

Operating Instruction

YAESU MUSEN CO., LTD.
FCC ID: K66RP80U
EXHIBIT #: 10A

1. CONTROLS AND CONNECTIONS

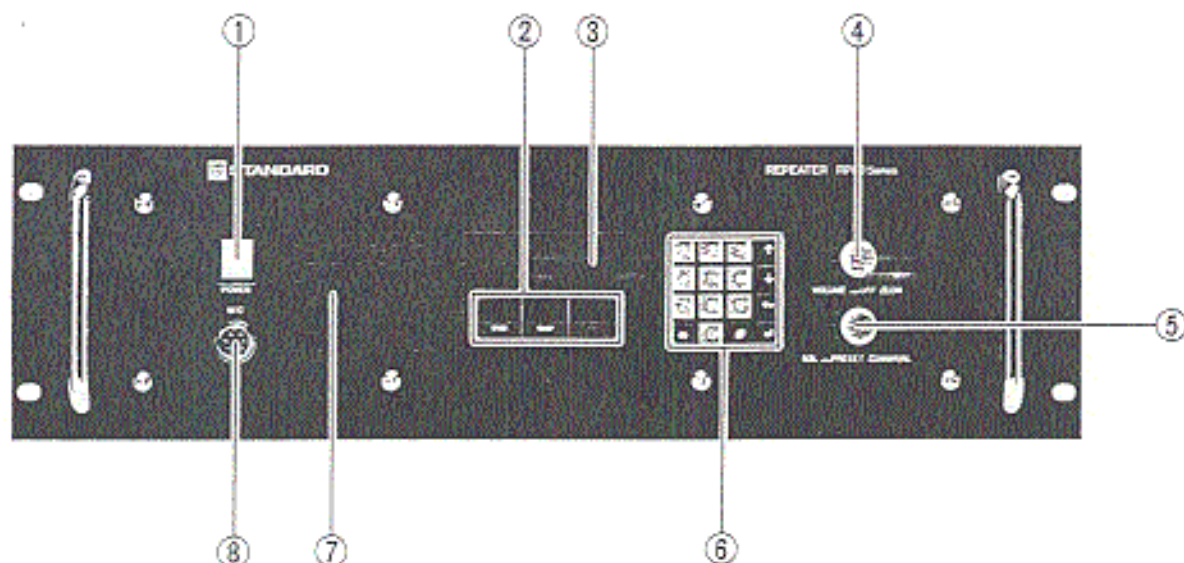


Figure 1-1 Front Panel

1.1 Front Panel

① POWER SWITCH

Press this switch to turn the power on.
This switch is used to turn on the DC power (13.2 V).

② LED Indicators

POWER : The orange LED is lit when the power is turned on.
BUSY : The green LED is lit when a signal is input.
TX : The red LED is lit when in the transmit mode.

③ LCD Indicator

REPEATER/BASE, MUTE/MONI, CHANNEL NUMBER and TAG settings are shown on the 16-digit, 2-line dot matrix LCD indicator.

④ AF VOLUME CONTROL/AUDIO MUTE SWITCH

The volume increases as this control is turned clockwise. When this control is depressed, sound from the speakers is cut off.

⑤ SQUELCH CONTROL/AUTO SQUELCH SWITCH

Use this control to eliminate the noise characteristic of the FM band when there is no input signal. When there is no input signal, turn this control clockwise until the noise is eliminated. When pressed, the squelch level set internally will be selected automatically. (SQUELCH PRESET)
The preset level can be adjusted internally.

⑥ NUMERIC KEYPAD

10 keys : Used to input channel numbers and, in the program mode, frequencies, etc.

* key : Used in the program mode.

key : Used to cancel (clear) functions.

Up key : Used to select menu items and, within the various functions, to set the timeout duration, on/off settings, etc.

Down key : Functions analogously to the up key.

Key lock : Disables input from the keypad. Key lock is activated by holding the key down for two seconds or more.

Enter key : Used to choose items selected using the up and down keys.

⑦ INTERNAL SPEAKER

⑧ MICROPHONE JACK

Use with the CMP820E (hand held type) microphone.

YAESU MUSEN CO., LTD.

FCC ID: K66RP80U

EXHIBIT #: 103

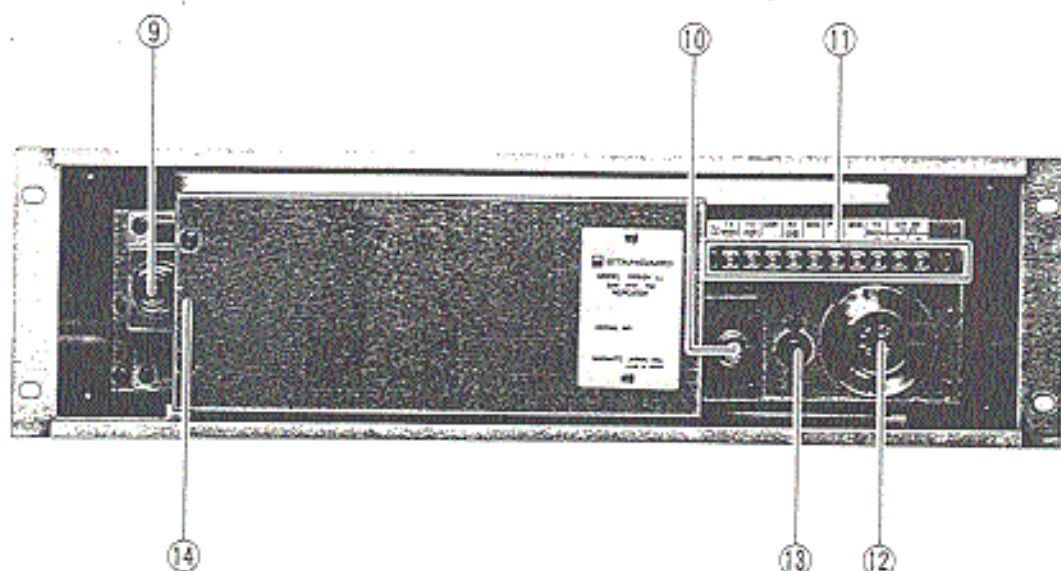


Figure 1-2 Rear Panel

1.2 Rear Panel

⑨ TX ANTENNA CONNECTOR

This is the connector for the TX (transmitter) antenna.

⑩ RX ANTENNA CONNECTOR

This is the connector for the RX (receiver) antenna.

⑪ REMOTE CONTROL TERMINALS

These are the signal input/output terminals for making connections with other equipment.

a) TX DISC IN

The audio signal input to this terminal is combined with the audio circuitry's pre-emphasis input by the control unit. Standard modulation is applied by the AG at an input level of about 20 mV rms (at 1 kHz) (open voltage with 600 Ω impedance).

b) TX AUD IN (TX AUDIO IN)

The audio signal input to this terminal is combined with the modulator circuit input by the TX unit. Standard modulation is applied by the AG at an input level of about 400 mV rms (at 1 kHz) (open voltage with 600 Ω impedance).

c) COR

This terminal outputs the status of reception signal detection by the RX unit's IF circuitry.

