

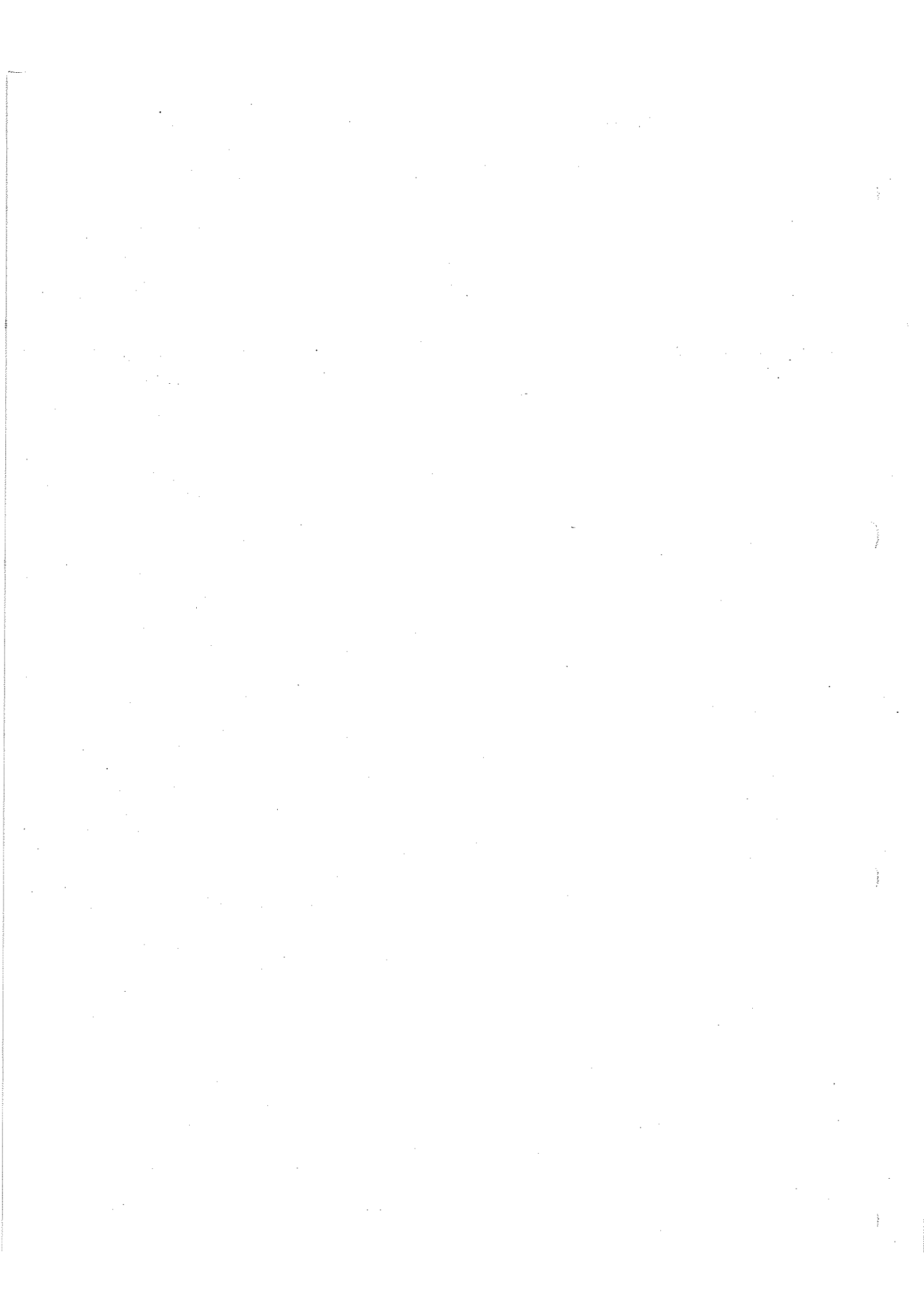
KYODO

OPERATION, INSTALLATION & SERVICE MANUAL

FOR

VHF FM BASE/REPEATER STATION RADIO

KG110-15A/B50K SERIES



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1. INTRODUCTION

This service manual is published for the information and guidance of the personnel responsible for the operation, maintenance, and installation of KG110-15A/B50K, called KG110 hereinafter, VHF FM radios, our most recently developed KG110 series versions for multiple applications - i.e., Simplex/Duplex Base, Repeater, or Channel-Combined Simplex Base and Repeater stations by mere jumpering, in a wide variety of system configurations.


Our preceding models of the KG110 series have been welcomed by worldwide markets for the past decade to gain a great deal of appreciation for their versatile functions, users' convenience, and maximum utilities with the availability of many optional units.

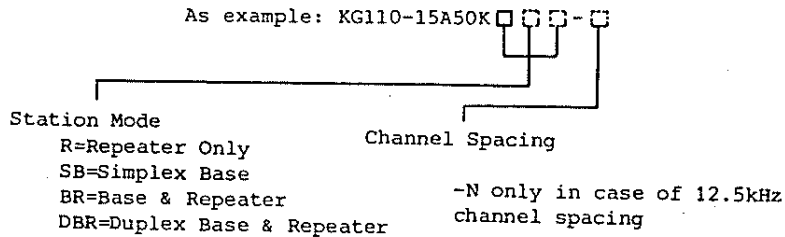
Our newest models, KG110, retain all the advantages of the preceding models, but have achieved further improvements to meet state-of-the-art performance and sophisticated designs called for the demand of ever-advancing radiotelephone services.

Accordingly, this service manual describes the operation, maintenance, and installation of the four KG110-15A/B50K models as listed below.

Model	Frequency Range	Channel Spacing	RF Power Output
KG110-15A50K()	136 - 155MHz	20/25/30kHz	Up to 50W
KG110-15A50K()-N	136 - 155MHz	12.5kHz	"
KG110-15B50K()	146 - 174MHz	20/25/30kHz	"
KG110-15B50K()-N	146 - 174MHz	12.5kHz	"

* EXACT MODEL INSCRIPTION

As example: KG110-15A50K 



Whereas, Model KG110-15A50KBR-N
 for 136-150MHz band, 50W, RF power output,
 base & repeater station mode, and 12.5kHz
 channel spacing.

2. FEATURES

These newly developed VHF FM BASE/REPEATER STATION RADIOS have the outstanding features as will be detailed.

2-1 Easy Maintenance

The basic theory and circuit designs of these KG110 series models generally conform to those of our mobile radios, KG105 and KG107.

Monitoring facilities for the five essential functions are provided on the front panel.

That is, RX Local Level, S-Meter, TX Drive Level, TX Power, and TX SWR can always be checked by front-panel-mounted LED indicators.

All units of which any KG110 radio is composed are of plug-in construction to facilitate rapid repair or replacement at the job site in case of malfunction.

2-2 Easy Alteration of Channel Frequencies

The channel frequencies are controlled by the Synthesizer System to enable programming up to a maximum of 99 channels.

Each of the TX and RX units contains one EP-ROM (2764D) and these 99 channel frequencies can be easily written, rewritten, or erased by means of these EP-ROMs.

Since the reference frequency is controlled by TCXO (Temperature-Controlled Crystal Oscillator) that guarantees frequency tolerances of 5 ppm (option 2.5 ppm) for ambient temperatures ranging from -30° to $+80^{\circ}\text{C}$, stable operation of the KG110 can be expected.

2-3 Simplex/Duplex Operation

The KG110 can be operated easily as a simplex/duplex base, or repeater station by jumpering connection inside of the radio.

Furthermore, an optional PCB when used can realize a channel-combined Base/Repeater station, provided a separate control unit (BP-110) be used for switching the duplex filtering circuit to Base mode by means of a coaxial relay.

2-4 No Possibility for Service Interruption during Power Failure

Besides 13.6V DC output, the AC Power Supply Unit (PS110) is equipped with the storage battery trickle charge output. With a storage battery externally connected to this output terminal, a continuous charge is available to maintain the battery in a fully charged state.

In case of commercial power failure, power is instantly switched to the battery power source by a relay to continue a radiotelephone service without interruption.

The primary power supply voltage of either 100 to 120V AC or 200 to 240V AC can be easily selected by easy jumpering connections within the power supply unit.

2-5 Heavy Duty TX Power Amplifier

The transmitter output can be varied freely from 25W to 50W. A heatsink made of die-cast is installed on the transceiver unit to absorb and dissipate heat, ensuring consecutive 24-hour transmitting operation.

All of the driver output, the transmitter output, and the SWR values can be monitored by means of CHECK switches and LED indicators.

2-6 Broad Bandwidth Properties for TX/RX

An extremely wide bandwidth can be secured with the KG110 by suitably adjusting TX/RX units. Readjustment for frequency alteration is quite simple. This relieves the administration personnel of their efforts for parts replacement or for the need of many stocked parts.

Version A	136 to 155 MHz
Version B	146 to 174 MHz

2-7 Squelch Tail Elimination

RX unit mounts, same as the mobile radios KG105 and KG107, BED IC to eliminate the squelch tail noise, thereby improving audibility.

In cases where the KG110 is used as a repeater station, the squelch tail noise incoming from a mobile unit will be superimposed upon that from a repeater station. Therefore, this facility will be of great help in eliminating the squelch tail noise from the communication signals.

2-8 TX Carrier Delay Circuit

This circuit is to hold the transmission state for a predetermined time interval at the termination of transmission in the repeater mode.

When the KG110 is placed in a weak electric field intensity, this circuit helps improve communication stability

The predetermined time interval can be variably set from 0 to 20 seconds. In base station mode, this function is automatically released.

2-9 Transmitter Time Limiter (TTL) Circuit

TX unit incorporates the TTL circuit as a standard in order to prevent a person from occupying a channel too long a time interval.

There are two alternative time-limiting ways with this circuit: One is to limit the time for one call and the other is to limit a time interval as counted from the start of the repeating function.

Each is capable of setting the time interval in 15 steps at maximum in units of either 15 or 30 seconds.

3. STANDARD COMPOSITION FOR BASE/REPEATER STATION

The standard BASE/REPEATER STATION equipment may be suitably broken down into the following:

3-1 Base/Repeater Station

	<u>Name</u>	<u>Q'ty</u>
(1)	VHF FM Radio	1
(2)	Hand Microphone, KD-357M	1
	inclusive of:	
(a)	one fixed bracket	
(b)	four pairs of washers and self-tapping screws	
(3)	Rubber Cushion for Bottom Cover	4
(4)	EP-ROM, 2764D	2
(5)	Wrench	1
(6)	Jumper	5

3-2 Power Supply Unit

(1)	Power Supply Unit, PS110	1
(2)	AC Cable	1
(3)	DC Cable for KC110	1
(4)	Battery Cable	1
(5)	AC Fuse, 5A	1
(6)	DC Fuse, 15A	2
(7)	AC Lamp, AC-283	1
(8)	Rubber Cushion for Bottom Cover	4

4. OPTIONS

The undermentioned optional units are prepared for the new models and will be delivered at your request. These options will provide excellent solutions in making your radiotelephone systems more convenient, attractive, and efficient in a wide variety of system configurations proposed by the user.

4-1 Duplexer

Any repeater station equipped with a single antenna system calls for the installation of a duplexer.

Since the duplexer specifications vary widely according to channel spacing and TX/RX frequency separation requirements, ask our engineering advice as to your particular needs for the duplexer.

4-2 Band Pass Filter (BPF) and Band Reject Filter (BRF)

Installation of these filters might be necessary depending on the channel spacing, frequencies used, and station site conditions such as interference effects of the existence of stray radio-wave originating sources.

Ask our engineering solutions for particular specifications of these filters.

4-3 5-Tone Encoder/Decoder PCBs

(1) For Base Station

When KG110 operates as a simplex or duplex base station, 10-5T(A) 5-Tone Encoder/Decoder incorporated in KG110 will permit access to any distant station, a mobile radio or a portable radio, by selective calling.

Pressing "TONE" switch provided on the front panel enables any one of a maximum of 1,000 stations to be selectively called.

By pressing "#" switch, a group call is capable. Note that the decoder is complete with the voice auto-reset function.

(2) For Repeater Station

Where KG110 operates as a repeater station, 10-5T(D) 5-Tone Decoder incorporated in KG110 will enable the repeater station to open - i.e., to initiate starting, by means of both the carrier frequency and the tone signal. (Relay Transmitter Keying)

4-4 CTCSS PCBs

(1) For Base Station

When KG110 operates as a simplex base station, incorporation in KG110 of 10-QCT(A) CTCSS PCB can display the function of CTCSS Encoder/Decoder. As combined with channel frequency, ENC/DEC frequency can be set.

(2) For Repeater Station

When KG110 operates as a repeater station, incorporation of 10-QCT(D) CTCSS PCB enables the repeater station function to "Open" by the carrier frequency and the CTCSS tone signal. As combined with channel frequency, ENC/DEC frequency can be set. (Relay Transmitter Keying)

4-5 Community Repeater Tone Panel

This panel is for use at repeater stations in providing community radiotelephone users with multiple radiotelephone service on a shared basis.

It is complete with the following functions:

- o Availability of any EIA tone frequency from 67 to 250.3 Hz.
- o Repeating audio processing
- o Re-generated CTCSS tone
- o Adjustable transmitter carrier delay
- o Adjustable transmitter time limiter
- o Relay transmitter keying

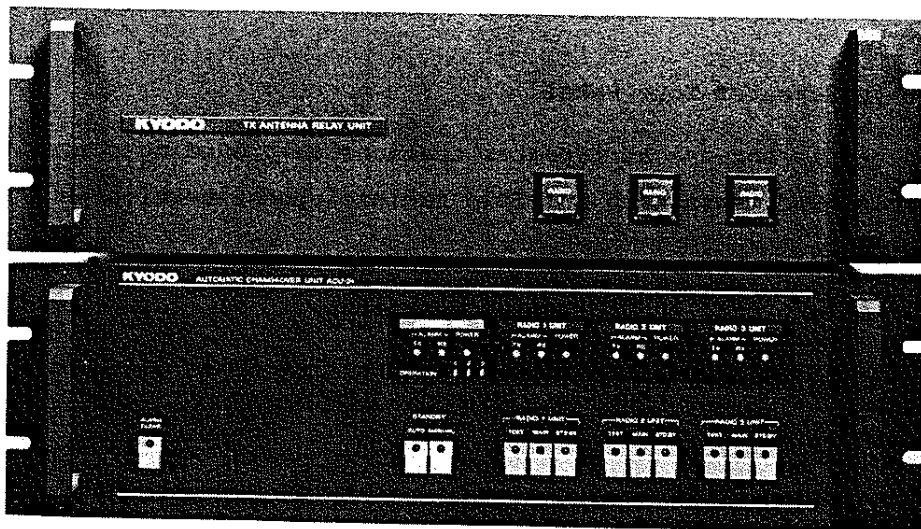
Sections 4-3, 4-4 and 4-5 may be conveniently summed up as listed below.

