM JST	
	Time & Date			
	Display Mode	Normal Reverse		
	Self Test			

2. Press [F5] and enter the answerback code and the ID.

Setting on FS-1503

· 9908 (TLX usage): 0 (TX/RX)

· 9909 (TLX RX bandwidth): 1 (Narrow) -------- Optional 0.4 kHz filter required

· 9910 (System delay): 10 msec

· 9921 (THRU signal to couper): 0 (Limited)

· 9924 (Remote signal format): 0 (MIF)

Chapter 5 Maintenance

DANGER

Electrical Shock Hazard:
This equipment contains high voltages which can cause death at several internal circuits. Any internal adjustment, servicing and repair shall only be perfomed by qualified service personnel totally familiar with electrical circuits and servicing of the equipment. A residual charge remains in capacitors and other devices several minutes after turning off the power.
It is therefore essential to wait at least 3 minutes to allow residual charge to subside before acceessing the inside of the equipment.

5.1 Periodical Checks

Regular maintenance is important for good performance. Before performing any maintenance, turn off the power.

1) Cleaning of the display

Use a soft cloth with a slight amount of anti-static-charge spray. Do not use thinner and benzene for cleaning.

2) Connections

Check connections on the main unit and the antenna coupler for loose connections. Poor grounding on the antenna coupler decreases the output power from the antenna. The connectors inside the unit are also checked at least every half year.

3) Insulators

Check for damage and salt deposits. Remove salt deposits with fresh water. Replace damaged insulators.

4) Water leakage

Check the antenna coupler for water leakage.

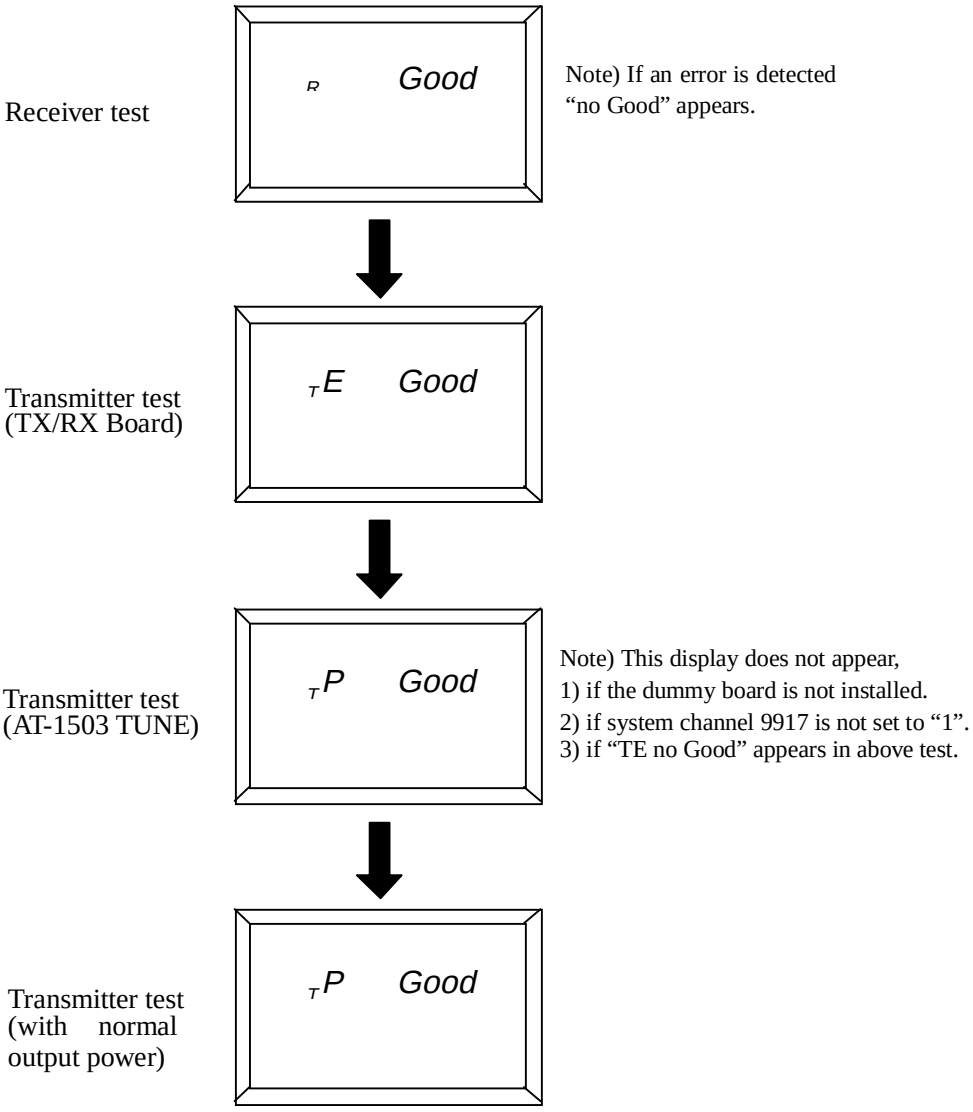
5.2 Self-test

Both the main unit and the antenna coupler contain a self-test facility which can check them for proper operation. The test checks transceiver circuit, LCD, keyboard, and antenna coupler.

Note) *If the dummy board is not fitted, the test is carried out only for TX/RX board.*

Transceiver Check

1. While pressing and holding down [TX] key, turn on the power.
2. Release the hand from [TX] when all indications appear on the screen. The test commences and the display changes as follows.



The flowchart of self-test algorithm is found on the next page.

3. Turn off the power after the test completed.

Self-test Algorithm
(TX/RX Board)

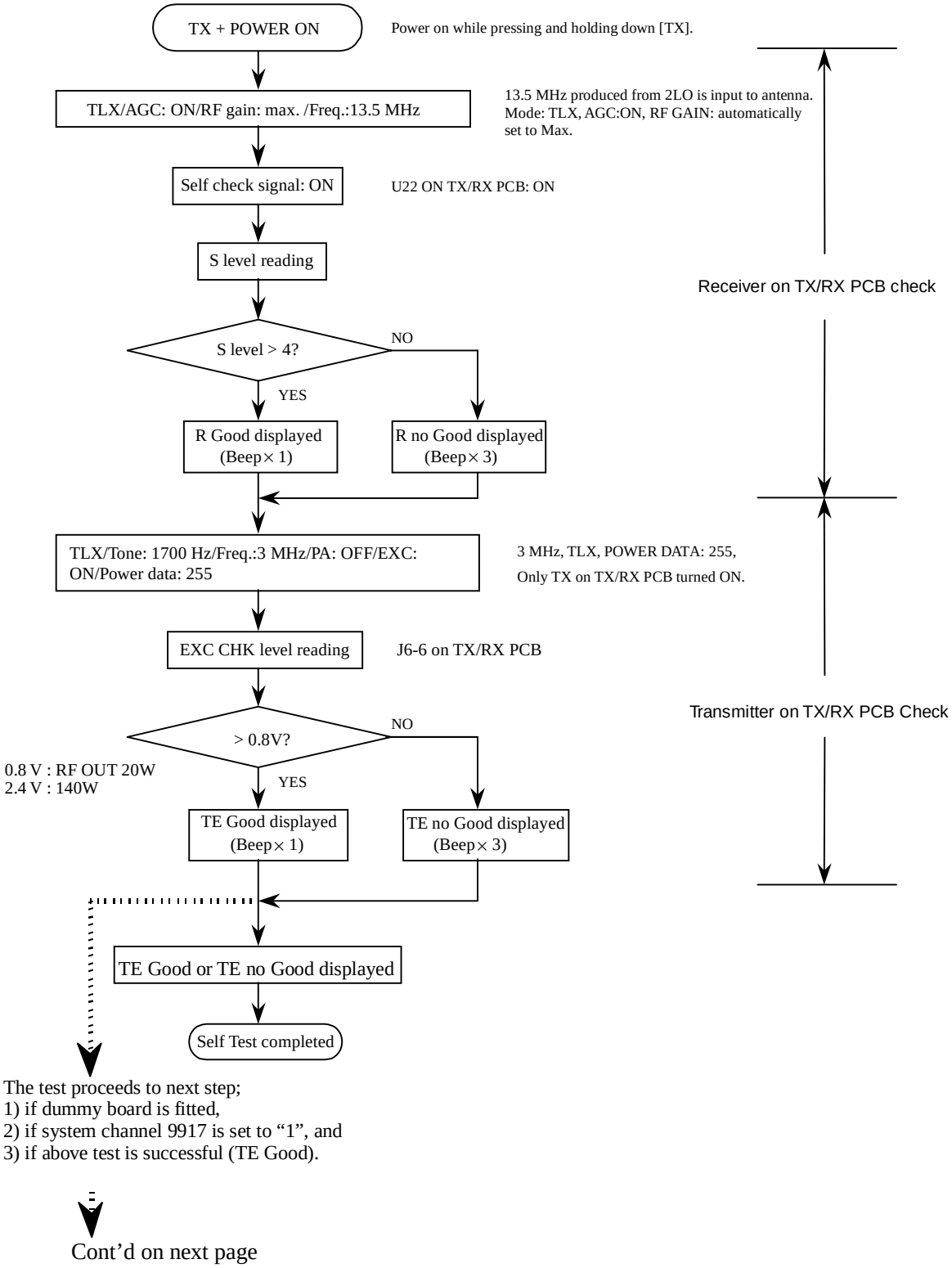


Figure 5-1 Self-Test Flow (1/2)

(PA and Antenna Coupler)

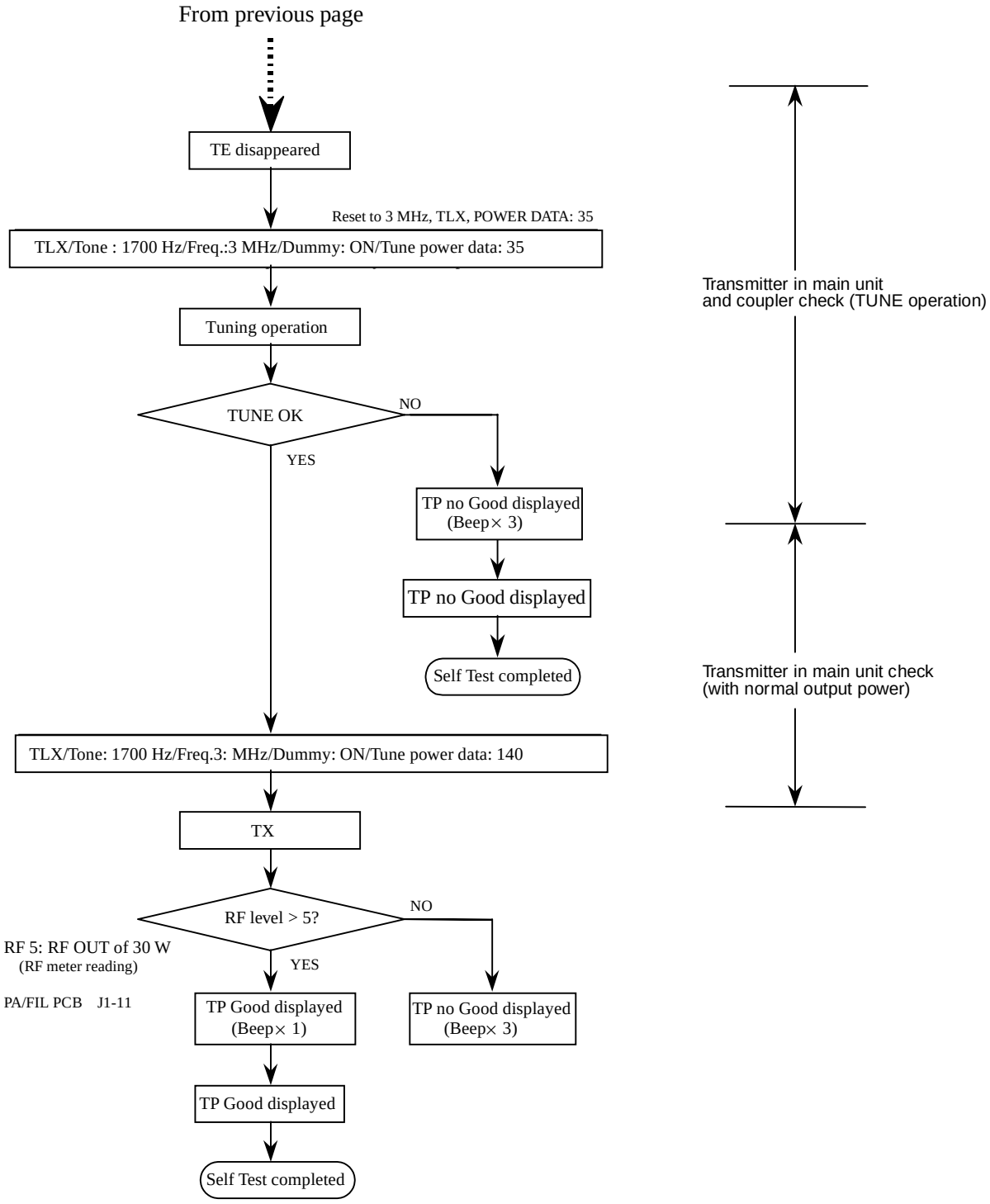


Figure 5-1 Self-Test Flow (2/2)

LCD/Keyboard Check

1. While pressing and holding down [ENT] key, turn on the power.
2. Release the hand from [ENT] when all indications appear on the screen.
3. Press each key so that the corresponding number appears on the screen. See table below. The program number plus its revision level appears on the bottom of the screen: 055019110X.

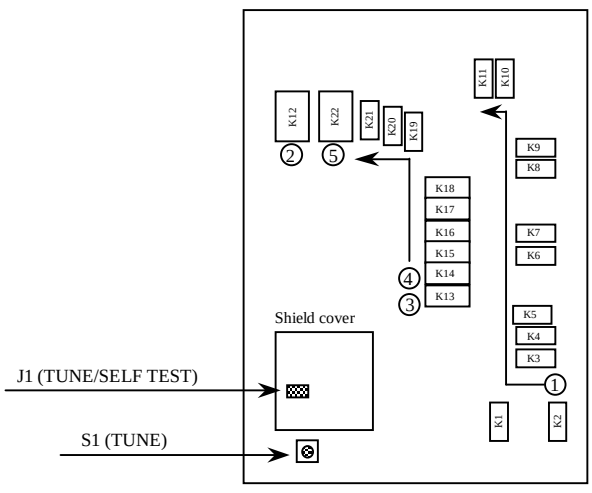
Key	MODE / 1	CURS / 2	CLARI / 3	TX
Indication	0	1	2	3
Key	/ 4	SQL / 5	SCAN / 6	RX
Indication	4	5	6	7
Key	TUNE / 7	H/L / 8	/ 9	CH
Indication	8	9	A	b
Key	2182	INT / 0	ALM	ENT
Indication	C	d	E	F

4. Turn off the power after the test.

Antenna Coupler Check

1. Remove the antenna coupler cover and shield cover inside.
2. Change the jumper J1 to "SELF TEST."
3. Press the TUNE switch in the antenna coupler.
4. All relays are turned on and off one by one as described in the figure below. At the last step, all relays are turned on and off at a time.
5. Change the jumper J1 to "TUNE."
6. Put the covers back.

AT-1503
(05O0669)



Relays are turned on and off one by one in order of number in the figure.

5.3 Troubleshooting

Table 5-1 Troubleshooting Guide List

Symptom		Possible Cause/Test		Remedy
1	No power being supplied	1	Brown in-line fuse (30A).	Replace fuse.
		2	Overvoltage protector (17 V) activated.	Check power supply for 13.6 V ± 15 %.
		3	Defective power switch. Disconnect power connector, check between J1 #1 and #2 on PA/FIL board for continuity.	Replace switch.
		4	Defective SW REG board (optional). Measure voltage between J2 #1 and #3 for 12 V (input), and between J3 #1 and #3 for 12 V (output).	If no input, replace PA/FIL board. If no output, replace SW REG board.
2	Power is shut down.	1	When getting into TX mode. Defective relay K1. Breaker F2 on PA/FIL board trips.	Replace PA/FIL board.
		2	Defective PA Transistor.	Replace PA Transistor, or PA/FIL board.
		3	When connecting BK line.	Check BK lines for correct wiring.
3	LCD blinks.	1	UNLOCK signal is detected; defective PLL.	Replace TX/RX board.
4	Nothing on LCD display	1	If 12 V is supplied to PA, F1 (4A) on PA/FIL board trips.	Check J2 (12 V line) on PA/FIL board for overload.
5	LCD display is freezed, or abnormal.	1	Loose connection on PCB. Defective flat cable on CPU board.	Check connections. Replace CPU board.
6	No key response	1	Specific key does not work. (Carry out self-test.)	Replace CPU board.
		2	All keys do not work. CR1 on CPU board does not blink.	
7	TUNE error	1	Carry out self-test.	If cannot, replace COUP board.
		2	If TUNE error appears immediately after TX, no RF signal is input to antenna coupler.	· Check coaxial cable between main unit and antenna coupler for discontinuity. · Check transmitter circuit in main unit. · Check TUNE power data for 40 (standard).
		3	If antenna coupler does not start tuning, control circuit is defective.	· Check system setting 9920. · Check control signal lines connected between main unit and antenna coupler
		4	If TUNE error occurs on specific band, antenna and/or grounding is abnormal.	Check antenna and ground wire connection. If OK, try to change antenna length.
		5	If tuning is unstable on specific band, antenna and/or grounding is abnormal, or matching relay in antenna coupler is defective.	· Check antenna and ground wire connection. If OK, try to change antenna length. · Replace COUP board.
		6	If frequency range in which TUNE error occurs is the same as that of a TX filter, TX FIL circuit is defective.	Replace PA/FIL board.

Symptom		Possible		Remedy
8	Abnormal transmission	1-1	Carry out self-test. If TE is NG, TX signal is not output from TX/RX board.	Replace TX/RX board.
		1-2	Carry out self-test. If TP is NG, TX signal is not output from PA/FIL board.	Replace PA/FIL board.
		2	Carry out self-test. If TE is good and no signal is emitted on all bands, PA transistor is defective.	Replace PA/FIL board or PA transmitter(s).
		3	Carry out self-test. If TE is good and no signal is emitted on specific band, power data is incorrect.	Check power data for 220 (standard).
9	Abnormal reception	1	Carry out self-test. If R is NG, receiver circuit on TX/RX board is defective.	Replace TX/RX board.
		2-1	If sensitivity is low on all bands, check main unit with antenna coupler disconnected. If main unit is OK, antenna coupler or antenna is defective.	Check antenna. Replace COUP board.
		2-2	If sensitivity is low on all bands, check main unit with antenna coupler disconnected. If main unit is NG, RX RF circuit is defective.	Replace TX/RX board.
		2-3	If sensitivity is low on specific band, FIL circuit on PA/FIL board is defective.	Replace PA/FIL board.
		3	Sensitivity is very low on less than 1.6 MHz.	Check jumper setting of J8/J9 for 2: 0.1 to 30 MHz.
		4	No receiving sound on specific emission mode (Defective demodulation circuit)	Replace TX/RX board.
		5	No TLX receiving sound	IF FIL (0.4 k) is not fitted on TX/RX board.
		6	No sound from either internal or external speaker	Replace the speaker.
		7	No receiving sound from both internal and external speakers (Receiver AF circuit U15 is defective.)	Replace TX/RX board.
		8	Heavy external noise.	Find noise source by turning on other equipments one at a time.

RF meter reading vs output power

RF meter reading	0	1	2	3	4	5	6	7	8	9	10	11
Output power (W)	0	+	2	10	15	30	40	50	60	67	72	75 <

5.4 Measurement

CAUTION: Do not turn any adjusters until you understand their functions. Use calibrated measuring instruments.

1. Frequency Adjustment

Note) *Allow a frequency counter for enough warm-up time.*

1. Turn on the FS-1503, and leave it for more than 3 minutes.
2. Connect a frequency counter to 2 nd Local oscillator output, TP3 (H) and TP4 (C) on the TX/RX board.
3. The reading must be 54 MHz ± 10 Hz. If not, adjust C554.

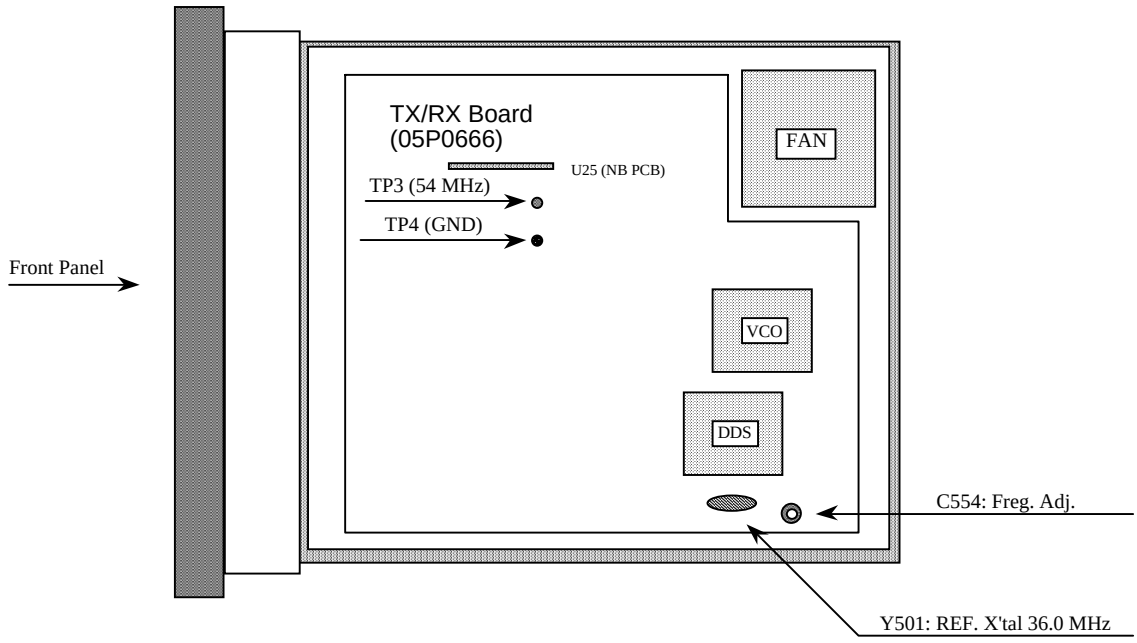


Figure 5-2 Frequency Adjustment

CAUTION: *Do not transmit during the measurement on receiver circuit, otherwise SSG may be damaged.*

2. J3E Receiver Gain

1. Make the connection as below.

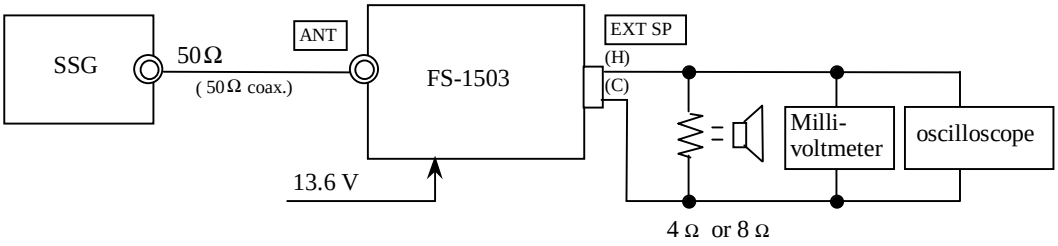


Figure 5-3 Measurement on RX Circuit

2. Set the FS-1503 as below.
   · RF GAIN: Maximum
   · RX Freq.: 4.0 MHz, MODE: J3E, AGC: on
   · AF GAIN: 50 % of rated noise output (100 mVrms for 4-ohm speaker, 200 mVrms for 8-ohm speaker)

3. Applying 4.0 MHz + 1.0 kHz signal from the SSG, adjust the SSG output level so that the ratio between AF output and noise output is 20 dB. The output should be less than 3 dBμV.
   With a 8 ohm speaker connected, the S/N is 20 dB when AF noise output is 200 mVrms and AF signal output is 2 Vrms.

3. J3E AGC Adjustment

1. Make a connection as shown in figure 5-3.

2. Set the FS-1503 as below.
   · RF GAIN: Maximum
   · RX Freq.: 4.0 MHz, MODE: J3E, AGC: on
   · AF GAIN: adequate AF output

3. Applying 4.0 MHz + 1.0 kHz signal from the SSG, adjust the SSG output level so that the S meter start deflecting. The output shoule be +10 dBμV. If not, adjust R210 on the TX/RX board.

SSG Output Level vs. S-meter Reading

SSG Output (dBμV)	10	20	30	40	50	60	70	80	90	100
S-meter	+ (1)	4	5	5 to 6	6 to 7	7	8	8 to 9	10	11

4. J3E RX Total Gain

1. Make a connection as shown in figure 5-3.

2. Set the FS-1503 as below.
   · RF GAIN: Maximum
   · RX Freq.: 4.0 MHz, MODE: J3E, AGC: on
   · AF GAIN: Maximum
3. Applying 4.0 MHz + 1.0 kHz signal from the SSG, adjust the SSG output level so that the AF output level is 1W.
   The output should be –5 to + 1dBμV.
   (Rated output; 2Vrms for 4-ohm speaker; 2.83Vrms for 8-ohm speaker)

5. J3E TX Output Power

Refer to 4.4 Power Data Setting in chapter 4 for power adjustment.

1. Make a connection as below.

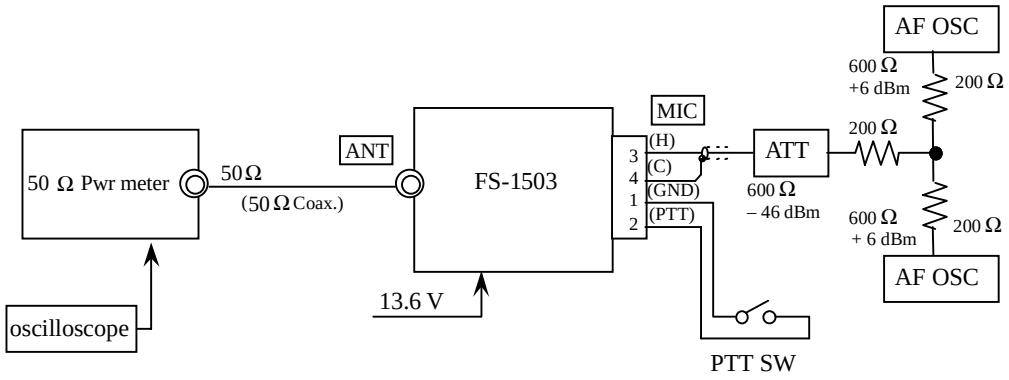


Figure 5-4 Measurement of TX output power

2. Set the measuring instrument as below.
   AF Oscillators: one for 1000 Hz and another for 1600 Hz, output level of +6 dBm
   Attenuator: 46dB or microphone input of –46 dBm

3. While pressing the PTT switch down, read the power meter. (Output power measurement with two tone signal) Double the reading for peak-to-peak power(Px).

