KENWOOD

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800MHz/900MHz FM TRANSCEIVER

TK-480/481

SERVICE MANUAL

REVISED II

KENWOOD

B51-8408-20 (N) 1015

This service manual applies to products with 30100001 or subsequent serial numbers.

Photo is TK-480/481 K2 type.
(Produced in Singapore)

CONTENTS

CAUTION
When using an external power connector, please use with maximum final module protection of 9V.

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 this publication date. Changes which may occur after publication are covered by either Service Bulletins or Manual Revisions, which 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, and 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 secure and any open connectors are properly terminated.
- SHUT OFF this equipment when near electrical blasting caps or while in an explosive atmosphere.
- This equipment should be serviced by only qualified technicians.

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 elements manufactured by companies other than KENWOOD or its authorized agents.

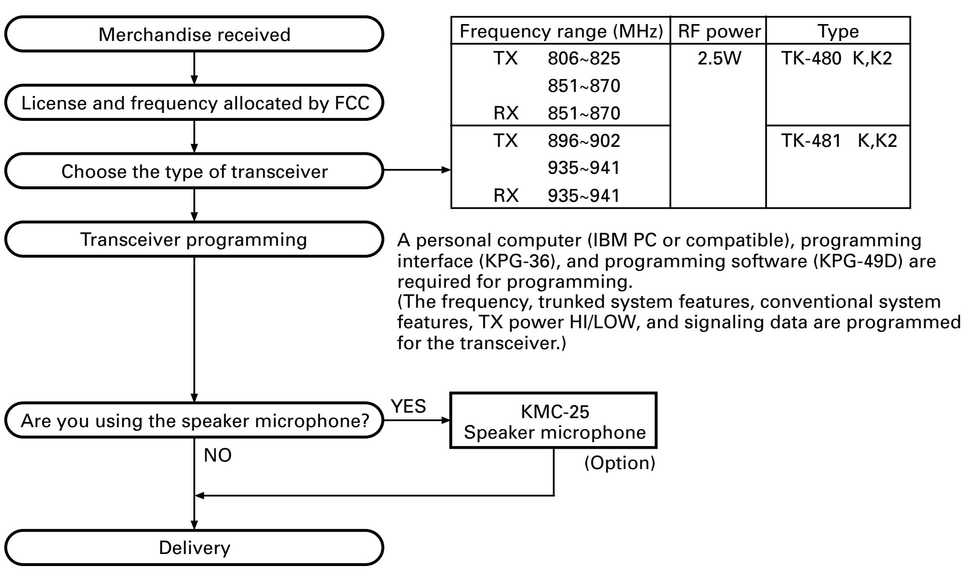
You must use the KPG-49D to program TK-480/481 transceivers with a serial number of 30100001 or greater. You cannot use the KPG-35D for those radios.

TK-480/481 transceivers with a serial number of 30100001 or greater have a red triangle in the KENWOOD logo label (B43-1139-04) on the front panel. You will also find the model name plate marked as “Ver 2.0” on the rear of the transceiver.

Model & destination	Unit	TX-RX unit X57-5630-XX 0-10	TX-RX unit X57-5630-XX 0-11	Display unit X54-3210-XX 0-10	Display unit X54-3210-XX 0-11	Frequency range	Remarks	QT/DQT	DTMF	Charger	Battery	16 key
TK-480	K	✓		✓		806~870MHz	IF1 : 44.85MHz	✓	✓	Option	✓	–
	K2	✓			✓		LOC : 44.395MHz					✓
TK-481	K		✓	✓		896~941MHz	IF1 : 44.85MHz	✓	✓	Option	✓	–
	K2		✓		✓		LOC : 44.395MHz					✓

Note X57-5630-XX/X54-3210-XX : Produced in Singapore

SYSTEM SET-UP



OPERATING FEATURES

1. Operation Features

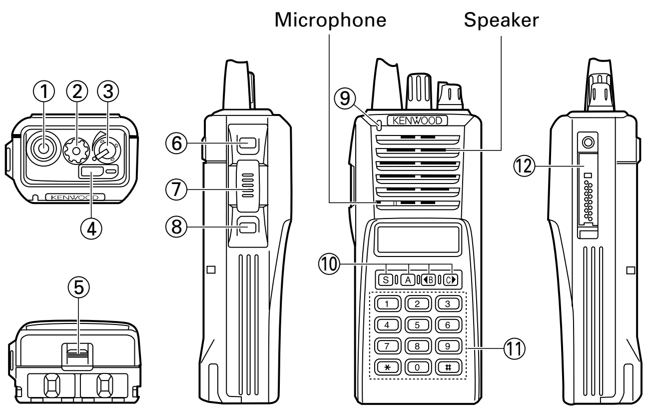
The TK-480/481 is an 800/900MHz band EFJ LTR™-compatible trunked radio designed to operate in both trunked and conventional modes. The programmable features are summarized.

Model ── Trunking mode
└── Conventional mode

This model can handle up to 32 systems with up to 250 groups in each system. The transceiver can be used in both trunked mode and conventional mode. Systems, groups, and their functions are programmed.

2. Transceiver Controls and Indicators

2-1. Physical Layout



Note : The transceiver is also available without the DTMF keypad (⑪).

2-2. Panel controls

The key on the top and front panel is momentary-type push buttons. The functions of these keys and knob are explained below.

① Antenna connector
Connect the supplied antenna here.

② System or Group selector knob (Programmable)
Turning the system (or group) selector knob clockwise increases the system (or group) number by one. Turning the knob in the counterclockwise direction decreases the system (or group) number by one.
After the system number (or group number) reaches the highest system number (or group number), it goes back to lowest system number (or group number).
System numbers (or group numbers) not set are skipped.
Caution : The FPU (KPG-49D) allows selecting between system selector and group selector.

③ Volume/Power switch
Transceiver Power and Volume switch. Turn clockwise to switch On the transceiver. Turn counterclockwise fully to switch OFF the transceiver. Also adjusts the volume level. When the power is switched off, all the parameters, such as the system and group, are stored in memory. When the power is switched on again, the system returns to the previous conditions.

④ Auxiliary (orange) key (Programmable)

⑤ Battery pack release catch
Push down to release the battery pack. See Installing the Ni-Cd Battery Pack.

⑥ MONITOR key* (Programmable)

⑦ PTT (Push-To-Talk) key
Press this key, then speak into the microphone to call a station.

⑧ LAMP key* (Programmable)

⑨ TX/BATT indicator
This red LED lights during transmission (it does not light during busy or when transmit is prohibited). If the battery voltage falls below the programmed voltage during transmission, the brightness of this indicator decreases at intervals of about one second, so it can be used as the battery voltage alert function.

⑩ S, A, ◀B, and C▶ key (Programmable)

⑪ DTMF keypad (keypad model only)
Press the keys on the telephone keypad to send DTMF tones.

⑫ Universal connector
Connect the external KMC-25 speaker/ microphone (optional) here. Otherwise, keep the supplied cover in place.

* : MONITOR and LAMP are arbitrary names chosen for these buttons. They can be used for any of the auxiliary functions.

2-3. Programmable keys

The FPU (KPG-49D) enables programmable keys to select the following functions.

Auto Tel, AUX(only when Voice Scrambler is not selected), DTMF ID (BOT), DTMF ID (EOT), Display Character, Emergency (only AUX key), Function, Group Down, Group Up, Home Group, Key Lock, Lamp, Memory (RCL/STO), Memory (RCL), Memory (STO), Monitor A, Monitor B, Monitor C, Monitor D, Redial, RF Power Lo, Scan, Scan Del/Add, Scan Temporary Delete, Scrambler (Only when Voice Scrambler is selected), SP Attenuation (Only MIC switch), System Down, System Up, TEL Disconnect and none.