KG110 Operating Mode / Tone System	Base Station	Repeater Relay Transmitter Keying	Through Repeater
5-Tone System	10-5T(A)	10-5T(D)	Through
CTCSS System	10-QCT(A)	10-QCT(D)	Repeater Tone Panel

4-6 Automatic Changeover Unit, ACU-31

When any base/repeater station operates on a basis of 3 working radios and 1 standby radio principle (3+1 system, standard), the ACU-31 unit will be capable of switching over the frequency of failed radio to the same frequency of standby multichannel radio on condition that the switching criteria be met.

The ACU-31 system is composed of signalling Logic Unit for changeover operation and Antenna System Changeover unit.

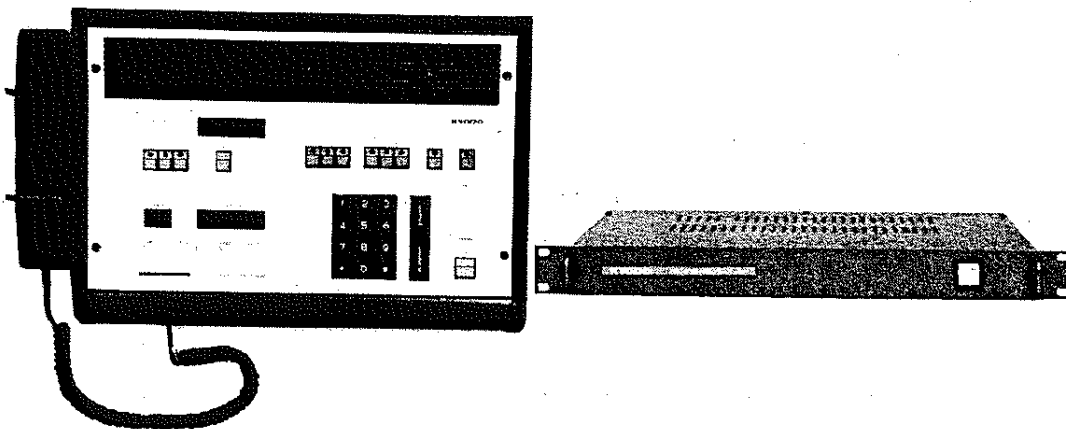


4-7 Remote Control System, KBC-2000

The KBC-2000 Remote Control Unit to be installed at a controlling position is intended to control the base/repeater station from a remote site by using 2-wire telephone lines. Composed of a control unit handled by the operator and an Interface Unit for controlling an unattended Base/Repeater station. Incidentally, EEA 10-tone system is used as controlling signal so that radios can be stably and rapidly controlled.

The KBC-2000 is complete with the following function availability.

- o Up to 99 channels can be controlled.
- o Manual changeover operation (with ACU-31)
- o CTCSS encoder ON/OFF control (with CTCSS UNIT)
- o Power switch ON/OFF control
- o 4-step squelch control
- o Base/Repeater mode control
- o 5-digit, 5-tone encoding
- o Phone patch facility
- o 5-digit ANI (5-TONE CCIR or ZVEI and 3-MEMORY).



Remote Control Unit

Interface Unit

4-8 Desk Top Microphone

4-9 19-Inch Rack with Slide Rails

Various kinds of 19-inch DIN size racks with slide rails are prepared in view of maximum convenience for the users. In installation, ask Kyodo's engineering advice.

4-10 High Stability TCXO, GFS-210X

KG110 incorporates, as a standard, TCXO, GFS-210W, with 5 ppm frequency tolerances from -30°C to $+80^{\circ}\text{C}$ throughout.

Where more rigorous tolerances are called for depending on the users' request for the narrower spacing requirements or regulations, please so notify. Kyodo is ready to furnish 2 ppm TCXO, GFS-210X.

4-11 Channel-Combined Base/Repeater Mode Switching System, BRC-110

The BRC-110 system is designed to operate one radio either in a base station mode or in a repeater station mode as designated according to the channel.

The system is composed of logic PCB for controlling data and a unit for switching the antenna system.

This unit is subject to change in the circuit designs, etc. depending on the user's system requirements.

4-12 Subscriber Telephone & Radio Interface Unit, STR-110

Installed in a base station, this unit is to provide an interface between subscriber telephones and a plurality of duplex mobile radios without the intervention of manual operations.

Since only one telephone line can be shared with many mobile radios, efficient utilization of the telephone line becomes essential.

Although any mobile radios can call up subscriber telephones individually by the DTMF signal, mobile radios cannot be called up individually from the subscriber telephones.

5. SPECIFICATIONS

5-1 General

Station mode	:	Simplex base, repeater, duplex base, duplex base/repeater, and channel-combined base and repeater
Mode of operation	:	Single or dual frequency simplex system, or duplex system with a duplexer or two antennas
Frequency range	:	Version A 136-155MHz 66-80 MHz Version B 146-174MHz 70-88 MHz
Number of channels	:	Up to 99 synthesis programmed channels
Switchable channel bandwidth	:	3MHz
Channel spacing	:	Narrow-band 12.5kHz Wide-band 20, 25 or 30kHz
Duplex TX/RX frequency separation	:	0.5MHz minimum
Duty cycle	:	Continuous
Antenna impedance	:	50 ohms
Transmit time limiter (TTL)	:	Provided as standard
Environmental conditions	:	Ambient temperature -30°C to +80°C Relative humidity 95% at +35°C
Dimensions and weight	:	Transceiver Unit Power Supply Unit 482 mm width 482 mm width 132 mm height 132 mm height 350 mm depth 350 mm depth 12.2 kg 10.6 kg

5-2 Transmitter

RF power output	:	25-50 watts (standard) <i>MAX 20 W</i> 1-50 watts with two-stage switch selection (option)
Maximum frequency deviation	:	Narrow-band $\pm 2.5\text{kHz}$ Wide-band $\pm 5\text{kHz}$
Oscillation system	:	Direct PLL synthesizer system
Type of crystal unit	:	TCXO
Frequency stability	:	$\pm 0.0005\%$ with standard TCXO, $\pm 0.0002\%$ with optional TCXO
Frequency response	:	Within +1, -3dB of 6dB/octave pre-emphasis from 0.3 to 3kHz, 1kHz reference
Signal to noise ratio	:	More than 50dB at 1kHz 70% modulation
Modulation distortion	:	Less than 3% at 1kHz 70% modulation
Spurious and harmonics	:	More than 70dB down below rated power
AF input	:	-34dBm $\pm 3\text{dB}$ (local control) -8dBm $\pm 3\text{dB}/600$ ohms (remote control)

5-3 Receiver

Receiving system	:	Double conversion superheterodyne
Intermediate frequency	:	1st IF 21.6MHz 2nd IF 455kHz
Frequency stability	:	$\pm 0.0005\%$ with standard TCXO, $\pm 0.0002\%$ with optional TCXO
Sensitivity	:	Less than 0.5 μV for 20dB noise quieting Less than 0.35 μV for 12dB SINAD
Squelch sensitivity	:	Less than 0.25 μV
Modulation acceptance	:	$\pm 7.0\text{kHz}$
Selectivity	:	More than 70dB at 25kHz point
Blocking	:	More than 90dB at $\pm 1\text{MHz}$ point
Intermodulation	:	More than 70dB
Spurious responses	:	More than 80dB, 100dB available with the use of optional band pass filter (BPF).

AF response : Within +1, -3dB of 6dB/octave
de-emphasis from 0.3 to 3kHz, 1kHz
reference

AF output : More than 2 watts into 4 ohm load for
local control
0dBm \pm 3dB for remote control

AF distortion : Less than 5% at 1kHz 70% modulation

Signal to noise ratio : More than 50dB at 1kHz 70% modulation

5-4 Power Supply

Power source : 13.6V DC \pm 20% negative ground, and
100-120V AC, or 200-240V AC, 50/60Hz
by the use of PS110 power supply unit

Power consumption :

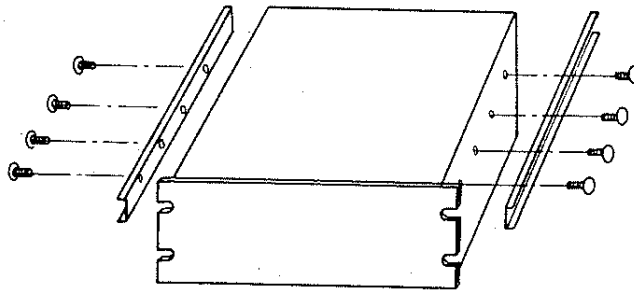
<u>Operation</u>	<u>AC</u>	<u>DC</u>
Standby	13VA	0.7A
Receiving	18VA	1A
Transmitting		
at 5W	45VA	2.5A
at 10W	65VA	3.5A
at 25W	110VA	6A
at 50W	220VA	12A

Trickle charge current : 0.5A

6. INSTALLATION

6-1 Rack and Desk Top Installation

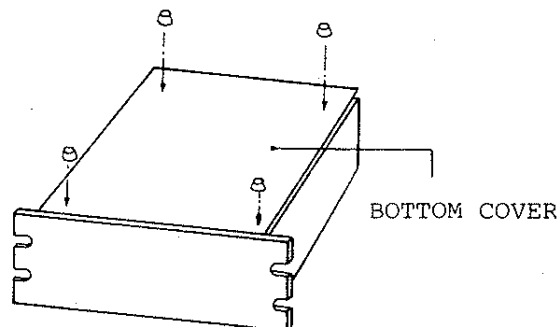
In case of rack mounting, install side rails (option) on both sides of the KG110 as illustrated:



Also install slide rails on the rack side as instructed in the rack fabrication manual.

Then, install the KG110, utilizing front panel holes and mounting screws and nuts.

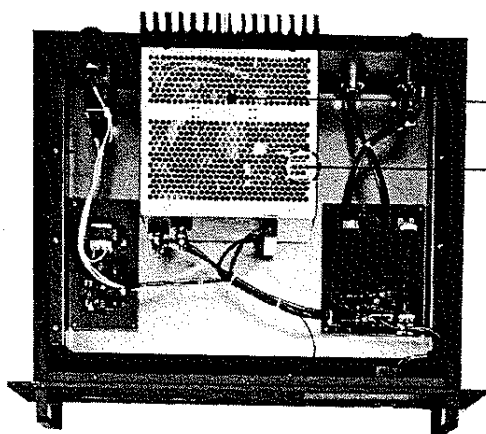
When the KG110 is used as a desk top radio, attach four rubber cushions to the bottom cover of KG110 and PS110.



6-2 AC Power Supply

PS110 AC Power Supply is usually set to 200-240V AC, 50/60Hz as shipped from the factory. If desired to change it to 100-120V AC at the job site, proceed as follows:

Remove the cover of KRV-300 power supply unit and perform rejumping for AC voltage changeover as illustrated.



KRV-300
Power Supply Unit
Power voltage
selectable jumper
is provided inside.

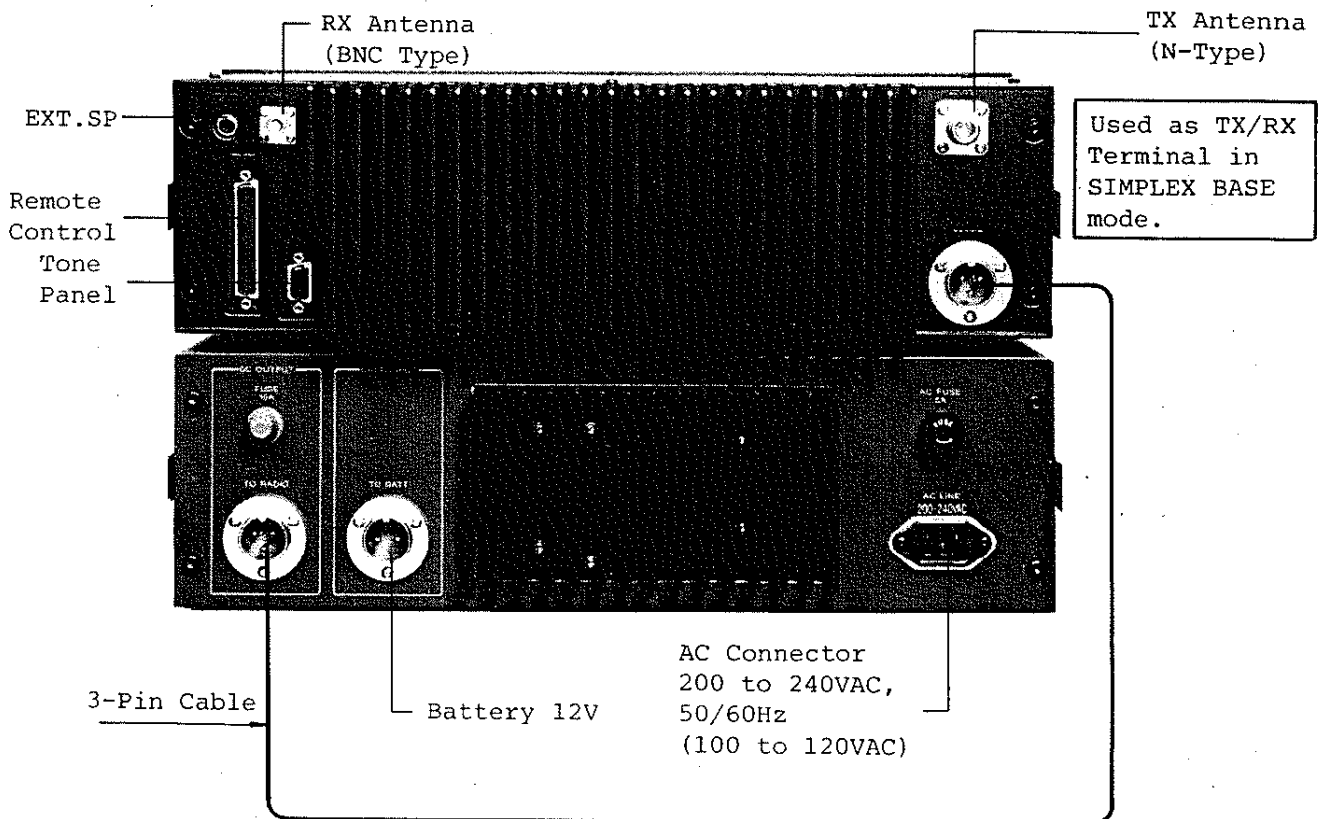
6-3 Electrical Connections

- (1) Interconnect DC OUTPUT connector on PS110 and DC INPUT connector on KG110 with the 3-pin cable (accessory).
- (2) In connecting the backup storage battery to BATT INPUT connector, use the 2-pin, 5-meter cable (accessory).
- (3) Connect N type connector and BNC connector on KG110 to the TX antenna and RX antenna, respectively.