0 V: No reception signal detected (squellch on)

5 V: Reception signal detected (squellch off)

d) RX AUD OUT (RX AUDIO OUT)

This terminal outputs the reception audio signal detected by the RX unit's IF circuitry. During reception with standard modulation, a 200 — 300 mV rms signal is output with open terminal voltage.

e) GND

This is a ground terminal.

f) PTT

This terminal is connected internally to the PTT switch of the microphone jack (JD61) on the front panel. The unit switches to transmit mode when it is connected to a ground.

0 V: Transmit mode (PTT switch on)

5 V: Standby mode (PTT switch off)

g) GND

This is a ground terminal.

h) TX DATA IN (DCS)

The audio signal input to this terminal is combined with the 2-point modulator circuit's input by the TX unit. It is used as the modulation input by the DCS, etc.

Modulation of ± 0.5 — 0.9 kHz is applied by the AG at an input level of about 280 mV rms (at 67 Hz) (open voltage with 600 Ω impedance).

i) EXT DC 13.2 V $\oplus$

This is a ground terminal.

j) EXT DC 13.2 V $\oplus$

This is a power supply output terminal for making connections with other equipment. The +13.2 V power that is supplied to the unit via the DC input terminals is output as is.

⑫ EXTERNAL DC POWER JACK

Input 13.2 V DC power to this connector.

⑬ SPEAKER TERMINAL

This is the terminal for connecting an external speaker.

⑭ FAN

The fan starts to rotate when the temperature of the RF power booster rises above a certain point.

YAESU MUSEN CO., LTD.

FCC ID: K66RP80U

EXHIBIT #: 10C

2. PROGRAMMING

Set the transmit and receive frequencies, TX timer value and other data which are to be used for operation by the repeater.

The items which can be set are given in the program features in Table 2-1.

Program Features

Table 2-1

Common Data	
Items	Description of functions
Frequency band	The two bands given below can be selected using the $\uparrow$ and $\downarrow$ keys as the target transmission and reception bands. These bands cannot be changed during programming.
VHF	50 MHz to 300 MHz, at channel step
UHF	300 MHz to 520 MHz, at channel step
Channel step	The two channel steps given below can be selected using the $\uparrow$ and $\downarrow$ keys depending on the target frequencies. These steps cannot be changed during programming.
5 kHz	The channel step is initialized to 5 kHz for the VHF band.
6.25 kHz	It is initialized to 6.25 kHz for the UHF band.
TX time-out timer	The range given below can be selected using the $\uparrow$ and $\downarrow$ keys as the limit to the TX time-out time.
0.1 to 25.5 min. 0.1 step	0.1/0.2/0.3/0.4/ /25.0/25.5 min.
TX inhibit timer	The range given below can be selected using the $\uparrow$ and $\downarrow$ keys as the limit to the TX inhibit time.
1 to 255 sec. 1 step	1/2/3/4/5/ /254/255 sec.
Hang-up Timer	The time from the discontinuation of the RX signal until transmission is cleared down when the timer is used for the repeater can be selected using the $\uparrow$ and $\downarrow$ keys.
0 to 15 sec. 1 step	0/1/2/3/ /14/15 sec.
Individual Data	
Items	Description of functions
Channel number	A hundred channel numbers can be programmed. ON/OFF for the TX/RX frequencies, tone, time-out timer, etc. can be selected for each of the channels.
CH1 to 99,0 1 step	CH1/2/3/4/5/ /99/0
Frequency	The target frequencies are input directly for each channel using the 10 keys. Frequencies outside the frequency bands or frequencies which are not multiples of the steps cannot be input. Input the frequencies separately for TX and RX. The TX and RX frequencies are both initialized to 000.00000 MHz (OFF). The TX frequency cannot be input unless the RX frequency has been input.
RX TX	RX frequency TX frequency
Tone	The target tones can be selected for each channel using the $\uparrow$ and $\downarrow$ keys. Input the tone separately for TX and RX. The TX and RX tones are both initialized to OFF. The tones cannot be input unless the TX/RX frequencies have been input.
RX	First, select the type of tone. OFF/CTCSS
TX	Next, select the type according to the tones. 67.0/69.3/71.9/74.4/ /241.8/250.3 Hz Follow the same procedure for selection as with RX.
TX time-out timer	The TX time-out timer can be selected for each channel using the $\uparrow$ and $\downarrow$ keys. OFF/RESET TYPE/CONT TYPE
Busy lockout	Busy lockout can be selected for each channel using the $\uparrow$ and $\downarrow$ keys. OFF/ON
Tone lockout	Tone lockout can be selected for each channel using the $\uparrow$ and $\downarrow$ keys. OFF/ON
Tag	A tag can be selected for each channel using the 10 keys. Up to 8 characters can be input. Three letters of the alphabet are assigned to each key. When one of the keys is pressed, one of its letters or its number is displayed and each time the key is pressed, this display rotates in sequence.

2.1 Common Data

Decide on the values which will be used in common for all the channels.

- First select "PROGRAM" on the mode sub menu and then select "COMMON."
- Move the ">" display using the $\uparrow$ and $\downarrow$ keys to select the item which is to be changed.
- Press the $\rightarrow$ key to enter the selection.
- The ">" display indicates the current setting on the right.
- Select the setting using the $\uparrow$ and $\downarrow$ keys.
- Press the $\rightarrow$ key to enter the setting.
- Use EXIT to return to the original display.

CAUTION: When the frequency band or channel step is changed, all the currently programmed individual data will be lost.

2.2 Individual Data

Decide on each of the values which will be used for each of the channels (100 channels).

- First select "PROGRAM" on the mode sub menu and then select "INDIVIDUAL."
- The procedure for making changes is now the same as for "Common Data."
- However, the 10 keys can be used to directly input the settings using numbers for the channel numbers and RX and TX frequencies.

Tags can be entered using letters of the alphabet. One number and three letters are allocated to each key. When one of the keys is pressed, one of its letters or its number is displayed, and each time the key is pressed, the display rotates in sequence.

Assignment of alphanumerics to keys Table 2-2

(QZ-)	(ABC)	(DEF)
1	2	3
(GHI)	(JKL)	(MNO)
4	5	6
(PRS)	(TUV)	(WXY)
7	8	9
(.)	()	
*	0	

□ denotes "space."

