

User Manual

Solid-State HF/50MHz Band
1kW Linear Power Amplifier

Model HL-1.5KFX



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1. Introduction

HL-1.5KFX is a most compact and light weight desk-top HF/50MHz band linear power amplifier with the maximum input power of 1.75kW. It boasts of being smallest and lightest in the industry using our solid state broad band power amp technology.

Typical output power is 900W PEP/SSB (1kW max.) on HF and 500W on 6m band with the drive power of 85-90W. The built-in band decoder will let you forget about the band setting when the amplifier is hooked to your modern radio through such band data cables as ICOM CI-V, DC voltage (ICOM, Yaesu), and RS-232C (Kenwood).

One of these data cables is included in the package as requested by the user at the time of order placement with the dealer or the factory.

2. Cautions

2-1 This amplifier is cooled through the forced air flow. Leave at least several inches of space off the room wall or from other substances for the smooth air intake to the fan. Do not block the ventilation window on the top of the cover.

2-2 Do not place the amplifier where there is a direct sun rays, high humidity and or high temperature environment.

2-3 There are high AC, DC, and RF voltages running inside of the cabinet especially when the amplifier is keyed for ON AIR. Do not try to make an access to the internal parts carelessly.

2-4 If you happen to hear the bang sound or smell something unusual, turn off the AC main power immediately. Check the multi meter readings of V_d and I_d . Also check the fuses and cable connections around the amplifier. If you find any kind of the failure, please contact the dealer or the factory.

2-5 Be sure to ground the amplifier for the best result of performance stability and your safety. It helps reduce RF strays and noises.

2-6 To eliminate the RF interferences to such home appliances as TV, FM radio, telephone sets etc., it is recommended that proper number of clamp-on ferrite cores are inserted to the both ends of remote control cable, ALC cable, coaxial jumper cable, and antenna cable. Also it is recommended that common mode AC line filter and low pass filter are inserted on AC cable (near the AC consent) and antenna coaxial cable.

2-7 This amplifier has fast acting sophisticated protection circuits controlled by the latest micro

processor. Please note, however, that such operations as to hit same protection circuits repeatedly will lead to the failure of the valuable final power transistors.

2-8 When checking the inside of the amplifier, be sure to wait for a few minutes until the high DC voltage is discharged (monitor Vd meter reading). Also do not try to turn the potentiometers for RF power detector, protection circuits, FET bias voltage circuit and so on, as they are precisely aligned at the factory. Adjustment of these parts need an aid of precise measurement instruments.

2-9 Power transformer primary is wired for AC 230V operation (or as specified by the user at the time of order placement) at time of shipment from the factory. The voltage change from 230V to 115V can be made by sliding the select switch located at bottom of the chassis. (See AC Power section.) Be sure to check this switch before you plug the AC power cord to the AC line.

2-10 To run the amplifier, be sure to connect either the dummy load (50 ohms, 1kW min.) or the well adjusted antenna to the output terminal. Operation with no load will give big stress to RF power FET's, although protection circuits may work at critical conditions.

2-11 Required drive power is slightly less than 100W to obtain full 1kW output. Do not attempt to over-drive with a high power transceiver.

2-12 When the aluminum heat sink and ventilation hole have become dirty with dust, clean them periodically, as the cooling efficiency will be degraded.

2-13 For the long continuous operation under RTTY/FM modes, it is recommended that RF drive is reduced to achieve 20% to 30% lower output compared with CW/SSB.

2-14 Do not apply hard physical shock to the amplifier as there are many precision electronic components used inside the cabinet. Also the original carton box is the best packing material for the amplifier transportation in the future when sending the amplifier back and forth to the service facilities.

3. Features

3-1 HL-1.5KFX is the most compact 1kW HF amplifier that is easy to handle and to operate due to the solid state broad band design. This amplifier is lightest and most compact in the industry. Our solid state design engineering successfully developed the world class compact 1kW HF/6m amplifier.

3-2 The amplifier is equipped with the newly developed band decoder which works with the band data signal supplied from the associated HF transceiver so that the band change of the amplifier is made automatically as the transceiver moves up and down the frequency bands.

3-3 Four units of powerful MOS FET SD2933's by ST Micro (French Italian firm) are used for the main PA section. 900W PEP (SSB typ.) is obtained on HF and 500W on 6m.. Due to the broad band amplifier characteristics, no tuning procedure is needed once the operating band is set.

3-4 The amplifier operates in full break-in CW mode due to the use of the high speed antenna relays made by Panasonic/Matsushita.

3-5 With the duct structure design, the heat sink aluminum block for RF PA module as well as other components are effectively cooled with the powerful blower fan . Fan runs quietly so that it may not annoy the operator for hearing the weak DX signal during the receive .

3-6 Advanced 16 bit MPU (micro processor) is employed to run the various high speed protection circuits such as over drive, high antenna SWR, DC over voltage, band miss-set etc.

3-7 This amplifier is compatible with both AC 230V (200/220/240V included) and AC 115V (100/110/120V included). See the illustration of AC Power Section for changing primary wiring of the power transformer.

3-8 Interlock system is employed for the safety of the operator. AC power is shut down as the top cover is lifted.

3-9 Analog multi-meter will allow the operator to monitor Pf (Forward output power), Pr (Reflected power), Vd (Drain voltage of power FET), Id (Drain current) etc.

3-10 For the future expansion of the amplifier system, there is equipped a socket at the rear panel

for the control cable to connect to model HC-1.5KAT, auto antenna tuner by Tokyo Hy-Power Labs. to be announced in 2006.

4. Specifications

Frequency : 1.8 ~ 28MHz all amateur bands including WARC bands and 50MHz
(US model to cover 1.8 ~ 21MHz only due to FCC regulation)
Mode : SSB, CW, RTTY
RF Drive : 85W typ. (100W max.)
Output Power : HF : 900W(+/-10%) PEP typ., 850W (+/-10%)CW typ.
50MHz : 500W PEP/CW

Matching Transceivers for Auto Band Decoder : ICOM, Yaesu, Kenwood

Drain Voltage : 53V (when no RF drive)
Drain Current : 40A max.
Input Impedance : 50 Ω (unbalanced)
Output Impedance : 50 Ω (unbalanced)
Final Transistor : SD2933 x 4 (MOS FET by ST micro)
Circuit : Class AB parallel push-pull
Cooling Method : Forced Air Cooling
MPU : PIC 18F452 x 2
Multi-Meter : Output Power Pf 1kW
Reflected Power Pr 100W
Drain Voltage Vd 60V
Drain Current Id 50A

Input/Output Connectors : Type M-J (UHF SO-239)

AC Power : AC 230V (200/220/240V) 10A max.
AC 115V (100/110/120V) 20A max.

AC Consumption : 1.9kVA max. when TX

Dimension : 272 x 142 x 363 mm (WxHxD)
10.7 x 5.6 x 14.3 inches

Weight : Approx. 20kgs. or 45.5lbs.

Accessories : AC Power Cord x 1
RCA Plug x 2
Band Decoder Cable x 1 (Either one for ICOM, Yaesu, or Kenwood)
Spare Fuse 15A (for AC 230V line) x 2
Spare Fuse 25A (for AC 115V line) x 2

Spare Fuse 1A (Miniature Fuse) x 3

(For PC1664 , main control board x 1,

For PC1662 , power amp board x 1)

Spare Fuse 2A (Miniature Fuse) x 1

(For PC1611 FN DC-DC board x 1)

User Manual x 1

Optional Items : Auto Antenna Tuner (HC-1.5KAT)

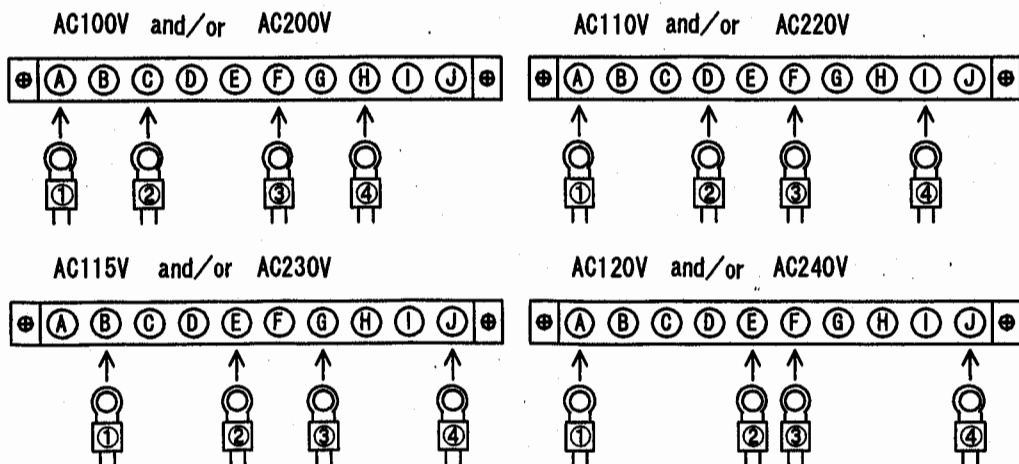
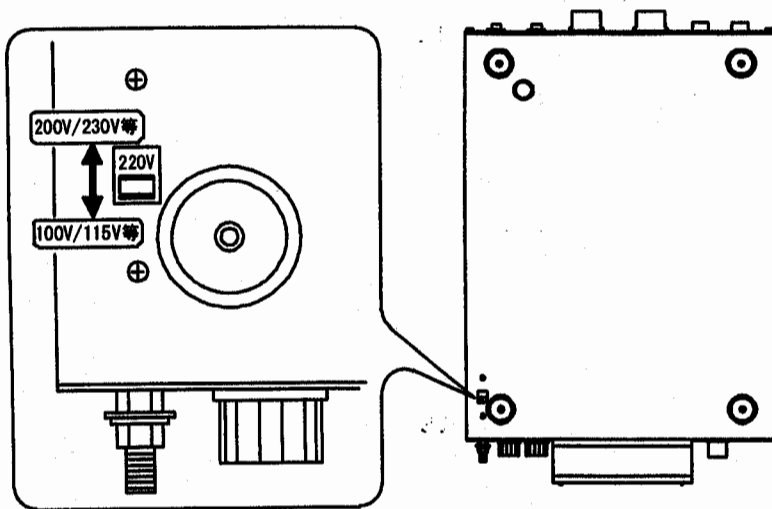
External Cooling Fan (HXT-1.5KF for high duty cycle RTTY)

5. AC Line Voltage

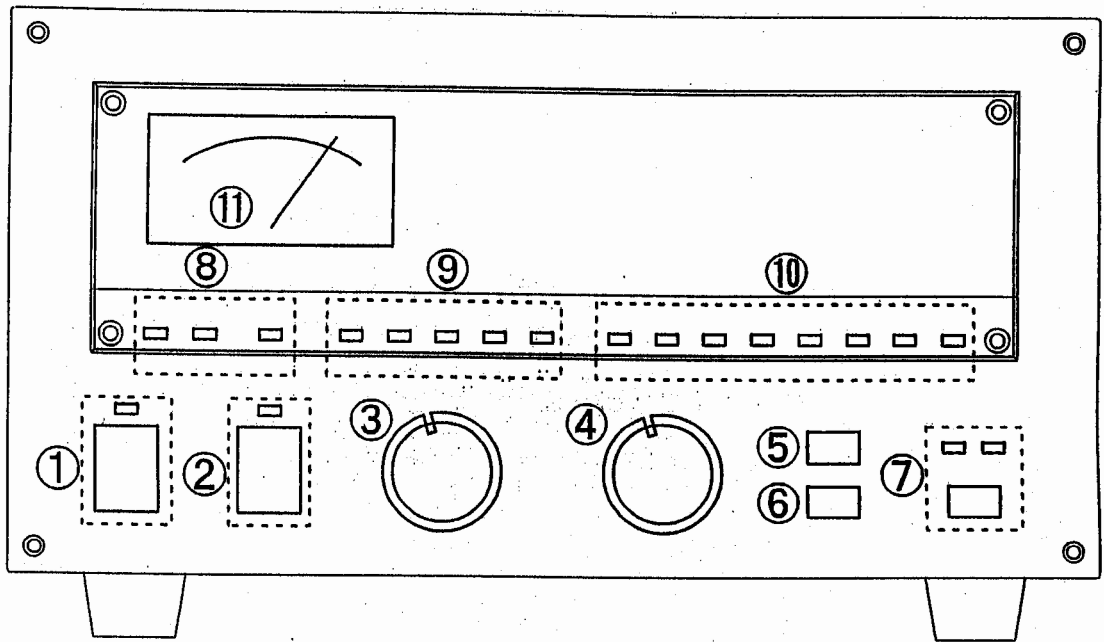
5-1 Although the amplifier is designed to work with both AC 115V (100-120V) and AC 230V (200- 240V), we recommend the user to operate with AC 230V line for the stability reason.

5-2 Since AC plug style differs from country to country. The plug is not included in the package. Please source locally the suitable one for your application.

5-3 AC voltage has been set for 230V use (or as requested by the customer at time of order placement) at the time of shipment. If you wish to change to AC 115V, change the voltage setting by sliding the switch knob that is located at the chassis bottom as illustrated below. Also the other illustration explains about how to cope with other AC voltages than 230/115V. Before starting this work, be sure to pull the AC plug out of the AC line for the safety.