References)

1) J2B(EIB): Power is measured by applying 0dB, 600 ohm.
2) NBDP : Measured in FEC-C mode.
3) DSC : Measured by transmitting DOT signal.

5.5 How to Change PA Transistor

CAUTION: Apply a thin coating of silicone grease to transistor 2SC3240. The grease aids the transfer of heat from the transistor to the chassis. Before wiring, transistor must be fixed to the chassis securely.

The PA bias must be checked after replacing the PA transistor.

1. Disconnect "PA IN" connector.
2. Make a open circuit on FL3 and connect a DC current meter.
3. While pressing the PTT switch down, adjust R39, PA BIAS so that the meter reads 450 to 550 mA.

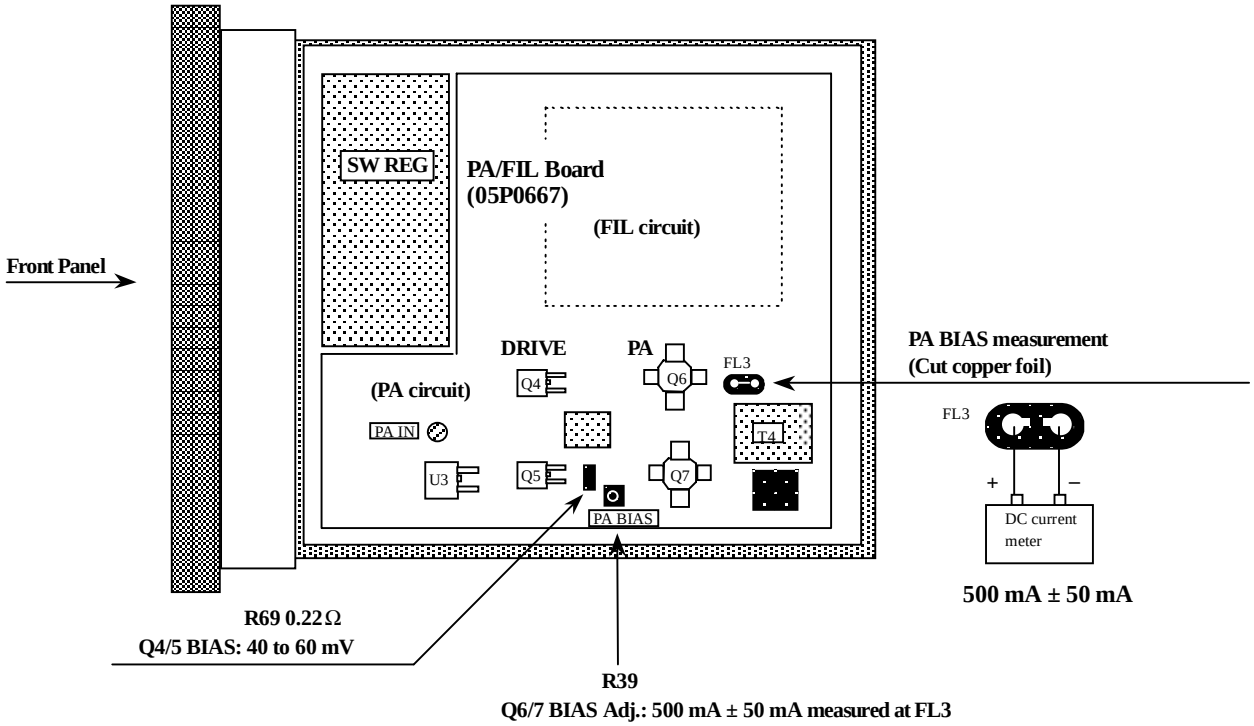


Figure 5-5 PA Circuit

Collector bias of Q4 and Q5 measured across R69, 0.22 ohm is 40 to 60 mA normally.

5.6 Measurements and Adjustment

CAUTION: Do not turn any adjusters until you understand their functions. The measuring instruments must be calibrated before using.

⚠ DANGER

Electrical Shock Hazard:

This equipment contains high voltages which can cause death at several internal circuits. Any internal adjustment, servicing and repair shall only be perfomed by qualified service personnel totally familiar with electrical circuits and servicing of the equipment. A residual charge remains in capacitors and other devices several minutes after turning off the power.

It is therefore essential to wait at least 3 minutes to allow residual charge to subside before acceessing the inside of the equipment.

1. Adjustment

Table 5-2 Adjustment (1/2)

Board	Item	Setting	Adjuster	Check Point	Level	Remarks
PA/FIL (050667)	Overvoltage protector	Input voltage: 17.0 to 18.5 V	-	-	Power: off	
	PA temperature	Temperature: 25 °C	-	J1 #7 (H) and 9 (C)	1.0 ± 0.1 V	
	DRIVE TR (Q4/Q5) BIAS	Disconnect [EXC IN], PTT ON	-	R69	40 to 60 mV	
	PA TR (Q6/Q7) BIAS	Disconnect [EXC IN], PTT ON	R39	FL3	500 mA ± 50 mA	
CPU (05P0665)	Contrast Adj.	-	R1	TP1 (H) and TP2 (C)	3.3 ± 0.05 V	Use high Z voltmeter.
SW REG (05P0668)	Output power Adj.	Input voltage: 13.6 V	R15	J2 #1 (H) and 3 (C)	13.0 V	Optional
	Oscillation Freq Adj.	Input voltage: 13.6 V	-	TP1 (H) and TP2 (C)	170 kHz ± 20 kHz (22 Vpp)	
COUP (05P0669)	Phase Det. Balance Adj.	-	R24	-	Mid. point	May be changed to fixed resistor

Table 5-2 Adjustment (2/2)

Board	Item	Setting	Adjuster	Check Point	Level	Remarks
TX/RX (05P0666)	OSC Circuit					
	Ref. OSC, Frequency	30 minutes after power-on	C554	TP3 (H) - TP4 (C)	54 MHz ± 1 Hz 1.1 Vp-p to 1.5 Vp-p	2Lo output (54 MHz)
	3rd Local OSC.	MODE: J3E	-	TP7 (H) - TP6 (C)	more than 1.0 Vp-p	456.5 kHz
	1st Local OSC.	MODE: TLX	-	TP1 (H) - TP2 (C)	0.8 Vp-p to 1.2 Vp-p	Fo + 54.455 kHz
	RX circuit					
	S-meter	RX SIG: 4 MHz/J3E	R210	S meter	+10 dBμV	SSG Level
	S/N Ratio	RX SIG: 4 MHz/J3E RF GAIN MAX/AGC ON	-	-	+2 dBμV ??	SSG Level (S/N = 20 dB)
	Total Gain	RX SIG: 4 MHz/J3E FR/AF GAIN MAX/AGC ON	-	-	+1 to -5 dBμV	SSG Level (AF output of 1 W)
	NB Function	External pulse noise mixed		CR11/12 (A) - GND	Negative pulse	
	LINE OUT Level	RX SIG: 4 MHz/TLX RF GAIN MAX/ AGC ON		REMOTE Connector 10 (H) -11 (C)	+3 to +9 dBm	600 Ω Load
	TX Circuit					
	MIC GAIN	MIC IN: 600 Ω/ -40 dBm/1500 Hz	-	TP8 (H) - TP9 (C)	1.6 ± 0.2 Vp-p	
	TX GAIN Adjustment	MIC IN: 600 Ω/ -40 dBm/1500 Hz	R156	TP5 (H)- TP6 (C)	0.4 Vp-p	
		MIC IN: 600 Ω / -54 dBm/1500 Hz 4 MHz/J3E/P.Data: 220	R156	Output from main unit	40 W	
	Output Level	2-TONE ALM: [ALM] + [ENT] 4 MHz/J3E/P.Data: 220	-	J2 (EXC OUT)	about 20 Vp-p	OUT 50 Ω Load
	H3E MOD Adjustment	MIC IN: -40 dBm/ 600 Ω /1500 Hz 2182 kHz/ H3E/P.Data: 200	R101	Output from main unit	100 % MOD	
	LINE IN Level	LINE IN: 0 dBm/ 1700 Hz 4 MHz/ TLX/ P.Data: 220	-	J2 (EXC OUT)	about 20 Vp-p	OUT 50 Ω Load

⚠ DANGER

Electrical Shock Hazard:

This equipment contains high voltages which can cause death at several internal circuits. Any internal adjustment, servicing and repair shall only be perfomed by qualified service personnel totally familiar with electrical circuits and servicing of the equipment. A residual charge remains in capacitors and other devices several minutes after turning off the power.

It is therefore essential to wait at least 3 minutes to allow residual charge to subside before acceessing the inside of the equipment.

2. Measurement

*Setting	Details
A	MIC IN: -40 dBm/1500 Hz/600 Ω, 4 MHz/J3E/Power Data 220
B	PTT ON (No AF signal)
C	Receiving mode
D	SSG: 100 dBμV/50 Ω, 4MHz/J3E
E	MIC IN: -40 dBm/1500 Hz/600 Ω, 4 MHz/J3E/Low Power Data 140

Table 5-3 Measurements (1/2)

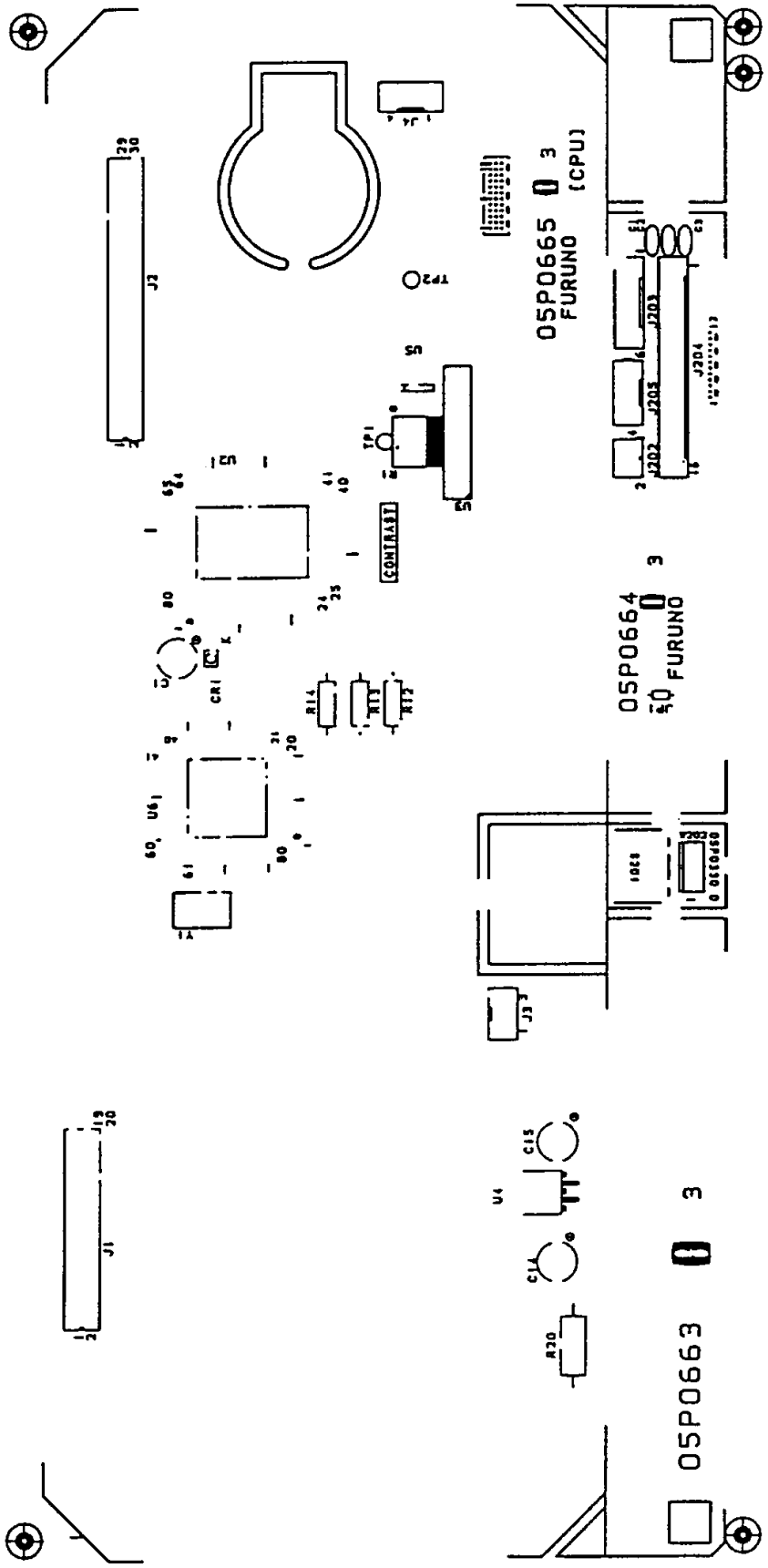
Board Name	Check Points	*Setting	Reading	Remarks
PA/FIL (05P0667)	T1 Input	A	14 Vp-p	[PA IN]: J4
	Q4/5: B-GND	A	2 Vp-p	DRIVE (2SC3133)
	C-GND		15 Vp-p	
	Q4/5: B-GND	B	0.68 Vdc	
	C-GND		13 Vdc	
	Q6/7: B-GND	A	4 Vp-p	PA (2SC3240)
	C-GND		25 Vp-p	
	Q6/7: B-GND	B	0.6 +Vdc	
	C-GND		13 Vdc	
	C33 OUT	A	250 Vp-p	PA OUT
	ANT	A	250 -Vp-p	50 Ω Load
	J1 #10 (ALC)	A	4.2 Vdc	ALC CONT
	U1-1 (Gate)	C	2.3 Vdc	Overvoltage protector (Input: 13.6 V)

Table 5-3 Measurements (2/2)

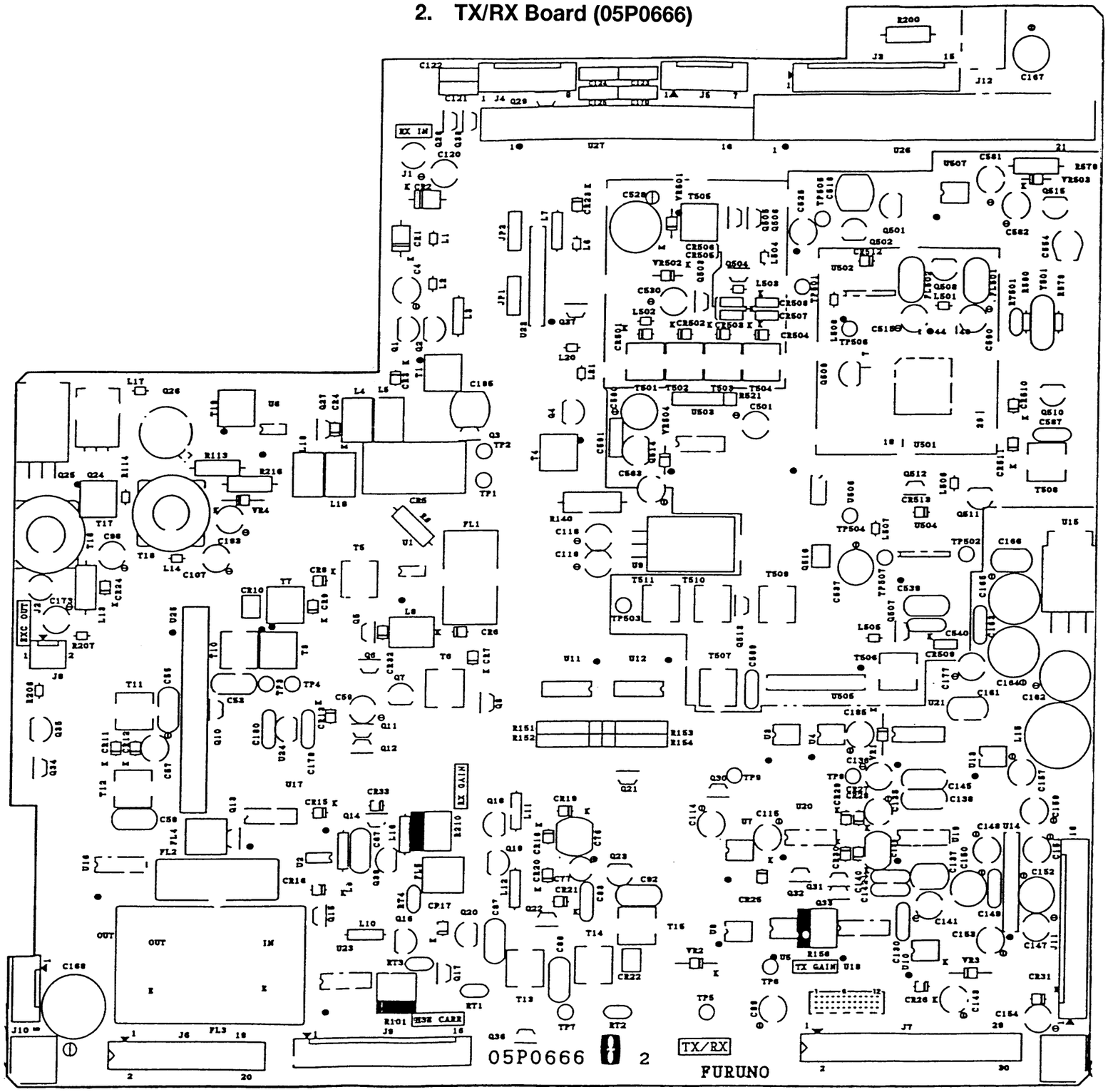
Board Name	Check Points	*Setting	Reading	Remarks
TX/RX (05P0666)	TX Circuit			
	EXC OUT	A	14 Vp-p	PA connected
	CHK EXC	A	2.4 Vdc	CR24-K
	Q25: B-GND	A	0.5 Vp-p	2SC3133
	C-GND		15 Vp-p	
	Q25: B-GND	B	0.65 Vdc	
	C-GND		13 Vdc	
	TP5 - TP6	A	0.65 Vp-p	1 MIX MOD AF Input
	TP8 - TP9		13 Vp-p	MIC Input
	OSC Circuit			
	TP1 - TP2	C	0.8 Vp-p	1 Lo (Fo + 54.455 MHz)
	TP3 - TP4	C	1.1 Vp-p	2 Lo (54 MHz)
	TP7 - TP6	C	1.0 Vp-p	3 Lo (456.5 kHz)
	RX Circuit			
	Q1/2: D-GND	D	1.2 Vp-p	RX RF FET (2SK937)
	S-GND		0.11 Vp-p	
	Q1/2: D-GND	C	13 Vdc	RX RF FET (2SK937)
	S-GND	C	2 Vdc	
	U3-7	RF VR MAX to MIN	4.2 Vdc to 5.6 Vdc	AGC
	U15-1	D	1.2 Vdc	AF Power AMP (TDA2003H) *Use high Z voltmeter.
	-2		0.8 Vdc	
	-3		0 Vdc	
	-4		6.0 Vdc	
	-5		13 Vdc	
SW REG (05P668)	TP1 - TP2	Input: 13.6 V	22 Vp-p	170 kHz
	Q1: G-TP2		14 Vp-p	2SK1266 (GATE)

5.7 Location of Parts

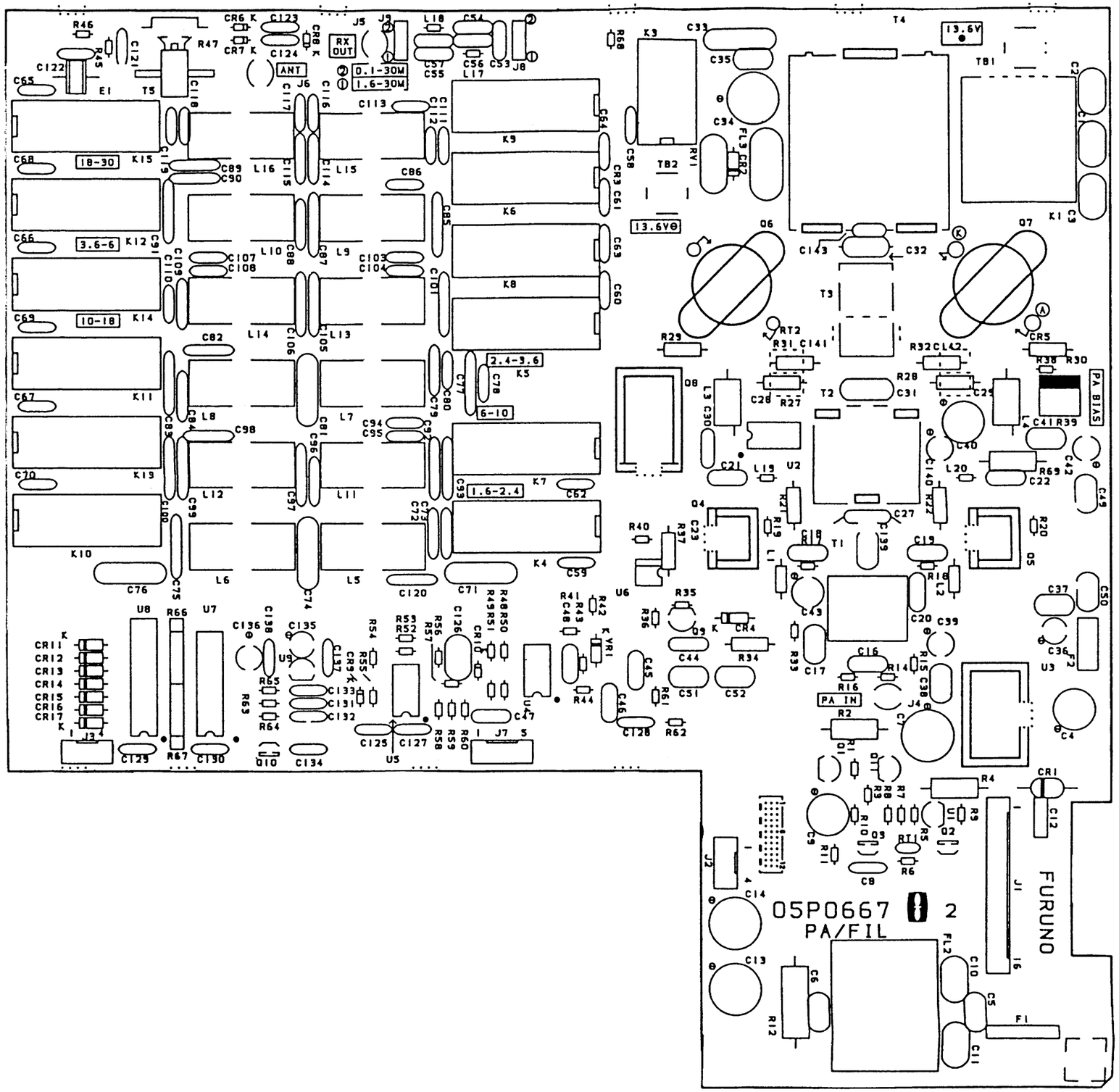
1. CPU Board (05P0665)



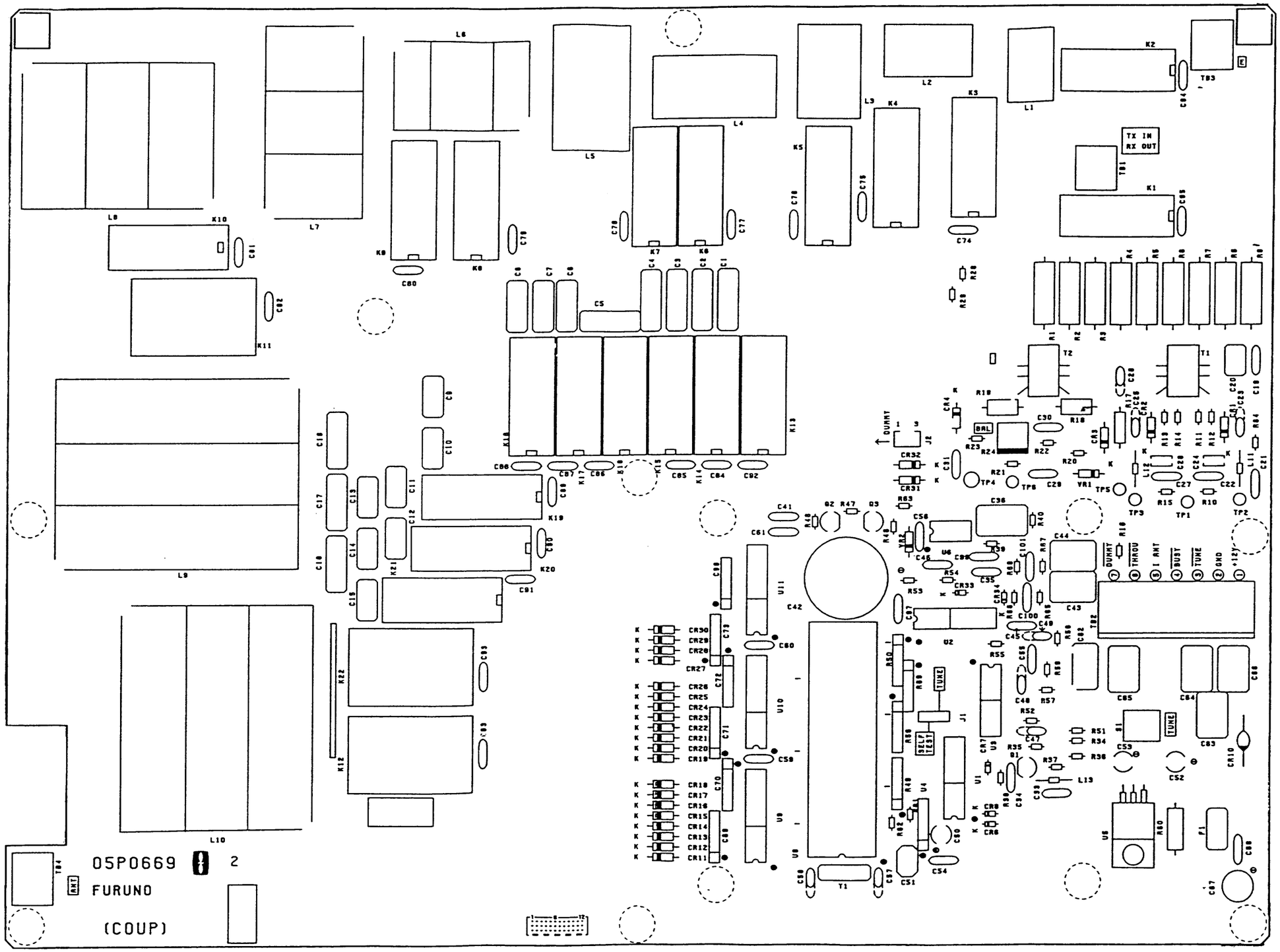
2. TX/RX Board (05P0666)