Rotational sequence for key "2"

Table 2-3

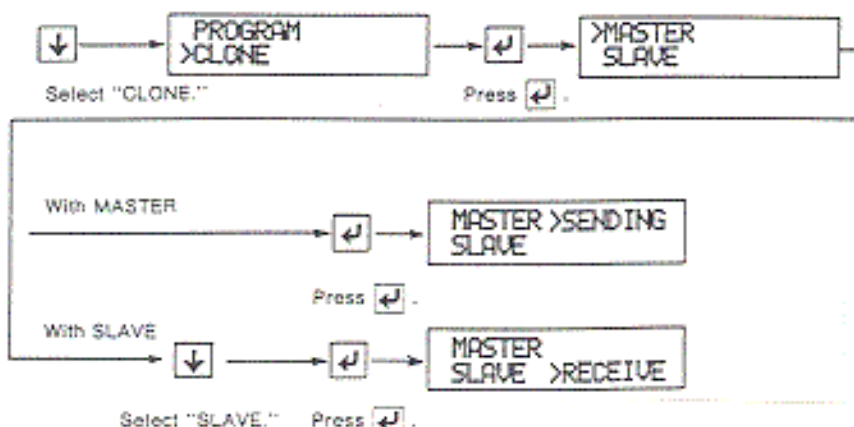
(Example) Using key "2"	LCD
When pressed for the 1st time	A
When pressed for the 2nd time	B
When pressed for the 3rd time	C
When pressed for the 4th time	2
When pressed for the 5th time	A
When pressed for the 6th time	B

2.3 Cloning

The programming for one repeater can be cloned to another repeater.

- First switch on the power to the two repeaters.
- Use the cloning cable (YB01002850) to connect the microphone jacks.
- Select "CLONE" on the mode sub menu for both repeaters.
- Next, select "MASTER" for the side sending the data and "SLAVE" for the side receiving the data.
- "SENDING" is displayed for the master side and "RECEIVE" for the slave side, and the data transfer begins.
- Upon completion of the data transfer, operation returns to the original display. (It takes about 15 seconds to transmit the data.)
- Disconnect the cloning cable.

CAUTION: Cloning is not possible between VHF and UHF.
Select SLAVE when connecting with a personal computer.



YAESU MUSEN CO., LTD.
FCC ID: K66RP80U
EXHIBIT #: 10E

5. DISASSEMBLY

5.1 Mount Bracket Removal Method

- Turn the RP80V unit gently upside down.
- Remove the four (A) screws and four (B) screws.
- The mount brackets can be detached when the four (C) screws and four (D) screws are then removed.

CAUTION: Take care when turning the unit over since it is heavy.
Take care not to lose or misplace the handle once the four (B) screws have been removed.

5.2 Speaker Bracket and Shield Lid Removal Method

- The speaker bracket is removed by removing the eight (E) screws.
- Remove the shield lids for the RX unit, TX unit and control unit in the directions indicated by the arrows.
The unit is now in a state enabling all the alignments and checks to be conducted.

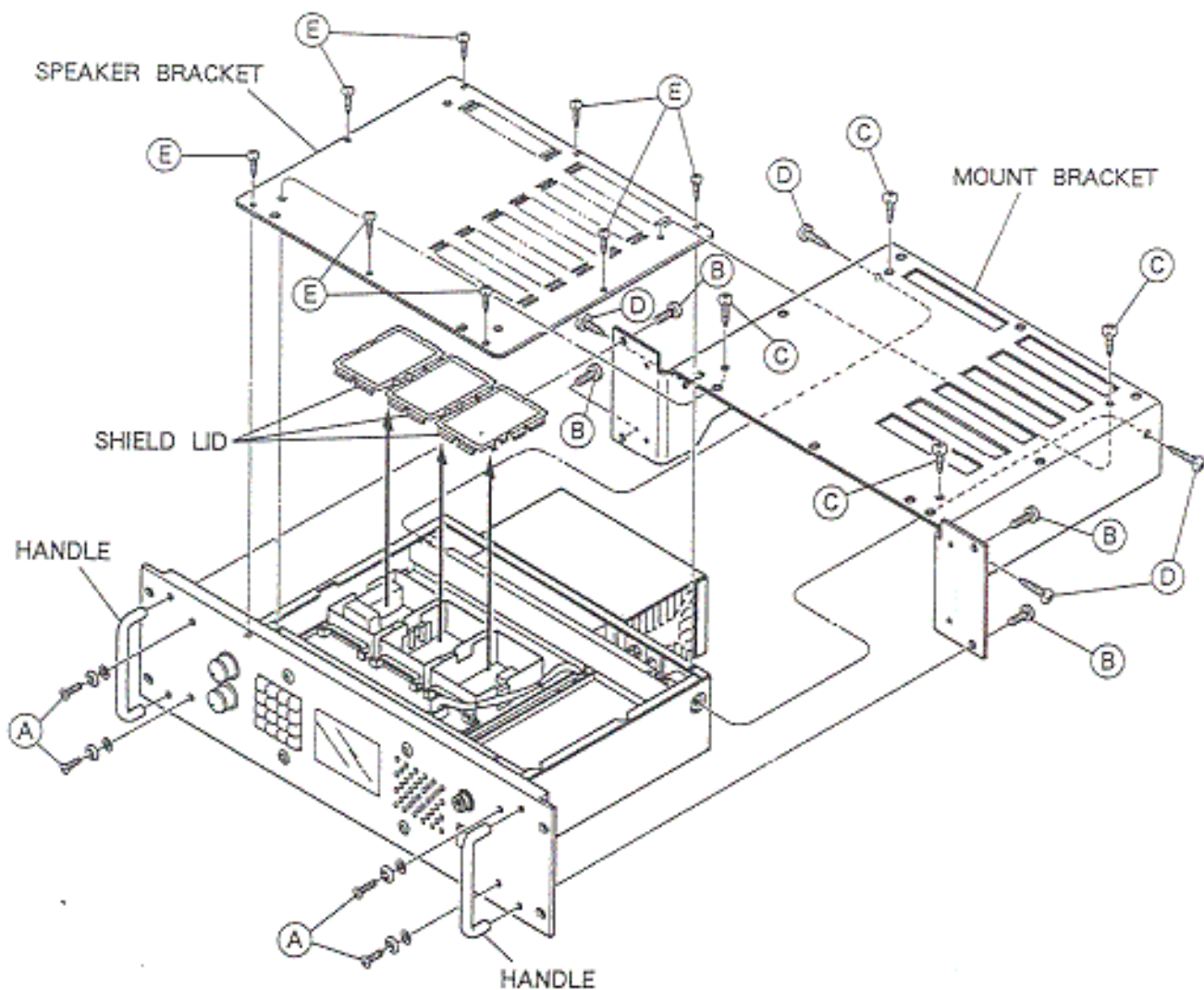


Figure 5-1

YAESU MUSEN CO., LTD.
FCC ID: K66RP80U
EXHIBIT #: 10F

6. ALIGNMENT

6.1 Test Set-up

— Standard test conditions —

- Supply voltage 13.2 V
- Audio output 0.4 W
- Audio load 4.0 Ω
- Transmission output 52 W
- Transmission load 50 Ω
- Standard modulation See Table 6-1.
- TX/RX alignment frequencies See Table 6-2.
- Room temperature 25°C $\pm$ 5°C

Standard modulation

Table 6-1

Type	Channel space (kHz)	Standard modulation (kHz)	Maximum modulation (kHz)
AA	12.5	$\pm$ 1.5	$\pm$ 2.5

TX/RX alignment frequencies

Table 6-2

F chart	Channel	TX frequency (MHz)	RX frequency (MHz)	Tone A frequency (Hz)	Tone B
F3	1	153.5	146.0	OFF	OFF
	2	157.8	150.3	OFF	OFF
	3	162.0	154.5	OFF	OFF
	4	157.8	150.3	67.0	OFF
	5	157.8	150.3	179.9	OFF
	6	157.8	150.3	250.3	OFF

CAUTION: CH2 is used for the RF alignment and CH5 for the tone alignment.