6-A. Front Panel Description



- ① POWER** Main power switch to turn on and off AC power.
LED (green) lights when turned on.
- ② OPER.** OPERATE /STAND-BY switch. At OPERATE , the amplifier is ready to go into ON AIR (TX) state and at STBY, it is on STAND-BY state.
- ③ METER** To change the multi-meter scales. Meter reads Pf, Pr, Vd, and Id.
- ④ BAND SELECT**
To select the band changing methods of AUTO and MANUAL. When AUTO, the manufacturer of the transceiver in use should be selected. When the band data cable is not used, MANUAL should be selected. (See page 14, 9. Bans Data cable Connection)
- ⑤ UP, DOWN** Push switch for the band change on manual mode. While the transceiver is on Receive (RX) state, push the button to select the desired frequency band to operate. The switches do not work when the transceiver and the amplifier are on Transmit (TX) state.
- ⑥ ANT** Select switch for antenna A and B. As the switch is pushed , A and B are selected reciprocally. Selected antenna is stored in the memory for the respective bands. Note that antenna is always held at A when the POWER switch is turned off.
- ⑦ FAN, ID, ON AIR**
- ⑦-1 ON AIR :** Green LED lights when the amplifier is on transmit state (TX).
- ⑦-2 FAN :** LED lights when cooling fan runs at high speed. If the PA heat sink temperature reaches 40 degrees C, fan will run at high speed to enhance the

cooling effect. It is recommended that the power switch is not turned off immediately after finishing the operation if FAN is lit. Leave the cooling fan running for the time being.

- ⑦-3 ID : Excessive Id Indicator ($> 35A$). Depending on the band and antenna used, a high drain current may flow into FET's. If 35A is exceeded, LED flickers and or lights to indicate the high ID is being drawn. (This lighting does not necessarily mean the failure of the amplifier. However if it lights too often, and too long, it is suggested that the drive power is somewhat reduced and that antenna is checked for SWR, as the stress may be given to FET's.)

⑧ O. DRIVE, O. HEAT, O. VOLT, FUSE, PR

- ⑧-1 O.DRIVE : When over drive or band mis-set is detected, LED lights to indicate the protection circuit has worked.

- ⑧-2 O.VOLT : When the DC drain voltage of FET (V_d) is too high, LED lights to indicate protection circuit has worked.

- ⑧-3 O.HEAT : When the PA module temperature reaches 70 deg. C, LED lights to indicate the protection has worked. (Usually it is needed for the cooling fan to keep running to cool off the PA module for several minutes at least.)

- ⑧-4 FUSE : LED lights when the 15A glass fuse is blown with a high Id. (Two 20A fuses are on PC1662 PA board.)

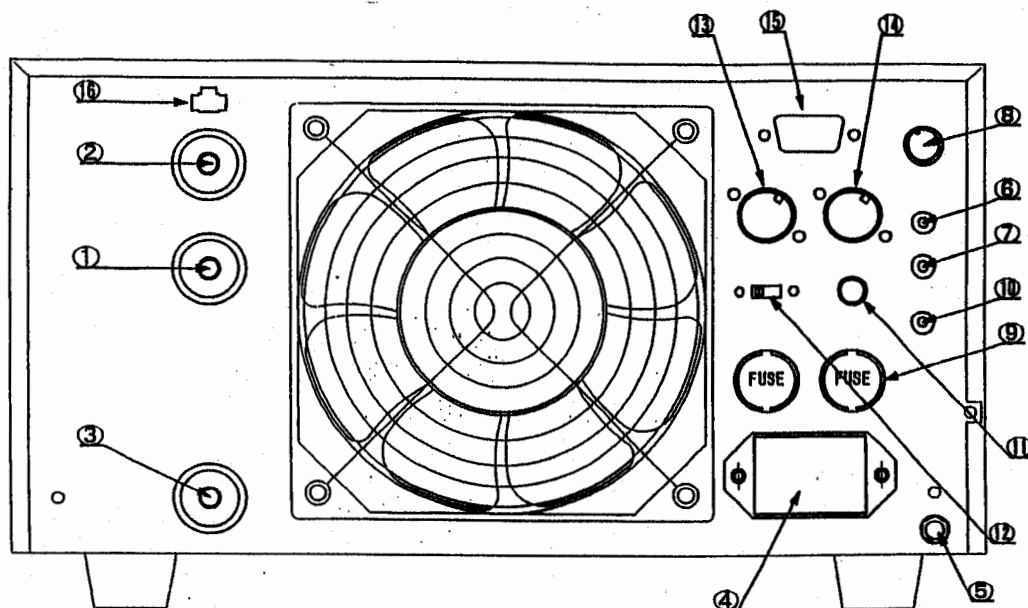
- ⑧-5 PR : LED lights when the reflected power from antenna exceeds 80W to indicate the protection circuit has worked.

(Protection can be reset by turning the main POWER switch off, and then turn on again.)

- ⑨ BAND : One of the green LED's lights to indicate that the band is selected for an operation.

- ⑩ MULTI METER : P_f (Forward output power), P_r (Reflected power from antenna), V_d (FET drain voltage), and I_d (FET drain current) are shown on the scale as selected by ③ METER select switch.

6-B. Rear Panel Description



- ① **ANT A** RF Output Connector. Connect the coax cable to the antenna.
- ② **ANT B** RF Output Connector. Connect the coax cable to another antenna or the dummy load (50Ω 1kW for example).
- ③ **INPUT** RF Input Connector. Connect the coax jumper cable from the transceiver.
- ④ **AC POWER** AC Mains Socket. Plug the AC power cord. (Socket is EMI filtered.)
- ⑤ **GND** Ground Terminal.
- ⑥ **SEND** RCA Jack. Connect the control cable from the ACC terminal (or SEND, TX GND etc.) of the transceiver. The center pin is to be shorted to the ground by way of the relay circuit of the transceiver. DC current to flow this pin is 5V, 1mA only.
- ⑦ **ALC** RCA Jack for ALC Voltage Output. Negative DC voltage appears at the center pin, which is to be fed back to the ALC terminal of the transceiver. ALC is effective to keep the amplifier output power at certain limit. Also it is useful when the transceiver output power is higher than 100W. (See page 13. 8. ALC Connection.)
- ⑧ **ALC ADJ.** Potentio-meter to adjust ALC voltage level. If turned fully counter-clockwise, minus 10V is available at maximum. Factory setting is 0 volts, the pot being turned fully clockwise.
- ⑨ **FUSE** A pair of fuses for AC Mains. 15A glass fuse. (Change to 25A fuses if 115V line is selected.)
- ⑩ **ICOM** RCA Jack for the DC voltage derived band data cable from the ICOM

transceiver. (See page 14, BAND DATA CABLE CONNECTION WITH ICOM.)

- ⑪ **CI-V** See Eye Five. Ear phone jack for CI-V band data cable from the ICOM transceiver. (See page 15.)

⑫ **BAND DECODE**

Slide switch to select band data communication methods with ICOM transceiver. To select either "DC voltage band data" or "CI-V band data".

- ⑬ **TUNER** DIN Socket for External Auto Antenna Tuner. (Our HC-1.5KAT is expected to avail in 2006.)

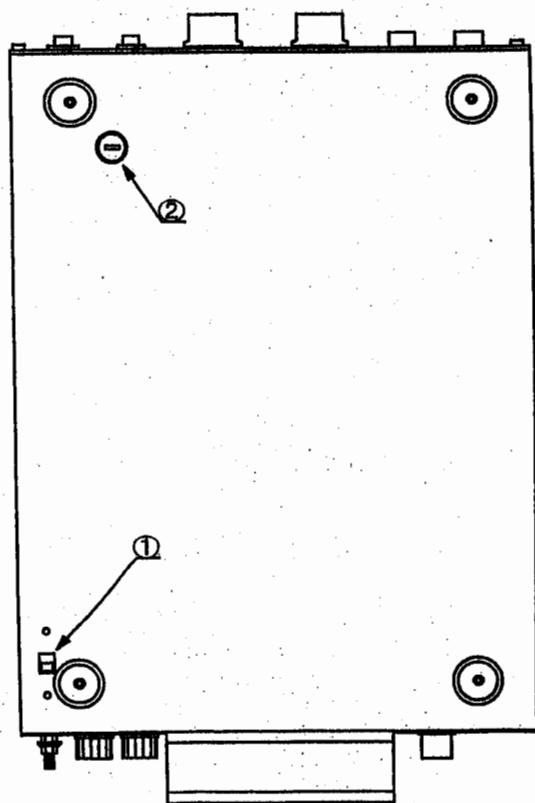
- ⑭ **YAESU** DIN Socket for band data cable from the Yaesu transceiver. (See page 16.)

- ⑮ **KENWOOD** D-Sub (9 pin) socket for band data cable from the Kenwood transceiver (RS-232C). (See page 17.)

⑯ **EXTERNAL FAN POWER**

Plastic Female Connector for the DC power supply cable to feed to optional external cooling fan kit (HXT-1.5KF).

7. Chassis Bottom Description



- ① **AC 115/220V** Slide switch to select AC line voltage. Set to 220V side for

200/220/230/240V. Set at 115V for 100/110/115/120V lines.

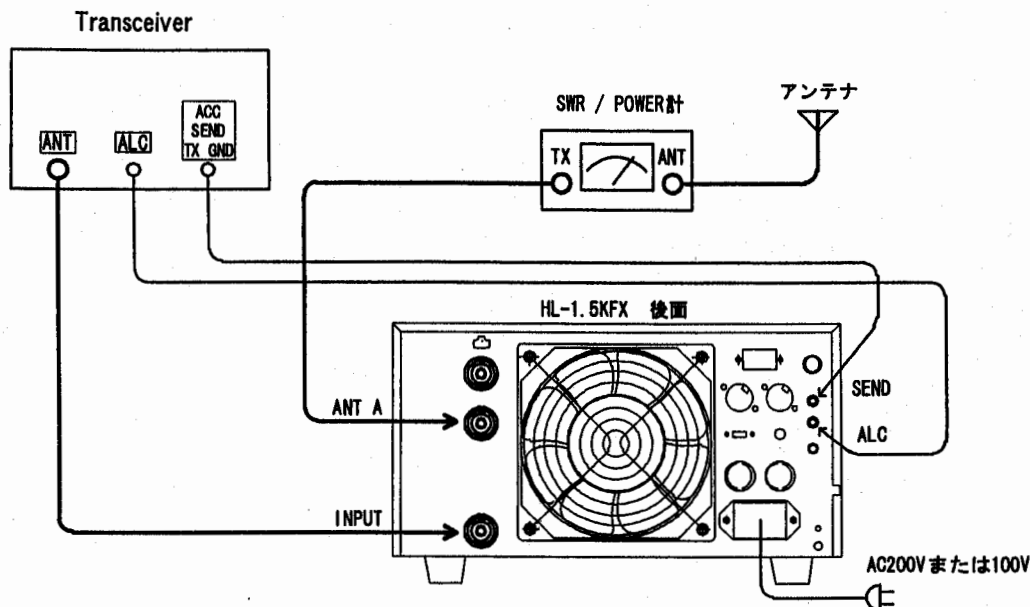
② FUSE

Holder of Fuse for the External Cooling Fan Unit, HXT-1.5KF. Use 2A glass fuse, when the optional fan is installed on top of the cover.

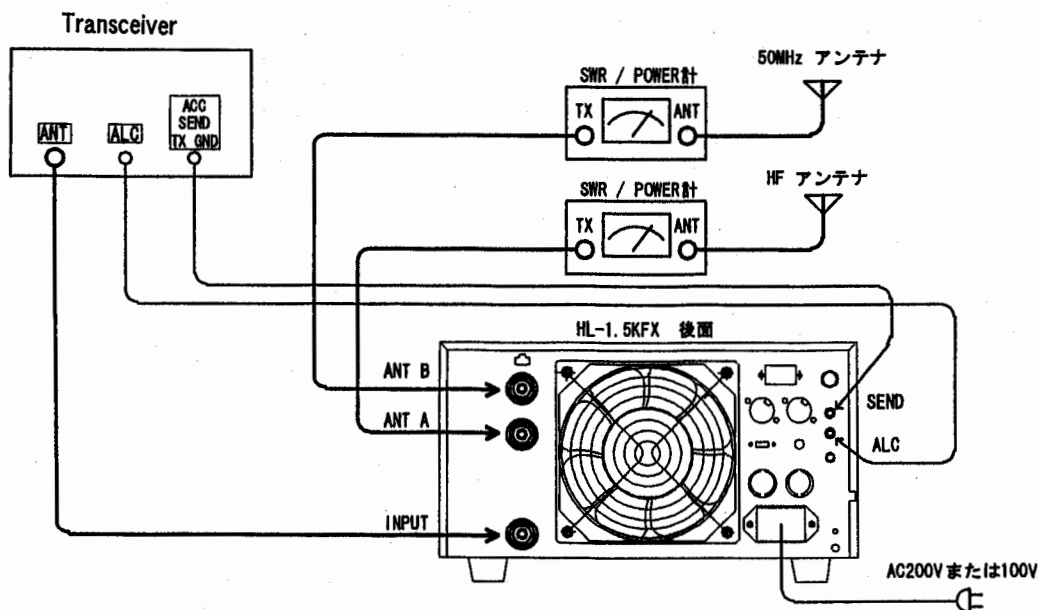
7. Connection & Operation

This section explains about one antenna system and two antenna systems with basic connections with the transceiver, where no band data cable is connected. In this case, band setting is made with MANUAL mode, pushing UP/DOWN keys. Advanced operation using the band data cable will be described later in Section 9.

One Antenna System Example



Two Antenna System Example



7-1 Connect AC cord and coax cables as illustrated above. Connect the cable from "SEND" to ACC

or the remote terminals of transceiver, where it is marked "SEND" or "TX GND". These terminal pins are ones that is shorted to the ground when the transceiver is at TX/ON AIR state. If this wiring is not made, the amplifier will not go into TX (amplification) state. For the temporary check of the amplifier, ground the SEND center pin by inserting an RCA plug whose center pin is soldered to the outer case of the plug with a small piece of wire. For your information, this SEND terminal is pulled up at DC 5V level being connected to the internal micro processor pin. When grounded, DC sink current of 1 mA (only) will flow. It is a very light load to the transceiver control circuit.

7-2 At first, turn fully clockwise ALC knob not to apply ALC voltage to the transceiver. Application of ALC will be covered in the following section 8.