These functions the FPU programs to the function keys are described in the following sections.

OPERATING FEATURES

■ Auto TEL

Automatically connects available repeaters that are connected to telephone circuits when operating as LTR system. The time allocated to search for available repeaters is 60 seconds, after which connection failure occurs, a DTMF tone is output and the function terminates.

If connection to an available circuit is made, only ID 253, EOT or hang-up time-out can terminate the function.

■ AUX

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

If this key is pressed, an underscore ("_") appears at the extreme right of the LCD and AUX port which is inside of the transceiver turns to the active level. If pressed again, the underscore disappears and the AUX ports turns to the deactive level.

■ DTMF ID (BOT)

Pressing this key in Conventional mode, automatically sends the preset Connect ID.

■ DTMF ID (EOT)

Pressing this key in Conventional mode, automatically sends the preset Disconnect ID.

■ Display character

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

■ Emergency

Pressing this key for longer than the programmed "Emergency Key Delay Time" causes the transceiver to enter the emergency mode. The transceiver jumps to the programmed "Emergency System/Group" and transmits for the programmed "Active Time".

The transceiver disables mic mute while transmitting. After finishing transmission, the transceiver receivers for the programmed "Interval Time". The transceiver mutes the speaker while receiving. Following the above sequence, the transceiver continues to transmit and receive.

If "Man Down Switch" has been programmed on the radio and the switch is activated, the radio enters Emergency mode after the specified "Man Down Delay Time" expires.

■ Function

Pressing this key causes the transceiver to display "FCN". Then, pressing a DTMF key causes the corresponding programmed function to start. This key may be convenient when using many functions with the 12-key keypad (K2 type).

■ Group up/down

When the key is pressed each time, the group number to be selected is incremented/decremented and repeats if held for one second or longer.

■ Home group

Each pressing of the key selects a preset system/group.

■ Key lock

Pressing this key causes the transceiver to accept entry of only the [Function], [Key Lock], [PTT], [Lamp], [Monitor A], [Monitor B], [Monitor C], [Monitor D], and [Emergency] keys.

The locked keys also include the tuning control.

■ Lamp

This key illuminates the LCD and keys on the front panel. When the key is pressed, the LED lamp goes on.

When it is released, the lamp goes off after about five seconds. If any key is pressed while the LED lamp is on, the lamp is kept on for five seconds.

■ Memory

This key allows DTMF memory data to be recalled; up to 32 memories each with a memory dial of up to 16 digits and an A/N of up to 10 digits per memory.

■ Monitor

Used to release signalling or squelch when operating as a conventional. It is also used to reset option signalling.

■ Redial

Pressing this key when System/Group is shown, displays the previously transmitted DTMF code. Pressing [PTT] at this time, transmits the code that is currently displayed.

■ RF power low

Used to temporarily switch transmission output to low power. Turning the function on enables:

Hi→Low, Low→Low

Key states are backed up, except in the PC mode when they are reset.

■ Scan

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

■ Scan Del/Add

Used to select whether system scan routines are used during system scan. Each pressing of the key (to ON) toggles between lockout and lock. The scan routine is started when on lock. The DEL indicator flashes when the system is on lockout.

■ Scan temporary delete

This key is temporarily deleted a system being scanned. If you press this key when scan is stopped (when a call is being received from another station), the system is temporarily deleted and scanning restarts.

This key operates even when "Scan Type" is set to "List Type System Scan".

■ Scrambler

If a scrambler code (1 to 4) has been set in the FPU, an underscore ("_") appears at the extreme right of the LCD display when scrambler is active. Pressing this key changes ON/OFF of scramble operation.

Holding this key down for 2 seconds sets Scramble Code Select Mode.

OPERATING FEATURES

■ **System up/down**

When the key is pressed each time, the system number to be selected is incremented/decremented and repeats if held for one second or longer.

■ **Telephone disconnect**

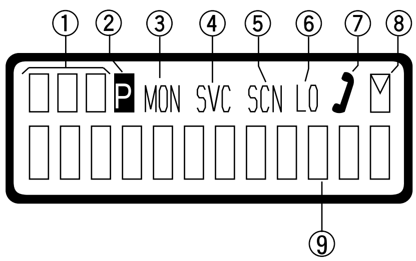
Pressing this key ends an RIC connection (disconnects the telephone line).

■ **None**

Sounds error operation beep, and no action will occur.

Use this function when the transceiver is required to be more simple operated.

2-4. Display



① **Sub display**
Displays the system, channel and group numbers. Also displays various functions, such as TA.

② **P (Priority) indicator**
The P indicator (P) appears when a selected channel is programmed as priority, in conventional operation.

③ **MON (Monitor) indicator**
The MON indicator appears when the button programmed as MONITOR is pressed.

④ **SVC (Service) indicator**
This icon is not used on this transceiver.

⑤ **SCN (Scan) indicator**
The SCN indicator appears when using Scan mode.

⑥ **LO indicator**
Appears when low power is selected.

⑦ **Handset indicator**
The handset indicator (☎) appears when the selected group is programmed as telephone IDs.

⑧ **MAIL indicator**
Flashes when a status message (FleetSync™) is received. Lights when a status message is stored in the stack memory.

⑨ **Alphanumeric display**
The twelve-character dot matrix alphanumeric display shows the system and group numbers. You can program system and group names with up to ten characters in place of these numbers. The left display is used as a delete indicator (▶) and the right is used for the selective call (✱) or scrambler (_) function. The delete/add indicator shows the systems locked out of the scanning sequence. Selective call and scrambler are optional functions that can be programmed.

3. Scan Operating

3-1. System scan

System scan can be selected with the "Scan" key by programming the scan feature. When the "Scan" key is pressed and the "SCN"' mark appears, scan mode in entered. Scanning starts from the system following the currently displayed system. When a call is received, scanning stops, and the system and group are displayed.

When the system knob or programming key is touched during scanning, the scan stops and the revert system or group can be changed. Scanning resumes one second after the key is released.

System scan consists of the following 2 types.

■ **Fix system scan**

All the set systems except locked-out ones are scanned. If the DEL/ADD feature is assigned to the programmable key, it can be controlled from the front panel.

■ **List type system scan**

A scan list can be set for each system.

The list to be scanned can be changed by changing the display system.

If many system have been set, the scan speed can be increased by narrowing the systems to be scanned with scan lists.

3-2. System lockout

The system lockout feature is used to lock systems out of the scan sequence, and can be selected by programming in the following two ways:

■ **Fixed lockout**

The system to be locked out is selected by programming. When a locked system is selected, the Delete (▶) indicator appears on the left of the SYSTEM indicator. The revert system is scanned even if it is locked out. If there is a locked system, the Delete (▶) indicator flashes during fixed scanning.

■ **User selectable lockout**

If the scan lockout feature is programmed to a key, the user can lock systems out of the scan sequence with the key. To lock a system out of the scan sequence, press the key when the system is displayed. The Delete (▶) indicator is displayed on the left of the SYSTEM indicator.

OPERATING FEATURES

To unlock a system, select the system and press the key. The Delete (▶) indicator disappears to indicate that the system has returned to the scan sequence. The revert system is scanned even if it is locked out. If there a locked system, the Delete (▶) indicator flashes during fixed scanning. If all systems are locked out, the scan stops and only the revert system is received.

3-3. Drop-out delay time (Scan resume time)

If a call is received during scan, the scan stops. The scan resume time can be programmed as 0 to 300 seconds in one-second increments. The default value is 3 seconds.