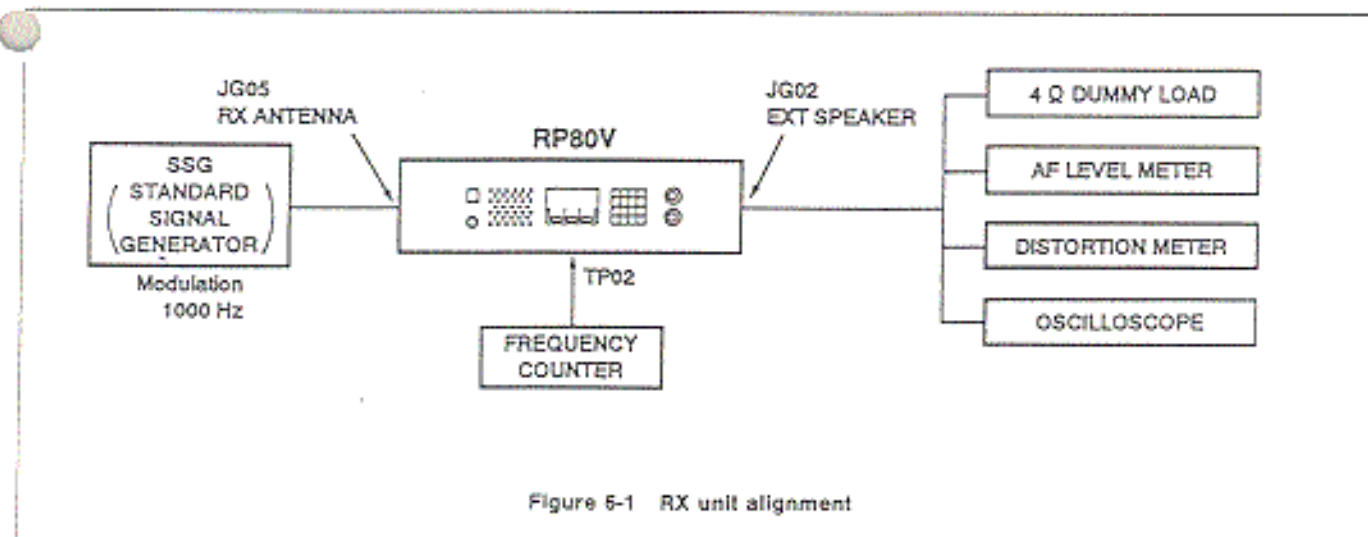


Figure 6-1 RX unit alignment

YAESU MUSEN CO., LTD.
FCC ID: K66RP80U
EXHIBIT #: 106

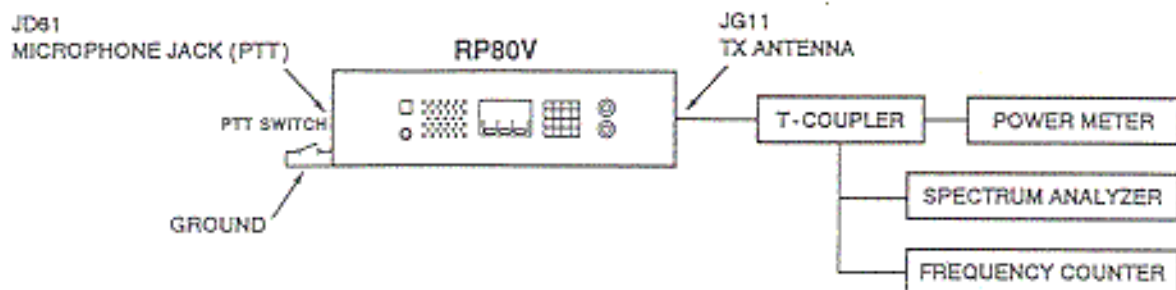


Figure 6-2 TX unit alignment

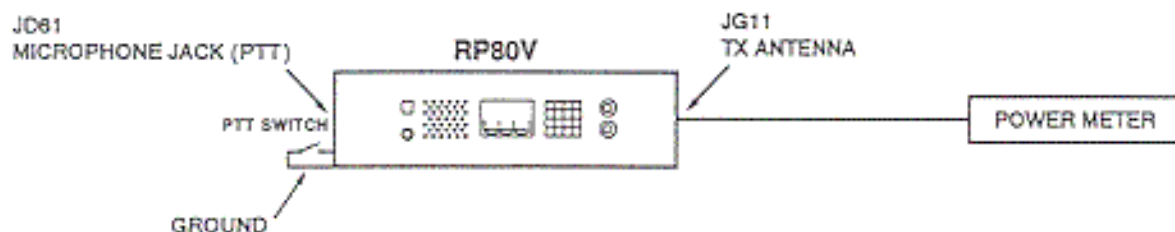


Figure 6-3 RF power alignment

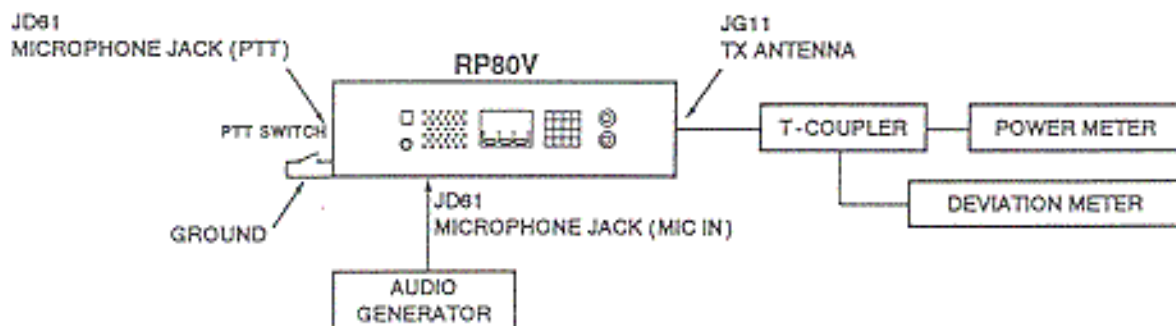


Figure 6-4 Microphone deviation alignment

YAESU MUSEN CO., LTD.