For a simplex base station, a coaxial relay is attached at the side of TX ANT and hence, RX ANT terminal is unused.

- (4) EXT SP terminal is used when an external speaker is installed or the receiving signal intensity is measured.
- (5) 37-pin terminal is used for remote control, or when Automatic Changeover Unit is used, or when channel-combined base/repeater mode is switched.

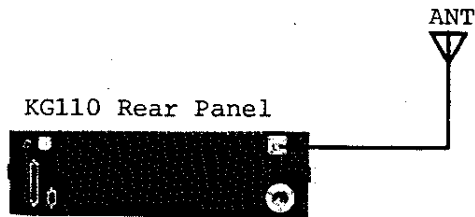
- (6) 9-pin TONE PANEL terminal is used to connect Tone Panel (option). Where the 3 + 1 automatic changeover unit is used together with the Tone Panel, the Tone Panel must be connected to the 3 + 1 changeover unit side.



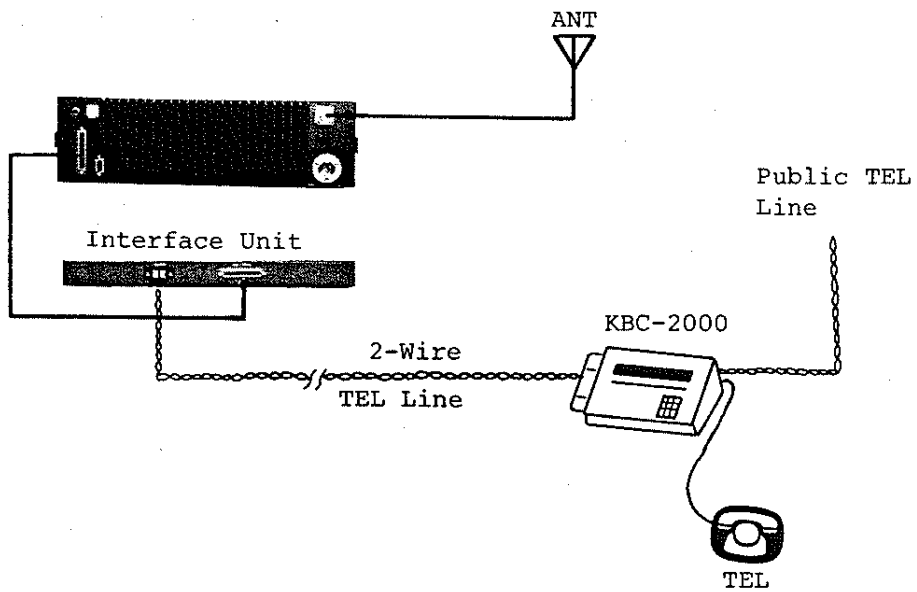
Note: Connect GND pin of AC connector to earth, when installed.

7. SYSTEM CONFIGURATIONS

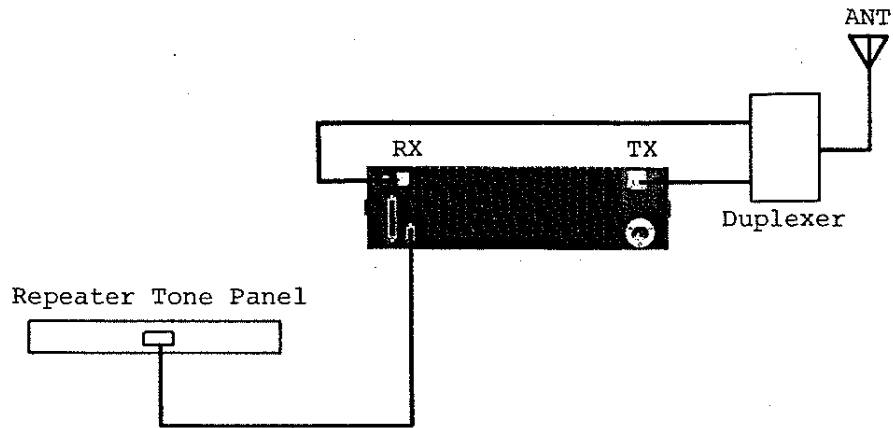
(1) Simplex Base Station Mode:



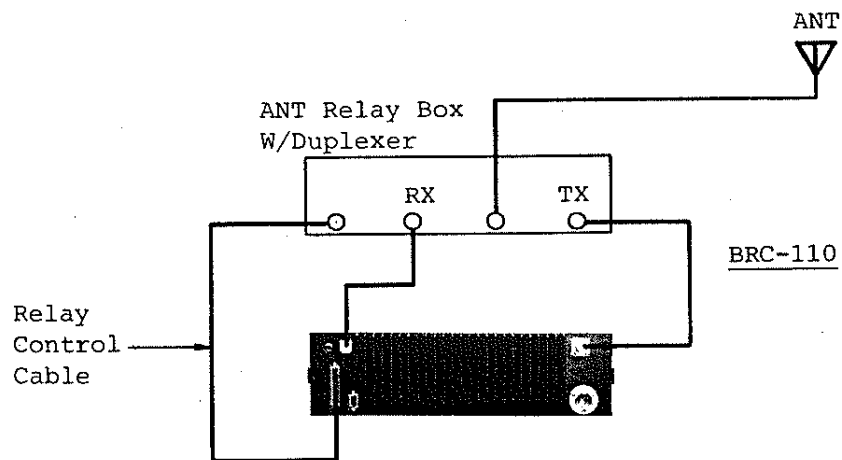
(2) Simplex Base Station Mode with Remote Control



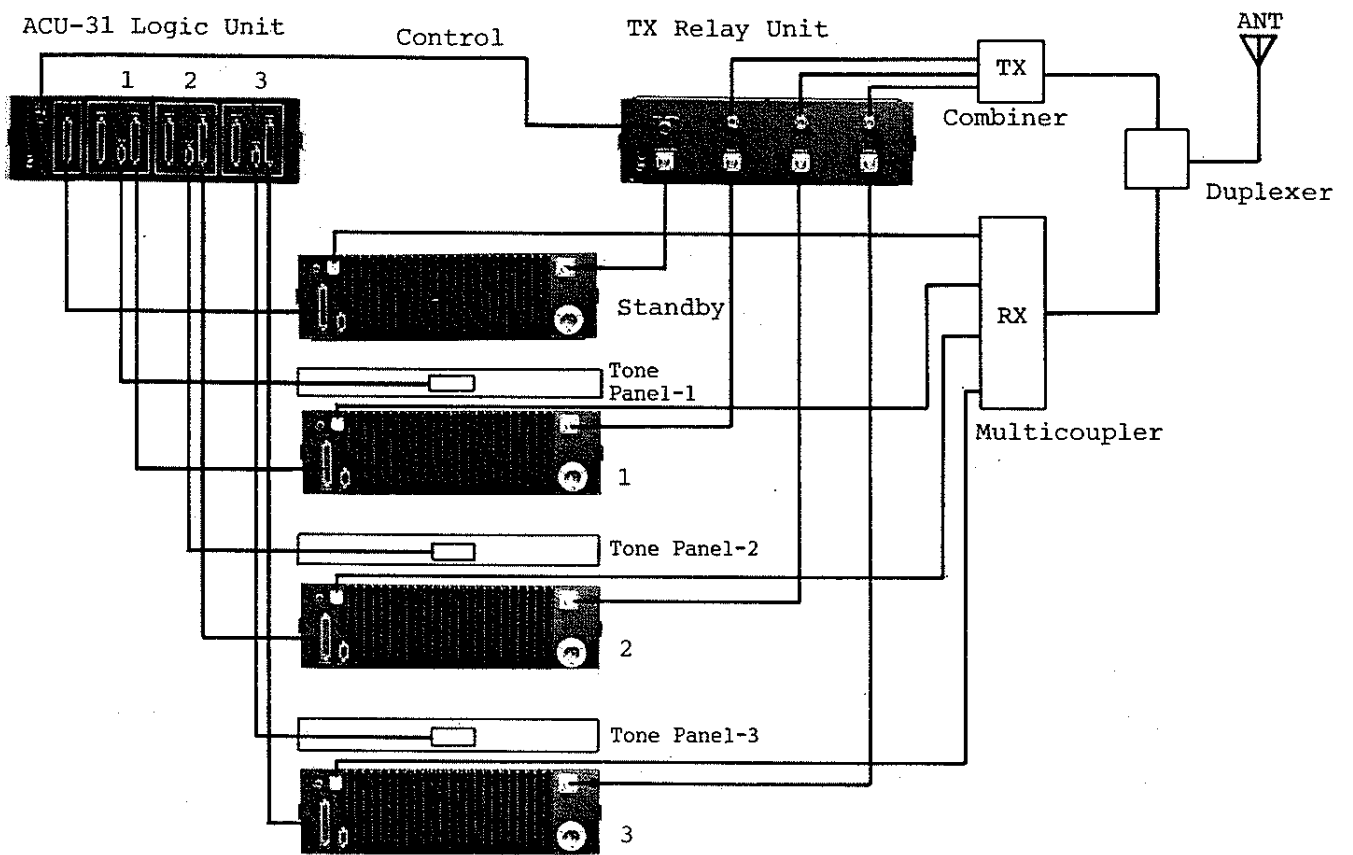
(3) Repeater Station Mode with Repeater Tone Panel



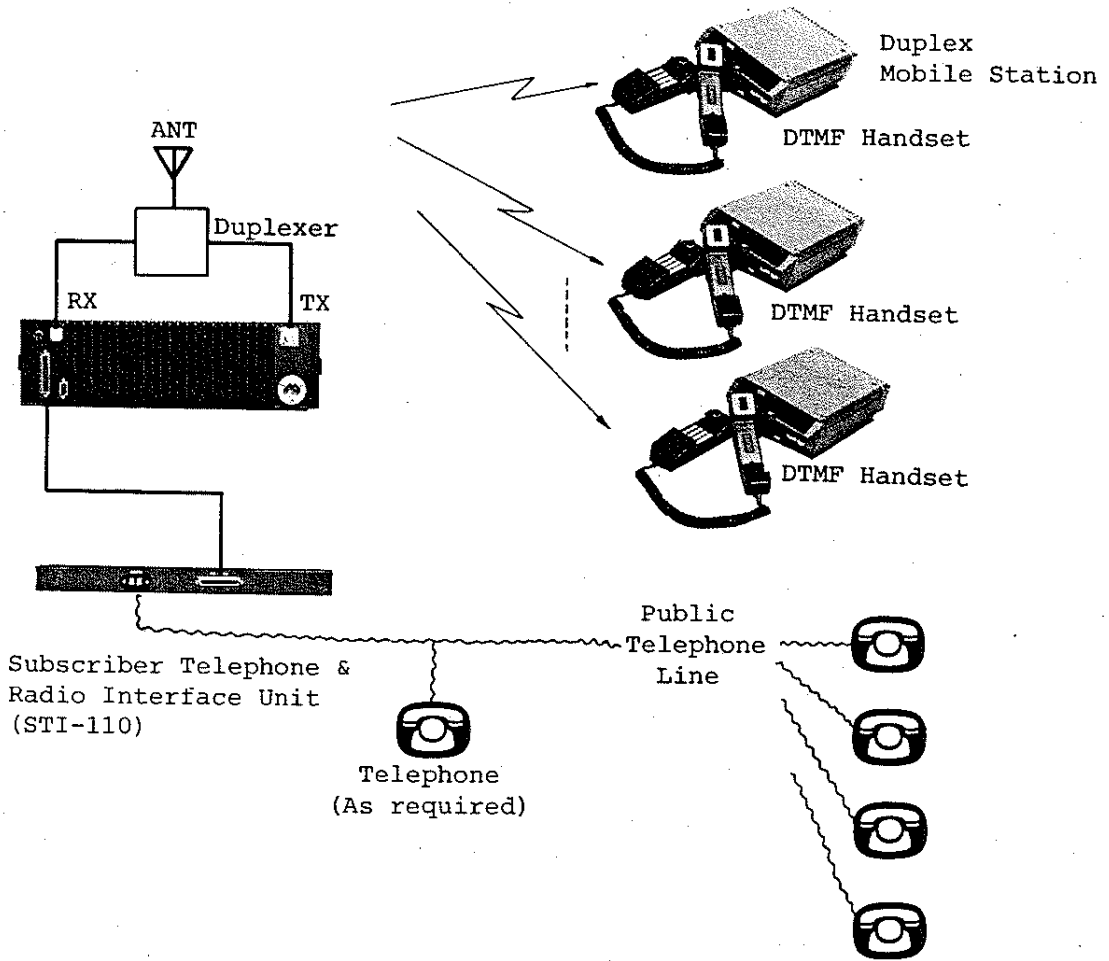
(4) Channel-Combined Base and Repeater Mode



(5) 3 + 1 System Automatic Changeover Unit with Tone Panel



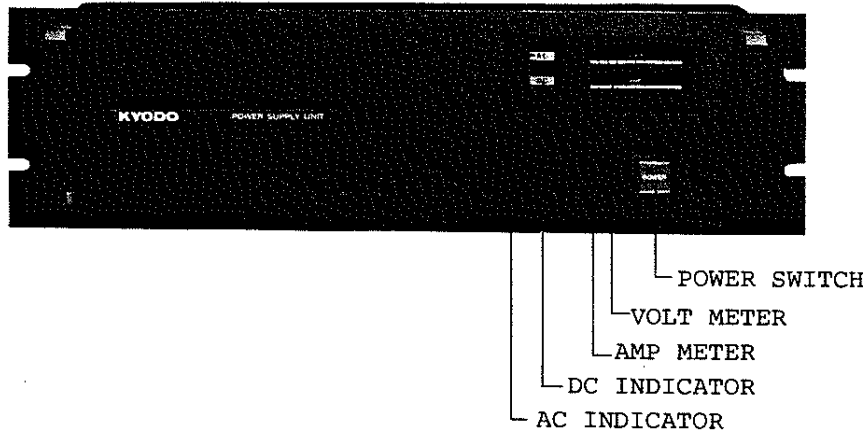
(6) Subscriber Telephones & Radio Network Interface Mode



8. OPERATING INSTRUCTIONS

The proper operations of the KG110 VHF FM Radios and PS110 Power Supply Unit will be outlined in connection with the controls, switches, indicators, etc.

