



Antenna  
(KRA-14 : Option)

Knob assy (SEL)  
(K29-5282-04)

Knob assy (VOL)  
(K29-5283-04)

Panel assy  
(A62-0537-53)

Knob assy  
(Side key)  
(K29-5441-04)

Cabinet assy  
(A02-2139-63)

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SPECIFICATIONS .....	BACK COVER

Photo is TK-290 K type.  
Does not come with antenna.  
Antenna is available as an option.

### CAUTION

When using an external power connector,  
please use with maximum final module protec-  
tion of 10V

## GENERAL / SYSTEM SET-UP

### INTRODUCTION

#### SCOPE OF THIS MANUAL

This manual is intended for use by experienced technicians familiar with similar types of commercial grade communications equipment. It contains all required service information for the equipment and is current as of the publication data. Changes which may occur after publication are covered by either Service Bulletins or Manual Revisions. These are issued as required.

#### ORDERING REPLACEMENT PARTS

When ordering replacement parts or equipment information, the full part identification number should be included. This applies to all parts : components, kits, or chassis. If the part number is not known, include the chassis or kit number of which it is a part, and a sufficient description of the required component for proper identification.

### PERSONNEL SAFETY

The following precautions are recommended for personnel safety :

- DO NOT transmit until all RF connectors are verified secure and any open connectors are properly terminated.
- SHUT OFF and DO NOT operate this equipment near electrical blasting caps or in an explosive atmosphere.
- This equipment should be serviced by a qualified technician only.

### SERVICE

This radio is designed for easy servicing. Refer to the schematic diagrams, printed circuit board views, and alignment procedures contained within.

### NOTE

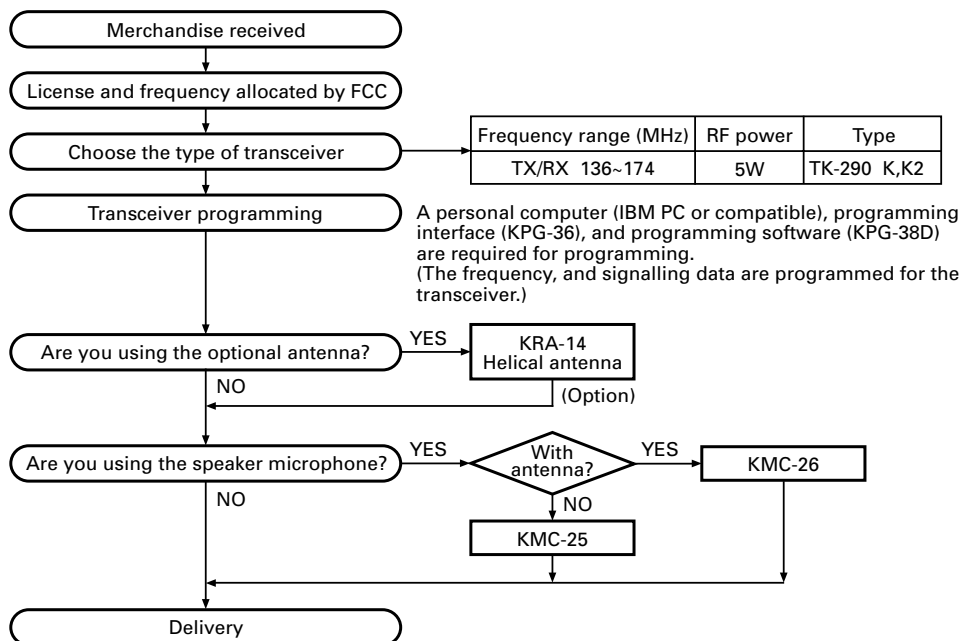
WE CANNOT guarantee oscillator stability when using channel element manufactured by other than KENWOOD or its authorized agents.

### FCC COMPLIANCE AND TYPE NUMBERS

Model	Type acceptance number	Frequency range	Compliance
TK-290	ALH21893110	136~174MHz	Parts 22,74,80,90

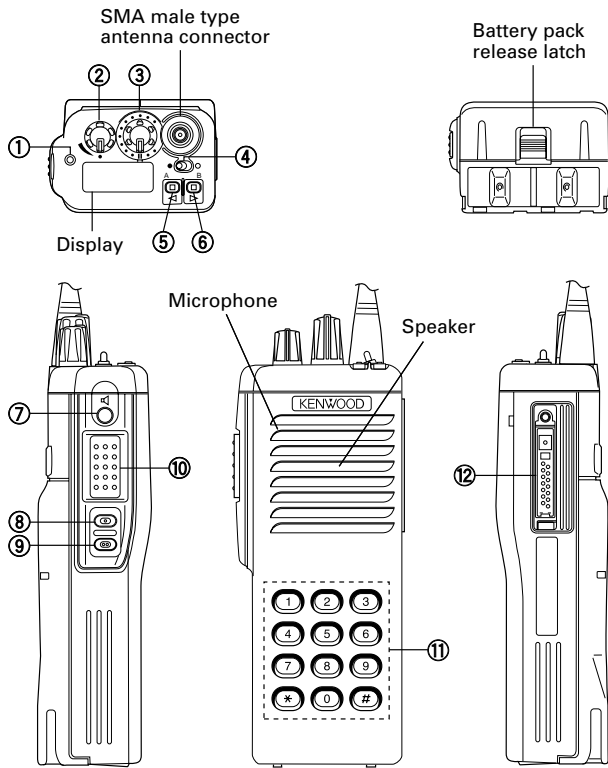
Model & destination	Unit	X57-539X-XX	X53-393X-XX		X45-359X-XX	Frequency range	Remarks	DTMF keypad
		0-10	0-11	0-12	2-71			
TK-290	K	✓	✓		✓	136~174MHz	1st IF : 44.85MHz	-
	K2	✓		✓	✓	136~174MHz	LOC : 45.305MHz	✓

### SYSTEM SET-UP



# OPERATING FEATURES

## 1. Getting Acquainted



### 1-1. Key Descriptions

#### ① TX/Busy/Battery low indicator

Lights red while transmitting. Lights green while receiving. Flashes red when the battery power is low while transmitting; replace or recharge the battery.

**Note :** This indicator can be disabled by your dealer.

#### ② Power switch/Volume control

Turn clockwise to switch ON the transceiver. Turn counterclockwise, until a click sounds, to switch OFF the transceiver. Rotate to adjust the volume level.

#### ③ Selector

Rotate this control to activate its programmable function (Page 8).

#### ④ Toggle switch

Switch the toggle position to activate its programmable function (Page 8).

#### ⑤ Top 1

#### ⑥ Top 2

#### ⑦ Orange

#### ⑧ Side 1

#### ⑨ Side 2

Press these PF (programmable function) keys to activate their programmable functions (Page 8)

#### ⑩ PTT (Push-To-Talk) switch

Press this switch, then speak into the microphone to call a station.

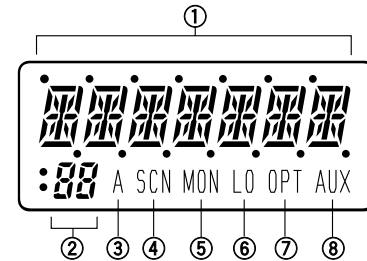
#### ⑪ DTMF keypad (keypad models only)

Press the keys on the telephone keypad to send DTMF tones.

#### ⑫ Universal connector

Connect the external speaker/microphone (optional) here. Otherwise, keep the supplied cover in place.

### 1-2. Display



#### ① Alphanumeric display

Displays the operating group or channel number, or the group or channel name. When making a DTMF or 2 Tone call, the display will alternate between CALL and the channel. Also displays various menu functions.

#### ② 7 Segment display

Displays the operating group or channel number. Also displays tA (Talk Around), P1 (Priority1), P2 (Priority2), PP (Priority1 and Priority2), or HC (Home Channel); depending on the function being used.

#### ③ A (Add) indicator

Appears when a channel is added to the scanning sequence.

#### ④ SCN (Scan) indicator

Appears when Scan mode is active.

#### ⑤ MON (Monitor) indicator

Appears when the monitor function is active.

#### ⑥ LO (Low) indicator

Appears when low power is selected.

#### ⑦ OPT indicator

Appears when Operator Selectable Tone is enabled.

#### ⑧ AUX (Auxiliary) indicator

Appears when Aux is ON. Appears and blinks when the optional scrambler board is enabled.

**Note :** The alphanumeric and 7 segment displays can be inverted if a PF key or the toggle switch is programmed with Invert Display (Page 8).

## OPERATING FEATURES

### 2. Scan Operating

#### 2-1. Scan Types

##### • Single Group Scan

You can scan all valid (ADD) channels in the displayed group that can be selected with the group selector.

##### • Multiple Group Scan

You can scan all valid (ADD) channels in the all valid (ADD) group.

#### 2-2. Scan Start Condition

One or more non-priority channels must be added to all channels that can be scanned. The transceiver must be in normal receive mode (PTT off).

When you activate the key or the toggle switch (to right position) programmed to the scan function, the scan starts. The scan icon "SCN" lights and "SCAN" or revert channel (programmable) is indicated on 7-digit alphanumeric display.

#### 2-3. Scan Stop Condition

The scan stops temporarily if the following conditions are satisfied.

- 1) A carrier is detected, then signalling matches on channels for which receive the signalling is set by the programming software.
- 2) A carrier is detected on the channel for which receiving signalling is not set by the programming software or when the monitor (signalling cancel) function is activated.

#### 2-4. Scan Channel Types

- 1) Priority channel 1 is the most important channel for the scan, and always detects a signal during scan and when the scan stops temporarily.
- 2) Priority channel 2 is the next important channel for the scan, and always detects a signal during scan and when the scan stops temporarily at a channel other than priority channel 1.
- 3) Non-priority channels detects a signal during scan. For the channels that can be selected with the group or channel selector when the scan does not occur, adds an indicator "A" lights.

#### 2-5. Priority Channel Setting

Priority channels 1 or 2 can be set as follows with the programming software (KPG-38D).

- 1) Specify priority channels 1 or 2 as fixed priority channels.
- 2) Make selected channels, priority channels.
- 3) Operator delectable  
Specify the initial channel before the operator changes it.

#### 2-6. Scan Type According to the Priority Channel

- 1) When no priority channels are set : Only the non-priority channels are scanned.  
If a non-priority channel stops temporarily, it stops until there is no signal on the channel.

- 2) When one priority channel is set : Either priority channel 1 or 2 is scanned.  
If a non-priority channel stops temporarily, a priority channel signal is detected at certain intervals.  
If a priority channel stops temporarily, it stops until there is no signal on the priority channel.
- 3) When two priority channels are set : The non-priority channel, priority channels 1 and 2 are scanned.  
If a non-priority channel stops temporarily, priority channel 1 and 2 signals are detected at certain intervals.  
If priority channel 2 stops temporarily, the priority channel 1 signal is detected at certain intervals.  
If priority channel 1 stops temporarily, it stops until there is no signal on priority channel 1.

#### 2-7. Revert Channel

The revert channel is used to transmit during scanning and set by the programming software (KPG-38D).

- 1) Priority 1  
The transceiver reverts to the priority channel 1.
- 2) Priority 1 with talkback  
The transceiver reverts to the priority channel 1.  
If you press PTT during a resume timer (dropout delay time, TX dwell time) or calling, you can transmit on current channel to answer to the call however revert channel is set to priority channel 1.  
After resume time, scan re-starts and transmission channel is return to priority channel 1.
- 3) Priority 2  
The transceiver reverts to the priority channel 2.
- 4) Priority 2 with talkback  
The transceiver reverts to the priority channel 2.  
If you press PTT during resume timer (dropout delay time, TX dwell time) or calling, you can transmit on current channel to answer to the call however revert channel is set to priority channel 2.  
After resume time, scan re-starts and transmission channel is return to priority channel 2.
- 5) Selected channel  
The transceiver reverts to the channel before scanning or the channel that you changed during scan.
- 6) Last called channel  
The transceiver reverts to the last called channel during the scan.
- 7) Last used channel  
The transceiver reverts to the last used (transmitted) channel during scan. "Last used" revert channel includes talkback function.
- 8) Selected with talkback  
The transceiver reverts to the channel before scanning or the channel that you changed during scan.

#### 2-8. Scan End

When you reactivate the key or the toggle switch (to left position) programmed to the scan function during scan mode, the scan ends.

The scan icon "SCN" and "SCAN" or revert channel (programmable) display goes off.

## OPERATING FEATURES

### 2-9. Temporarily Delete/Add

It is possible to delete or add channel temporarily during scan. When scan stops on unnecessary channel for example by interference of the other party, activate the delete/add function (for example press the key), then that channel is deleted temporarily and scan re-start immediately.

When you would like to add the deleted channel temporarily to scan sequence, select the desired (deleted) channel during scan, activate the delete/add function (for example press the key) before scan re-start.

That channel is added temporarily to scan sequence. The temporary deleted or added channels are returns to pre-set delete/add, when the transceiver exits from scan mode.

## 3. Optional Features

You can use these features using the programming software (KPG-38D).

### 3-1. Alphanumeric Display (Group/Channel Name)

The programming software (KPG-38D) enables you to set the alphanumeric display for group/channel name. The total text size of group and channel name are 7-digits.

For example, If you set 2-digits for group name, then you can use 5-digits for channel name. The characters can be used as shown in Figure 1.

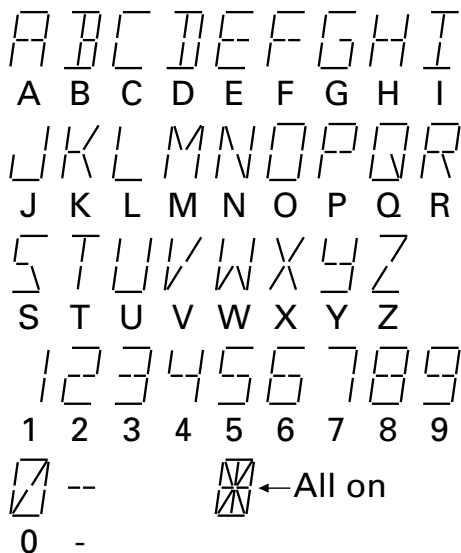


Fig. 1

### 3-2. Beep Tones

The beep tones (power on tone, control tone, warning tone, alert tone) are individually programmable to the fixed level 0 to 31 or follow the mechanical volume position.

### 3-3. Minimum Volume

The minimum volume is programmable (0 to 31). The transceiver remains the minimum volume level however the mechanical volume position is set to zero.

### 3-4. Squelch Threshold Level

Squelch threshold level value.  
0 (Most loose)~15 (Most tight)

### 3-5. BCL (Busy Channel Lockout) Override

You can transmit in spite of Busy Channel Lockout situation. For example : To make an emergency voice call.

To transmit under busy channel lockout situation, press PTT once more within approx. 500ms after the PTT release.

### 3-6. Selective Call Alert LED

You can select whether or not the LED on the transceiver flashes in an orange color when Selective call was occurred.

### 3-7. Battery Warning

This transceiver has battery warning feature. If the low voltage is detected during transmission, the transceiver warns it by flashing red "LED".

Then more low voltage is detected during transmission, the transceiver stops transmission and warns it by flashing red "LED" and beep.

Please notice "standard" for the battery exchange, charging time by flashing red LED and beep.

### 3-8. Busy LED

You can program the enable or disable the busy "LED" function when a carrier is detected. "Disable" saves battery life.

### 3-9. TX LED

You can program the enable or disable the transmission "LED" function.

### 3-10. 2-Digit 7-Segment Display

You can use 2-digit 7-segment the display to display the channel number or group number. It is useful when the main (7-digit 13-segment) display indicates group or channel name.

### 3-11. Invert Display

Main (7-digit 13-segment) display and sub (2-digit 7-segment) display can be programmed to invert display.

It is easy to read the display when the operator suspended the transceiver on a waste belt. The operator also can change the display between normal and invert using key. Refer the invert display function of key function.

### 3-12. Clear to Transpond

The transceiver waits the transpond of 2-Tone/DTMF if channel is busy until channel open. This feature prevents the interference to other party.

### 3-13. External Speaker

It can be selected if the receive sound is made by SP-Mic SP or the main body SP at a SP-Mic mount.

### 3-14. Noise Cancelling MIC

Enable or disable the noise cancelling function of the internal microphone. It is not valid for the external SP/MIC.

## OPERATING FEATURES

### 3-15. Mode (Enable/Disable)

The transceiver has many special modes mainly for maintenance.

- Self Programming mode
- Panel Test mode
- Clone mode
- Firmware Programming mode
- Version info.

It is possible to set enable/disable for each mode. We recommend to set these mode to Disable after set up to save contents.

### 3-16. ID

The transceiver is capable to have ID. The format is DTMF, MSK or ANI board (if installed). The timing that the transceiver sends ID is programmable.

Connect ID : Connect ID is send on beginning of transmission.

Disconnect ID : Disconnect ID is send on end of transmission.

Both : Connect ID is send on beginning of transmission and disconnect ID is send on end of transmission.

Off : Sending ID function is disabled.

There is also "PTT ID" setting for each channel. Refer "PTT ID" of channel feature.

When you use an ID code for ANI board, the ID code and transmitting timing are configured to the optional ANI board.

### 3-17. OST (Operator Selectable Tone)

The transceiver is capable to have "OST" function and 16 tone pair (QT/DQT) with max 7-digit name for each tone pair.

#### • "OST" Back Up

The transceiver is programmable the selected "OST" code is memorized or not. If you set to Disable (no memorized), the "OST" function always starts at "off".

#### • Direct "OST"

It is possible to call "OST" number directory using keypad. In this case, keypad is used for "OST", then "DTMF Auto PTT", "DTMF Auto Dial" functions by keypad are not usable.

### 3-18. Emergency

#### • Active Time

Automatic transmission period in the emergency mode.

#### • Interval Time

Interval time between the automatic transmissions.

#### • Duration of Locator Tone 1

Duration of an alert tone before the automatic transmission is performed.

#### • Duration of Locator Tone 2

Duration of an alert tone after the automatic transmission is performed.

#### • Man Down Delay Time

Delay time of entering the emergency mode when the internal Man Down port becomes active.

#### • Man Down Pre-alert

Wait time of the alert tone when the internal Man Down port becomes active to enter the emergency mode. (After an alarm sounds, the transceiver waits for the programmed wait time then enter the emergency mode.)

#### • Emergency Channel Display

Setting for the display in the emergency mode.

The transceiver can be programmed to display "EMERGENCY" channel name when it is in emergency mode.

If you set to "off" by KPG-38D the transceiver shows selected group/channel/status before entering to the emergency mode however the transceiver is in an emergency mode.

#### • Emergency Mode Type

Speaker mute on or off in the emergency mode.

#### • Emergency Type

Select an Emergency code format from DTMF, MSK, ANI board or OFF (Disabled).

#### • Emergency DTMF ID

The Fleet number when you select DTMF in the emergency type.

#### • Emergency Call Fleet

The emergency fleet number when you select MSK in the emergency type.

#### • Emergency Call ID

The emergency DTMF ID code when you select MSK in the above emergency type.

### 3-19. Radio Password (Keypad Model Only)

The radio password prevent unauthorized users operation. Every time the power on, transceiver is locked and unusable until entering correct password.

Enter pre-programmed password by FPU and [#] key causes the transceiver unlocked.

### 3-20. Data Password

The data password prevents unauthorized reading of the programmed transceiver data by FPU. Enter pre-programmed password in FPU reading process. This password also protects the clone.

Enter pre-programmed password by FPU and [#] key to clone.

## OPERATING FEATURES

### 4. Group Features

You can use these features using the programming software (KPG-38D).

#### 4-1. "TOT" (Time-Out Timer)

The transceiver has the "TOT". This parameter selects the period of time users can continuously transmit.

When the selected period passes, the transceiver generates a warning tone and stops the transmission.

#### 4-2. "TOT" Pre-Alert

The transceiver has "TOT" pre-alert timer. This parameter selects the time at which the transceiver generates "TOT" pre-alert tone before "TOT" is expired.

"TOT" will be expired when the selected time passes from a TOT pre-alert tone.

#### 4-3. "TOT" Re-Key Time

The transceiver has "TOT" re-key timer. This timer is the time you can not transmit after "TOT" exceeded. After "TOT" re-key time expired you can transmit again.

#### 4-4. "TOT" Reset Time

The transceiver has "TOT" reset timer. This timer is the minimum wait time allowed during a transmission that will reset the "TOT" count.

"TOT" reset time causes the "TOT" to continue even after PTT is released unless the "TOT" reset timer has expired.

#### 4-5. Group Delete/Add

The transceiver can set the delete/add in each group. If "Delete" is selected, the transceiver does not scan the deleted group in multi group scan.

#### 4-6. Battery Save

This is the automatic battery saver during a standby mode operation. The receiver circuit is repeated on and off to conserve the battery life.

#### 4-7. Signalling

Signalling "AND/OR" sets the audio unmute condition for any channel programmed with the option signalling (2-Tone/DTMF).

AND : "AND" requires both the valid option signalling and the programmed QT/DQT to be received for audio to unmute (and initiate an option signalling decode alert).

OR : "OR" requires either the valid option signalling or the programmed QT/DQT to be received for audio to unmute (an option signalling decode alert is only initiated if the proper option signalling is decoded).

### 5. Channel Features

You can use these features using the programming software (KPG-38D).

#### 5-1. Option Signalling

The transceiver is programmable to the option signalling (2-Tone decode program 1, 2-Tone decode program 2, 2-Tone decode program 3, DTMF decode) to each channel. It is useful to receive an individual call.

Receive format is selectable "AND" or "OR" with QT/DQT for each group. The radio response of option signalling is programmable "(Call) Alert tone" or "Transpond" for each option signalling (2-Tone decode program 1, 2-Tone decode program 2, 2-Tone decode program 3, DTMF).

#### 5-2. PTT ID

PTT ID provides a DTMF ANI, MSK ANI or ANI board ID (if installed) to be sent with every time PTT (connect ID at beginning of transmission, disconnect ID at end of transmission, or both).

You can program PTT ID "on" or "off" for each channel. The contents of ID are programmed for each transceiver.

#### 5-3. Busy Channel Lockout

Transmission is inhibited when the channel is busy. It is able to set this feature "Yes" or "No" for each channel.

#### 5-4. Beat Shift

This is the feature that the microprocessor shifts its system clock frequency slightly to prevent the receive interference. This transceiver can program this feature "Yes" or "No" for each channel.

#### 5-5. TX Power

You can set the transmission power "High" or "Low" for each channel. The each power setting is tuned at factory.

However, you can re-tune the power, using PC Tuning Mode of KPG-38D.

#### 5-6. Wide/Narrow

You can set the occupied band width mode "Wide" or "Narrow" for each channel. It is useful for the operator to use the transceiver on various sites.

#### 5-7. Scan Delete/Add

Scanning "delete/add" is programmable for each channel. Set the currently selected channel required to include in the scan sequence to "add".

The operator can change the "delete/add" information using the key programmed to "delete/add" function.

#### 5-8. Compander

This function reduces the noise on the communications channel used by the transceiver and improves reception.

If Wide/Narrow function is set to wide, this function doesn't perform.

## OPERATING FEATURES

### 6. Key Functions

You can use these features, using the programming software (KPG-38D). Selector function is selectable channel select or group select.

The functions for Toggle switch are listed page 8 (Fig. 2). Right position is active for programmed function on toggle switch except "group select".

The functions for the top key are listed page 8 (Fig.2). Hold action and shift action are programmable.

The functions for side key are listed page 8 (Fig.2). Hold action and shift action are programmable.

The functions for microphone key are listed page 8 (Fig.2). Hold action is programmable.

#### 6-1. No Function

Sounds error operation beep, and no action will occur. Use this function when the transceiver is required to be more simple operated.

#### 6-2. AUX.

This function can be programmed when the voice scrambler board is not installed.

If this key is pressed, "AUX" icon lights on the LCD and AUX port which is inside of the transceiver turns to the high level. If pressed again, the "AUX" icon goes off and the AUX ports turns to the lower level.

#### 6-3. Channel Down

If this key is pressed once, the channel number decreases by one step. If this key holds down for 500ms (approximate), the channel number decreases continuously.

This key works as the squelch level adjuster in a squelch level adjust mode. This key works as the OST (operator selectable tone) number selector in the OST mode. This key works as the SCR (voice scrambler) code selector in the voice scrambler code select mode.

#### 6-4. Channel Up

If this key is pressed once, the channel number increases by one step. If this key holds down for 500ms (approximate), channel number increases continuously.

This key works as the squelch level adjuster in squelch level adjust mode. This key works as the OST (operator selectable tone) number selector in the OST mode. This key works as the SCR (voice scrambler) code selector in the voice scrambler code select mode.

#### 6-5. Channel Name

This key switches the LCD display between the group/channel number and the group/channel name.

#### 6-6. Delete/Add

This key switches the currently displayed channel between "Delete" and "Add".

The "Add" channel contained in the scan sequence, and "Delete" channel is not contained. In the scan mode, this key switches the channel delete or add temporarily.

Function Name	Selector ③	Toggle Switch ④	PF Keys ⑤ ⑥ ⑦ ⑧ ⑨	Speaker/ Microphone PF Keys
Aux <sup>1</sup>		✓	✓	✓
Channel Down			✓	✓
Channel Name			✓	✓
Channel Select	✓			
Channel Up			✓	✓
Delete/Add			✓	✓
Emergency Call <sup>2</sup>			✓	✓
Group Down			✓	✓
Group Scan		✓		
Group Select	✓	✓		
Group Up			✓	✓
Home Channel			✓	✓
Invert Display		✓	✓	✓
Key Lock		✓	✓	✓
Lamp			✓	✓
Low Power		✓	✓	✓
Monitor		✓	✓	✓
Monitor Momentary			✓	✓
No Function		✓	✓	✓
Operator Selectable Tone			✓	✓
Operator Selectable Priority 1			✓	
Operator Selectable Priority 2			✓	
Scan		✓	✓	✓
Scrambler <sup>3</sup>		✓	✓	✓
Shift		✓	✓	
SP Attenuation				✓
Squelch Level			✓	✓
Squelch OFF		✓	✓	✓
Squelch Momentary			✓	✓
Talk Around		✓	✓	✓

1 This function can be selected when the scrambler board has not been installed.

2 This function can be selected when the ANI board has been installed.

3 This function can be selected when the scrambler board has been installed.

**Note :** If "Shift" is programmed onto one of the PF keys or the toggle switch, the remaining PF keys can be programmed with two different functions. If "Shift" is programmed onto a PF key and the toggle switch, an error will occur and the function will not operate.

**Fig. 2 Programmable functions**



## OPERATING FEATURES

### 6-7. Group Down

If this key is pressed once, the group number decreases by one step. If this key holds down for 500ms (approximate), the group number decreases continuously.

This key works as the squelch level adjuster in squelch level adjust mode. This key works as the OST (operator selectable tone) number selector in the OST mode. This key works as the SCR (voice scrambler) code selector in the voice scrambler code select mode.

### 6-8. Group Up

If this key is pressed once, the group number increases by one step. If this key holds down for 500ms (approximate), the group number increases continuously.

This key works as the squelch level adjuster in the squelch level adjust mode. This key works as the OST (operator selectable tone) number selector in the OST mode. This key works as the SCR (voice scrambler) code selector in the voice scrambler code select mode.

### 6-9. Home Channel

Press this key once, the channel switches to the pre-programmed home channel. Press this key again, the channel goes back to the previous channel.

### 6-10. Invert Display

Press this key once, the displayed the group/channel number or group/channel name are inverted. Press this key again, the display returns to the normal.

For the operator who does not change the display and needs "Invert" only, refer "Invert Display" setting of optional feature.

### 6-11. Key Lock

Pressing this key causes the transceiver to accept an entry of only the [Shift], [KeyLock], [PTT], [Emergency], [LAMP], [Monitor], [Monitor Momentary], [Squelch Off], [Squelch Momentary], [SP MIC Attenuation] keys, [Selector switch], [Volume], [Toggle], [Lamp], [Moni], [Moni momentary], [SQ off] and [SQ momentary].

"Lock" is used to prevent users from unexceptionable key press which might cause a transceiver malfunction. The display does not change while the key is being locked.

Switching the transceiver off and on or pressing Key Lock again cancels the key lock. Key locked transceiver can still receive. Pressing this key while scanning, keys are locked but a scanning continues.

### 6-12. Lamp

Press this key, the transceiver illuminates the display and keypad back lit approximate 5 seconds. Press this key again, the transceiver stops the illuminating.

Pressing any key except the LAMP key while the illuminated restarts the 5 second timer.

### 6-13. Low Power

Press this key, the transmission power of all channel changes to Low. Press this key again, the transmission power returns to programmed value.

### 6-14. Monitor

Monitor the channel before a transmission.

Press this key once, "MON" appears and unmutes speaker if a carrier is present, regardless of the specified signalling (including option signalling). Press this key again, "MON" disappears and mutes speaker.

Press this key after the Option Signalling is matched, the Option Signaling is reset and monitor is activated. DBD (Dead Beat Disable) mode is not reset by this operation.

### 6-15. Monitor Momentary

While pressing this key, the monitor function (refer 6-14) is activated. Release this key, the monitor function is deactivated.

### 6-16. Operator Selectable Tone

This key switches the pre-set decode QT/DQT and encode QT/DQT to OST (Operator Selectable Tone) tone pair.

Press this key, the transceiver enters to OST select mode. In this mode, the display shows "OFF" and the operator can select one of the OST tone pair using the channel up/down key or the group up/down key. The display shows "TONE \*\*" and tone pair No. \*\* is selected.

Press OST key again, the transceiver exits from the OST select mode, and returns to the group/channel mode with "OPT" icon. "OPT" icon means that the OST tone pair is selected. OST tone pair number or OFF can be memorized for each channel.

16 kinds of tone pair for OST can be programmed by KPG-38D. OST is useful to access the repeater with same radio frequency and different tone (QT/DQT).

### 6-17. Operator Selectable P1

If priority channel 1 is set as "Fixed" and "None" in the scan information. The operator can select the priority channel 1, using this key (operator selectable fixed P1).

Press this key on normal channel, the channel becomes to priority channel 1. Previous priority channel 1 returns to the normal channel. Press this key on the priority channel 1, the priority 1 will be lost (no priority 1).

### 6-18. Operator Selectable P2

If priority channel 2 is set as "Fixed" and "None" in the scan information. The operator can select the priority channel 2, using this key (operator selectable fixed P2).

Press this key on the normal channel, the channel becomes to the priority channel 2. Previous priority channel 2 returns to the normal channel. Press this key on priority channel 2, the priority 2 will be lost (no priority 2).

### 6-19. Scan

Press this key starts scanning. Pressing this key stops scanning.

### 6-20. Shift

This key activates "Shift + [Key]" function. It is useful when the numbers or more of the functions are necessary.

## OPERATING FEATURES

### 6-21. Squelch Level

The preset squelch level is varied in user mode (0 to 15). Press the key programmed to "squelch level", the transceiver enters to "squelch level adjust mode".

The squelch level can be adjusted by group "up/down" function key or channel "up/down" function key. Press the key programmed to "squelch level" again, the adjusted level is memorized and returns to the normal user mode.