 FCC ID: K66RP80U
 EXHIBIT #: 104

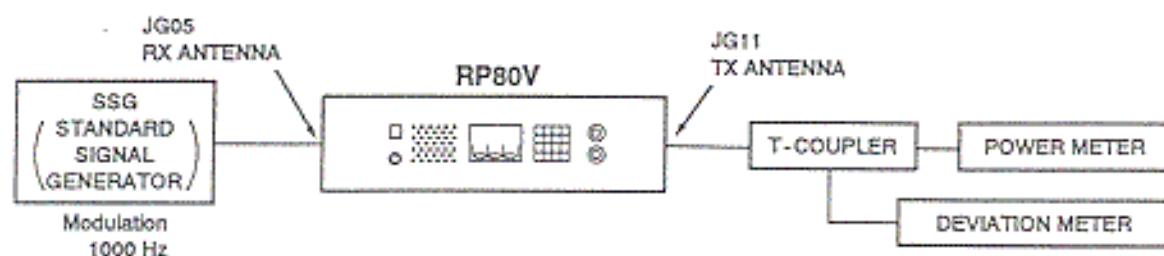


Figure 6-5 Repeater deviation alignment

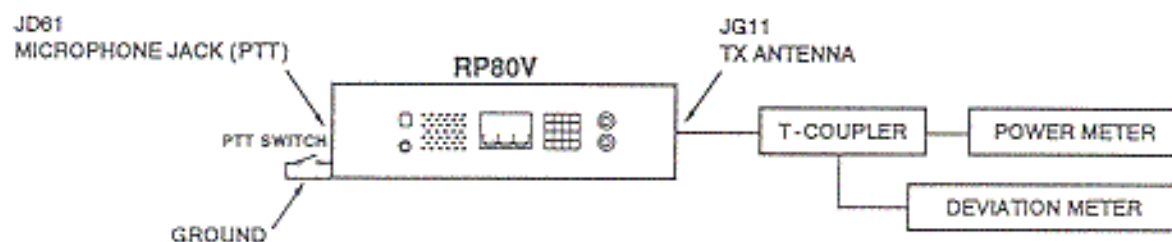


Figure 6-6 Tone deviation alignment

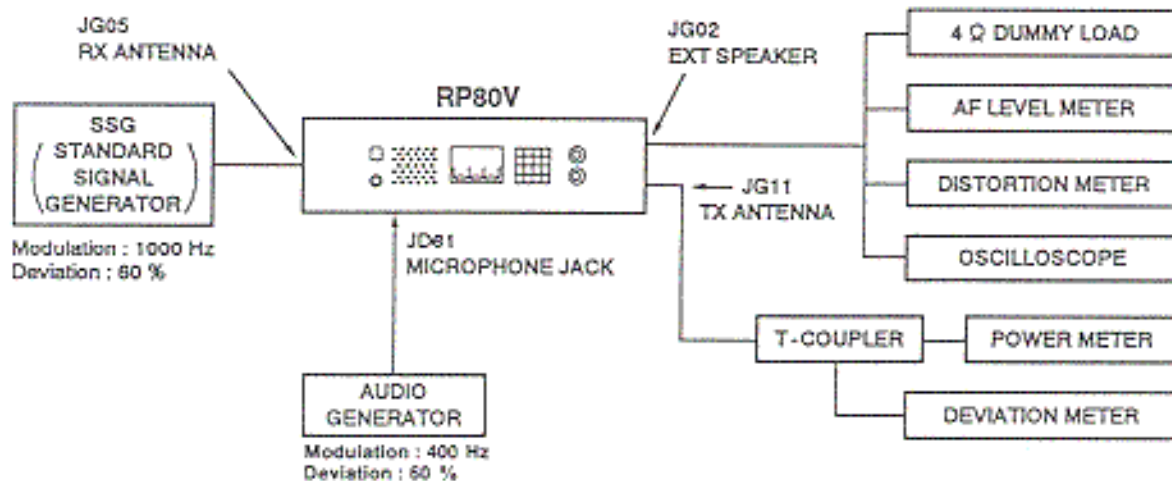


Figure 6-7 Blocking/desensitization alignment

6.2 Alignment Reference Points

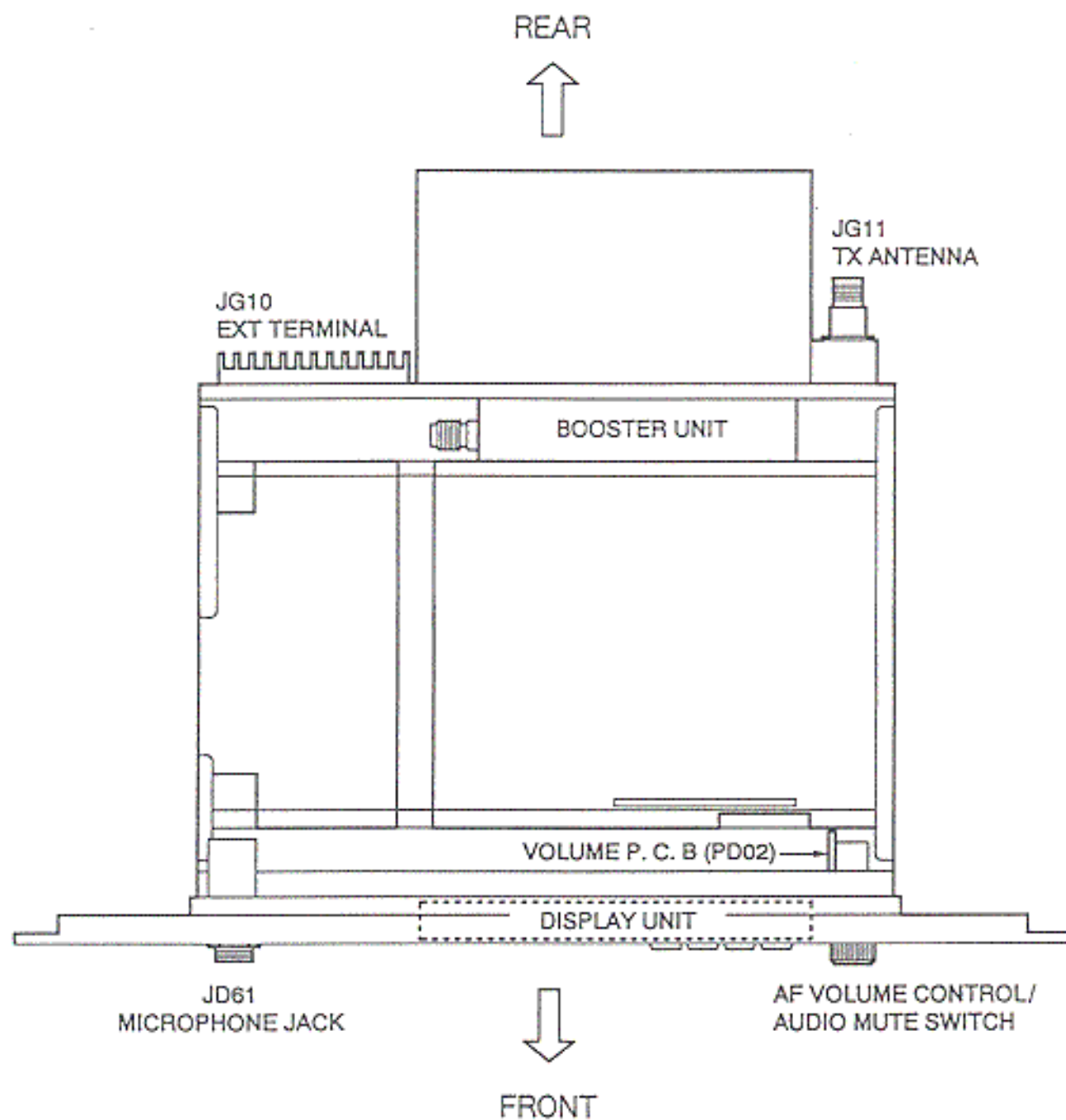