7-3 Keeping the POWER (for AC mains) switch off, check the SWR of your antenna by keying the transceiver to TX state (CW or RTTY mode). Monitor the SWR with an external SWR/Power meter. If SWR is as high as 1.8 or more at band center, antenna has to be adjusted for better value. As an alternative, antenna tuner may be inserted and have the tuner match the antenna impedance.

7-4 Turn the POWER switch on. Turn the BAND switch to MANUAL position. Then push UP/DOWN keys to select desired operation band. Turn on the STAND-BY switch to OPER (operate) position and the amplifier is ready to work. If you key the transceiver with carrier level set at relatively low level such as 20-30W, amplified out put signal of a few hundreds watts will come out of the amplifier. Monitor this output with multi-meter (Pf position) or with external power meter. Increase drive level to roughly 50W and see if antenna SWR stays constant. (Some antenna may show changed SWR value due to heated connectors junctions and trap coils as higher RF currents flows.)

7-5 Now you can increase drive level to nearly 80-90W to achieve maximum carrier output power of 900W (CW, RTTY) from the amplifier. If you change to SSB mode, peak voice power will reach approximately 1kW. For high duty cycle transmission in RTTY, SSTV,FM modes, it is recommended to reduce the drive power by 20-30% compared with SSB/CW. In AM mode, the drive power should be strictly reduced to one third of SSB, or 30W at most, otherwise modulated amplitude peak will be distorted.

7-6 With high power transceiver in SSB mode, it may happen that you will over drive the amplifier to have output signal distorted if you speak too loud or if you set microphone gain too high. Speak to the microphone properly not to splatter the spurious to the neighborhood. ALC is effective to prevent the output signal from being distorted or to limit the carrier level within rated output level. As long as you do not over drive, you may disregard ALC connection. For the details, see Section 8, ALC CONNECTION.

7-7 Protection circuits may work during operation depending on the conditions. If the protection circuit has shut down the amplifier, check the antenna SWR, Vd , AC line voltage, or try to reduce the drive level. To reset , turn off the POWER switch once and turn on again. Also the power transformer has the over heat protection in the coil layer. If this temperature switch once works, the amplifier is set to the receive mode for a while with cooling fan kept running until the transformer cools off. It may take ten to fifteen minutes for this cooling depending on the room temperature. For the more details of protection circuit, see Section 10.

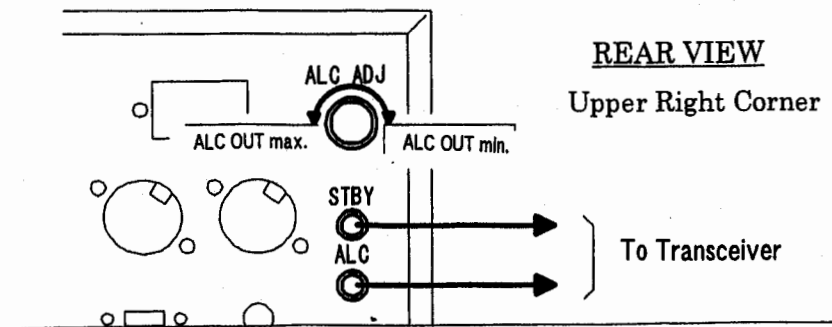
8. ALC Connection

ALC voltage is available at the terminal marked ALC (RCA phono jack) on the right upper corner of the rear panel. Negative maximum DC voltage of ten volts (- 10V) is produced at this terminal when the amplifier is fully driven. This voltage is adjustable with ALC ADJ. knob located above ALC jack. If ALC voltage is properly fed back to the transceiver, it is most useful to keep the maximum output power constant or hold the power at certain level. Also ALC is effective to avoid SSB signal from being distorted when overdriven. If you , however, set the mic gain properly and do not overdrive the amplifier, you may not always need to connect ALC to the transceiver. Depending on the manufacturer of the transceiver, suitable ALC voltage differs. ICOM may need 0~ -4V, and Yaesu may need 0~ -5V range.. Kenwood may need -6 ~ -8V maximum. Check your transceiver manual.

8-1 Prepare an ALC control cable using the RCA plug supplied in the package. Solder a single wire or more preferably a shielded single wire to center pin of RCA plug and the shield braid being soldered to outer side of the plug. Connect the control cable to the “ALC (or EXTERNAL ALC)” jack of the transceiver. External ALC input is sometimes available at one of the pins of “ACC” socket of the transceiver also.

8-2 At first turn ALC ADJ. fully counterclockwise. Drive the amplifier on CW/RTTY mode up to full output power. Then turn the ALC ADJ counter clockwise. Observe the SWR/Power meter at the output (or Pf of multi-meter). When the power started to drop a bit, stop turning ALC ADJ. and leave the ALC ADJ. there. Or if you wish to further reduce the power, keep turning ALC ADJ until the desired level is achieved. With these adjustments, you will now see that output power is rather saturated, if you further try to increase the drive power.

(-10V is produced as maximum ALC voltage when the amplifier output is over 200W.)



REAR VIEW

Upper Right Corner

9. Band Data Cable Connection

Connection methods with ICOM, Yaesu and Kenwood transceivers are described in detail here respectively. This connection enables the automatic band setting of the amplifier with the band set command from the transceiver. Four types of cable connections are explained.

9-1 ICOM DC Voltage Band Data

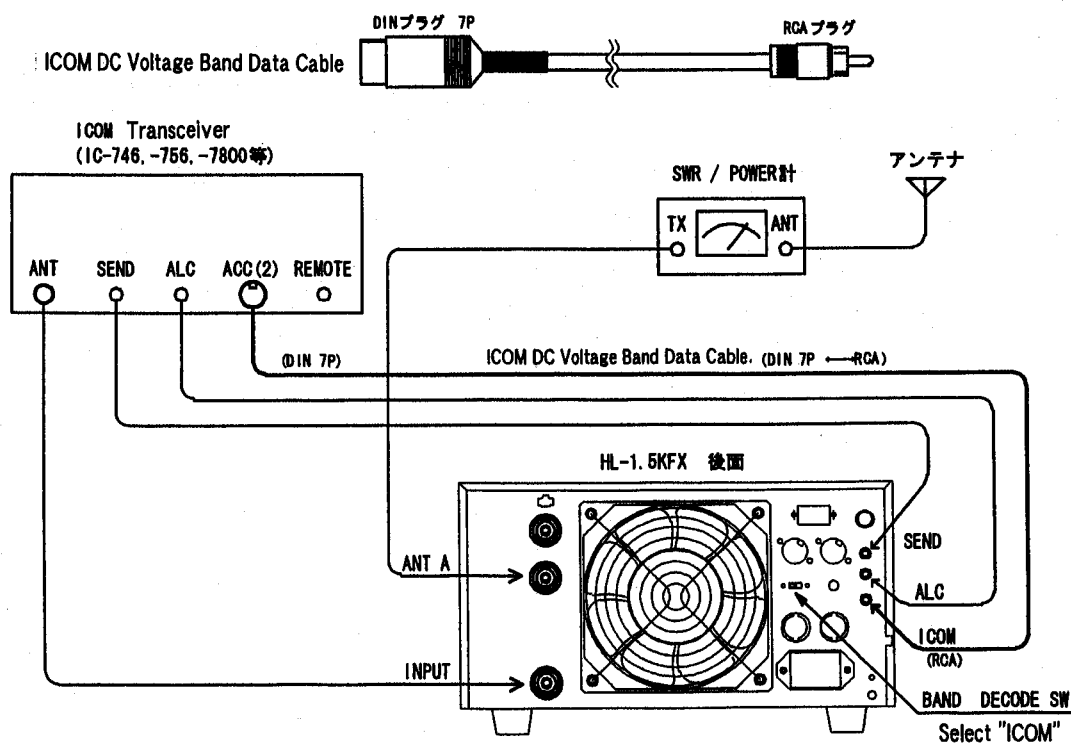
Turn off the AC mains of transceiver and amplifier for safety.

Connect the cable (for ICOM DC Voltage Band Data Connection) as shown in the following illustration.

Slide the “ BAND DECODE ” slide switch on the rear panel toward “ ICOM “. (Other side is for CI-V.)

Set the “ BAND SELECT ” rotary switch on the front panel to “ ICOM “. Turn on the AC mains of transceiver, and then turn the POWER switch of the amplifier on.

Observe the band indicator (LED) of the amplifier matches that of the transceiver.



Note : This connection is at least good for ICOM models of 746, 756, 7800 and so on. (706MK II G needs a special connection to the ACC socket using the 706 accessory cable assembly. See 706 manual.)

9-2 ICOM CI-V (See Eye-Five)

Following initial setting is needed to the ICOM transceiver ;

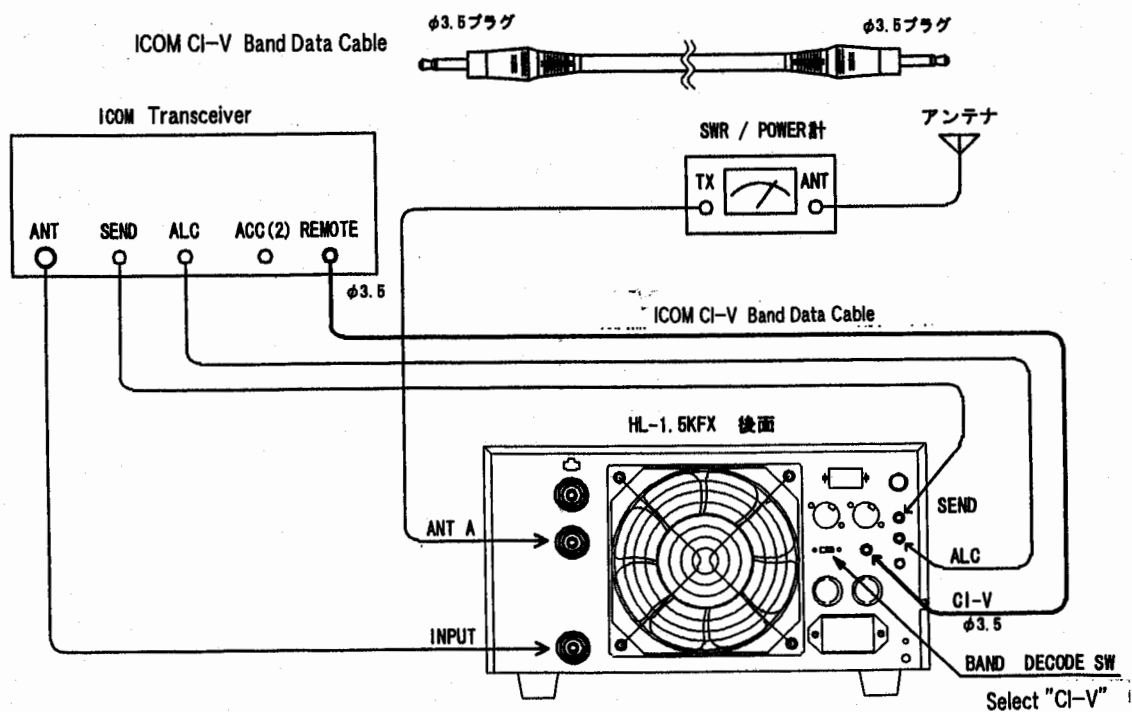
CI-V BAUDT RATE : 4800
CI-V ADDRESS : 5ch
CI-V TRANSCEIVE : ON
CI-V with IC-731 : OFF

(For the details, refer to the ICOM radio manuals.)

Turn off the AC mains of the transceiver and amplifier. Connect the following CI-V band data cable as shown in the illustration.

Slide the BAND DECODE switch knob to the CI-V side. BAND SELECT rotary switch on the front panel should be set to ICOM position.

Check if the transceiver is in the receive state. Turn on the POWER switches of the transceiver and the amplifier. Observe the band indicator (LED) of the amplifier matches that of the transceiver.

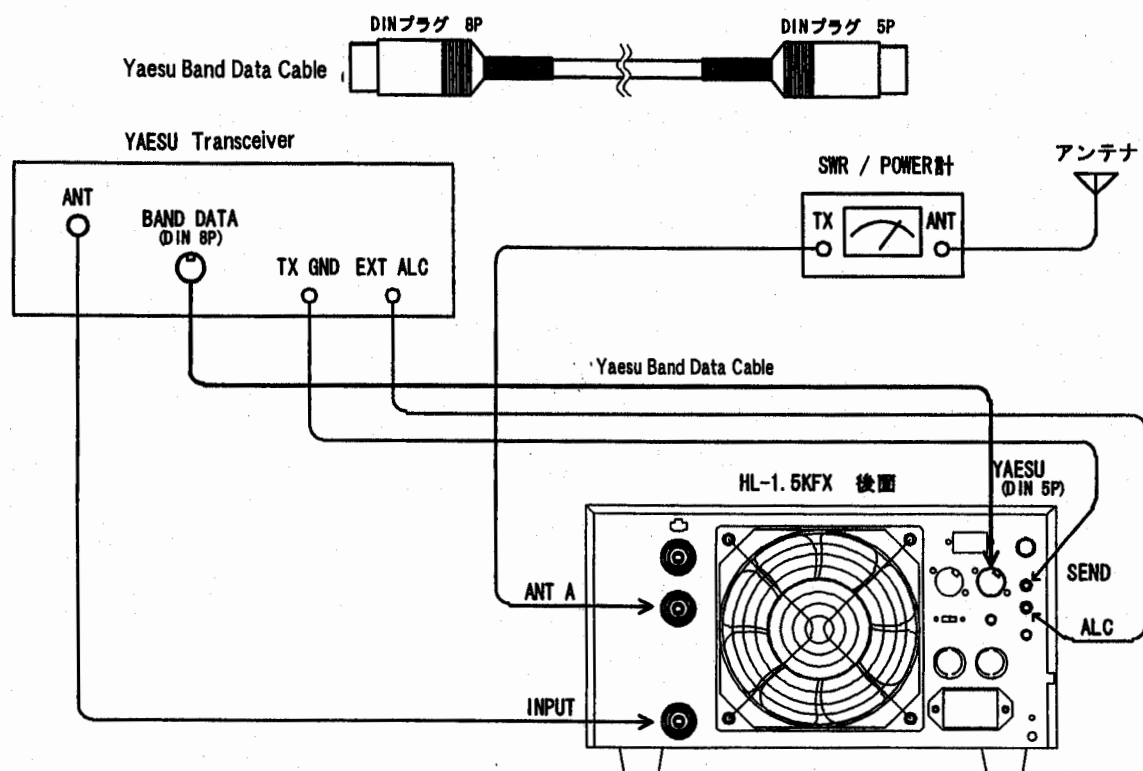


9-3 Yaesu Band Data

Using the Yaesu band data connection cable (shown below), connect the transceiver (example, FT-1000MP MK-V) to the HL-1.5KFX.