8-1 PS110 Power Supply Unit



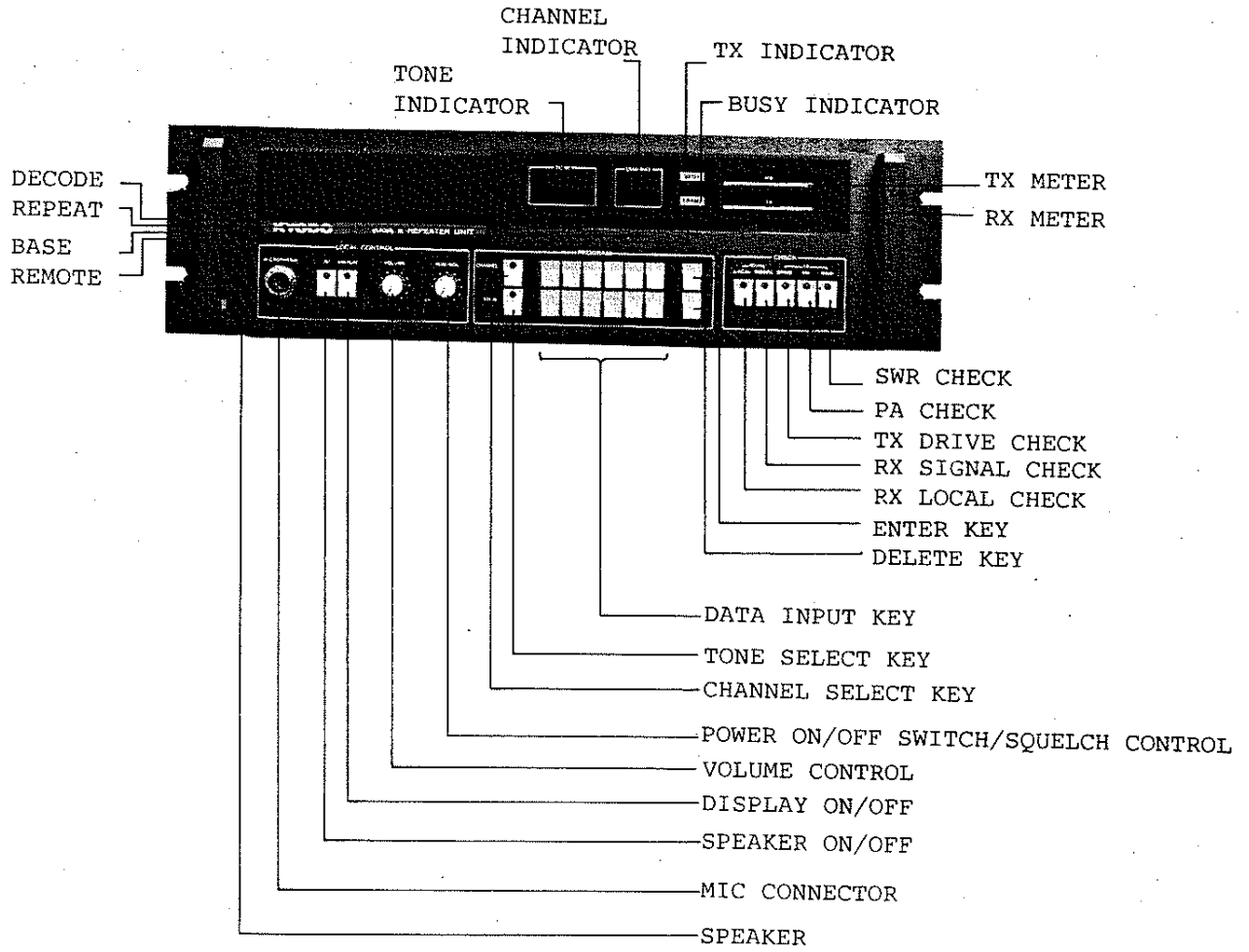
- (1) AC INDICATOR Glows "orange" on application of AC input power, regardless of AC voltage, 100 or 200V.
Remains unlit in battery operation only.
- (2) DC INDICATOR Glows "green" when DC output appears.
- (3) POWER SW To turn power source ON/OFF. Glows "green" when power is ON.
Glows "green" even if power fuse is blown, but in this case, DC INDICATOR remains unlit.

(4) VOLT METER 7 \pm 1 segments out of ten segments should glow for 13.6V DC. Check for proper output voltage.

(5) AMP METER 7 \pm 1 segments out of ten should glow for output current of 10A.

One segment should glow even at no load.

8-2 KG110 Transceiver Unit



- (1) SPEAKER Rated 8Ω/1W. Insertion of EXT. SP jack provided on the rear panel, disconnects speaker circuit.
- (2) MIC CONNECTOR Be sure to connect KD-357M hand microphone as standard into this connector. Note that a desk top microphone is an option.

A handset is also supplied upon request.
- (3) SPEAKER ON/OFF ... To turn speaker ON/OFF. SW-inbuilt LED SW
"red" for "ON".
- (4) DISPLAY ON/OFF ... To conserve unnecessary power consumption SW
in an unattended base/repeater station, this SW is turned ON.

All indicator lights should go out when SW is turned ON, but KG110 operation remains unchanged.

In "ON" period, SW-inbuilt LED glows "red".

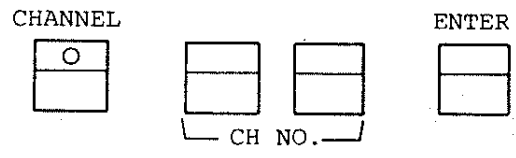
- (5) VOLUME To control speaker sound.
- (6) SQL/POWER Turning this control fully counterclockwise ON/OFF CONTROL
turns OFF power supply.

Turning this control clockwise makes the squelch action more effective.

Set to a point at which noise becomes none.

The POWER/SQUELCH function becomes invalid in repeater or remote control mode.

(7) CHANNEL SELECTION To set CHANNEL, press keys in the following sequence:



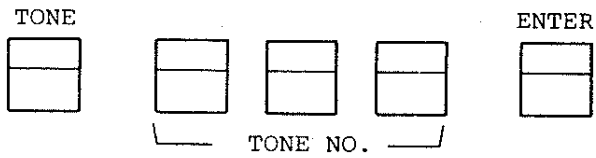
Note that only one data key needs pressing for CH 1 to CH 9.

If CH NO. key is erroneously pressed after pressing CHANNEL, press DELETE and then, CH NO. key correctly. If no data is incoming EP-ROM after CH has been set, CHANNEL INDICATOR flashes. Also note that this CHANNEL SELECTION setting fails to work in remote control mode.

(8) TONE SELECTION ... Pressing this key enables 5-TONE ENCODE NO. setting.

This function is valid in remote control mode as well.

In setting, press keys in the following sequence:



In resetting TONE NO., press DELETE key and see that TONE NO. goes out from display. Then, set once more.

[GROUP CALL]

To actuate "A" tone using GROUP CALL frequency, use DATA INPUT key * as follows:

Example

3 9 5 4 * → Group Call from 39540 to 39549

3 9 * * * → Group Call from 39000 to 39999

- (9) RX LOCAL CHECK ... To verify RX VCO output level. 7 ±1 segments should glow under normal conditions.
- (10) RX SIGNAL CHECK .. To indicate receiver's detected output. So adjusted that full segments will glow for 40dBµV input as shipped from the factory.
- (11) TX DRIVE CHECK ... To verify the DRIVE level in transmitting periods. 7 ±1 segments should glow for TX unit's output of 200mW.
- (12) PA CHECK On pressing this key, the TX output can be checked. 7 ±1 segments should glow for PA output of 50W.
- (13) SWR CHECK On pressing this key, the SWR of Antenna System is indicated. If normal, one or two segments should glow. Nine to ten should glow if Antenna is shorted or open.
- (14) TRANS INDICATOR .. This indicator should glow "red" in transmitting periods.
- (15) BUSY INDICATOR ... To glow in busy operation in receiving periods.
- (16) CHANNEL To indicate CH NO. Flashes for INDICATOR unprogrammed channels.

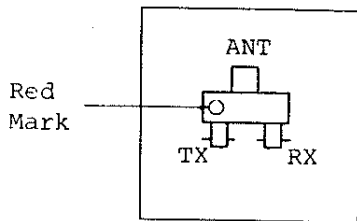
- (17) TONE INDICATOR ... To glow only when 5-Tone Encoder/Decoder (option) is installed. Digitally input the tone according to the tone selection.
- (18) "DECODE" On decoding the tone signal when 5-Tone INDICATOR Encoder/Decoder is installed, this indicator glows.
- (19) "REPEATER" Glows in case of Repeater Station mode. INDICATOR
- (20) "BASE" Glows in case of Simplex/Duplex Base INDICATOR Station mode.
- (21) "REMOTE" Glows when KG110 operates on a remote INDICATOR control basis as a result of connecting Remote Control Unit (KBC-2000) or Automatic Changeover Unit (ACU-31).

9. JUMPERING INSTRUCTIONS

Various kinds of jumpering connections are prepared for the KG110 for their individual or compound connections in order to meet a variety of system configurations and operational modes. Any operational mode that has been once set at the factory will have to be changed, once in a while, at the job site, as a matter of fact. Your careful reading of this section is desired for a thorough comprehension of each jumpering point for maximal utilization and convenience of your radiotelephone service.

(1) Coaxial Relay

This relay is necessary when KG110 operates as a simplex base station.

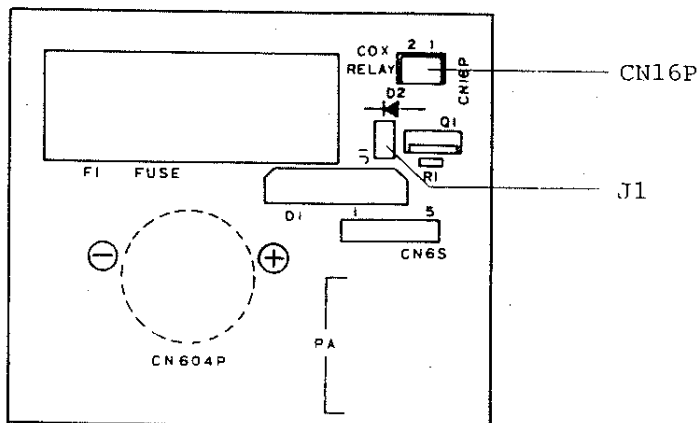


Coaxial Relay

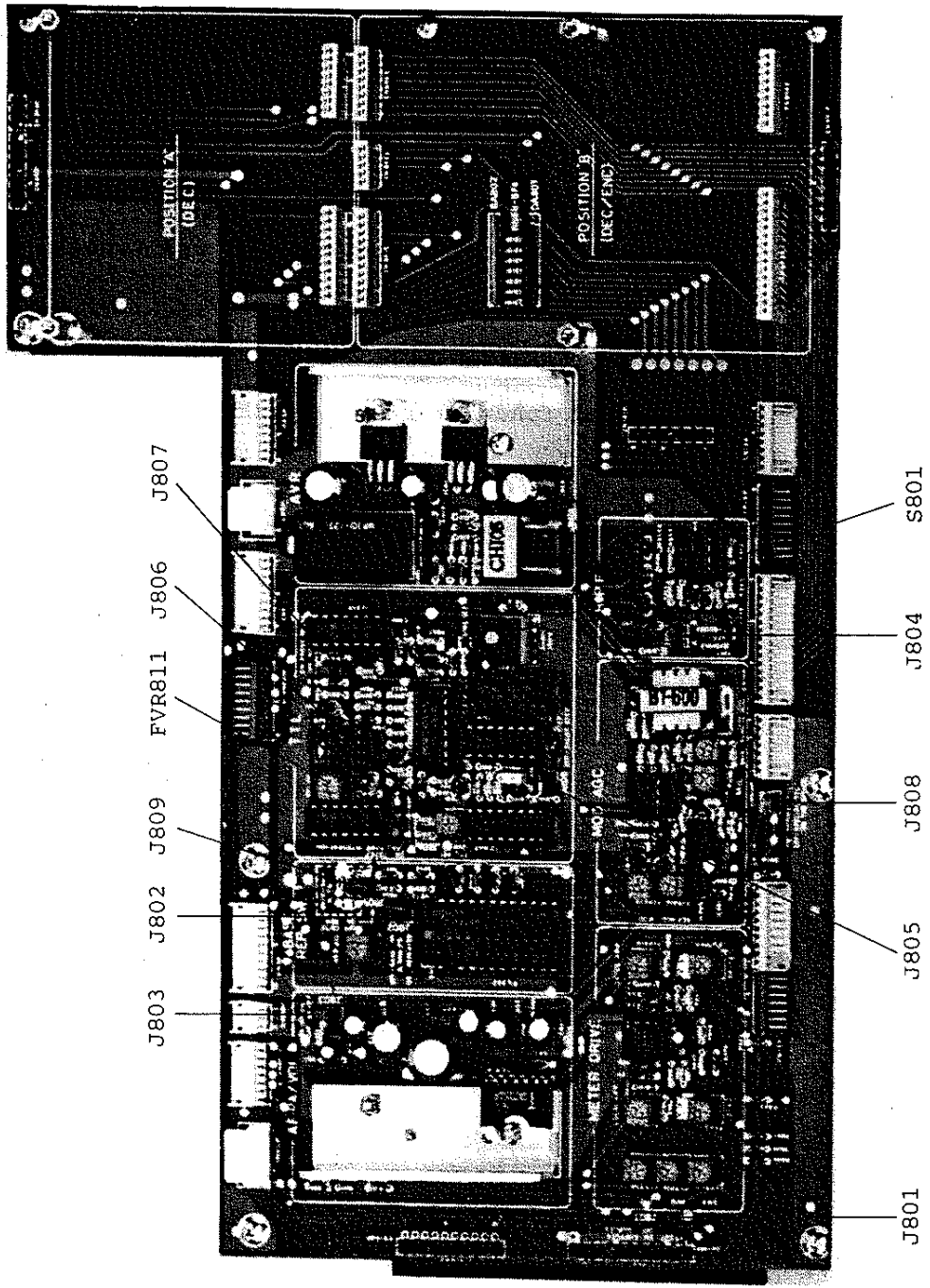
Red mark denotes TX side. Green mark denotes RX side. Connect TX and RX output/input cables respectively to these terminals.