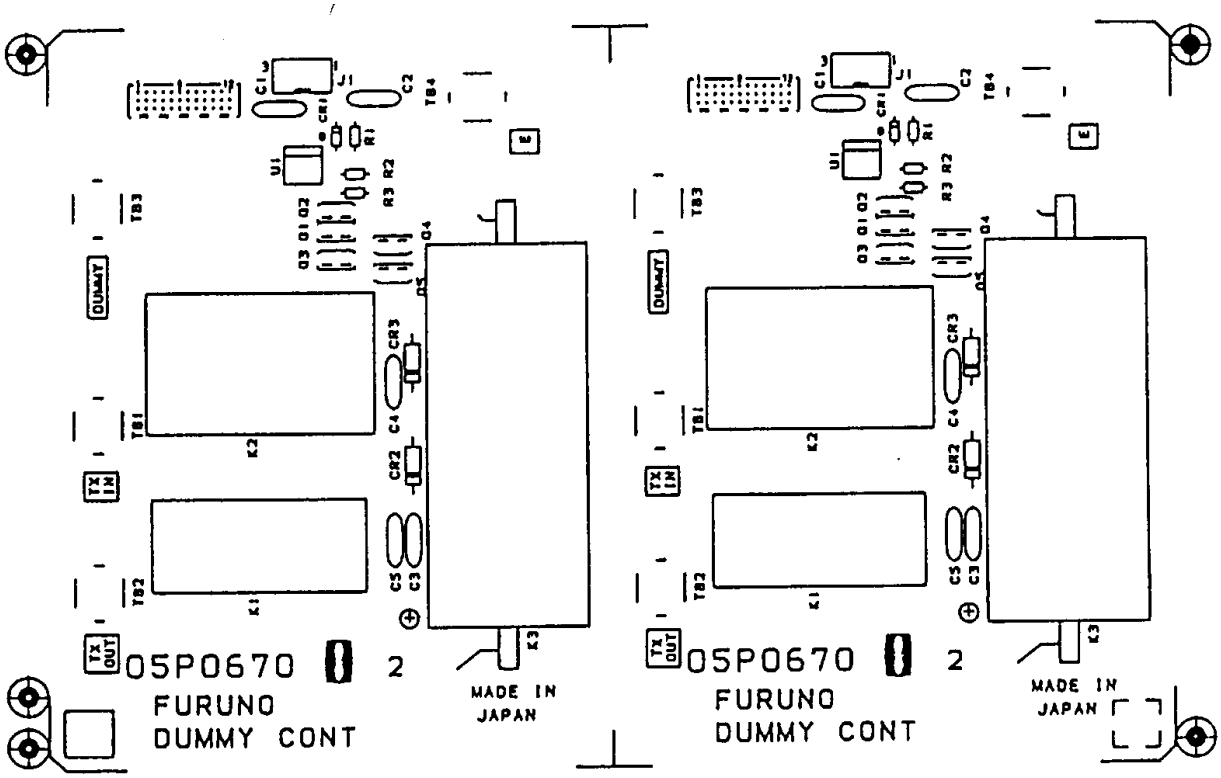
3. PA/FIL Board (05P0667)



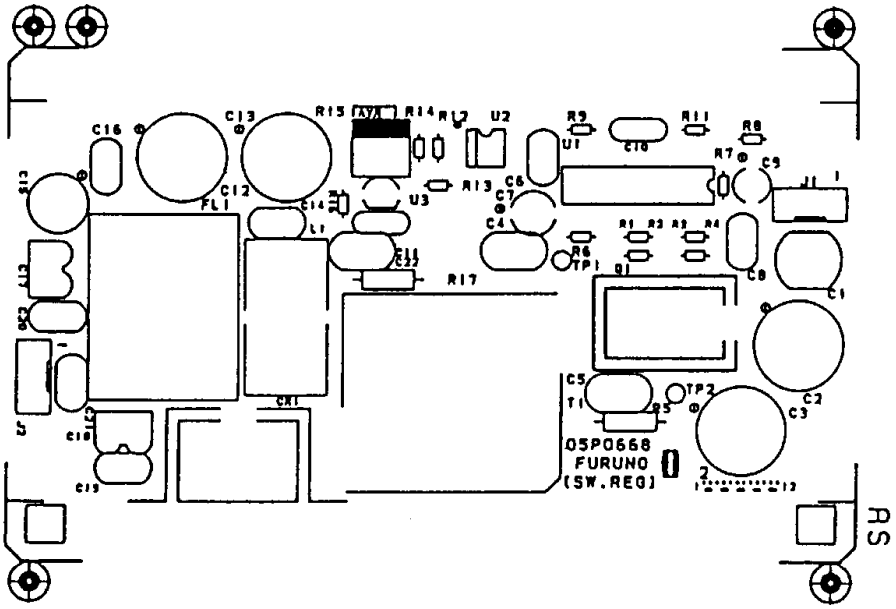
4. COUP Board (05P0669)



5. DUMMY CONT Board (05P0670): Optional



6. SW REG Board (05P068): Optional



Specifications

1. GENERAL

(1)	Communication System	Simplex or semi-duplex
(2)	Frequency Range	1.6 to 27.5 MHz (transmit) 0.1 to 29.9 MHz (receive)
(3)	Frequency Resolution	Transmit: 100 Hz Receive: 10 Hz
	Class of Emission	J3E , H3E, J2B, F3C(receive only)
(4)	Frequency Stability	Within ±10 Hz
(5)	Number of Channels	199 semi-duplex or simplex channels max., presettable Factory preset ITU SSB, Telex, USA SSB channels 2182 kHz (single action)
(6)	Frequency Selection	Key or dial encoder
(7)	Dimmer	Illumination for keyboard and LCD (four levels include off)
(8)	Display	Channel number, frequency, class of emission, status of controls, signal strength, transceiver output level, station number
(9)	I/O Connection	Standard: microphone, external antenna coupler, external speaker RC-232C port for connecting DP-6 NBDP Terminal (option) Current loop port for connecting RB-500 Remote Station / DB-500 distributor (option)

2. RECEIVER

(1)	Receiving System	Double-conversion superheterodyne IF: 54.455 MHz and 455 kHz
(2)	Sensitivity	Input level at 50 ohms to produce SINAD 20 dB J3E: 3 dBμV (1.4μV) H3E: 17 dBμV (7.1μV)
(3)	Selectivity	2.4 kHz at -6 dB (J3E) 4.5 kHz at -60 dB (J3E)
(4)	Spurious Response	Better than 70 dB
(5)	Intermodulation	Better than 80 dB
(6)	Audio Output	1 W rated into internal speaker 3.5 W max. into external 4 ohm speaker
(7)	Other Features	RF Gain: Adjustable Squelch: ON/OFF, Activated by voice/signal level Dimmer: High/Medium/Low/Off AGC: ON/OFF Noise blanker: ON/OFF, system setting available

3. TRANSMITTER

(1)	Output Impedance	50 ohms
(2)	RF Output Power	J3E/H3E: 150 W pep (greater than 75 W pep for 23 to 27.5 MHz) F1B/J2B: 100 W (greater than 50 W for 23 to 27.5 MHz) Tune: 10 W approx.
(3)	Power Reduction	60 to 70 W pep
(4)	Controls	Output HI/LOW, test/send of two-tone alarm generator (optional dummy load required), 2182 kHz single action key

4. ANTENNA COUPLER

(1)	Tuning System	CPU controlled fully automatic tuning system
(2)	Frequency Range	1.6 to 27.5 MHz
(3)	Input Impedance	50 ohms
(4)	Antenna Required	6 to 15 m wire or whip
(5)	Power Capability	150 W pep, 75 W continuous
(6)	Tuning Power	10 W
(7)	VSWR	Less than 1.5
(8)	Tuning Time	Within 2 to 15 seconds Within 0.5 seconds on pretuned bands
(9)	Dummy Load	Internal (10 ohms + 250 pF), optional supply
(10)	Power Requirement	12 VDC 0.6 A (supplied from transceiver)
(11)	Construction	Waterproof plastic cabinet, stainless steel mount

5. DIMENSIONS AND MASS

See Outline Drawings

6. POWER SUPPLY & POWER CONSUMPTION

(1)	Power Supply	13.6 VDC +/- 15% (floating ground requires optional SW REG Board on negative ground)
(2)	Power Consumption	Receive: 1.5 A Transmit speech: 18 A Transmit (max.): 30 A

7. ENVIRONMENTAL CONDITION

(1)	Ambient Temperature	Transceiver: -20 °C to 55 °C Antenna coupler: -30 °C to 70 °C
(2)	Relative Humidity	Transceiver: 93 % at 40 °C

	Antenna coupler: 95% at 40 °C
(3) Waterproof	Transceiver: IPX-4 (Panel), IPX-2 (Chassis)
	Antenna unit: IPX-6

8. COATING COLOR

(1) Transceiver Unit	Chassis: 2.5GY 5/1.5 Newtone No.5
	Panel: N-3.0
(2) Antenna Coupler	White

APPENDIX

CUSTOM CHANNELS/FREQUENCIES

Where permitted user may program both Tx and Rx frequencies or Rx frequencies; Tx frequencies to be programmed by FURUNO dealer.

CH NO	Ship Receive (kHz)	Ship Transmit (kHz)	Remarks (Station name)

MF band working carrier frequencies - ref. US CFR 47 Part 80.371

Region	Ship Receive (kHz)	Ship Transmit (kHz)
East Coast	2490.0	2031.5
	2514.0	2118.0
	2522.0	2126.0
	2538.0	2142.0
	2558.0	2166.0
	2590.0	2198.0
	2450.0	2366.0
	2482.0	2382.0
	2566.0	2390.0
	2400.0	2400.0
	2506.0	2406.0
West Coast	2450.0	2003.0
	2442.0	2009.0
	2566.0	2009.0
	2566.0	2031.5
	2522.0	2126.0
	2598.0	2206.0
	2466.0	2382.0
	2482.0	2430.0

Region	Ship Receive (kHz)	Ship Transmit (kHz)
Gulf Coast	2466.0	2009.0
	2530.0	2134.0
	2538.0	2142.0
	2550.0	2158.0 [1]
	2558.0	2166.0
	2598.0	2206.0
	2450.0	2366.0
	2482.0	2382.0
	2572.0	2430.0
	2506.0	2458.0
Great Lakes [2]	2514.0	2118.0
	2550.0	2158.0
	2582.0	2206.0
Alaska	2309.0	2131.0
	2312.0	2134.0
	2400.0	2240.0
Hawaii	2530.0	2134.0
Caribbean	2506.0	2009.0
	2585.0	2086.0 [3]
	2530.0	2134.0
Guam	2506.0	2009.0

Above is not factory programmed, should be programmed by Furuno representatives.

1 Unlimited use December 15 to April 1
2 2206 kHz for distress only.
3 Limited to pep of 150 W.

NOTE: [1] to [3] indicate the outline only. Refer to the relative documentation for full detail. For other coast stations, consult with your dealers.

MF band SSB working carrier frequencies

CH NO	Ship Receive (kHz)	Ship Transmit (kHz)
241	1635	2060
242	1638	2063
243	1641	2066
244	1644	2069
245	1647	2072
246	1650	2075
247	1653	2078
248	1656	2081
249	1659	2084
250	1662	2087
251	1665	2090
252	1668	2093
253	1671	2096
254	1674	2099
255	1677	2102
256	1680	2105
257	1683	2108
258	1686	2111
259	1689	2114
260	1692	2117
261	1695	2120
262	1698	2123
263	1701	2126
264	1704	2129
265	1707	2132
266	1710	2135
267	1713	2138
268	1716	2060
269	1719	2063
270	1722	2066

CH NO	Ship Receive (kHz)	Ship Transmit (kHz)
271	1725	2069
272	1728	2072
273	1731	2075
274	1734	2078
275	1737	2081
276	1740	2084
277	1743	2087
278	1746	2090
279	1749	2093
280	1752	2096
281	1755	2099
282	1758	2102
283	1761	2105
284	1764	2108
285	1767	2111
286	1770	2114
287	1773	2117
288	1776	2120
289	1779	2123
290	1782	2126
291	1785	2129
292	1788	2132
293	1791	2135
294	1794	2138
295	1797	2060

Change of system setting required to use above channels. Ask a FURUNO dealer. Above is factory programmed. A channel can be recalled by hitting the keys [CH], [2], [4], [1], [ENT] for channel 241 as an example. The channel number and Rx frequencies appear on the display. The channel number is displayed in 4 digits, such as 2041. (Additional zero is inserted automatically.) The Tx frequency and Rx frequency are checked by pressing the [ENT] key.

4/6 MHz ITU SSB carrier frequencies (ITU RR APPENDIX 16)

The following frequencies are factory programmed.

4 MHz SSB (J3E)		
ITU CH NO	Ship RX	Ship TX
401	4357	4065
402	4360	4068
403	4363	4071
404	4366	4074
405	4369	4077
406	4372	4080
407	4375	4083
408	4378	4086
409	4381	4089
410	4384	4092
411	4387	4095
412	4390	4098
413	4393	4101
414	4396	4104
415	4399	4107
416	4402	4110
417	4405	4113
418	4408	4116
419	4411	4119
420	4414	4122
421	4417	4125
422	4420	4128
423	4423	4131
424	4426	4134
425	4429	4137
426	4432	4140
427	4435	4143
428	4351	4351
429	4354	4354
430	4146	4146
431	4149	4149
432 (01)	4000	4000
433 (02)	4003	4003
434 (03)	4006	4006
435 (04)	4009	4009
436 (05)	4012	4012
437 (06)	4015	4015
438 (07)	4018	4018
439 (08)	4021	4021
440 (09)	4024	4024
441 (10)	4027	4027
442 (11)	4030	4030
443 (12)	4033	4033
444 (13)	4036	4036
445 (14)	4039	4039
446 (15)	4042	4042
447 (16)	4045	4045
448 (17)	4048	4048
449 (18)	4051	4051
450 (19)	4054	4054
451 (20)	4057	4057
452 (21)	4060	4060

6 MHz SSB (J3E)		
ITU CH NO	Ship RX	Ship TX
601	6501	6200
602	6504	6203
603	6507	6206
604	6510	6209
605	6513	6212
606	6516	6215
607	6519	6218
608	6522	6221
609	6224	6224
610	6227	6227
611	6230	6230

A channel can be recalled by hitting the keys [CH], [4], [0], [1], [ENT] for CH 401 as an example.
Channel number and Rx frequency appear on the display. The CH NO is displayed in 4 digits such as 4001. To see Tx frequency and Rx frequency, press [ENT].

CH NOs in ( ) are ITU NOs (RR Section C-1). Use 3-digit FURUNO's designators for selections.

8 MHz ITU SSB carrier frequencies (ITU RR APPENDIX 16)

The following frequencies are factory programmed.

8 MHz SSB (J3E)		
ITU CH NO	Ship RX	Ship TX
801	8719	8195
802	8722	8198
803	8725	8201
804	8728	8204
805	8731	8207
806	8734	8210
807	8737	8213
808	8740	8216
809	8743	8219
810	8746	8222
811	8749	8225
812	8752	8228
813	8755	8231
814	8758	8234
815	8761	8237
816	8764	8240
817	8767	8243
818	8770	8246
819	8773	8249
820	8776	8252
821	8779	8255
822	8782	8258
823	8785	8261
824	8788	8264
825	8791	8267
826	8794	8270
827	8797	8273
828	8800	8276
829	8803	8279
830	8806	8282
831	8809	8285
832	8812	8288
833	8291	8291
834	8707	8707
835	8710	8710
836	8713	8713
837	8716	8716
838	8294	8294
839	8297	8297

8 MHz SSB (J3E)		
(ITU CH NO)	Ship RX	Ship TX
840 (01)	8101	8101
841 (02)	8104	8104
842 (03)	8107	8107
843 (04)	8110	8110
844 (05)	8113	8113
845 (06)	8116	8116
846 (07)	8119	8119
847 (08)	8122	8122
848 (09)	8125	8125
849 (10)	8128	8128
850 (11)	8131	8131
851 (12)	8134	8134
852 (13)	8137	8137
853 (14)	8140	8140
854 (15)	8143	8143
855 (16)	8146	8146
856 (17)	8149	8149
857 (18)	8152	8152
858 (19)	8155	8155
859 (20)	8158	8158
860 (21)	8161	8161

CH NOs in ( ) are ITU NOs (RR Section C-1).
Use 3-digit Furuno's designators for selection in this radiotelephone.

A channel can be recalled by hitting the keys [CH], [8], [0], [1], [ENT] for channel 801 as an example. CH NO and Rx frequency appear on the display. The channel number is displayed in 4 digits, such as 8001. (Additional zero is inserted automatically.) The Tx frequency and Rx frequency are checked by pressing the [ENT] key.

12/16 MHz ITU SSB carrier frequencies (ITU RR APPENDIX 16)

12 MHz SSB (J3E)		
CH NO.	SHIP RX	SHIP TX
1201	13077	12230
1202	13080	12233
1203	13083	12236
1204	13086	12239
1205	13089	12242
1206	13092	12245
1207	13095	12248
1208	13098	12251
1209	13101	12254
1210	13104	12257
1211	13107	12260
1212	13110	12263
1213	13113	12266
1214	13116	12269
1215	13119	12272
1216	13122	12275
1217	13125	12278
1218	13128	12281
1219	13131	12284
1220	13134	12287
1221	13137	12290
1222	13140	12293
1223	13143	12296
1224	13146	12299
1225	13149	12302
1226	13152	12305
1227	13155	12308
1228	13158	12311
1229	13161	12314
1230	13164	12317
1231	13167	12320
1232	13170	12323
1233	13173	12326
1234	13176	12329
1235	13179	12332
1236	13182	12335
1237	13185	12338
1238	13188	12341
1239	13191	12344
1240	13194	12347
1241	13197	12350
1242	12353	12353
1243	12356	12356
1244	12359	12359
1245	12362	12362
1246	12365	12365

16 MHz SSB (J3E)		
CH NO.	SHIP RX	SHIP TX
1601	17242	16360
1602	17245	16363
1603	17248	16366
1604	17251	16369
1605	17254	16372
1606	17257	16375
1607	17260	16378
1608	17263	16381
1609	17266	16384
1610	17269	16387
1611	17272	16390
1612	17275	16393
1613	17278	16396
1614	17281	16399
1615	17284	16402
1616	17287	16405
1617	17290	16408
1618	17293	16411
1619	17296	16414
1620	17299	16417
1621	17302	16420
1622	17305	16423
1623	17308	16426
1624	17311	16429
1625	17314	16432
1626	17317	16435
1627	17320	16438
1628	17323	16441
1629	17326	16444
1630	17329	16447
1631	17332	16450
1632	17335	16453
1633	17338	16456
1634	17341	16459
1635	17344	16462
1636	17347	16465
1637	17350	16468
1638	17353	16471
1639	17356	16474
1640	17359	16477
1641	17362	16480
1642	17365	16483
1643	17368	16486
1644	17371	16489
1645	17374	16492
1646	17377	16495
1647	17380	16498
1648	17383	16501
1649	17386	16504
1650	17389	16507

16 MHz SSB (J3E)		
CH NO.	SHIP RX	SHIP TX
1651	17392	16510
1652	17395	16513
1653	17398	16516
1654	17401	16519
1655	17404	16522
1656	17407	16525
1657	16528	16528
1658	16531	16531
1659	16534	16534
1660	16537	16537
1661	16540	16540
1662	16543	16543
1663	16546	16546

Above is factory programmed.

A channel can be recalled by hitting the keys [CH], [1], [2], [0], [1], [ENT] for channel 1201 as an example. CH NO and Rx frequency appear on the display. The CH NO is displayed in 5 digits, such as 12001. (Additional zero is inserted automatically.)

The Tx and Rx frequencies are checked by pressing the [ENT] key.

18/19, 22, 25/26 MHz ITU SSB carrier frequencies (ITU RR APPENDIX 16)

The following frequencies are factory programmed.

18/19 MHz SSB (J3E)		
CH NO.	SHIP RX	SHIP TX
1801	19755	18780
1802	19758	18783
1803	19761	18786
1804	19764	18789
1805	19767	18792
1806	19770	18795
1807	19773	18798
1808	19776	18801
1809	19779	18804
1810	19782	18807
1811	19785	18810
1812	19788	18813
1813	19791	18816
1814	19794	18819
1815	19797	18822
1816	18825	18825
1817	18828	18828
1818	18831	18831
1819	18834	18834
1820	18837	18837
1821	18840	18840
1822	18843	18843

A channel can be recalled by hitting the keys [CH], [1], [8], [0], [1], [ENT] for channel 1801 as an example. CH NO and Rx frequency appear on the display. The CH NO displayed in 5 digits, such as 18001. (Additional zero is inserted automatically.)

The Tx and Rx frequencies are checked by pressing the [ENT] key.

22 MHz SSB (J3E)		
CH NO.	SHIP RX	SHIP TX
2201	22696	22000
2202	22699	22003
2203	22702	22006
2204	22705	22009
2205	22708	22012
2206	22711	22015
2207	22714	22018
2208	22717	22021
2209	22720	22024
2210	22723	22027
2211	22726	22030
2212	22729	22033
2213	22732	22036
2214	22735	22039
2215	22738	22042
2216	22741	22045
2217	22744	22048
2218	22747	22051
2219	22750	22054
2220	22753	22057
2221	22756	22060
2222	22759	22063
2223	22762	22066
2224	22765	22069
2225	22768	22072
2226	22771	22075
2227	22774	22078
2228	22777	22081
2229	22780	22084
2230	22783	22087
2231	22786	22090
2232	22789	22093
2233	22792	22096
2234	22795	22099
2235	22798	22102
2236	22801	22105
2237	22804	22108
2238	22807	22111
2239	22810	22114
2240	22813	22117
2241	22816	22120
2242	22819	22123
2243	22822	22126
2244	22825	22129
2245	22828	22132
2246	22831	22135
2247	22834	22138
2248	22837	22141
2249	22840	22144
2250	22843	22147

22 MHz SSB (J3E)		
CH NO.	SHIP RX	SHIP TX
2251	22846	22150
2252	22849	22153
2253	22852	22156
2254	22159	22159
2255	22162	22162
2256	22165	22165
2257	22168	22168
2258	22171	22171
2259	22174	22174
2260	22177	22177

25/26 MHz SSB (J3E)		
CH NO	Ship RX	Ship TX
2501	26145	25070
2502	26148	25073
2503	26151	25076
2504	26154	25079
2505	26157	25082
2506	26160	25085
2507	26163	25088
2508	26166	25091
2509	26169	25094
2510	26172	25097
2511	25100	25100
2512	25103	25103
2513	25106	25106
2514	25109	25109
2515	25112	25112
2516	25115	25115
2517	25118	25118

TELEX CHANNELS

MF BAND Telex FREQUENCY TABLE

The following frequencies are factory programmed.

CH NO.	Ship Receive (NBDP, DSC)	Ship Transmit (NBDP, DSC)	
201	2142.0	1607.0	
202	2142.5	1607.5	
203	2143.0	1608.0	
204	2143.5	1608.5	
205	2144.0	1609.0	
206	2144.5	1609.5	
207	2145.0	1610.0	
208	2145.5	1610.5	
209	2146.0	1611.0	
210	2146.5	1611.5	
211	2147.0	1612.0	
212	2147.5	1612.5	
213	2148.0	1613.0	
214	2148.5	1613.5	
215	2149.0	1614.0	NBDP/DSC
216	2149.5	1614.5	
217	2150.0	1615.0	
218	2150.5	1615.5	
219	2151.0	1616.0	
220	2151.5	1616.5	
221	2152.0	1617.0	
222	2152.5	1617.5	
223	2153.0	1618.0	
224	2153.5	1618.5	
225	2154.0	1619.0	
226	2154.5	1619.5	
227	2155.0	1620.0	
228	2155.5	1620.5	
229	2156.0	1621.0	
230	2156.5	1621.5	
231	2157.0	1622.0	
232	2157.5	1622.5	DSC
233	2158.0	1623.0	
234	2158.5	1623.5	
235	2159.0	1624.0	
236	2159.5	1624.5	

For Europe MF frequencies selection of ITU+MF on system setting necessary. A channel can be recalled by hitting the keys [CH], [2], [0], [1], [ENT] for channel 201 as an example. CH NO and Rx frequency appear on the display. The channel number is displayed in 4 digits, such as 2001. (Additional zero is inserted automatically.) The Rx and Tx frequencies are checked by pressing the [ENT] key.