### 6-22. Squelch Momentary

While pressing this key, the transceiver unmutes speaker regardless of an existence of a carrier and "MON" appears and busy "LED" lights on.

Release this key, the transceiver mutes the speaker and "MON" disappears and busy "LED" lights off.

### 6-23. Squelch Off

Press this key, the transceiver unmutes speaker regardless of the existence of a carrier and "MON" appears and busy "LED" lights.

Press this key again, the transceiver mutes the speaker and "MON" disappears and busy "LED" lights off.

### 6-24. Talk Around

Press this key, the transceiver uses the receive frequency and the tone for transmission.

The operator can call the other party directory (without repeater). Press this key again, the talk around function goes off.

### 6-25. Emergency Call

Press this key, the transceiver enters to an emergency mode. In this mode, the channel is switched to the programmed emergency channel automatically and starts transmission with an emergency ID code which is programmed to ANI board.

The display depends on "Emergency Channel Display" setting.

### 6-26. SP Attenuation

Press this key once, the volume level of speaker-microphone is attenuated. Press this key again, the volume level of speaker-microphone returns to the previous level.

## 7.2-Tone

Built-in 2-Tone decoder (decoder program 1, decoder program 2, decoder program 3) is available for option signalling. It is possible to use individual call or group call.

## 8. DTMF

Built-in DTMF encoder is available for dialing (Manual dial, Auto-dial (9 memory), Re-dial (1 memory)) (Keypad model only). Built-in DTMF decoder is available for option signalling.

It is possible to use individual call, group call, DBD (Dead Beat Disable).

## 9. Data Programming (PC Mode)

### 9-1. Preparation and Connection

TK-290 transceiver is programmed by using a personal computer, programming interface cable KPG-36, and programming software KPG-38D.

The programming software can be used with an IBM-PC or compatible machine. Figure 3 shows the setup for programming.

### 9-2. Programming Interface Cable KPG-36 Description

The KPG-36 is required to interface TK-290 to the computer. It has a circuit in its D-sub 25pin connector case that converts RS-232C logic level to TTL level.

KPG-36 is used to connect between TK-290 universal connector and RS-232C serial port of computer.

### 9-3. Programming Software KPG-38D Description

KPG-38D is the programming software for TK-290 supplied on a 3.5" floppy disk. This software runs under MS-DOS version 3.1 or later on an IBM-PC/XT, AT, or PS2 or compatible machine.

The data can be input to or read from TK-290 and edited on the screen. The programmed or edited data can be printed out. It is also possible to tune the transceiver.

We recommend that install KPG-38D for example to harddisk first then use it.

KPG-38D instruction manual part No. : B62-0814-XX.

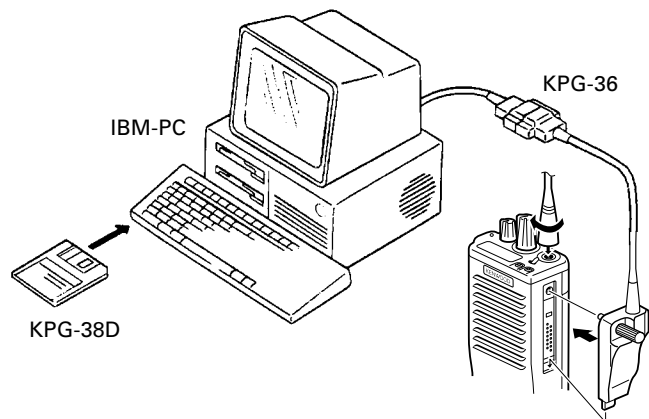
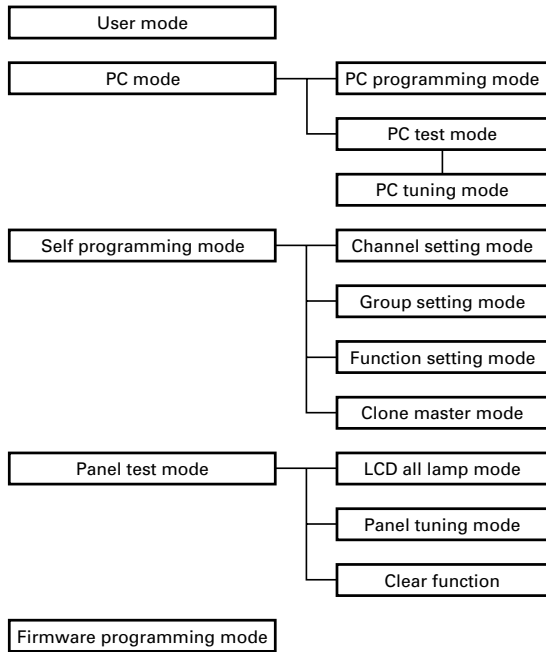


Fig. 3

## REALIGNMENT

### 1. Mode



Mode	Function
User mode	Customer use this mode
PC mode	Communication between the radio and PC (IBM compatible). It requires the KPG-38D
PC programming mode	Frequency, signalling and features write to the radio and read from the radio.
PC test mode	Check the radio using the PC. This feature is included in the FPU.
Self programming mode	Frequency, signalling and features write to the radio.
Panel test mode (Refer to Adjustment)	Dealer use to check the fundamental characteristics.
Firmware programming mode	Re-write the firmware of the flash ROM.

### 2. How to Enter Each Mode

Mode	Operation
User mode	Power on
PC mode	Power on begins the USER MODE.
Self programming mode	Hold down the [Side 1] key and the [Side 2] key, turn the radio power on.
Panel test mode	Hold down the [Side 2] key and [PTT], turn the radio power on, and release [PTT] first.
Firmware programming mode	Held down the [Side 2] key and [PTT], turn the radio power on, and release [Side 2] key first.

### 3. Self Programming

Write mode for frequency data and signalling etc. Mainly used by the person maintaining the user equipment.

#### 3-1. Enter to the self programming mode

Turn the power switch on, with the lead wire with plug PF (8 pin) shorted to the E (10 pin) lead (Figure 5), or delete R491 (SELF, Figure 6) in the TX-RX unit and turn the power switch on while pressing the [Side 1] and [Side 2] keys.

#### Note :

This mode (self programming mode) cannot be set when it has been disabled with the FPU.

#### • Additional Modification of the Plug

It's available to enter the self programming mode by modifying the pattern of lead wire as following.

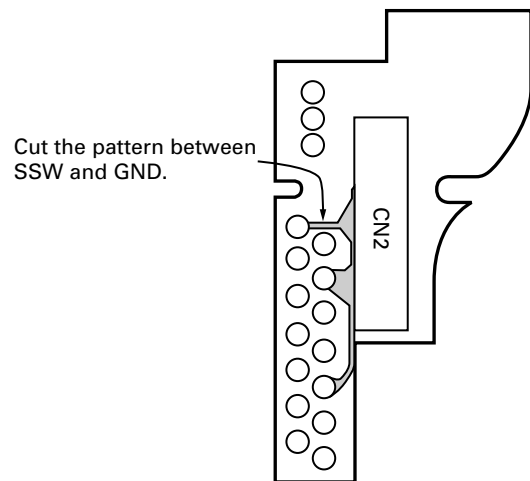


Fig. 4

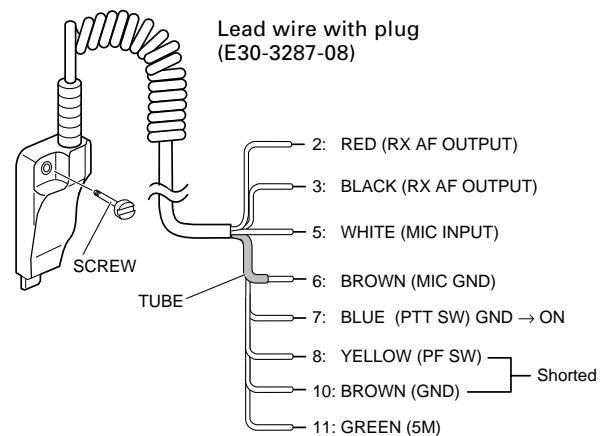
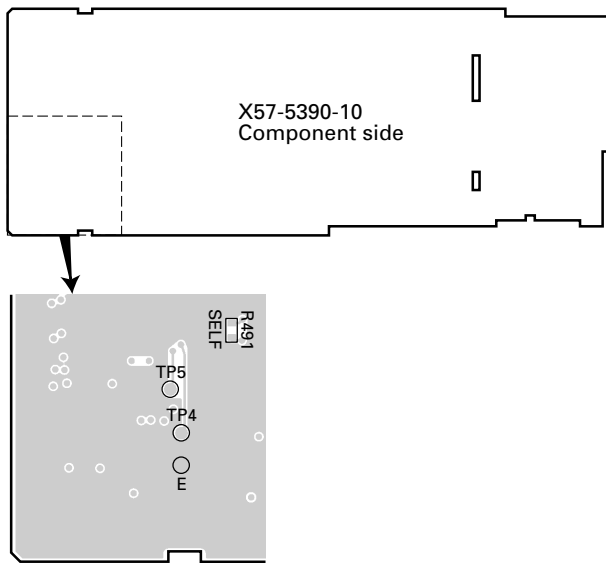


Fig. 5

## REALIGNMENT



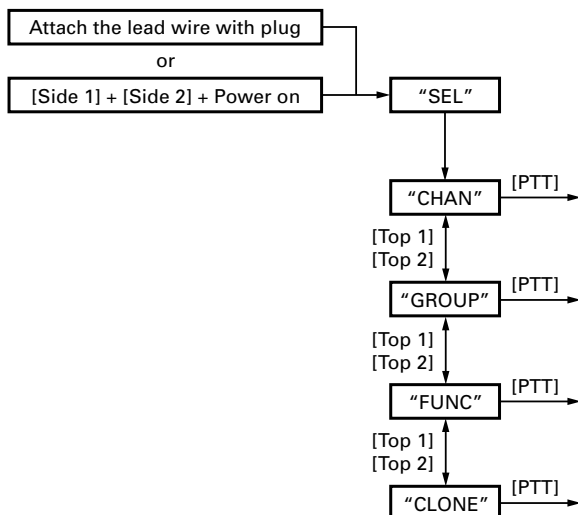
**Fig. 6**

When enter the self programming mode, "FUNC" appears after "SEL" is displayed for half a second.

Selecting any of Channel setting, Group setting, Function setting, or Clone master with the [Top 1] [Top 2] keys and then pressing [PTT] sets the Setting mode for that time.

Key operations in Self programming mode are as follows.

- [Selector switch] : Not used
- [PTT] : Functions as a RUN or Execute key
- [Top 1] : Use as a Down key
- [Top 2] : Use as an Up key
- [Side 1] : Use for select channel steps in Channel setting mode, or switching for QT/DQT.
- [Side 2] : Use as a cancel key
- [Orange] : Add or delete frequencies in Channel setting mode
- [Toggle] : Flipping this to the right while in Channel setting mode, shifts to MHz steps.

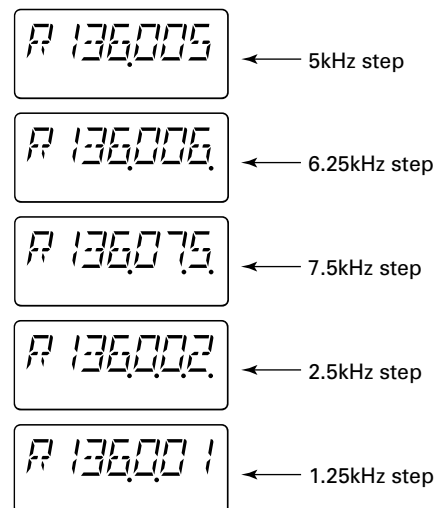


### 3-2. Channel Setting Mode

Set data for each channel while in this mode. After first entering Self programming mode, select the "CHAN" display with [Top 1] [Top 2] and press [PTT] to set Channel Setting mode. Once in Channel Setting mode, select the group that needs setting with the [Top 1] [Top 2] keys and press [PTT]. Next select the channel for setting with the [Top 1] [Top 2] keys and press [PTT]. The setting items and setting data will then appear so reset the data with the [Top 1] [Top 2] keys and press [PTT]. When finished, the display shifts to the next setting item. After finished setting all items press [PTT] to return to Group selection. Changes in the frequency CH steps and the QT/DQT steps can be made in [Side 1].

No.	Function name	Display	Remarks
	Select Group/Channel	1.-1 during group selection 1-1. during channel selection	1-160~160-1
1	RX frequency	R150.0125	Receive frequency
2	RX signalling	RX 023N	Receive QT/DQT (Dot on right edge is lit up during 1 step changes)
3	TX frequency	T150.0125	Transmit frequency
4	TX signalling	TX 250.3	Transmit QT/DQT (Dot on right edge is lit up during 1 step changes)
5	Option signalling	2ToneA	OFF, DTMF, 2ToneA, 2ToneB, 2ToneC
6	DEL/ADD	D/A ADD	Delete, Add
7	Wide/Narrow	WIDE	Wide. Narrow
8	PTT ID	ID OFF	OFF, ON
9	TX power	POW HI	High, Low
10	Busy channel lockout	BCL OFF	OFF, ON
11	Beat shift	SFT OFF	OFF, ON

#### • Channel step display



## REALIGNMENT

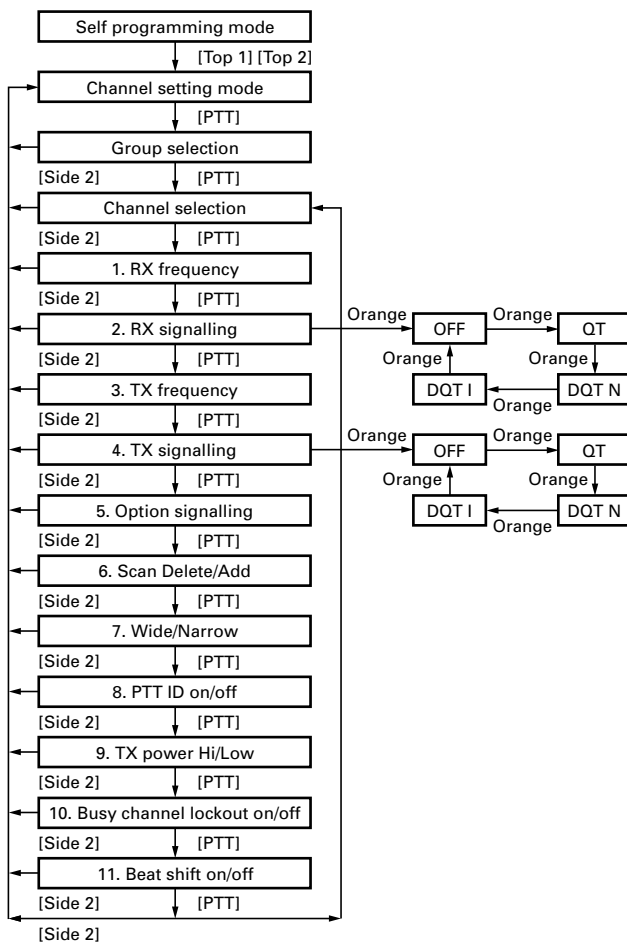
### • Operation

1. Select the setting value with the [Top 1] [Top 2] keys.
2. Press the [PTT] and the selected value is backed up and operation shifts to the next item for setting.
3. Press [Side 2] on the Group selection screen in order to return to Self programming mode.

### • Note

1. Different sample displays are shown.
2. Setting item No.s are displayed with a 7-segment 2-digit figure on the LCD.
3. Self programming mode cannot be set when set to Disaable with the FPU.
4. A red LED lights up during TX frequency and TX signalling.
5. Press [Orange] on the TX, RX frequencies setting screen in order to clear in the channel frequencies data.
6. Press [Orange] on the signalling setting screen in order to change or off the signalling function.
7. Flipping [Toggle] to the right during setting of RX, TX frequencies and performing Up/Down operation allows frequencies to be changed in MHz steps.
8. The RX and TX frequencies can be entered with the number pad keys.

### • Flow Chart



### 3-3. Group Setting Mode

Set data for each Group while in this mode. After first entering Self programming mode, select the "GROUP" display with [Top 1] [Top 2] and press [PTT] to set Group Setting mode. Once in Group Setting mode, select the group that needs setting with the [Top 1] [Top 2] keys and press [PTT]. Next select the channel for setting with the [Top 1] [Top 2] keys and press [PTT]. The setting items and setting data will then appear so reset the data with the [Top 1] [Top 2] keys and press [PTT]. When finished, the display shifts to the next setting item. After finished setting all items press [PTT] to return to next Group selection.

No.	Function name	Display	Remarks
	Select Group	GRP 1	1~160
1	Battery save	BATT L	OFF, Short, Mid, Long
2	Time out timer	TOT 60	OFF, 30s~300s (30s step)
3	TOT pre alert	TOT.P 10	OFF, 1s~10s (1s step)
4	TOT rekey time	TOT.K 2	OFF, 1s~60s (1s setp)
5	TOT reset time	TOT.S 2	OFF, 1s~15s (1s step)
6	Group Delete/Add	D/A ADD	Delete, Add
7	Signalling	SIG AND	AND, OR

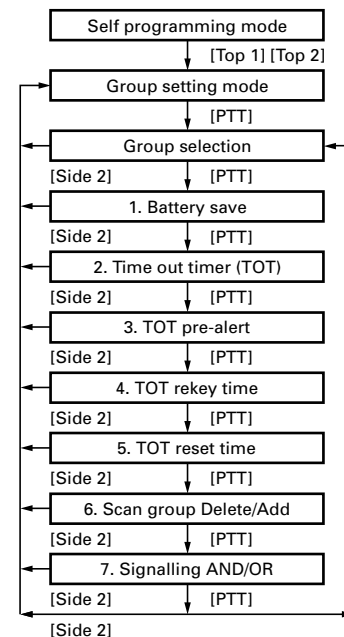
### • Operation

1. Select the setting value with the [Top 1] [Top 2] keys.
2. Press the [PTT] and the selected value is backed up and operation shifts to the next item for setting.
3. Press [Side 2] on the Group selection screen in order to return to the Self programming mode initial display.

### • Note

1. Different sample displays are shown.
2. Setting item No.s are displayed with a 7-segment 2-digit figure on the LCD.
3. Self programming mode cannot be set when set to Disaable with the FPU.

### • Flow Chart



## REALIGNMENT

### 3-4. Function Setting Mode

This mode allows making function settings for the transceiver. After first entering Self programming mode, select "FUNC" display with [Top 1] [Top 2] and then press [PTT] to set this mode. Function setting items are listed below.

No.	Function name	Display	Remarks
1	Power on tone	POW.T 15 (or C)	Continuas, 0~31
2	Control tone	CON.T 15 (or C)	Continuas, 0~31
3	Warning tone	WAR.T 15 (or C)	Continuas, 0~31
4	Alert tone	ALR.T 15 (or C)	Continuas, 0~31
5	Minimum volume	MIN.V 8	0~31
6	Battery warning	BATT ON	Disable, Enable
7	Busy LED	B.LED ON	OFF, ON
8	TX LED	T.LED ON	OFF, ON
9	Invert Display	LCD ON	Disabel, Enable
10	Priority 1	P1 NONE	None, Selected, Fixed
11	Priority 1 group	1,-1	1~1~10~16
12	Priority 1 channel	1-1.	(Priority 1= In fixed)
13	Priority 2	P2 NONE	None, Selected, Fixed
14	Priority 2 group	1,-1	1~1~10~16
15	Priority 2 channel	1-1.	(Priority 2= In fixed)
16	Revert channel	REVT 1	1~8 1 : Selected 2 : Last called 3 : Last used 4 : Sel+Talk back 5 : Priority 1 6 : Priority 1+Talk back 7 : Priority 2 8 : Priority 2+Talk back
17	Squelch level	SQ.LV 15	0~15

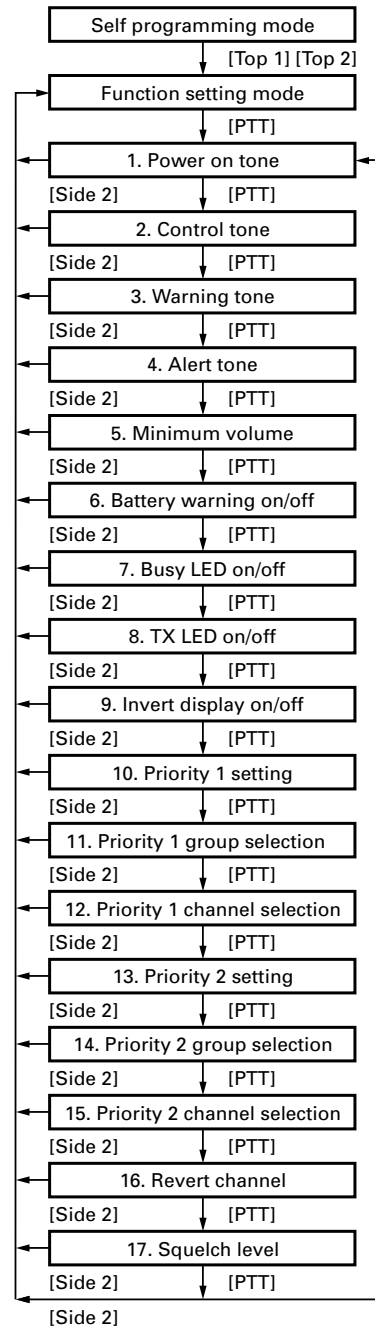
#### • Operation

1. Select the setting value with the [Top 1] [Top 2] keys.
2. Press the [PTT] and the selected value is backed up and operation shifts to the next item for setting.
3. Press [Side 2] on the Group selection screen in order to return to the Self programming mode initial display.

#### • Note

1. Different sample displays are shown.
2. Setting item No.s are displayed with a 7-segment 2-digit figure on the LCD.
3. Self programming mode cannot be set when set to Dis-able with the FPU.

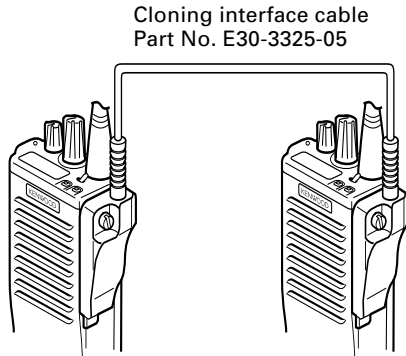
#### • Flow Chart



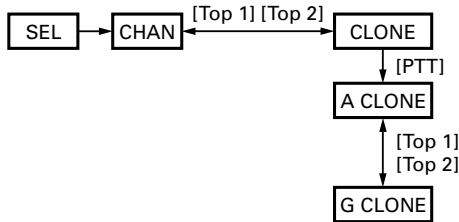
## REALIGNMENT

### 3-5. Clone Mode

1. Connect the cloning interface cable between the master side transceiver (source) and slave side transceiver (clone) as shown in the figure.



2. Set the master side transceiver to Self programming mode, and the transceiver display to "CLONE" with the [Top 1] key or [Top 2] key and press [PTT].



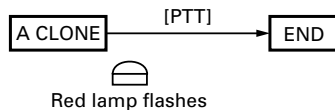
3. Set the power switch on the slave side transceiver to ON.
4. The red LED on the master side transceiver flashes when cloning starts and an "END" message appears when cloning ends.
5. The green LED on the slave side transceiver flashes.
6. When a problem occurs during cloning, an "ERROR" message appears on the master side transceiver.
7. Pressing the [Side 2] key sets clone mode.

#### Note :

The master transceiver copies only to type matched slave.

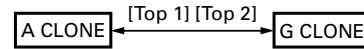
#### • All Clone

1. Press [PTT] on the master side transceiver to start cloning of all data except for the transceiver model type and alignment data.



#### • Group Clone

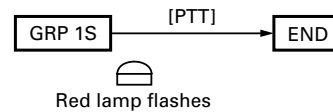
1. To clone the transceiver group data and channel data within the group, as well as group alphanumeric data, use the [Top 1] key or [Top 2] key to switch the display on the master side transceiver from "A CLONE" to "G CLONE".



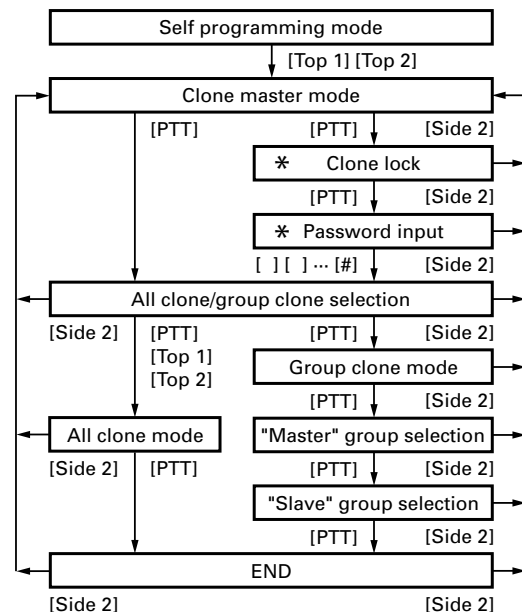
2. Press [PTT] to show the group cloning selection.
3. Select the group with the [Top 1] or [Top 2] keys.
4. Press [PTT] to show the slave side group cloning selection.
5. Select the group with the [Top 1] or [Top 2] keys.



6. Press the master side [PTT] to start cloning.



#### • Flow Chart



\* Only the keypad model and set to password with the FPU.

## REALIGNMENT

### 4. Firmware Programming Mode

#### 4-1. Preface

Flash memory is mounted on the TK-290. This allows the TK-290 to be upgraded when new features are released in the future. (For details on how to obtain the firmware, contact Customer Service.)

#### 4-2. Connection Procedure

Connect the TK-290 to the personal computer (IBM PC or compatible) with the interface cable (KPG-36). (Connection is the same as in the PC Mode.)

#### 4-3. Programming

1. Start up the programming software (KPG-38D), select "firmware program" in the "Program" item, and press the Return key on the personal computer. This starts up the firmware programmer.
2. The top screen is displayed. Press any key to advance to the next screen.
3. Set the communications speed (normally, 38400 bps) and communications port in the Setup item.
4. Set the firmware to be updated by File select.
5. Held down the [Side 2] and [PTT]. Turn the TK-290 power on, and release [Side 2] first. Until the display change to "PROGRAM".
6. Check the connection between the TK-290 and the personal computer, and make sure that the TK-290 is in the Program mode.
7. Press F10 on the personal computer. A window opens on the display to indicate progress of writing. When the TK-290 starts to receive data, "PG" is appeared on 2 digit sub display.
8. If writing ends successfully, the red LED on the TK-290 lights and the checksum is displayed.
9. If you want to continue programming other TK-290s, repeat steps 5 to 8.

#### Notes :

- To start the Firmware Programmer from KPG-38D, the Fpro path must be set up by KPG-38D setup.
- This mode cannot be entered if the Main Program mode is set to Disable in the Programming software (KPG-38D).

#### 4-4. Function

1. If you press the [Top 2] switch while "PROGRAM" is displayed, the checksum is displayed. If you press the [Top 1] switch while the checksum is displayed, "PROGRAM" is redisplayed.
2. If you press the [Top 1] switch while "PROGRAM" is displayed, 1 dot light ("M.") to indicate that the write speed is low-speed (19200 bps). If you press the [Top 1] switch again while low-speed (19200 bps), 2 dot lights (".M.") to indicate, and the write speed becomes the high-speed mode (38400 bps).  
The communication speed changes 19200 bps, 38400 bps, 57600 bps (3 dots), and 115200 bps (4 dots) every time you press [PTT] and [Top 1].

#### Note :

Normally, write in the high-speed mode.  
When the Flash ROM is replaced, the initial communication speed for writing becomes 115200 bps.

### 5. Panel Test Mode

Setting method refer to ADJUSTMENT.



## CIRCUIT DESCRIPTION

### 1. Overview

The KENWOOD model TK-290 is a VHF/FM hand-held transceiver designed to operate in the frequency range of 136 to 174MHz, the unit consists of a receiver, a transmitter, a phase-locked loop (PLL) frequency synthesizer, power supply circuits, a control unit.

### 2. Circuit Configuration by Frequency

The receiver is a double-conversion superheterodyne with a first intermediate frequency (IF) of 44.85MHz and a second IF of 455kHz. Incoming signals from the antenna are mixed with the local signal from the PLL to produce the first IF of 44.85MHz.

This is then mixed with the 45.305MHz second local oscillator output to produce the 455kHz second IF. This is detected to give the demodulated signal.

The transmit signal frequency is generated by the PLL VCO, and modulated by the signal from the microphone. It is then amplified and sent to the antenna.

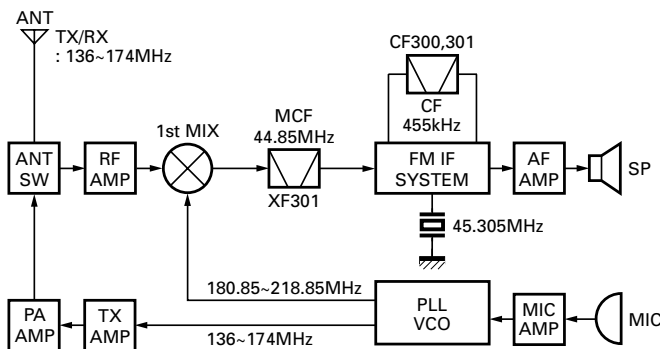


Fig. 1 Frequency configuration

### 3. Receiver System

#### 3-1. Front-end RF amplifier

The signal are then passed through an antenna matching coil, where the high-frequency components are amplified by a GaAs FET (Q200). The signals are then fed into band-pass filter that uses varactor diode tuning to reject unwanted signal components, and is fed to the 1st mixer.

#### 3-2. First mixer

The 1st mixer uses the GaAs IC (IC200). The 1st mixer mixes the signal with the 1st local oscillator frequency from the VCO, and converts it to the 1st IF (44.85MHz).

The signal then passes through monolithic crystal filter (XF301) to remove unnecessary nearby frequency components. The signal from the MCF is used as the 1st IF signal.

#### 3-3. IF amplifier

The 1st IF signal is amplified (Q302) and fed into IC300 in the FM IF IC. The IF signal is then mixed with the 2nd local oscillator frequency of 45.305MHz to generate the 2nd IF of 455kHz. The 455kHz signal is then passed through a ceramic filter (CF300, CF301 ; Wide, CF302, CF303 ; Narrow) and fed back into IC300 for additional amplification.

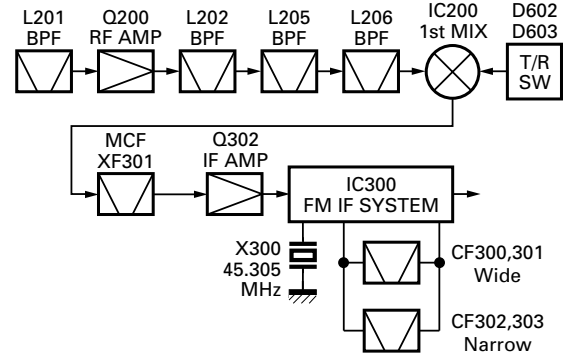


Fig. 2 Receiver section

Item	Rating
Nominal center frequency	44.85MHz
Pass band width	±5~7kHz at 3dB
Attenuation band width	±25kHz or less at 30dB
Ripple	1.0dB or less
Insertion loss	4dB or less
Guaranteed attenuation	80dB or more at fo±910kHz 40dB or more within fo±1MHz
Terminating impedance	350Ω / 4.5pF

Table 1 Crystal filter XF301 (L71-0588-05)

## CIRCUIT DESCRIPTION

### 3-4. Wide/Narrow changeover circuit

Narrow and Wide settings can be made for each channel by switching the ceramic filters CF300, CF301 (Wide), CF302, CF303 (Narrow).