Also plug 2-Pin Connector of Relay Drive Circuit into plug CN16P on Power Supply PCB.

To operate KG110 as a duplex base station or a repeater station with the coaxial relay installed, insert Jumper J1, to keep the relay on the MAKE side (TX side).



(2) Jumpering Positions on Terminal Unit PCB



a) J801 AUD10 CUT-OFF

To decide whether receiver output is cut-off or kept alive in transmitting periods.

ON : Audio CUT-OFF in TX period. (Simplex base station)

OFF : Audio kept alive in TX period. (Duplex base or repeater station)

b) J802 BASE/REPEATER CONTROL

To control Base/Repeater mode control relay. With jumper ON, relay operates to become Repeater mode. Jumper should remain uninserted to operate the Base/Repeater function externally.

In repeater mode, the following functions become effective:

- Press control function due to SQL OUT.
- "REPEATER" INDICATOR glows.
- Transfer of receiver output (0dBm) to repeating modulation.
- Transfer of the Variable Squelch Circuit to the internal semi-fixed setting.
- Function of the Press Delay Circuit becomes effective.

c) J803 SP ON/OFF

To turn ON/OFF SP within KG110. Set to SP ON usually.

ON : SP ON

OFF : SP OFF

d) J804 HPF

Where KG110 mounts Tone Squelch PCB, 10-QCT(A), or Tone Panel, this HPF jumper is to eliminate DISC output tone component.

A-side : When 10-QCT(A) or Tone Panel is mounted.

B-side : When no Tone Squelch PCB is mounted (THROUGH).

e) J805 TTL TIME STEP

This jumper is to arrange the step time setting when KG110 is operated by the TTL (Transmitter Time Limiter) circuit.

ON : 1 STEP = 30 seconds

OFF : 1 STEP = 15 seconds

Incidentally, TTL steps can freely be varied in sixteen (0 to 9 plus A to F) steps with DIP SW, S801. In other words, $30 \times 15 = 450$ seconds max. (7 min. 30 sec.) for J805 "ON". $15 \times 15 = 225$ seconds (3 min. 45 sec.) for J805 "OFF". At step "0", TTL time becomes "0"- i.e., "no TTL".

f) J806 TTL MODE

This jumper is to select either of the two alternatives:

Whether one press-to-talk time, for instance, should be taken as TTL TIME or one conversation time should be taken as TTL TIME.

The latter case is effective only when 10-5T(D) 5-TONE DECODER for Repeater Press Key is installed in KG110.

ON : 1 STEP TTL MODE

OFF : INTEGRATION TTL MODE

g) J807 PRESS DELAY CONTROL

This jumper is to hold (or extend) a transmission time interval by an optionally preset time at the termination of conversation in repeating periods.

ON : PRESS DELAY

OFF : NO DELAY

In case of "ON", the time can be set to 20 seconds, max., with FVR811 (without steps). (Usually set to 9 ±1 seconds before shipment.)

h) J808 PRESS SW CONTROL

To prevent all transmitting functions from being controlled by the microphone press-to-talk signal, when a particular TTL mode is set with PCB (option) or a function such as 10-5T(A) Encoder/Decoder having a call signal is provided.

ON : Mic press-to-talk SW only is effective (no other options)

OFF : 10-5T(A) or special TTL is installed.

i) J809 JUMPER FOR COMMUNITY REPEATER OPERATION

Where KG110 operates as a community repeater with the addition of Tone Panel (option), this jumper is to prevent KG110 from becoming TX mode merely because of signal reception. The microphone press-to-talk function works irrespective of this jumpering.

ON : When operated as a normal repeater (i.e., without Tone Panel), or, when operated with 10-QCT(D)/10-5T(D).

OFF : When Tone Panel is used for Community Repeater.

JUMPERING CHART FOR TYPICAL SYSTEM CONFIGURATIONS

		OPTION																		
		10-5T (A)	10-5T (D)	10-QCT (A)	10-QCT (D)	TONE PANEL	KBC-2000	ACU-31	STR-110	BRC-110	J801	J802	J803	J804	J805	J806	J807	J808	J809	
Duplex Base Station Mode	-	-	-	-	-	-	-	-	-	-	OFF	OFF	ON	B	*1	ON	ON	OFF	ON	
	-	-	-	-	-	-	-	-	-	-	OFF	OFF	ON	A	*1	ON	ON	ON	ON	
Repeater Station Mode	-	-	-	-	-	-	-	-	-	-	OFF	ON	ON	B	*1	ON	ON	ON	ON	
	-	-	-	-	-	-	-	-	-	-	OFF	ON	ON	A	*1	ON	ON	ON	ON	
Base & Repeater Station Mode	-	-	-	-	-	-	-	-	-	-	OFF	OFF	ON	B	*1	ON	ON	ON	ON	
	-	-	-	-	-	-	-	-	-	-	OFF	OFF	ON	A	*1	ON	ON	ON	ON	
Simplex Base Station Mode	-	-	-	-	-	-	-	-	-	-	ON	OFF	ON	B	*1	ON	ON	ON	ON	
	-	-	-	-	-	-	-	-	-	-	ON	OFF	ON	A	*1	ON	ON	OFF	ON	
Mode	-	-	-	-	-	-	-	-	-	-	ON	OFF	ON	A	*1	ON	ON	ON	ON	
	-	-	-	-	-	-	-	-	-	-	ON	OFF	ON	A	*1	ON	ON	ON	ON	

LEGEND:

Δ : Standard function needs modification.

o : Standard function.

*1 : Select ON or OFF.

*2 : OFF when Tone Panel is used for Community Repeater.

10. CIRCUIT DESCRIPTION

10-1 PLL Section

The 12.00MHz output frequency from the RX-UNIT-mounted reference oscillator (TCXO) is divided into 1:16 to obtain the 750kHz strobe signal to become the reference frequency division input and the frequency division data input to the PLL IC (MC145146).

In order to share the reference frequency between TX and RX, the 750kHz strobe signal is received from RX UNIT with the TX UNIT.

The 750kHz strobe signal is counted up by IC and its data output becomes the data latch address signals for the EP-ROM and PLL IC.

The PLL IC (MC145146) needs 29-bit data for one frequency. The data is divided into eight sets each of 4 bits and they are applied in parallel to the PLL IC.

Therefore, the frequency-determining data are input in eight addresses for each RX channel or TX channel as regards the addresses of the EP-ROM.

Since the one-address data is input to the PLL IC as short a time interval as $1/750\text{kHz}$, data recognition for the input of one frequency data is accomplished within as brief a time as $1 \times 8/750\text{kHz}$.

Furthermore, since the data is being refreshed at all times, the data can easily be altered with the same timing, even when the channel is changed.

Also, since the transmit and receive data are written into separate EP-ROMs, write-in operation, or programming, is feasible, even if the transmit and receive frequencies are different from each other.

Since the reference frequency division ratio can also be designated by ROM, division ratios ranging 3 to 4,096 of 750kHz are theoretically feasible. Be sure to adopt either 6.25kHz, 10kHz or 12.5kHz as the reference.

The RF signal from VCO is frequency-divided into 1:64 (1:32 in case of Low-Band VHF) before application to PLL IC and further, undergoes frequency division according to the ROM data and phase comparison with the reference frequency.

The phase difference signal passes through the low-pass filter to become a DC voltage to control the oscillation frequency of VCO.

10-2 VCO Section

This section incorporates oscillation circuits independently incorporated in TX and RX units. Whereas Q201 (RX VCO) is for use with RX 1st local oscillator (LO) (F-21.6MHz), Q401 (TX VCO) is to initiate oscillations at the transmit frequency.

These two VCOs when used for a simplex base station are switched over by means of a press-to-talk switch, but they operate simultaneously when used for a duplex base station.

Control for either alternative is enabled by Jumper J801 in the terminal board.

Either oscillator output is amplified by the buffer amplifier IC μ PC1651 to become the input signal to amplifier Transistor 2SC2753 and a part of the prescaler IC μ PC571C. The RX LO signal is amplified by Q202 to cause the 1st mixer DBM-1 to drive.

The transmit signal is amplified by Q402 and the amplified signal becomes the input signal to the TX section. The PLL circuit when unlocked causes Q203 and Q204 in case of RX section or Q403, Q404 in case of TX Section to operate, thereby turning "OFF" the TX output.

10-3 RX Section

The RF input signal incoming from the antenna passes through the antenna coaxial relay, and the bandpass filter (BPF-1) in succession to undergo amplification by Q1. The amplified signal passes through the bandpass filter (BPF-2) to be applied as the input to the DBM-1 (diode, double-balanced mixer).

The DBM-1 is to mix the amplified RF signal with the 1st local oscillator (LO) signal to develop the 1st IF signal at 21.6MHz as its mixed output.

The output signal is further amplified by Q102, followed by still further amplification by Q103 after the initially amplified signal being applied to the crystal filter (XF101). The finally amplified signal is applied to IC107 as its input. At IC107, the 1st IF signal at 21.6MHz is converted into 455kHz through the 2nd mixer. The 455kHz signal passes through the 455kHz ceramic filter (CF101) to obtain an AF signal via the limiting amplifier and discriminating circuit.

The AF signal is then separated into the audio signal and the noise signal necessary for squelch control.

The audio signal passes through the lowpass filter IC108 (1/2), the delay circuit consisting of Q106, Q107, and IC109, the lowpass filter Q108, and the highpass filter of IC110 (1/2), the integrating circuit of IC110 (1/2), and the squelch gate circuit Q111 in succession to undergo 0dBm power amplification by IC111. The BTL 0dBm signal is applied to the Final Power Amp TA7252.

The squelch noise signal undergoes amplification by IC107 and IC108 (1/2) and detection by DC, to become a DC signal.

The DC signal passes through the switching circuit consisting of IC107 and Q104 to obtain the SQL OUT signal.

10-4 TX Section

The RF signal from VCO is amplified by Transistors Q301, Q302 to serve as power for driving the RF power amplifier module. The amplified RF signal, on the other hand, becomes a signal for driving the DRIVE meter. The signal amplified by the module is further amplified by the final-stage RF power amplifier consisting of the stripline to become the RF power output ranging from 50W to 60W.

The output is radiated from the antenna via the low-pass filter and coaxial antenna relay.

Part of the module output undergoes detection and DC amplification for feeding back to the 1-stage amplifier to become a control signal for the output power.

Even if the antenna is mismatched, reflected waves can be detected, causing the module input power to decrease and the module to be protected from damage.

The transceiver unit is equipped with a heatsink for sufficiently dissipate generated heat. This enables a consecutive 24-hour transmission capability.

The detected control signal is amplified to become a power alarm and a SWR alarm for controlling the Automatic Changeover Unit. The power alarm operates on reaching one-half the rated power, while the SWR alarm operates when the ANTENNA is open or shorted. No sooner than the two alarms work, LED (D606) glows "red".

10-5 Modulator Section

An audio signal produced by a human voice radiated to the MIC undergoes amplification by the ALC (Automatic Level Control) amplifier IC I803 (M51304) and IC804 (NJM4556).

Standard input level to the MIC is rated at 1kHz, -34dBm, while that in case of remote control is rated at 1kHz, -8dBm.

The amplified audio signal passes through the preemphasis circuit consisting of C356 and R346 before it is amplitude-limited by the limiting amplifier IC309 (1/2). The amplitude-limited signal passes through the lowpass filter consisting of L310 and L311 to become a modulating signal to be applied to the gate of TX VCO FET (Q401).

On the other hand, the 5-Tone Encode signal undergoes modulation without preemphasis, while the CTCSS Encode signal undergoes modulation without passing through the limiting amplifier and the preemphasis circuit.