3-4. Dwell time

The dwell time is the time after transmission ends until the scan resumes in scan mode. It can be set 0 to 300 seconds by programming. The default value is 3 seconds.

3-5. System/Group revert

System/Group revert can be programmed for one of the following;

■ Last called revert

The system or group changes to the revert system or group when a call is received with the system or group being scanned.

■ Last used revert

If a system/group call is received during scanning and the PTT button is pressed for transmission and response within the drop out delay time, the system or group is assigned as the new revert system or group.

■ Selected revert

If the system/group was changed while scanning, the newly selected system/group.

■ Selected + Talkback

If the system/group was changed while scanning, the newly selected system/group. The transceiver "talks back" on the current receive group.

3-6. Scan message wait

The time for staying with the home repeater that receives a signal during system scan and monitoring data messages can be programmed. If there is no signal from the home repeater, the system is scanned for about 50ms. If there is a signal, three data messages are monitored. Normally, three data messages are monitored for each system, and it can be increased in multiples of three data messages per line to up to eight lines.

If the repeater data message indicates that there is no call, data monitoring is terminated and the home repeater of the next system is scanned.

3-7. Group scan operation

Group scan can be programmed for each group. In addition to the ID codes of the selected group, the ID codes of the other groups that are permitted for group scan are decoded. (The two fixed ID and block decode codes are always decoded.)

If, during group scanning, a call is received with one of the selectable group ID codes for which group scan is enabled, the group display indicates the group number that the call came in with. That group then becomes the new selected group. Group scan resumes after the specified drop-out delay time or dwell time shared by the system scan elapses.

3-8. In Conventional system.

If QT or DQT is set for the channel, the channels, including signalling, are scanned.

In case of the priority group is set in conventional system, if a group scan (including group scan during a system scan) temporarily stops (receiving) in a group that does not have priority, a look back is performed to the priority group. Look back is performed according to the look back time A and B settings. If a call is received on the priority group, reception immediately switches to the priority group.

4. Details of Features

4-1. Time-out timer

The time-out timer can be programmed in 15 seconds increments from 15 seconds to ten minutes. If the transmitter is keyed continuously for longer than the programmed time, the transmitter is disabled and a warning tone sounds while the PTT button is held down. The alert tone stops when the PTT button is released.

4-2. Sub LCD

You can use 3-digit the display to display the system number, channel number or group number. It is useful when the main (12-digit) display indicates system, group or channel name or other functions.

4-3. 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.

4-4. PTT ID

PTT ID provides a DTMF ANI or MSK ID 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 group channel (DTMF). The contents of ID are programmed for each transceiver.

The transceiver is capable to have ID. The format is DTMF. The timing that the transceiver sends ID is programmable.

BOT : Connect ID is sent on beginning of transmission.

EOT : Disconnect ID is sent on end of transmission.

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

There is also "PTT ID" setting for each channel.

OPERATING FEATURES

4-5. Radio password

When the password is set in the transceiver, user can not use the transceiver unless enter the correct password.

This code can be up to 6 digits from 0 to 9 and input with the keypad or selector, and "S" key.

4-6. 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.

4-7. Minimum Volume

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

4-8. Call indicator

The call indicator can be programmed for each group. In trunked system, it can be set to respond to a selectable decode ID or one of two fixed IDs, except block IDs. When a call is received with a selectable decode ID, the call indicator flashes. When a call is received with a fixed ID, the call indicator lights continuously.

On a conventional system, the call indicator can be programmed to light for each QT or DQT code. It keeps flashing while a call is being received. It is turned off by pressing any front panel key.

4-9. Free system ringback

This feature is available only when a telephone interconnected ID code is selected. If a busy tone sounds when the PTT button is pressed, the transceiver enters this mode automatically.

When the PTT button is released, a beep sounds for 400ms to indicate that the mode has been entered. If the scan is on, it is resumed (the "SCN" mark goes on). When any repeater becomes available, a ringing tone sounds and this mode ends.

The mode is terminated when the system, group, scan, PTT, key is changed.

4-10. System search

This feature can be programmed to automatically access other programmed systems when the selected system cannot be accessed. If an intercept tone sounds when the PTT button is pressed after setting the mode, the transceiver has entered the mode.

If the group ID is a telephone interconnect ID, the transceiver then attempts to access, in succession, other systems that have a telephone interconnect ID in the revert group location. If the group ID is a dispatch ID, the transceiver attempts to access other systems that have a dispatch ID programmed in the revert group location.

If there is no system to be accessed, an intercept tone sounds, the mode is terminated, and the transceiver returns to the first system. If the access is successful, the mode is terminated, and the searched system becomes the new selected system (If during scanning, the scan stops).

4-11. Transpond

This feature can be programmed to turn on and off for each group. If the ID of the group for which transpond is enabled is received, two data messages (transmit ID and turn-off code) are automatically transmitted if the PTT button is not pressed as a response within the time set (0 to 300 seconds in 1-second increments). If the PTT button is pressed within the time, the transpond is not preformed.

4-12. Transmit inhibit

The transceiver can be programmed with a transmit inhibit block of ID codes. If an ID code within this block is decoded the preset time before the PTT button is pressed, transmission is inhibited. The BUSY indicator lights and a busy tone sounds until the PTT button is released to indicate that transmission is not possible (except clear-to talk mode).

Transmission with the group for which the encode ID is not set is inhibited, and the busy tone is output while the PTT button is held down, regardless of the clear-to -talk setting.

4-13. Auto TEL

A telephone interconnect call can be made by simply pressing the key by assigning this feature to the key. This feature accesses the TEL channel of the available system automatically.

When the key is pressed, a queue tone is output, and the "AUTO TEL" appears on the alphanumeric display along with a flashing handset indicator (☎) to indicate that this mode has been entered. If the TEL ID is set for the revert system, the TEL channel of that system is accessed. If all TEL channels are busy, an attempt is made to access the TEL channels of another system in which the TEL ID code has been programmed. It is repeated for 60 seconds until the access succeeds. If the access succeeds, a dial tone returns from the repeater. If the key is pressed again when the queue tone is sounding, this mode is canceled.

If the access fails after 60 seconds, a deny tone is output and this mode is terminated. When the talk ends, the revert system/group returns. When the scan mode is effective, the scan resumes. The Auto TEL feature can be programmed to turn on or off for each system.

■ ARQ mode

If affects Trunking mode only. Automatic Repeat Request (ARQ) mode is a manner to minimize the air traffic of data communication. Also, it enables to occupy the trunking repeater channel for the data communication period.

■ Data TX with QT/DQT

Whether programmed QT/DQT is modulated or not with a data transmission except for Selcall. A radio unit can receive a data message regardless of QT/DQT if the receiving unit is not scanning.

OPERATING FEATURES

5. Option Signalling

5-1. DTMF

Built-in DTMF decoder is available for option signalling.

It is possible to use individual call, group call, D.B.D. (Dead Beat Disable). D.B.D. is used with DTMF only.

If the option signalling matches, a predetermined action will occur.

If option signalling matches on a group which is set up with option signalling, the option signalling indicator (⚹) will flash and option signalling will be released. The transpond or alert tone will sound.

If the selective call alert LED is set up, the orange LED will flash.

While option signalling matches (or if option signalling is deactivated when you are transmitting), you can mute or unmute ID/QT/DQT/Carrier.

■ AND/OR

You can select AND or OR for option signalling match conditions.

	Alert/Transpond
AND	QT/DQT/ID+DTMF; Option matches = Action
OR	QT/DQT/ID+DTMF; Option matches = Action
	AF mute open
AND	QT/DQT/ID+DTMF; Option matches = Action
OR	QT/DQT/ID; Signalling only matches = Action

With OR set up, alert/transpond will not function with only DTMF.