The WIDE (high level) and NARROW (low level) data is output from IC400 (I/O port expansion) pin 4.

When a WIDE (high level) data is received, Q303 turn off and Q304 turn on. When a NARROW (low level) data is received, Q303 turn on and Q304 turn off. D302, D303 are switched to ceramic filters when a high/low level data is received.

Q305 turns on/off with the Wide/Narrow data and the IC300 detector output level is changed to maintain a constant output level during wide or narrow signals.

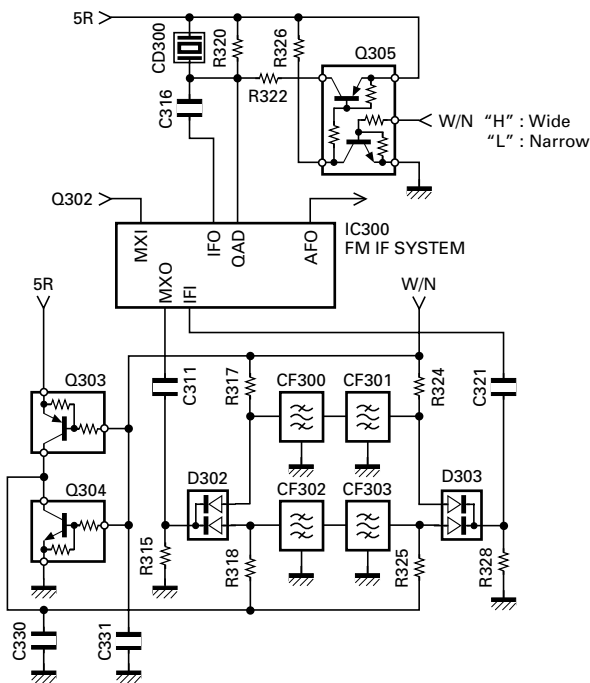


Fig. 3 Wide/Narrow changeover circuit

### 3-5. Audio amplifier circuit

#### • TX-RX unit

The demodulated signal from IC300 goes through IC301, and is amplified by IC601 (2/2), high-pass filtered, low-pass filtered, high-pass filtered, band-eliminate filtered, and de-emphasized by IC607.

The signal then goes through an electronic volume control (IC603), an AF amplifier IC604 (2/2), and an AF switch (Q8 is on and Q7 is on of the control unit), and is routed to audio power amplifier (IC1 of the control unit), where it is amplified and output to the internal speaker.

#### • Control unit

The audio mute signal (AMP SW) from the microprocessor becomes Low in the standby and Q5, Q6 which are power supply circuit for IC1 turn off. When the audio is output, AMP SW becomes High to turn Q5, Q6 on, and voltage is supplied to power terminal VP of IC1.

Speaker switching is done from IC403 (TX-RX unit) by INT AFC or EXT AFC. First, the logic level at the speakers switching terminal (SSW) on the universal connector is input to the microprocessor (IC406 TX-RX unit). The microprocessor then outputs data to IC403 based on this input.

When there is no SP-MIC installed, this logic level is high. When the INT AFC is high, the EXT AFC goes low, so the AF signal is only input to the amplifier for the internal speaker (INT SP) of IC1. However, when a SP-MIC has been installed, this logic level is low, so the INT AFC goes low and the EXT AFC goes high. So that the AF signal is input only to amplifier for the external speaker (EXT SP) of IC1.

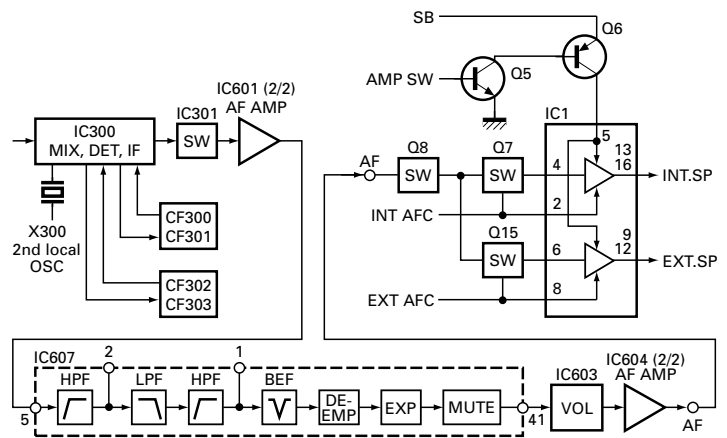


Fig. 4 Audio amplifier circuit

### 3-6. Squelch circuit

It amplifies the demodulated noise signal from FM IC (IC300) after filtering through BPF circuit. Then, the amplified signal is converted to DC signal by the detection circuit. The converted signal is feeded through the microprocessor (IC 406) and the voltage level is detected by ADC (A/D converter) to control the squelch circuit.

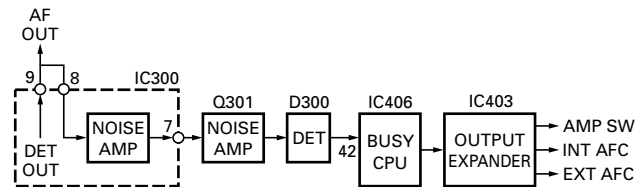


Fig. 5 Squelch circuit

## CIRCUIT DESCRIPTION

### 4. Transmitter System

#### 4-1. Microphone amplifier

The signal from IC3 (control unit) goes through the mute switch (Q403).

When the SP-MIC is not attached, the microphone switching terminal (MSW) on the universal connector becomes High, and mute switch (Q403) is turned on. When the SP-MIC is attached, MSW is connected to GND at inside of SP-MIC. For this reason, Q403 is turned off, the internal microphone is muted, and only the input of the external microphone is supplied to the microphone amplifier of the TX-RX unit.

The signal from microphone passes through the limiter circuit in D601, and through the high-pass filter, the ALC circuit, the low-pass filter, the high-pass filter, and pre-emphasis/IDC circuit in IC607. When encoding DTMF, mute switch (Q601) is turned off for muting the microphone input signal.

The signal passes through the D/A converter (IC603) for the maximum deviation adjustment, and enters the summing amplifier consisting of IC605 (1/2), and is mixed with the low speed data from the CPU (IC406).

The output signal from the summing amplifier goes to the VCO modulation input.

The other output signal from the summing amplifier passes through the D/A converter (IC603) again for the BAL adjustment, and the buffer amplifier (IC604 1/2), and goes to the VCXO modulation input.

#### 4-2. Noise cancelling microphone circuit

The two signals from INT MIC (Main & Sub) are input to the positive (+) input (Sub) and to the negative (-) input (Main) of the IC3. If the same signal is input to both Main and Sub, the Main signal is canceled at the output of IC3 (pin 7). In other words, noise from nearby sources not directly connected to the transceiver enters the Main and Sub inputs at the same signal and is therefore canceled out.

When a signal is only input to Main and there is no signal at Sub, the Main signal is output as is, from IC3 (pin 7). In other words, only the voice audio of the operator in extremely close proximity to the Main MIC is input to Main so that the signal is output as is from IC3 (pin 7). Also, when the "N/C" switch is set to "L", transistor Q14 turns off so Sub microphone turns off and operation is the same as above.

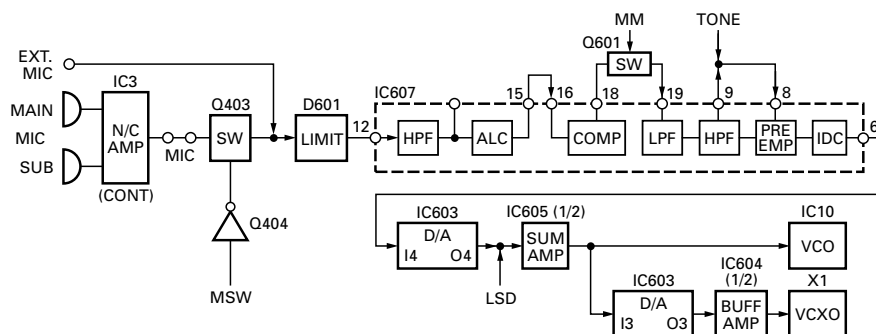


Fig. 6 Microphoen circuit

#### 4-3. Drive and Final amplifier

The signal from the T/R switch (D602 is on) is amplified by the pre-drive (Q6) and drive amplifier (Q8) to 20mW. The output of the drive amplifier is amplified by the RF power amplifier (IC801) to 5W (1W when the power is low).

The RF power amplifier consists of two stages MOS FET transistor. The output of the RF power amplifier is then passed through the Transmit-Receive (TX-RX) antenna switching (D10 is on) and the harmonic filter (LPF) and the Internal-External (INT-EXT) antennal switching (in the universal connector) and applied to the antenna terminal.

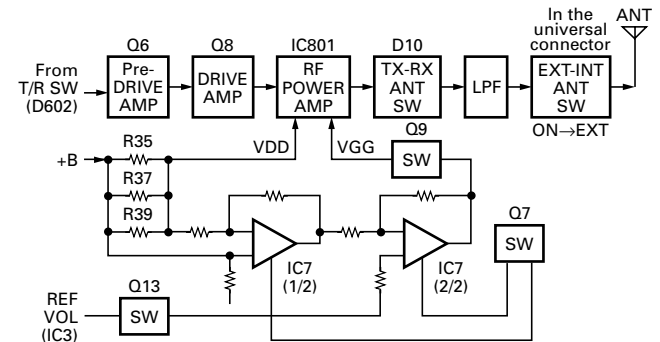


Fig. 7 Drive and final amplifier and APC circuits

#### 4-4. Internal-External (INT-EXT) antenna switching

The INT-EXT antenna switch housed inside the universal connector only switches to the EXT ANT side when an antenna speaker-microphone has been installed.

This INT-EXT antenna switch works mechanically and switches based on the operation shown in Figure 8.

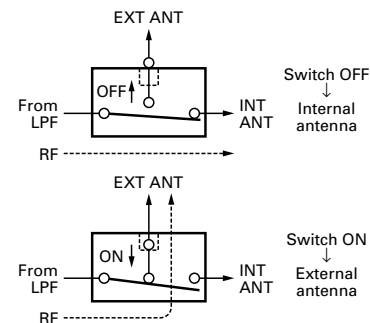


Fig. 8 Internal-External antenna switching

## CIRCUIT DESCRIPTION

### 4-5. APC circuit

The APC circuit always monitors the current flowing through the RF power amplifier (IC801) and keeps a constant current. The voltage drop at R35, R37, and R39 is caused by the current flowing through the RF power amplifier and this voltage is applied to the differential amplifier (IC7 1/2).

IC7 (2/2) compares the output voltage of IC7 (1/2) with the reference voltage from IC3, and the output of IC7 (2/2) controls the VGG of the RF power amplifier to make the both voltages to same voltage.

The change of power high/low is carried out by the change of the reference voltage. Q7, Q9, and Q13 are turned on in transmit and the APC circuit is active. (See Figure 7)

### 5. PLL Frequency Synthesizer

The frequency synthesizer consists of the VCXO (X1), VCO (L800), PLL IC (IC5) and buffer amplifiers.

The VCXO generates 16.8MHz. The frequency stability is within  $\pm 2.0$ ppm (temperature range of  $-30$  to  $+60^\circ\text{C}$ ). The frequency tuning and modulation of the VCXO are done to apply a voltage to pin 1 of the VCXO. The output of the VCXO is applied to pin 8 of the PLL IC.

The VCO of TK-290 covers the 38MHz spread, setting frequencies in r1, r2 (receive) and t1, t2 (transmit) with a bias voltage applied to the  $-V$  terminal of the VCO. A zero (0) volt bias is applied at frequencies lower than r1, t1. Frequencies r1, t1 through r2, t2 are biased with  $-3$  volts. Frequencies higher than r2, t2 are biased with  $-6$  volts, and at 174MHz tp 178MHz are biased with  $-9$  volts.

The relation of VCO frequency versus PLL lock voltage is shown in Figure 11.

The output of the VCO is amplified by the buffer amplifier (Q3) and routed to the pin 5 of the PLL IC. Also the output of the VCO is amplified by the buffer amplifier (Q5) and routed to the next stage according to T/R switch (D602,603).

The PLL IC consists of a prescaler, fractional divider, reference divider, phase comparator, charge pump. This PLL IC is fractional-N type synthesizer and performs is the 40 or 50kHz reference signal which is eighth of the channel step (5, 6.25 or 7.5kHz). The input signal from the pins 1 and 5 of the PLL IC is divided down to the 40 or 50kHz and compared at phase comparator. The pulsed output signal of the phase comparator is applied to the charge pump and transformed into DC signal in the loop filter (LPF). The DC signal is applied to the pin 4 of the VCO and locked to keep the VCO frequency constant.

PLL data is output from DT (pin 85), CLK (pin 84) and LE (pin 93) of the microprocessor (IC406). The data are input to the PLL IC when the channel is changed or when transmission is changed to reception and vice versa. A PLL lock condition is always monitored by the pin 30 (UL) of the microprocessor. When the PLL is unlocked, the UL goes low.

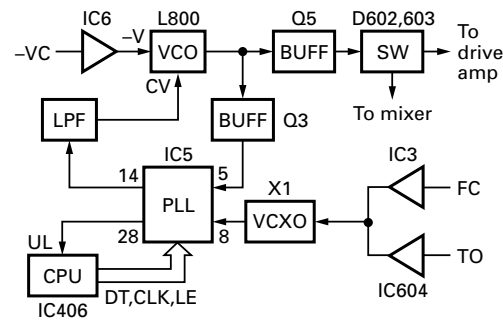


Fig. 9 PLL block diagram

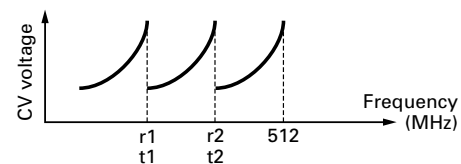


Fig. 10 CV voltage vs frequency

### 6. Power Supply Circuit

Battery +B is supplied via a 3A fuse from the battery terminal connected to the TX-RX unit. After passing through the power switch power supply (SB) is applied to the two AVR ICs, and AVR circuit.

IC401 supplies 5V (5CM) to the control circuit. IC402 supplies 5V (5M) to the common circuit.

AVR circuit (Q400, Q402, Q405, Q406) supplies voltage to the TX circuit and the RX circuit. 5C is common 5V and output when SAVE is not set at off. 5R is 5V for reception and output during reception. 5T is 5V for transmission and output during transmission.

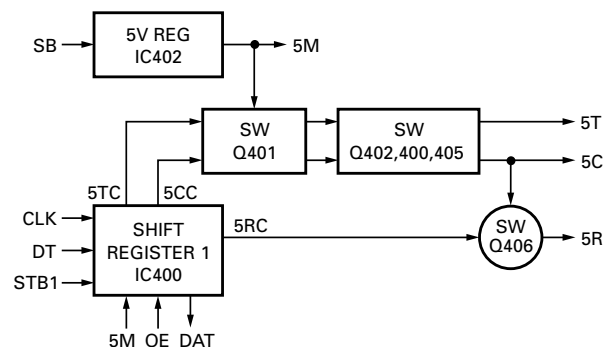


Fig. 11 Power supply circuit

## CIRCUIT DESCRIPTION

### 7. Control Circuit

The control unit consists of microprocessor IC406, flash memory IC414, and its peripheral circuits. It controls the TX-RX unit and transfers data to and from the control unit. The CPU (IC406) mainly performs the following :

- 1) Switching between transmission and reception by PTT signal input.
- 2) Reading channel, frequency, and program data from the memory circuit.
- 3) Sending frequency program data to the PLL.
- 4) Controlling squelch on/off by the pulse signal input from the squelch circuit.
- 5) Controlling the audio mute circuit by decode data input.
- 6) Transmitting encode data (QT, DQT).
- 7) Sending serial data to output expander (IC400, IC403, IC404 and IC405) to control various function in the unit.

#### 7-1. Memory circuit

IC414 is a flash memory with a capacity of 2M bits that contains the transceiver control program for the CPU and data such as transceiver channels and operating features.

This program can be easily written from an external devices. Data, such as DTMF memories and operating status, are programmed into the EEPROM (IC412).

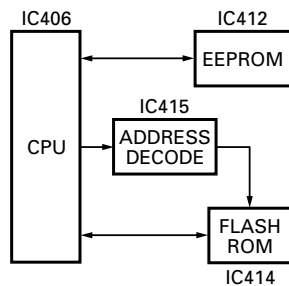


Fig. 12 Memory circuit

#### 7-2. CPU clock shift

When the CPU (IC406) 12MHz clock (X400) high frequency is multiplexed with the reception frequency, it becomes an internal beat signal, suppressing the signal sensitivity. To prevent this, by turning Q407 on, the clock frequency is shifted (about 4kHz).

(Shift on/off can be set through programming.)

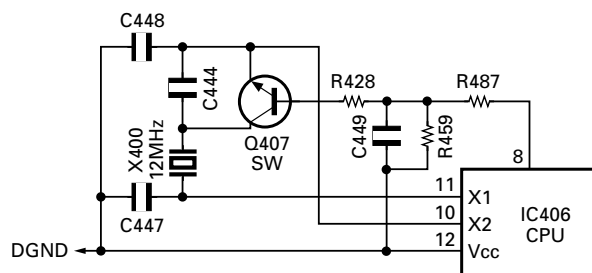


Fig. 13 CPU clock frequency shift

#### 7-3. Shift register

IC400, 403, 404 and 405 is an interface IC for output port expansion. It is used to expand the CPU (IC406) output ports.

#### 7-4. D/A converter

IC3 and IC603 is used as a conventional semi-fixed-resistor converter. It sets the following :

- 1) RX sensitivity
- 2) Transmission power
- 3) Modulation level
- 4) Audio power
- 5) Frequency

#### 7-5. Key input

K11 or K12 becomes HIGH when any key is pressed (or Enable signal on the optional circuit).

When K11 or K12 becomes HIGH, K10 also becomes HIGH to trigger the interrupt to IC406 in order to start the key scan.

When the key scan starts, the output terminals (Q1~Q5) become LOW. Only the key sensing circuit remains HIGH. When a key is pressed, the signal is routed through K11 or K12 to the microprocessor. Then, the microprocessor determines which key is pressed using this signals.

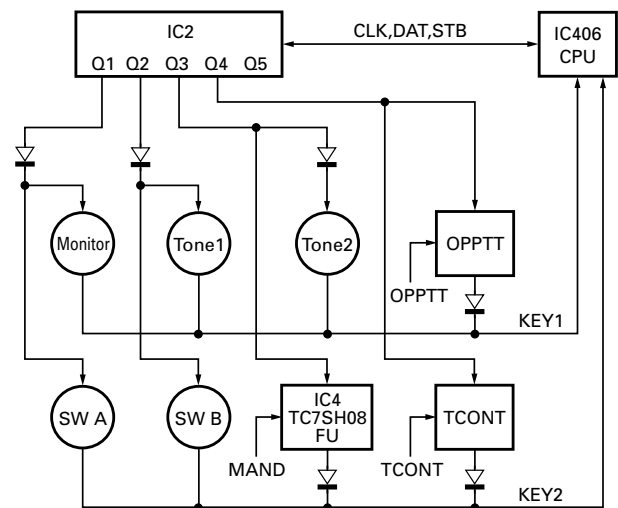


Fig. 14 Key input

## CIRCUIT DESCRIPTION

### 7-6. Low battery warning

The battery voltage is monitored by the microprocessor (IC406). When the battery voltage falls below the voltage set by the Low Battery Warning adjustment, the red LED flashes to notify the operator that it is time to replace the battery. If the battery voltage falls even more (approx. 5.5V), a beep sounds and transmission is stopped.

Low battery warning	Battery condition
The red LED flashes during transmission	The battery voltage is low but the transceiver is still usable
The red LED flashes and continuous beep sounds while PTT pressed.	The battery voltage is low and the transceiver is not usable to make calls.

## 8. Signalling Circuit

### 8-1. Encode

The CPU (IC406) transmits the encode data selected by the program.

#### • Low-speed data (QT, DQT)

Low-speed data is output from pin 34 of the CPU. The signal passes through a low-pass CR filter, and goes to the summing amplifier (IC605 1/2). The signal is mixed with the audio signal and goes to the VCO (IC10) and VCXO (X1) modulation input after passing through the D/A converter (IC603) for BAL adjustment.

#### • High-speed data (DTMF)

High-speed data is output from pin 35 of the CPU. The signal passes through a low-pass filter consisting of IC413, and provides a TX DTMF tone and a RX DTMF tone including a beep tone. The TX DTMF tone is passed to the D/A converter (IC603) for DTMF deviation adjustment, and then applied to the audio processor (IC607).

The signal is mixed with the audio signal and goes to the VCO and VCXO. The RX DTMF tone is passed the D/A converter (IC603) for audio control, summing amplifier (IC604 2/2), audio power amplifier and then to the speaker.

#### • MSK

The MSK signal (1200 bps) is output from pin 6 of IC607. The signal passes through the D/A converter (IC603) for the MSK deviation adjustment, and is routed to the VCO.

When encoding MSK, the microphone input signal is muted.

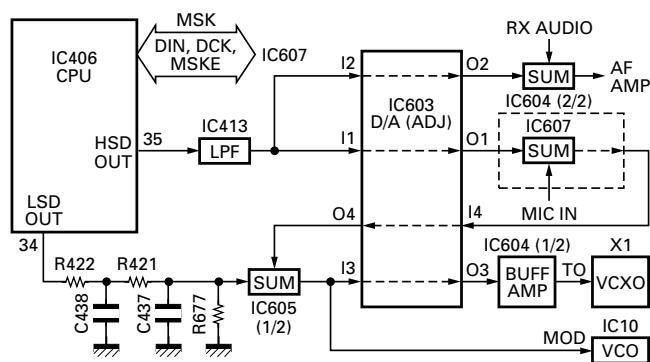


Fig. 15 Encode

### 8-2. Decode

#### • Low-speed data (QT, DQT)

The demodulated signal from the FM IF IC (IC300) is amplified by IC601 (2/2) and passes through a low-pass filter (IC602) to remove audio components. The signal is input to pin 28 of the CPU.

The CPU digitizes this signal, performs processing such as DC restoration, and decodes the signal.

#### • High-speed data (DTMF)

The DTMF input signal from the FM IF IC (IC300) is amplified by IC601 (2/2) and goes to IC600, the DTMF decoder. The decoded information is then processed by the CPU. During transmission and standby, the DTMF IC is set to the power down mode when the PD terminal is High. When the line is busy, the PD terminal becomes Low, the power down mode is canceled and decoding is carried out.

#### • MSK

The MSK input signal from the IF IC is amplified by IC601 (2/2) and goes to pin 5 of IC607. The signal is demodulated by MSK demodulator in IC607. The demodulated data goes to the CPU for processing.

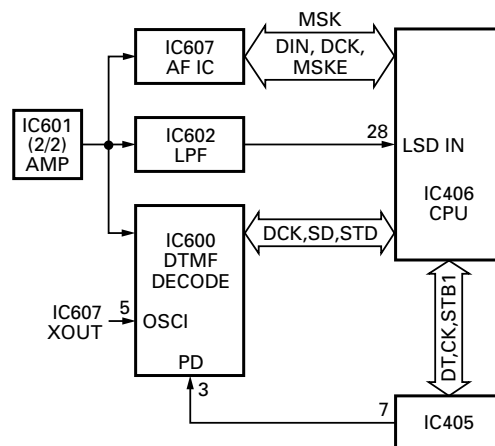


Fig. 16 Decode

## CIRCUIT DESCRIPTION

### 9. Componder Circuit

The term compander is a compound of compressor and expander. The compander reduces noise by utilizing a compressor and an expander.

As shown in Fig. 17, the signal input to the compressor is compressed so that the logarithmic ratio is 1/2 with reference to -10dBV, and then output onto the transmission path. The signal is expanded by the expander so that the logarithmic ratio is 2 with reference to -10dBV. This reduces noise on the transmission path and prevents deterioration of the signal quality due to noise during transmission.

The TK-290 contains IC607 (TC35453F) to perform this operation.

- Pin 16 : Compressor input pin
- Pin 18 : Compressor output pin
- Pin 43 : Expander input pin
- Pin 41 : Expander output pin

The TK-290 compander can be turned on or off only when modulation is set to Narrow by FPU setting. The compander cannot be turned on when modulation is set to Wide (OFF).

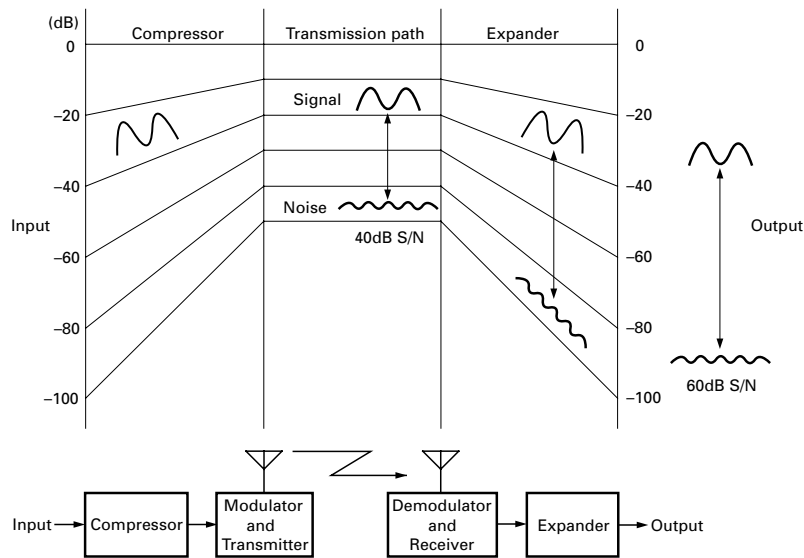


Fig. 17

### 10. Option Board Terminal

Terminals for mounting the option board are provided at the bottom of the TX-RX unit. The table below shows the correspondence between the board and terminals. Disconnect R414 and R665 in TX-RX unit when the scrambler board is attached.

Connect the option board to the connection terminals of the TX-RX unit.

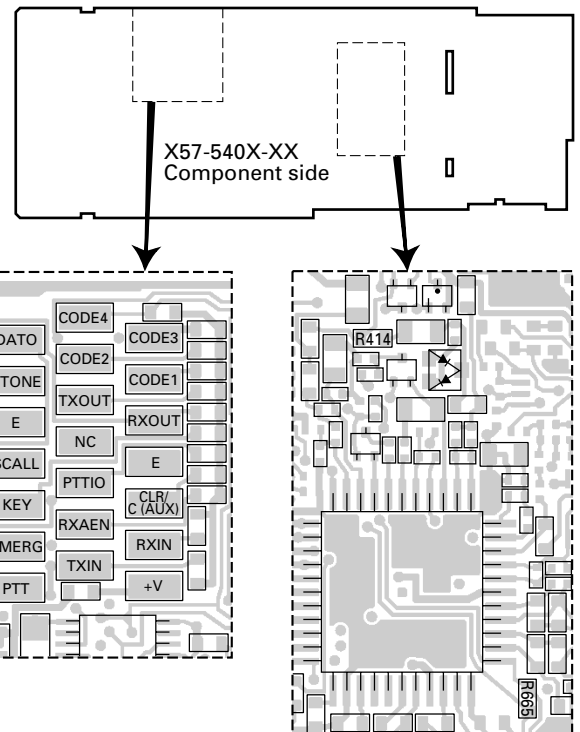


Fig. 18

## CIRCUIT DESCRIPTION

### 10-1. Option port 1 (For ANI board etc.)

Port name		Description	Connection	Note
Abbreviation (PCB)	Name			
DATI	Data In	Board data input Transceiver (Receiver demodulation circuit) → ANI board	Connected to the circuit	Reference 1kHz STD Dev → 250~350mVrms
DATO	Data Out	Board data output ANI board → Transceiver (Transmitter modulation circuit)	Connected to the circuit	Reference 1kHz/150mVrms → 2.5~3.5kHz/wide 1.25~1.75kHz/narrow
TCONT	T Control	Audio amplifier power control → Control unit (X53) counter → TX-RX unit (X57) microcomputer	Microcomputer input	L : Audio amp on H : Audio amp off
STONE	Side Tone	Beep during PTT ID	Connected to the circuit	
AUDIH	Audio Inhibit	Microphone muting during PTT ID	Connected to the circuit	
E	Ground	Ground	Ground	
MUTE	Mute	Mutes transceiver receive tone	Connected to the circuit	
SCALL	Selective Call	LED drive port for selective call	Unused, no connection	
AUX	Aux	Emergency Channel request → Control unit (X53) counter → TX-RX unit (X57) microcomputer	Microcomputer input	L : EMG CH request H : No EMG CH request
PTT	PTT	Microcomputer PTT logic → ANI board	Microcomputer output	L : TX, H : RX
MAND	Man Down	Man Down mercury switch input port Transceiver → ANI board	Microphone connector	L : Switch on H : Switch off
EMERG	Emergency	Microcomputer Emergency Channel logic → ANI board	Microcomputer output	L : Emergency operation request H : No emergency operation request
BUSY	Channel Busy	Microcomputer Busy logic → ANI board	Microcomputer output	L : Busy H : Not busy
KEY	(Transmission) Key	Transmission start control GE-Star → Control unit (X53) counter → TX-RX unit (X57) microcomputer	Microcomputer input	L : Transmission request H : No transmission request
A+	Board power supply	Switched B	Power supply	

### 10-2. Option port 2 (For voice scrambler etc.)

Abbreviation (PCB)	Name	Description	Check mode operation	Note
CODE1	Scramble Code 1	First of four bits of scramble code	Microcomputer output	Board code selection (Logic by binary code)
CODE2	Scramble Code 2	Second of four bits of scramble code		
CODE3	Scramble Code 3	Third of four bits of scramble code		
CODE4	Scramble Code 4	Fourth of four bits of scramble code		
TXOUT	TX Out	Board → Transceiver (Transmitter modulation circuit)	Connected to the circuit	Reference 1kHz/15mVrms → 2.5~3.5kHz/wide 1.25~1.75kHz/narrow
RXOUT	RX Out	Board → Transceiver (Audio amp)	Connected to the circuit	
NC	No Connection	No connection	No connection	
E	Ground	Ground	Ground	
PTTIO		Scramble modulation/demodulation control	Microcomputer output	L : TX, H : RX
CLR/C (AUX)	Clear/Code	Specifies whether to scramble	Microcomputer output	L : Scramble H : Normal
RXAEN		Enables the power save mode of the board	Microcomputer output	L : Power save mode H : Normal
RXIN	RX In	Transceiver (Receiver detection output) → Board	Connected to the circuit	Reference 1kHz STD Dev → 250~350mVrms
TXIN	TX In	Transceiver (Microphone circuit) → Board	Connected to the circuit	
+V	Board power supply	Switched B	Power supply	