4/6 MHz BAND ITU NBDP (Telex) FREQUENCY TABLE

(ITU RR APPENDIX 32)

4 MHz TELEX		
CH NO.	SHIP RX	SHIP TX
4001	4210.5	4172.5
4002	4211.0	4173.0
4003	4211.5	4173.5
4004	4212.0	4174.0
4005	4212.5	4174.5
4006	4213.0	4175.0
4007	4213.5	4175.5
4008	4214.0	4176.0
4009	4214.5	4176.5
4010	4215.0	4177.0
4011	4177.5	4177.5
4012	4215.5	4178.0
4013	4216.0	4178.5
4014	4216.5	4179.0
4015	4217.0	4179.5
4016	4217.5	4180.0
4017	4218.0	4180.5
4018	4218.5	4181.0
4019	4219.0	4181.5
4020	4202.5	4202.5
4021	4203.0	4203.0
4022	4203.5	4203.5
4023	4204.0	4204.0
4024	4204.5	4204.5
4025	4205.0	4205.0
4026	4205.5	4205.5
4027	4206.0	4206.0
4028	4206.5	4206.5
4029	4207.0	4207.0
4030	4207.5	4207.5
4031	4219.5	4208.0
4032	4220.0	4208.5
4033	4220.5	4209.0

6 MHz TELEX		
CH NO.	SHIP RX	SHIP TX
6001	6314.5	6263.0
6002	6315.0	6263.5
6003	6315.5	6264.0
6004	6316.0	6264.5
6005	6316.5	6265.0
6006	6317.0	6265.5
6007	6317.5	6266.0
6008	6318.0	6266.5
6009	6318.5	6267.0
6010	6319.0	6267.5
6011	6268.0	6268.0
6012	6319.5	6268.5
6013	6320.0	6269.0
6014	6320.5	6269.5
6015	6321.0	6270.0
6016	6321.5	6270.5
6017	6322.0	6271.0
6018	6322.5	6271.5
6019	6323.0	6272.0
6020	6323.5	6272.5
6021	6324.0	6273.0
6022	6324.5	6273.5
6023	6325.0	6274.0
6024	6325.5	6274.5
6025	6326.0	6275.0
6026	6326.5	6275.5
6027	6327.0	6281.0
6028	6327.5	6281.5
6029	6328.0	6282.0
6030	6328.5	6282.5
6031	6329.0	6283.0
6032	6329.5	6283.5
6033	6330.0	6284.0
6034	6330.5	6284.5
6035	6300.5	6300.5
6036	6301.0	6301.0
6037	6301.5	6301.5
6038	6302.0	6302.0
6039	6302.5	6302.5
6040	6303.0	6303.0

6 MHz TELEX		
CH NO.	SHIP RX	SHIP TX
6041	6303.5	6303.5
6042	6304.0	6304.0
6043	6304.5	6304.5
6044	6305.0	6305.0
6045	6305.5	6305.5
6046	6306.0	6306.0
6047	6306.5	6306.5
6048	6307.0	6307.0
6049	6307.5	6307.5
6050	6308.0	6308.0
6051	6308.5	6308.5
6052	6309.0	6309.0
6053	6309.5	6309.5
6054	6310.0	6310.0
6055	6310.5	6310.5
6056	6311.0	6311.0
6057	6311.5	6311.5
6058	6312.0	6312.0
6059	6331.0	6312.5
6060	6331.5	6313.0
6061	6332.0	6313.5

Above is factory programmed.

8 MHz BAND ITU NBDP (Telex) FREQUENCY TABLE

(ITU RR APPENDIX 32)

8 MHz TELEX		
CH NO.	SHIP RX	SHIP TX
8001	8376.5	8376.5
8002	8417.0	8377.0
8003	8417.5	8377.5
8004	8418.0	8378.0
8005	8418.5	8378.5
8006	8419.0	8379.0
8007	8419.5	8379.5
8008	8420.0	8380.0
8009	8420.5	8380.5
8010	8421.0	8381.0
8011	8421.5	8381.5
8012	8422.0	8382.0
8013	8422.5	8382.5
8014	8423.0	8383.0
8015	8423.5	8383.5
8016	8424.0	8384.0
8017	8424.5	8384.5
8018	8425.0	8385.0
8019	8425.5	8385.5
8020	8426.0	8386.0
8021	8426.5	8386.5
8022	8427.0	8387.0
8023	8427.5	8387.5
8024	8428.0	8388.0
8025	8428.5	8388.5
8026	8429.0	8389.0
8027	8429.5	8389.5
8028	8430.0	8390.0
8029	8430.5	8390.5
8030	8431.0	8391.0
8031	8431.5	8391.5
8032	8432.0	8392.0
8033	8432.5	8392.5
8034	8433.0	8393.0
8035	8433.5	8393.5
8036	8434.0	8394.0
8037	8434.5	8394.5
8038	8435.0	8395.0
8039	8435.5	8395.5
8040	8436.0	8396.0
8041	8396.5	8396.5
8042	8397.0	8397.0
8043	8397.5	8397.5
8044	8398.0	8398.0
8045	8398.5	8398.5

8 MHz TELEX		
CH NO.	SHIP RX	SHIP TX
8046	8399.0	8399.0
8047	8399.5	8399.5
8048	8400.0	8400.0
8049	8400.5	8400.5
8050	8401.0	8401.0
8051	8401.5	8401.5
8052	8402.0	8402.0
8053	8402.5	8402.5
8054	8403.0	8403.0
8055	8403.5	8403.5
8056	8404.0	8404.0
8057	8404.5	8404.5
8058	8405.0	8405.0
8059	8405.5	8405.5
8060	8406.0	8406.0
8061	8406.5	8406.5
8062	8407.0	8407.0
8063	8407.5	8407.5
8064	8408.0	8408.0
8065	8408.5	8408.5
8066	8409.0	8409.0
8067	8409.5	8409.5
8068	8410.0	8410.0
8069	8410.5	8410.5
8070	8411.0	8411.0
8071	8411.5	8411.5
8072	8412.0	8412.0
8073	8412.5	8412.5
8074	8413.0	8413.0
8075	8413.5	8413.5
8076	8414.0	8414.0
8077	8414.5	8414.5
8078	8436.5	8415.0
8079	8437.0	8415.5
8080	8437.5	8416.0

Above is factory programmed.

12 MHz BAND ITU NBDP (Telex) FREQUENCY TABLE

The following frequencies are factory programmed.

12 MHz TELEX		
CH NO.	SHIP RX	SHIP TX
12001	12579.5	12477.0
12002	12580.0	12477.5
12003	12580.5	12478.0
12004	12581.0	12478.5
12005	12581.5	12479.0
12006	12582.0	12479.5
12007	12582.5	12480.0
12008	12583.0	12480.5
12009	12583.5	12481.0
12010	12584.0	12481.5
12011	12584.5	12482.0
12012	12585.0	12482.5
12013	12585.5	12483.0
12014	12586.0	12483.5
12015	12586.5	12484.0
12016	12587.0	12484.5
12017	12587.5	12485.0
12018	12588.0	12485.5
12019	12588.5	12486.0
12020	12589.0	12486.5
12021	12589.5	12487.0
12022	12590.0	12487.5
12023	12590.5	12488.0
12024	12591.0	12488.5
12025	12591.5	12489.0
12026	12592.0	12489.5
12027	12592.5	12490.0
12028	12593.0	12490.5
12029	12593.5	12491.0
12030	12594.0	12491.5
12031	12594.5	12492.0
12032	12595.0	12492.5
12033	12595.5	12493.0
12034	12596.0	12493.5
12035	12596.5	12494.0
12036	12597.0	12494.5
12037	12597.5	12495.0
12038	12598.0	12495.5
12039	12598.5	12496.0
12040	12599.0	12496.5
12041	12599.5	12497.0
12042	12600.0	12497.5
12043	12600.5	12498.0
12044	12601.0	12498.5
12045	12601.5	12499.0
12046	12602.0	12499.5
12047	12602.5	12500.0
12048	12603.0	12500.5
12049	12603.5	12501.0
12050	12604.0	12501.5
12051	12604.5	12502.0
12052	12605.0	12502.5
12053	12605.5	12503.0
12054	12606.0	12503.5
12055	12606.5	12504.0

12 MHz TELEX		
CH NO.	SHIP RX	SHIP TX
12056	12607.0	12504.5
12057	12607.5	12505.0
12058	12608.0	12505.5
12059	12608.5	12506.0
12060	12609.0	12506.5
12061	12609.5	12507.0
12062	12610.0	12507.5
12063	12610.5	12508.0
12064	12611.0	12508.5
12065	12611.5	12509.0
12066	12612.0	12509.5
12067	12612.5	12510.0
12068	12613.0	12510.5
12069	12613.5	12511.0
12070	12614.0	12511.5
12071	12614.5	12512.0
12072	12615.0	12512.5
12073	12615.5	12513.0
12074	12616.0	12513.5
12075	12616.5	12514.0
12076	12617.0	12514.5
12077	12617.5	12515.0
12078	12618.0	12515.5
12079	12618.5	12516.0
12080	12619.0	12516.5
12081	12619.5	12517.0
12082	12620.0	12517.5
12083	12620.5	12518.0
12084	12621.0	12518.5
12085	12621.5	12519.0
12086	12622.0	12519.5
12087	12520.0	12520.0
12088	12622.5	12520.5
12089	12623.0	12521.0
12090	12623.5	12521.5
12091	12624.0	12522.0
12092	12624.5	12522.5
12093	12625.0	12523.0
12094	12625.5	12523.5
12095	12626.0	12524.0
12096	12626.5	12524.5
12097	12627.0	12525.0
12098	12627.5	12525.5
12099	12628.0	12526.0
12100	12628.5	12526.5
12101	12629.0	12527.0
12102	12629.5	12527.5
12103	12630.0	12528.0
12104	12630.5	12528.5
12105	12631.0	12529.0
12106	12631.5	12529.5
12107	12632.0	12530.0
12108	12632.5	12530.5
12109	12633.0	12531.0
12110	12633.5	12531.5

12 MHz TELEX		
CH NO.	SHIP RX	SHIP TX
12111	12634.0	12532.0
12112	12634.5	12532.5
12113	12635.0	12533.0
12114	12635.5	12533.5
12115	12636.0	12534.0
12116	12636.5	12534.5
12117	12637.0	12535.0
12118	12637.5	12535.5
12119	12638.0	12536.0
12120	12638.5	12536.5
12121	12639.0	12537.0
12122	12639.5	12537.5
12123	12640.0	12538.0
12124	12640.5	12538.5
12125	12641.0	12539.0
12126	12641.5	12539.5
12127	12642.0	12540.0
12128	12642.5	12540.5
12129	12643.0	12541.0
12130	12643.5	12541.5
12131	12644.0	12542.0
12132	12644.5	12542.5
12133	12645.0	12543.0
12134	12645.5	12543.5
12135	12646.0	12544.0
12136	12646.5	12544.5
12137	12647.0	12545.0
12138	12647.5	12545.5
12139	12648.0	12546.0
12140	12648.5	12546.5
12141	12649.0	12547.0
12142	12649.5	12547.5
12143	12650.0	12548.0
12144	12650.5	12548.5
12145	12651.0	12549.0
12146	12651.5	12549.5
12147	12652.0	12555.0
12148	12652.5	12555.5
12149	12653.0	12556.0
12150	12653.5	12556.5
12151	12654.0	12557.0
12152	12654.5	12557.5
12153	12655.0	12558.0
12154	12655.5	12558.5
12155	12656.0	12559.0
12156	12656.5	12559.5
12157	12560.0	12560.0
12158	12560.5	12560.5
12159	12561.0	12561.0
12160	12561.5	12561.5
12161	12562.0	12562.0
12162	12562.5	12562.5
12163	12563.0	12563.0
12164	12563.5	12563.5
12165	12564.0	12564.0

12/16 MHz BAND ITU NBDP (Telex) FREQUENCY TABLE

The following frequencies are factory programmed.

12 MHz TELEX		
CH NO.	SHIP RX	SHIP TX
12166	12564.5	12564.5
12167	12565.0	12565.0
12168	12565.5	12565.5
12169	12566.0	12566.0
12170	12566.5	12566.5
12171	12567.0	12567.0
12172	12567.5	12567.5
12173	12568.0	12568.0
12174	12568.5	12568.5
12175	12569.0	12569.0
12176	12569.5	12569.5
12177	12570.0	12570.0
12178	12570.5	12570.5
12179	12571.0	12571.0
12180	12571.5	12571.5
12181	12572.0	12572.0
12182	12572.5	12572.5
12183	12573.0	12573.0
12184	12573.5	12573.5
12185	12574.0	12574.0
12186	12574.5	12574.5
12187	12575.0	12575.0
12188	12575.5	12575.5
12189	12576.0	12576.0
12190	12576.5	12576.5
12191	12577.0	12577.0
12192	12577.5	12577.5
12193	12578.0	12578.0
12194	12578.5	12578.5

16 MHz TELEX		
CH NO.	SHIP RX	SHIP TX
16001	16807.0	16683.5
16002	16807.5	16684.0
16003	16808.0	16684.5
16004	16808.5	16685.0
16005	16809.0	16685.5
16006	16809.5	16686.0
16007	16810.0	16686.5
16008	16810.5	16687.0
16009	16811.0	16687.5
16010	16811.5	16688.0
16011	16812.0	16688.5
16012	16812.5	16689.0
16013	16813.0	16689.5
16014	16813.5	16690.0
16015	16814.0	16690.5
16016	16814.5	16691.0
16017	16815.0	16691.5
16018	16815.5	16692.0
16019	16816.0	16692.5
16020	16816.5	16693.0
16021	16817.0	16693.5
16022	16817.5	16694.0
16023	16818.0	16694.5
16024	16695.0	16695.0
16025	16818.5	16695.5
16026	16819.0	16696.0
16027	16819.5	16696.5
16028	16820.0	16697.0
16029	16820.5	16697.5
16030	16821.0	16698.0
16031	16821.5	16698.5
16032	16822.0	16699.0
16033	16822.5	16699.5
16034	16823.0	16700.0
16035	16823.5	16700.5
16036	16824.0	16701.0
16037	16824.5	16701.5
16038	16825.0	16702.0
16039	16825.5	16702.5
16040	16826.0	16703.0
16041	16826.5	16703.5
16042	16827.0	16704.0
16043	16827.5	16704.5
16044	16828.0	16705.0
16045	16828.5	16705.5
16046	16829.0	16706.0
16047	16829.5	16706.5
16048	16830.0	16707.0
16049	16830.5	16707.5
16050	16831.0	16708.0
16051	16831.5	16708.5
16052	16832.0	16709.0
16053	16832.5	16709.5
16054	16833.0	16710.0
16055	16833.5	16710.5

16 MHz TELEX		
CH NO.	SHIP RX	SHIP TX
16056	16834.0	16711.0
16057	16834.5	16711.5
16058	16835.0	16712.0
16059	16835.5	16712.5
16060	16836.0	16713.0
16061	16836.5	16713.5
16062	16837.0	16714.0
16063	16837.5	16714.5
16064	16838.0	16715.0
16065	16838.5	16715.5
16066	16839.0	16716.0
16067	16839.5	16716.5
16068	16840.0	16717.0
16069	16840.5	16717.5
16070	16841.0	16718.0
16071	16841.5	16718.5
16072	16842.0	16719.0
16073	16842.5	16719.5
16074	16843.0	16720.0
16075	16843.5	16720.5
16076	16844.0	16721.0
16077	16844.5	16721.5
16078	16845.0	16722.0
16079	16845.5	16722.5
16080	16846.0	16723.0
16081	16846.5	16723.5
16082	16847.0	16724.0
16083	16847.5	16724.5
16084	16848.0	16725.0
16085	16848.5	16725.5
16086	16849.0	16726.0
16087	16849.5	16726.5
16088	16850.0	16727.0
16089	16850.5	16727.5
16090	16851.0	16728.0
16091	16851.5	16728.5
16092	16852.0	16729.0
16093	16852.5	16729.5
16094	16853.0	16730.0
16095	16853.5	16730.5
16096	16854.0	16731.0
16097	16854.5	16731.5
16098	16855.0	16732.0
16099	16855.5	16732.5
16100	16856.0	16733.0
16101	16856.5	16733.5
16102	16857.0	16739.0
16103	16857.5	16739.5
16104	16858.0	16740.0
16105	16858.5	16740.5
16106	16859.0	16741.0
16107	16859.5	16741.5
16108	16860.0	16742.0
16109	16860.5	16742.5
16110	16861.0	16743.0

16 MHz BAND ITU NBDP (Telex) FREQUENCY TABLE

The following frequencies are factory programmed.

16 MHz TELEX		
CH NO.	SHIP RX	SHIP TX
16111	16861.5	16743.5
16112	16862.0	16744.0
16113	16862.5	16744.5
16114	16863.0	16745.0
16115	16863.5	16745.5
16116	16864.0	16746.0
16117	16864.5	16746.5
16118	16865.0	16747.0
16119	16865.5	16747.5
16120	16866.0	16748.0
16121	16866.5	16748.5
16122	16867.0	16749.0
16123	16867.5	16749.5
16124	16868.0	16750.0
16125	16868.5	16750.5
16126	16869.0	16751.0
16127	16869.5	16751.5
16128	16870.0	16752.0
16129	16870.5	16752.5
16130	16871.0	16753.0
16131	16871.5	16753.5
16132	16872.0	16754.0
16133	16872.5	16754.5
16134	16873.0	16755.0
16135	16873.5	16755.5
16136	16874.0	16756.0
16137	16874.5	16756.5
16138	16875.0	16757.0
16139	16875.5	16757.5
16140	16876.0	16758.0
16141	16876.5	16758.5
16142	16877.0	16759.0
16143	16877.5	16759.5
16144	16878.0	16760.0
16145	16878.5	16760.5
16146	16879.0	16761.0
16147	16879.5	16761.5
16148	16880.0	16762.0
16149	16880.5	16762.5
16150	16881.0	16763.0
16151	16881.5	16763.5
16152	16882.0	16764.0
16153	16882.5	16764.5
16154	16883.0	16765.0
16155	16883.5	16765.5
16156	16884.0	16766.0
16157	16884.5	16766.5
16158	16885.0	16767.0
16159	16885.5	16767.5
16160	16886.0	16768.0
16161	16886.5	16768.5
16162	16887.0	16769.0
16163	16887.5	16769.5
16164	16888.0	16770.0
16165	16888.5	16770.5

16 MHz TELEX		
CH NO.	SHIP RX	SHIP TX
16166	16889.0	16771.0
16167	16889.5	16771.5
16168	16890.0	16772.0
16169	16890.5	16772.5
16170	16891.0	16773.0
16171	16891.5	16773.5
16172	16892.0	16774.0
16173	16892.5	16774.5
16174	16893.0	16775.0
16175	16893.5	16775.5
16176	16894.0	16776.0
16177	16894.5	16776.5
16178	16895.0	16777.0
16179	16895.5	16777.5
16180	16896.0	16778.0
16181	16896.5	16778.5
16182	16897.0	16779.0
16183	16897.5	16779.5
16184	16898.0	16780.0
16185	16898.5	16780.5
16186	16899.0	16781.0
16187	16899.5	16781.5
16188	16900.0	16782.0
16189	16900.5	16782.5
16190	16901.0	16783.0
16191	16901.5	16783.5
16192	16902.0	16784.0
16193	16902.5	16784.5
16194	16785.0	16785.0
16195	16785.5	16785.5
16196	16786.0	16786.0
16197	16786.5	16786.5
16198	16787.0	16787.0
16199	16787.5	16787.5
16200	16788.0	16788.0
16201	16788.5	16788.5
16202	16789.0	16789.0
16203	16789.5	16789.5
16204	16790.0	16790.0
16205	16790.5	16790.5
16206	16791.0	16791.0
16207	16791.5	16791.5
16208	16792.0	16792.0
16209	16792.5	16792.5
16210	16793.0	16793.0
16211	16793.5	16793.5
16212	16794.0	16794.0
16213	16794.5	16794.5
16214	16795.0	16795.0
16215	16795.5	16795.5
16216	16796.0	16796.0
16217	16796.5	16796.5
16218	16797.0	16797.0
16219	16797.5	16797.5
16220	16798.0	16798.0

16 MHz TELEX		
CH NO.	SHIP RX	SHIP TX
16221	16798.5	16798.5
16222	16799.0	16799.0
16223	16799.5	16799.5
16224	16800.0	16800.0
16225	16800.5	16800.5
16226	16801.0	16801.0
16227	16801.5	16801.5
16228	16802.0	16802.0
16229	16802.5	16802.5
16230	16803.0	16803.0
16231	16803.5	16803.5
16232	16804.0	16804.0
16233	16804.5	16804.5
16234	16805.0	16805.0
16235	16805.5	16805.5
16236	16806.0	16806.0

18/19 MHz BAND ITU NBDP (Telex) FREQUENCY TABLE

The following frequencies are factory programmed.

18/19 MHz TELEX		
CH NO.	SHIP RX	SHIP TX
18001	19681.0	18870.5
18002	19681.5	18871.0
18003	19682.0	18871.5
18004	19682.5	18872.0
18005	19683.0	18872.5
18006	19683.5	18873.0
18007	19684.0	18873.5
18008	19684.5	18874.0
18009	19685.0	18874.5
18010	19685.5	18875.0
18011	19686.0	18875.5
18012	19686.5	18876.0
18013	19687.0	18876.5
18014	19687.5	18877.0
18015	19688.0	18877.5
18016	19688.5	18878.0
18017	19689.0	18878.5
18018	19689.5	18879.0
18019	19690.0	18879.5
18020	19690.5	18880.0
18021	19691.0	18880.5
18022	19691.5	18881.0
18023	19692.0	18881.5
18024	19692.5	18882.0
18025	19693.0	18882.5
18026	19693.5	18883.0
18027	19694.0	18883.5
18028	19694.5	18884.0
18029	19695.0	18884.5
18030	19695.5	18885.0
18031	19696.0	18885.5
18032	19696.5	18886.0
18033	19697.0	18886.5
18034	19697.5	18887.0
18035	19698.0	18887.5
18036	19698.5	18888.0
18037	19699.0	18888.5
18038	19699.5	18889.0
18039	19700.0	18889.5
18040	19700.5	18890.0
18041	19701.0	18890.5
18042	19701.5	18891.0
18043	19702.0	18891.5
18044	19702.5	18892.0
18045	19703.0	18892.5
18046	18893.0	18893.0
18047	18893.5	18893.5
18048	18894.0	18894.0
18049	18894.5	18894.5
18050	18895.0	18895.0

18/19 MHz TELEX		
CH NO.	SHIP RX	SHIP TX
18051	18895.5	18895.5
18052	18896.0	18896.0
18053	18896.5	18896.5
18054	18897.0	18897.0
18055	18897.5	18897.5
18056	18898.0	18898.0
18057	18898.5	18898.5
18058	18899.0	18899.0
18059	18899.5	18899.5

22 MHz BAND ITU NBDP (Telex) FREQUENCY TABLE

The following frequencies are factory programmed.