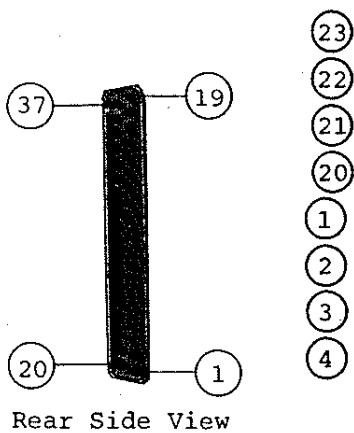
10-6 Description of Remote Control

10-6-1 37-Pin D-SUB Connector for Remote Control

Provided on the rear panel of KG110 radio, the 37-PIN D-SUB CONNECTOR has 37 pins whose functions are as follows:

③⑥ ③⑦ 13.6V DC

①⑧ , ①⑨ , ⑦ GND



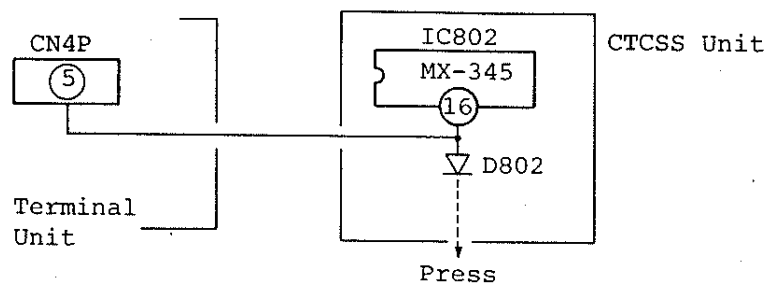
A1 }
 A2 }
 A3 }
 A4 } For CH
 A5 } DATA
 A6 }
 A7 }

ROM DATA ... 5V voltage emerges on this pin after ER-ROM is programmed.

CH1 is preceded by all "0's".
 CH128 is preceded by all "1's".
 "0" = open or 0V
 "1" = 5V to 13.6V

- ⑤ ENCODE ... CTCSS Tone Encode signal is available from this pin. Used in connecting TONE PANEL to AUTOMATIC CHANGEOVER UNIT.
- ⑥ DISC OUT ... CTCSS Decode input signal is available. Used in connecting TONE PANEL to AUTOMATIC CHANGEOVER UNIT.
- ⑧ REMOTE ... When controlled externally from a remote controlling position, KG110 is grounded. When this signal is grounded, all of POW SW, SQL CONTROL, and CH can only be controlled from remote control side (i.e., fail to be controlled from KG110 side). Note in this case that LED "REMOTE" on KG110 front panel glows.
- ⑨ BUSY ... 8V voltage emerges on this pin during receive period. 0V emerges when KG110 is in standby status.
- ⑩ VOL (-) ... Volume control common.
- ⑪ VOL ... For volume control use. Use type 10K-B Volume.
- ⑫ SQL ... For SQL control use. Use type 10K-B Volume
- ⑬ , ⑭ AF OUT ... To obtain RX 0dBm output. A -6dBm output is available between either ⑬ or ⑭ pin and GND.
- ⑮ PRESS ... When grounded, KG110 radio operates in TX mode.

- ①⑥ SP ... An AF output of either 4W/4Ω or 2W/8Ω at max. is available.
- ②④ , ②⑤ , ②⑥ ... No connection.
- ②⑦ CTCSS ON ... A signal for ON/OFF controlling CTCSS ENCODE Signal is available from Remote Control Unit KBC-2000. No wiring being provided within KG110, as a rule, wiring must be installed (either at the site or before shipment) to make this signal available.



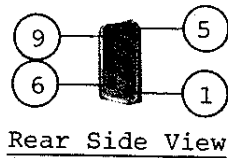
Connect across CN4P ⑤ pin on Terminal Unit and IC802 (MX-345) ①⑥ pin on CTCSS Unit and remove D802.

- ②⑧ , ②⑨ BASE 1, BASE 2 ... To obtain a signal for automatically or manually changing-over one to the other of two KG110 radios where KBC-2000 Remote Control Unit is connected to ACU-31 Automatic Changeover Unit. The Control is processed between ACU-31 and Interface Unit.

- ③① AUX 2 (BASE REP) ... A signal for switching KG110 between BASE and REPEATER STATION modes from the REMOTE CONTROL UNIT is available. Provided with the same function as possessed by J802 in KG110. When grounded, KG110 is placed in REPEATER STATION mode. When open, it is placed in BASE STATION mode.
- ③② AUX 1 ... No connection.
- ③③ TX ALARM ... This signal is used as a TX alarm for the ACU-31. The TX alarm signal voltage ranges from 5 to 6 volts when TX power is reduced to one-half or ANTENNA is open or shorted.
- ③③ , ③④ MODULATION INPUT ... Standard modulation input is 1kHz, -8dBm.
- ③⑤ POW SWITCH ... To operate POW SWITCH on a REMOTE CONTROL basis. When grounded, KG110 power switch turns "ON".

10-6-2 9-Pin D-SUB Connector for Tone Panel

Provided on the rear panel of KG110, the 9-Pin D-SUB Connector has nine pins whose functions are as follows:



- ① +13.6V DC is available.
- ② No connection.
- ③ DISC IN ... CTCSS DECODE input signal is incoming.
- ④ No connection.
- ⑤ PRESS ... When grounded, KG110 is placed in TX mode.
- ⑥ No connection.
- ⑦ } GND
- ⑧ }
- ⑨ TONE OUT ... CTCSS TONE ENCODE signal is available.

11. MAINTENANCE INSTRUCTIONS

11-1 General

The KG110 radio has been designed to ensure a high degree of reliability over a long trouble-free service life without maintenance efforts.

However, occasional inspections and adjustments are required to maintain the radio in the optimal conditions.

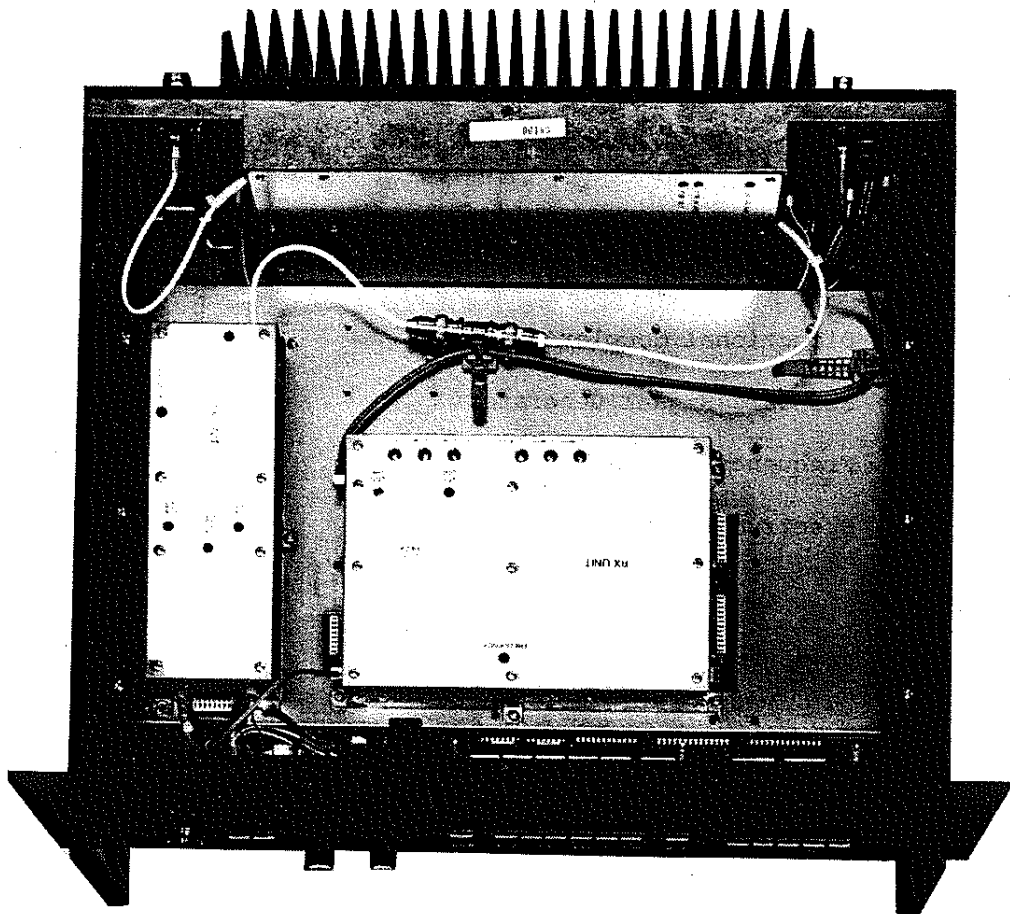
11-2 Necessary Tools and Measuring Equipment

It is recommended that the undermentioned measuring equipment and maintenance tools be properly stored in your maintenance shop for ready use:

1. Circuit Tester
2. RF Power Meter
3. Vacuum-Tube Voltmeter
4. AF Generator (600 ohms, 100 through 10,000 Hz)
5. Linear Detector
6. Distortion Meter/Level Meter
7. Directional Coupler
8. Standard Signal Generator
9. Frequency Counter
10. Spectrum Analyzer

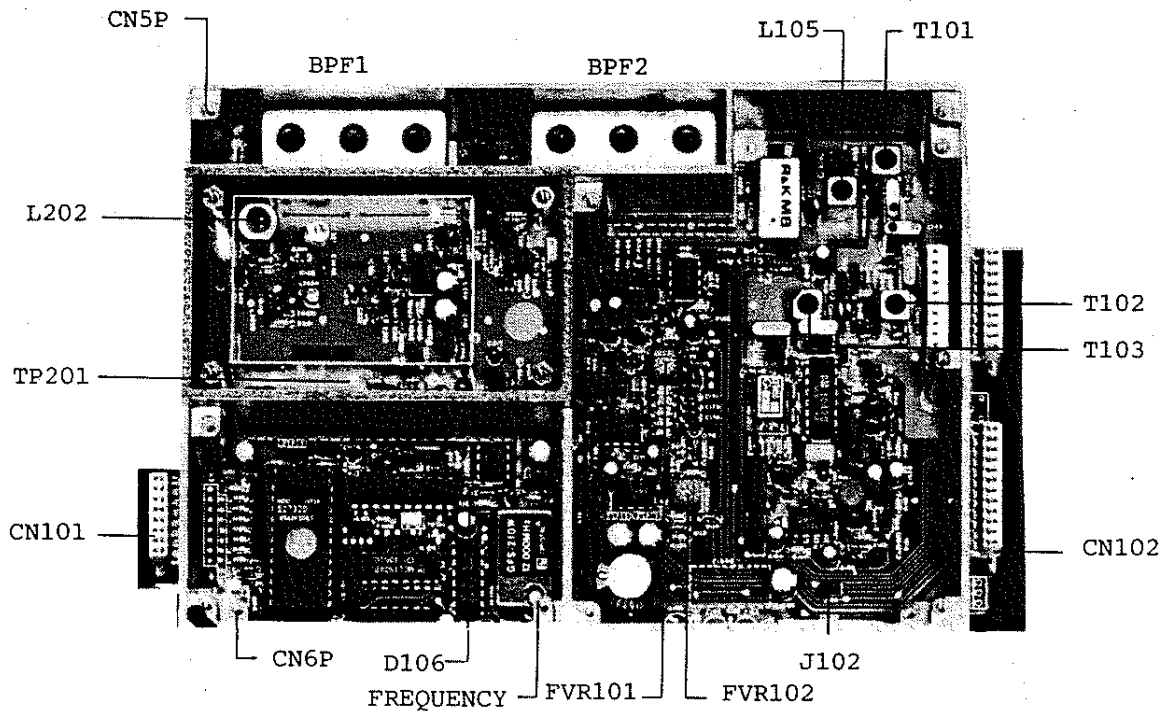
11-3 Precautions in Inspection and Adjustment

1. Always use standard-tip screwdrivers that best fit core slots in adjustment. Be very slow and cautious in turning the cores.
2. In adjusting the VCO, never turn trimmer capacitors or cores with an ordinary screwdriver. Be sure to use an RF screwdrivers. Otherwise, adjustments may result in failure due to the effect of stray capacitances.
3. Keep all measuring instruments well calibrated at all times for availability of accurate measurements.



11-4

11-4-1 RX VCO/PLL Adjustment



RX MAIN UNIT

- (1) Connect a Voltmeter to TP201 and adjust L202 to read 3V on the Voltmeter.
- (2) Adjust the trimmer in TCXO to obtain an output frequency of 750kHz from CN6P. (No need for adjustment at the site, if the frequency tolerances of the TCXO remain within ± 1 ppm at room temperature.)

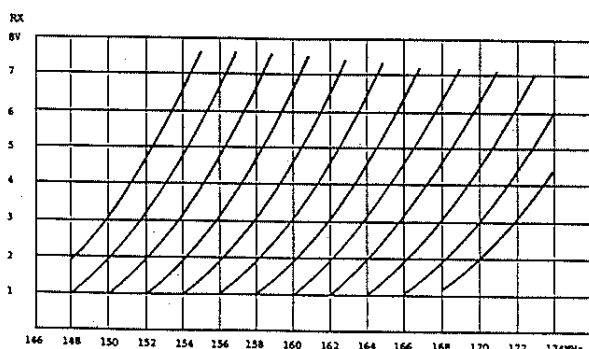
PRECAUTIONS:

The radio performs trouble-free operation within the VCO voltage range, 1 to 5V, as read on a voltmeter connected to TP201.

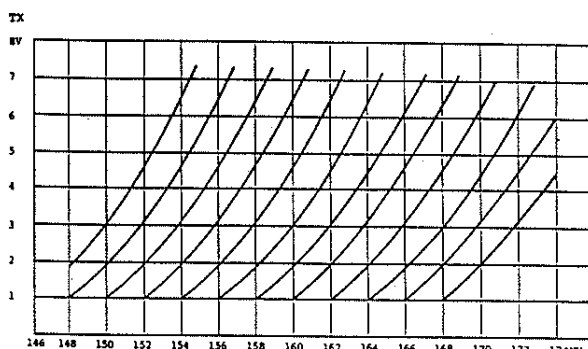
Adjust trimmer capacitor to read 3V (mid-position) on the voltmeter in case of single channel.

In case of multichannel, verify VCO voltages for the lowest and the highest frequencies and perform centering so that all fall between 1 and 5V. IF VCO is unlocked in this case, LED (D106) should glow.

Be sure to refer to the RX/TX characteristic curve in adjusting VCO.



RX FREQ - VCO VOLTAGE



TX FREQ - VCO VOLTAGE

11-4-2 Adjustment of RX Section

In adjusting the RX Unit singly (without being fixed in KG110), exercise care for the following:

- o J102 turned "ON" Be sure to turn it "OFF" before installing in KG110.
- o Connect a 10kΩ PULL DOWN resistor array to CN101.