Turn off the AC POWER switches of the transceiver and the amplifier. Connect the plug of DIN 8 pin connector to the BAND DATA (8 pin) socket of Yaesu transceiver. Connect the other plug of DIN (5 pin) connector to the ⑭ YAESU of DIN (5 pin) socket on the rear panel of the amplifier.

Check if the transceiver is in the receive state and turn on the AC POWER of the amplifier. Observe the band indicator (LED) of the amplifier matches that of the transceiver.



9-4 Kenwood RS-232C Band Data

Using the Kenwood band data connection cable (shown below), connect the transceiver (example TS-950, TS-870) to the HL-1.5KFX as illustrated below.

Initial setting to the transceiver is as follows ;

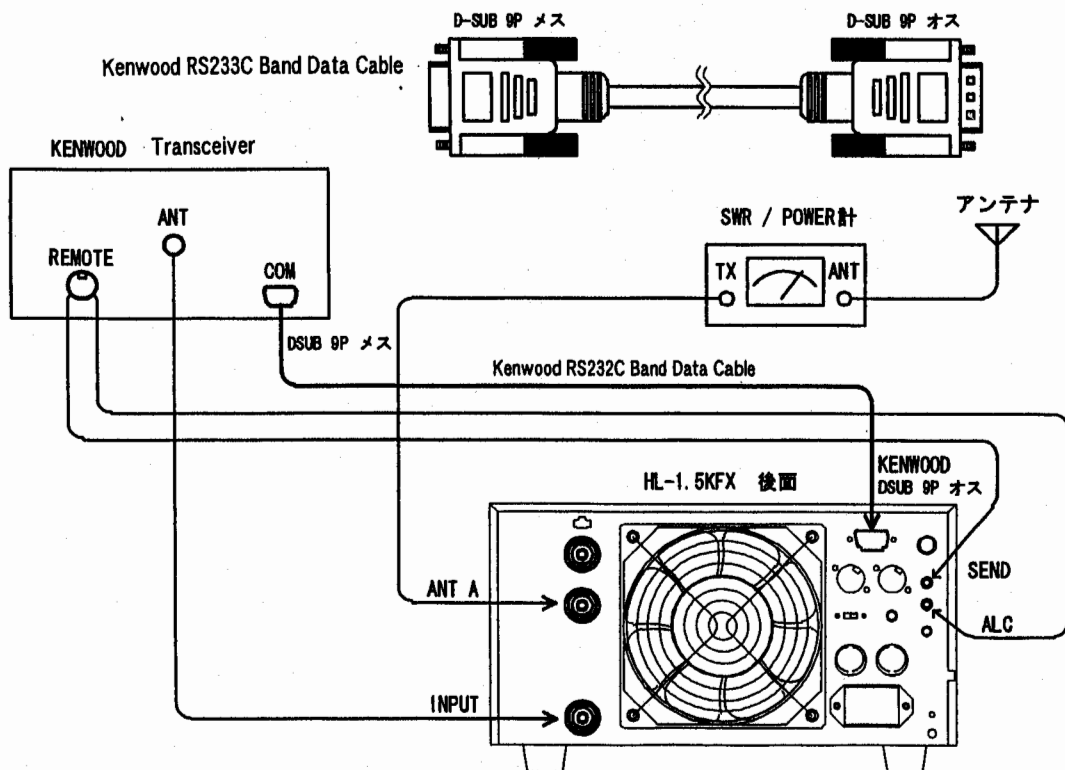
Communication Speed : 4800 (bps)

Stop Bit : 1 bit

(For the details, refer to the Kenwood radio manual.)

Turn off the AC POWER switches of the transceiver and the amplifier. Connect the D-SUB (9 pin) plug to the COM (D-SUB 9 pin socket) on the rear panel of the Kenwood transceiver. Connect another D-sub 9 pin plug to the KENWOOD (D-SUB 9 pin socket) on the rear panel of the amplifier.

Turn on the AC POWER switch of the transceiver and check if transceiver is in the receive state.
Turn on the AC POWER of the amplifier. Observe the band indicator (LED) of the amplifier matches that of the transceiver.



10. Protection Circuits

There are five major protection functions in this amplifier. When the set was shut down for some reason, correct the possible cause of the shut down. Turn off the POWER once and then turn on to reset.

10-1 O.DRIVE (Over Drive/ Band Mis-set)

When the drive power exceeds 100W level, the amplifier is shut down to become STAND-BY mode (or receive) in order to protect the input side of power FET's. Also if the band setting is wrong, protection may work. This especially occurs, on MANUAL BAND mode, when amplifier band setting is lower than that of the transceiver

10-2 O.HEAT (Over Heat)

When the temperature of the power amplifier aluminum heat sink reaches 70 degrees C, the amplifier becomes RECEIVE state for the safety of the power FET devices. Also if the temperature of the inside layer of the power transformer reaches 130 deg. C, the amplifier will become RECEIVE state for safety. O.HEAT protection can not be reset before the heat sink or transformer is sufficiently cooled off.

10-3 O.VOLT (Over Voltage)

Due to the sudden AC line voltage rise, and or the erroneous transformer primary wiring, the FET drain voltage may rise above acceptable level. If O.VOLT protection works, check the AC line voltage with the circuit tester or the AC voltage meter.

10-4 FUSE (Fuse Blown)

If either of glass fuses (20A) on PC1662 fails, O.VOLT protection works. This failure will rarely happen under normal usage of the amplifier. When it occurs, there is a possibility that power FET's have failed together. If the amplifier can not be recovered, consult with the dealer or the service center.

10-5 PR (Reflected Power Protection)

If the reflected power from the antenna reaches approximately 80W, PR protection may work. In this case, one solution is to reduce the drive power from the transceiver. Or you may have to check antenna matching (SWR) status. If the matching can not be corrected properly, use the antenna tuner.

As seen above, the amplifier is equipped with several kinds of fast acting protection circuits using the latest micro processor. If the amplifier is, however, operated in such a manner that multiple protections work repeatedly over the long time period, the amplifier may be seriously damaged.

11. Explanation of Major Circuits

Five major circuit blocks are explained on its basics and signal flows.

11-1 Main DC Power Supply

11-2 Power Amp, L.P.F.

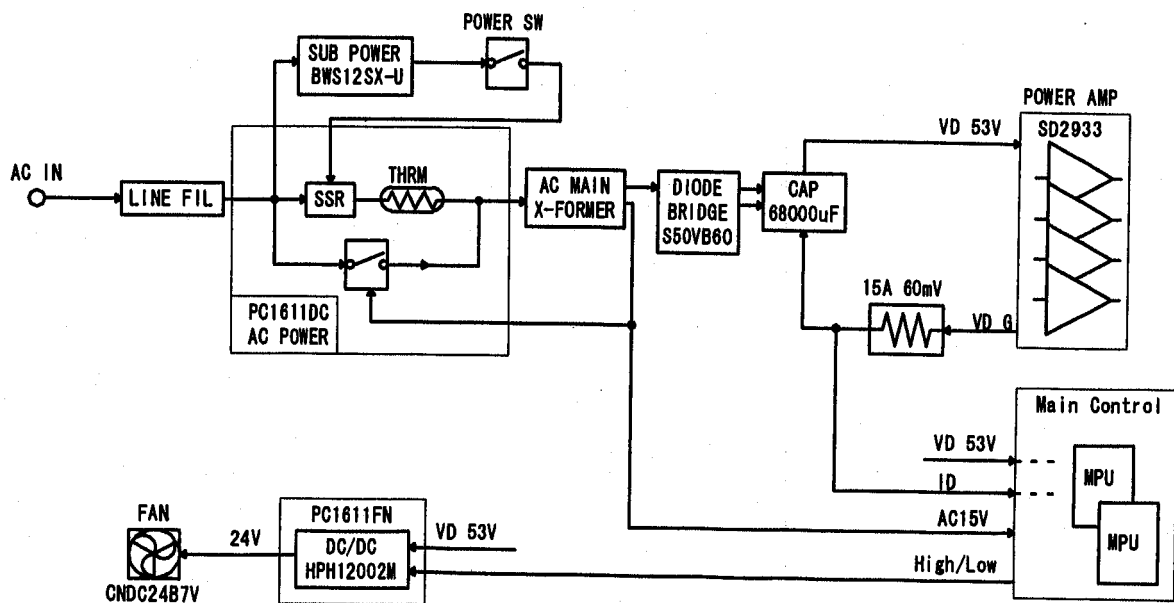
11-3 RF Power Detector, TX/RX Switching

11-4 Main Controller

11-5 Band Decoder, Frequency Counting

11-1 Main DC Power Supply

The main DC power supply feeds the 50V DC power to the final PA stage. It is a non-regulated power supply and consists of the compact power transformer using the oriented core, bridge diode rectifier, and high capacity electrolytic capacitor of 68,000uF for the filter. Soft start circuit suppresses the AC rush current using the thyristor. A part of 50V line is converted to 24V through DC-DC converter and is supplied to the cooling fan.

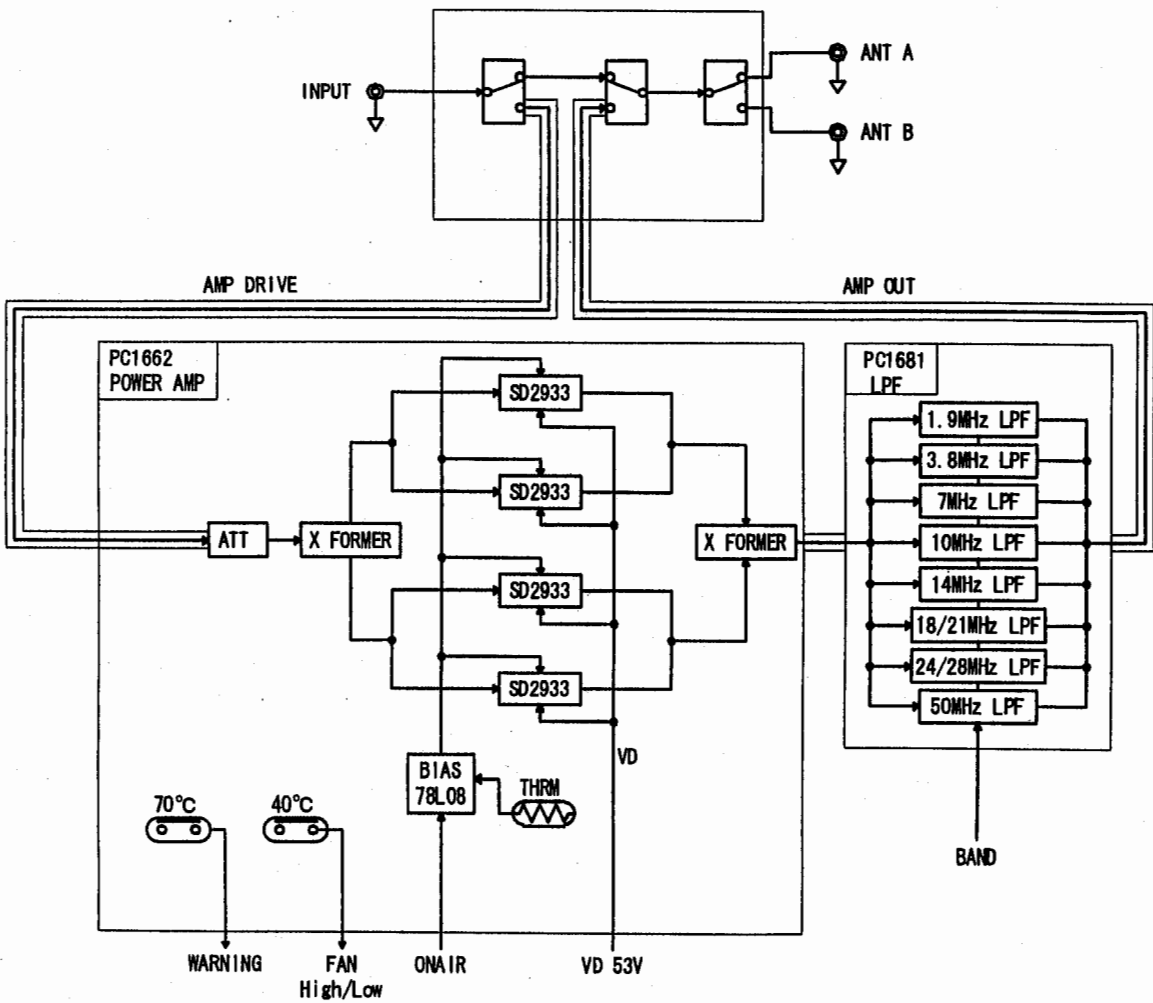


11-2 Power Amp (PA PC1662) / L.P.F. (PC1681)

RF PA is the heart of this amplifier and is composed of four pieces of SD2933 FET made by ST Micro, a French-Italian joint venture firm. The amplifier type is a parallel push-pull of class AB . Gate bias supply circuit is regulated for the best stability and is thermally compensated as well.

The PA has a 6dB attenuator at the input side for the gain reduction and enhanced stability of wide band power PA characteristics. On the heat sink are two kinds of thermal sensors to detect temperatures of 40 deg C, and 70 deg C respectively. At 40 deg C, the cooling fan is shifted to high speed mode. At 70 deg C, the amplifier is locked to RECEIVE state for the safety of FET devices.