22 MHz TELEX		
CH NO.	SHIP RX	SHIP TX
22001	22376.5	22284.5
22002	22377.0	22285.0
22003	22377.5	22285.5
22004	22378.0	22286.0
22005	22378.5	22286.5
22006	22379.0	22287.0
22007	22379.5	22287.5
22008	22380.0	22288.0
22009	22380.5	22288.5
22010	22381.0	22289.0
22011	22381.5	22289.5
22012	22382.0	22290.0
22013	22382.5	22290.5
22014	22383.0	22291.0
22015	22383.5	22291.5
22016	22384.0	22292.0
22017	22384.5	22292.5
22018	22385.0	22293.0
22019	22385.5	22293.5
22020	22386.0	22294.0
22021	22386.5	22294.5
22022	22387.0	22295.0
22023	22387.5	22295.5
22024	22388.0	22296.0
22025	22388.5	22296.5
22026	22389.0	22297.0
22027	22389.5	22297.5
22028	22390.0	22298.0
22029	22390.5	22298.5
22030	22391.0	22299.0
22031	22391.5	22299.5
22032	22392.0	22300.0
22033	22392.5	22300.5
22034	22393.0	22301.0
22035	22393.5	22301.5
22036	22394.0	22302.0
22037	22394.5	22302.5
22038	22395.0	22303.0
22039	22395.5	22303.5
22040	22396.0	22304.0
22041	22396.5	22304.5
22042	22397.0	22305.0
22043	22397.5	22305.5
22044	22398.0	22306.0
22045	22398.5	22306.5
22046	22399.0	22307.0
22047	22399.5	22307.5
22048	22400.0	22308.0
22049	22400.5	22308.5
22050	22401.0	22309.0

22 MHz TELEX		
CH NO.	SHIP RX	SHIP TX
22051	22401.5	22309.5
22052	22402.0	22310.0
22053	22402.5	22310.5
22054	22403.0	22311.0
22055	22403.5	22311.5
22056	22404.0	22312.0
22057	22404.5	22312.5
22058	22405.0	22313.0
22059	22405.5	22313.5
22060	22406.0	22314.0
22061	22406.5	22314.5
22062	22407.0	22315.0
22063	22407.5	22315.5
22064	22408.0	22316.0
22065	22408.5	22316.5
22066	22409.0	22317.0
22067	22409.5	22317.5
22068	22410.0	22318.0
22069	22410.5	22318.5
22070	22411.0	22319.0
22071	22411.5	22319.5
22072	22412.0	22320.0
22073	22412.5	22320.5
22074	22413.0	22321.0
22075	22413.5	22321.5
22076	22414.0	22322.0
22077	22414.5	22322.5
22078	22415.0	22323.0
22079	22415.5	22323.5
22080	22416.0	22324.0
22081	22416.5	22324.5
22082	22417.0	22325.0
22083	22417.5	22325.5
22084	22418.0	22326.0
22085	22418.5	22326.5
22086	22419.0	22327.0
22087	22419.5	22327.5
22088	22420.0	22328.0
22089	22420.5	22328.5
22090	22421.0	22329.0
22091	22421.5	22329.5
22092	22422.0	22330.0
22093	22422.5	22330.5
22094	22423.0	22331.0
22095	22423.5	22331.5
22096	22424.0	22332.0
22097	22424.5	22332.5
22098	22425.0	22333.0
22099	22425.5	22333.5
22100	22426.0	22334.0

22 MHz TELEX		
CH NO.	SHIP RX	SHIP TX
22101	22426.5	22334.5
22102	22427.0	22335.0
22103	22427.5	22335.5
22104	22428.0	22336.0
22105	22428.5	22336.5
22106	22429.0	22337.0
22107	22429.5	22337.5
22108	22430.0	22338.0
22109	22430.5	22338.5
22110	22431.0	22339.0
22111	22431.5	22339.5
22112	22432.0	22340.0
22113	22432.5	22340.5
22114	22433.0	22341.0
22115	22433.5	22341.5
22116	22434.0	22342.0
22117	22434.5	22342.5
22118	22435.0	22343.0
22119	22435.5	22343.5
22120	22436.0	22344.0
22121	22436.5	22344.5
22122	22437.0	22345.0
22123	22437.5	22345.5
22124	22438.0	22346.0
22125	22438.5	22346.5
22126	22439.0	22347.0
22127	22439.5	22347.5
22128	22440.0	22348.0
22129	22440.5	22348.5
22130	22441.0	22349.0
22131	22441.5	22349.5
22132	22442.0	22350.0
22133	22442.5	22350.5
22134	22443.0	22351.0
22135	22443.5	22351.5
22136	22352.0	22352.0
22137	22352.5	22352.5
22138	22353.0	22353.0
22139	22353.5	22353.5
22140	22354.0	22354.0
22141	22354.5	22354.5
22142	22355.0	22355.0
22143	22355.5	22355.5
22144	22356.0	22356.0
22145	22356.5	22356.5
22146	22357.0	22357.0
22147	22357.5	22357.5
22148	22358.0	22358.0
22149	22358.5	22358.5
22150	22359.0	22359.0

22, 25/26 MHz BAND ITU NBDP (Telex) FREQUENCY TABLE

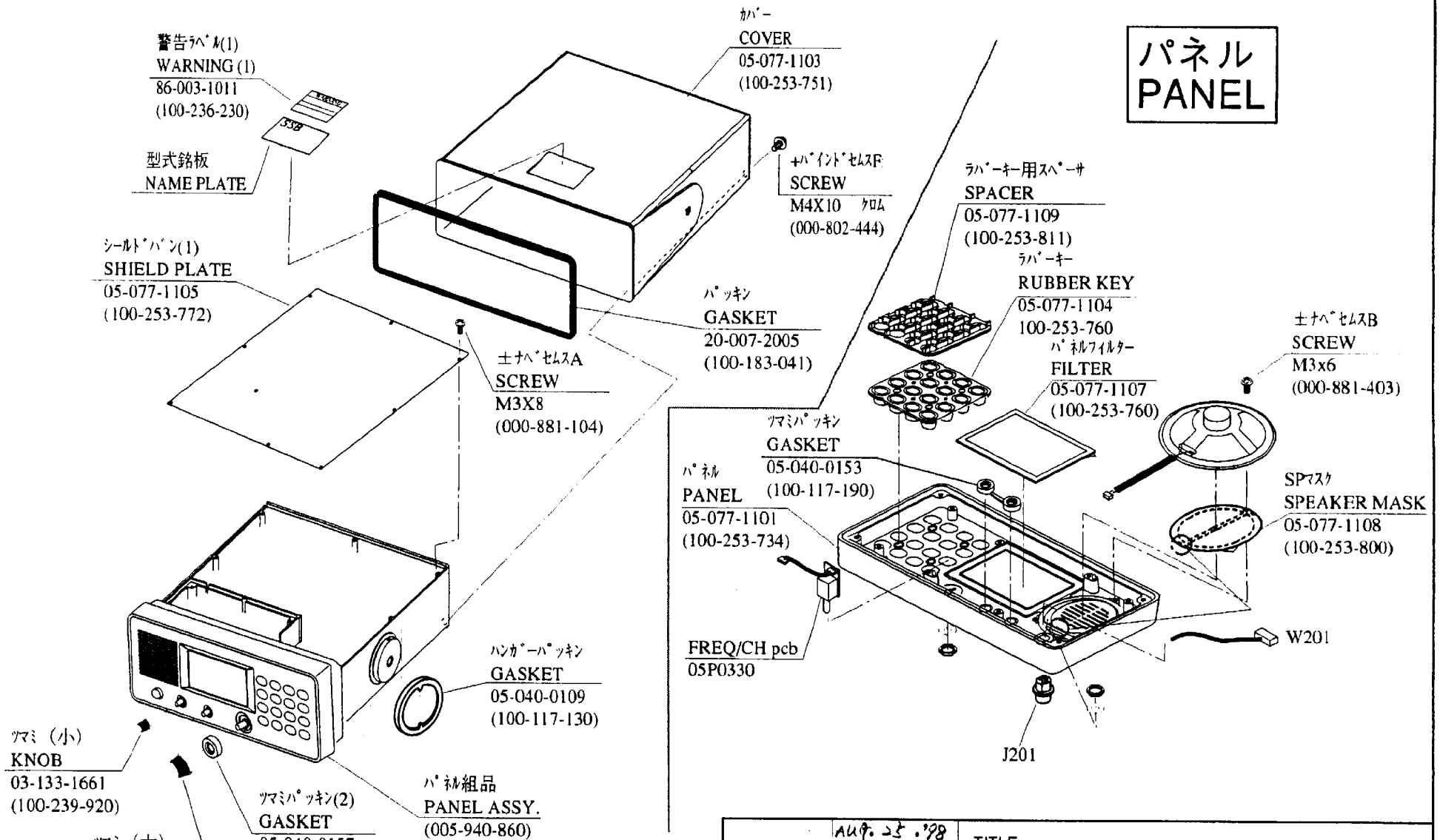
The following frequencies are factory programmed.

22 MHz TELEX		
CH NO.	SHIP RX	SHIP TX
22151	22359.5	22359.5
22152	22360.0	22360.0
22153	22360.5	22360.5
22154	22361.0	22361.0
22155	22361.5	22361.5
22156	22362.0	22362.0
22157	22362.5	22362.5
22158	22363.0	22363.0
22159	22363.5	22363.5
22160	22364.0	22364.0
22161	22364.5	22364.5
22162	22365.0	22365.0
22163	22365.5	22365.5
22164	22366.0	22366.0
22165	22366.5	22366.5
22166	22367.0	22367.0
22167	22367.5	22367.5
22168	22368.0	22368.0
22169	22368.5	22368.5
22170	22369.0	22369.0
22171	22369.5	22369.5
22172	22370.0	22370.0
22173	22370.5	22370.5
22174	22371.0	22371.0
22175	22371.5	22371.5
22176	22372.0	22372.0
22177	22372.5	22372.5
22178	22373.0	22373.0
22179	22373.5	22373.5
22180	22374.0	22374.0
22181	22374.5	22374.5
22182	22375.0	22375.0
22183	22375.5	22375.5

25/26 MHz TELEX		
CH NO.	SHIP RX	SHIP TX
25001	26101.0	25173.0
25002	26101.5	25173.5
25003	26102.0	25174.0
25004	26102.5	25174.5
25005	26103.0	25175.0
25006	26103.5	25175.5
25007	26104.0	25176.0
25008	26104.5	25176.5
25009	26105.0	25177.0
25010	26105.5	25177.5
25011	26106.0	25178.0
25012	26106.5	25178.5
25013	26107.0	25179.0
25014	26107.5	25179.5
25015	26108.0	25180.0
25016	26108.5	25180.5
25017	26109.0	25181.0
25018	26109.5	25181.5
25019	26110.0	25182.0
25020	26110.5	25182.5
25021	26111.0	25183.0
25022	26111.5	25183.5
25023	26112.0	25184.0
25024	26112.5	25184.5
25025	26113.0	25185.0
25026	26113.5	25185.5
25027	26114.0	25186.0
25028	26114.5	25186.5
25029	26115.0	25187.0
25030	26115.5	25187.5
25031	26116.0	25188.0
25032	26116.5	25188.5
25033	26117.0	25189.0
25034	26117.5	25189.5
25035	26118.0	25190.0
25036	26118.5	25190.5
25037	26119.0	25191.0
25038	26119.5	25191.5
25039	26120.0	25192.0
25040	26120.5	25192.5
25041	25193.0	25193.0
25042	25193.5	25193.5
25043	25194.0	25194.0
25044	25194.5	25194.5
25045	25195.0	25195.0
25046	25195.5	25195.5
25047	25196.0	25196.0
25048	25196.5	25196.5
25049	25197.0	25197.0
25050	25197.5	25197.5

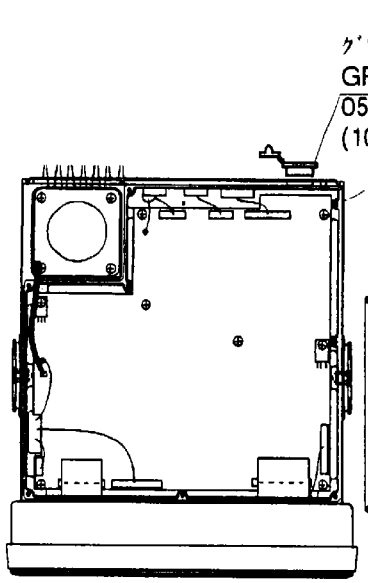
25/26 MHz TELEX		
CH NO.	SHIP RX	SHIP TX
25051	25198.0	25198.0
25052	25198.5	25198.5
25053	25199.0	25199.0
25054	25199.5	25199.5
25055	25200.0	25200.0
25056	25200.5	25200.5
25057	25201.0	25201.0
25058	25201.5	25201.5
25059	25202.0	25202.0
25060	25202.5	25202.5
25061	25203.0	25203.0
25062	25203.5	25203.5
25063	25204.0	25204.0
25064	25204.5	25204.5
25065	25205.0	25205.0
25066	25205.5	25205.5
25067	25206.0	25206.0
25068	25206.5	25206.5
25069	25207.0	25207.0
25070	25207.5	25207.5
25071	25208.0	25208.0
25072	26121.0	25208.5
25073	26121.5	25209.0
25074	26122.0	25209.5

パネル
PANEL



APPROVED	AUG. 25 '98 S.KOIZUMI	TITLE	本体展開図 1/2 MAIN UNIT 1/2
CHECKED	AUG. 25 '98 TAKAHASHI	FS-1503	
DRAWN	AUG. 25 '98 E.MIYOSHI	DWG. NO.	C5614-E01-A

筐体
CHASSIS



ｸﾞﾛﾒｯﾄ
GROMET
05-024-0112
(100-075-970)

ｱﾃｺﾞﾑ
RUBBER
05-077-1112
(100-266-090)

ﾅﾍﾞｾﾑｽA
SCREW
M3X8
(000-881-104)

ｼｰﾙﾄﾞﾊﾟﾝ(2)
SHIELD PLATE
05-077-1106
(100-253-782)

ﾎﾟﾘｴｽﾊﾟｰﾃｰﾌﾟ
TAPE
#900 巾25mm L=30
(000-801-593)

絶縁板
ISOLATION SHEET
AC238
(000-189-415)

放熱ｼｰﾄ(1)
SHEET (1)
05-029-0126
(100-087-882)

J101

防水パッキン(3)
GASKET (3)
05-029-0122
(100-801-849)

座金
WASHER
16.2X22X0.5SUS
(000-801-849)

M4×20

M4

本体ｼｬｰｼ
MAIN CHASSIS
05-077-1102
(100-253-743)

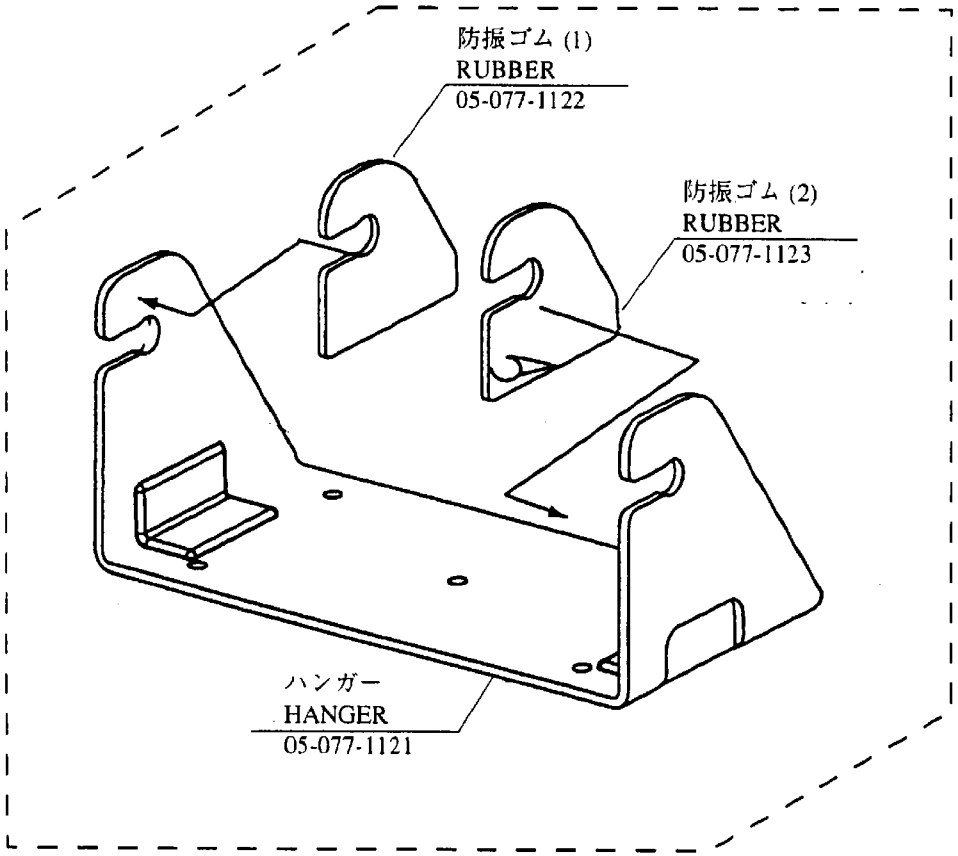
ｺﾈｸﾀｼｰﾙ
CONNECTOR SEAL
05-029-0145
(100-095-221)

防水パッキン(3)
GASKET (3)
05-029-0122
(100-087-873)

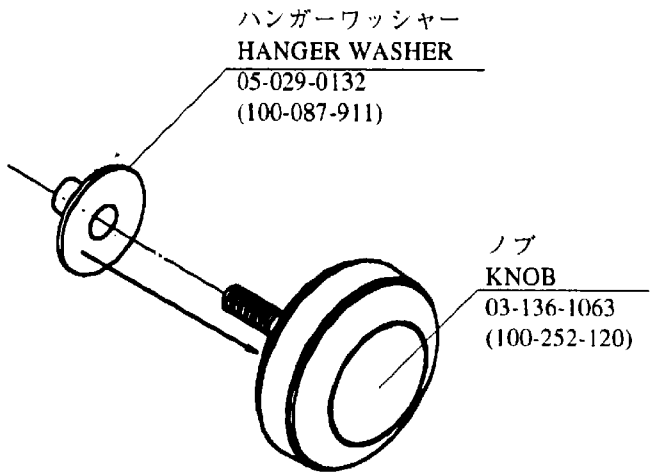
ｺﾈｸﾀｼｰﾙ
CONNECTOR SEAL
05-040-0108
(100-117-120)

APPROVED	AUG. 25. '98 S.KOIZUMI	TITLE	本体展開図 2/2 MAIN UNIT 2/2
CHECKED	AUG. 25. '98 TAKAHASHI	FS-1503	
DRAWN	AUG. 25. '98 F. MIYOSHI	DWG. NO.	C5614-E02-A

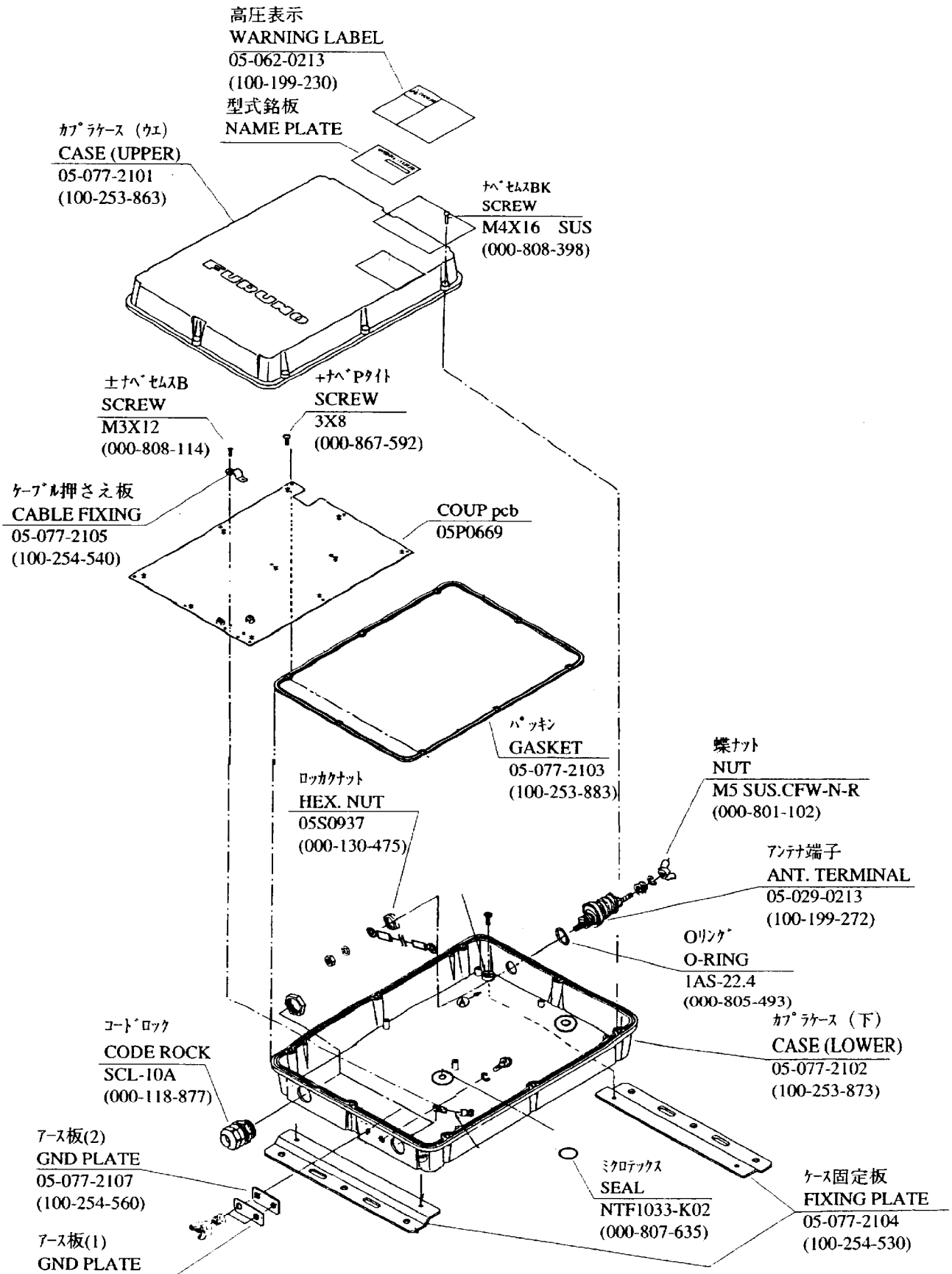
ハンガー
HANGER



ハンガー組品
HANGER ASSY.
FP05-05001
(005-940-810)



APPROVED	AUG 25 '98 S.KOIZUMI	TITLE	本体展開図
CHECKED	AUG 25 '98 TAKAHASHI	FS-1503	MAIN UNIT
DRAWN	AUG 25 '98 E MIYOSHI	DWG. NO.	C5614-E03-A



APPROVED	AUG 25 '98 S. KOIZUMI	TITLE	アンテナカプラー
CHECKED	AUG. 25 '98 TAKAHASHI	AR-1503	ANTENNA COUPLER
DRAWN	AUG. 25 '98 E. MIYOSHI	DWG. NO.	C5614-E04-A

FS-1503

FURUNO

電気部品表

ELECTRICAL PARTS LIST

98年　8月

Model	FS-1503	
Unit	SSB 送受信機 SSB RADIOTELEPHONE	
Ref. Dwg.	C5614-K01-B	Page
Blk. No.		E-1

SYMBOL 回路記号	TYPE 型式	CODE No. コード番号	REMARKS 備考	SHIPPABLE ASSEMBLY 出荷単位組品
	PRINTED CIRCUIT BOARD	**プリント基板**		
1B3	05P0665, CPU	005-940-870		○
1B4	05P0666, TX/RX	005-940-880		○
1B5	05P0667, PA/FIL	005-940-890		○
1B6	05P0668, SW REG	005-940-830	OPTION	○
	ASSEMBLY	**組品**		
1B2	FS-1503, PANEL	005-940-860		○
	FAN MOTOR ASSY.	**ファンモーター組品**		
B101	05-805 (BL-R2P)	005-940-900		○
	SPEAKER	**スピーカー**		
LS201	66P15N-20	000-116-923		
	CABLE w/CONNECTOR	**コネクタ付ケーブル**		
W101	SMCD-1.25-20-150-N	000-140-254		
W102	SMCD-1.25-30-150-N	000-140-255		
W103	PH16D-150	000-138-512		
W104	L-160	000-522-075		
W105	L-160	000-522-075		
W106	PH16D-150	000-138-512		
W107	PH05D-200	000-140-232		
W108	L-100	000-140-625		
W110	PH04D-200	000-132-239		
W201	PH06S-100	000-140-233		
W203	PH02S-100	000-125-006		
EW204	PH04D-50	000-124-966		
	JACK	**ジャック**		
J101	05S0942	000-130-436		
J102	M-BR-191	000-125-916		
J201	FM10RS(1)-6MA	000-113-456		
	TRANSISTOR	**トランジスタ**		
TR	2SC3240	005-592-820	PAIR SET	
	SWITCH	**スイッチ**		
S201	05S0517	000-114-134		

FURUNO

電気部品表

ELECTRICAL PARTS LIST

98年　8月

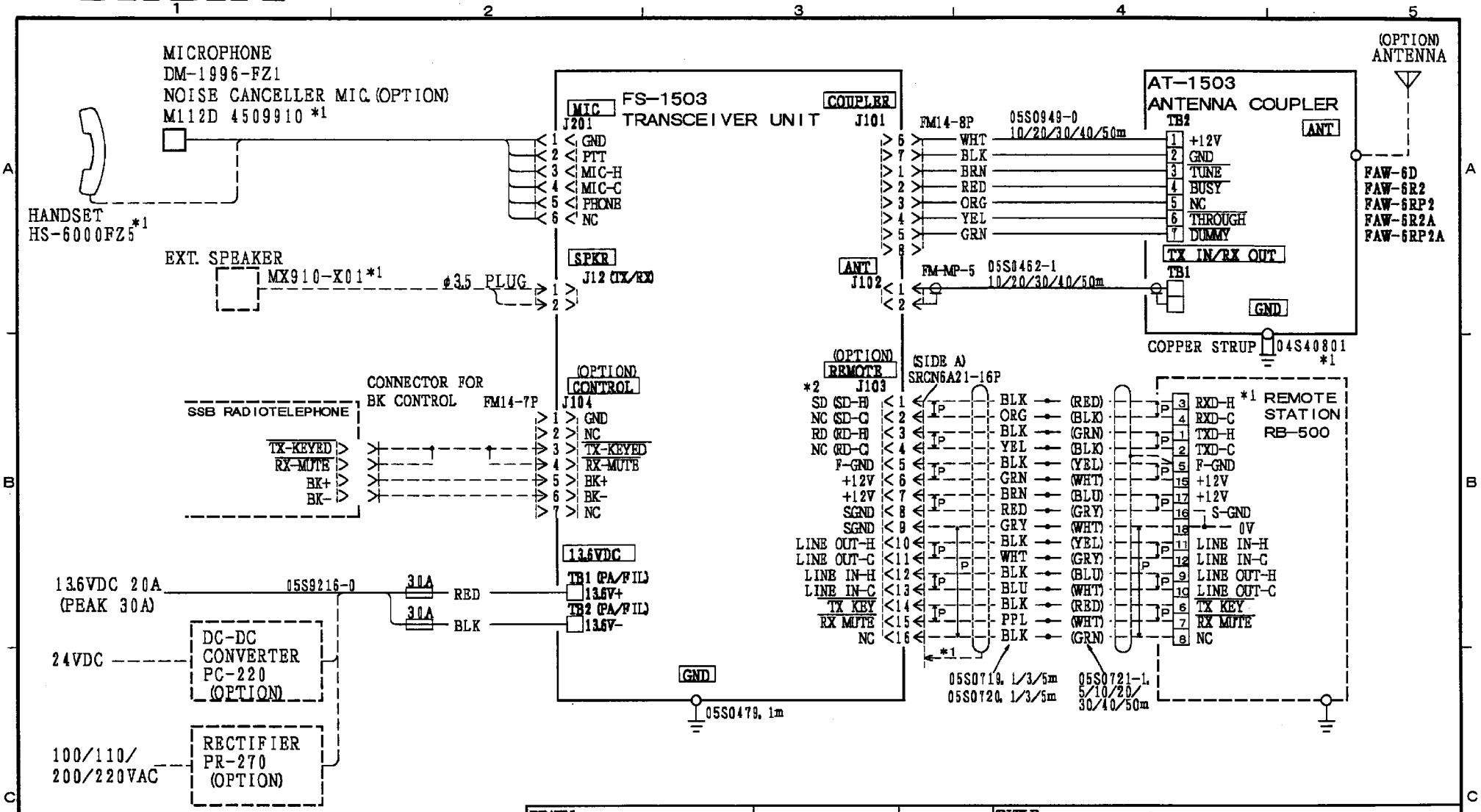
Model	FS-1503		
Unit	アンテナカプラー ANTENNA COUPLER		
Ref. Dwg.	C5614-K02-B	Page	
Blk. No.			E-2

SYMBOL 回路記号	TYPE 型式	CODE No. ｺｰﾄﾞ番号	REMARKS 備考	SHIPPABLE ASSEMBLY 出荷単位組品
	PRINTED CIRCUIT BOARD	**プリント基板**		
2B2	05P0669, COUP	005-940-850		○
	ASSEMBLY	**組品**		
2B3/2B4	OP05-85, DUMMY LOAD	005-940-840	OPTION	○
	CABLE w/CONNECTOR	**コネクタ付ケーブル**		
W1	M3-M4 L-60	000-140-327		
W2	M3-M5 L-40	000-140-328		