(1) RF Stage Adjustment

Adjust BPF1 and BPF2 for maximum sensitivity points (with a screwdriver).

A better result can be obtained by measurement using a tracking generator.

Note: Where the KG110 operates as a base station with a wide RX bandwidth, notify us in advance a wider bandwidth BPF you desire. As shipped from the factory, a standard 3MHz bandwidth BPF is mounted.

(2) IF Stage Adjustment

(1) L105 and T101: Adjust to sensitivity maxima.

(2) T102 and T103: Adjust to SINAD sensitivity maxima, with 1kHz, 70% MOD signal applied to Antenna.

(3) AF Stage Adjustment

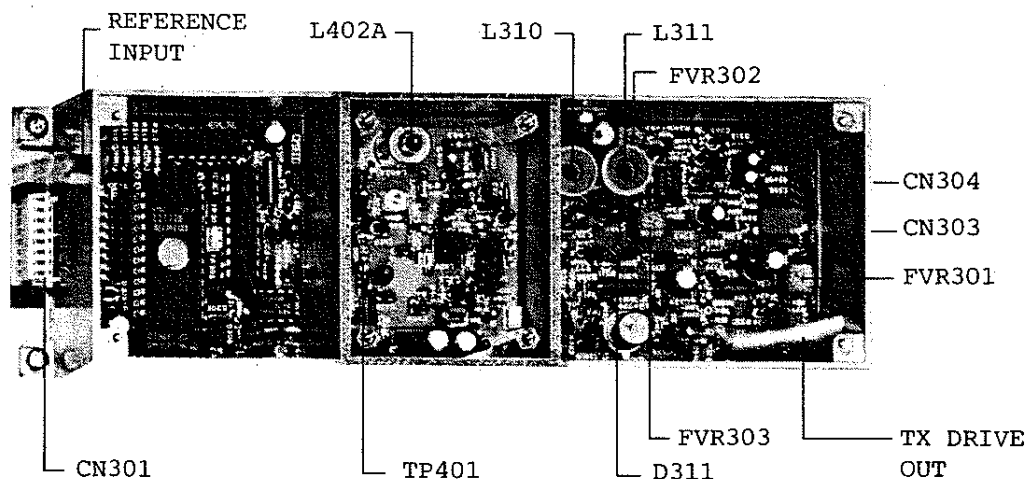
A BTL (Balanced Transformer Line) output obtains from IC111 (NJM2073) as the AF output. The AF output is usually measured with a transformer connected. In the absence of a transformer, adjust between the one-side line and GND.

With a 1kHz 70% modulation signal from a SG applied as input to CN5P, adjust FVR102 so as to make the output level between (8) and (9) of CN102 equal to 0dBm, or adjust FVR102 to obtain -6dBm between (8) or (9) and GND.

(4) RX 3kHz Frequency Response Adjustment

Apply a 1kHz 20% modulation signal from a SG to CN5P, calibrate the receive output level to 0dB, raise the modulation frequency to 3kHz, 20% modulation, and adjust FVR101 to obtain the receive output level of $-9.5 \pm 0.5\text{dB}$.

11-4-3 TX VCO/PLL Adjustment



- (1) Connect a Voltmeter to TP401 and adjust L402A to read 3V.
- (2) TCXO for the reference frequency generation is not provided in TX unit; connect RX unit or apply a 750kHz 4 to 8Vp-p signal to the PLL.

PRECAUTIONS:

The radio performs trouble-free operation within the VCO voltage range, 1 to 5V, as read on a voltmeter connected to TP401.

Adjust trimmer capacitor to read 3V (mid-position) on the voltmeter in case of single channel.

In case of multichannel, verify VCO voltages for the lowest and the highest frequencies and perform centering so that all fall between 1 and 5V. If VCO is unlocked in this case, LED (D311) should glow.

11-4-4 TX Main Unit Adjustment

In adjusting TX Unit singly (without being fixed in KG110), exercise care for the following:

- o Connect a 10k Ω PULL DOWN resistor array to CN301.
- o Apply a REFERENCE 750kHz signal.

(1) DRIVE Output Adjustment

Connect a power meter to TX DRIVE output and adjust FVR301 to read 200 \pm 10mW.

(2) MODULATION Adjustment (Install TX Unit on the KG110)

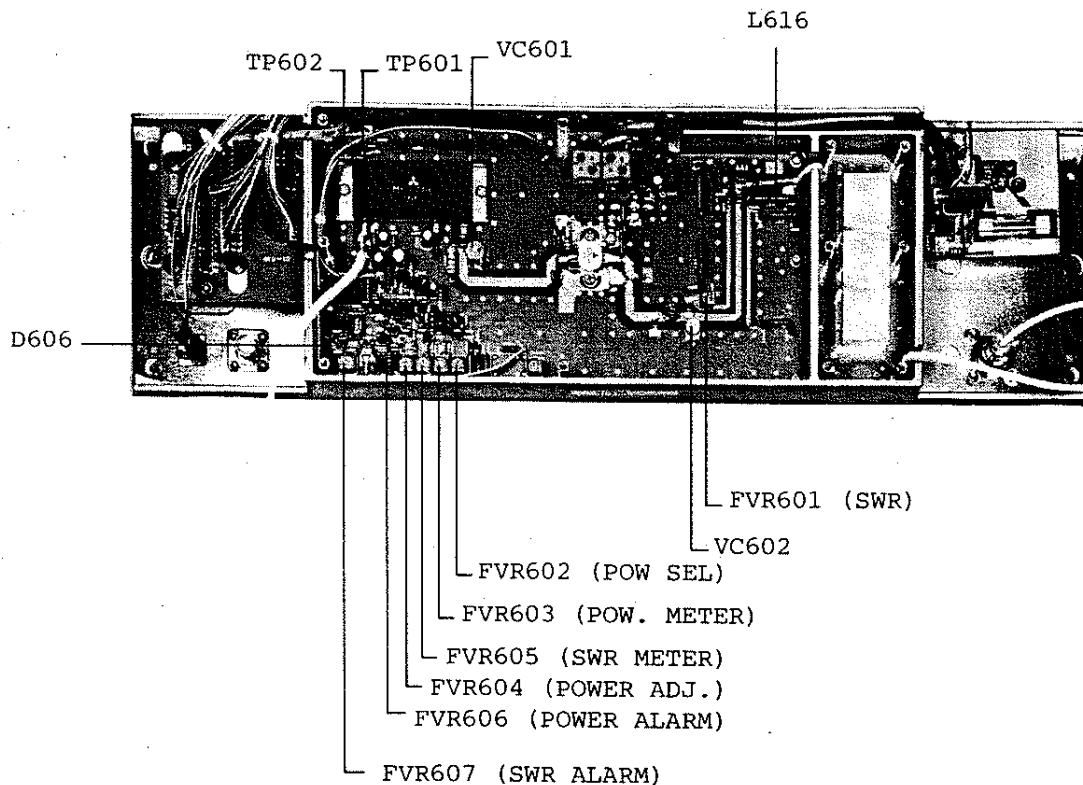
Apply a 1kHz, -34dBm signal from an Audio Generator to MIC connector and adjust FVR303 for a 70% modulation.

Then, raise the input level to 1kHz, -14dBm and adjust FVR302 for a maximum deviation. Repeat this procedure a few times.

(3) Adjustment of TX Frequency Response

Adjust L310 and L311 for a +9.5 \pm 1dB deviation when a REFERENCE 1kHz, 20% modulation signal is varied to a 3kHz, 20% modulation signal.

11-4-5 PA Unit Adjustment



(1) POWER Adjustment

Maximize POWER with FVR604 and take a balancing in turning between VC601 and VC602 for an in-band output in excess of 50W.

Then, fix VC601 and VC602 in position to manipulate them no more. Finally, adjust FVR604 to obtain the rated output of 50W.

(2) SWR Adjustment

Adjust FVR601 to minimize the L616 line voltage as read on a voltmeter.

(3) SWR ALARM Adjustment

LED (D606) should remain unlit for the rated power, as a rule. Adjust FVR607 to provide a visual alarm when ANTENNA is open or shorted.

(4) POWER ALARM Adjustment

With FVR604 set to obtain one-half the rated power, adjust FVR606 to cause LED (D606) to glow under this condition. After adjustment, be sure to restore FVR604 to the initial rated power position.

(5) LOW POWER Adjustment

The KG110 is designed to be capable of modifying as HI-LOW switching on front panel. (But, in order for this facility to be feasible, an additional relay must be installed at the user's request.)

Then, set a "LOW" state output to a desired output with FVR602.

(6) POWER METER Adjustment

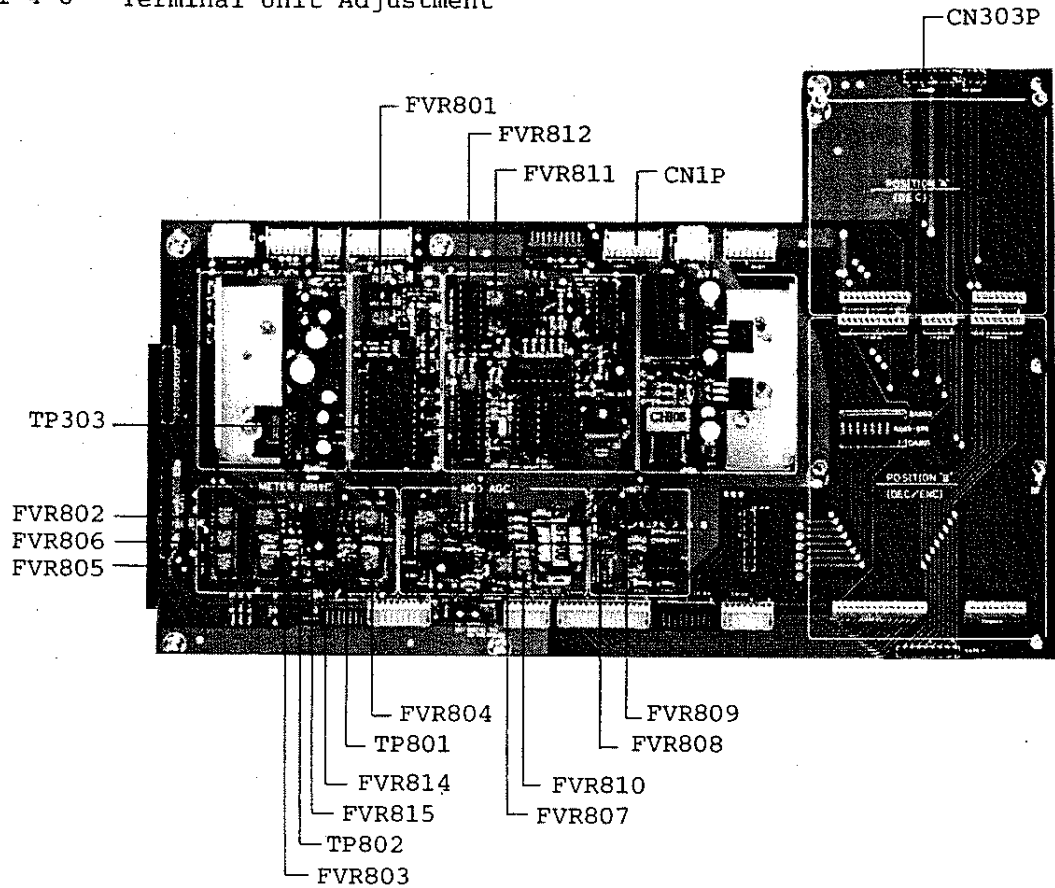
Adjust FVR603 to obtain TP601 voltage of 5.5V under rated power output conditions.

(7) SWR METER Adjustment

Adjust FVR605 to obtain TP602 voltage of 1.3V for rated power and TP602 voltage of 7.3V when ANTENNA is open.

Note: Items (2), (3), (4), (6), and (7) have been adjusted at the factory before shipment. No need for readjustment at the site, unless a trouble occurs

11-4-6 Terminal Unit Adjustment



Terminal Unit is designed not only for overall interconnections of TX Unit, RX Unit, PA Unit, Control Panel Unit, and optional units, but also for incorporating the undermentioned functional facilities.

- (1) Main AVR Unit
- (2) Transmitter Time Limiter
- (3) TX Carrier Delay Unit
- (4) BASE/REPEATER Changeover Relay Unit
- (5) Local AF AMP Unit
- (6) Modulation AGC Unit
- (7) Meter Drive AMP/Meter Sensitivity Adjustment Function for Meters
- (8) HPF Unit for CTCSS Use

(1) Transmitter Time Limiter

With a Frequency Counter connected to TP803, adjust FVR812 to read a frequency of 4kHz.

(2) TX Carrier Delay Unit

With the KG110 in repeater mode (J802 ON), adjust FVR811 to set the delay time properly by operating the MIC press-to-talk switch. The delay time is set to 9 ± 1 sec. as shipped from the factory.

(3) Repeater Squelch Level Setting

Place KG110 in repeater mode and adjust FVR801 so that SQL opens at the SINAD ratio of 12dB.

(4) Modulation AGC Unit

With the MIC input set at 1kHz, -34dBm, adjust FVR807 to obtain a -8dBm output level from pins (1) and (2) of connector CN303. Then, raise MIC input level to 1kHz, -14dBm and adjust FVR809 to obtain an output level of +2dBm.

(REPEATER MODULATION Adjustment)

Apply a 1kHz, 70% modulation, 40dB μ V signal from a SG as input and adjust FVR808 to obtain a 70% modulation.

(REMOTE MODULATION Adjustment)

Apply a 1kHz, -8dBm signal as input to pins (6) and (7) of CN1P or pins (33) and (34) of D-SUB connector and adjust FVR810 to obtain a 3.5kHz deviation.

(5) Meter Drive AMP Adjustment

[S-METER]

Apply a 40dB signal from a SG as input and adjust FVR802 so that the entire segments (ten) of the meter glow.

[POWER METER]

Adjust FVR806 so that seven segments of the meter glow for the rated output.

[SWR METER]

Adjust FVR805 so that ten segments glow upon pressing SW, with ANTENNA open-circuited, and one segment glows for the rated load.