In L.P.F. (output low pass filter) circuit, there are eight kinds of band filter that is selected either by auto band decoder or by manual band switch. Each L.P.F. has a harmonics rejection capability to meet the international telecommunication equipment standards.

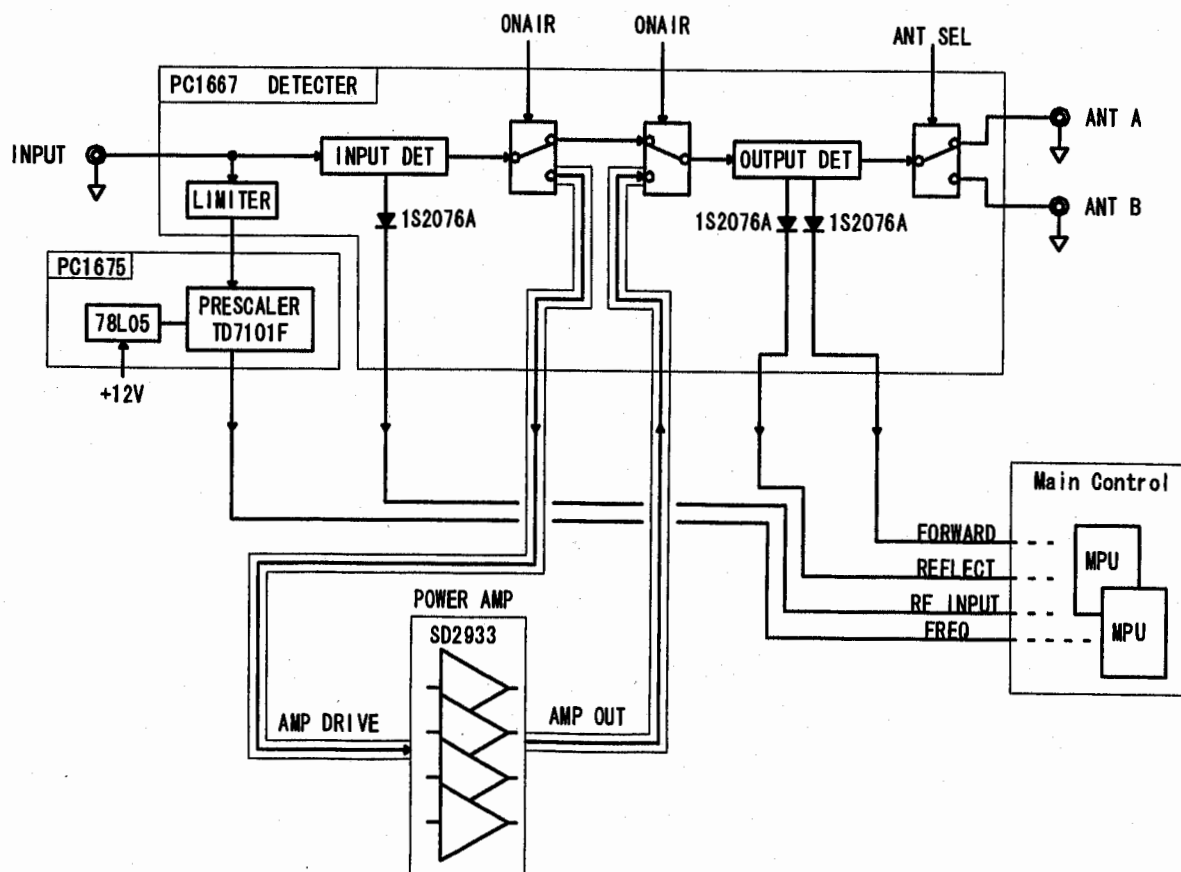


11-3 RF Power Detector/ TX-RX Switch (PC1667)

As illustrated below, there are two RF power detectors on this board. The one detects the drive signal level from the radio and the other monitors the out going power as well as reflected power from the load (antenna). These detected signals are sent to the MPU of PC1665, Main Control board, that monitors the operating condition of the whole amplifier.

The TX-RX switch (Send-Receive switching) will switch the flows of drive power/ output power and incoming signal from antenna with two high speed relays mounted at input and output sides of the PA. Two channel antenna switch (A/B) is also installed on this board.

The limiter on this board together with prescaler on PC1675 help MPU in Main Control count the frequency of the RF drive signal.

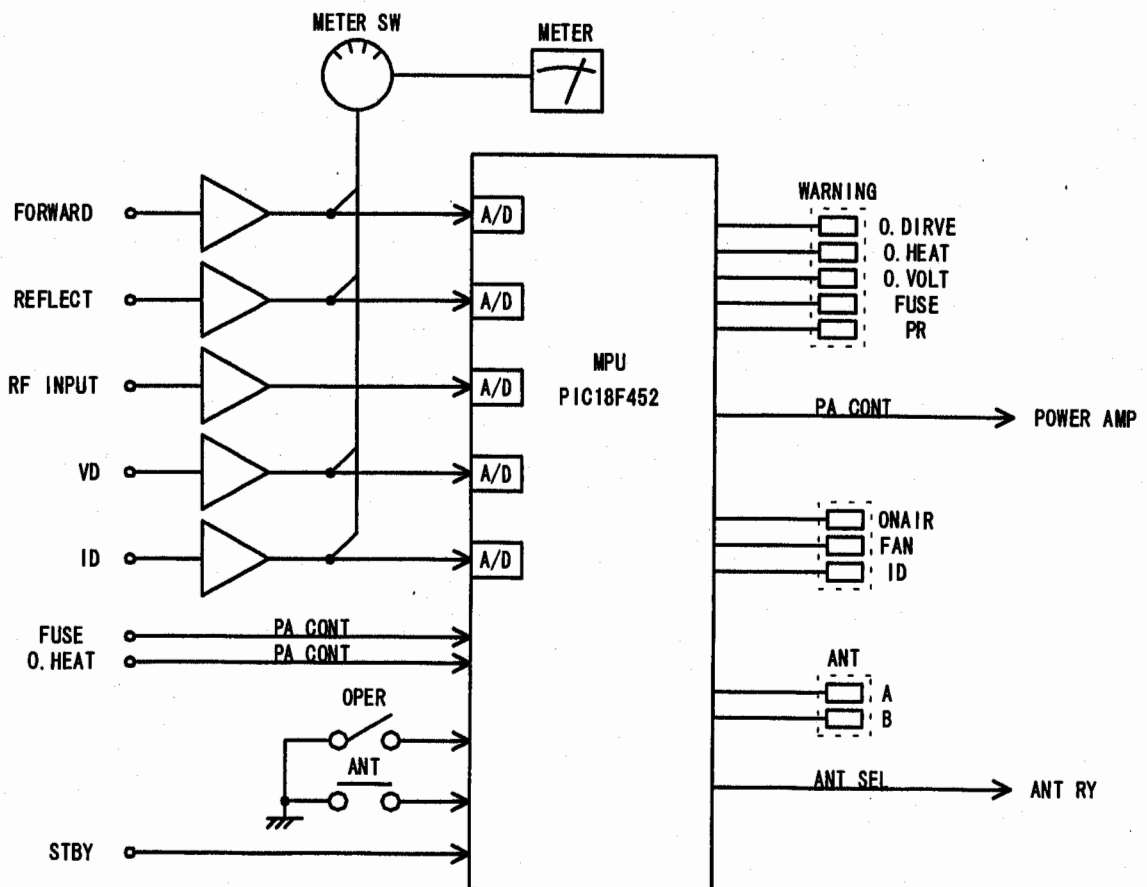


11-4 Main Control (PC1665)

This is the heart of the control signal processing of HL-1.5KFX. It judges the operating condition of the amplifier and issues the commands to the peripheral circuits as well. Various analog signals are put into MPU such as RF drive from the transceiver, RF power signals at various points, DC power supply information and so on.

These are converted to the digital signals through A/D converter . MPU will then numerically compute the data, to judge the amplifier status, and issue commands for protections.

Transmit-Receive switching, high/low control of fan, and LED lightings are all commanded by the MPU on this board.



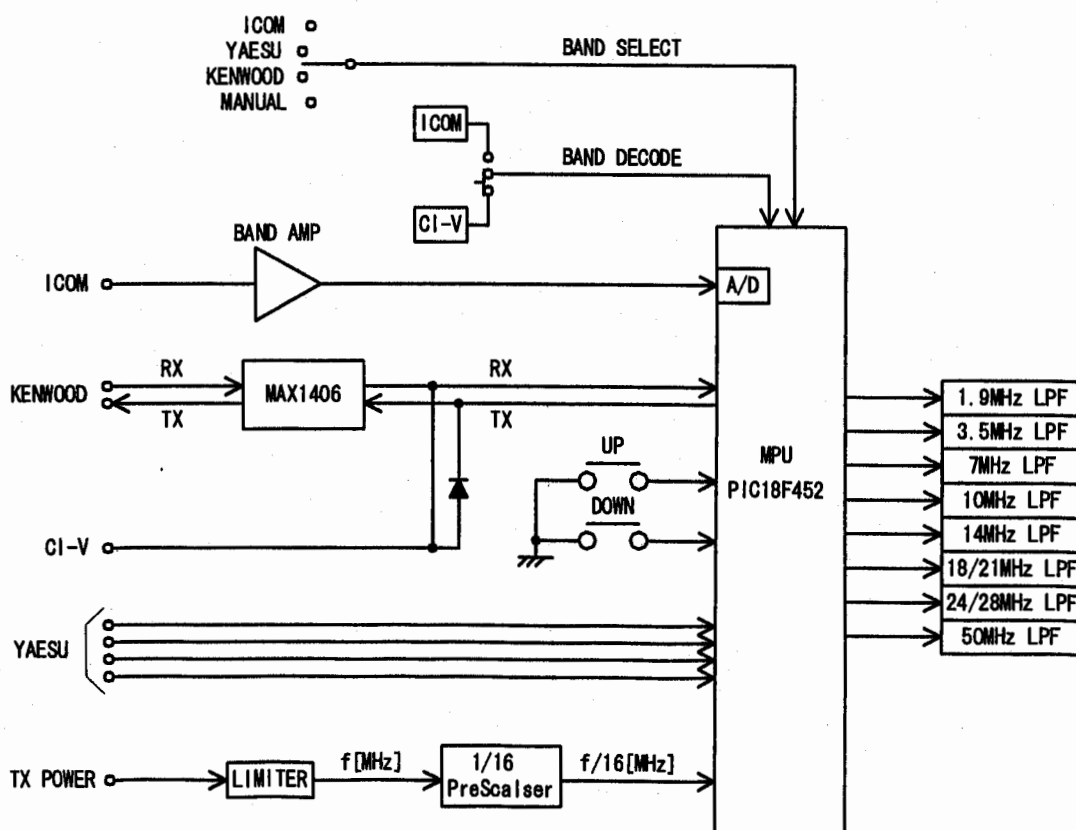
11-5 Band Decoder/ Frequency Counter

The band decoder decodes the various operating band data issued by the major brands of the radios (ICOM, Yaesu, Kenwood). With the decoded signal, the amplifier will automatically follow the frequency band of the radio.

With these three manufacturers, there are four kinds of band data used in their latest radio models, i.e. DC voltage, 4 bit TTL, RS-232C, and serial data. HL-1.5KFX is designed to meet any of these methods, if matched cable is connected respectively.

The MPU has the frequency counting function also. RF drive signal from the transceiver is sampled and divided by 16 (PC1675), and then reaches the input of the MPU.

Under the manual band select mode, if the frequency of RF drive and band setting of the amplifier do not match each other, MPU will judge band mis-set to issue the amplification “halt” command (shut down).



12. Trouble Shooting

Failure	Possible Cause	Solution
AC mains not Come on	① AC fuses blown ② AC cord not plugged in ③ Inter-lock switch lifting ④ Wrong tapping on power transformer primary	① Replace with new ones. ② Plug in securely. ③ Screw bolts tightly for top cover. ④ Correct primary wiring.
Not enter into Transmit state	① Remote control cable not connected ② Protection circuits on.	① Check the cable and connect correctly. ② Check drive power, antenna SWR, antenna selection A/B etc. Reset with AC POWER switch.
O.Drive lights	① RF over-drive ② Band mis-set	① Decrease drive. ② Match the BAND correctly (Manual mode)
PR lights	① Reflected power high, Antenna SWR high ② Poor connection of coax cables	① Check, adjust antenna. (Or decrease drive.) ② Check the coax cable connectors.
FUSE lights	① Fuse blown ② Antenna SWR high ③ Short circuit	① Replace F202 and F203 (20A) on the PA board (PC1662). ② Adjust the antenna. ③ Contact the distributor, or service center.
O.Heat lights	① Inside over heated above 70deg. C	Cool off until sign goes off. Check if air in-take area blocked with substances. Also check ventilation window on top cover.
TVI, FMI	① Over drive. ② RF leakage from coax cable, grounding wire, AC power cord etc.	① Decrease the drive. Check ALC setting. ② Insert common mode filters on antenna cable or AC line. Add clamp-on cores (by TDK, Amidon, Palomar) on various cables.