Contents of Drawings

Board Name	Type	Dwg. No.	Page
Outline Drawing	FS-1503	C5614-G01	S-1
Outline Drawing	AT-1503	C5614-G02	S-2
Outline Drawing	RP-270	C5485-031	S-3
Outline Drawing	PC-220	C5485-029	S-4
Interconnection Diagram		E5614-C01	S-5
FS-1503 General Ckt	FS-1503	C5614-K01	S-6
CPU	05P0665	C5614-K07	S-7
TX/RX	050666 (1/2)	C5614-K04	S-8
	05P0666 (2/2)	C5614-K05	S-9
NB DET	05P0466	C5548-K12	S-10
CONTROL	05P0459	C5548-K11	S-11
REMOTE (A)	05P0457	C5548-K08	S-12
REMOTE (B)	05P0458	C5548-K09	S-13
PA/FIL	05P0667	C5614-K06	S-14
SW REG	05P0668	C5614-K03	S-15
AT-1503 General Ckt	AT-1503	C5614-K02	S-16
COUP	05P0669	C5614-K08	S-17
DUMMY CONT	05P0670	C5614-K09	S-18
AC Power	PR-270	C5485-032	S-19
DC-DC Converter	PC-220	C5485-030	S-20

FURUNO



NOTE
1. OPTIONAL SUPPLY.
2. ( ) : INDICATES SIGNAL FOR REMOTE B.
REMOTE A:RB-500. REMOTE B:DB-500 & DB-120

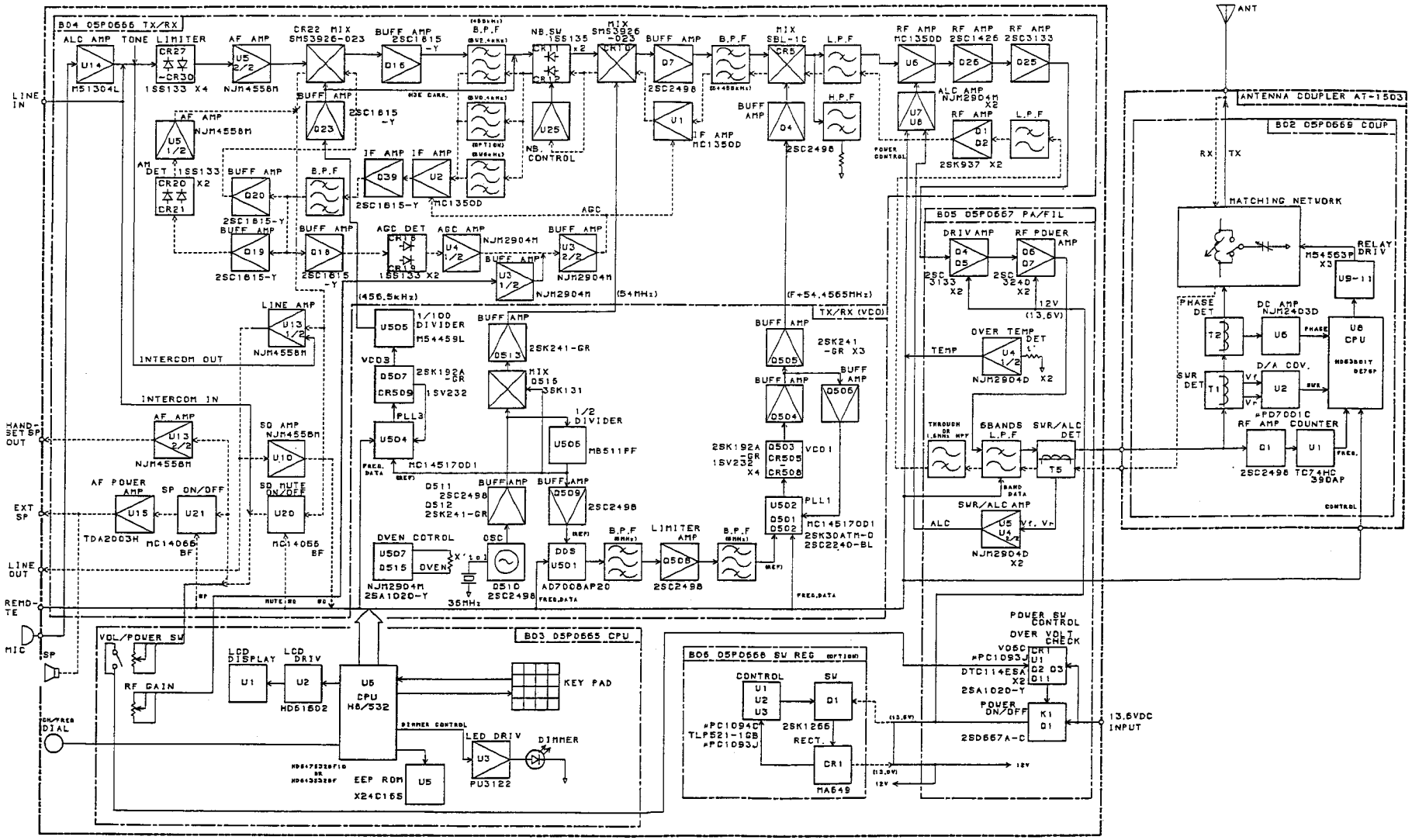
DRAWN	Mar. 25'98 T.YAMASAKI	TITLE	FS-1503
CHECKED	Mar.25'98 K.Kusunoki	NAME	RADIOTELEPHONE
APPROVED	Mar.25'98 K.Kusunoki		INTERCONNECTION DIAGRAM
SCALE	MASS kg		
DWG No.	E5614-C01- A		

S-1-1

FURUNO ELECTRIC CO., LTD.

FURUNO

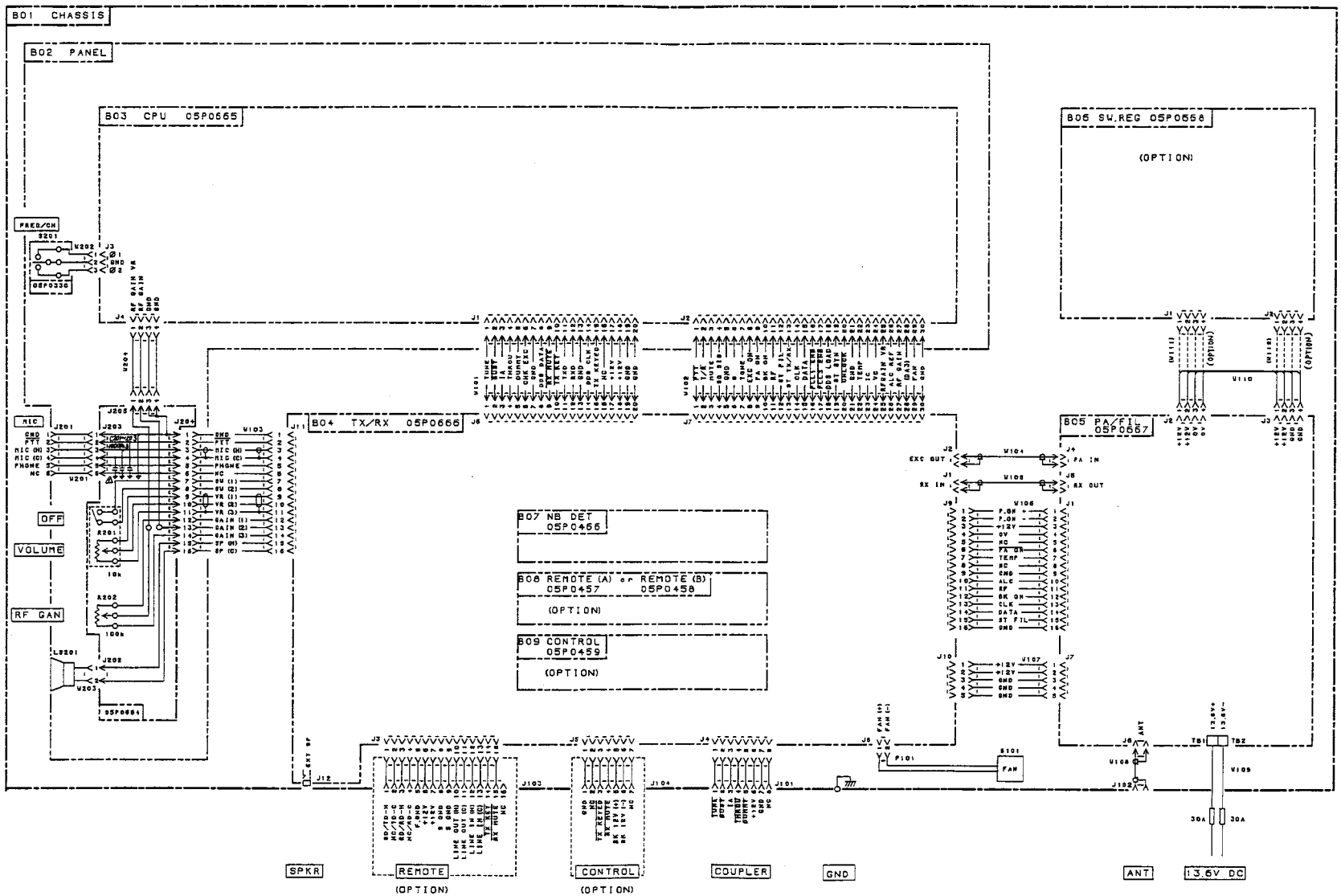
S - 2



DRAWN Apr/27/'98 N.Nakayama			TYPE FS-1503
CHECKED Apr 27 '98 K.Okamoto			名称 SSB送受信機
APPROVED Apr 27 '98			ブロック図（系統図）
SCALE / (MASS kg)	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME SSB TRANSCEIVER
DWG NO. C5614-B01- A	05-001-3802- 0		BLOCK DIAGRAM

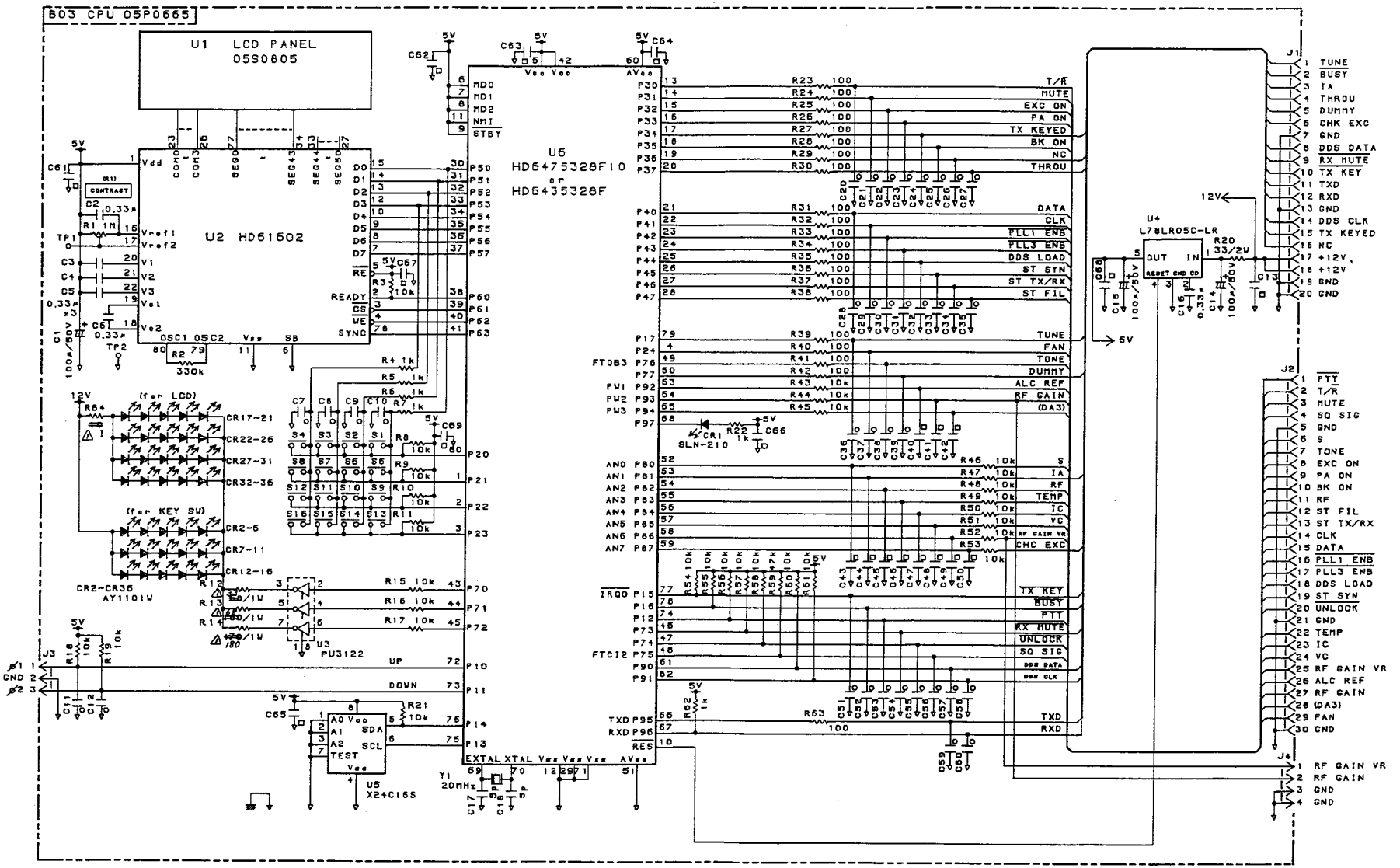
FURUNO ELECTRIC CO., LTD.

FURUNO



DRAWN APR 7/7/98 N.Yokoyama			TYPE FS-1503
CHECKED APR 7 '98 K.Ochimoto			名称 総合
APPROVED APR 7 '98		1B 1	回路図
SCALE / MASS kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME GENERAL
DWG NO. C5614-K01- B	05-001-3789- 1		SCHEMATIC DIAGRAM

FURUNO ELECTRIC CO., LTD.



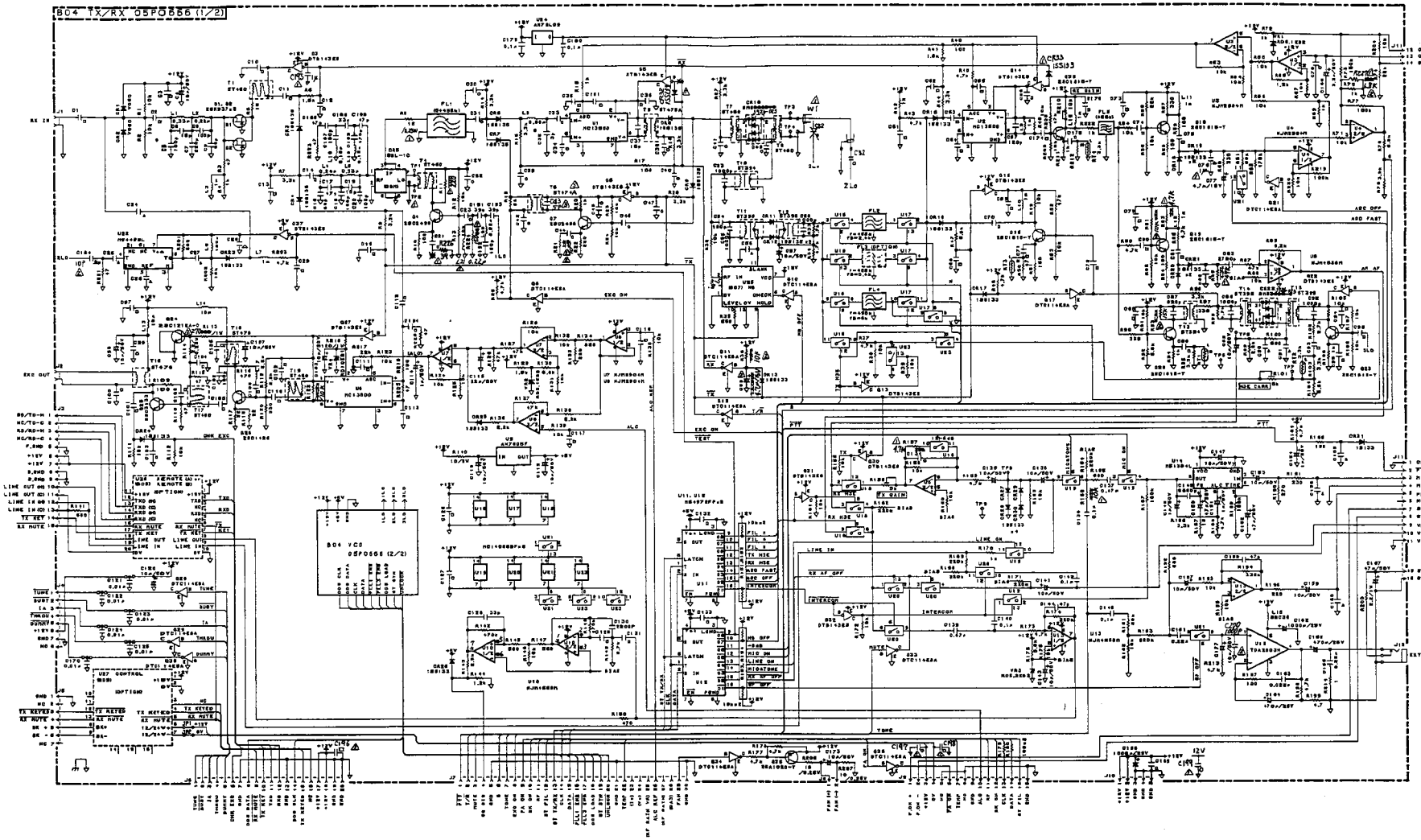
NOTE : (1) RESISTORS ARE IN Ω (0.1W), CAPACITORS ARE IN F.
INDUCTORS ARE IN H. UNLESS OTHERWISE NOTED.
(2) MARKS ○ ARE 1000pF/50WV CAPACITORS.
△ ARE 0.01μF/50WV CAPACITORS.
□ ARE 0.1μF/25WV CAPACITORS.

DRAWN APR/7/'98 N. Yokoyama			TYPE 05P0665
CHECKED APR.7'98 K.Okamoto			名称 CPU基板
APPROVED APR.7'98	FS-1503	1B 3	回路図
SCALE / MASS kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME CPU BOARD
DWG NO. C5614-K07- A	05-001-3790- 1		SCHEMATIC DIAGRAM

FURUNO ELECTRIC CO., LTD.

FURUNO

S - 5

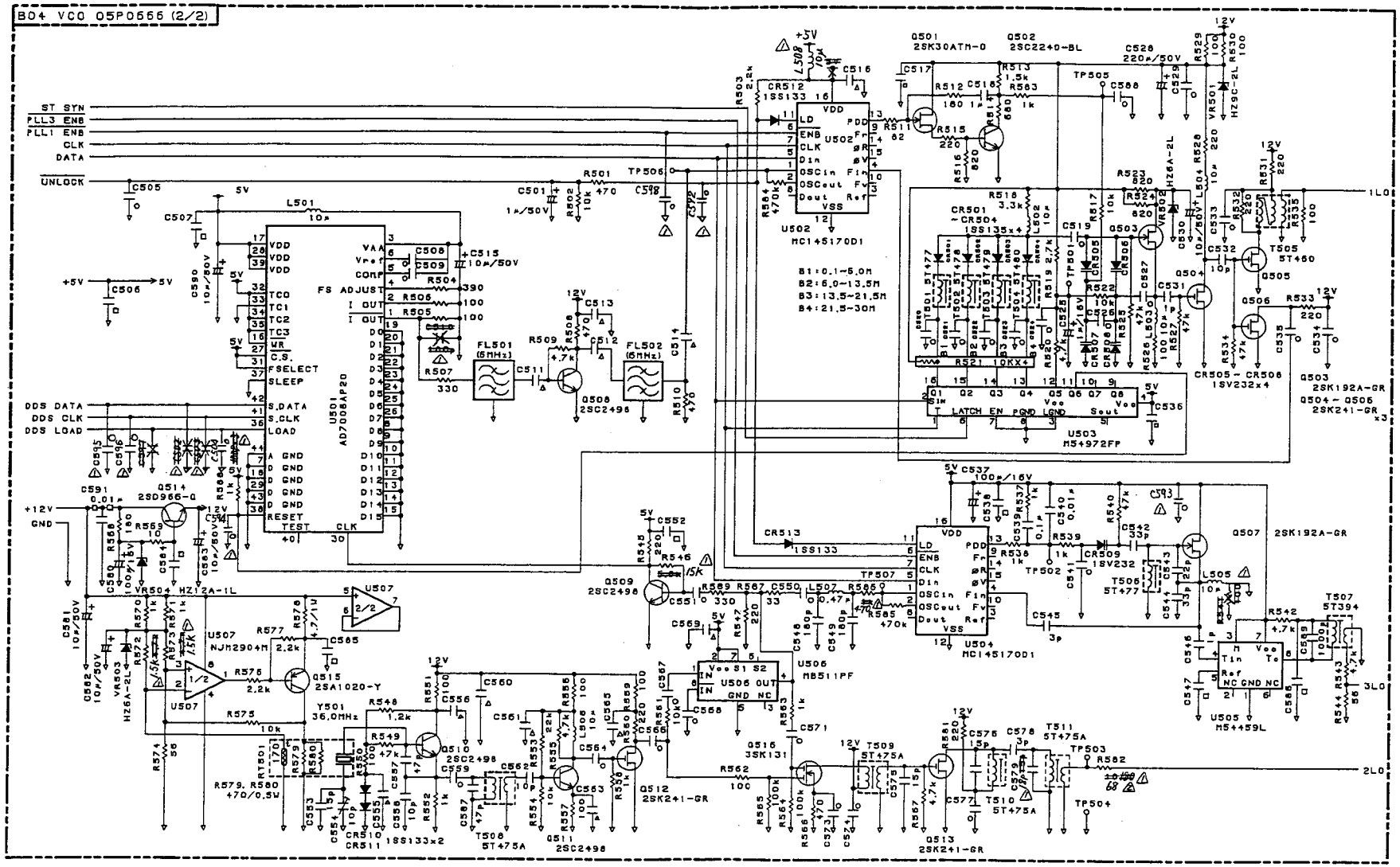


NOTE (1) RESISTORS ARE IN Ω (0.1W)
CAPACITORS ARE IN F
INDUCTORS ARE IN H
UNLESS OTHERWISE NOTED.
(2) MARKS ○ ARE 1000pF/50V CAPACITORS.
MARKS △ ARE 0.01uF/50V CAPACITORS.
MARKS □ ARE 0.1uF/25V CAPACITORS.

DRAWN APR 27 '98 M. YOKOYAMA			TYPE 05P0666
CHECKED APR 27 '98 K. OKAMOTO			名称 TX/RX基板 (1/2)
APPROVED APR 27 '98	FS-1503	1B 4	回路図
SCALE / MASS kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME TX/RX BOARD(1/2)
DWG NO. C5614-K04- B	05-001-2155- 3		SCHEMATIC DIAGRAM

FURUNO ELECTRIC CO., LTD.