[RX LOCAL LEVEL METER]

Connect a voltmeter to TP802 and adjust FVR815 to read 5.5V. Then, adjust FVR803 so that seven segments of the meter glow in RX mode upon pressing LOCAL SW.

[TX DRIVE LEVEL METER]

Connect a voltmeter to TP801 and adjust FVR814 to read 5.5V. Then, adjust FVR804 so that seven segments of the meter glow in TX mode upon pressing DRIVE SW.

Adjustments (1), (4) and (5) have been finished at the factory before shipment. NO need for further adjustments at the site, if no trouble occurs.

11-4-7 Adjustment for PS110 Power Supply Unit

(1) Adjustment of DC Power Supply Voltage

Adjust the semi-fixed resistor (V. ADJ) on the panel of PS Unit KRV-300 to obtain a DC output voltage of 13.6V.

(2) VOLTAGE METER Adjustment

Adjust FVR4 so that seven segments of the meter glow for the rated voltage of 13.6V.

(3) CURRENT METER Adjustment

- o Make sure that the entire segments (ten segments) of the meter glow with FVR2 maximized under full load conditions (13.6V, 10A).
- o Adjust FVR1 to a point at which METER that has been lit goes out suddenly.
- o Further, turn FVR2 counterclockwise to a minimum point.
- o Finally, adjust FVR3 so that seven segments of the meter glow.

11-5 Voltage Chart

(1) RX UNIT, PLL

REF.	DESCRIPTION	FUNCTION	BASE	EMITTER	COLLECTOR
Q101	2SC2407		0.77 V	0 V	6.56 V
Q103	2SC2669		2.2 V	1.55 V	6.6 V
Q104	2SC2458	SQ OPEN	0.66 V	0 V	0 V
		TIGHT	0 V	0 V	8.0 V
Q105	RN2202	SQ OPEN	1.1 V	8.0 V	8.0 V
		TIGHT	8.0 V	8.0 V	0 V
Q106	2SA1048		7.0 V	6.6 V	3.5 V
Q107	2SA1048		7.0 V	6.6 V	3.5 V
Q109	2SA950	J801 OFF	7.2 V	8.0 V	7.9 V
		J801 ON PRESS	8.0 V	8.0 V	0 V
Q110	RN2202	J801 OFF	8.0 V	8.0 V	7.2 V
		J801 ON PRESS	0.72 V	8.0 V	8.0 V
Q112	RN2202	RX	8.0 V	8.0 V	0 V
		RX UNLOCK	1.7 V	8.0 V	8.0 V
Q108	2SC2458		3.9 V	3.3 V	7.9 V

REF.	DESCRIPTION	FUNCTION	GATE	SOURCE	DRAIN
Q102	2SK152		0 V	0.74 V	7.4 V
Q111	2SK184	MONITOR ON	4.5 V	4.0 V	4.0 V
		OFF	1.3 V	4.0 V	2.0 V

REF.	DESCRIPTION	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
IC107	TK10420	7.9 V	7.2 V	7.5 V	7.9 V	1.1 V	1.1 V	1.2 V	7.9 V
		(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
		3.5 V	2.0 V	2.0 V	0.86 V	0 V	0.66 V	0 V	2.1 V

REF.	DESCRIPTION	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
IC104	μPC571C	5.0 V	2.4 V	0 V	0 V	3.8 V	5.6 V	0 V	0 V
IC108	NJM4558D	3.7 V	3.7 V	3.7 V	0 V	4.4 V	4.4 V	4.4 V	8.0 V
IC109	CX7932	4.5 V	0 V	3.3 V	0 V	4.8 V	3.6 V	0 V	7.9 V
IC110	NJM4558D	4.0 V	4.0 V	3.7 V	0 V	4.0 V	4.0 V	4.0 V	8.0 V
IC111	NJM2073	3.7 V	8.0 V	3.7 V	0 V	0.6 V	0 V	0 V	0.6 V

REF.	DESCRIPTION	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
IC115	TA7303	1.85 V	1.7 V	0.28 V	0.57 V	0 V	3.7 V	0 V	0 V	7.9 V

(2) RX UNIT, VCD

REF.	DESCRIPTION	FUNCTION	BASE	EMITTER	COLLECTOR
Q202	2SC2753	J801 OFF RX	1.85 V	1.26 V	7.8 V
		J801 ON PRESS TX	0 V	0 V	0 V
Q203	2SA1048	RX	7.3 V	8.0 V	8.0 V
		PRESS TX	8.0 V	8.0 V	0 V
Q204	RN2202	RX	8.0 V	8.0 V	7.3 V
		PRESS TX	1.0 V	8.0 V	8.0 V
Q205	2SA1048	RX	6.7 V	7.4 V	7.4 V
		TX	6.9 V	7.5 V	0 V
Q206	RN2202	RX	7.4 V	7.4 V	0 V
		TX	0.7 V	7.5 V	7.5 V
Q207	2SC3623	RX	8.0 V	7.4 V	8.0 V
		TX	8.0 V	7.5 V	8.0 V
Q208	2SC2458	RX	5.6 V	4.9 V	8.0 V
		TX	5.6 V	4.9 V	8.0 V

REF.	DESCRIPTION	FUNCTION	GATE	SOURCE	DRAIN
Q201	SST310	RX	0 V	2.8 V	7.4 V
		TX	0 V	0 V	0 V

REF.	DESCRIPTION	①	②	③	④
IC201	μPC1651	4.9 V	0.85 V	0 V	2.8 V

(3) TX UNIT, PLL/VCO

REF.	DESCRIPTION	FUNCTION	BASE	EMITTER	COLLECTOR
Q301	2SC2644	TX	0.43 V	0.42 V	5.9 V
Q302	2SC1947	TX	0.45 V	0 V	6.2 V
Q303	2SB1019	TX	12.6 V	13.2 V	7.9 V
Q304	RN2202	TX	8.0 V	8.0 V	0 V
		TX UN LOCK	1.8 V	8.0 V	8.0 V
Q305	RN2202	RX	8.0 V	8.0 V	0 V
		TX	0.72 V	8.0 V	8 V
Q306	RN1202	RX	0 V	0 V	7 V
		TX	8 V	0 V	0 V

REF.	DESCRIPTION	①	②	③	④	⑤	⑥	⑦	⑧
IC304	μPC571C	5.0 V	2.3 V	0 V	0 V	3.7 V	5.6 V	0 V	0 V
IC309	NJM4556D	4.45 V	4.45 V	4.45 V	0 V	4.37 V	4.37 V	4.37 V	8.1 V

REF.	DESCRIPTION	①	②	③
IC308	M5236L	11.3 V	0 V	1.23 V


REF.	DESCRIPTION	FUNCTION	BASE	EMITTER	COLLECTOR
Q402	2SC2753	RX	0 V	0 V	0 V
		TX	1.9 V	1.23 V	7.95 V
Q403	2SA1048	RX	8.0 V	8.0 V	0 V
		TX	7.3 V	8.0 V	8.0 V
Q404	RN2202	RX	0.8 V	8.0 V	8.0 V
		TX	8.0 V	8.0 V	7.3 V
Q405	2SA1048	RX	7.7 V	7.7 V	0 V
		TX	7.45 V	6.7 V	7.4 V
Q406	2SC3623	RX	8.0 V	7.7 V	8.0 V
		TX	8.0 V	7.45 V	8.0 V
Q407	2SC2458	RX	5.6 V	4.9 V	8.0 V
		TX	5.6 V	4.9 V	8.0 V

REF.	DESCRIPTION	FUNCTION	GATE	SOURCE	DRAIN
Q401	SST310	RX	0 V	0 V	0 V
		TX	0 V	1.73 V	7.4 V

REF.	DESCRIPTION	①	②	③	④
IC401	μPC1651	4.9 V	0.9 V	0 V	3.0 V

(4) TERMINAL/CONTROL UNIT

REF.	DESCRIPTION	FUNCTION	BASE	EMITTER	COLLECTOR
Q801	2SC2120	POW SW OFF	0 V	0 V	13.8 V
		ON	0.77 V	0 V	0.14 V
Q802	RN2202	RX	13.7 V	13.7 V	0 V
		TX	0.76 V	13.7 V	13.6 V
Q803	RN2202	BASE	0 V	5.0 V	5.0 V
		REP	5.0 V	5.0 V	0 V
Q804	RN2202	BASE	5.0 V	5.0 V	0 V
		REP	0 V	5.0 V	5.0 V
Q805	2SC2458	BASE	2.1 V	1.7 V	4.8 V
		REP	0 V	0 V	4.8 V
Q806	RN2202	RX	5.0 V	5.0 V	0 V
		TX	0.55 V	5.0 V	5.0 V
Q807	2SC3623	J807 OFF NO DELAY	0 V	0 V	13.5 V
		ON PRESS DELAY	0.68 V	0 V	0.15 V
Q805	2SC2458	DURING REPEATING	1.2 V	0.57 V	0.58 V

REF.	DESCRIPTION	FUNCTION	①	②	③	④	⑤	⑥	⑦	⑧
IC803	M51304L		8.0 V	0 V	0 V	1.4 V	2.9 V	1.3 V	0 V	0 V
IC804	NJM4556D		4.3 V	4.3 V	4.3 V	0 V	4.3 V	4.3 V	4.3 V	8.0 V
IC811	555		0 V	5.0 V	0 V	0 V	3.3 V	0 V	0 V	5.0 V
IC812	NJM4558D	RX	5.5 V	4.2 V	4.2 V	0 V	4.2 V	4.4 V	1.4 V	8.0 V
		TX	1.35 V	4.7 V	4.2 V	0 V	4.2 V	4.2 V	5.5 V	8.0 V
IC814	TA7252		1.4 V	1.4 V	6.8 V	0 V	6.7 V	13.0 V	13.7 V	
IC815	NJM4558D		4.4 V	4.4 V	4.4 V	0 V	4.0 V	4.0 V	4.0 V	8.0 V

REF.	DESCRIPTION	FUNCTION	①	②	③	④	⑤	⑥	⑦	⑧	⑨
IC813	AN5733	VOLUME MIN	4.3 V	4.4 V	8.0 V	3.1 V	3.4 V	2.4 V	0 V	2.5 V	3.0 V
		VOLUME MAX	1.22 V	4.4 V	8.0 V	3.1 V	3.4 V	2.4 V	0 V	2.5 V	3.2 V

(5) TX PA

REF.	DESCRIPTION	FUNCTION	BASE	EMITTER	COLLECTOR
Q603	2SB1019	50W	12.7 V	13.4 V	10.0 V
		Max.	12.5 V	13.2 V	13.0 V
Q604	2SA950	50W	12.7 V	13.4 V	13.4 V
		Max.	12.5 V	13.3 V	13.3 V
Q605	2SC2120	50W	1.1 V	0.45 V	11.2 V
		Max.	2.2 V	1.5 V	7.7 V

REF.	DESCRIPTION	FUNCTION	①	②	③	④	⑤	⑥	⑦	⑧
IC602	NJM4558	50W	5.5 V	1.75 V	1.71 V	0 V	1.5 V	5.7 V	1.4 V	8.0 V
		Max.	6.1 V	1.85 V	1.8 V	0 V	1.7 V	5.7 V	1.4 V	8.0 V
IC603	NJM4556	50W	3.6 V	4.5 V	4.5 V	0 V				8.0 V
		Max.	7.3 V	4.9 V	7.2 V	0 V				8.0 V
IC604	NJM4558	50W	1.35 V	2.36 V	1.5 V	0 V	3.5 V	4.5 V	1.37 V	8.0 V
		Max.	1.4 V	2.35 V	1.7 V	0 V	3.5 V	4.9 V	1.38 V	8.0 V
IC602		ANT. OPEN	4.5 V	1.6 V	1.6 V	0 V	6.5 V	6.4 V	7.2 V	8.0 V
IC603		ANT. OPEN	7.3 V	3.9 V	4.5 V	0 V				8.0 V
IC604		ANT. OPEN	6.8 V	2.4 V	6.4 V	0 V	3.5 V	3.8 V	1.3 V	8.0 V

12. EP-ROM PROGRAM METHOD

12-1 Calculating the "Reference Division Rate" Address Data

REFERENCE DIVISION RATE "R"

The Reference Division Rate must always be calculated for both the transmit and the receive frequencies.

The 12.000MHz TCXO output signal is divided by 16 (by the divider, IC101) to provide a 750kHz Reference Frequency. This Reference Frequency is sampled and divided by the "Reference Division Rate" to determine the channel spacing, e.g. $12.000\text{MHz}/16 = 750\text{kHz}$ then $750\text{kHz}/(\text{Channel Spacing}) = \text{Reference Frequency}$ as follows:

<u>Channel Spacings</u>	<u>Calculations</u>	<u>Ref. Div. Rate "R"</u>
25kHz	$750\text{kHz}/25\text{kHz}$	= 30
12.5kHz	$750\text{kHz}/12.5\text{kHz}$	= 60
10kHz	$750\text{kHz}/10\text{kHz}$	= 75
6.25kHz	$750\text{kHz}/6.25\text{kHz}$	= 120
5kHz	$750\text{kHz}/5\text{kHz}$	= 150

Next it is necessary to determine the address information by referring to the attached "A - D CONVERSION LIST".

e.g. 12.5kHz channel spacing

= Reference Division Rate "R"

$$= \frac{60}{\downarrow} \\ \text{c } 30$$

12-2 Calculating the Transmit and Receive Address Data

It is necessary to calculate the following information for each transmit and receive frequencies required. TX and RX allow two TX and RX data to be written respectively into their EP-ROMs.

(Note: The receive frequency is the 1st local oscillator frequency.)

D = Basic Division Rate

d = Prescaler Division Rate

N = Number of Complete Divisions

R = Remainder of the Basic Division Rate

(a) "D" Calculation

"D" is obtained by dividing the frequency required by the channel spacing required.

(b) "d" Calculation

"d" is the prescaler division rate, and it is fixed at 64.

(c) "N" and "A" Calculation

"N" and "A" are calculated using the following equation:

$$D = (N * d) + A$$

(d) Example Calculation

Channel #1 460.000MHz, Simplex, 25kHz Channel Spacing