With OR set up, AF mute will not release when only DTMF matches.

With a conventional group not set up with QT or DQT, only the carrier is considered when signalling matches.

■ Auto Reset

If option signalling matches a group set up with option signalling, option signalling is released. After matching option signalling, option signalling will temporarily reset automatically.

■ Dead Beat Disable

If the D.B.D. code matches, a predetermined action will occur. Whether option signalling is activated or not, when D.B.D. matches on any group, the transceiver will become TX inhibited or TX/RX inhibited. While D.B.D. is active, if the D.B.D. code + "#" code is received, D.B.D. will disactivate.

When D.B.D. matches, transpond will function. Alert will not be output, and option signalling match icon will not appear.

5-2. MSK

Built-in MSK (FleetSync™ : Fleet-ID) decoder is available for option signalling. When the group ID matches, squelch remains muted while the station waits for reception of proper MSK signal. When MSK signal matches, squelch unmutes.

■ AND/OR

AND : QT/DQT/ID + MSK to unmute. MSK matches = alert tone

OR : QT/DQT/ID to unmute. MSK matches = alert tone

6. Alphanumeric Two-way Paging Function (FleetSync™)

6-1. General

The Alphanumeric Two-way Paging Function (FleetSync™) is a Kenwood proprietary protocol. It enables a variety of paging functions.

6-2. ID Construction

A radio unit ID is defined by a combination of 3-digit Fleet and 4-digit ID numbers. Each radio unit must be assigned its own Fleet and ID numbers.

6-3. PTT ID

A pre-programmed unique ID (Own) can be sent at the beginning of transmission and/or the end of transmission to identify which radio unit is on air.

When selecting (Sel) for MSK ID, the radio calls the specific Fleet user the same as selective call.

6-4. Selective Call (SELCALL)

This is a voice call to a particular individual or group of stations.

■ Example of call types;

[100][ALL] : <Group Call>
All the units whose fleet number is "100" are called.
[100][1000] : <Individual Call>
The unit, whose the fleet number is "100" and ID number is "1000", is called.
[ALL][ALL] : <Broadcast Call>
All the units are called.
[ALL][1000] : <Supervisor Call>
All ID "1000" are called regardless of their fleet number.

■ Unit ID Encode Block

Encode ID Block can be set to limit manual dial ID. The radio unit will not accept an ID other than these IDs which are entered from the keypad. If Inter-fleet Call is enabled, block ID setting affects each fleet group.

6-5. Status Message

Using a 2-digit number, you can send and receive a Status message which may be decided in your talk group. Each Status may be displayed with 16 alphanumeric characters if programmed in the radio. A maximum of 9 received messages can be stored in the stack memory, and it can be reviewed after reception. If the message memory becomes full, the oldest one will be erased. The stack memory will be cleared by turning radio power off.

OPERATING FEATURES

■ Status 80~99 (Special)

Status numbers from 80 to 99 are reserved for special purposes. Entering these statuses from the DTMF keypad can be inhibited.

Please notice that the following status numbers are used for special purposes;

80~87 : Reserved for future use.
88 : Terminates to emergency mode.
89 : Request for hornalert (For Mobile).
90 : Remote stun on. Disable the received radio unit's TX.
91 : Remote stun on. Disable the received radio unit's TX/RX.
92 : Cancel remote stun. Enable the received radio unit's TX/RX.
93 : Acknowledgement status sent when the radio unit is in stun mode (TX disabled).
94 : Acknowledgement status sent when the radio unit is in stun mode (TX/RX disabled).
95~97 : Reserved for future use.
98 : Man Down Emergency status.
99 : Emergency Status.

Note : Remote stun works with DTMF D.B.D. function also.

■ Automatic Status Response

If you pre-select a status number and leave the radio in the Status Mode, it can automatically respond with the selected status number upon request from the base station. (The request function is initiated by serial control on the base station (Optional).)

6-6. Short Message (Optional)

A maximum of 48 characters can be sent (External equipment is required). Received Short Messages will be displayed in the same manner as a Status Message. A maximum of 4 received messages can be stored in the stack memory. In the Stack Mode, 3-digit LCD indicates the received Short Message as "M01"~"M04".

6-7. Long Message (Optional)

A maximum of 1024 characters can be sent (External equipment is required). Received Long Message will not be displayed or stacked in the radio memory but is output through the COM (Data) port.

6-8. Emergency Function

Emergency status 99 will be sent at the beginning of each emergency transmission.

■ Emergency Status response

"Alert" can be selected for the called radio unit's response to reception of status 99 which is used as an emergency status.

6-9. Other Functions

■ Manual Dial

Fleet, ID and Status numbers can be entered from DTMF keypad. (DTMF microphopne is required.)

■ FleetSync™ Baud Rate

MSK data baud rate setting. The same rate must be set as a communication partner.

1200bps :
Data communication is made in 1200bps. The communication area is much wider than 2400bps. Recommended for repeater operation.

2400bps :
Data communication is made in 2400bps. The communication area is narrower than 1200bps, but it will decrease the data traffic. Data rate 2400bps may not work properly depending on the repeater's characteristic.

■ Message Mode Timer

Message Mode Timer is a delay timer returning from message/stack mode to Normal mode.

■ Status/Short/Long Message on Data Group

Status/Short/Long Message transmission is made whether on the Data System/Group.

■ Status/Short/Unit ID Message Serial Output (Option)

Whether a received Status/Short message or PTT ID is output or not from serial port.

■ Call Alert (Continuous)

The radio can provide the alert tone repeatedly until next operation.

■ PTT ID Sidetone

This function allows a single beep sound after the PTT ID (MSK) for FleetSync singalling is encoded.

■ Caller ID Stack

The radio stores the last 3 received caller IDs to volatile memory.

■ Caller ID Display

PTT ID is displayed on LCD.

6-10. Parameters

■ GTC Count

Number of Go To data Channel messages to be sent before transmitting a data message if it is being made on Data System/ Group. If a radio unit receives a GTC message, it will move to the Data System/Group of the current system. Increase this item to make sure the called radio unit moves to the Data System/Group.

■ Random Access (Contention)

When a channel (or all the repeater channels for Trunking mode) is busy, radio unit will not transmit (depending on its Busy Channel Lockout setting in conventional mode). As soon as a channel is cleared, some transmissions may crash. Random access is used to avoid this by employing a random transmission sequence.

OPERATING FEATURES

■ Number of Retries

Number of Retries is the maximum number of retry transmission when no acknowledgement is received in the Maximum ACK Wait Time. Increase this item to improve data communication reliability.

■ TX Busy Wait Time

TX Busy Wait Time is the maximum amount of time before giving up the data transmission when the channel (or all the repeater channels for Trunking mode) is busy. Also, this timer affects if it expires during Random Access period.

■ Maximum ACK Wait Time

Maximum ACK Wait Time is the maximum amount of time to wait for an acknowledgement from the called radio unit. It is used as an interval time of retries. It must be set greater than the ACK Delay Time of the called radio unit.

■ ACK Delay Time

ACK Delay Time is the amount of time from the end of receiving a data to the beginning of sending an acknowledgement. It should be adjusted as the repeater's hang-up delay time. Also, it must be set less than the Maximum ACK Wait Time of the calling radio unit.

■ TX Delay Time (RX Capture)

TX Delay Time is the amount of unmodulated transmission to let the called unit stop scanning or exit its battery save mode. It is used only when starting a data communication sequence.

■ Data TX Modulation Delay Time

Data TX Modulation Delay Time is the amount of time from the beginning of transmission to the beginning of a data modulation. It is used every time data is transmitted. It must be set to more than 300ms if data communication is made in Trunking Mode.