Figure 6-8 Top view

YAESU MUSEN CO., LTD.
FCC ID: K66RP80U
EXHIBIT #: 103

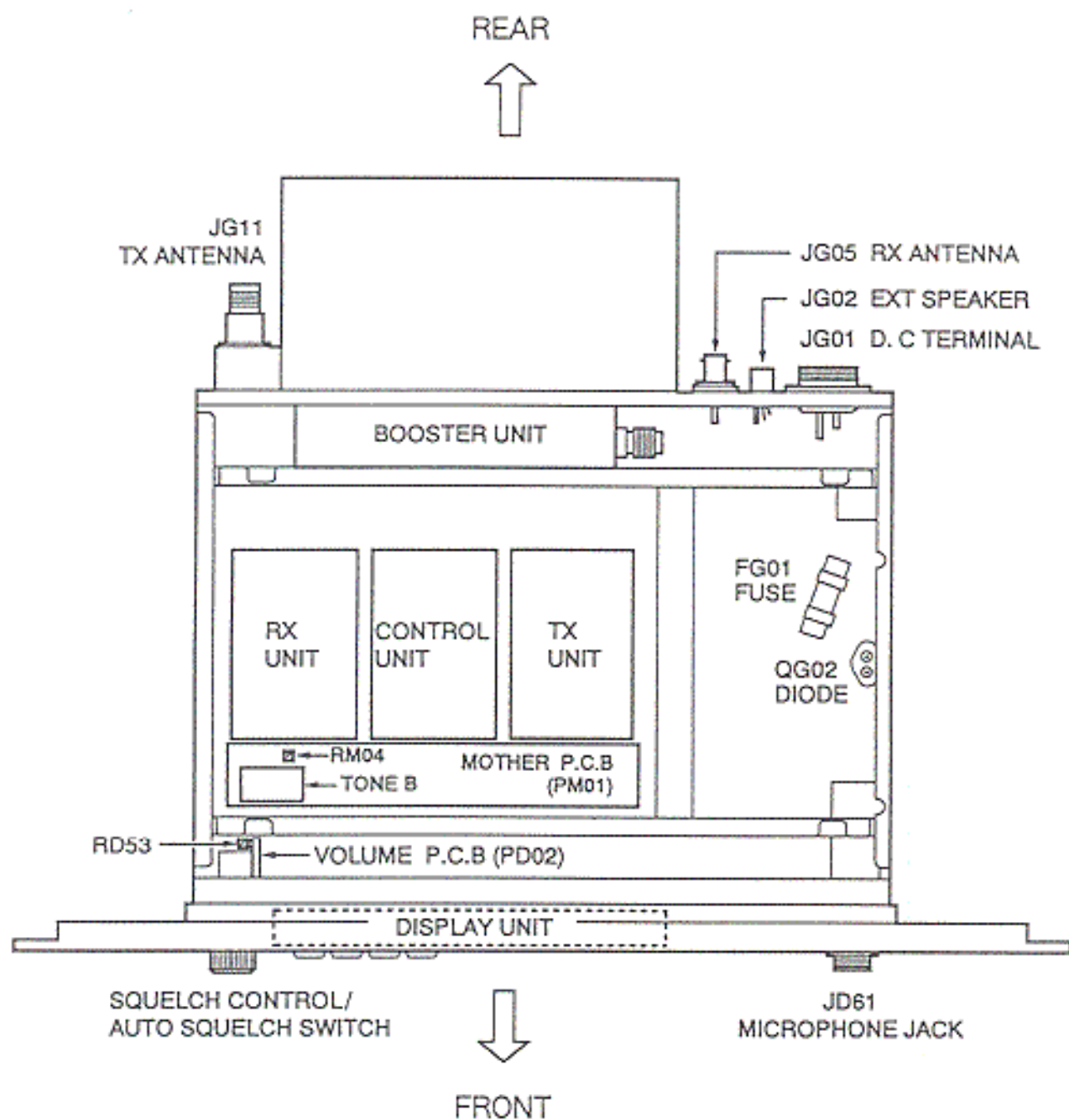


Figure 6-9 Bottom view

YAESU MUSEN CO., LTD.
FCC ID: K66RP80U
EXHIBIT #: 10K

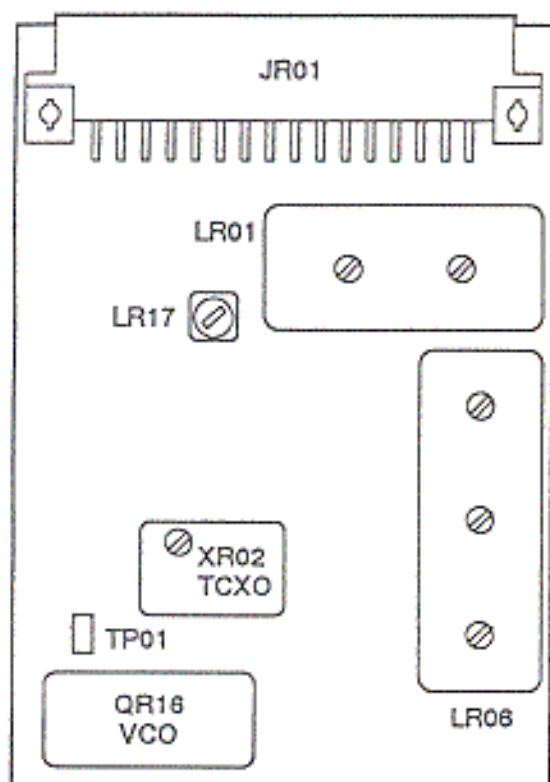


Figure 6-10 RX unit

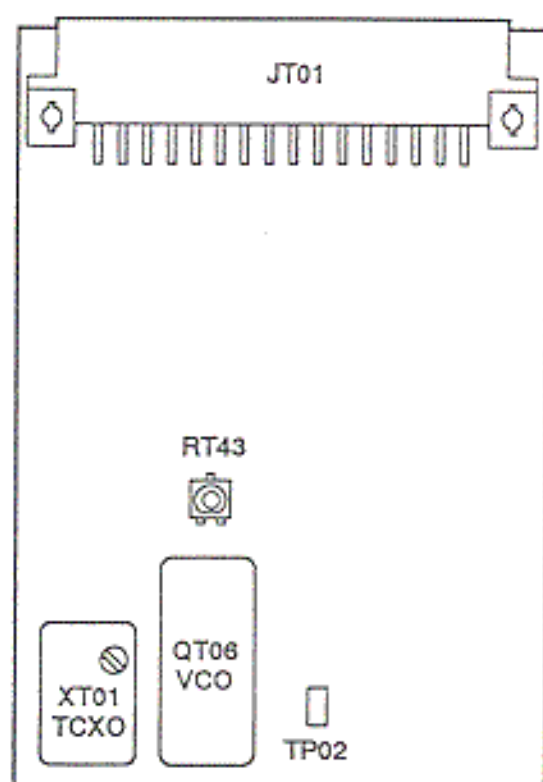


Figure 6-11 TX unit

* These figures show the units without their top panels.