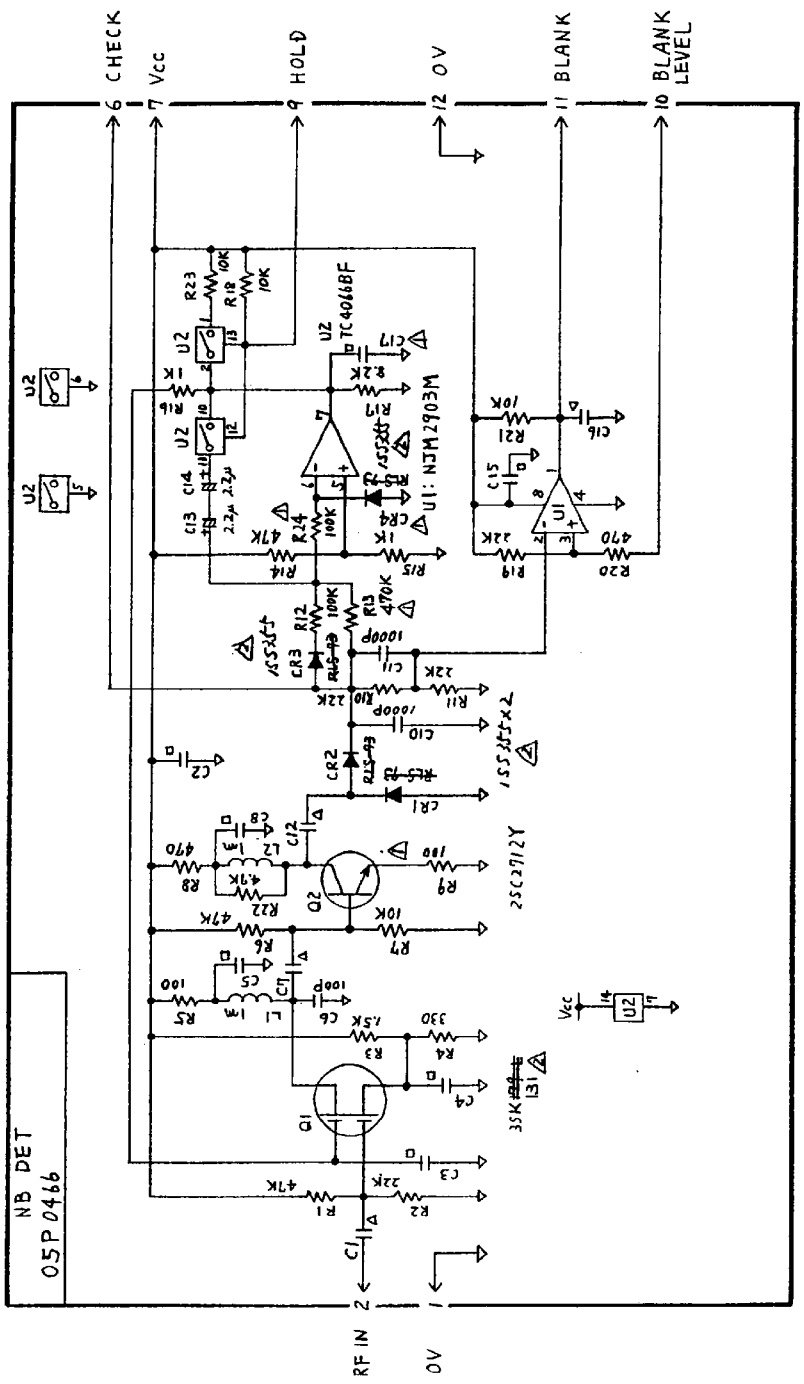
FURUNO



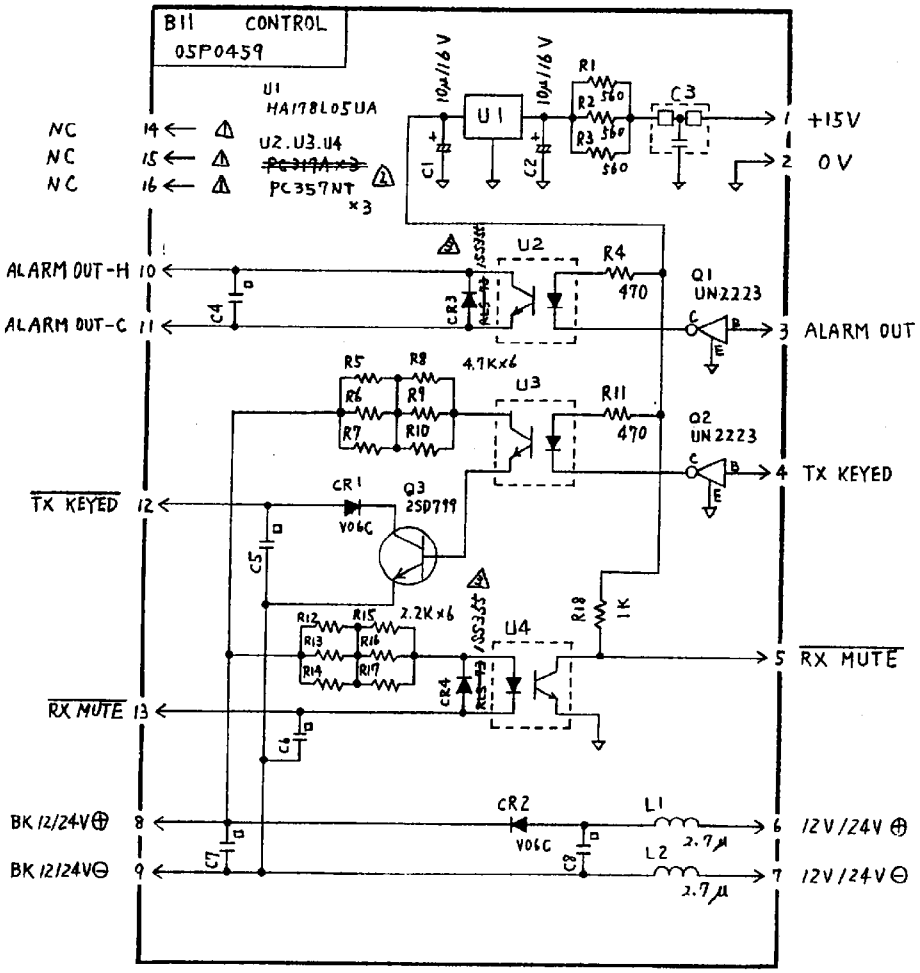
NOTE : (1) RESISTORS ARE IN Ω (0.1W). CAPACITORS ARE IN F.
INDUCTORS ARE IN H. UNLESS OTHERWISE NOTED.
(2) MARKS ○ ARE 1000pF/50VV CAPACITORS.
△ ARE 0.01μF/50VV CAPACITORS.
□ ARE 0.1μF/25VV CAPACITORS.

DRAWN Apr/7/'98 N.Yokoyama			TYPE 05P0666
CHECKED Apr 7 '98 K.Okamoto			名称 TX/RX基板 (2/2)
APPROVED Apr 7 '98	FS-1503	1B 4	回路図
SCALE / MASS kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME TX/RX BOARD(2/2)
DWG NO. C5614-K05- A	05-001-3791- 2		SCHEMATIC DIAGRAM

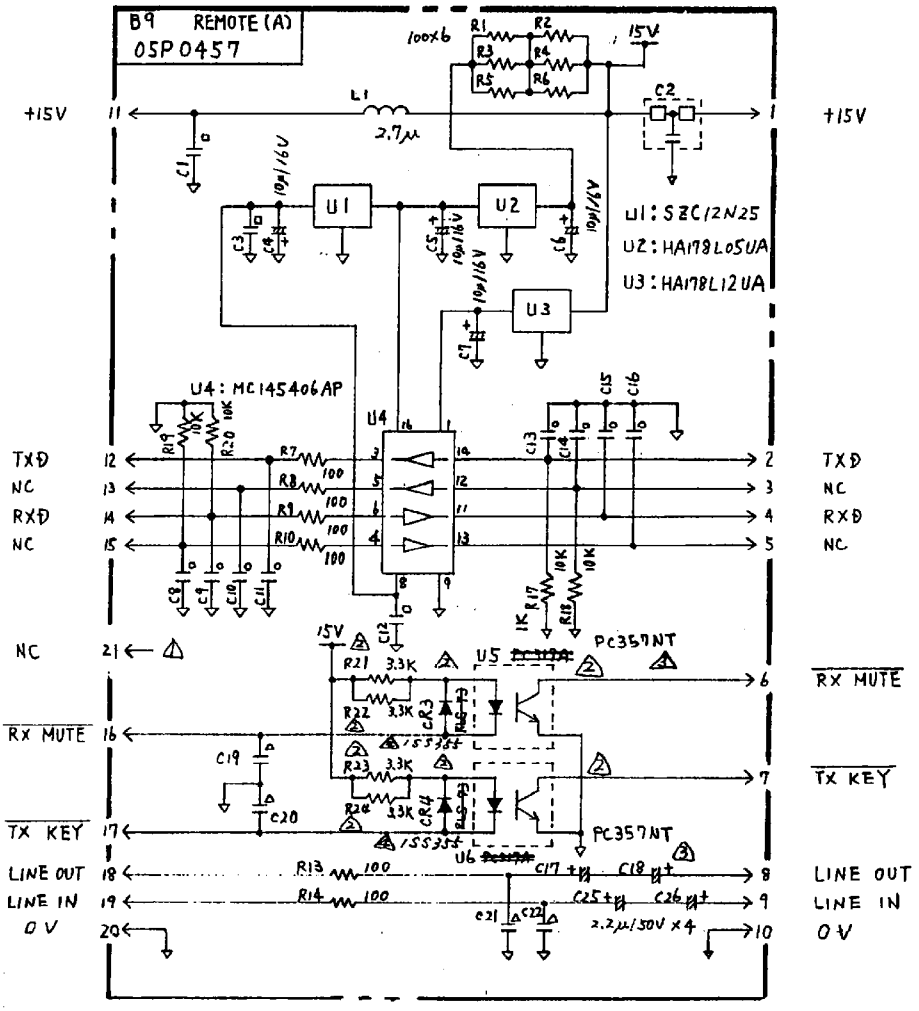
FURUNO ELECTRIC CO., LTD.



DRAWN APR/7/98 N. Kobayama CHECKED APR/7/98 K. Okamoto APPROVED APR.7.98.	FS-1503 FS-1552 FS-1502 FS-2550 FS-15/75 FS-1562	1B14 1B13	TYPE 05P0466 名称 NB DET基板 回路図
SCALE 0 / MASS kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME NB DET BOARD
DWG NO. C5548-K12- E	05-001-4235- 2		SCHEMATIC DIAGRAM

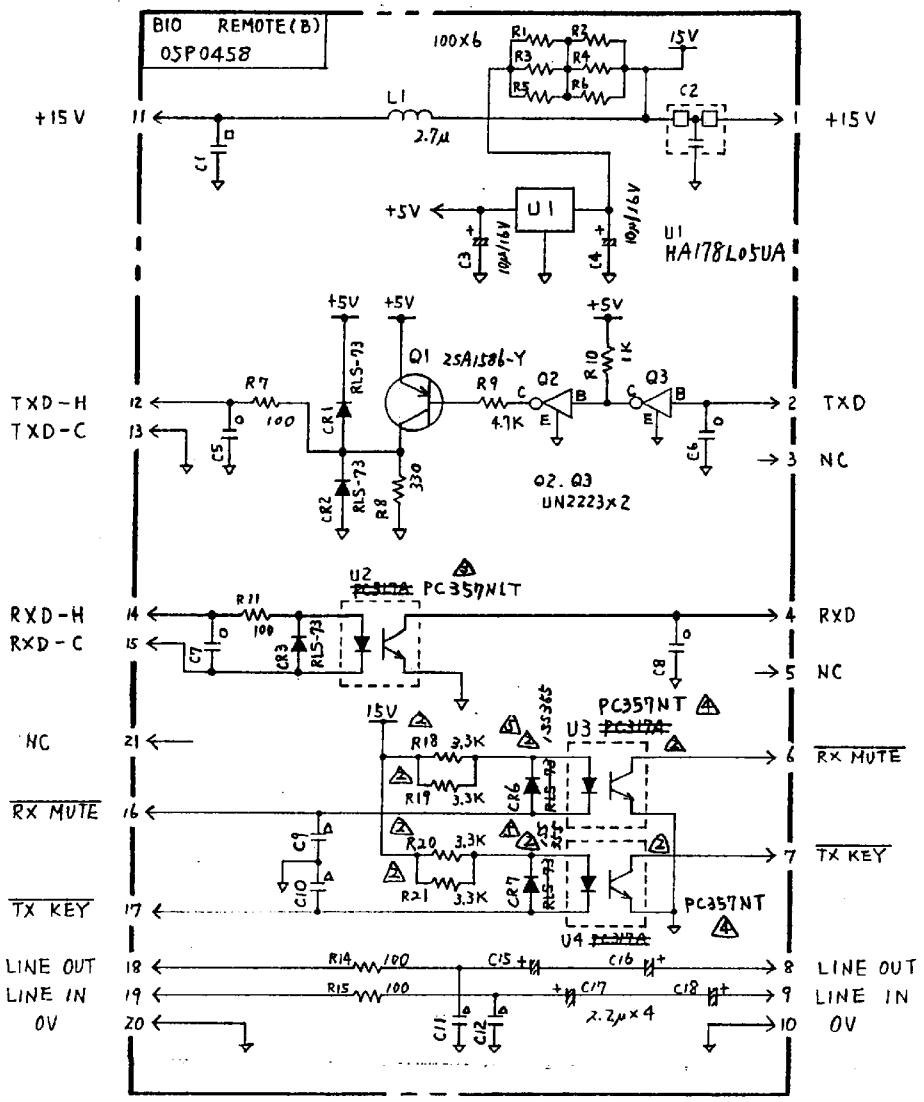


DRAWN APR/7/98 N.Yokoyama	FS-1503 FS-1552		TYPE 05P0459
CHECKED APR 7 '98 K. Okamoto	FS-1502 FS-2550	1B11	名称 コントロール基板
APPROVED APR.7 '98 Kenji Wanibe	FS-15/75 FS-1562	1B17	回路図
SCALE / MASS kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME CONTROL BOARD
DWG NO. C5548-K11- E	05-001-4254- 3		SCHEMATIC DIAGRAM



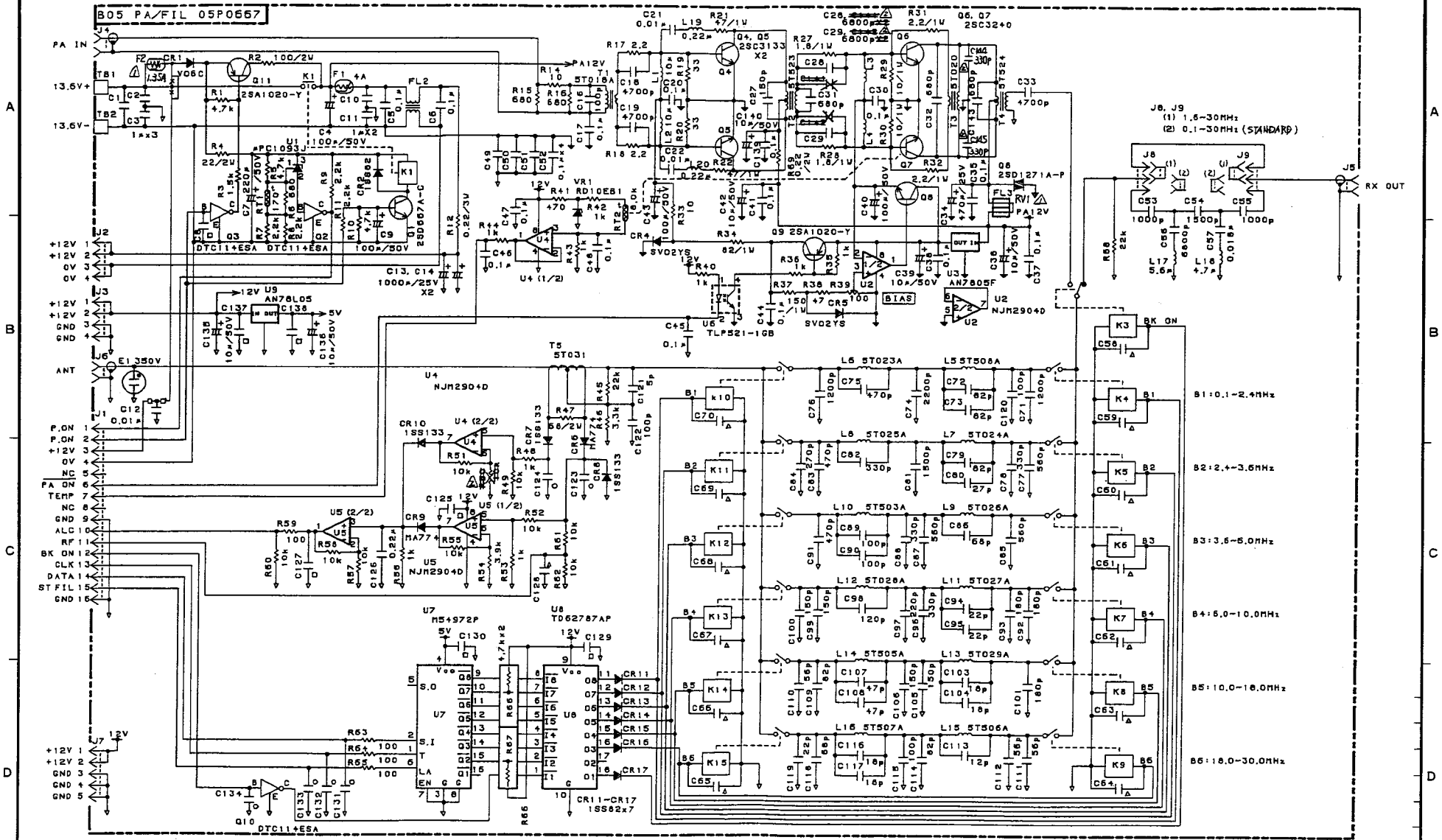
DRAWN 4/9/98 N.Kobayashi	DB-500(*) FS-1552	1B	TYPE 05P0457
CHECKED Apr. 7 '98 K. Okamoto	FS-1502/3 FS-2550	1B 9	名称 リモート (A)
APPROVED Apr. 7 '98 Kazuo Ohmi	FS-1575 FS-1562	1B15	回路図
SCALE / MASS kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME REMOTE(A)
DWG NO. C5548-K08- F	05-001-4237- 4		SCHEMATIC DIAGRAM

FURUNO ELECTRIC CO., LTD.



DRAWN APR/7/'98 N. Yokoya CHECKED APR 7 '98 K. Okamoto APPROVED APR. 7. 98 Kazuo Naito	DB-500(*) FS-1552 FS-1502/3 FS-2550 FS-15/75 FS-1562	1B 1B10 1B16	TYPE 05P0458 名称 リモート(B) 回路図
SCALE / MASS kg	APPLICABLE TO: (MODEL)	BLOCK NO.	NAME REMOTE(B)
DWG NO. C5548-K09- F	05-001-4238- 5		SCHEMATIC DIAGRAM

FURUNO

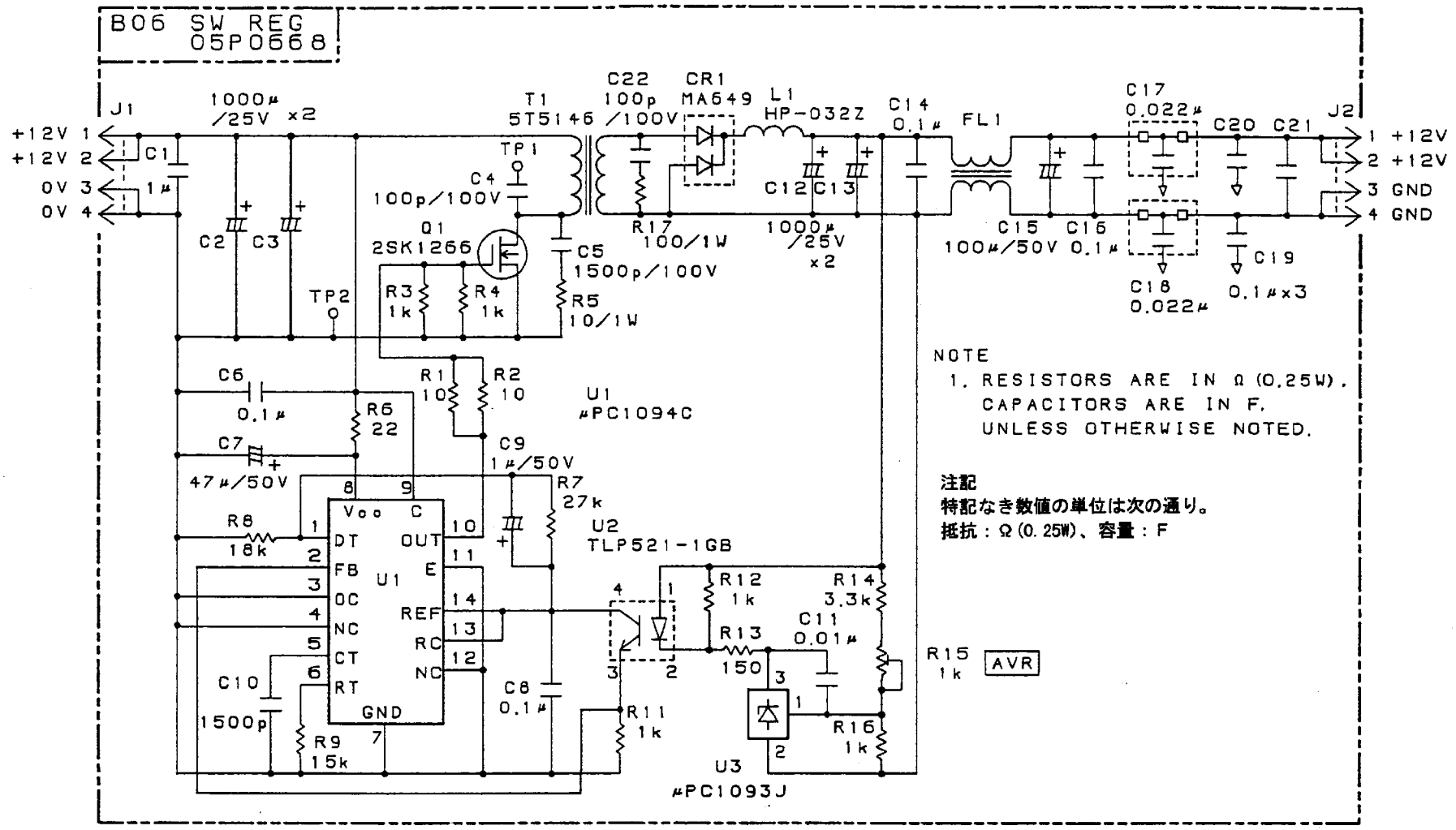


NOTE : (1) RESISTORS ARE IN Ω (0.25W). CAPACITORS ARE IN F. INDUCTORS ARE IN H. UNLESS OTHERWISE NOTED.
(2) MARKS ○ ARE 1000pF/50WV CAPACITORS.
△ ARE 0.01μF/50WV CAPACITORS.
□ ARE 0.1μF/25WV CAPACITORS.

DRAWN Apr/7/98 N.Yokoyama			TYPE 05P0667
CHECKED Apr 7 '98 K.Okamoto			名称 PA/FIL基板
APPROVED Apr 7 '98	FS-1503	1B 5	回路図
SCALE / MASS kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME PA/FIL BOARD
DWG NO. C5614-K06- A	05-001-3792- 2		SCHEMATIC DIAGRAM

FURUNO ELECTRIC CO., LTD.

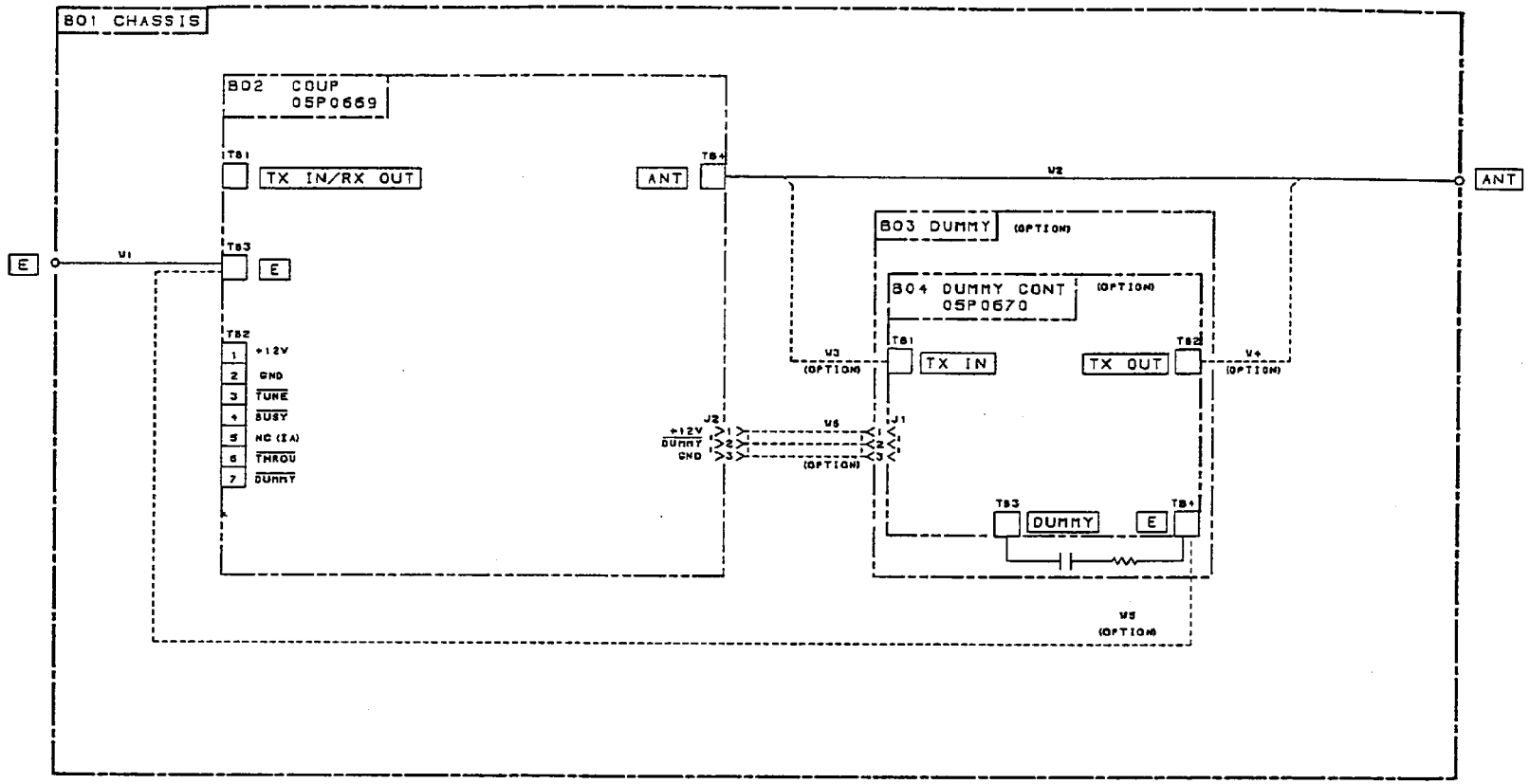
FURUNO



DRAWN Dec 5 '97 T.YAMASAKI			TYPE 05P0668
CHECKED Dec 9 '97 K.Kusunoki			名称 電源基板
APPROVED Dec 9 '97 H.Yamaguchi	FS-1503	1B 6	回路図
SCALE / MASS kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME SW REG BOARD
DWG NO. C5614-K03- A	05-001-4400- 0		SCHEMATIC DIAGRAM

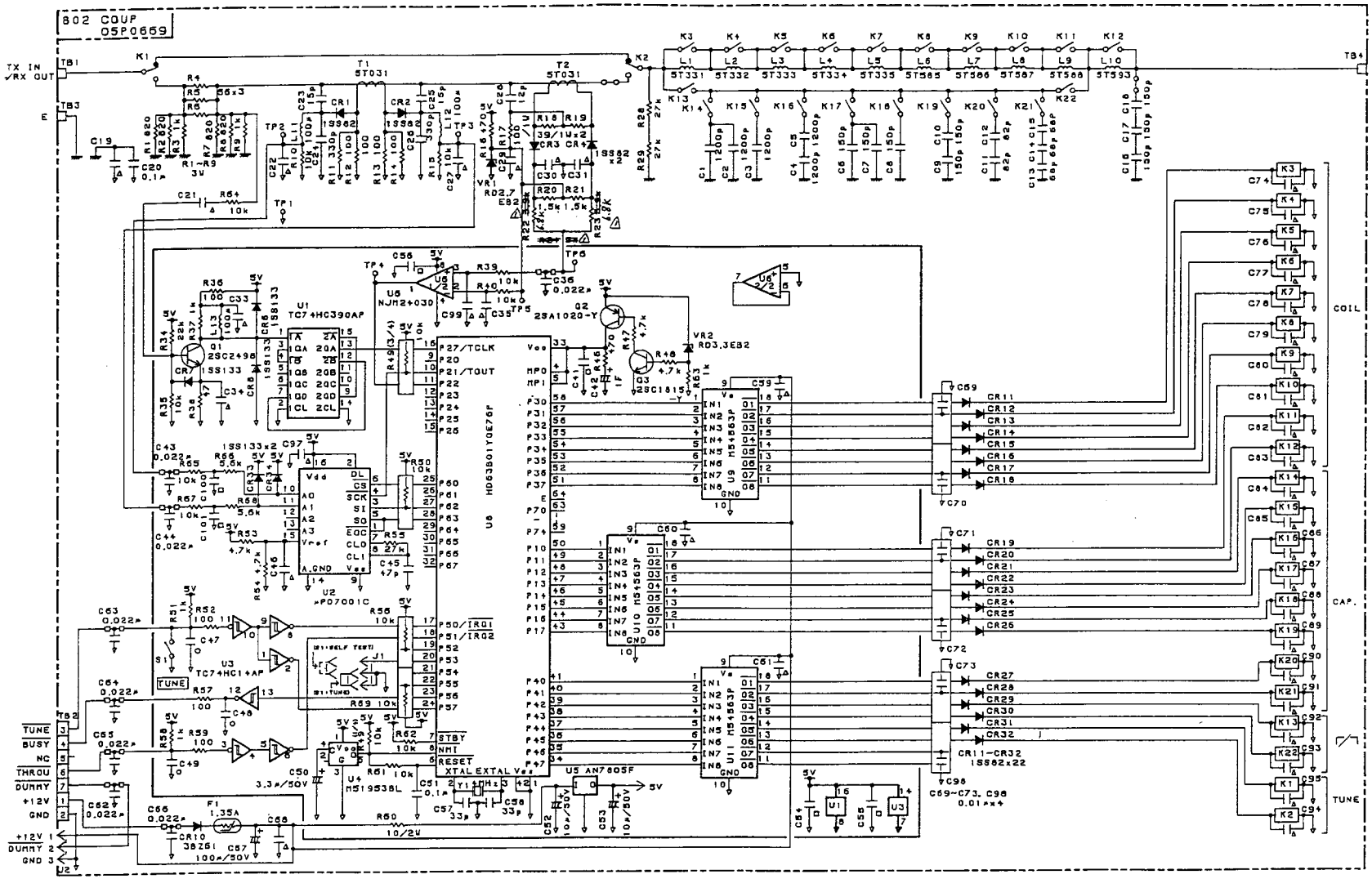
FURUNO ELECTRIC CO., LTD.