7. Audible User Feedback Tones

The transceiver outputs various combinations of tones to notify the user of the transceiver operating state. The main tones are listed below.

The high tone is 1477Hz, the mid tone is 941Hz, and the low tone is 770Hz.

7-1. Power On Tone

This tone is output when the transceiver is turned on. (The high tone is output for 500ms.)

7-2. Alert Tone

This tone is output when the transceiver is TX inhibition for TOT and PLL unlocked. It is output until the PTT button is released. (The 697Hz tone is output.)

7-3. DBD On Tone

When a D.B.D. code is received, transpond tone sounds.

7-4. DBD Off Tone

When a D.B.D. release code is received, transpond tone sounds.

7-5. Password Agreement Tone

When the correct password is entered, the tone sounds. The optional feature's control tone can be set to yes or no.

7-6. PTT Release Tone

When you release the PTT switch, the PTT release tone sounds.

7-7. Busy Tone

Sounds in LTR mode, when you cannot use a repeater (system busy or TX inhibit). Sounds in conventional mode, when busy channel lockout is functioning. You can select yes or no for the optional feature's warning tone.

7-8. Group Call Tone

Sounds when a group call with the correct DTMF option signalling is received, repeats 7 times. You can select yes or no for the optional feature's warning tone.

7-9. Individual Call Tone

Sounds when an individual call with the correct DTMF option signalling is received. You can select yes or no for the optional feature's warning tone.

7-10. Key Press Tone [A]

Sounds when a key is pressed. For toggle keys, sounds when toggle function is turned on (key press tone [B] sounds when it is turned off). You can select yes or no for the optional feature's control tone.

7-11. Key Press Tone [B]

Sounds when a key is pressed. For toggle keys, sounds when the toggle function is turned off (key press tone [A] sounds when it is turned on). You can select yes or no for the optional feature's control tone.

7-12. Key Press Tone [C]

Sounds when a key is pressed. Also sounds when storing data, adding a DTMF code to memory, and when changing test mode settings. You can select yes or no for the optional feature's control tone.

7-13. Key Input Error Tone

Sounds when a key is pressed but that key cannot be used. You can select yes or no for the optional feature's warning tone.

7-14. Roll Over Tone

Sounds at the smallest system/group. You can select yes or no for the optional feature's control tone.

7-15. Transpond Tone

Sounds when an individual call with the correct LTR/DTMF option signalling is received. For group calls, only the group tone will sound, not the transpond tone.

7-16. Intercept Tone

This tone indicates that the transceiver is out of range. It indicates that the PTT button is pressed, and transmission has started, but the repeater cannot be connected and talking is not possible. It is output until the PTT button is released. (The mid tone and low tone are output alternately in 200ms intervals.)

7-17. Delay Tone

This tone is output when the PTT button is pressed and the repeater is accessed three times or more to indicate connection with the repeater is delayed. This tone is the same as the busy tone. (It is not output of clear to talk has been set to yes.)

7-18. Proceed Tone

This tone is output when the PTT button is pressed, transmission starts, and the repeater is connected to indicate that the user can talk if the clear to talk function has been set. (The high tone is output for 100ms.)

7-19. Queue Tone

This tone is output until the auto TEL function is set and the TEL channel is accepted successfully. (The mid tone on for 50ms, off for 50ms, and on for 50ms in 1 second intervals.)

7-20. Deny Tone

This tone is output if the auto TEL function is set, the queue tone is output, but the TEL channel cannot be accessed within 60 seconds. It is similar to the intercept tone. (The mid tone and low tone are output alternately in 150ms intervals.)

7-21. Free System Ringback Mode Tone, System Search Mode Tone

This tone indicates that the transceiver is free system ringback mode or system search mode. (The mid tone is output for 400ms.)

7-22. Ringing Tone

This tone indicates that the transceiver can use the repeater in free system ringback mode. (The mid tone and no tone are output eight cycles alternately in 50ms intervals.)

7-23. System Search Tone

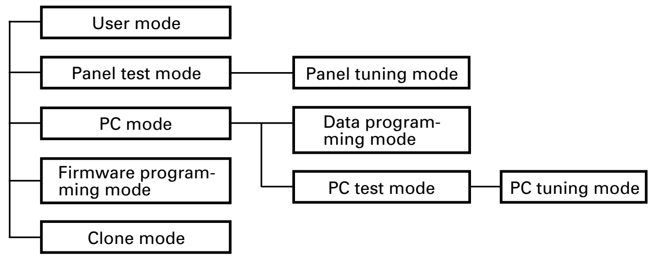
Sounds when the system changes during system search. You can select yes or no for the optional feature's warning tone.

7-24. System Search End Tone

Sounds when a possible connection to a repeater in system search is not mode. You can select yes or no for the optional feature’s warning tone.

REALIGNMENT

1. Modes



Mode	Function
User mode	For normal use.
Panel test mode	Used by the dealer to check the fundamental characteristics.
Panel tuning mode	Used by the dealer to tune the radio.
PC mode	Used for communication between the radio and PC (IBM compatible).
Data programming mode	Used to read and write frequency data and other features to and from the radio.
PC test mode	Used to check the radio using the PC. This feature is included in the FPU. See panel tuning.
Firmware programming mode	Used when changing the main program of the flash memory.
Clone mode	Used to transfer programming data from one radio to another.

2. How to Enter Each Mode

Mode	Operation
User mode	Power ON
Panel test mode	[A]+Power ON (Two seconds)
PC mode	Received commands from PC
Panel tuning mode	[Panel test mode]+[S]
Firmware programming mode	[S]+Power ON (Two seconds)
Clone mode	[C]+Power ON (Two seconds)

3. Panel Test Mode

Setting method refer to ADJUSTMENT.

4. Panel Tuning Mode

Setting method refer to ADJUSTMENT.

REALIGNMENT

5. PC Mode

5-1. Preface

The TK-480/481 transceiver is programmed by using a personal computer, programming interface (KPG-36) and programming software (KPG-49D).

The programming software can be used with an IBM PC or compatible. Figure 1 shows the setup of an IBM PC for programming.

5-2. Connection procedure

1. Connect the TK-480/481 to the personal computer with the interface cable.
2. When the POWER switch on, user mode can be entered immediately. When PC sends command the radio enter PC mode, and "PROGRAM" is displayed on the LCD.
   When data transmitting from transceiver, the red LED is blinking.
   When data receiving to transceiver, the green LED is blinking.

Notes:

- The data stored in the personal computer must match model type, when it is written into the flash memory.
- Change the TK-480/481 to PC mode, then attach the interface cable.

5-3. KPG-36 description (PC programming interface cable: Option)

The KPG-36 is required to interface the TK-480/481 to the computer. It has a circuit in its D-subconnector (25-pin) case that converts the RS-232C logic level to the TTL level.

The KPG-36 connects the universal connector of the TK-480/481 to the computers RS-232C serial port.

5-4. Programming software description

The KPG-49D programming disk is supplied in 3-1/2" disk format. The software on this disk allows a user to program TK-480/481 radios via programming interface cable (KPG-36).

5-5. Programming with IBM PC

If data is transferred to the transceiver from an IBM PC with the KPG-49D, the destination data (basic radio information) for each set can be modified. Normally, it is not necessary to modify the destination data because their values are determined automatically when the frequency range (frequency type) is set.

The values should be modified only if necessary. Data can be programmed into the flash memory in RS-232C format via the universal connector.