## SEMICONDUCTOR DATA

## 1. Microprocessor : 784214GC0648EU (TX-RX Unit IC406)

## 1-1. Terminal function

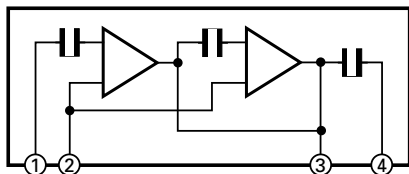
Pin No.	Port name	I/O	Function	Pin No.	Port name	I/O	Function
1	P120/RTP0	O	Modem FCLR	50	P82/A2	–	Flash ROM access port.
2	P121/RTP1	O	SB control	51	P83/A3	–	
3	P122/RTP2	O	D/A converter CS	52	P84/A4	–	
4	P123/RTP3	O	Modem MSKE (MSK enable)	53	P85/A5	–	
5	P124/RTP4	O	Modem DIN (DATA/TX DATA)	54	P86/A6	–	
6	P125/RTP5	I	Model select 1	55	P87/A7	–	
7	P126/RTP6	I	Model select 2	56	P40/AD0	–	
8	P127/RTP7	O	Clock shift	57	P41/AD1	–	
9	VDD	–	+5V	58	P42/AD2	–	
10	X2	–	X'tal (12.0MHz)	59	P43/AD3	–	
11	X1	–					
12	VSS	–	GND	60	P44/AD4	–	
13	XT2	–	Open	61	P45/AD5	–	
14	XT1	–	GND	62	P46/AD6	–	
15	RESET	–	CPU reset	63	P47/AD7	–	
16	P00/INTP0	I	μ-com stop	64	P50/A8	–	
17	P01/INTP1	I	Modem TRD (TX clock)	65	P51/A9	–	
18	P02/INTP2/NMI	I	Modem RTM (RX clock)	66	P52/A10	–	
19	P03/INTP3	I	DTMF decode STD	67	P53/A11	–	
20	P04/INTP4	I	Key interrupt	68	P54/A12	–	
21	P05/INTP5	I	Power switch detect	69	P55/A13	–	
22	P06/INTP6	I	MIC PTT	70	P56/A14	–	
23	AVDD	–	+5V	71	P57/A15	–	
24	AVREF0	–	+5V	72	VSS	–	GND
25	P10/ANI0	I	Volume level input	73	P60/A16	–	Flash ROM access port
26	P11/ANI1	I	SP key 1/2	74	P61/A17	–	
27	P12/ANI2	I	(Temp)	75	P62/A18	–	Flash ROM (4M bit) access port.
28	P13/ANI3	I	QT/DQT input	76	P63/A19	–	Open
29	P14/ANI4	I	Battery level input	77	P64/RD	–	Flash ROM access port.
30	P15/ANI5	I	PLL unlock detect input	78	P65/WR	–	
31	P16/ANI6	I	*SQL level input	79	P66/WAIT	I	TX Inhibit (Radio kill)
32	P17/ANI7	I	*RSSI level input	80	P67/ASTB	–	Open
33	AVSS	–	GND	81	VDD	–	+5V
34	P130/ANO0	O	LSD (QT/DQT) output	82	P100/TI5/TO5	O	EEPROM clock
35	P131/ANO1	O	DTMF/BEEP output	83	P101/TI6/TO6	I/O	EEPROM data
36	AVREF1	–	+5V	84	P102/TI7/TO7	O	Common clock
37	P70/RXD2/SI2	O	Battery DET SW	85	P103/TI8/TO8	O	Common data
38	P71/TXD2/SO2	I	EXT. SP install check (No : H)	86	P30/TO0	O	Shift register output enable
39	P72/ASCK2/SCK2	O	Non connect	87	P31/TO1	I	Key counter return 1
40	P20/RXD1/SI1	I	←FPU	88	P32/TO2	I	Key counter return 2
41	P21/TXD1/SO1	O	→FPU	89	P33/TI1	I	Self program flag (Soft pull up)
42	P22/ASCK1/SCK1	O	Modem STB	90	P34/TI2	O	Key counter enable
43	P23/PCL	O	DTMF clock	91	P35/TI00	I	2-tone decode latch
44	P24/BUZ	I	DTMF decoder SD	92	P36/TI01	I	Digital SQL
45	P25/SI0	O	LCD CS	93	P37	O	PLL LE
46	P26/SO0	O	Shift register 1 STB	94	TEST	–	GND
47	P27/SCK0	O	Shift register 2 STB	95~98	P90~P93	I	Rotary SW 1~4
48	P80/A0	–	Flash ROM access port.	99	P94	I	Toggle SW input
49	P81/A1	–					
				100	P95	I	Modem RDT (RX DATA)

## SEMICONDUCTOR DATA / DESCRIPTION OF COMPONENTS

### 2. RF Power Amplifier (Final Unit IC801)

M68776

#### 2-1. Block diagram



#### 2-2. Maximum ratings (Flange temperature = 25°C)

Rating	Symbol	Value	Unit
DC supply voltage (Pins 3)	V <sub>DD</sub>	12	V
DC control voltage (Pin 2)	V <sub>cont</sub>	4	V
RF input power	P <sub>in</sub>	40	mW
RF output power	P <sub>out</sub>	10	W
Operating case temperature range	T <sub>c</sub>	-30 to +110	°C
Storage temperature range	T <sub>stg</sub>	-40 to +110	°C

### Final Unit (X45-3592-71)

Ref. No.	Use / Function	Operation / Condition
IC801	RF power amplifier	

### Control Unit (X53-3930-XX) -11 : K -12 : K2

Ref. No.	Use / Function	Operation / Condition
IC1	Audio power amplifier	0.5W/16Ω, BTL method
IC2	Shift register	
IC3	MIC noise canceling circuit	
IC4	Option board (MAND) control switch	AND circuit MAND : "H", OUT : "H" when Q3 port is "H"
IC5	Option board (OPPTT) control switch	AND circuit OPPTT : "H", OUT : "H" when Q4 port is "H"
IC6	Option board (TCONT) control switch	AND circuit MAND : "H", OUT : "H" when Q4 port is "H"
IC7	Shift register	
IC10	Inverter	
IC101	LCD driver	
Q5	Power supply switch control	AF AMP SW "H" : on
Q6	AF amplifier power supply switch	
Q7	Int. audio mute switch	INT. AFC "H" : INT. SP audio signal on
Q8	Audio mute switch signal off	MUTE "L" : RX audio
Q14	Noise cancelling (N/C) switch	N/C switch "H" : N/C on
Q15	Ext. audio mute switch	EXT AFC "H" : EXT. SP audio signal on
D2	AVR	AF AMP power supply
D6~9	Key pad backlight	
D11	Reverse current prevention for number key pad	
D12,13	Reverse current prevention for PF key.	
D14	Reverse current prevention for number key pad	
D15,16	Reverse current prevention for PF key.	
D17,18	Reverse current prevention for number key pad	
D19,20	Reverse current prevention for PF key.	
D101	Speed up	
D102,103	LCD backlight	
D104	LED	Red, green

## DESCRIPTION OF COMPONENTS

## TX-RX UNIT (X57-5390-10)

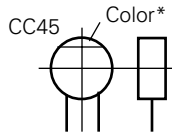
Ref. No.	Use / Function	Operation / Condition	Ref. No.	Use / Function	Operation / Condition
IC2	Level shift		Q302	IF amplifier	Post amplifier
IC3	D/A converter (adjustment)		Q303	DC switch	2nd IF W/N switch sets to on when Narrow
IC4	DC-DC converter	Outputs $\pm$ twice the input voltage 5M	Q304	DC switch	2nd IF W/N switch sets to on when Wide
IC5	Phase locked loop system		Q305	DC switch	
IC6	Level shift		Q400	DC switch	5TC "H" : on
IC7	APC comparator		Q401	DC switch	5CC "H" : on, 5TC "H" : on
L800	VCO system		Q402	DC switch	Regulator 5T, 5C
IC200	Active DBM		Q403	DC switch	MIC mute
IC300	FM IF system	2nd mixer, Quadrature detector, AF output, Noise amplifier output, S-meter output	Q404	DC switch	MIC switch
IC301	Audio mute switch		Q405	DC switch	5CC "H" : on
IC400	Shift register	Output expander	Q406	DC switch	5R
IC401	Voltage regulator	5CM	Q407	Clock frequency shift	
IC402	Voltage regulator	5M	Q408	DC switch	TX LED (Red) driver
IC403~405	Shift register	Output expander	Q409	DC switch	Busy LED (Green) driver
IC406	Microprocessor	16 bit	Q410	DC switch	Lamp
IC409	Voltage detector	Reset	Q411	Current driver	Lamp : Backlight
IC412	EEPROM		Q412	DC switch	SB
IC413	Active filter	For HSD output	Q413	DC switch	BATT voltage detector
IC414	Flash ROM		Q414	DC switch	Power supply switch
IC415	Address decode latch	NOR gate	Q415	DC switch	SB
IC600	DTMF decoder		Q601	Mute switch	MIC line mute
IC601	Buffer amplifier		Q602	DC switch	
IC602	Active filter	LPF for LSD input	D4	Noise rejection	
IC603	D/A converter (Adjustment)		D5	Frequency shift	2nd local cutoff frequency
IC604	Summing amplifier/ Buffer amplifier	AF/TO	D6	Current steering	
IC605	Summing amplifier	MOD : Summing amplifier	D8	Temperature compensation	
IC606	Active filter	LPF for 2-tone	D9	Voltage protection	
IC607	Audio processor		D10,11	ANT switch	
Q1	DC switch	T/R "H" : RX	D200	Overload protection	
Q2	DC convert switch		D201,202	Varactor tuning	For L201
Q3	RF amplifier	Buffer for RF input	D203,204	Varactor tuning	For L202
Q4	Ripple filter	4C	D205,206	Varactor tuning	For L205
Q5	Buffer amplifier		D207,208	Varactor tuning	For L206
Q6	RF amplifier	TX drive	D300	AM detector	Noise squelch
Q7	DC switch	APC circuit power switch	D302,303	RF switch	2nd IF wide/narrow
Q8	RF amplifier	TX drive	D400	Reverse protection	
Q9	DC switch	APC voltage control	D401	Overload protection	
Q10	DC switch	APC off : Speed up	D402,403	Surge absorption	
Q13	DC switch	D/A port protection	D404	Reverse current prevention	
Q200	RF amplifier	RX front	D408	Reverse current prevention	
Q301	Noise amplifier	RX on	D409	Voltage reference	
			D601	Voltage clamp	
			D602,603	TX/RX switch	

## PARTS LIST

### CAPACITORS

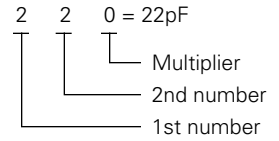
CC 45 TH 1H 220 J  
 1 2 3 4 5 6

- 1 = Type ... ceramic, electrolytic, etc.
- 2 = Shape ... round, square, ect.
- 3 = Temp. coefficient
- 4 = Voltage rating
- 5 = Value
- 6 = Tolerance



#### Capacitor value

- 010 = 1pF
- 100 = 10pF
- 101 = 100pF
- 102 = 1000pF = 0.001μF
- 103 = 0.01μF



#### Temperature coefficient

1st Word	C	L	P	R	S	T	U
Color*	Black	Red	Orange	Yellow	Green	Blue	Violet
ppm/°C	0	-80	-150	-220	-330	-470	-750

2nd Word	G	H	J	K	L
ppm/°C	±30	±60	±120	±250	±500

Example : CC45TH = -470 ± 60ppm/°C

#### Tolerance (More than 10pF)

Code	C	D	G	J	K	M	X	Z	P	No code
(%)	±0.25	±0.5	±2	±5	±10	±20	+40 -20	+80 -20	+100 -0	More than 10μF -10 ~ +50 Less than 4.7μF -10 ~ +75

#### (Less than 10pF)

Code	B	C	D	F	G
(pF)	±0.1	±0.25	±0.5	±1	±2

#### Voltage rating

2nd word \ 1st word	A	B	C	D	E	F	G	H	J	K	V
0	1.0	1.25	1.6	2.0	2.5	3.15	4.0	5.0	6.3	8.0	-
1	10	12.5	16	20	25	31.5	40	50	63	80	35
2	100	125	160	200	250	315	400	500	630	800	-
3	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	-

#### Chip capacitors

(EX) C C 7 3 F S L 1 H 0 0 0 J  
 1 2 3 4 5 6 7

(Chip) (CH, RH, UJ, SL)

(EX) C K 7 3 F F 1 H 0 0 0 Z  
 1 2 3 4 5 6 7

(Chip) (B, F)

Refer to the table above.

- 1 = Type
- 2 = Shape
- 3 = Dimension
- 4 = Temp. coefficient
- 5 = Voltage rating
- 6 = Value
- 7 = Tolerance

#### Dimension (Chip capacitors)

Dimension code	L	W	T
Empty	5.6 ± 0.5	5.0 ± 0.5	Less than 2.0
A	4.5 ± 0.5	3.2 ± 0.4	Less than 2.0
B	4.5 ± 0.5	2.0 ± 0.3	Less than 2.0
C	4.5 ± 0.5	1.25 ± 0.2	Less than 1.25
D	3.2 ± 0.4	2.5 ± 0.3	Less than 1.5
E	3.2 ± 0.2	1.6 ± 0.2	Less than 1.25
F	2.0 ± 0.3	1.25 ± 0.2	Less than 1.25
G	1.6 ± 0.2	0.8 ± 0.2	Less than 1.0
H	1.0 ± 0.05	0.5 ± 0.05	0.5 ± 0.05

### RESISTORS

#### Chip resistor (Carbon)

(EX) R D 7 3 E B 2 B 0 0 0 J  
 1 2 3 4 5 6 7

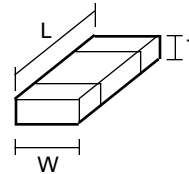
(Chip) (B, F)

#### Carbon resistor (Normal type)

(EX) R D 1 4 B B 2 C 0 0 0 J  
 1 2 3 4 5 6 7

- 1 = Type ... ceramic, electrolytic, etc.
- 2 = Shape ... round, square, ect.
- 3 = Dimension
- 4 = Temp. coefficient
- 5 = Voltage rating
- 6 = Value
- 7 = Tolerance

#### Dimension



#### Dimension (Chip resistor)

Dimension code	L	W	T
E	3.2 ± 0.2	1.6 ± 0.2	1.0
F	2.0 ± 0.3	1.25 ± 0.2	1.0
G	1.6 ± 0.2	0.8 ± 0.2	0.5 ± 0.1
H	1.0 ± 0.05	0.5 ± 0.05	0.35 ± 0.05

#### Rating wattage

Code	Wattage	Code	Wattage	Code	Wattage
1J	1/16W	2C	1/6W	3A	1W
2A	1/10W	2E	1/4W	3D	2W
2B	1/8W	2H	1/2W		

## PARTS LIST

\* New Parts.  $\Delta$  indicates safety critical components.  
 Parts without **Parts No.** are not supplied.  
 Les articles non mentionnés dans le **Parts No.** ne sont pas fournis.  
 Teile ohne **Parts No.** werden nicht geliefert.

**L** : Scandinavia      **K** : USA      **P** : Canada  
**Y** : PX (Far East, Hawaii)      **T** : England      **E** : Europe  
**Y** : AAFES (Europe)      **X** : Australia      **M** : Other Areas

**TK-290**  
**FINAL UNIT (X45-3592-71)**  
**CONTROL UNIT (X53-3930-XX)**

Ref. No.	Address	New parts	Parts No.	Description	Destination
<b>TK-290</b>					
1	1A	*	A02-2139-63	CABINET ASSY	K
1	1A	*	A02-2140-63	CABINET ASSY	K2
2	3A		A10-4015-21	CHASSIS	
4	2B	*	A22-2501-25	SUB PANEL ASSY	
5	2B		A62-0537-53	PANEL ASSY	
7	1C		B03-0594-04	DRESSING PLATE	ACCESSORY
8	1C		B09-0363-03	CAP	ACCESSORY
9	1B	*	B11-1183-14	ILLUMINATION GUIDE	
10	1B		B38-0786-05	LCD	
11	1A		B42-3394-14	STANDARD LABEL	
12	1A	*	B43-1111-14	BADGE	
13	1D	*	B62-0816-30	INSTRUCTION MANUAL	
14	3A	*	B72-1288-14	MODEL NAME PLATE	
16	1D	*	D32-0421-24	STOPPER	
19	3A		E23-1163-04	BATT TERMINAL	
20	1B		E29-1165-05	INTER CONNECTOR (LCD)	
-	-		E30-3325-05	CLONING CABLE	
22	2A		E37-0682-05	FLAT CABLE (TX/RX-CONT)	
23	1B		E37-0684-05	LEAD WIRE WITH CONNECTOR (SP)	
24	2B		E37-0692-05	PROCESSED LEAD WIRE (TOGGLE SW)	
25	2B		E37-0722-05	ANTENNA CABLE	
26	3B		E58-0443-25	UNIVERSAL CONNECTOR	
27	2A		E72-0411-04	TERMINAL BLOCK (BATT+)	
-	-		F10-2344-04	SHIELDING CASE	
32	2A		G01-0891-04	COIL SPRING (BATT RELEASE)	
34	2B		G11-2554-04	SHEET (KEY TOP)	
35	2B		G11-2555-04	SHEET (TOGGLE SW)	
36	1A		G11-2658-04	SHEET (PTT)	
37	2A		G13-1678-04	CUSHION (TX/RX)	
38	1C		G13-1688-04	CUSHION (CAP)	
39	2A		G13-1695-04	CUSHION (DTMF)	K2
40	3A		G13-1800-04	CUSHION (BATT TERMINAL)	
41	3B		G53-0822-04	PACKING (CHASSIS)	
42	1B		G53-0823-04	PACKING (SP)	
43	2A		G53-0874-03	PACKING (RING)	
44	3A		G53-1511-04	PACKING (BATT-)	
45	3A		G53-1518-04	PACKING (BATT TERMINAL)	
47	2C		H12-3018-02	PACKING FIXTURE	
48	1C		H25-0029-04	PROTECTION BAG	
49	3D		H52-0998-02	ITEM CARTON CASE	
51	2A	*	J19-5330-14	HOLDER (BATT RELEASE)	
52	1A	*	J21-8326-14	HARDWARE FIXTURE (SIDE KEY)	
53	1B	*	J21-8328-14	HARDWARE FIXTURE (LCD)	
54	2A	*	J21-8329-14	HARDWARE FIXTURE (CONT UNIT)	
56	2B	*	J21-8343-14	HARDWARE FIXTURE	
57	1C	*	J29-0652-35	BELT HOOK	ACCESSORY
58	1A		J82-0047-05	FPC (SIDE KEY)	
59	2B		J82-0049-15	FPC (VOL-ENC)	
60	3A	*	J82-0052-15	FPC (UNIVERSAL CONNECTOR)	
61	2B		J99-0346-24	ADHESIVE TAPE (TOGGLE SW)	
63	2B	*	K29-5172-32	KEY TOP (TOP KEY)	
<b>FINAL UNIT (X45-3592-71)</b>					
C802			CC73GCH1H030C	CHIP C	3.0PF C
C803			CC73GCH1H101J	CHIP C	100PF J
C804			CK73GB1C104K	CHIP C	0.10UF K
C805			CC73GCH1H101J	CHIP C	100PF J
C806			CK73GB1C104K	CHIP C	0.10UF K
L801			L33-0763-05	SMALL FIXED INDUCTOR	
IC801	3B		M68776	RF POWER MODULE	
<b>CONTROL UNIT (X53-3930-XX) -11 : K -12 : K2</b>					
D6-9			B30-2171-05	LED	
D102,103			B30-2231-05	LED	K2
D104			B30-2019-05	LED	
C1-5			CK73GB1H471K	CHIP C	470PF K
C8			CK73FB1C474K	CHIP C	0.47UF K
C10,11			CK73GB1H102K	CHIP C	1000PF K
C12,13			CK73FB1C474K	CHIP C	0.47UF K
C14			CK73FB1C104KTD	CHIP C	0.10UF K
C15			CK73GB1H471K	CHIP C	470PF K
C16			C92-0734-05	CHIP-TAN	100UF 10WV
C19			CK73FB1C474K	CHIP C	0.47UF K
C22			CK73GB1H471K	CHIP C	470PF K
C27-29			CK73GB1C104K	CHIP C	0.10UF K
C30			CK73FB1C474K	CHIP C	0.47UF K
C31			CK73GB1E223K	CHIP C	0.022UF K
C32			CK73FB1C474K	CHIP C	0.47UF K
C33,34			CK73GB1H471K	CHIP C	470PF K

## PARTS LIST

### CONTROL UNIT (X53-3930-XX)

### TX-RX UNIT (X57-5390-10)

Ref. No.	Address	New parts	Parts No.	Description	Destination	Ref. No.	Address	New parts	Parts No.	Description	Destination
C35			CK73GB1H102K	CHIP C 1000PF K		D2			DTZ3.9(B)	ZENER DIODE	
C37			CC73GCH1H101J	CHIP C 100PF J		D2		*	UDZ3.9(B)	ZENER DIODE	
C38			CK73GB1H102K	CHIP C 1000PF K		D11			IMN10	DIODE	K2
C39			CK73GB1H471K	CHIP C 470PF K		D12,13			MA2S111	DIODE	
C41			CK73GB1H102K	CHIP C 1000PF K		D14			IMN10	DIODE	K2
C43			CK73GB1H471K	CHIP C 470PF K		D15			MA2S111	DIODE	
C45,46			CK73GB1H471K	CHIP C 470PF K		D16			IMN10	DIODE	K
C103			CK73GB1H102K	CHIP C 1000PF K		D16-18			IMN10	DIODE	K2
C104,105			CC73GCH1H101J	CHIP C 100PF J		D19,20			MA2S111	DIODE	
C106			C92-0602-05	CHIP-TAN 1.0UF 10WV		D101			1SS373	DIODE	
CN1			E40-5947-05	FLAT CABLE CONNECTOR		IC1			TDA7053AT	BI-POLAR IC	
CN3			E40-5948-05	FLAT CABLE CONNECTOR		IC2			BU4094BCFV	MOS IC	
CN4			E40-5662-05	PIN ASSY SOCKET		IC3			NJM2904V	MOS IC	
CN101			E40-5920-05	FLAT CABLE CONNECTOR		IC4-6			TC7SH08FU	MOS IC	
CN501,502			E04-0403-05	PIN SOCKET		IC7			BU4094BCFV	MOS IC	K2
L1-4			L92-0141-05	FERRITE CHIP		IC10			TC7W04FU	MOS IC	
L6			L92-0149-05	FERRITE CHIP		IC101			LC75824W	MOS IC	
L9			L92-0138-05	FERRITE CHIP		Q5			2SC4617(S)	TRANSISTOR	
L101			L92-0138-05	FERRITE CHIP		Q6			2SB798(DL,DK)	TRANSISTOR	
CP1			R90-0723-05	MULTI-COMP 47K X2		Q7,8			2SK1824	FET	
R1			RK73GB1J273J	CHIP R 27K J 1/16W		Q14			UMC4	TRANSISTOR	
R2			RK73GB1J102J	CHIP R 1.0K J 1/16W		Q15			2SK1824	FET	
R3			RK73GB1J470J	CHIP R 47 J 1/16W		<b>TX-RX UNIT (X57-5390-10)</b>					
R4,5			RK73GB1J473J	CHIP R 47K J 1/16W		C1			C92-0560-05	CHIP-TAN 10UF 6.3WV	
R6-8			R92-1252-05	CHIP R 0 OHM		C5			CK73GB1H102K	CHIP C 1000PF K	
R9,10			RK73GB1J562J	CHIP R 5.6K J 1/16W		C6			C92-0560-05	CHIP-TAN 10UF 6.3WV	
R11			R92-1252-05	CHIP R 0 OHM		C8-10			CK73GB1H102K	CHIP C 1000PF K	
R12			RK73GB1J102J	CHIP R 1.0K J 1/16W		C11			C92-0588-05	CHIP-TAN 1.5UF 16V	
R13			RK73GB1J473J	CHIP R 47K J 1/16W		C13			CK73GB1C104K	CHIP C 0.10UF K	
R14			RK73GB1J104J	CHIP R 100K J 1/16W		C14,15			C92-0588-05	CHIP-TAN 1.5UF 16V	
R15			RK73GB1J222J	CHIP R 2.2K J 1/16W		C16			CK73GB1C104K	CHIP C 0.10UF K	
R17,18			RK73GB1J473J	CHIP R 47K J 1/16W	K2	C17			CK73GB1H102K	CHIP C 1000PF K	
R19,20			RK73GB1J101J	CHIP R 100 J 1/16W		C18			C92-0588-05	CHIP-TAN 1.5UF 16V	
R22,23			RK73GB1J102J	CHIP R 1.0K J 1/16W		C19,20			CK73GB1C104K	CHIP C 0.10UF K	
R26-28			RK73GB1J103J	CHIP R 10K J 1/16W		C21			C92-0560-05	CHIP-TAN 10UF 6.3WV	
R29,30			RK73GB1J223J	CHIP R 22K J 1/16W		C22			CK73GB1H103K	CHIP C 0.010UF K	
R31			R92-1252-05	CHIP R 0 OHM	K2	C23			CC73GCH1H101J	CHIP C 100PF J	
R32			RK73GB1J680J	CHIP R 68 J 1/16W		C24			C92-0502-05	CHIP-TAN 0.33UF 35WV	
R33			RK73GB1J223J	CHIP R 22K J 1/16W		C27			CK73GB1C104K	CHIP C 0.10UF K	
R34			RK73GB1J182J	CHIP R 1.8K J 1/16W		C28			CK73GB1E223K	CHIP C 0.022UF K	
R35			RK73GB1J103J	CHIP R 10K J 1/16W		C29			CC73GCH1H100D	CHIP C 10PF D	
R36			RK73GB1J182J	CHIP R 1.8K J 1/16W		C30			CC73GCH1H220J	CHIP C 22PF J	
R37-42			RK73GB1J102J	CHIP R 1.0K J 1/16W	K2	C31			CK73GB1H471K	CHIP C 470PF K	
R43,44			RK73GB1J473J	CHIP R 47K J 1/16W		C32			C92-0002-05	CHIP-TAN 0.22UF 35WV	
R45-49			RK73GB1J102J	CHIP R 1.0K J 1/16W	K	C33			CC73GCH1H220J	CHIP C 22PF J	
R45-55			RK73GB1J102J	CHIP R 1.0K J 1/16W	K2	C34			CC73GCH1H331J	CHIP C 330PF J	
R56			RK73GB1J153J	CHIP R 15K J 1/16W		C35			CC73GCH1H100D	CHIP C 10PF D	
R57			R92-1252-05	CHIP R 0 OHM		C36			CC73GCH1H150J	CHIP C 15PF J	
R59			RK73GB1J102J	CHIP R 1.0K J 1/16W		C37			CK73GB1H471K	CHIP C 470PF K	
R60			RK73GB1J101J	CHIP R 100 J 1/16W		C38			CC73GCH1H050C	CHIP C 5.0PF C	
R63,64			R92-1252-05	CHIP R 0 OHM		C39			CK73GB1H102K	CHIP C 1000PF K	
R66,67			R92-1252-05	CHIP R 0 OHM		C40			C92-0560-05	CHIP-TAN 10UF 6.3WV	
R101			RK73GB1J104J	CHIP R 100K J 1/16W		C41			CK73GB1H471K	CHIP C 470PF K	
R102-104			RK73GB1J103J	CHIP R 10K J 1/16W		C42			CC73GCH1H100D	CHIP C 10PF D	
R105			RK73GB1J471J	CHIP R 470 J 1/16W		C43			C92-0507-05	CHIP-TAN 4.7UF 6.3WV	
R106			RK73GB1J274J	CHIP R 270K J 1/16W		C45			CC73GCH1H120J	CHIP C 12PF J	
R107			RK73GB1J472J	CHIP R 4.7K J 1/16W		C46			CK73GB1H102K	CHIP C 1000PF K	
R108			RK73GB1J100J	CHIP R 10 J 1/16W							
R502			RK73GB1J102J	CHIP R 1.0K J 1/16W							

## PARTS LIST

TX-RX UNIT (X57-5390-10)