13. Schematic Diagrams

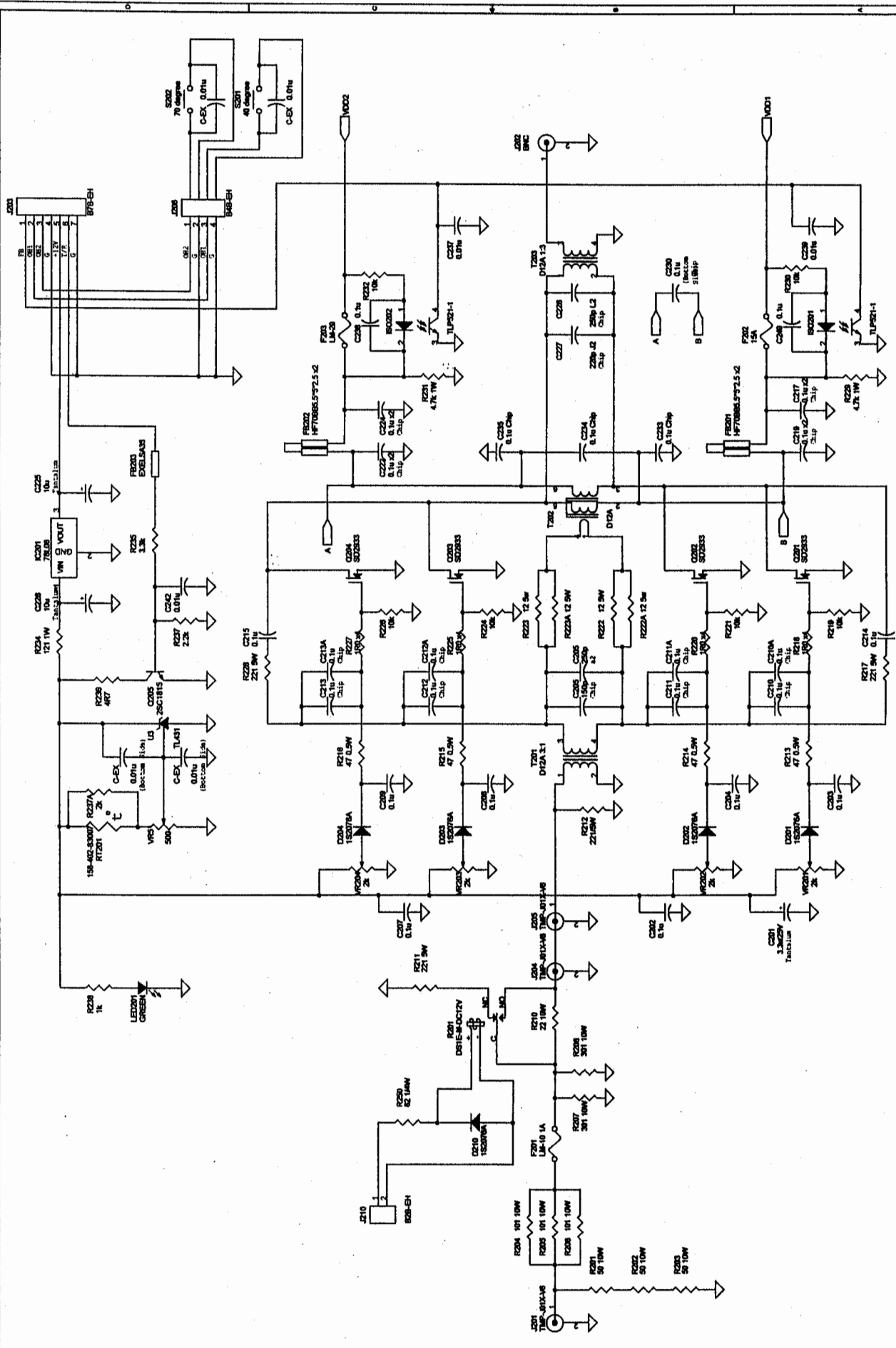
- 13-1 PC1662 PA (Power Amplifier)**
- 13-2 PC1664 Band Decoder**
- 13-3 PC1681 L.P.F. (Low Pass Filter)**
- 13-4 PC1665 Main Control**
- 13-5 PC1667 RF Power Detector**
- 13-6 PC1669 Front Panel Board**
- 13-7 PC1675 Pre Scaler**
- 13-8 PC1611FN/PC1611DC DC-DC Converter for Fan**

14. Parts Layout

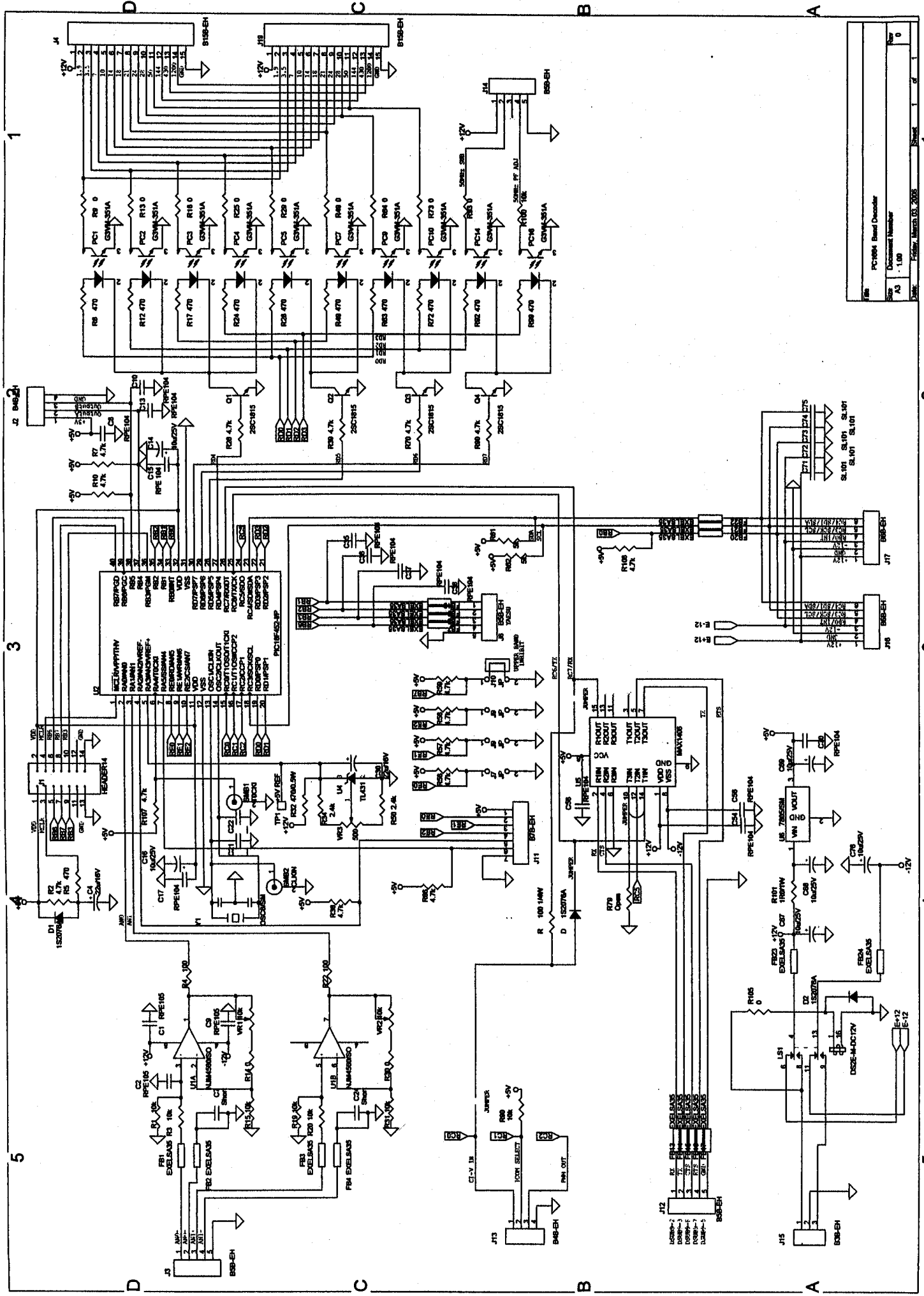
- 14-1 Top View (Detailed)**
- 14-2 Top View & Side View (Left)**
- 14-3 Side View (Right) & PC1664, PC1665**
- 14-4 PA (PC1662), LPF (PC1663) Top & Bottom**
- 14-5 Power Detector (PC1667), Prescaler (PC1675), DC-DC Converter (PC1611FN)**
- 14-6 Main Control (PC1665) Front View**

15. Block Diagram

- 15-1 Simplified Diagram**
- 15-2 Overall Diagram**

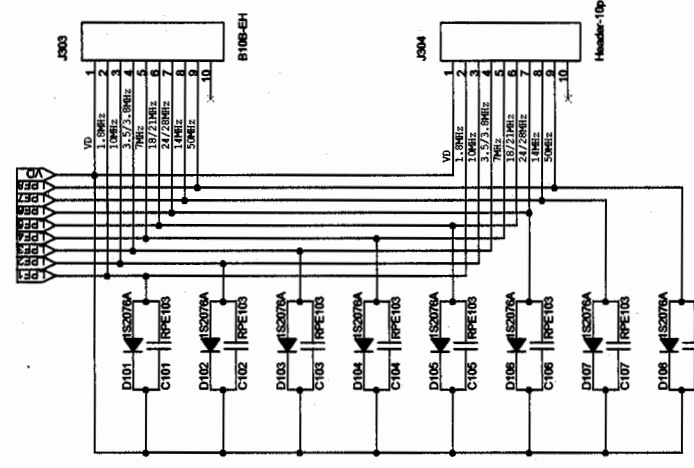
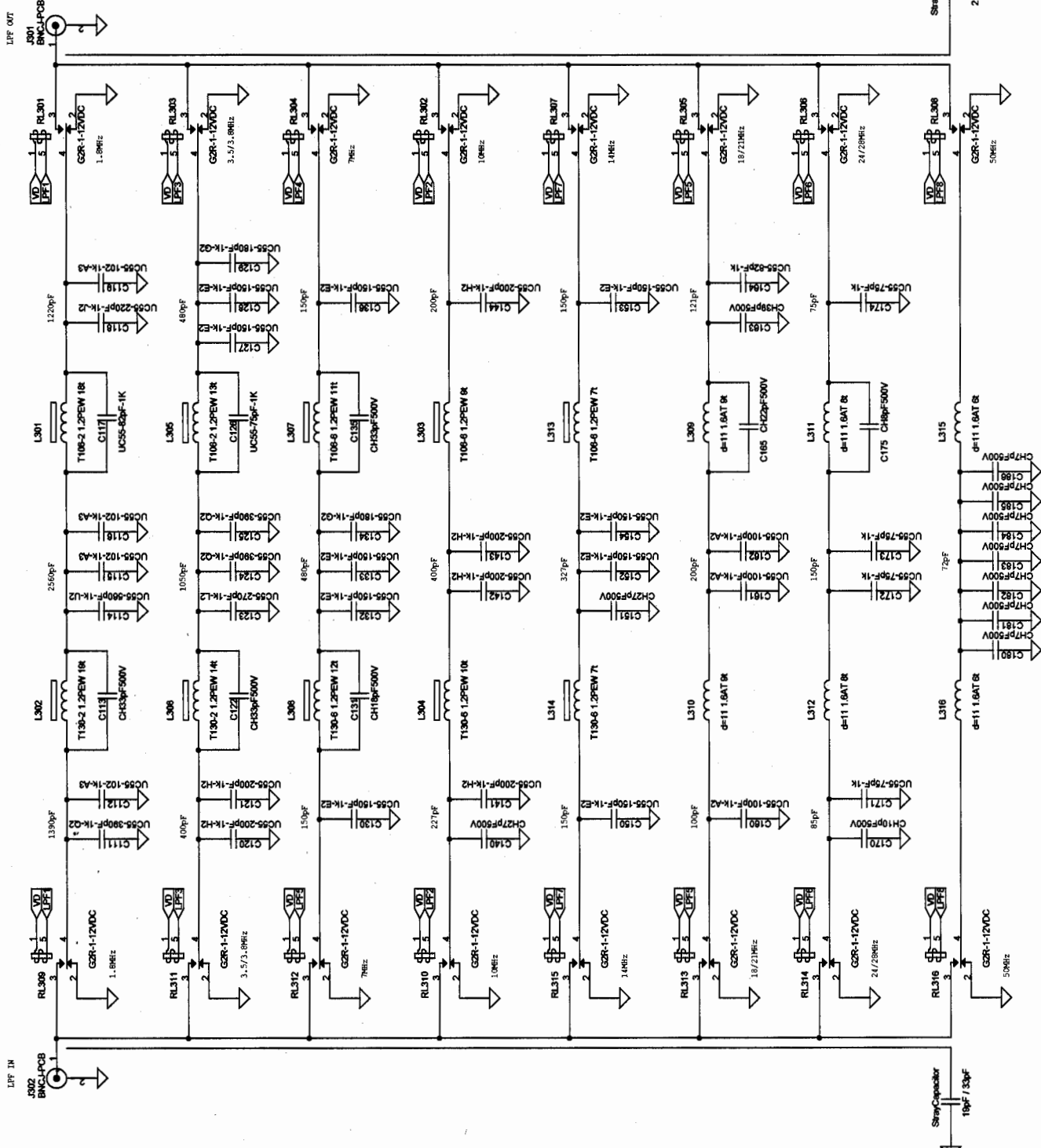


PC1662 PA (RF P.A. Unit)			
Size	Document Number	Rev	1.00
A3	<Rev>		
Doc	Version	February 08, 2008	Sheet 1 of 1