KPG-49D instruction manual parts No. : B62-1096-XX

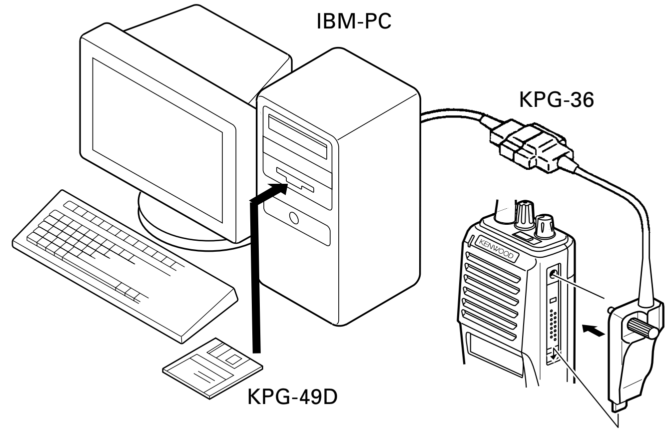


Fig. 1

6. Firmware Programming Mode

6-1. Preface

Flash memory is mounted on the TK-480/481. This allows the TK-480/481 to be upgraded when new features are released in the future. (For details on how to obtain the firmware, contact Customer Service.)

6-2. Connection procedure

Connect the TK-480/481 to the personal computer (IBM PC or compatible) with the interface cable (KPG-36). (Connection is the same as in the PC Mode.)

6-3. Programming

1. Start up the programming software (KPG-49D), 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, 57600 bps) and communications port in the Setup item.
4. Set the firmware to be updated by File select (=F1).
5. Turn the TK-480/481 power ON with the [S] switch held down. Hold the switch down for two seconds until the display changes to "PROG 57600". When "PROG 57600" appears, release your finger from the switch.
6. Check the connection between the TK-480/481 and the personal computer, and make sure that the TK-480/481 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-480/481 starts to receive data. the [P] icon is blinking.
8. If writing ends successfully. the LED on the TK-480/481 lights and the checksum is displayed.
9. If you want to continue programming other TK-480/481 s, repeat steps 5 to 8.

REALIGNMENT

Notes:

- To start the Firmware Programmer from KPG-49D, the Fpro path must be set up by KPG-49D Setup.
- This mode cannot be entered if the Firmware Programming mode is set to Disable in the Programming software (KPG-49D).
- When programming the firmware, it is recommend to copy the data from the floppy disk to your hard disk before update the radio firmware.
  Directry copying from the floppy disk to the radio may not work because the access speed is too slow.

6-4. Function

1. If you press the [MON] switch (top of left side) while "PROG 57600" is displayed, the checksum is displayed. If you press the [MON] switch again while the checksum is displayed, "PROG 57600" is redisplayed.
2. If you press the [LAMP] switch (bottom of left side) while "PROG 57600" is displayed, the display changes to "PROG 19200" to indicate that the write speed is low speed (19200 bps). If you press the [LAMP] switch again while "PROG 19200" is displayed, the display changes to "PROG 38400", and the write speed becomes the middle-speed mode (38400 bps). If you press the [LAMP] switch again while "PROG 38400" is displayed, the display returns to "PROG 57600".

Note:

Normally, write in the high-speed mode.

7. Clone Mode

Programming data can be transferred from one radio to another by connecting them via their external universal connectors. The operation is as follows (the transmit radio is the master and the receive radio is a slave).

1. Turn the master TK-480/481 power ON with the [C] key held down. If the password is set to the TK-480/481, the TK-480/481 displays "CLONE LOCK". If the password is not set, the TK-480/481 displays "CLONE MODE".
2. When "CLONE LOCK" is displayed, only the knob (encoder) and [S], and [0] to [9] keys can be accepted. When you enter the correct password, and "CLONE MODE" is displayed, the TK-480/481 can be used as the cloning master. The following describes how to enter the password.
3. How to enter the password with the keypad;
   If you press a key while "CLONE LOCK" is displayed. The number that was pressed is displayed on the TK-480/481. Each press of the key shifts the display in order to the left. When you enter the password and press the [S] key, "CLONE MODE" is displayed if the entered password is correct. If the password is incorrect, "CLONE LOCK" is redisplayed.
   How to enter the password with the encoder;
   If the encoder is rotated while "CLONE LOCK" is displayed, numbers (0 to 9) are displayed flashing. When you press the [S] key, the currently selected number is determined. If you press the [S] key after entering the password in this procedure, "CLONE MODE" is displayed if the entered password is correct. If the password is incorrect, "CLONE LOCK" is redisplayed.
4. Power on the slave TK-480/481.
5. Connect the cloning cable (No. E30-3325-05) to the universal connectors on the master and slave.
6. Press the [S] key on the master while the master displays "CLONE MODE". The data of the master is sent to the slave. While the slave is receiving the data, "PROGRAM" is displayed. When cloning of data is completed, the master displays "END", and the slave automatically operates in the User mode. The slave can then be operated by the same program as the master.
7. The other slave can be continuously cloned. When the [S] key on the master is pressed while the master displays "END", the master displays "CLONE MODE". Carry out the operation in step 4 to 6.

Note:

Only the same models can be cloned together.

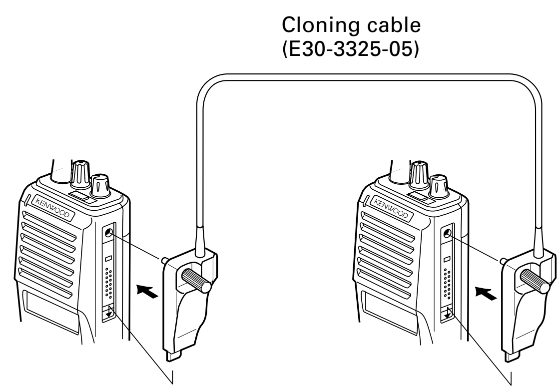


Fig. 2

CIRCUIT DESCRIPTION

1. Overview

This transceiver is an 800/900MHz band EFJ LTR™ trunked system compatible FM portable transceiver that can be programmed to operate on both LTR and conventional systems.

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 44.395MHz 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.

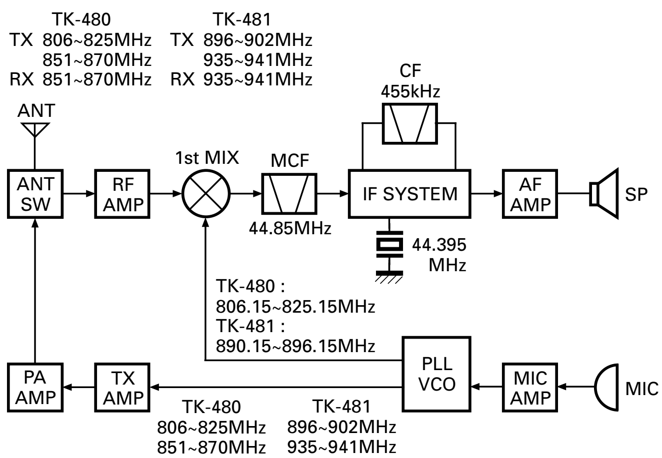


Fig. 1 Frequency configuration

3. Receiver System

3-1. RF unit

An incoming RF signal from the antenna terminal is passed through the antenna switch (D7, D9, and D10 are off) and then the bandpass filter (L11). The signal is amplified by RF amplifier Q9, and passed through the bandpass filter (L20) to remove the spurious signal again. The resulting signal is applied to the first mixer (Q6), where it is mixed with the first local oscillator signal output from the frequency synthesizer to produce the first IF (44.85MHz).