Ref. No.	Address	New parts	Parts No.	Description	Destination	Ref. No.	Address	New parts	Parts No.	Description	Destination
C47			CK73GB1H471K	CHIP C 470PF K		C303			CK73GB1C104K	CHIP C 0.10UF K	
C48			CK73GB1H102K	CHIP C 1000PF K		C304			CK73GB1H102K	CHIP C 1000PF K	
C49,50			CK73GB1H471K	CHIP C 470PF K		C305			CK73GB1H103K	CHIP C 0.010UF K	
C52			CK73GB1H102K	CHIP C 1000PF K		C306-308			CK73GB1H102K	CHIP C 1000PF K	
C53-57			CK73GB1H471K	CHIP C 470PF K		C309			C92-0602-05	CHIP-TAN 1.0UF 10WV	
C58			CC73GCH1H101J	CHIP C 100PF J		C310,311			CK73GB1C104K	CHIP C 0.10UF K	
C59			CC73GCH1H680J	CHIP C 68PF J		C312			CK73GB1C333K	CHIP C 0.033UF K	
C60-62			CK73GB1H471K	CHIP C 470PF K		C313,314			CC73GCH1H220J	CHIP C 22PF J	
C63			CC73GCH1H101J	CHIP C 100PF J		C315			CK73GB1H102K	CHIP C 1000PF K	
C64			CK73GB1H471K	CHIP C 470PF K		C316			CC73GCH1H820J	CHIP C 82PF J	
C65			CK73GB1H103K	CHIP C 0.010UF K		C317			CK73GB1H102K	CHIP C 1000PF K	
C66,67			CK73GB1H471K	CHIP C 470PF K		C318			CK73GB1C104K	CHIP C 0.10UF K	
C69			CC73GCH1H070D	CHIP C 7.0PF D		C319			CK73GB1H103K	CHIP C 0.010UF K	
C70			CC73GCH1H101J	CHIP C 100PF J		C320			C92-0560-05	CHIP-TAN 10UF 6.3WV	
C71			CK73FB1C474K	CHIP C 0.47UF K		C321			CK73GB1C104K	CHIP C 0.10UF K	
C73			C92-0512-05	CHIP-TAN 1.0UF 16WV		C323			C92-0560-05	CHIP-TAN 10UF 6.3WV	
C76			CC73GCH1H101J	CHIP C 100PF J		C327			CK73GB1H103K	CHIP C 0.010UF K	
C78			CK73GB1H103K	CHIP C 0.010UF K		C330-332			CK73GB1H103K	CHIP C 0.010UF K	
C79			CK73FB1C474K	CHIP C 0.47UF K		C333			CK73GB1H102K	CHIP C 1000PF K	
C81			CK73GB1H102K	CHIP C 1000PF K		C334			CK73GB1C104K	CHIP C 0.10UF K	
C82			CC73GCH1H680J	CHIP C 68PF J		C335			CK73GB1H102K	CHIP C 1000PF K	
C83			CC73GCH1H200J	CHIP C 20PF J		C336			CK73GB1A224K	CHIP C 0.22UF K	
C84,85			CK73GB1H102K	CHIP C 1000PF K		C337			CK73FB1C334K	CHIP C 0.33UF K	
C86			CC73GCH1H220J	CHIP C 22PF J		C400,401			CC73GCH1H101J	CHIP C 100PF J	
C87			CC73GCH1H680J	CHIP C 68PF J		C403-411			CC73GCH1H101J	CHIP C 100PF J	
C88			CC73GCH1H120J	CHIP C 12PF J		C413			CK73GB1H471K	CHIP C 470PF K	
C89			CC73GCH1H090D	CHIP C 9.0PF D		C414			CK73GB1H103K	CHIP C 0.010UF K	
C90			CC73GCH1H270J	CHIP C 27PF J		C415			CK73FB1C105K	CHIP C 1.0UF K	
C91			CC73GCH1H100D	CHIP C 10PF D		C416,417			CK73GB1H471K	CHIP C 470PF K	
C92			CC73GCH1H120J	CHIP C 12PF J		C419			C92-0589-05	CHIP-TAN 47UF 6.3WV	
C93,94			CC73GCH1H100D	CHIP C 10PF D		C420			C92-0702-05	ELECTRO 47UF 6.3WV	
C95-97			CK73GB1H102K	CHIP C 1000PF K		C421			CK73GB1H471K	CHIP C 470PF K	
C99			CK73GB1H102K	CHIP C 1000PF K		C422			CK73FB1C105K	CHIP C 1.0UF K	
C100			C92-0560-05	CHIP-TAN 10UF 6.3WV		C423,424			CK73GB1H471K	CHIP C 470PF K	
C101			CK73FB1C105K	CHIP C 1.0UF K		C425			CK73GB1H103K	CHIP C 0.010UF K	
C202			CC73GCH1H060D	CHIP C 6.0PF D		C426			CK73GB1H471K	CHIP C 470PF K	
C204			CK73GB1H102K	CHIP C 1000PF K		C427			CK73GB1H103K	CHIP C 0.010UF K	
C205			CC73GCH1H030C	CHIP C 3.0PF C		C428			C92-0004-05	CHIP-TAN 1.0UF 16WV	
C206,207			CK73GB1H102K	CHIP C 1000PF K		C429			CK73GB1H102K	CHIP C 1000PF K	
C209,210			CK73GB1H102K	CHIP C 1000PF K		C430			CK73FB1C105K	CHIP C 1.0UF K	
C212,213			CK73GB1H102K	CHIP C 1000PF K		C431			CK73GB1H471K	CHIP C 470PF K	
C214			CC73GCH1H060D	CHIP C 6.0PF D		C432			CK73FB1C105K	CHIP C 1.0UF K	
C215			CC73GCH1H030C	CHIP C 3.0PF C		C433			C92-0698-05	ELECTRO 47UF 10WV	
C216			CC73GCH1H1R5C	CHIP C 1.5PF C		C434,435			CK73GB1H471K	CHIP C 470PF K	
C217			CK73GB1H102K	CHIP C 1000PF K		C436			CK73FB1C105K	CHIP C 1.0UF K	
C219			CC73GCH1H060D	CHIP C 6.0PF D		C437			CK73GB1H472K	CHIP C 4700PF K	
C222			CC73GCH1H151J	CHIP C 150PF J		C438			CK73GB1H103K	CHIP C 0.010UF K	
C223			CC73GCH1H070D	CHIP C 7.0PF D		C439			CK73GB1E103K	CHIP C 0.010UF K	
C224			CK73GB1H471K	CHIP C 470PF K		C440			CK73GB1C273K	CHIP C 0.027UF K	
C225			CC73GCH1H151J	CHIP C 150PF J		C441,442			CK73GB1H102K	CHIP C 1000PF K	
C226-228			CK73GB1H471K	CHIP C 470PF K		C443			CK73GB1H222K	CHIP C 2200PF K	
C229,230			CK73GB1C104K	CHIP C 0.10UF K		C444			CC73GCH1H470J	CHIP C 47PF J	
C232			CC73GCH1H151J	CHIP C 150PF J		C445,446			CK73GB1H222K	CHIP C 2200PF K	
C233			CK73GF1A105Z	CHIP C 1.0UF Z		C447,448			CC73GCH1H180J	CHIP C 18PF J	
C234			CK73GB1H102K	CHIP C 1000PF K		C449			CK73GB1H103K	CHIP C 0.010UF K	
C237			CK73GB1H102K	CHIP C 1000PF K		C450			C92-0713-05	CHIP-TAN 10UF 6.3WV	
C238			CK73GB1C273K	CHIP C 0.027UF K		C454			CC73GCH1H101J	CHIP C 100PF J	
C240			CC73GCH1H060D	CHIP C 6.0PF D		C456-477			CC73GCH1H101J	CHIP C 100PF J	
C300			CK73GB1H472K	CHIP C 4700PF K		C478			CK73GB1C104K	CHIP C 0.10UF K	
C301,302			CC73GCH1H221J	CHIP C 220PF J		C479			CC73GCH1H271J	CHIP C 270PF J	

## PARTS LIST

## TX-RX UNIT (X57-5390-10)

Ref. No.	Address	New parts	Parts No.	Description	Destination	Ref. No.	Address	New parts	Parts No.	Description	Destination
C480			CC73GCH1H221J	CHIP C 220PF J		CN401			E40-5947-05	FLAT CABLE CONNECTOR	
C481			CK73FB1C105K	CHIP C 1.0UF K		CN403			E40-5856-05	FLAT CABLE CONNECTOR	
C482			CK73GB1C104K	CHIP C 0.10UF K		CN404,405			E23-0342-05	TEST TERMINAL	
C483			CK73GB1H102K	CHIP C 1000PF K							
C484			C92-0560-05	CHIP-TAN 10UF 6.3WV		F400			F53-0143-05	FUSE	
C485			CK73GB1H102K	CHIP C 1000PF K		CD300			L79-1072-05	TUNING COIL	
C487			CK73GB1C104K	CHIP C 0.10UF K		CF300,301			L72-0916-05	CERAMIC FILTER	
C488			C92-0565-05	CHIP-TAN 6.8UF 10WV		CF302,303			L72-0939-05	CERAMIC FILTER	
C600			CK73GB1C473K	CHIP C 0.047UF K		L1			L92-0138-05	FERRITE CHIP	
C601			C92-0003-05	CHIP-TAN 0.47UF 25WV		L3			L92-0138-05	FERRITE CHIP	
C602			CK73GB1C104K	CHIP C 0.10UF K		L4			L40-4775-44	SMALL FIXED INDUCTOR (47.0NH)	
C603			CK73GB1C683K	CHIP C 0.068UF K		L5			L40-3981-37	SMALL FIXED INDUCTOR (0.390UH)	
C604			CK73GB1H103K	CHIP C 0.010UF K		L6			L40-6875-44	SMALL FIXED INDUCTOR (68.0NH)	
C606			CK73GB1H222K	CHIP C 2200PF K		L7			L40-1085-44	SMALL FIXED INDUCTOR (100.0NH)	
C607			CC73GCH1H101J	CHIP C 100PF J		L8			L40-5675-44	SMALL FIXED INDUCTOR (56.0NH)	
C608			CK73GB1H103K	CHIP C 0.010UF K		L9			L40-1081-36	SMALL FIXED INDUCTOR (100NH)	
C609			CC73GCH1H121J	CHIP C 120PF J		L10,11			L92-0149-05	FERRITE CHIP	
C610			CK73GB1H103K	CHIP C 0.010UF K		L12			L33-0763-05	SMALL FIXED INDUCTOR	
C611			CK73GB1E123K	CHIP C 0.012UF K		L13			L40-1095-34	SMALL FIXED INDUCTOR (1UH)	
C612			C92-0714-05	CHIP-TAN 4.7UF 6.3WV		L14			L33-0765-05	SMALL FIXED INDUCTOR	
C613			CK73GB1H103K	CHIP C 0.010UF K		L15,16			L33-1226-05	SMALL FIXED INDUCTOR	
C619			CC73GCH1H471J	CHIP C 470PF J		L17			L40-1092-81	SMALL FIXED INDUCTOR	
C621			CK73GB1C104K	CHIP C 0.10UF K		L18			L40-4791-37	SMALL FIXED INDUCTOR (4.700UH)	
C623			CK73GB1E103K	CHIP C 0.010UF K		L20,21			L92-0140-05	FERRITE CHIP	
C625,626			CK73GB1C104K	CHIP C 0.10UF K		L22			L40-8275-44	SMALL FIXED INDUCTOR (82.0NH)	
C627			CK73GB1H122J	CHIP C 1200PF J		L23			L92-0138-05	FERRITE CHIP	
C629,630			CK73GB1H103K	CHIP C 0.010UF K		L201			L34-4492-05	COIL	
C631,632			CK73GB1C104K	CHIP C 0.10UF K		L202			L34-4493-05	COIL	
C633			CK73GB1H103K	CHIP C 0.010UF K		L204			L40-6885-34	SMALL FIXED INDUCTOR (680NH)	
C634,635			CK73GB1H562J	CHIP C 5600PF J		L205			L34-4493-05	COIL	
C636			CK73GB1C333K	CHIP C 0.033UF K		L206			L34-4492-05	COIL	
C637			CK73GB1H562J	CHIP C 5600PF J		L207			L40-8275-44	SMALL FIXED INDUCTOR (82.0NH)	
C638			CK73GB1H272J	CHIP C 2700PF J		L208			L40-5675-44	SMALL FIXED INDUCTOR (56.0NH)	
C639			CC73GCH1H090D	CHIP C 9.0PF D		L209,210			L40-8275-44	SMALL FIXED INDUCTOR (82.0NH)	
C640,641			CK73GB1H272J	CHIP C 2700PF J		L211,212			L39-1272-05	TOROIDAL COIL	
C642			CC73HCH1H151J	CHIP C 150PF J		L213			L92-0138-05	FERRITE CHIP	
C643			CK73GB1H122K	CHIP C 1200PF K		L214			L39-1272-05	TOROIDAL COIL	
C644			CK73HB1H102K	CHIP C 1000PF K		L215			L40-8275-44	SMALL FIXED INDUCTOR (82.0NH)	
C645			CC73GCH1H090D	CHIP C 9.0PF D		L216			L40-1095-34	SMALL FIXED INDUCTOR (1UH)	
C646			C92-0713-05	CHIP-TAN 10UF 6.3WV		L301			L40-3391-37	SMALL FIXED INDUCTOR (3.300UH)	
C647			CK73HB1A104K	CHIP C 0.10UF K		L400			L92-0136-05	FERRITE CHIP	
C648			CC73HCH1H101J	CHIP C 100PF J		L401			L92-0138-05	FERRITE CHIP	
C649-651			CK73HB1A104K	CHIP C 0.10UF K		L404			L40-1001-37	SMALL FIXED INDUCTOR (10.00UH)	
C652			C92-0714-05	CHIP-TAN 4.7UF 6.3WV		L601			L92-0162-05	BEADS CORE	
C653,654			CK73HB1E472K	CHIP C 4700PF K		L800		*	L78-0487-05	VCO	
C655			CC73HCH1H101J	CHIP C 100PF J		L905			L92-0138-05	FERRITE CHIP	
C656			CK73FB1H563K	CHIP C 0.056UF K		X1			L77-1798-05	VXCO (16.8MHZ)	
C657			C92-0714-05	CHIP-TAN 4.7UF 6.3WV		X300			L77-1742-05	CRYSTAL RESONATOR (45.305MHZ)	
C659			CK73GB1C104K	CHIP C 0.10UF K		X400			L78-0453-05	RESONATOR (12.0MHZ)	
C660			C92-0560-05	CHIP-TAN 10UF 6.3WV		X600			L77-1708-05	CRYSTAL RESONATOR (3.579545MHZ)	
C661			CK73GB1C104K	CHIP C 0.10UF K		XF301		*	L71-0588-05	MCF (44.85MHZ)	
C663			CK73HB1H102K	CHIP C 1000PF K		CP1			R90-0714-05	MULTI-COMP 10K X4	
C664			CK73HB1A104K	CHIP C 0.10UF K		CP700-707			R90-0741-05	MULTIPLE RESISTOR	
C665			CK73GB1C333K	CHIP C 0.033UF K		CP711-716			R90-0741-05	MULTIPLE RESISTOR	
C666			CK73GB1E153K	CHIP C 0.015UF K		CP718-721			R90-0741-05	MULTIPLE RESISTOR	
C668			CK73GB1H102K	CHIP C 1000PF K		R4			R92-1252-05	CHIP R 0 OHM	
C669			CC73GCH1H101J	CHIP C 100PF J		R5			RK73GB1J104J	CHIP R 100K J 1/16W	
C681			CK73GB1E103K	CHIP C 0.010UF K		R6			RK73GB1J473J	CHIP R 47K J 1/16W	
CN400			E40-5563-05	FLAT CABLE CONNECTOR		R7			RK73GB1J104J	CHIP R 100K J 1/16W	



## PARTS LIST

TX-RX UNIT (X57-5390-10)

Ref. No.	Address	New parts	Parts No.	Description	Destination	Ref. No.	Address	New parts	Parts No.	Description	Destination
R8			RK73GB1J103J	CHIP R 10K J 1/16W		R208			RK73GB1J122J	CHIP R 1.2K J 1/16W	
R9			RK73GB1J682J	CHIP R 6.8K J 1/16W		R209			RK73GB1J330J	CHIP R 33 J 1/16W	
R11			RK73GB1J563J	CHIP R 56K J 1/16W		R210,211			RK73GB1J104J	CHIP R 100K J 1/16W	
R12			RK73GB1J100J	CHIP R 10 J 1/16W		R212			RK73GB1J222J	CHIP R 2.2K J 1/16W	
R13			RK73GB1J104J	CHIP R 100K J 1/16W		R213			RK73GB1J271J	CHIP R 270 J 1/16W	
R14			RK73GB1J184J	CHIP R 180K J 1/16W		R214			RK73GB1J101J	CHIP R 100 J 1/16W	
R15			RK73GB1J682J	CHIP R 6.8K J 1/16W		R215,216			R92-1252-05	CHIP R 0 OHM	
R16			RK73GB1J151J	CHIP R 150 J 1/16W		R219			R92-1252-05	CHIP R 0 OHM	
R17			RK73GB1J394J	CHIP R 390K J 1/16W		R222			R92-1252-05	CHIP R 0 OHM	
R18			RK73GB1J102J	CHIP R 1.0K J 1/16W		R226			RK73GB1J100J	CHIP R 10 J 1/16W	
R20-23			RK73GB1J473J	CHIP R 47K J 1/16W		R300			RK73GB1J220J	CHIP R 22 J 1/16W	
R24			RK73GB1J101J	CHIP R 100 J 1/16W		R301			RK73GB1J102J	CHIP R 1.0K J 1/16W	
R25			RK73GB1J224J	CHIP R 220K J 1/16W		R303			RK73GB1J274J	CHIP R 270K J 1/16W	
R27			RK73GB1J472J	CHIP R 4.7K J 1/16W		R304			RK73GB1J182J	CHIP R 1.8K J 1/16W	
R28			RK73GB1J223J	CHIP R 22K J 1/16W		R305			RK73GB1J183J	CHIP R 18K J 1/16W	
R29			RK73GB1J104J	CHIP R 100K J 1/16W		R306			RK73GB1J271J	CHIP R 270 J 1/16W	
R31			RK73GB1J471J	CHIP R 470 J 1/16W		R307			RK73GB1J223J	CHIP R 22K J 1/16W	
R32			RK73GB1J122J	CHIP R 1.2K J 1/16W		R308			R92-1252-05	CHIP R 0 OHM	
R33			RK73GB1J103J	CHIP R 10K J 1/16W		R313			RK73GB1J331J	CHIP R 330 J 1/16W	
R34			RK73GB1J223J	CHIP R 22K J 1/16W		R315			RK73GB1J472J	CHIP R 4.7K J 1/16W	
R35			RK73EB2ER39K	CHIP R 0.39 K 1/4W		R317,318			RK73GB1J223J	CHIP R 22K J 1/16W	
R36			R92-1252-05	CHIP R 0 OHM		R319			RK73GB1J123J	CHIP R 12K J 1/16W	
R37			RK73EB2ER39K	CHIP R 0.39 K 1/4W		R320			RK73GB1J392J	CHIP R 3.9K J 1/16W	
R38			RK73GB1J222J	CHIP R 2.2K J 1/16W		R321			RK73GB1J102J	CHIP R 1.0K J 1/16W	
R39			RK73EB2ER39K	CHIP R 0.39 K 1/4W		R323			RK73GB1J471J	CHIP R 470 J 1/16W	
R40			RK73GB1J822J	CHIP R 8.2K J 1/16W		R324,325			RK73GB1J223J	CHIP R 22K J 1/16W	
R41,42			RN73GH1J154D	CHIP R 150K D 1/16W		R328			RK73GB1J472J	CHIP R 4.7K J 1/16W	
R43			RK73GB1J180J	CHIP R 18 J 1/16W		R329			RK73GB1J104J	CHIP R 100K J 1/16W	
R44,45			RN73GH1J154D	CHIP R 150K D 1/16W		R330			R92-1252-05	CHIP R 0 OHM	
R46			RK73GB1J101J	CHIP R 100 J 1/16W		R331			RK73GB1J104J	CHIP R 100K J 1/16W	
R47,48			RN73GH1J154D	CHIP R 150K D 1/16W		R332			RK73GB1J224J	CHIP R 220K J 1/16W	
R49			RK73GB1J101J	CHIP R 100 J 1/16W		R333			R92-1252-05	CHIP R 0 OHM	
R50			RK73GB1J470J	CHIP R 47 J 1/16W		R334			RK73GB1J100J	CHIP R 10 J 1/16W	
R51			R92-1252-05	CHIP R 0 OHM		R335			RK73GB1J681J	CHIP R 680 J 1/16W	
R52			RK73GB1J103J	CHIP R 10K J 1/16W		R336			RK73GB1J224J	CHIP R 220K J 1/16W	
R53			RK73GB1J560J	CHIP R 56 J 1/16W		R337			RK73GB1J332J	CHIP R 3.3K J 1/16W	
R54			RK73GB1J152J	CHIP R 1.5K J 1/16W		R339			RK73GB1J473J	CHIP R 47K J 1/16W	
R56			RK73GB1J473J	CHIP R 47K J 1/16W		R341			RK73GB1J473J	CHIP R 47K J 1/16W	
R57			RK73GB1J104J	CHIP R 100K J 1/16W		R400			RK73GB1J102J	CHIP R 1.0K J 1/16W	
R58			RK73GB1J105J	CHIP R 1.0M J 1/16W		R401			RK73GB1J272J	CHIP R 2.7K J 1/16W	
R59			RK73GB1J104J	CHIP R 100K J 1/16W		R402			RK73GB1J332J	CHIP R 3.3K J 1/16W	
R60			RK73GB1J221J	CHIP R 220 J 1/16W		R403			RK73GB1J473J	CHIP R 47K J 1/16W	
R61			R92-1252-05	CHIP R 0 OHM		R404			RK73GB1J182J	CHIP R 1.8K J 1/16W	
R65			RK73GB1J103J	CHIP R 10K J 1/16W		R405			RK73GB1J332J	CHIP R 3.3K J 1/16W	
R67			RK73GB1J102J	CHIP R 1.0K J 1/16W		R406			RK73GB1J100J	CHIP R 10 J 1/16W	
R69-71			RK73GB1J391J	CHIP R 390 J 1/16W		R407			RK73GB1J102J	CHIP R 1.0K J 1/16W	
R73			RK73GB1J223J	CHIP R 22K J 1/16W		R408			RK73GB1J104J	CHIP R 100K J 1/16W	
R74			RK73GB1J101J	CHIP R 100 J 1/16W		R409			RK73GB1J102J	CHIP R 1.0K J 1/16W	
R75			RK73GB1J102J	CHIP R 1.0K J 1/16W		R410			RK73GB1J272J	CHIP R 2.7K J 1/16W	
R76			RK73GB1J101J	CHIP R 100 J 1/16W		R411			RK73GB1J821J	CHIP R 820 J 1/16W	
R77			RK73GB1J560J	CHIP R 56 J 1/16W		R412			RK73GB1J182J	CHIP R 1.8K J 1/16W	
R79			RK73GB1J104J	CHIP R 100K J 1/16W		R413			RK73GB1J473J	CHIP R 47K J 1/16W	
R82			R92-1252-05	CHIP R 0 OHM		R414			R92-1252-05	CHIP R 0 OHM	
R200			RK73GB1J473J	CHIP R 47K J 1/16W		R415			RK73GB1J471J	CHIP R 470 J 1/16W	
R201			RK73GB1J104J	CHIP R 100K J 1/16W		R416			RK73GB1J104J	CHIP R 100K J 1/16W	
R202,203			RK73GB1J103J	CHIP R 10K J 1/16W		R418,419			RK73GB1J104J	CHIP R 100K J 1/16W	
R204			RK73GB1J121J	CHIP R 120 J 1/16W		R420			RK73GB1J103J	CHIP R 10K J 1/16W	
R205			RK73GB1J104J	CHIP R 100K J 1/16W		R421			RK73GB1J223J	CHIP R 22K J 1/16W	
R206			RK73GB1J473J	CHIP R 47K J 1/16W		R422			RK73GB1J103J	CHIP R 10K J 1/16W	
R207			RK73GB1J100J	CHIP R 10 J 1/16W		R423			RK73GB1J473J	CHIP R 47K J 1/16W	

## PARTS LIST

## TX-RX UNIT (X57-5390-10)

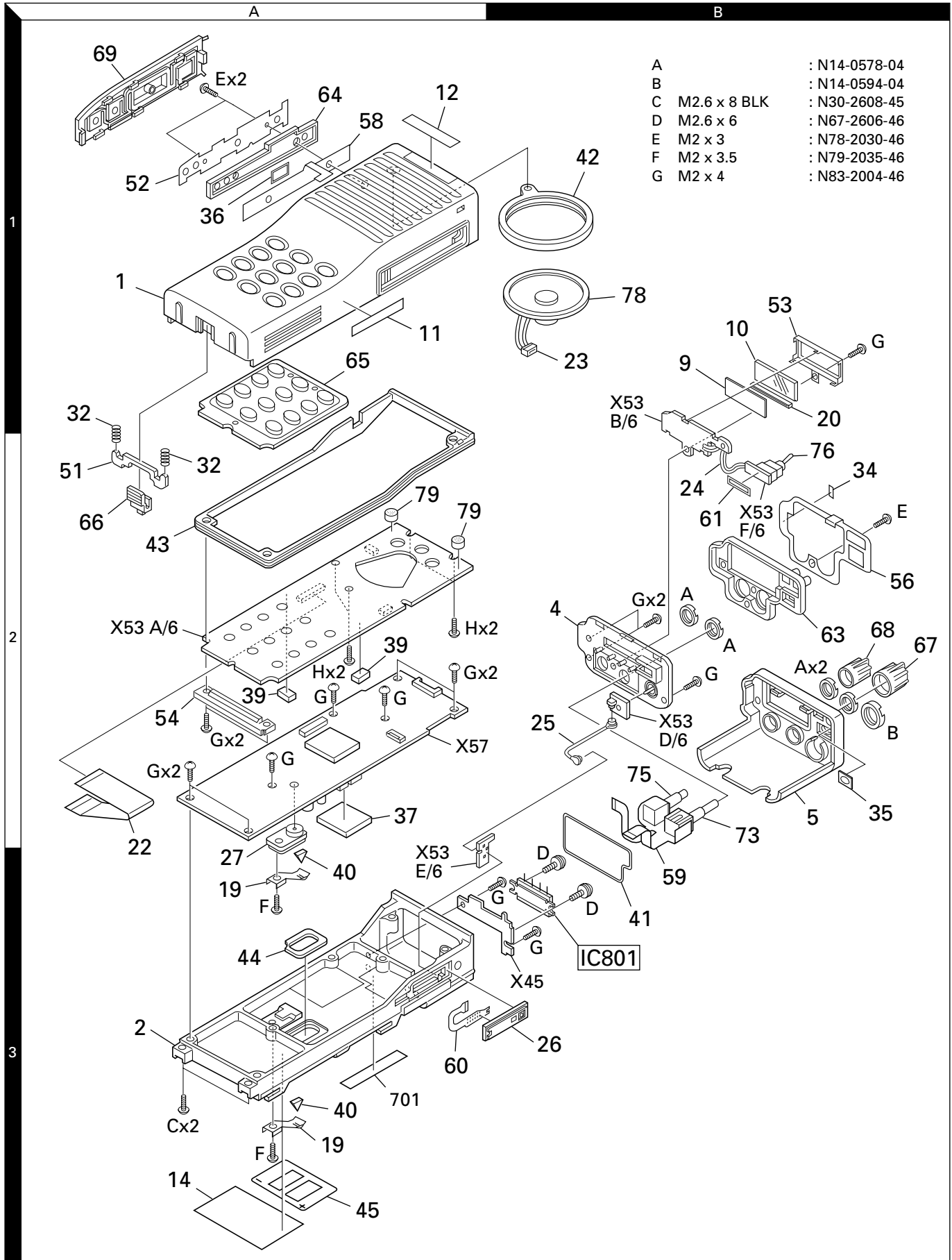
Ref. No.	Address	New parts	Parts No.	Description	Destination	Ref. No.	Address	New parts	Parts No.	Description	Destination
R424			RK73GB1J103J	CHIP R 10K J 1/16W		R618			RK73GB1J683J	CHIP R 68K J 1/16W	
R425			RK73GB1J102J	CHIP R 1.0K J 1/16W		R619			RK73GB1J101J	CHIP R 100 J 1/16W	
R426,427			RK73GB1J103J	CHIP R 10K J 1/16W		R621			RK73GB1J103J	CHIP R 10K J 1/16W	
R428			RK73GB1J472J	CHIP R 4.7K J 1/16W		R622			RK73GB1J223J	CHIP R 22K J 1/16W	
R429			RK73GB1J103J	CHIP R 10K J 1/16W		R623			RK73GB1J334J	CHIP R 330K J 1/16W	
R430			RK73GB1J473J	CHIP R 47K J 1/16W		R624			RK73GB1J273J	CHIP R 27K J 1/16W	
R431			RK73GB1J102J	CHIP R 1.0K J 1/16W		R626			RK73GB1J104J	CHIP R 100K J 1/16W	
R432,433			RK73GB1J473J	CHIP R 47K J 1/16W		R628			RK73GB1J334J	CHIP R 330K J 1/16W	
R434			RK73GB1J103J	CHIP R 10K J 1/16W		R629			RK73GB1J223J	CHIP R 22K J 1/16W	
R435,436			RK73GB1J102J	CHIP R 1.0K J 1/16W		R635			RK73GB1J393J	CHIP R 39K J 1/16W	
R437			RK73GB1J473J	CHIP R 47K J 1/16W		R636,637			R92-1252-05	CHIP R 0 OHM	
R438-441			RK73GB1J102J	CHIP R 1.0K J 1/16W		R638			RK73GB1J472J	CHIP R 4.7K J 1/16W	
R442			RK73GB1J152J	CHIP R 1.5K J 1/16W		R639			RN73GH1J913D	CHIP R 91K D 1/16W	
R443			RK73GB1J821J	CHIP R 820 J 1/16W		R640			RN73GH1J683D	CHIP R 68K D 1/16W	
R444			R92-0670-05	CHIP R 0 OHM		R641			RN73GH1J913D	CHIP R 91K D 1/16W	
R445			R92-1252-05	CHIP R 0 OHM		R642			RN73GH1J333D	CHIP R 33K D 1/16W	
R446			RK73GB1J472J	CHIP R 4.7K J 1/16W		R643			RK73GB1J564J	CHIP R 560K J 1/16W	
R447			RK73GB1J473J	CHIP R 47K J 1/16W		R644			RK73GB1J474J	CHIP R 470K J 1/16W	
R448			RK73GB1J102J	CHIP R 1.0K J 1/16W		R645			RN73GH1J274D	CHIP R 270K D 1/16W	
R449-451			RK73GB1J473J	CHIP R 47K J 1/16W		R646			RK73GB1J472J	CHIP R 4.7K J 1/16W	
R452-455			RK73GB1J104J	CHIP R 100K J 1/16W		R647			R92-1252-05	CHIP R 0 OHM	
R456-459			RK73GB1J473J	CHIP R 47K J 1/16W		R648			RN73GH1J913D	CHIP R 91K D 1/16W	
R460-462			R92-1252-05	CHIP R 0 OHM		R649			RN73HH1J682D	CHIP R 6.8K D 1/16W	
R464			RK73GB1J473J	CHIP R 47K J 1/16W		R650			RK73GB1J103J	CHIP R 10K J 1/16W	
R466			R92-1252-05	CHIP R 0 OHM		R651			RK73GB1J155J	CHIP R 1.5M J 1/16W	
R467,468			RK73GB1J473J	CHIP R 47K J 1/16W		R652			RK73HB1J473J	CHIP R 47K J 1/16W	
R469			RK73GB1J102J	CHIP R 1.0K J 1/16W		R653			RK73HB1J184J	CHIP R 180K J 1/16W	
R470-472			R92-1252-05	CHIP R 0 OHM		R654			RN73HH1J683D	CHIP R 68K D 1/16W	
R474			RK73GB1J103J	CHIP R 10K J 1/16W		R655			RK73HB1J474J	CHIP R 470K J 1/16W	
R475-477			RK73GB1J101J	CHIP R 100 J 1/16W		R656			RN73HH1J682D	CHIP R 6.8K D 1/16W	
R478			RK73GB1J471J	CHIP R 470 J 1/16W		R657			RK73GB1J101J	CHIP R 100 J 1/16W	
R479			RK73GB1J473J	CHIP R 47K J 1/16W		R658			RK73HB1J224J	CHIP R 220K J 1/16W	
R480			RK73GB1J472J	CHIP R 4.7K J 1/16W		R659			RK73HB1J103J	CHIP R 10K J 1/16W	
R481			R92-1252-05	CHIP R 0 OHM		R660			RK73HB1J223J	CHIP R 22K J 1/16W	
R482			RK73GB1J102J	CHIP R 1.0K J 1/16W		R661			RK73HB1J394J	CHIP R 390K J 1/16W	
R483			RK73GB1J473J	CHIP R 47K J 1/16W		R662			RK73HB1J470J	CHIP R 47 J 1/16W	
R484			RK73GB1J102J	CHIP R 1.0K J 1/16W		R663			RK73HB1J220J	CHIP R 22 J 1/16W	
R486			RK73GB1J473J	CHIP R 47K J 1/16W		R664			RK73GB1J333J	CHIP R 33K J 1/16W	
R487			RK73GB1J102J	CHIP R 1.0K J 1/16W		R665,666			R92-1252-05	CHIP R 0 OHM	
R488			R92-1368-05	CHIP R 0 OHM		R668			RK73GB1J334J	CHIP R 330K J 1/16W	
R489			RK73GB1J103J	CHIP R 10K J 1/16W		R669			R92-1252-05	CHIP R 0 OHM	
R490			RK73GB1J104J	CHIP R 100K J 1/16W		R670-673			RK73GB1J472J	CHIP R 4.7K J 1/16W	
R491			R92-1252-05	CHIP R 0 OHM		R674			RK73HB1J104J	CHIP R 100K J 1/16W	
R493			RK73GB1J100J	CHIP R 10 J 1/16W		R675			RK73HB1J473J	CHIP R 47K J 1/16W	
R494			RK73GB1J473J	CHIP R 47K J 1/16W		R677			RK73GB1J333J	CHIP R 33K J 1/16W	
R495			RK73GB1J471J	CHIP R 470 J 1/16W		R679			R92-1252-05	CHIP R 0 OHM	
R496			R92-1252-05	CHIP R 0 OHM		R688			R92-1368-05	CHIP R 0 OHM	
R601			RK73GB1J153J	CHIP R 15K J 1/16W		R742			RK73GB1J272J	CHIP R 2.7K J 1/16W	
R602			RK73GB1J223J	CHIP R 22K J 1/16W		R743			RK73GB1J473J	CHIP R 47K J 1/16W	
R603			R92-1252-05	CHIP R 0 OHM		R922			RK73GB1J103J	CHIP R 10K J 1/16W	
R605,606			R92-1252-05	CHIP R 0 OHM		R923,924			R92-1368-05	CHIP R 0 OHM	
R607			RK73GB1J153J	CHIP R 15K J 1/16W		D4			MA2S111	DIODE	
R608			RK73GB1J103J	CHIP R 10K J 1/16W		D5			DAN235E	DIODE	
R609			RK73GB1J154J	CHIP R 150K J 1/16W		D6			MA2S111	DIODE	
R610			RK73GB1J563J	CHIP R 56K J 1/16W		D8			DA221	DIODE	
R611			RK73GB1J184J	CHIP R 180K J 1/16W		D9			HZU4CLL	ZENER DIODE	
R612			RK73GB1J334J	CHIP R 330K J 1/16W		D10			MI809	DIODE	
R614			RK73GB1J184J	CHIP R 180K J 1/16W		D10			XB15A709	DIODE	
R615,616			RK73GB1J103J	CHIP R 10K J 1/16W		D11			MA77	DIODE	
R617			R92-1252-05	CHIP R 0 OHM							