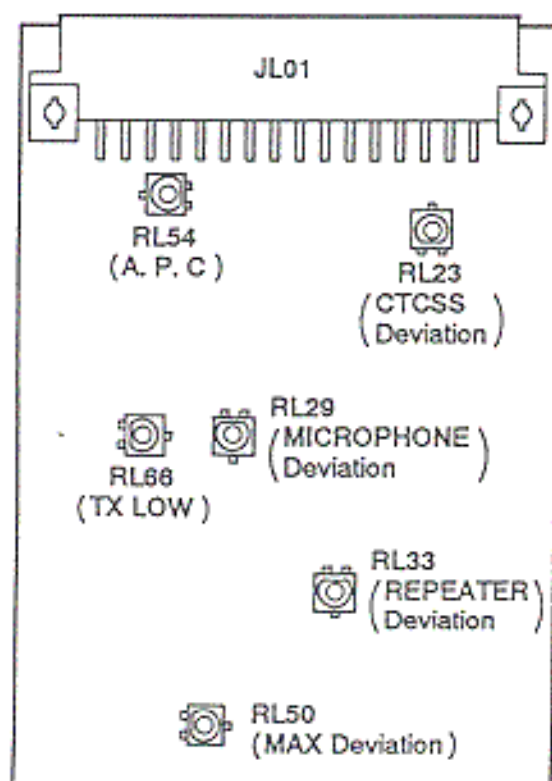


Figure 6-12 Control unit

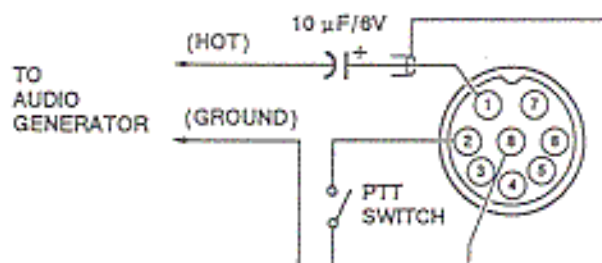


Figure 6-13 Microphone jig

YAESU MUSEN CO., LTD.
FCC ID: K66RP80U
EXHIBIT #: 10 L

6.3 Alignments and Checks

6.3.1 RX Unit Alignment

- Connect the measuring instruments as shown in Figure 6-1. Connect the standard signal generator (SSG) to JG05 (RX antenna connector).
- Select "BASE MODE" on the main menu and set to CH2. Turn the squelch control counterclockwise to its leftmost position.
- Connect the frequency counter to the TCXO (XR02) output pin (pin 2), and check that the crystal oscillator frequency is 12.6 MHz (± 5 Hz or less). If the frequency deviates from the above rating, turn the trimmer built into TCXO and adjust to 12.6 MHz (± 5 Hz or less).

CAUTION: Be sure to set the frequency at a room temperature of $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$.

- Set the SSG to the RX frequency and standard modulation, and increase the SSG output until the AF signal is output.
- Adjust LR17 in such a way that the AF output is brought to its maximum and its distortion is at its minimum.
- Adjust LR01 (2 adjust screws) in the signal flow sequence in such a way that the SINAD sensitivity is set to its maximum, and then adjust LR06 (3 adjust screws).
Adjust the SSG output as the alignment proceeds so that the SINAD sensitivity is set to between 12 and 20 dB while the alignment is in progress.

CAUTION: If the core goes too deep, the alignment will become too broad at some point. Stop the alignment at this point.

- Repeat the adjustment of LR17 in step e).
- Finally, check that the 12 dB SINAD sensitivity is less than -4 dB μ V.
- Repeat the adjustments of steps d) through h) when the channel (frequency) has been changed.

6.3.2 TX Unit Alignment

- Connect the measuring instruments as shown in Figure 6-2.
- Connect the power meter to JG11 (TX antenna connector). Select "BASE MODE" on the main menu and set to CH2.
- Plug the microphone jig shown in Fig. 6-13 into the microphone jack (JD61). Press the PTT switch and set to the TX mode.
- Turn the trimmer built into TCXO (XT01) and adjust the crystal oscillator frequency to 157.8 MHz (± 50 Hz or less) so that the frequency counter is set to the frequency used.

CAUTION: Be sure to set the frequency at a room temperature of $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$.
Perform the adjustment as quickly as possible since prolonged operation in the TX mode will cause the unit to warm up and make it impossible to adjust the frequency properly.
The booster may be damaged if transmission is performed with the end of the TX antenna open or shorted. When using an external antenna, use one with a VSWR (voltage standing wave ratio) of 2 or less.

6.3.3 Control Unit Alignment

— A.P.C —

- Connect the measuring instruments as shown in Figure 6-2.
- Connect the power meter to JG11 (TX antenna connector). Select "BASE MODE" on the main menu and set to CH2.
- Plug the microphone jig shown in Figure 6-13 into the microphone jack (JD61). Press the PTT switch and set to the TX mode.
- Turn RL54 clockwise to its rightmost position and check that a maximum power of 52 W or more is delivered.
- Turn RL54 and adjust it in such a way that the power meter indicates 52 W (± 2 W).

CAUTION: Perform the adjustment as quickly as possible since prolonged operation in the TX mode will cause the unit to warm up and make proper adjustment impossible.

— TX LOW —

- Connect the measuring instruments as shown in Figure 6-2.
- Connect the power meter to JG11 (TX antenna connector). Select "BASE MODE" on the main menu and set to CH2.
- Plug the microphone jig shown in Figure 6-13 into the microphone jack (JD61). Press the PTT switch and set to the TX mode.
- Press the tactile switch (SL01) on the control P.C.B (PL01) and forcibly set to LOW POWER.
- Turn RL66 and adjust it in such a way that the power meter indicates 25 W (± 5 W).