3-2. IF unit

The first IF signal is passed through a four-pole monolithic crystal filter (XF1) to remove a adjacent channel signal. The filtered first IF signal is amplified by the first IF amplifier (Q5) and then applied to the IF system IC (IC9). The IF system IC provides a second mixer, second local oscillator, limiting amplifier, quadrature detector and RSSI (Received Signal Strength Indicator). The second mixer mixes the first IF signal with the 44.395MHz of second local oscillator output (crystal unit X1) and produces the second IF signal of 455kHz.

The second IF signal is passed through the ceramic filter (CF1,2) to more remove the adjacent channel signal. The filtered second IF signal is amplified by the limiting amplifier and demodulated by the quadrature detector with ceramic discriminator (CD1). The demodulated signal is routed to the audio circuit.

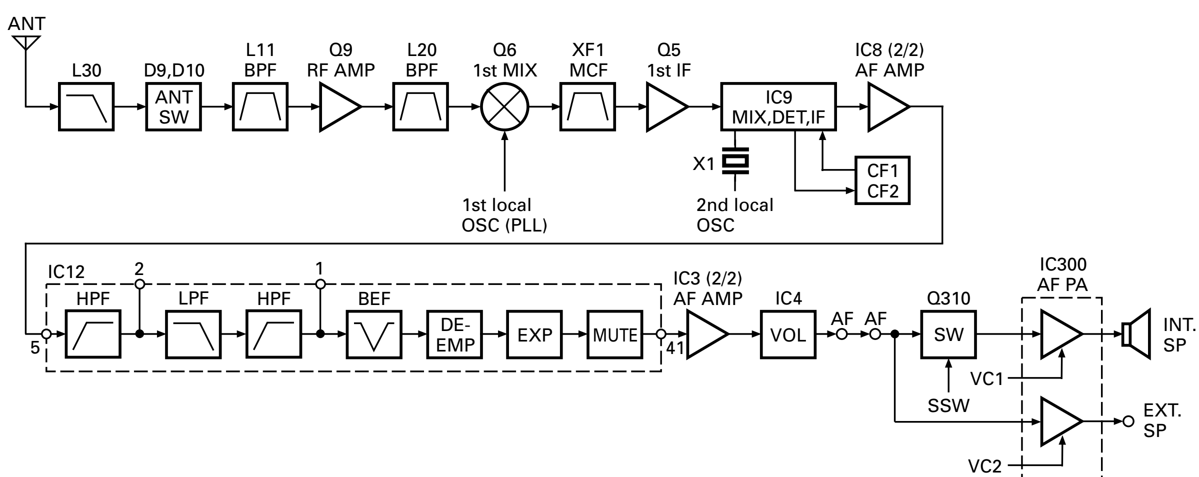


Fig. 2 Receiving system

CIRCUIT DESCRIPTION

3-3. Audio amplifier circuit

The demodulated signal from IC9 is amplified by IC8 (2/2), high-pass filtered, low-pass filtered, high-pass filtered, band-eliminate filtered,and de-emphasized by IC12.

The signal then goes through an AF amplifier IC3 (2/2), an electronic volume control (IC4), and an AF switch (Q310 is on), and is routed to audio power amplifier (IC300), where it is amplified and output to the internal speaker.

The audio mute signal (AM) from the microcomputer becomes Low in the standby and Q304, Q305 which are power supply circuit for IC300 turn off. Also, IC12 is set to the power down mode according to data from microprocessor, and the AF signal is muted. When the audio is output, AM becomes High to turn Q304, Q305 ON, and voltage is supplied to power terminal VP of IC300. Also, IC12 is canceled out of the power down mode.

The speaker is switched by the logic of speaker switching terminal SSW on the universal connector. When SP-MIC is not attached, the logic of SSW becomes High and SW (Q310) is turned ON, and the AF signal is input to both amplifiers of IC300.

When SP-MIC is attached, SSW is connected to GND at inside of SP-MIC. For this reason, Q310 is turned OFF, and the AF signal is input only to amplifier for EXT SP of IC300.

Change of INT/EXT SP refer to Fig. 3.

AM	SSW	VC1	VC2	SP
H	H	H	L	INT
H	L	L	H	EXT
L	H	L	L	MUTE
L	L	L	L	MUTE

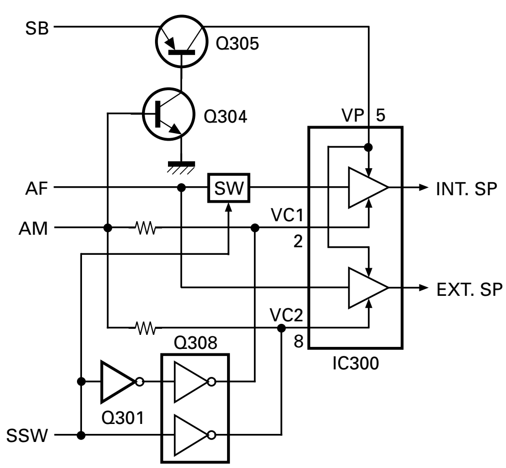


Fig. 3 Audio amplifier circuit

3-4. Squelch circuit

The output from IC9 enters FM IC again, then passed through a band-pass filter. The noise component output from IC9 is amplified by Q19 and rectified by D3 to produce a DC voltage corresponding to the noise level. The DC voltage is sent to the analog port of the CPU (IC15). And IC9 outputs a DC voltage (RSSI) corresponding to the input of the IF amplifier. The CPU reads the RSSI signal via pin 24.

IC15 determines whether to output sounds from the speaker by comparing the input voltage of pin 28 and pin 24 with the preset value.

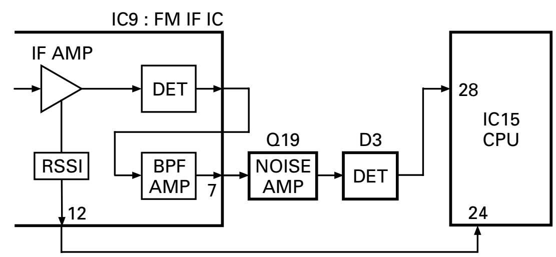


Fig. 4 Squelch circuit

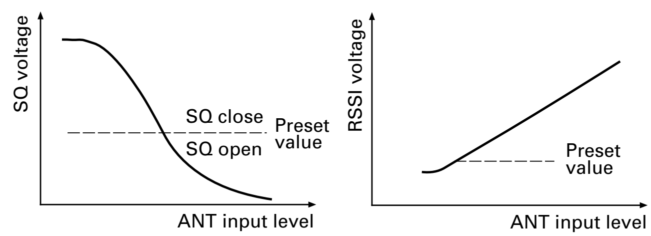


Fig. 5 Squelch and RSSI voltage vs ANT input level

4. Transmitter System

4-1. Microphone amplifier

The signal from the internal microphone goes through the mute switch (Q300).

When the SP-MIC is not attached, the microphone switching terminal (MSW) on the universal connector becomes High, and mute switch (Q300) is turned ON. When the SP-MIC is attached, MSW is connected to GND at inside of SP-MIC. For this reason, Q300 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.

CIRCUIT DESCRIPTION

The signal from microphone passes through the limitter circuit in D11, and through the high-pass filter, the ALC circuit, the low-pass filter, the high-pass filter, and pre-emphasis/IDC circuit in IC12. When encoding DTMF, mute switch (Q7) is turned OFF for muting the microphone input signal.

The signal passes through the D/A converter (IC4) for the maximum deviation adjustment, and enters the summing amplifier consisting of IC3 (2/2), and is mixed with the low speed data from the CPU (IC15).

The output signal from the summing amplifier passes through the D/A converter (IC4) again for the TA maximum deviation adjustment,and the AF switch (Q21 is off in TX), and goes to the VCO modulation input.