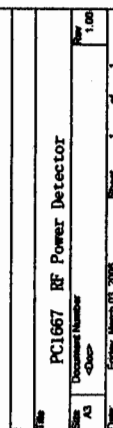


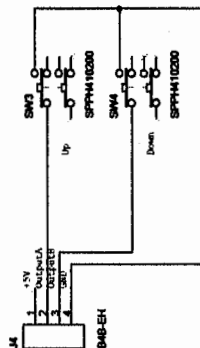
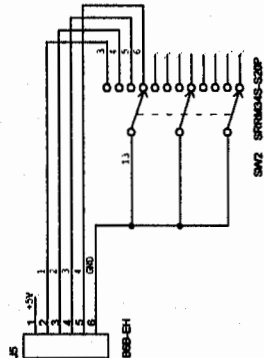
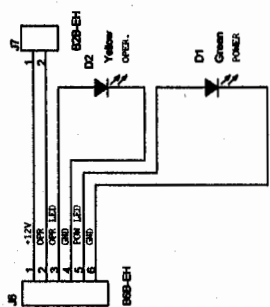
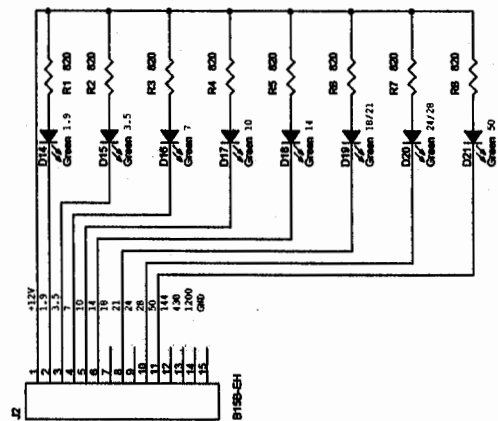
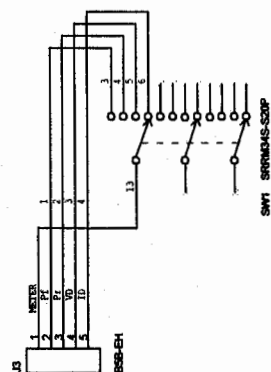
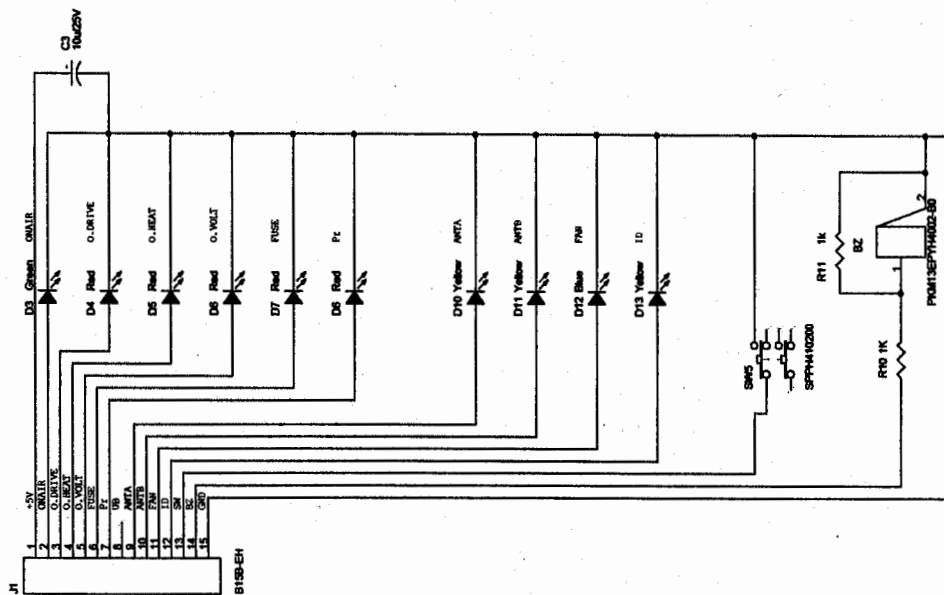
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Rev	1.00
Doc	Document Number
Rev	0
Date	Friday, March 03, 2006
Sheet	1 of 1

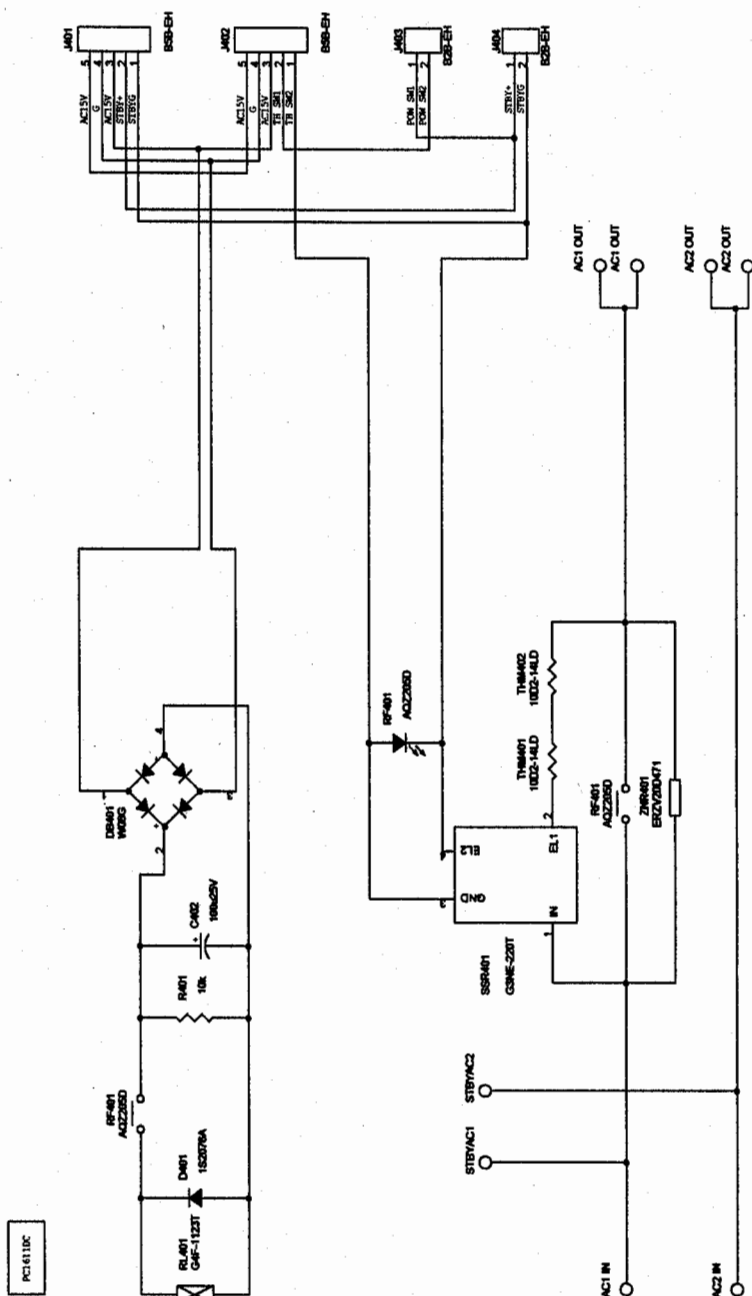
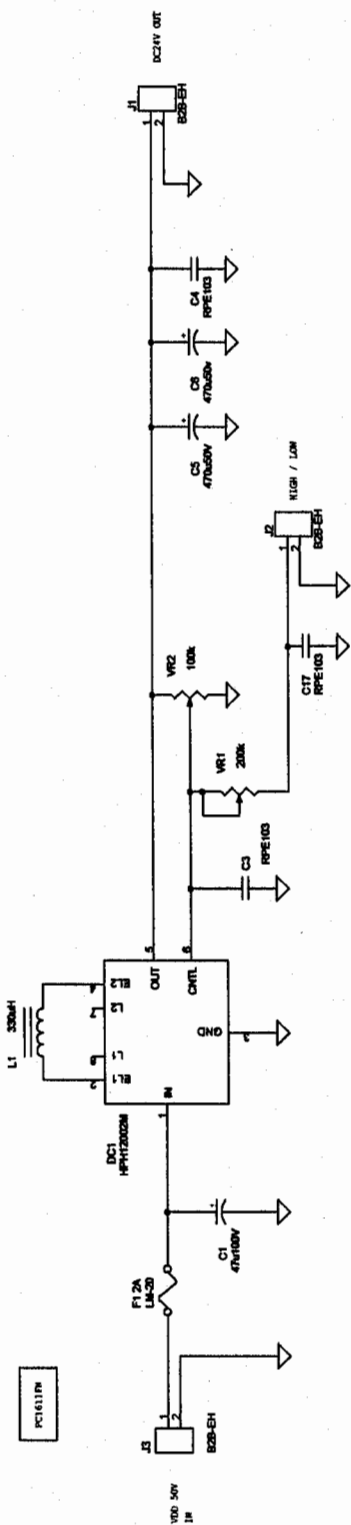
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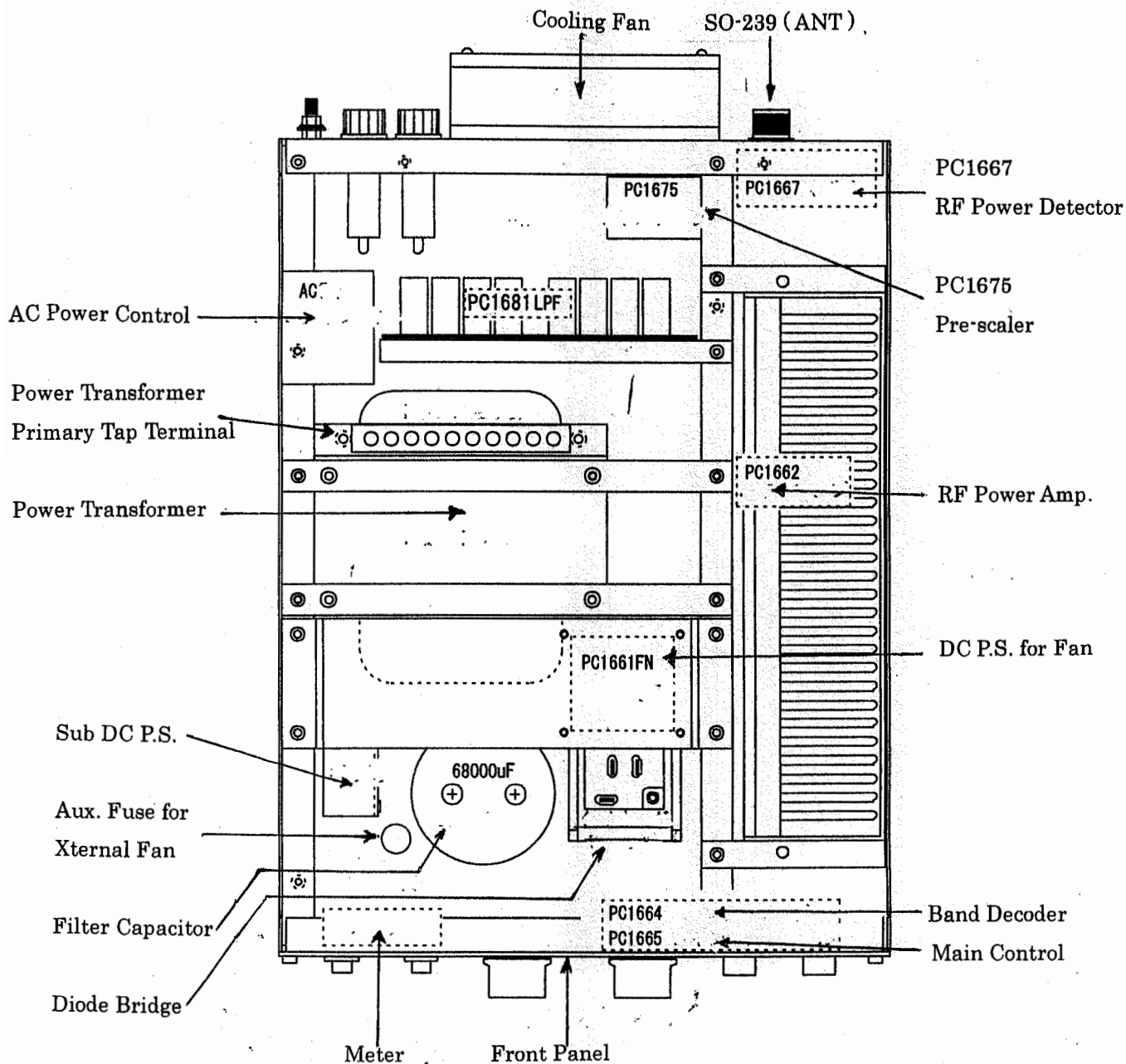
PC1681 Output Low Pass Filter (LPF)			
File	Document Number	Rev	1.0
Size	A3	<Doc>	
Date	Monday, April 10, 2006	Sheet	1 of 1