FURUNO



DRAWN Dec 5 '97 T.YAMASAKI			TYPE AT-1503
CHECKED Dec 9 '97 H.Kusumoto			名称 アンテナカプラー
APPROVED Dec 9 '97 H.Yamaguchi	FS-1503	2B 1	回路図
SCALE / MASS kg	APPLICABLE TO; (MODEL)	BLOCK NO.	NAME ANTENNA COUPLER
DWG NO. C5614-K02- A	05-001-3793- 0		SCHEMATIC DIAGRAM

FURUNO ELECTRIC CO., LTD.

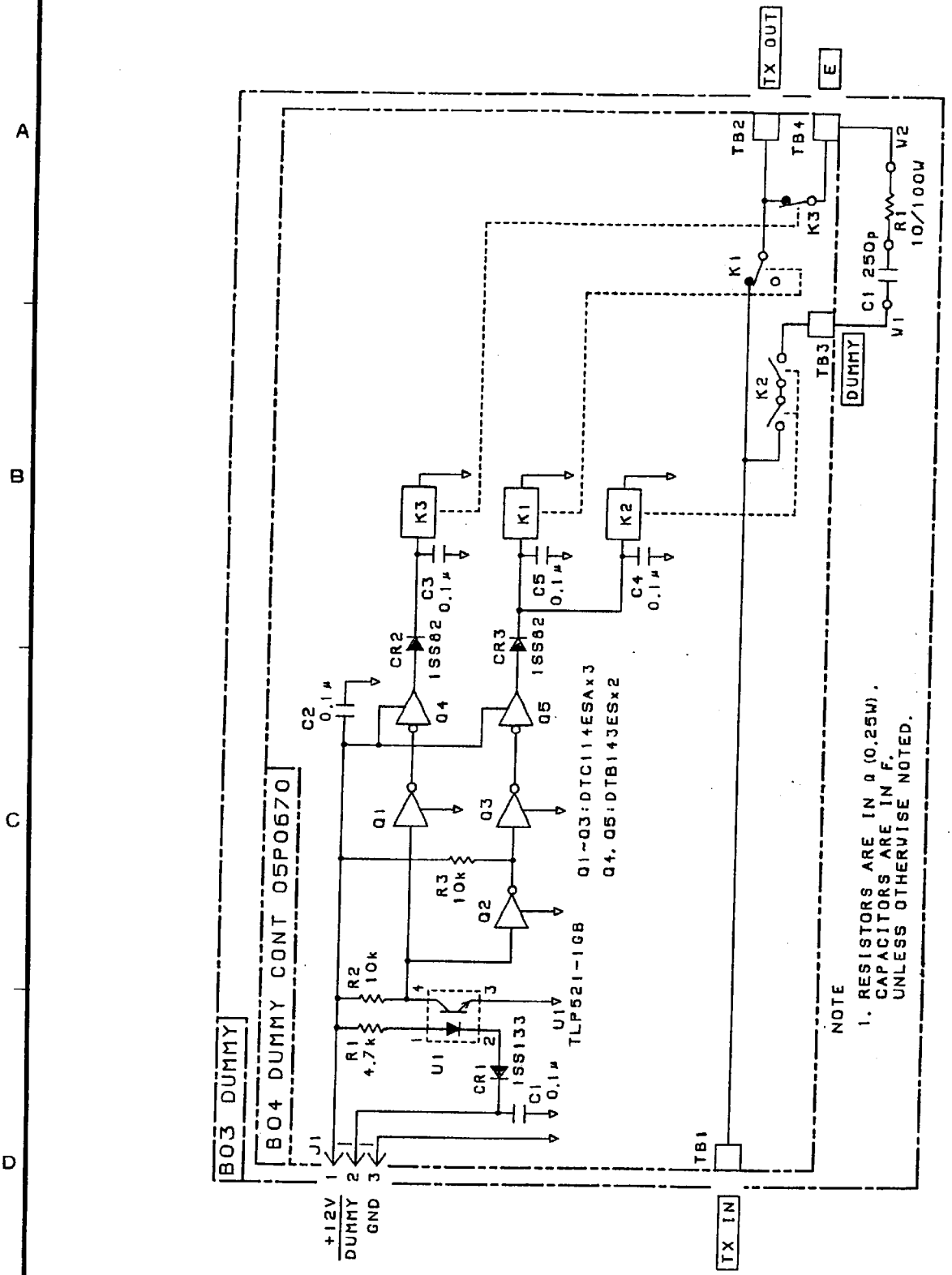


NOTE : (1) RESISTORS ARE IN Ω (0.25W). CAPACITORS ARE IN F.
INDUCTORS ARE IN H. UNLESS OTHERWISE NOTED.
(2) MARKS ○ ARE 1000pF/50WV CAPACITORS.
△ ARE 0.01μF/50WV CAPACITORS.
□ ARE 0.1μF/25WV CAPACITORS.

DRAWN APR/27/'98 N. Yokoyama			TYPE 05P0669
CHECKED APR. 27 '98 K. OKAMOTO			名称 COUP基板
APPROVED APR. 27'98 K. OKAMOTO	AT-1503	2B 2	回路図
SCALE /	MASS kg	APPLICABLE TO: (MODEL)	BLOCK NO.	NAME COUP BOARD
DWG NO. C5614-K08- B	05-001-3794- 1			SCHEMATIC DIAGRAM

FURUNO ELECTRIC CO., LTD.

FURUNO

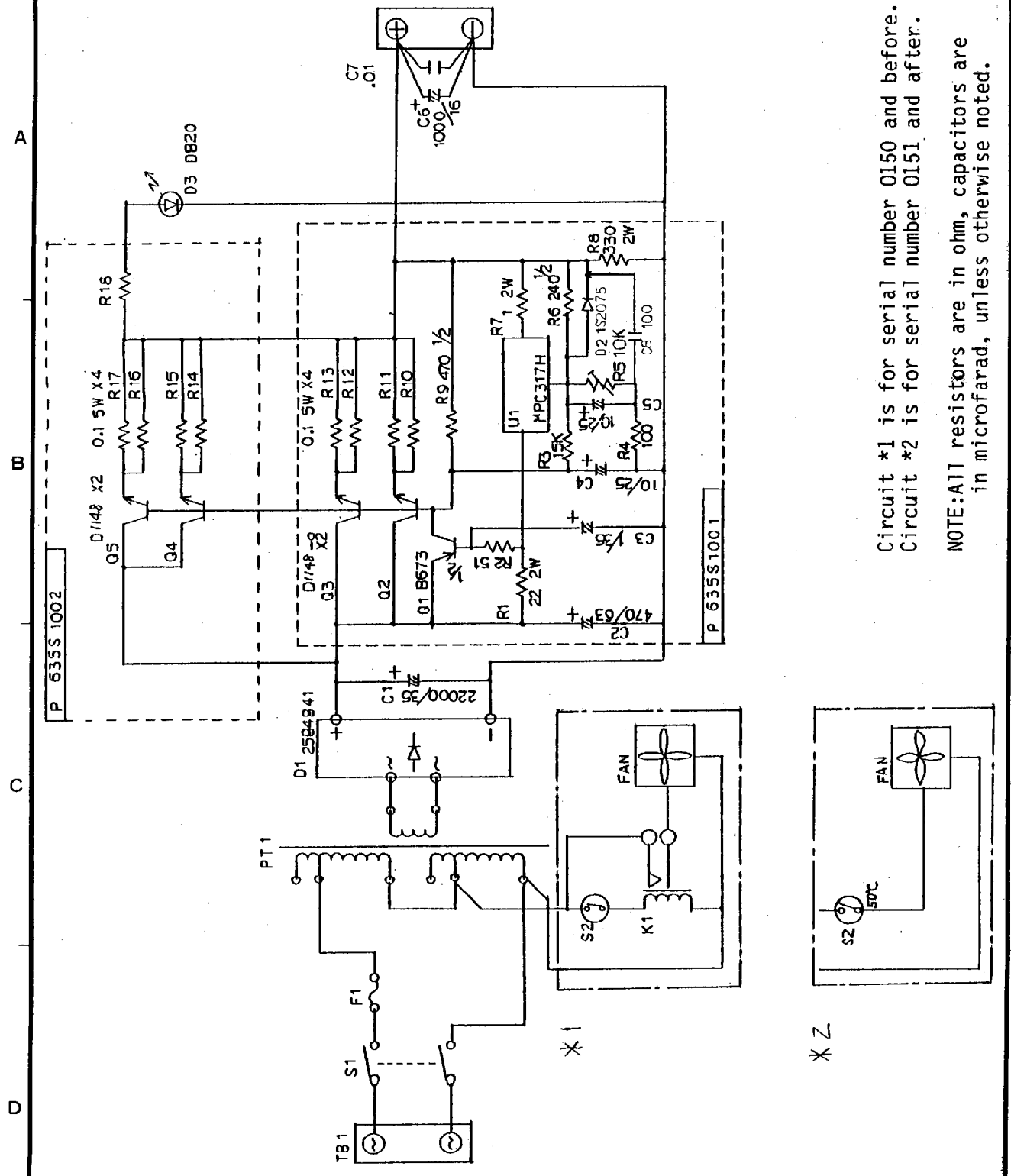


DRAWN APR/7/'98. N. Yokoyama CHECKED APR.7.'98 K. Okamoto APPROVED APR 7 '98			TYPE 05P0670 名称 DUMMY基板 回路図
SCALE / MASS kg	AT-1503 APPLICABLE TO: (MODEL)	B 4 2B 3 BLOCK NO.	NAME DUMMY CONT BOARD
DWG NO. C5614-K09- A	05-001-4401- 0		SCHEMATIC DIAGRAM

FURUNO ELECTRIC CO., LTD.

FURUNO

S-16



品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS

承認 APPROVED	DEC・14・'88 T. KAWAGUCHI	三角法 THIRD ANGLE PROJECTION		名称 TITLE	PR-270 AC 電源 POWER SUPPLY
検図 CHECKED	Dec・14・'88 M. HIRATA	尺度 SCALE	/		
製図 DRAWN	Dec・14・'88 S. NISHI	重量 WEIGHT	kg	図番 DWG.NO.	C5485-032-C

FURUNO ELECTRIC CO., LTD.

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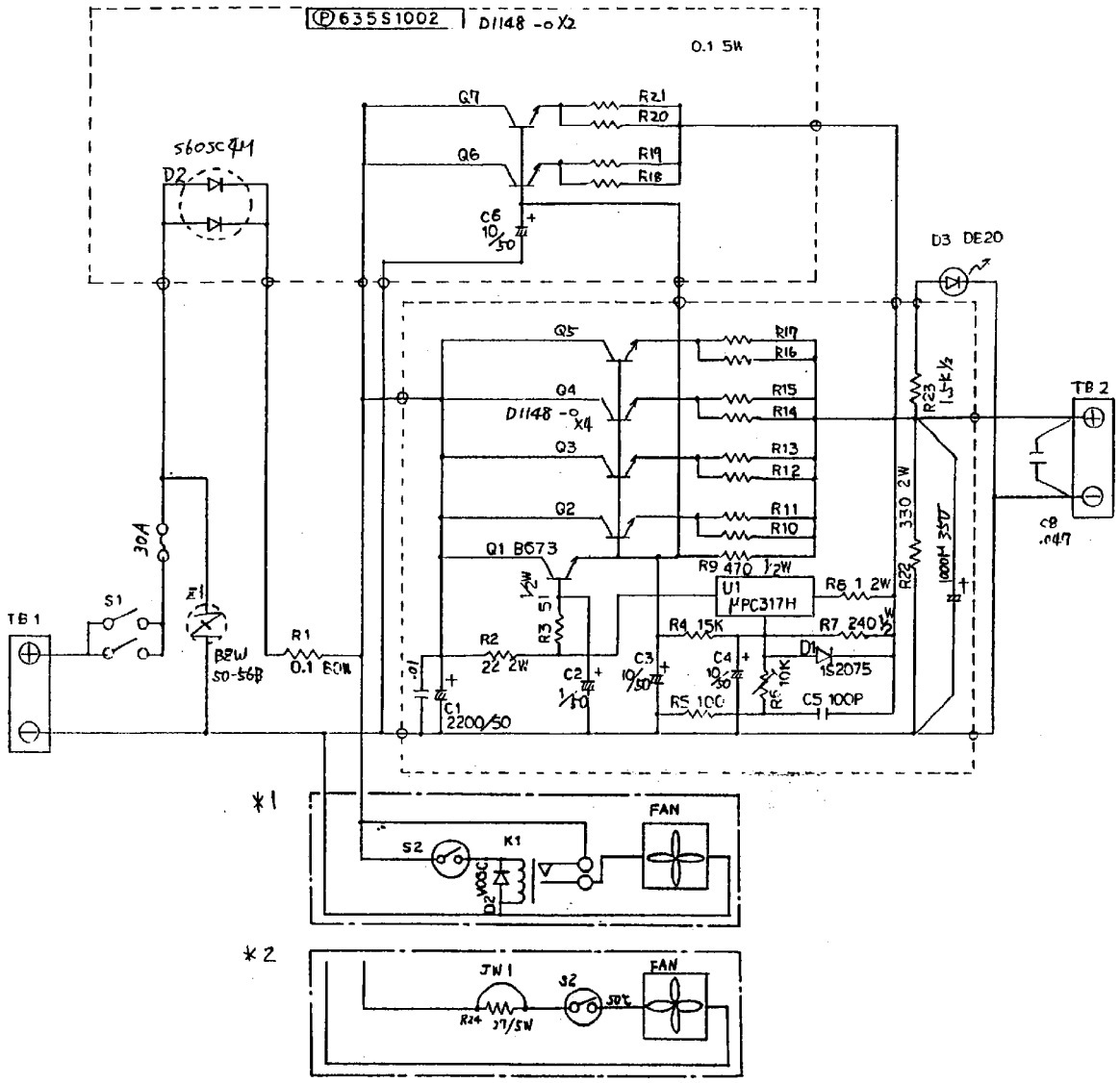

Circuit *1 is for serial number 0150 and before.
Circuit *2 is for serial number 0151 and after.

NOTE: All resistors are in ohm, capacitors are in microfarad, unless otherwise noted.

品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS

承認 APPROVED	DEC・14・'88 T. KAKAKO	三角法 THIRD ANGLE PROJECTION		名称 TITLE	PC-220 DC-DC コンバータ DC-DC CONVERTER
検図 CHECKED	Dec・14・'88 M. IKEDA	尺度 SCALE	/		
製図 DRAWN	Dec・14・'88 S. Mishi	重量 WEIGHT	kg	図番 DWG.NO.	C5485-030-C

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Information

No. : FQ5-2006-013

Date: 2006-11

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SERVICE MANAGEMENT & COMMANDING DEPARTMENT

APPROVED BY

WRITTEN BY

Addenda No. 2 to FS-1503 Service Manual, Pub. No. SME-56140

FS-1503
New Boards, No Compatibility

Due to the discontinuity of parts, PANEL, CPU, TX/RX, PA/FIL boards are modified. There exits no compatibility between original and current boards.

The unit which includes new boards is identified with 3556, the model code, the left side four digit of the dash in the serial number.

Table 1

Board Name	Original type	Current type	Major Changes
PANEL	05P0664 (005940860)	05P0664A (005376530)	Location of connectors
CPU	05P0665 (005940870)	05P0665A (005376510)	1) Speaker mounting hole 2) Program number The current type uses program number, 0550191-101 and above.
TX/RX	05P0666 (005940880)	05P0666B (005376580)	Sensitivity improved.
	05P0666A (005941980)	05P0666C (005376550)	05P0666(B) with Remote-A board
PA/FIL	05P0667 (005940890)	05P0667A (05376560)	PA transistor is changed from SD1487 to 2SC2879A.
SW REG*	05P0668		SW REG kit, OP05-84 (005-939-830)
CONTROL*	05P0459		CONTROL kit, OP05-41 (005-920-330)
REMOTE-A*	05P0457 (RS232C)		REMOTE-A kit, OP05-82 (005-939-810)
REMOTE-B*	05P0458 (Current Loop)		REMOTE-B kit, OP05-83 (005-939-820)

*: Board is supplied in kit.

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SSB

Table 2

Serial number	Boards in use
3513-xxxx	Original type
3556-xxxx	Current type

The unit including new boards has a PA cooling fan, MFC25E-05, DC5V 0.12A in the upper shield plate as shown in Fig.3 and a speaker of new type.

Factory-modified sets
3556-0011 and after (April 2006)

When PA transistor 2SC2879A, (005-376-690, Code number for 2 pcs.) is used on 05P0667 board, add C27 (DM15C331J5, 000-154-416) across the primary winding of T2 as shown in Figs.1 and 2. If C27 is already fitted, change it to 330 pF.
The PA transistor, 2SC2879A does not require an insulator.
(Related Furuno Information: FQ5-2004-036)

Transistor	C27
2SC2879A	330 pF
SD1487	None or about 150 pF

Fig.1 C27, 330 pF on 05P0667 with 2SC2879A

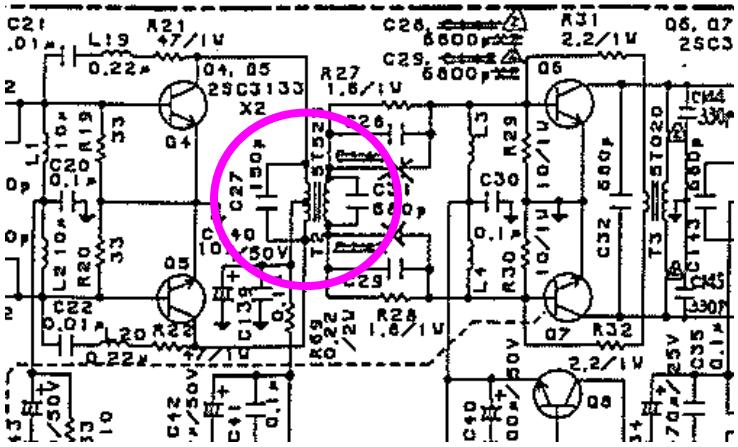


Fig.2

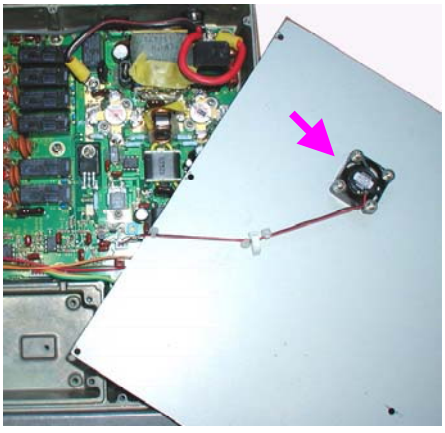


Fig.3 PA Cooling Fan in the upper shield plate

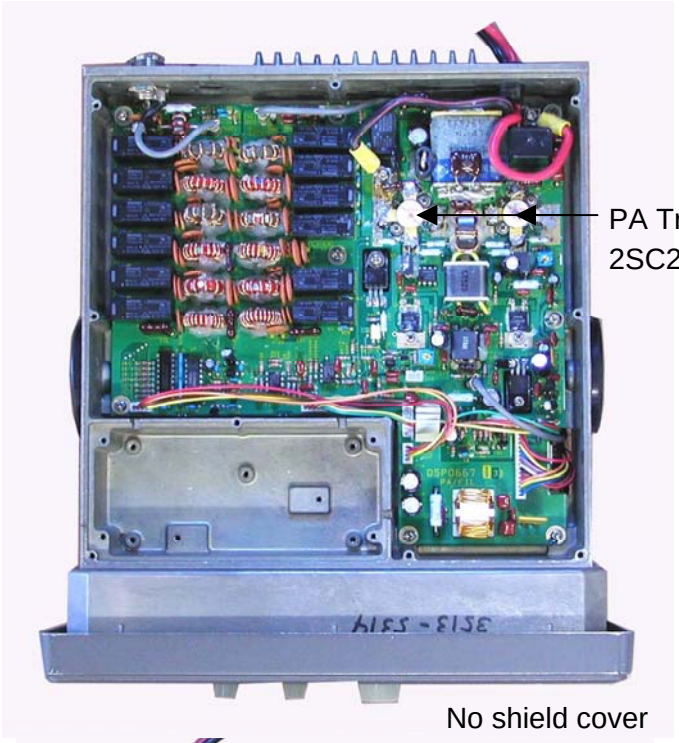
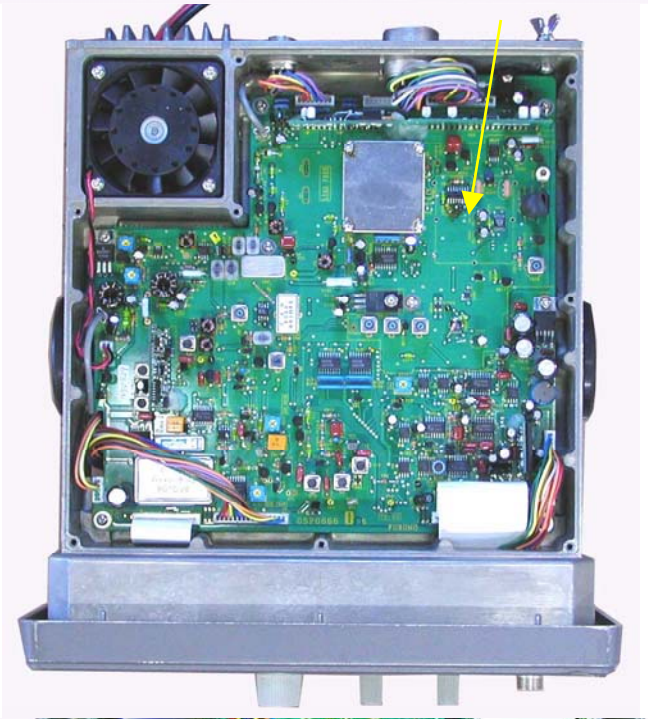


Fig.4 PA/FIL board, 05P0667A



New TX/RX board has no shield cover for PLL circuit.

Fig.5 TX/RX board, 05P0666B/C

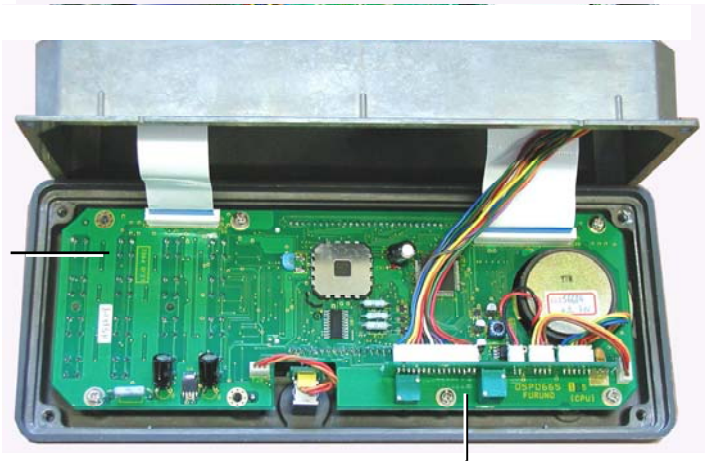


Fig.6 CPU board, 05P0665A and PANEL board, 05P0664A

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Information

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Addenda No. 3 to FS-1503 Service Manual, Pub. No. SME-56140

FS-1503-B (USA Version)
Remedy for "RX Error" in Selftest

Symptom

FS-1503-B (USA version) shows RX error in selftest.

Cause

Incorrect factory-settings

Remedy

Change settings as below.

	Wrong	Correct
9900 (Country):	0 ------>	**1**
9908 (Telex usage):	0 ------>	**2**
9909 (Telex RX bandwidth):	1 ------>	**0**

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SSB

Units having incorrect settings

Not available yet