## PARTS LIST

TX-RX UNIT (X57-5390-10)

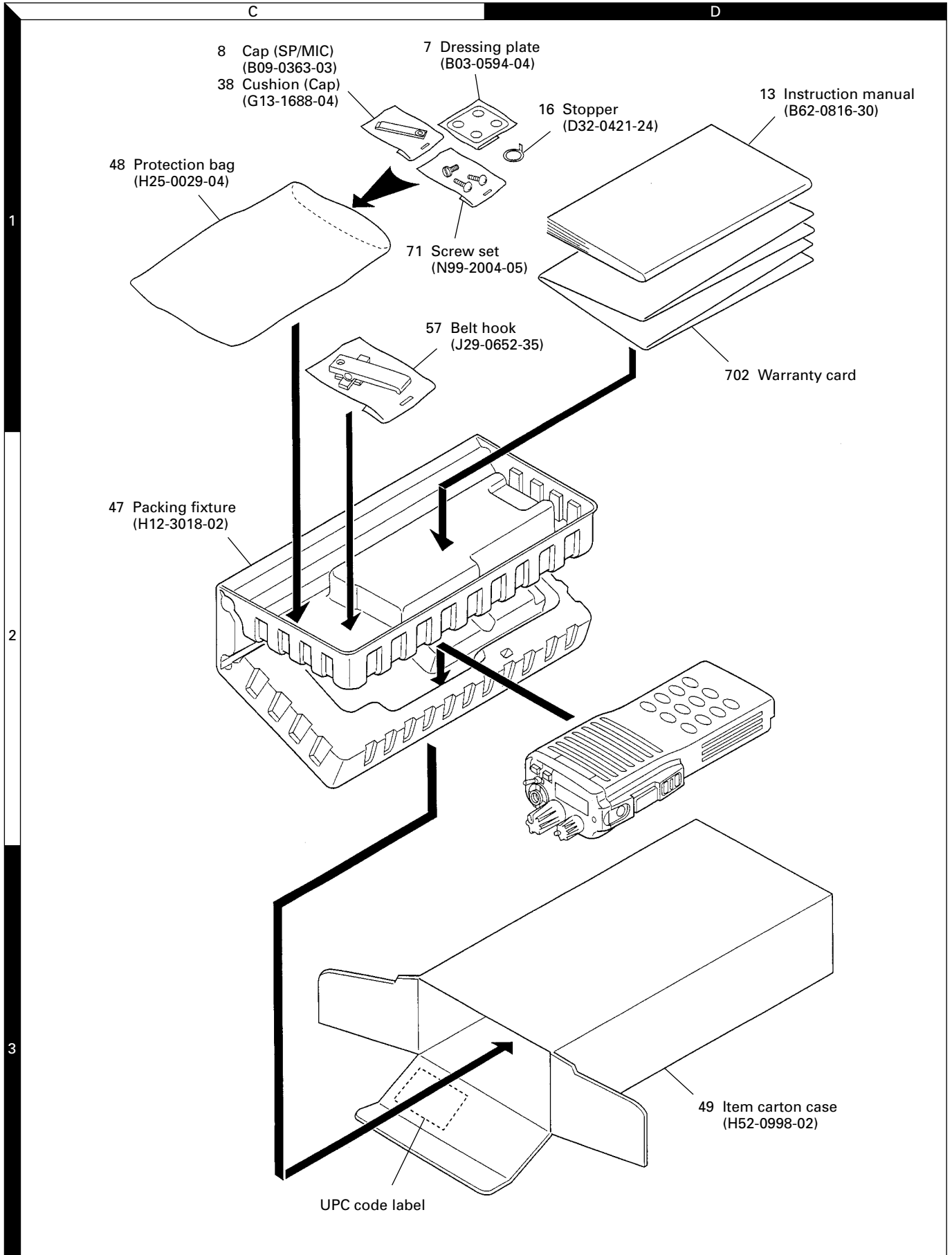
Ref. No.	Address	New parts	Parts No.	Description	Destination	Ref. No.	Address	New parts	Parts No.	Description	Destination
D200			HSM88AS	DIODE		Q407			2SC4215(Y)	TRANSISTOR	
D201-208			1SV273	VARIABLE CAPACITANCE DIODE		Q408-410			2SC4617(S)	TRANSISTOR	
D300			MA742	DIODE		Q411			2SB1132(Q,R)	TRANSISTOR	
D302,303			DAN235E	DIODE		Q412			2SK1824	FET	
D400			1SR154-400	DIODE		Q413			HN1L02FU	FET	
D401			MA2S111	DIODE		Q414			2SK1824	FET	
D402,403			NNCD6.8G	ZENER DIODE		Q415			2SJ517	FET	
D404			1SS301	DIODE		Q601,602			2SK1824	FET	
D408			1SS301	DIODE		TH301			157-104-65001	THERMISTOR	
D409			MA2S111	DIODE							
D601			MA742	DIODE							
D602,603			MA2S077	DIODE							
IC2			LMC7101BIM5	MOS IC							
IC3		*	M62354GP	MOS IC							
IC4		*	MAX865	MOS IC							
IC5			SA7025DK	MOS IC							
IC6			LMC7101BIM5	MOS IC							
IC7			NJM2904V	MOS IC							
IC200		*	GN2011(Q)	MOS IC							
IC300			TA31136FN	MOS IC							
IC301			TC7S66FU	MOS IC							
IC400			BU4094BCFV	MOS IC							
IC401,402			TK11250BM	MOS IC							
IC403-405			BU4094BCFV	MOS IC							
IC406			784214GC0648EU	MPU							
IC409			PST9132NR	MOS IC							
IC412			AT2408N10SI2.5	ROM IC							
IC413			TC75W51FU	MOS IC							
IC414			AT29C020-90TI	ROM IC							
IC415			TC7S02F	MOS IC							
IC600			LC73872M	MOS IC							
IC601			TC75W51FU	MOS IC							
IC602			TA75W01FU	MOS IC							
IC603			M62364FP	MOS IC							
IC604-606			TC75W51FU	MOS IC							
IC607			TC35453F	MOS IC							
Q1			DTA114EE	DIGITAL TRANSISTOR							
Q2			2SJ144(GR)	FET							
Q3			2SC4619(P,Q)	TRANSISTOR							
Q4			2SC4617(S)	TRANSISTOR							
Q5			2SC4619(P,Q)	TRANSISTOR							
Q6			2SC5110(O)	TRANSISTOR							
Q7			DTC114EE	DIGITAL TRANSISTOR							
Q8			2SC4988	TRANSISTOR							
Q9			DTA144EE	DIGITAL TRANSISTOR							
Q10			DTC144EE	DIGITAL TRANSISTOR							
Q13			2SK1824	FET							
Q200			3SK274*J	FET							
Q301			2SC4617(S)	TRANSISTOR							
Q302			2SK1215(E)	FET							
Q303			DTA144EE	DIGITAL TRANSISTOR							
Q304			DTC144EE	DIGITAL TRANSISTOR							
Q305			UMC4	TRANSISTOR							
Q400			UMG3N	TRANSISTOR							
Q401			UPA572T	FET							
Q402			FP210	TRANSISTOR							
Q403			2SJ243	FET							
Q404			DTC144EE	DIGITAL TRANSISTOR							
Q405			UMG3N	TRANSISTOR							
Q406			DTA123JE	DIGITAL TRANSISTOR							

## EXPLODED VIEW



A	:	N14-0578-04
B	:	N14-0594-04
C	M2.6 x 8 BLK	: N30-2608-45
D	M2.6 x 6	: N67-2606-46
E	M2 x 3	: N78-2030-46
F	M2 x 3.5	: N79-2035-46
G	M2 x 4	: N83-2004-46

## PACKING

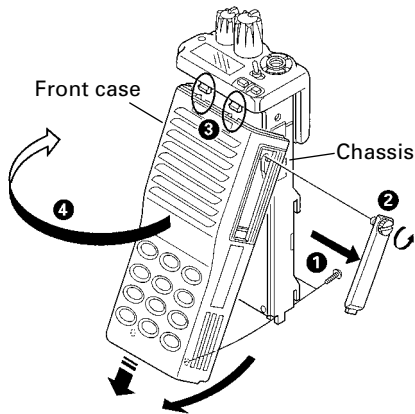


Parts with the exploded numbers larger than 700 are not supplied.

## DISASSEMBLY FOR REPAIR

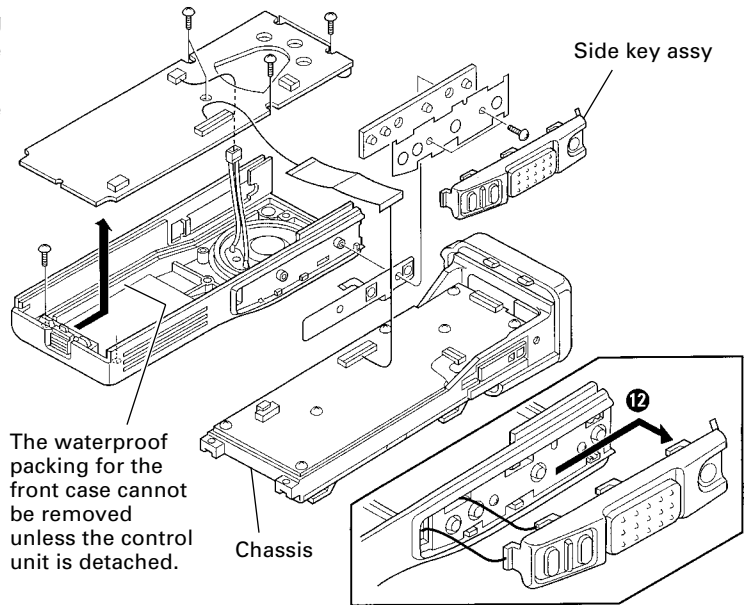
### Disassembly of Front Case and Chassis

1. Remove the 2 screws (1) and a cap fixed screw (2).
2. Press the chassis bottom upwards and remove the clips (3) at the top. The front case is still connected to the chassis by the FPC at this time so be gentle when lifting upwards, otherwise unwanted stress is applied on the FPC.
3. The front case and chassis can only be opened to the side when connected by the FPC (4).



### Remove the Side Key Assy

1. The side key assy is clips form a slide-hook structure. Lift up gently and take from the side (12).



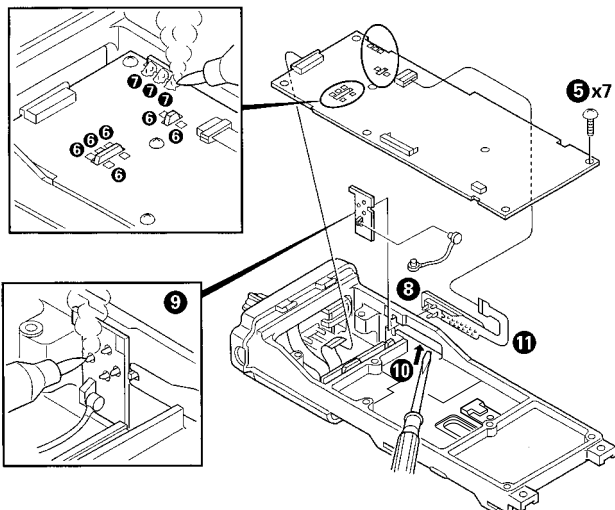
### Remove the TX-RX Unit from the Chassis

1. The TX-RX unit cannot be removed simply by removing the seven screws (5).
2. A total of 9 solder connections, 6 on the RF power module (6) and 3 on the antenna daughter board (7) must be disconnected.

### Remove the Universal Connector

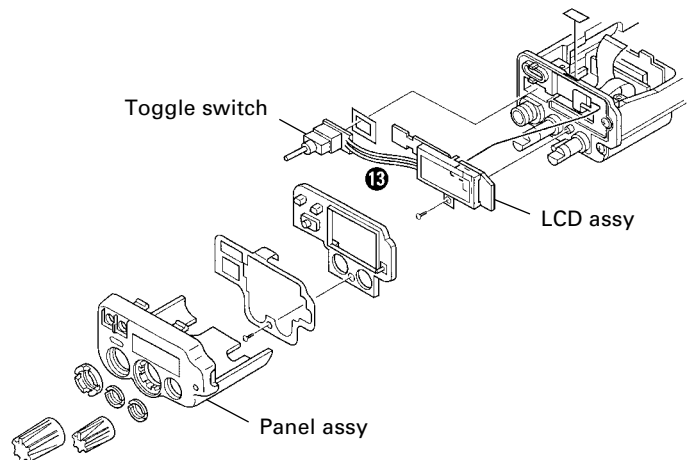
1. The universal connector (8) is fastened to the chassis with double-side tape.
2. First unsolder the connection on the antenna daughter board (9).
3. Press firmly with a tool such as a screwdriver and so that it can peel (10).

**Note :** You must replace both parts together when replacing the universal connector or the FPC (11).



### Disassembly of the Panel Assy

1. The LCD assy and toggle switch are joined by wire (13). Use caution not to break this wire during handling.



# ADJUSTMENT

## Test Equipment Required for Alignment

No.	Test Equipment	Major Specifications	
1	Standard Signal Generator (SSG)	Frequency Range Modulation Output	Maximum 600MHz or more. Frequency modulation and external modulation. -133dBm/0.05 $\mu$ V to 7dBm/501mV
2	Power Meter	Input Impedance Operation Frequency Measurement Range	50 $\Omega$ . Up to 600MHz. Full scale of 10W or so.
3	Deviation Meter	Frequency Range	100 to 200MHz.
4	Digital Volt Meter (DVM)	Measuring Range Accuracy	FS=18V or so. High input impedance for minimum circuit loading.
5	Oscilloscope		DC through 30MHz.
6	High Sensitivity Frequency Counter	Frequency Range Frequency Stability	Up to 1GHz or so. 0.2ppm or less.
7	Ammeter		5A.
8	AF Volt Meter (AF VTVM)	Frequency Range Voltage Range	50Hz to 1MHz. 1mV to 10V.
9	Audio Generator (AG)	Frequency Range Output	100Hz to 100kHz or more. 0 to 1V.
10	Distortion Meter	Capability Input Level	3% or less at 1kHz. 50mV to 10Vrms.
11	16 $\Omega$ Dummy Load		Approx. 16 $\Omega$ , 5W.
12	Regulated Power Supply		5V to 10V, approx. 5A Useful if ammeter equipped.
13	Spectrum Analyzer	Measuring Range	DC to 1GHz or more.
14	Tracking Generator	Center Frequency Frequency Deviation Output Voltage	50kHz to 600MHz. $\pm$ 35MHz. 100mV or more.

### ■ The following parts are required for adjustment

#### 1. Antenna connector adapter

The antenna connector of this radio uses an SMA terminal.

Use an antenna connector adapter [SMA(f) – BNC(f) or SMA(f) – N(f)] for adjustment. (The adapter is not provided as an option, so buy a commercially-available one.)

#### Note

When the antenna connector adapter touches the knob, draw out the knob to mount the connector.

#### 2. Universal connector

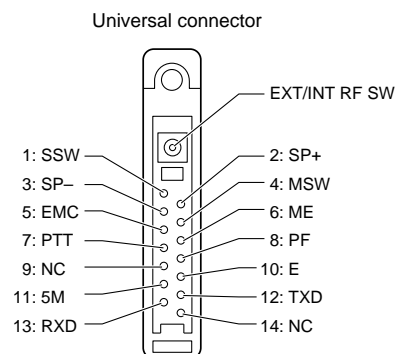
Use the interface cable (KPG-36) for PC tuning or the lead wire with plug (E30-3287-08) and screw (N08-0535-08) for panel tuning. Connect the plug to the universal connector of the radio and tighten the screw.

The lead wire with plug (E30-3287-08) and screw (N08-0535-08) terminals are as follows. Numbers are universal connector terminal numbers.

#### Caution

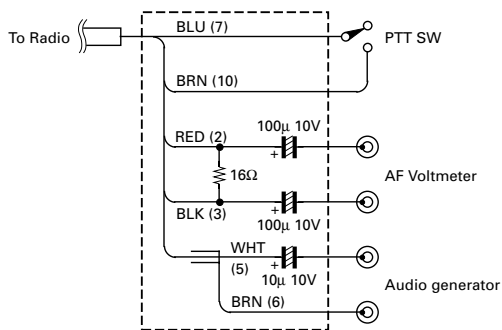
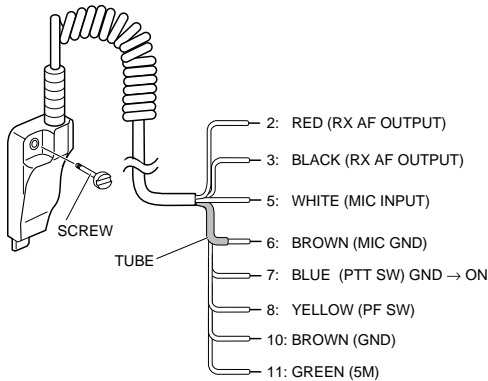
- When connecting the plug to the universal connector of the radio, a short circuit may occur. To prevent this, be sure to turn the radio POWER switch off.
- Since the RX AF output is a BTL output, there is a DC component. Isolate this with a capacitor or transformer as shown in the figure.
- Do not connect an instrument between red or black and GND.

#### • Universal connector



## ADJUSTMENT

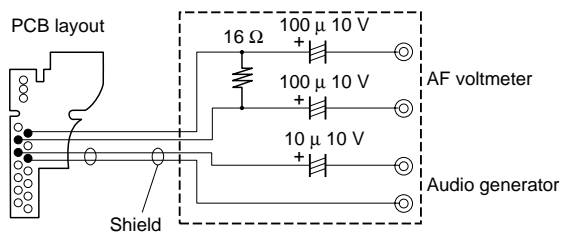
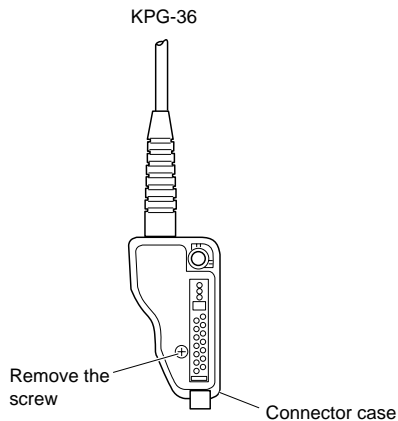
### • Panel tuning



### • PC tuning

Connect the wires to the PCB in the connector case of interface cable.

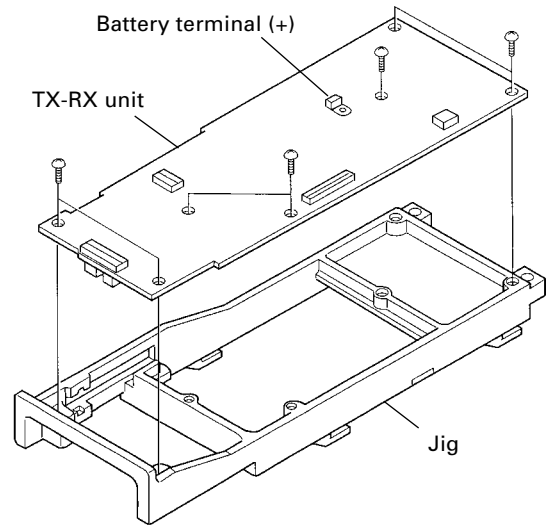
For output the wires out of the connector case, need to process the connector case.



### Repair Jig (Chassis)

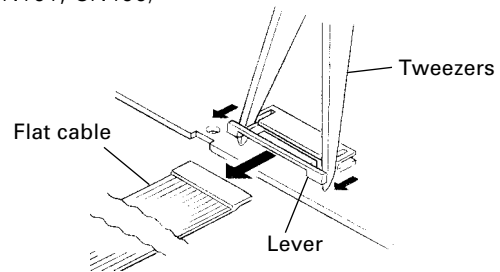
Use jig (part No.: A10-1399-03) for repairing the TK-390. Place the TX-RX unit on the jig and fit it with 7 screws.

**Note :** Supply power from an external power supply (Battery terminal : +, jig (chassis) : -)



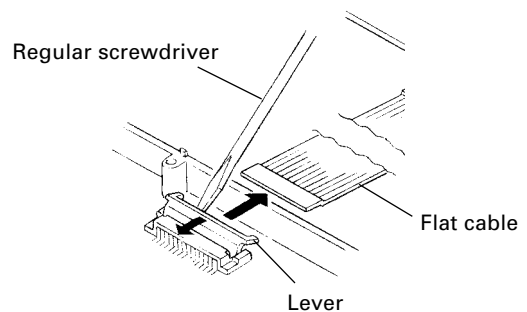
### How to Remove the Flat Cable

1. Gently draw out both sides of the connector lever uniformly in the direction of the arrow with tweezers. (CN101, CN400)



2. Gently rise up the connector lever in the direction of the arrow with a fine regular screwdriver or tweezers. (CN1, CN3, CN401, CN403)

**Note :** Gently push both sides of the connector lever, when put in the flat cable.





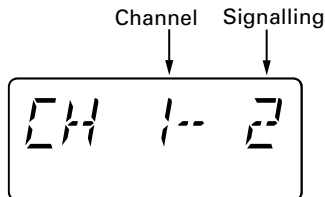
## ADJUSTMENT

### Panel Test Mode

This mode is used for making transceiver connection tests and clearing the memory.

To set Panel test mode, turn on the power with [Side 2] and [PTT] are still held down and then first release [PTT]. This mode cannot be set when disabled with the FPU.

In Panel test mode, when channel or signalling is selected, the signalling that was most recently used is displayed.



Key operations in Panel test mode are as follows.

- [Selector switch] : Use to select the test channel.
- [PTT] : For transmit.
- [Top 1] : For down signalling.
- [Top 2] : For up signalling.
- [Side 1] : For setting Panel tuning mode.
- [Side 2] : For switching power between Hi/Low.  
Enter the LCD all lamp mode if held down for 2 seconds.
- [Orange] : For monitoring.
- [Toggle] : For switching between Wide/Narrow.

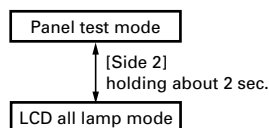
### Frequency (MHz)

CH	RX	TX
1	470.1000 (Center)	470.0000 (Center)
2	450.1000 (Low)	450.0000 (Low)
3	489.9000 (Hi)	489.9750 (Hi)
4	470.0000	470.0000
5	470.2000	470.2000
6	470.4000	470.4000

### Signalling

No.	Encode tone	Decode tone
1	None	None
2	QT 67.0Hz	QT 67.0Hz
3	QT 250.3Hz	QT 25.03Hz
4	DQT 023N	DQT 023N
5	None	2 tone 321.7/928.1Hz
6	DTMF (9)	DTMF (159)
7	MSK PN pattern	None
8	100Hz square wave	None
9	Single tone 1633Hz	None

### LCD all lamp mode



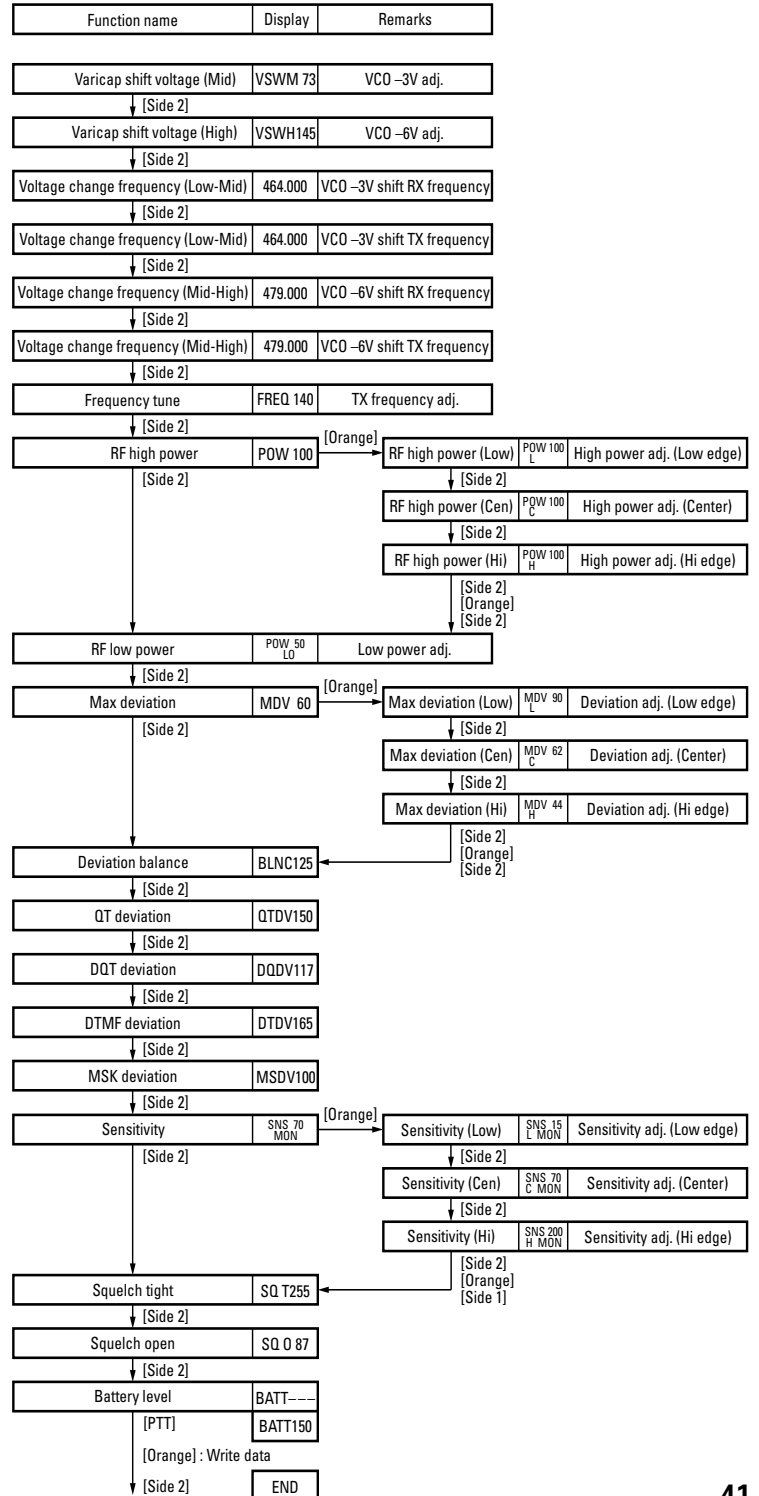
### Clear function

Pressing [PTT] while holding down [Orange] in Panel test mode, triggers the clear function which clears all transceiver data settings.

### Panel tuning mode

Press [Side 1] in Panel test mode to set Panel tuning mode.

**Note :** Different sample displays are shown.



## ADJUSTMENT

### Common Section

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
1. Varicap shift voltage Mid	1) Set panel tuning mode Push Side2 to select VSWM ***	DC VTVM	TX-RX	TP2	Panel	Top1/ Top2	-3V	±0.1V
High	2) Push Side2 to select VSWH ***						-6V	±0.1V
2. Voltage change frequency Low-Mid RX	1) Set panel tuning mode Push Side2 to select ***.*** r1	DC VTVM	TX-RX	TP1	Panel	Top1/ Top2	4.15V	±0.05V
TX	2) Push Side2 to select ***.*** t1						4.15V	±0.05V
Mid-Hi RX	3) Push Side2 to select ***.*** r2						4.15V	±0.05V
TX	4) Push Side2 to select ***.*** t2						4.15V	±0.05V

**Caution :** When adjusting transmit power and sensitivity, connect the cable to the SMA antenna connector on the top panel. At this time, use the antenna-less type jig connector (E30-3287-08) in the universal connector.

### Transmitter Section

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
1. Frequency adjustment	1) Set panel test mode CH No. : 1 Signalling No. : 1 Select FRQ *** in panel tuning mode PTT : ON	Power meter f. counter	Panel	ANT	Panel	Top1/ Top2	155.000MHz	±50Hz
2. Maximum power check	1) Set panel test mode CH No. : 3 Signalling No. : 1 BATT terminal voltage : 7.5V Select POW 255 in panel tuning mode PTT : ON	Power meter  Ammeter	Panel	ANT			Check	5.0W or more
3. TX high power adjustment	1) Set panel test mode CH No. : 3 Signalling No. : 1 Select POW *** in tuning mode Push Orange to 3 point adjustment mode Select POW *** L PTT : ON				Panel	Top1/ Top2	4.50W	±0.1W 2.3A or less
	2) Push Side2 to select POW *** M PTT : ON							
	3) Push Side2 to select POW *** H PTT : ON							

## ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
4. TX high power check	1) Set panel test mode CH No. : 1 Signalling No. : 1 PTT : ON	Power meter	Panel	ANT			Check	3.7W~5.2W 2.3A or less
	2) CH No. : 2 Signalling No. : 1 PTT : ON	Ammeter						
	3) CH No. : 3 Signalling No. : 1 PTT : ON							
5. TX low power adjustment	1) Set panel test mode CH No. : 3 Signalling No. : 1 Select POW *** LO PTT : ON				Panel	Top1/ Top2	1.0W	±0.1W 1.2A or less
6. TX low power check	1) Set panel test mode CH No. : 1 Signalling No. : 1 Set low power (Push Side2) PTT : ON						Check	0.5W~1.5W 1.2A or less
	2) CH No. : 2 Signalling No. : 1 Set low power (Push Side2) PTT : ON							
	3) CH No. : 3 Signalling No. : 1 Set low power (Push Side2) PTT : ON							
7. DQT balance adjustment	1) Set panel test mode CH No. : 3 Signalling No. : 1 Select BLNC *** in panel tuning mode Deviation meter filter setting LPF : 3kHz HPF : OFF PTT : ON	Power meter Deviation meter Oscilloscope  AG AF VTVM	Panel  Side	ANT  Universal	Panel	Top1/ Top2	Make the demodulation waves into square waves.	

## ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
8. Maximum deviation adjustment (Wide)	1) Set panel test mode CH No. : 3 Signalling No. : 1 Select MDV *** in panel tuning mode Push Orange to 3 point adjustment mode Select MDV *** L AG : 1kHz/150mV Deviation meter filter setting LPF : 15kHz HPF : OFF PTT : ON	Power meter Deviation meter Oscilloscope	Panel	ANT	Panel	Top1/ Top2	3.95kHz (According to the larger +, -)	±50Hz
	2) Push Side2 to select MDV *** M PTT : ON	AG	Side	Universal				
	3) Push Side2 to select MDV *** H PTT : ON	AF VTVM						
9. Maximum deviation adjustment (narrow)	1) Set panel test mode CH No. : 3 Signalling No. : 1 Select MDV *** in panel tuning mode Turn the toggle SW to the right (narrow). Push Orange to 3 point adjustment mode Select MDV *** N L AG : 1kHz/150mV Deviation meter filter setting LPF : 15kHz HPF : OFF PTT : ON						1.90kHz (According to the larger +, -)	±50Hz
	2) Push Side2 to select MDV *** N M PTT : ON							
	3) Push Side2 to select MDV *** N H PTT : ON							
10. MIC sensitivity check	1) Set panel test mode CH No. : 3 Signalling No. : 1 AG : 1kHz/15mV Deviation meter filter setting LPF : 15kHz HPF : OFF PTT : ON						Check	1.8kHz~3.6kHz
	2) Turn the toggle SW to the right (narrow) PTT : ON							0.9kHz~1.8kHz

## ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
11. QT deviation adjustment (wide)	1) Set panel tuning mode CH No. : 3 Signalling No. : 1 MIC input : OFF Select QTDV *** in panel tuning mode Deviation meter filter setting LPF : 3kHz HPF : 50Hz De-emphasis : 750μs PTT : ON	Power meter Deviation meter Oscilloscope  AG AF VTVM	Panel  Side	ANT  Universal	Panel	Top1/ Top2	0.75kHz	±0.05kHz
12. QT deviation adjustment (narrow)	1) Set panel tuning mode CH No. : 3 Signalling No. : 1 MIC input : OFF Select QTDV *** in panel tuning mode Turn the toggle SW to the right (narrow) Deviation meter filter setting LPF : 3kHz HPF : 50Hz De-emphasis : 750μs PTT : ON						0.375kHz	±0.05kHz
13. DQT deviation adjustment (wide)	1) Set panel test mode CH No. : 3 Signalling No. : 1 Select DQDV *** in panel tuning mode Deviation meter filter setting LPF : 3kHz HPF : OFF PTT : ON						0.75kHz	±0.05kHz
14. DQT deviation adjustment (narrow)	1) Set panel tuning mode CH No. : 3 Signalling No. : 1 Select DQDV *** in panel tuning mode Turn the toggle SW to the right (narrow) Deviation meter filter setting LPF : 3kHz HPF : OFF PTT : ON						0.375kHz	±0.05kHz
15. DTMF deviation adjustment (wide)	1) Set panel test mode CH No. : 3 Signalling No. : 1 Select DTDV *** in tuning mode Deviation meter filter setting LPF : 15kHz HPF : OFF PTT : ON						3.0kHz	±50Hz

## ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
16. DTMF deviation adjustment (narrow)	1) Set panel tuning mode CH No. : 3 Signalling No. : 1 Select DTDV *** in panel tuning mode Turn the toggle SW to the right (narrow) Deviation meter filter setting LPF : 15kHz HPF : OFF PTT : ON	Power meter Deviation meter Oscilloscope  AG AF VTVM	Panel  Side	ANT  Universal	Panel	Top1/ Top2	1.5kHz	±50Hz
17. MSK deviation adjustment (wide)	1) Set panel test mode CH No. : 3 Signalling No. : 1 Select MSDV *** in panel tuning mode Deviation meter filter setting LPF : 15kHz HPF : OFF PTT : ON						3.00kHz	±50Hz
18. MSK deviation adjustment (narrow)	1) Set panel tuning mode CH No. : 3 Signalling No. : 1 Select MSDV *** in panel tuning mode Turn the toggle SW to the right (narrow) Deviation meter filter setting LPF : 15kHz HPF : OFF PTT : ON						1.50kHz	±50Hz
19. Transmission S/N check (wide)	1) Set panel test mode CH No. : 3 Signalling No. : 1 Deviation meter filter setting LPF : 300Hz HPF : 3kHz De-emphasis : 750µs PTT : ON						Check	42dB or more
20. Transmission S/N check (narrow)	1) Set panel test mode CH No. : 3 Signalling No. : 1 Turn the toggle SW to the right (narrow) Deviation meter filter setting LPF : 300Hz HPF : 3kHz De-emphasis : 750µs PTT : ON							37dB or more
21. BATT detection writing	1) Set panel test mode CH No. : 3 Signalling No. : 1 Select BATT *** in panel tuning mode PTT : ON	Power meter  DC VTVM	Panel  Bottom	ANT  BATT terminal	Side	Orange	Write the voltage level	6.2V

## ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
22. BATT detection check	1) Set panel test mode CH No. : 3 Signalling No. : 1 BATT terminal voltage : 5.3V PTT : ON	Power meter	Panel	ANT			Check	Cannot transmit LED (TX) blinks
	2) BATT terminal voltage : 6.5V PTT : ON	DC VTVM	Bottom	BATT terminal				Transmit

## Receiver Section

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
1. AF level check	1) Set panel test mode CH No. : 3 Signalling No. : 1 SSG freq. : Each freq. output : -53dBm/501 $\mu$ V MOD. : 1kHz DEV. : 3kHz	SSG	Panel	ANT			Check	0.63V $\pm$ 0.3V 3% or less
	2) Turn the toggle SW to the right (narrow) SSG freq. : Each freq. output : -53dBm/501 $\mu$ V MOD. : 1kHz DEV. : 1.5kHz	AF VTVM Oscilloscope Distortion meter Audio analyzer	Side	Universal				0.63V $\pm$ 0.3V 5% or less
2. Hum and noise ratio check	1) Set panel test mode CH No. : 3 Signalling No. : 1 SSG output : -53dBm/501 $\mu$ V							42dB or more
	2) Turn the toggle SW to the right (narrow) SSG output : -53dBm/501 $\mu$ V							37dBm
3. BPF coil  Use this adjustment procedure after replacing any of the BPF coils	1) Set panel test mode CH No. : 1 Connect the spectrum analyzer to TP3. Signalling No. : 1 Push Orange to 3 point adjustment mode Select SNS 70 M	Tracking generator  Spectrum analyzer	Panel  TX-RX	ANT  TP3	TX-RX	L201 L202 L205 L206	Adjust the BPF coil so that the waveform is peaked. The frequency with the peak waveform does not have to be the center frequency. After finished peaking the waveform, perform a 3 point adjustment and set for maximum sensitivity.	

## ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
4. Sensitivity adjustment and check (wide)	1) Set panel test mode CH No. : 3 Signalling No. : 1 Select SNS *** in panel tuning mode Push Orange to 3 point adjustment mode Select SNS *** L SSG freq. : Low output : -116dBm/0.35μV	SSG  AF VTVM Oscilloscope Distortion meter Audio analyzer	Panel  Side	ANT  Universal	Panel	Top1/ Top2	Adjust for maximum SINAD	12dB SINAD or more
	2) Push Side2 to select SNS *** M SSG freq. : Center							
	3) Push Side2 to select SNS *** H SSG freq. : Hi							
5. Sensitivity check (narrow)	1) Set panel test mode CH No. : 1 Signalling No. : 1 SSG output : -116dBm/0.35μV MOD. : 1kHz DEV. : 1.5kHz Turn the toggle SW to the right (narrow)					Check	12dB SINAD or more	
	2) Set panel test mode CH No. : 3 Signalling No. : 1 Turn the toggle SW to the right (narrow)							
	3) Set panel test mode CH No. : 5 Signalling No. : 1 Turn the toggle SW to the right (narrow)							
6. Tight squelch adjustment (wide)	1) Set panel test mode CH No. : 3 Signalling No. : 1 Select SQ T*** in panel tuning mode SSG output : 6dB above to 12dB SINAD level.				Panel	Top1/ Top2	Adjust to point of opening squelch	
7. Tight squelch adjustment (narrow)	1) Set panel test mode CH No. : 3 Signalling No. : 1 Select SQ T*** in panel tuning mode Turn the toggle SW to the right (narrow) SSG output : 6dB above to 12dB SINAD level.							
8. Squelch adjustment (wide)	1) Set panel test mode CH No. : 3 Signalling No. : 1 Select SQ O*** in panel tuning mode SSG output : 3dB below to 12dB SINAD level							

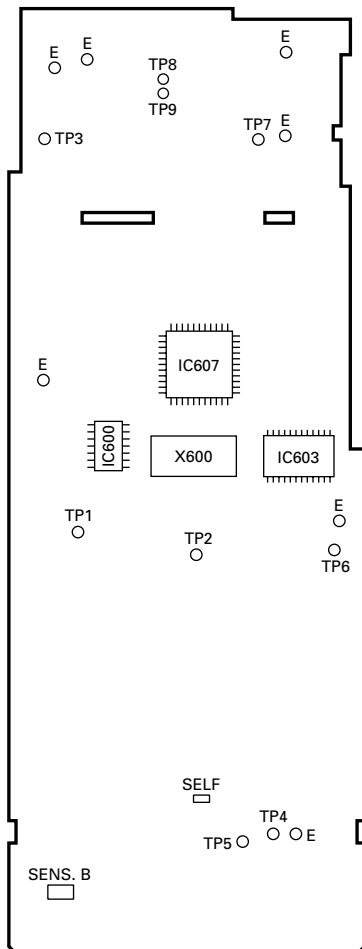


## ADJUSTMENT

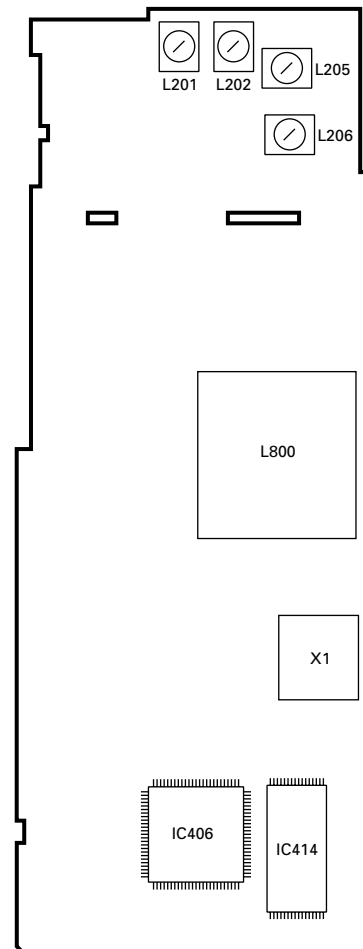
Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
9. Squelch adjustment (narrow)	1) Set panel test mode CH No. : 3 Signalling No. : 1 Select SQ O * * * in panel tuning mode Turn the toggle SW to the right (narrow) SSG output : 3dB below to 12dB SINAD level.	SSG	Panel	ANT	Panel	Top1/ Top2	Adjust to point of opening squelch	
10. Squelch check (wide)	1) Set panel test mode CH No. : 3 Signalling No. : 1 SSG output : -118dBm/0.28μV						Check	Squelch must be opened
	2) SSG output : -127dBm/0.1μV							Squelch must be closed
11. Squelch check (narrow)	1) Set panel test mode CH No. : 3 Signalling No. : 1 Turn the toggle SW to the right (narrow) SSG output : -118dBm/0.28μV						Check	Squelch must be opened
	2) SSG output : -127dBm/0.1μV							Squelch must be closed

### Adjustment Point

#### ■ Component side

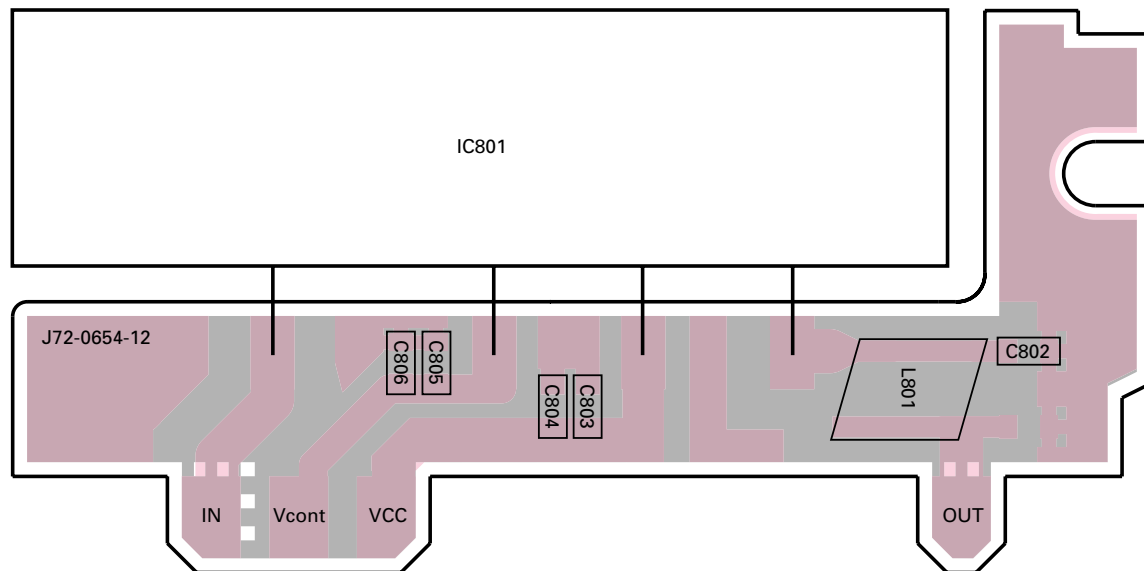


#### ■ Foil side



# TK-290 PC BOARD VIEW

## FINAL UNIT (X45-3592-71) Component side view



1

2

3

4

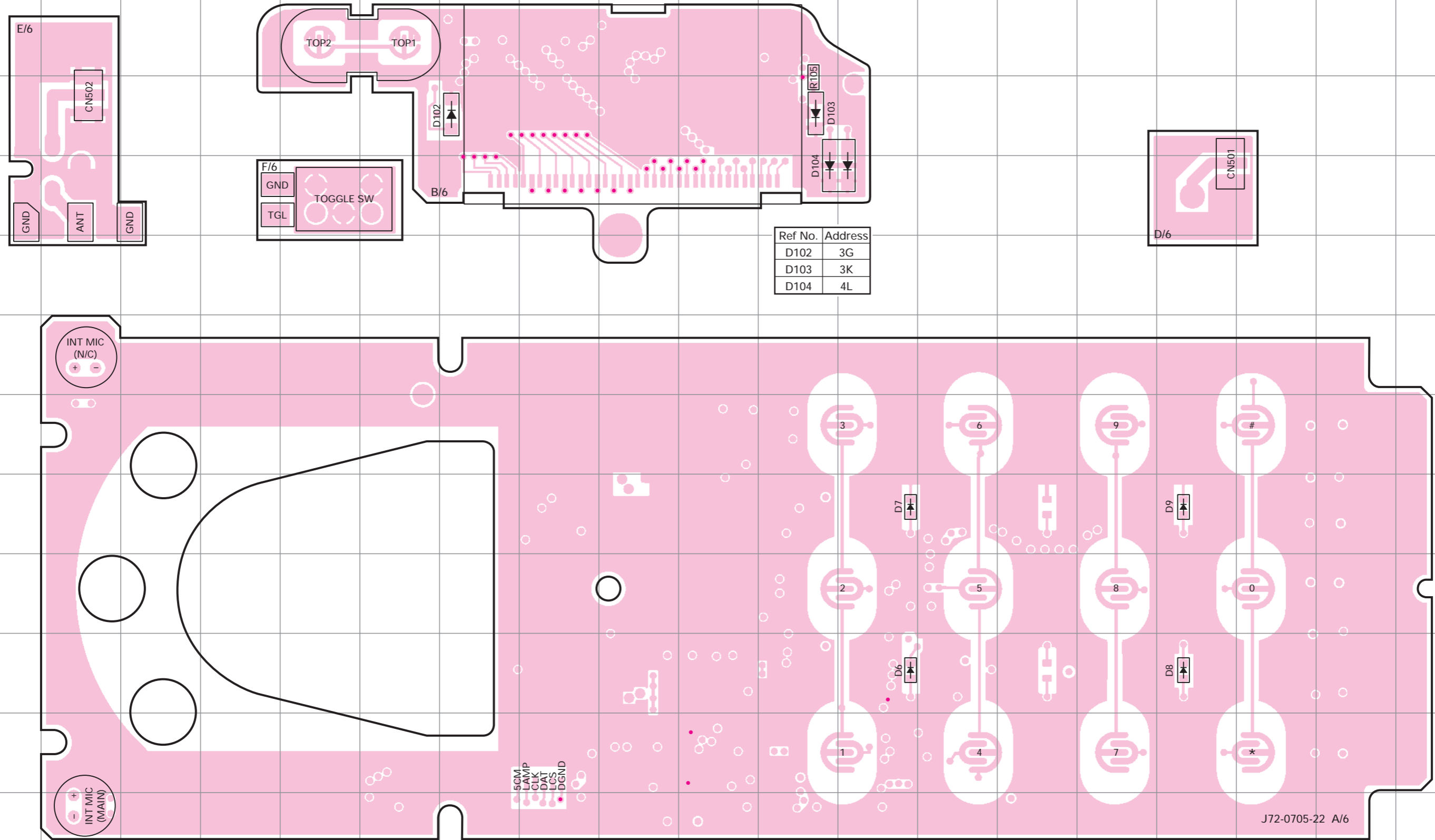
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6

7

# TK-290 PC BOARD VIEWS

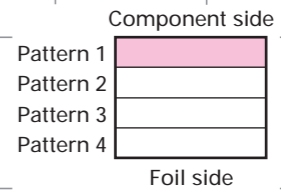
CONTROL UNIT (X53-3930-XX) -11 : K -12 : K2 Component side view



Ref No.	Address
D102	3G
D103	3K
D104	4L

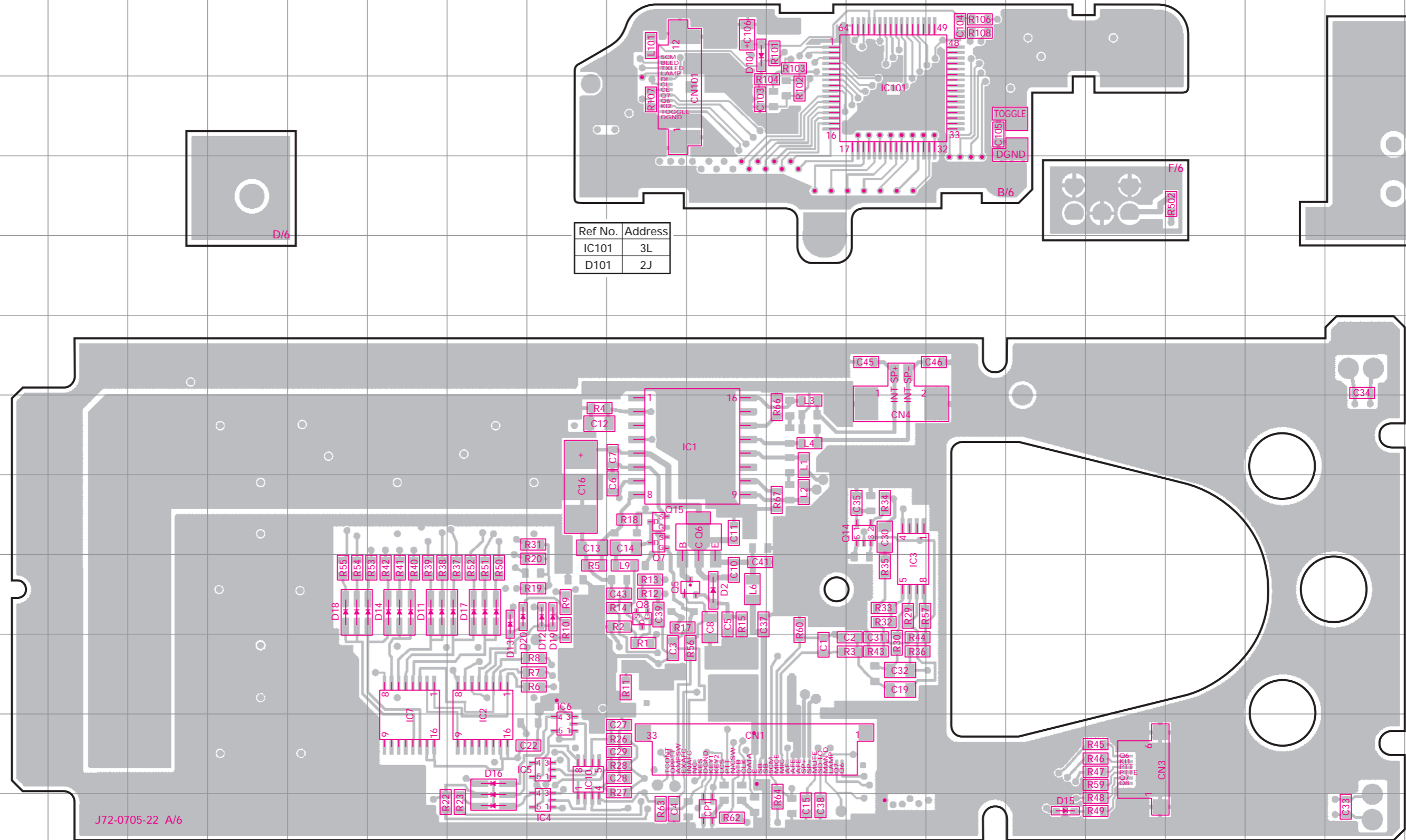
Ref No.	Address
D6	10L
D7	8L
D8	10P
D9	8P

J72-0705-22 A/6



● Connect 1 and 4

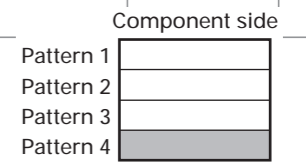
## CONTROL UNIT (X53-3930-XX) -11 : K -12 : K2 Foil side view



Ref No.	Address
IC101	3L
D101	2J

J72-0705-22 A/6

Ref No.	Address	Ref No.	Address	Ref No.	Address	Ref No.	Address	Ref No.	Address
IC1	7J	IC6	11H	Q7	8I	D11	9F	D16	12G
IC2	11G	IC7	11F	Q8	9I	D12	9H	D17	9G
IC3	9L	IC10	11H	Q14	8L	D13	9G	D18	9E
IC4	12H	Q5	9J	Q15	8I	D14	9F	D19	9H
IC5	11H	Q6	8J	D2	9J	D15	12N	D20	9G

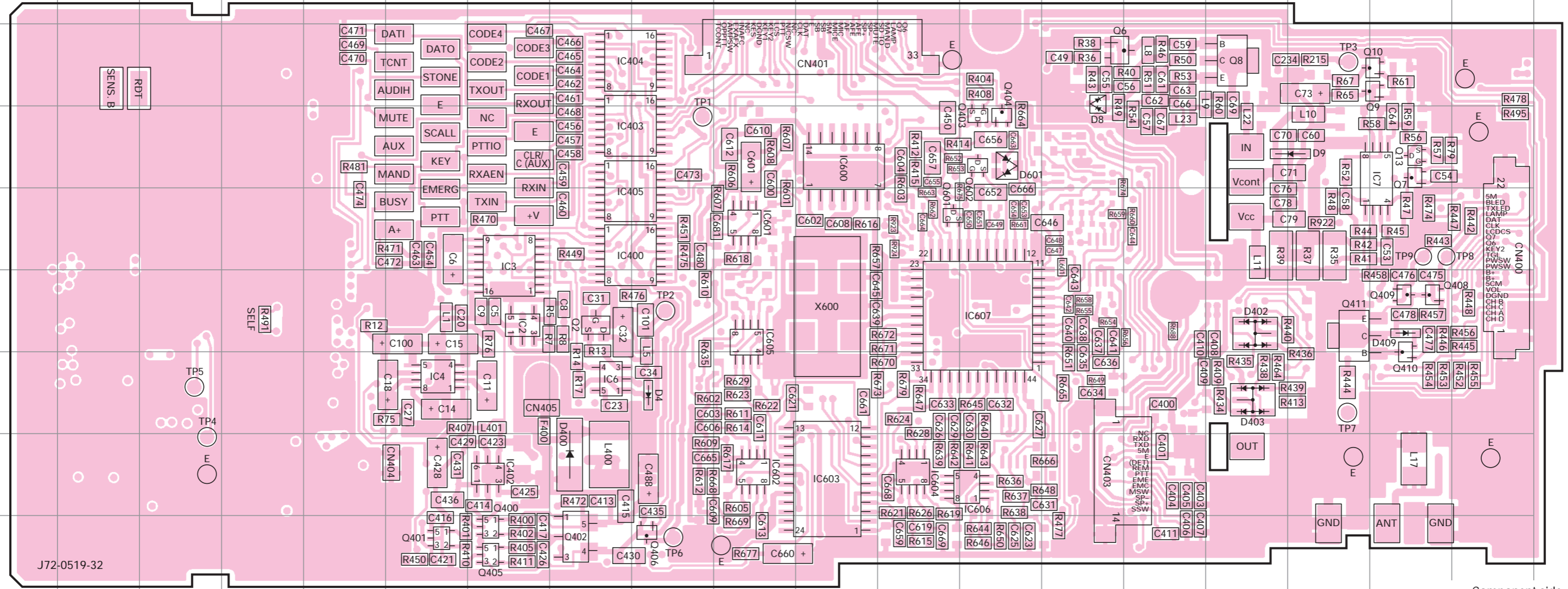


Foil side

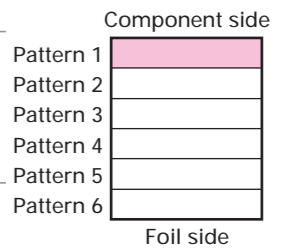
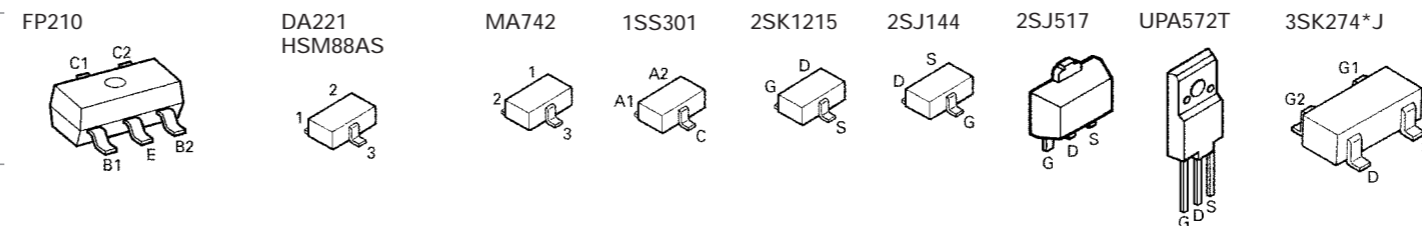
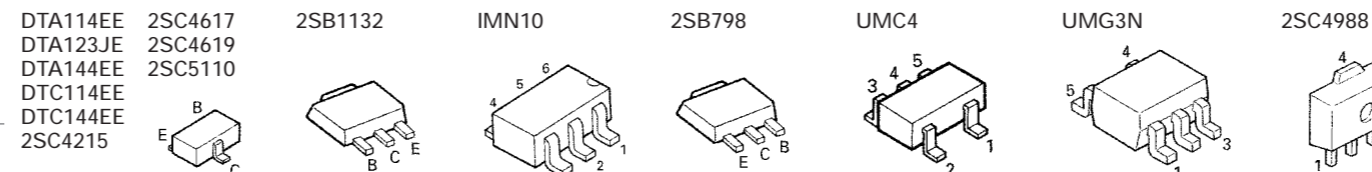
● Connect 1 and 4

# TK-290 PC BOARD VIEW

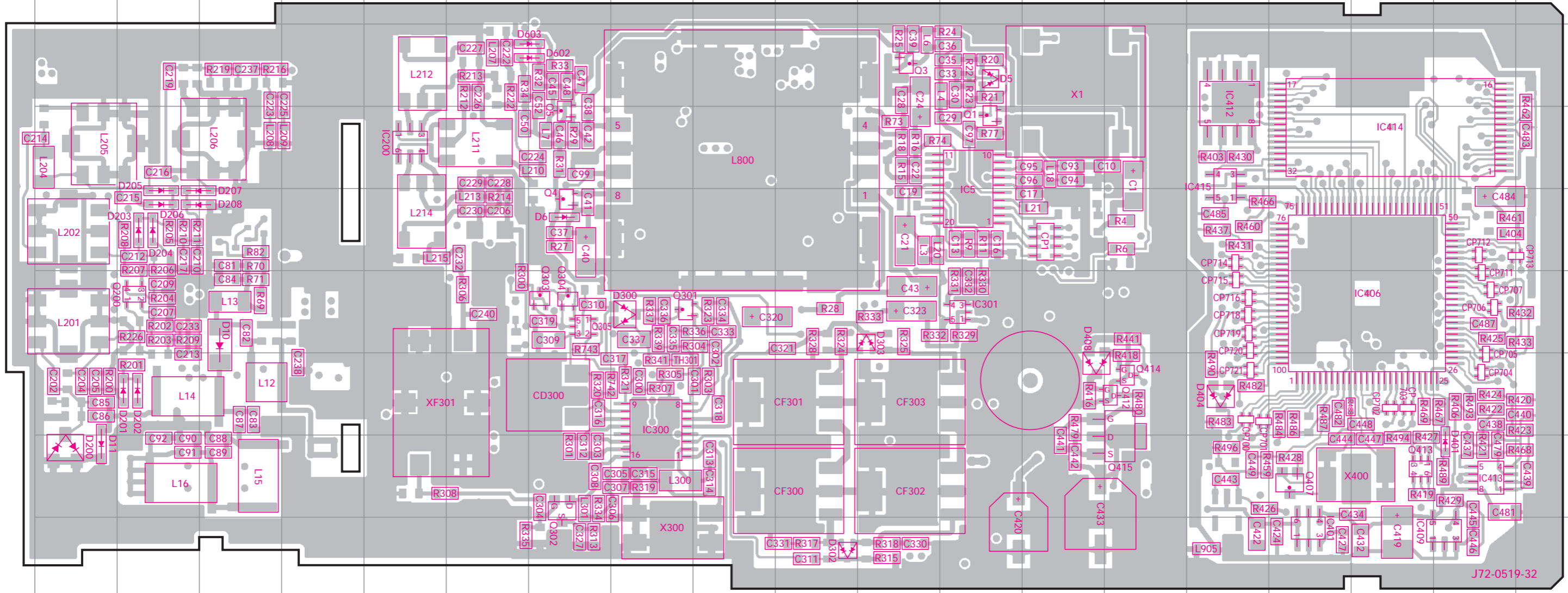
## TX-RX UNIT (X57-5390-10) Component side view