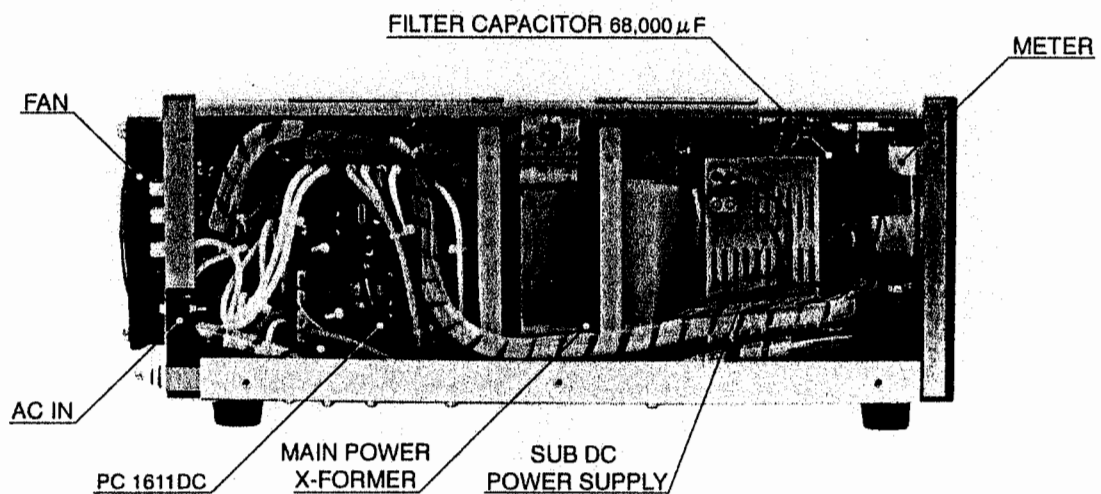
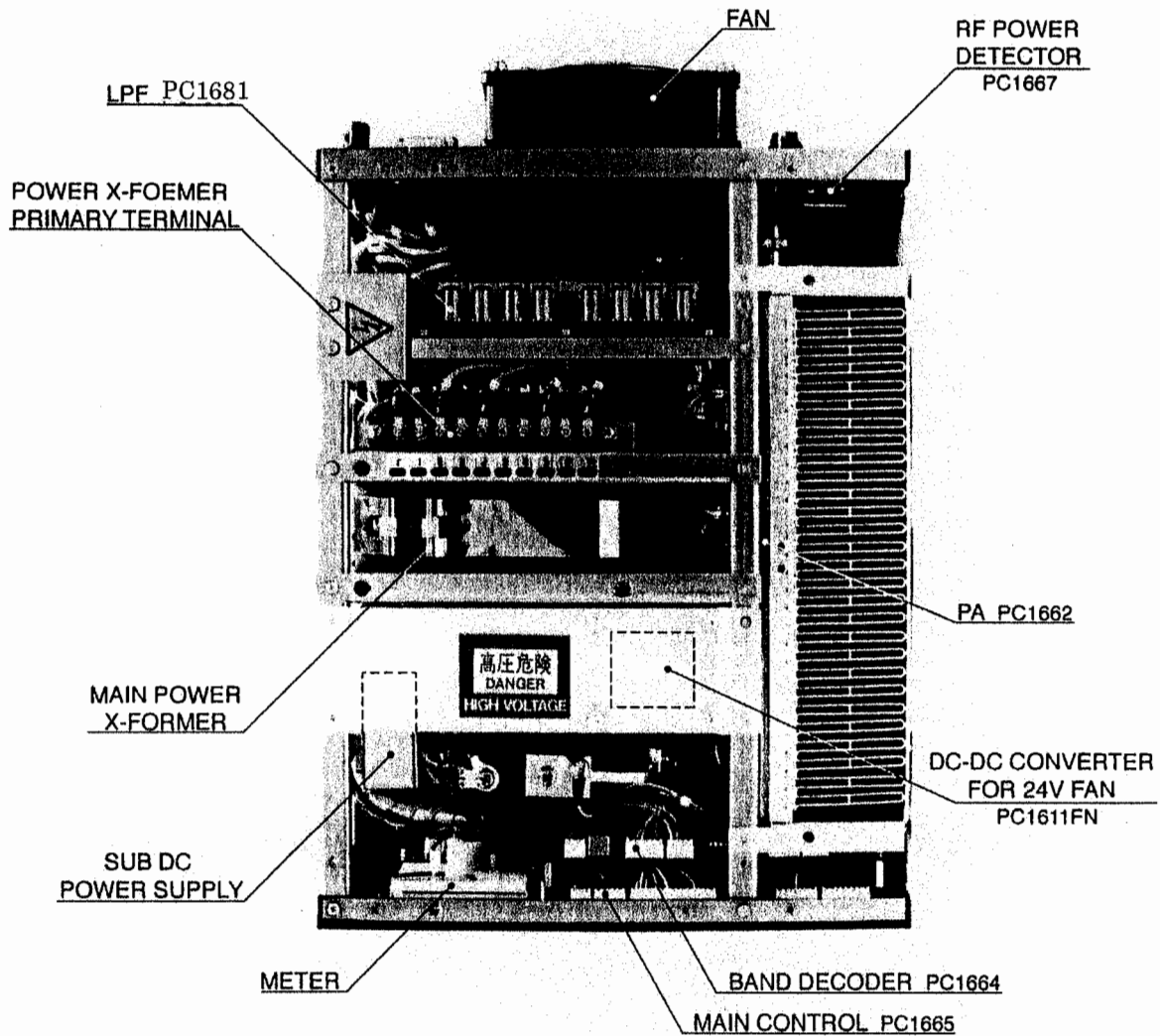


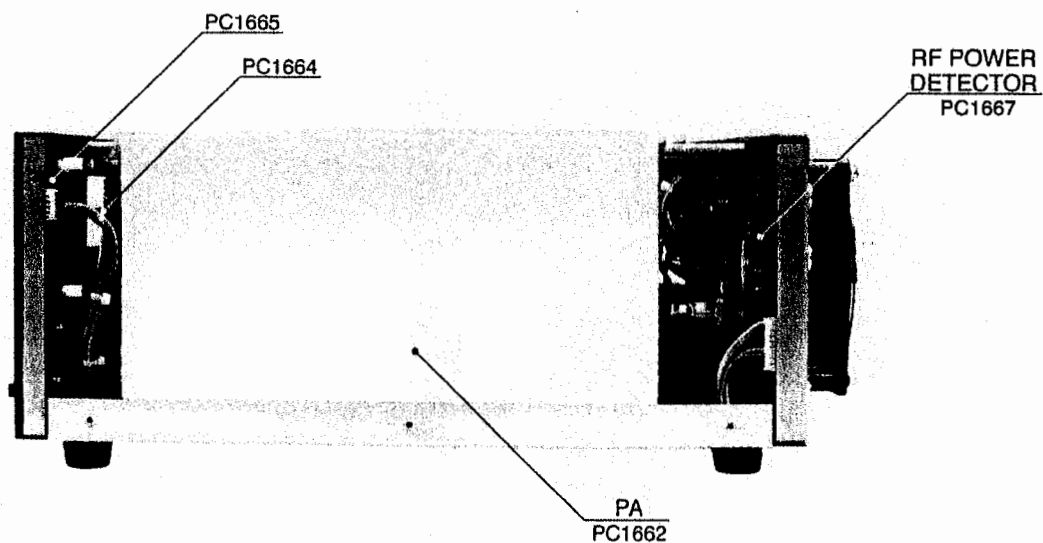




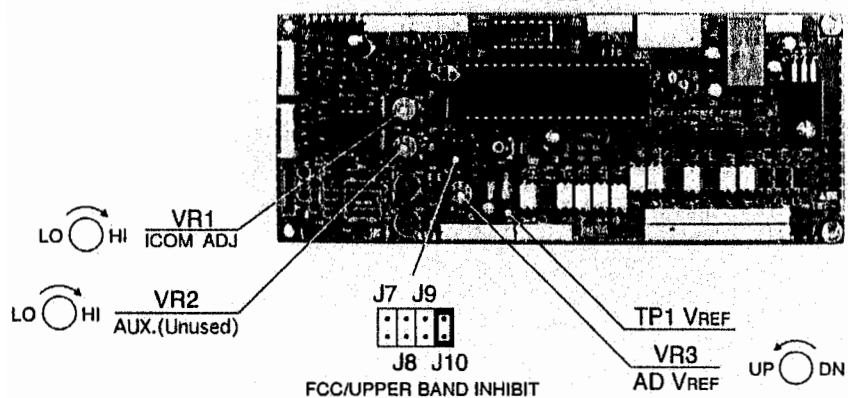
14-1 Parts Layout (Detailed, Top View)



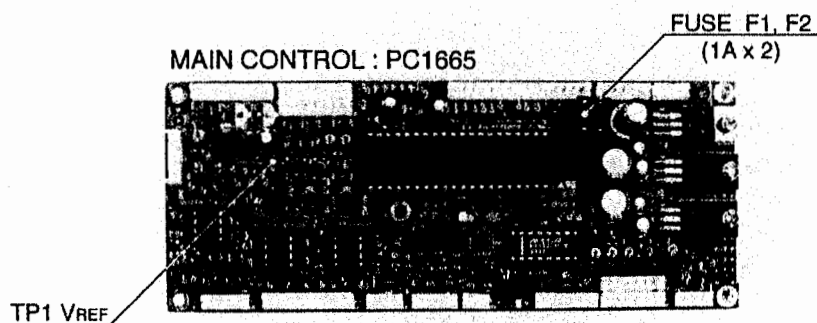




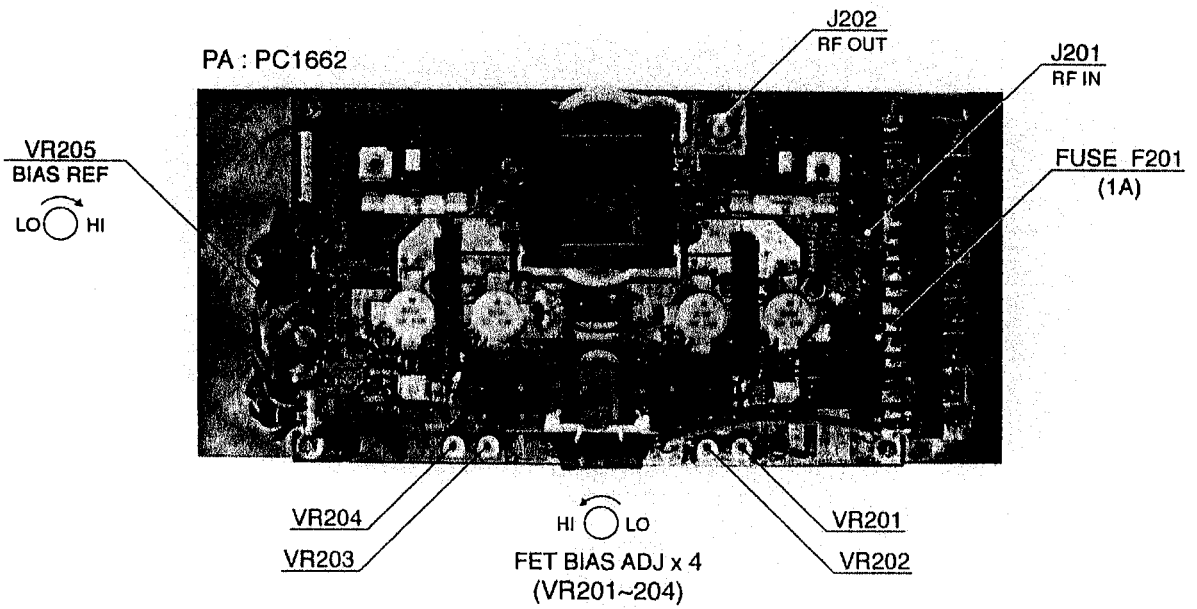
BAND DECODER : PC1664



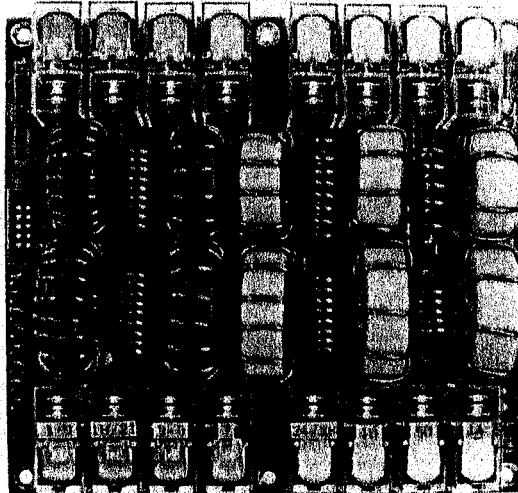
MAIN CONTROL : PC1665



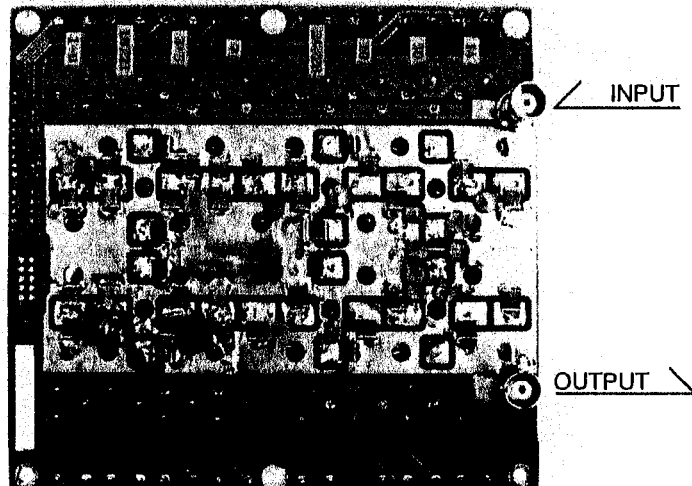
POTENTION-METERS ON BOARD PC1665
TO BE MADE ACCESS FROM FRONT SUB
PANEL.



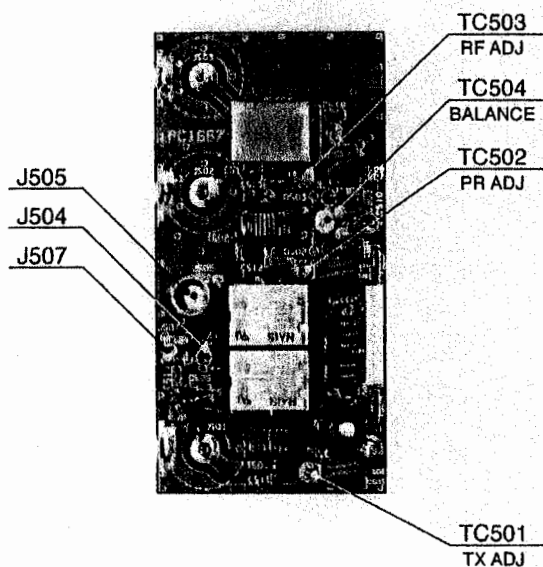
LPF : PC1681 (TOP VIEW)



LPF : PC1681 (BOTTOM VIEW)



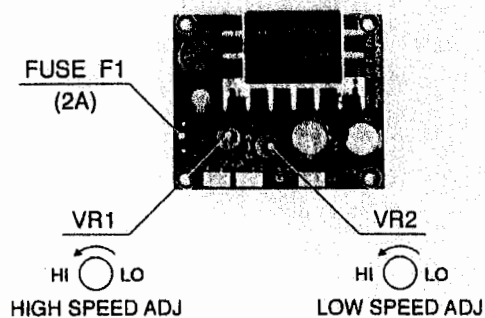
RF POWER DETECTOR : PC1667



PRESCALER : PC1675



DC-DC CONVERTER FOR 24V DC : PC1611FN



MAIN CONTROL (FRONT VIEW) : PC1665