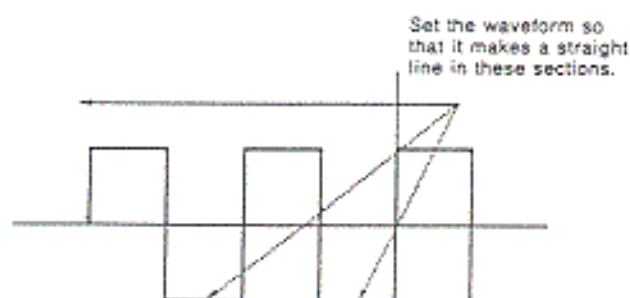
CAUTION: After switching to low power, the PTT switch must be turned off and then on again in order to return to the high power setting.

YAESU MUSEN CO., LTD.
FCC ID: K66RP80U
EXHIBIT #: 10M

— Hand microphone —

CAUTION: Proceed with the adjustment below after having performed the frequency alignment.

- Connect the measuring instruments as shown in Figure 6-4.
- Preset all the RL23, RL29, RL33, RL50 and RT43 semi-fixed resistors to the center of their rotational angle.
- Select "BASE MODE" on the main menu and set both TONE A and B to OFF.
- Supply a 1 kHz 5 mV signal from the audio generator (AG) through a 10 μ F/16 V electrolytic capacitor to the MIC IN pin (pin 1) of the microphone jack (JD61).
Connect the PTT pin (pin 2) or JG10 PTT pin to the ground pin, and set to the TX mode.
- Turn on the 15 kHz low-pass filter (L.P.F) of the deviation meter.
- Turn RL29 and adjust it in such a way that the deviation meter indicates ± 1.5 kHz (± 1.4 to ± 1.6 kHz).
- Increase the AG output to 50 mV (+20 dB), and adjust RL50 in such a way that the deviation meter indicates ± 2.0 kHz (± 1.9 to ± 2.1 kHz).
- Repeat the adjustments two or three times until the values in steps f) and g) are set to the ratings.
- Next, connect the AG output (sine wave with a 1 kHz frequency) to the TX DATA IN pin (pin 8) of the EXT terminal (JG10).
- Adjust the AG output and set the deviation to ± 1 kHz.
- Next, set the AG output to a square wave and the frequency to 50 Hz.
- Adjust RT43 in such a way that the output waveform of the linear detector appears as shown in the figure below.



- Supply the AG output from the microphone jack again, and adjust RL29 in such a way that the deviation is set to ± 1.5 kHz (± 1.4 to ± 1.6 kHz) with a 5 mV output and 1 kHz sine wave.

— Repeater —

- Connect the measuring instruments as shown in Figure 6-5.
- Select "REPEATER MODE" on the main menu and set both TONE A and B to OFF. Set to CH2. Turn the squelch control/auto squelch switch clockwise as far as it will go.
- Supply a 60 dB SSG output, a 1 kHz modulation and a ± 1.5 kHz deviation to JG05 (RX antenna connector).
- Adjust RL33 in such a way that the deviation meter indicates ± 1.5 kHz (± 1.4 to ± 1.6 kHz). Turn on the 15 kHz low-pass filter (L.P.F) of the deviation meter.

— Tone —

- Connect the measuring instruments as shown in Figure 6-7.
- Program a 179.9 Hz CTCSS for tone A. (Set to CH5.)
- Select "BASE MODE" on the main menu and set TONE A ON.
- Connect the PTT pin (pin 2) of the microphone jack (JD61) or JG10 PTT pin to the ground pin, and set to the TX mode.
- Adjust RL23 in such a way that the deviation meter indicates ± 0.4 kHz (± 0.35 to ± 0.45 kHz). Turn on the 3 kHz low-pass filter (L.P.F) of the deviation meter.

6.3.4 Auto Squelch Alignment

- Connect the measuring instruments as shown in Figure 5-2.
- Select "BASE MODE" on the main menu and set both TONE A and B to OFF.
- Turn all the SSG modulation to OFF, and supply an output at a level to achieve a -5 dB μ OS to JG05 (RX antenna connector).
- Set the squelch control/auto squelch switch to AUTO (push the knob to lock). Turn RD53 (AUTO squelch control) clockwise as far as it will go so that the squelch disengages.
- Change the SSG output and confirm that auto squelch opens at between -4 and -6 dB μ .

6.3.5 Frequencies When Unit Is Shipped

Channel settings

Table 6-3

F chart	Channel	TX alignment frequency (MHz)	RX alignment frequency (MHz)	Tone A	Tone B
F3	1	157.8	150.3	OFF	OFF

Other settings

Table 6-4

Data set for all channels		Data set for each channel	
Channel Step	5.00 kHz	TX timer	OFF
TX timer	0.1 min.	Busy lockout	OFF
TX inhibit	1 sec.	Tone lockout	OFF
Hang-up	0 sec.	Tag	Blank

YAESU MUSEN CO., LTD.
FCC ID: K66RP80U
EXHIBIT #: 10N

6.3.6 Tone B (CTN190) Installation Method and Alignment

- a) Plug the optional CTN190 into JM06 on the mother P.C.B. (PM01).
- b) Connect the measuring instruments as shown in Figure 6-7.
- c) Program a 179.9 Hz CTCSS for tone B.
- d) Select "BASE MODE" on the main menu and set TONE B ON.
- e) Connect the PTT pin (pin 2) of the microphone jack (JD61) or JG10 PTT pin to the ground pin, and set to the TX mode.
- f) Adjust RM04 in such a way that the deviation meter indicates ± 0.4 kHz (± 0.35 to ± 0.45 kHz). Turn on the 3 kHz low-pass filter (L.P.F) of the deviation meter.
- g) After having installed tone B, re-adjust the tone A deviation using RL23. Also, re-adjust the repeater deviation using RL33.

6.3.7 Blocking Check Method

- a) Connect the measuring instruments as shown in Figure 6-7. Insert the power attenuator between JG05 and SSG.
Use a power attenuator which is capable of withstanding 60 W inputs and which has an attenuation of 30 to 40 dB or so.

CAUTION: Failure to use a power attenuator may cause the SSG attenuator to burn out in an instant when the SSG is connected and the TX mode established.

- b) Select "BASE MODE" on the main menu and turn the squelch control/auto squelch switch counter-clockwise as far as it will go.
- c) Set the SSG modulation to 1000 Hz and the deviation to 1.5 kHz. Adjust the RF output to a level at which a 20 dB SINAD sensitivity can be obtained.
- d) Supply a 400 Hz signal from the AG to the hand microphone connector (JD61 pin 1), connect the JD61 PTT pin or JG10 PTT pin to the ground pin or chassis, and set to the TX mode. Adjust the AG output in such a way that the deviation is set to 3 kHz.
- e) Since RX AUDIO will be set OFF during the operation in step d), short-circuit JM04 AF MUTE 1 (pin 15) and REG +5 V (pin 36) to forcibly set RX AUDIO on and perform both send and receive operations simultaneously.
- f) Turn TX ON/OFF (disconnect PTT) and perform both send and receive operations simultaneously. Read the level at which TX affects the 20 dB SINAD sensitivity obtained in step c).

YAESU MUSEN CO., LTD.

FCC ID: K66RP80U

EXHIBIT #: _____ 100