Ref No.	Address	Ref No.	Address	Ref No.	Address	Ref No.	Address
IC2	6G	IC602	8J	Q13	4R	Q601	5L
IC3	5G	IC603	8K	Q400	9G	Q602	4M
IC4	7F	IC604	8L	Q401	9F	D4	7I
IC6	7H	IC605	6J	Q402	9H	D8	3N
IC7	4R	IC606	8M	Q403	4M	D9	4Q
IC400	5H	IC607	6M	Q404	4M	D400	8H
IC402	8G	Q2	6H	Q405	9G	D402	6P
IC403	4H	Q6	3N	Q406	9I	D403	7P
IC404	3H	Q7	4R	Q408	6R	D409	6R
IC405	5H	Q8	3P	Q409	6R	D601	4M
IC600	4K	Q9	3R	Q410	6R		
IC601	5J	Q10	3R	Q411	6Q		



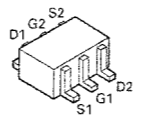
## TX-RX UNIT (X57-5390-10) Foil side view



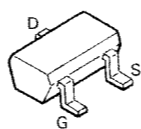
J72-0519-32

Ref No.	Address	Ref No.	Address	Ref No.	Address	Ref No.	Address	Ref No.	Address
IC5	4L	Q1	4L	Q412	7N	D203	5B	D408	7M
IC200	4E	Q3	3K	Q413	8Q	D204	5B	D602	3G
IC300	7H	Q4	5G	Q414	7N	D205	5B	D603	3G
IC401	6L	Q5	4G	Q415	8N	D206	5B		
IC406	9P	Q200	6B	D5	3L	D207	5C		
IC409	6Q	Q301	6H	D6	5G	D208	5C		
IC412	3O	Q303	6G	D10	6C	D300	6H		
IC413	8R	Q304	6G	D11	8A	D302	9J		
IC414	4Q	Q305	6G	D201	7B	D401	8R		
IC415	4O	Q407	8P	D202	7B	D404	7O		

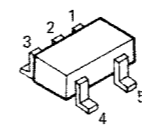
HN1L02FU



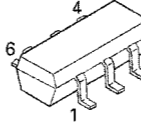
2SJ243  
2SK1824



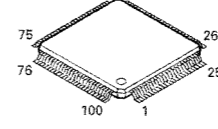
TC7SH08FU  
TC7S66FU



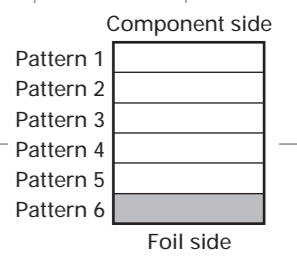
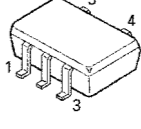
TK11250BM



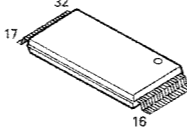
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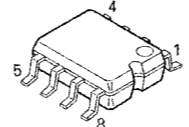
LMC7101BIM5



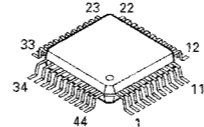
AT29C020-90T1



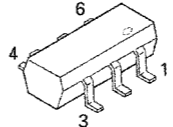
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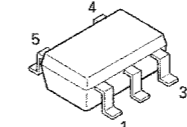
TC35453F



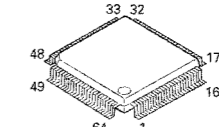
GN2011



TC7S02F



LC75824W





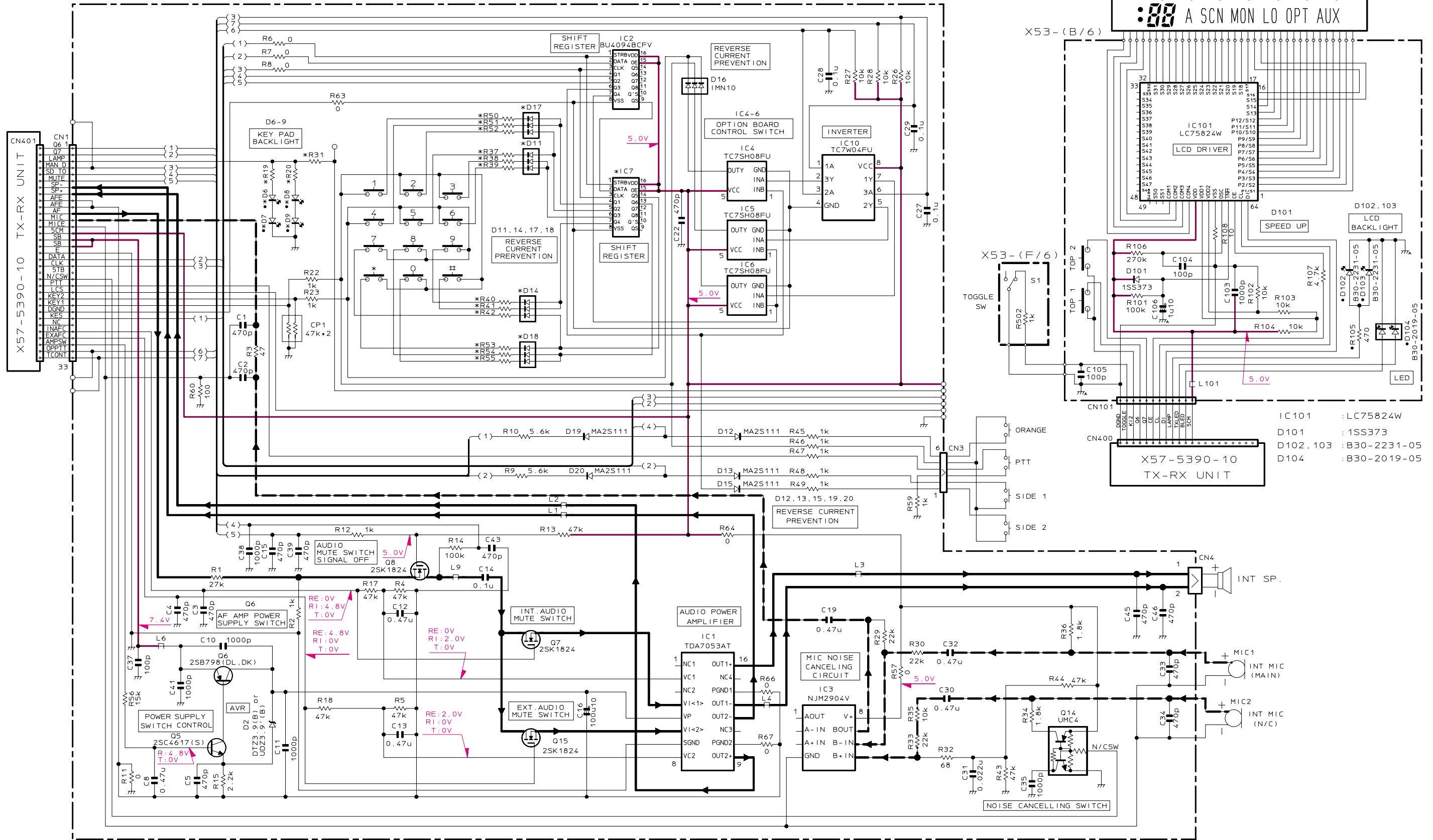




# TK-290 SCHEMATIC DIAGRAM

Note : Components marked with a dot (·) are parts of pattern 1.

- |                  |                    |                             |
|------------------|--------------------|-----------------------------|
| IC1 : TDA7053AT  | Q5 : 2SC4617(S)    | D2 : DTZ3.9(B) or UDZ3.9(B) |
| IC2 : BU4094BCFV | Q6 : 2SB798(DL,DK) | D12,13,15,19,20 : MA2S111   |
| IC3 : NJM2904V   | Q7,8,15 : 2SK1824  | D16 : 1MN10                 |
| X53-3930-XX(A/6) | IC4-6 : TC7SH08FU  | D14 : UMC4                  |
| CONTROL UNIT     | IC10 : TC7W04FU    |                             |

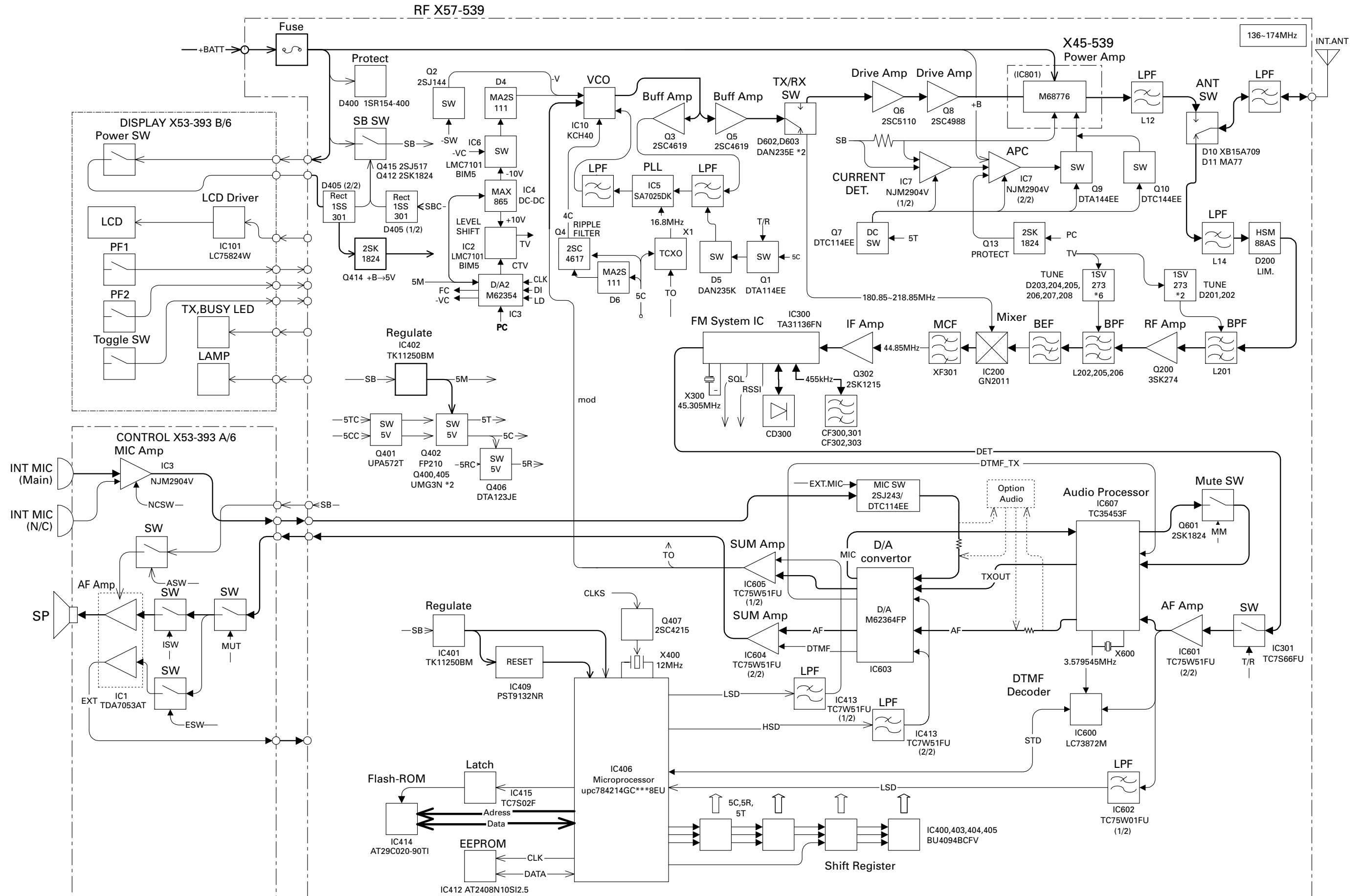


- |          |               |
|----------|---------------|
| IC101    | : LC75824W    |
| D101     | : 1SS373      |
| D102,103 | : B30-2231-05 |
| D104     | : B30-2019-05 |

	D6	D7	D8	D9	D11	D14	D17	D18	R19	R20	R31	R37	R38	R39	R40	R41	R42	R50	R51	R52	R53	R54	R55	IC7	
-11	K	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
-12	K2	B30-2171-05	B30-2171-05	B30-2171-05	B30-2171-05	1MN10	1MN10	1MN10	1MN10	100	100	0	1k	1k	1k	1k	1k	1k	1k	1k	1k	1k	1k	1k	BU4094BCFV

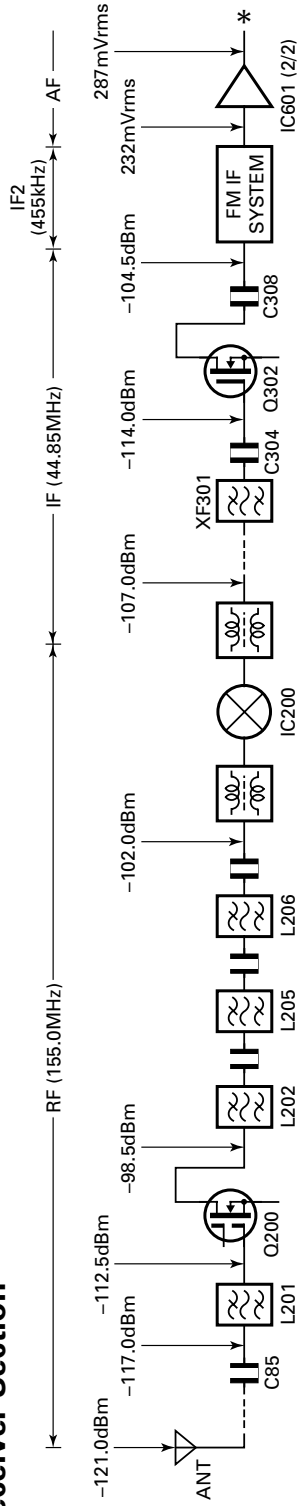
# TK-290 TK-290

## BLOCK DIAGRAM

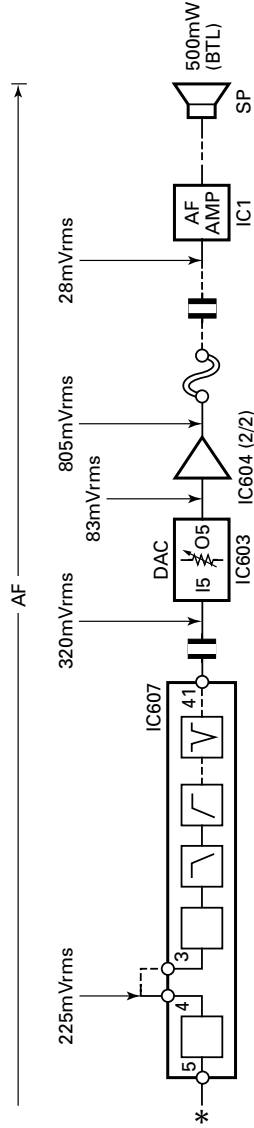


## LEVEL DIAGRAM

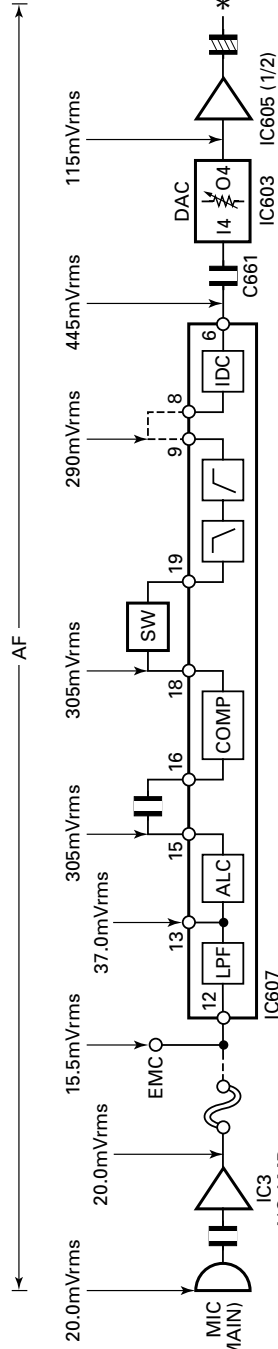
### Receiver Section



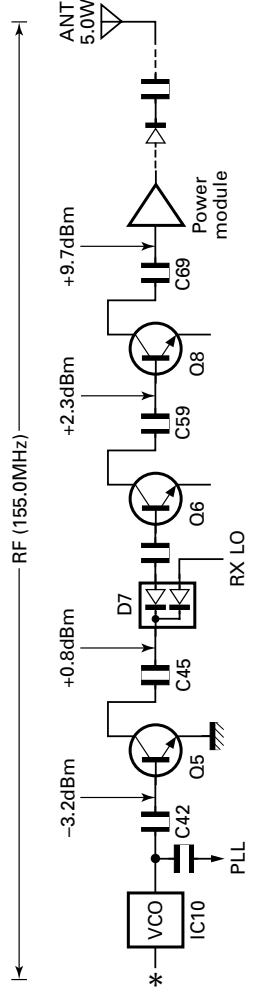
To make measurements in the AF section, connect the AC level meter. (ANT input : -53dBm, 1kHz FM, 3kHz DEV.)  
In the RF section, use a 1000pF coupling capacitor. (The display shows the SSG input value required to obtain 12dB SINAD.)



### Transmitter Section



AG is set to the MIC input becomes 3kHz DEV. at 1kHz MOD.  
To make measurements in the AF section, connect the AC level meter.  
In the RF section, use a 1000pF coupling capacitor.



# TERMINAL FUNCTION

CN No.	Pin No.	Name	I/O	Function	CN No.	Pin No.	Name	I/O	Function				
<b>TX-RX UNIT (X57-5390-10)</b>													
CN400 for X53 (B/6)	1	CH D	I	CH switch data.	26	SP+	I	BTL input + for external speaker.					
	2	CH A	I	CH switch data.					27	SP-	I	BTL input - for external speaker.	
	3	CH C	I	CH switch data.					28	MUTE	O	Audio mute signal output.	
	4	CH B	I	CH switch data.					29	SD TO	O	For optional board.	
	5	E	-	GND.					30	MAN D	O	For optional board.	
	6	VOL	I	Voltage level input for audio control.					31	LAMP	O	Backlight LED control. Normally : 0V, Lighting : 7.5V	
	7	5CM	-	5V.					32	Q7	O	Key scan IC Q7 signal input.	
	8	B+	-	Power input after passing through the fuse.					33	Q6	O	Key scan IC Q6 signal input.	
	9	B+	-	Power input after passing through the fuse.					CN402	1	AFE	-	Audio GND.
	10	SB	-	Power output after power switch.					2	AFE	-	AUdio GND.	
	11	SB	-	Power output after power switch.					CN403	1	SSW	I	EXT/INT speaker switch input.
	12	TOGGLE	I	Normally : 5V, switched toggle when connected GND.						2	SP+	O	BTL output + for external speaker.
	13	KEY2	I	Key input.						3	SP-	O	BTL output - for external speaker.
	14	Q6	O	Key scan IC Q6 signal output.						4	MSW	I	EXT/INT MIC switch input.
	15	Q7	O	Key scan IC Q7 signal output.	5	EMC	I	External microphone input.					
	16	LCDCS	O	Chip select output for LCD driver.	6	ME	-	External microphone GND.					
	17	CLK	O	Clock data output for LCD driver.	7	PTT	I	External PTT input.					
	18	DAT	O	Data output for LCD driver.	8	PF	I	Programmable function key input.					
	19	LAMP	-	Backlight LED control. Normally : 0V, Lighting : 7.5V	9	NC	-	Not use.					
	20	TXLED	-	TX LED control. Normally : 0V, Lighting : 7.5V	10	E	-	GND					
	21	BLED	-	Busy LED control. Normally : 0V, Lighting : 7.5V	11	5M	-	5V.					
	22	5M	-	5V.	12	TXD	O	Serial data output.					
CN401 for X53 (A/6)	1	TCONT	O	For optional board. (See page 22.)	13	RXD	I	Serial data input.					
	2	OPPTT	O	For optional board. (See page 22.)	14	NC	-	Not use.					
	3	AMPSW	O	Audio AMP control switch output.	<b>CONTROL UNIT (X53-3930-XX) (A/6)</b>								
	4	EXAFC	O	External speaker switch control.	CN1	1	Q6	O	Key scan IC Q6 output.				
	5	INAFc	O	Internal speaker switch control.	2	Q7	O	Key scan IC Q7 output.					
	6	KRS	O	Key scan IC reset output.	for X57	3	LAMP	I	Backlight LED control. Normally : 0V, Lighting : 7.5V				
	7	KCK	O	Key scan IC clock data output.		4	MAN D	I	For optional board. (See page 22.)				
	8	SOD	-	Not use.		5	SD TO	I	For optional board. (See page 22.)				
	9	KEY1	I	Key input.		6	MUTE	I	Audio mute signal input.				
	10	KEY2	I	Key input.		7	SP-	O	BTL output - for external speaker.				
	11	LCS	-	Not use.		8	SP+	O	BTL output + for external speaker.				
	12	PTT	I	PTT signal input.		9	AFE	-	Audio GND.				
	13	N/CSW	O	Noise canseler microphone switch output.		10	AFE	-	Audio GND.				
	14	NC	-	Not use.		11	AF	I	Audio output.				
	15	CLK	O	Clock data output.		12	MIC	O	MIC signal input.				
	16	DAT	O	Data output.		13	MICE	-	MIC GND.				
	17	E	-	GND.		14	5M	-	5V.				
	18	SB	-	Power output after power switch.		15	SB	-	Power output after power switch.				
	19	SB	-	Power output after power switch.		16	SB	-	Power output after power switch.				
	20	5M	-	5V.		17	E	-	GND.				
	21	MICE	-	MIC GND.		18	DATA	I	Data input.				
	22	MIC	I	MIC signal input.		19	CLK	I	Clock data input.				
	23	AF	O	Audio output.		20	NC	-	Not use.				
	24	AFE	-	Audio GND.		21	N/CSW	I	Noise canseler microphone switch input.				
	25	AFE	-	Audio GND.		22	PTT	O	PTT signal output.				
				23		LCS	-	Not use.					
				24		KEY2	O	Key output.					
				25		KEY1	O	Key output.					

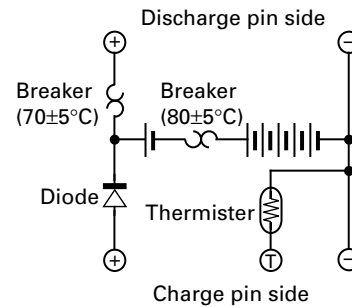
## TERMINAL FUNCTION / KNB-17A (Ni-Cd BATTERY)

CN No.	Pin No.	Name	I/O	Function
	26	NC	-	Not use.
	27	KCK	I	Key scan IC clock data input.
	28	KRS	I	Key scan IC reset input.
	29	INAFc	I	Internal speaker switch input.
	30	EXAFc	I	External speaker switch input.
	31	AMPSW	I	Audio AMP control switch input.
	32	OPPTT	I	For optional board. (See page 22.)
	33	TCONT	I	For optional board. (See page 22.)
CN2 for X57	1	AFE	-	Audio GND.
	2	AFE	-	Audio GND.
CN3	1	Q8	O	Key scan IC Q8 signal output.
	2	Q7	O	Key scan IC Q7 signal output.
	3	PTTE	-	PTT GND.
	4	PTT	I	Normally : 5V, transmit when connected GND.
	5	KI1	I	Key input.
	6	Q6	O	Key scan IC Q6 signal output.
CN4	1	+	-	BTL + output for internal speaker.
	2	-	-	BTL - output for internal speaker.
<b>CONTROL UNIT (X53-3930-XX) (B/6)</b>				
CN101 for X57	1	E	-	GND.
	2	TOGGLE	O	Normally : 5V, switched toggle when connected GND.
	3	KI2	O	Key output.
	4	Q6	I	Key scan IC Q6 signal input.
	5	Q7	I	Key scan IC Q7 signal input.
	6	CE	I	Chip select input for LCD driver.
	7	CL	I	Clock data input for LCD driver.
	8	DI	I	Data input for LCD driver.
	9	LAMP	-	Backlight LED control. Normally : 0V, Lighting : 7.5V
	10	TX LED	-	TX LED control. Normally : 0V, Lighting : 7.5V
	11	BLED	-	Busy LED control. Normally : 0V, Lighting : 7.5V
	12	5M	-	5V.

### KNB-17A External View



### KNB-17A Circuit Diagram



### KNB-17A Specifications

Voltage .....	7.2V (1.2V x 6)
Charging current .....	1500mAh
Dimensions (mm) .....	58.0 W x 110.8 H x 20.0 D (Projections included)
Charger and charging time	
KSC-19 (Normal Charger) .....	Approx. 8 hours
KSC-20 (Rapid charger) .....	Approx. 1.3 hour
Weight .....	220g

# TK-290

## KMC-25/26 (SPEAKER MICROPHONE)

### KMC-25 External View



### KMC-26 External View

Note : Stubby antenna are options



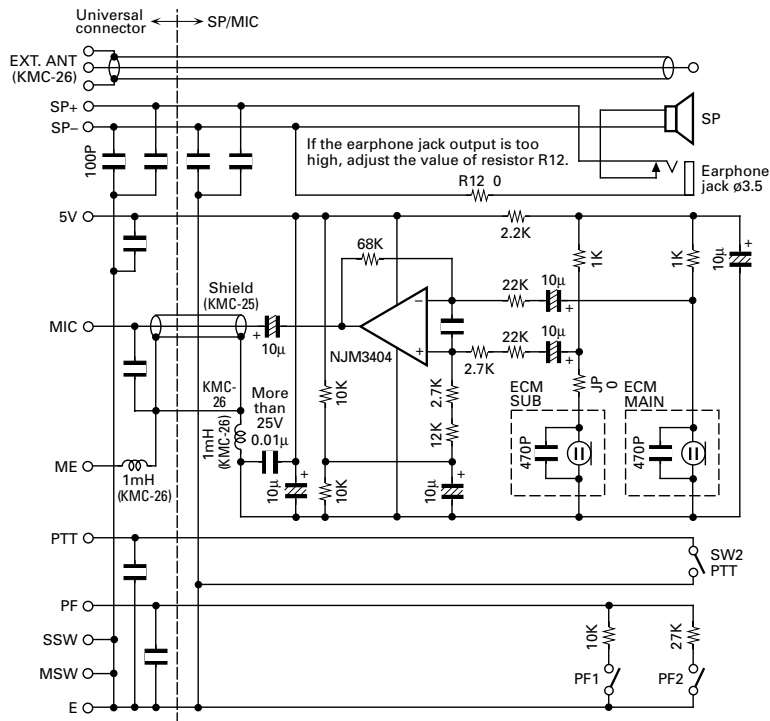
### KMC-25/26 Specifications

Microphone  
 Impedance ..... 2k $\Omega$   
 Sensitivity ..... -65dB $\pm$ 4.0dB at 1kHz

Speaker  
 Impedance ..... 16 $\Omega$   
 Input ..... 0.5W  
 Maximum input ..... 1.5W

Dimensions ..... 62 W x 81 H x 29 D (mm)  
 Weight (With plug cord) ..... Approx. 0.17kg

### KMC-25/26 Circuit Diagram



### KMC-25/26 Parts List

\* : New parts

Ref. No.	New parts	Parts No.	Description	Model
	*	A02-2092-08	Case (Front)	25
		A02-2253-08	Case (Front)	26
		A02-2093-08	Case (Rear)	25
	*	A02-2254-08	Case (Rear)	26
		B09-0382-08	Cap (Phone)	
		D10-0629-08	Lever (PTT)	
		E04-0415-08	RF coaxial receptacle	26
		E30-3287-08	Lead wire with plug assy	25
	*	E30-3322-08	Lead wire with plug assy	26
		J29-0644-08	Clip assy	
		J42-0495-08	Bushing	
		S70-0459-08	Tact switch	
		T07-0359-08	Speaker	
		T91-0584-08	MIC element	
		N08-0535-08	Dressed screw	

## KSC-19 (CHARGER) / KSC-20 (RAPID CHARGER) / KPG-36 (PROGRAMMING INTERFACE CABLE) / KRA-14 (HELICAL ANTENNA)

**KSC-19 External View**



**KPG-36 External View**



### KSC-19 Charging

KNB-17A	
Voltage .....	7.2V
Battery capacity .....	1500mAh
Charging time .....	Approx. 8 hours

**KSC-20 External View**



**KRA-14 External View**

M	: 148~162MHz
M2	: 162~174MHz
M3	: 136~150MHz



### KSC-20 Specifications

Charging current .....	1100mA±150mA
Charging time .....	KNB-17A : 80 min.±24%
Source voltage .....	Approx 15V
Ambient temperature .....	0°C~40°C
Dimensions .....	105 W x 135 D x 52 H (mm)
Weight .....	0.18kg

# SPECIFICATIONS

## GENERAL

Frequency Range .....	136 to 174MHz
Number of Channels .....	160 channels
Channel Spacing .....	Wide : 25kHz, 30kHz, Narrow : 12.5kHz, 25kHz (PLL channel step 5kHz, 6.25kHz, 7.5kHz)
Battery Voltage .....	7.5V DC $\pm$ 20%
Battery Life .....	10 hours at 5W (5-5-90 duty cycle)
Temperature Range .....	-30°C to +60°C (-22°F to +140°F)
Dimensions and Weight .....	6-3/32" (155mm) H x 2-5/16" (58mm) W x 1-1/2" (38mm) D, 1.25 lbs (565g)
With Keypad Model .....	6-3/32" (155mm) H x 2-5/16" (58mm) W x 1-9/16" (39.5mm) D

## RECEIVER (Measurements made per EIA standard EIA-603)

Sensitivity	
EIA 12dB SINAD .....	0.25 $\mu$ V
20dB Quieting .....	0.35 $\mu$ V
Selectivity .....	Wide : -75dB, Narrow : -70dB
Intermodulation .....	Wide : -75dB, Narrow : -68dB
Spurious and Image Rejection .....	-75dB
Audio Power Output .....	500mW at less than 3% distortion
Frequency Stability .....	$\pm$ 0.00025% from -30°C to +60°C
Channel Frequency Spread .....	38MHz

## TRANSMITTER (Measurements made per EIA standard EIA-603)

RF Power Output .....	Hi : 5W, Low : 1W
Spurious and Harmonics .....	-70dB
Type of Emission .....	F3E, $\pm$ 5kHz for 100% at 1000Hz
FM Noise .....	Wide : -45dB, Narrow : -40dB
Audio Distortion .....	Less than 3.0% at 1000Hz
Frequency Stability .....	$\pm$ 0.00025% from -30°C to +60°C
Channel Frequency Spread .....	38MHz

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