The other output signal from the summing amplifier passes through the D/A converter (IC4) again for the BAL adjustment,and the buffer amplifier (IC1 (2/2)), and goes to the VCXO modulation input.

4-2. Drive and Final amplifier

The signal from the T/R switch (D5 is on) is amplified by the pre-drive (Q11) and drive amplifier (Q12) to 50mW.

The output of the drive amplifier is amplified by the RF power amplifier (IC30) to 2.5W (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 harmonic filter (LPF) and antenna switch (D7 is on) and applied to the antenna terminal.

4-3. APC circuit

The APC circuit always monitors the current flowing through the RF power amplifier (IC30) and keeps a constant current. The voltage drop at R127, R128 and R129 is caused by the current flowing through the RF power amplifier and this voltage is applied to the differential amplifier (IC21 1/2).

IC21 (2/2) compares the output voltage of IC21 (1/2) with the reference voltage from IC4, and the output of IC21 (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. Q14,15 and 18 are turned on in transmit and the APC circuit is active.

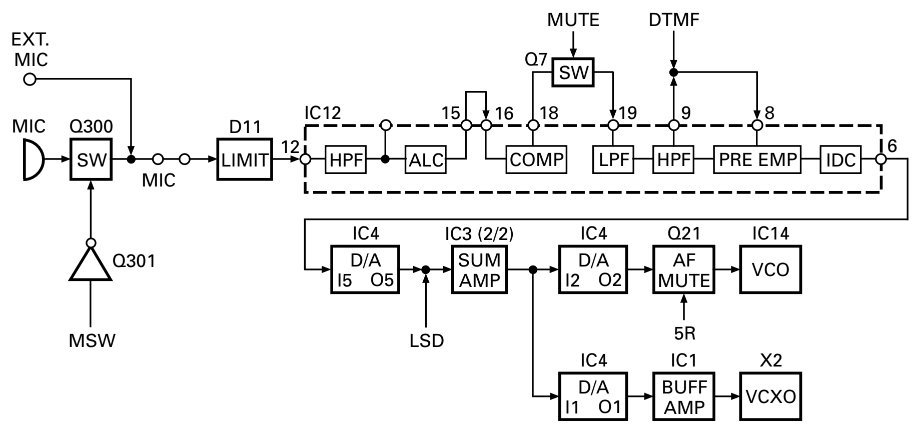


Fig. 6 Microphone amplifier

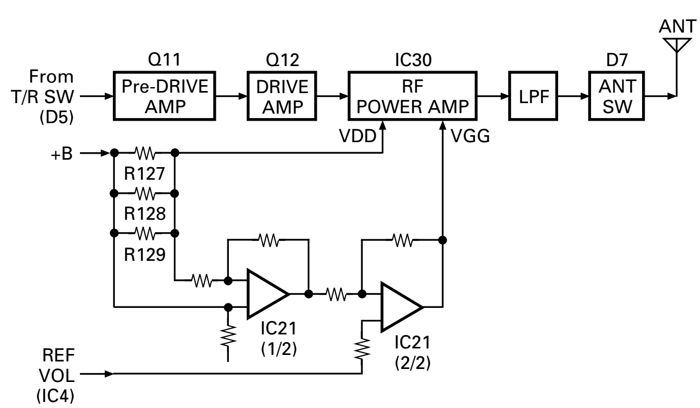


Fig. 7 Drive and final amplifier and APC circuit

CIRCUIT DESCRIPTION

5. Frequency Synthesizer Unit

5-1. Frequency synthesizer

The frequency synthesizer consists of the VCXO (X2), VCO (IC14), PLL IC (IC11) and buffer amplifiers.

The VCXO generates 16.8MHz. The frequency stability is 1.5ppm within the temperature range of –30 to +60°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 TK-480's VCO covers a dual range of the 806~825MHz, and the 851~870MHz. The VCO generates 806.15~825.15MHz for providing to the first local signal in receive. In TA mode, the pin 1 of the VCO goes low and the VCO generates 851~870MHz.

The TK-481's VCO covers a dual range of the 896~902MHz, and the 935~941MHz. The VCO generates 890.15~896.15MHz for providing to the first local signal in receive. In TA mode, the pin 1 of the VCO goes low and the VCO generates 935~941MHz.

The output of the VCO is amplified by the buffer amplifier (Q8) and routed to the pin 5 of the PLL IC. Also the output of the VCO is amplified by the two-buffer amplifier (Q10, Q17) and routed to the next stage according to T/R switch (D4, D5).

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 in the 100kHz reference signal which is eighth of the channel step (12.5kHz). The input signal from the pins 1 and 5 of the PLL IC is divided down to the 100kHz 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 3 of the VCO and locked to keep the VCO frequency constant.

PLL data is output from DT (pin 52), CP (pin 64) and EP (pin 69) of the microprocessor (IC15). 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 21 (UL) of the microprocessor. When the PLL is unlocked, the UL goes low.

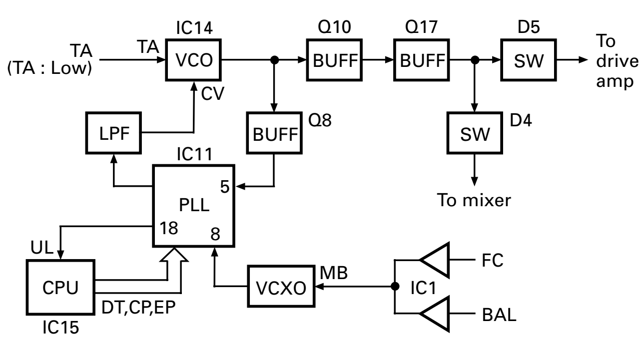


Fig. 8 PLL block diagram

6. Control Circuit

The control circuit consists of microprocessor (IC15) and its peripheral circuits. It controls the TX-RX unit and transfers data to and from the display unit. IC15 mainly performs the following;

1) Switching between transmission and reception by PTT signal input.
2) Reading system, group, frequency, and program data from the memory circuit.
3) Sending frequency program data to the PLL.
4) Controlling squelch on/off by the DC voltage from the squelch circuit.
5) Controlling the audio mute circuit by decode data input.
6) Transmitting tone and encode data.

6-1. Memory circuit

Memory circuit consists of the CPU (IC15) and a flash memory (IC17), a flash memory has 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. The data, such as operating status, is programmed into the EEPROM (IC16).

- **Flash Memory**

Note : The flash memory holds data such as written with the FPU (KPG-49D), firmware program (User mode, Test mode, Tuning mode, etc.) This data must be rewritten when replacing the flash memory.

- **EEPROM**

Note : The EEPROM stores tuning data (Deviation, Squelch, etc.).
Realign the transceiver after replacing the EEPROM.

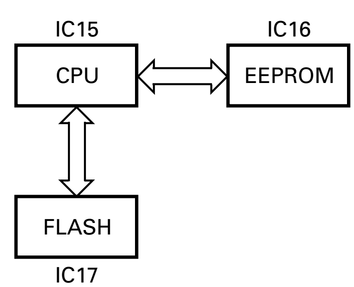


Fig. 9 Memory circuit

CIRCUIT DESCRIPTION

6-2. Low battery warning

The battery voltage is monitored by the microprocessor (IC15). 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. 5.8V), 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.

6-3. Key input

If the clock is supplied to CLK terminal when the RES terminal (CPU pin 53) of the decade counter (IC301) is set to Low, Q0 to Q7 become High sequentially. Normally, KI1 and KI2 are Low (pulled down). When any key is pressed, KI1 or KI2 become High. The CPU detects which key is pressed, according to the voltage of KI1 and KI2 and clock timing.

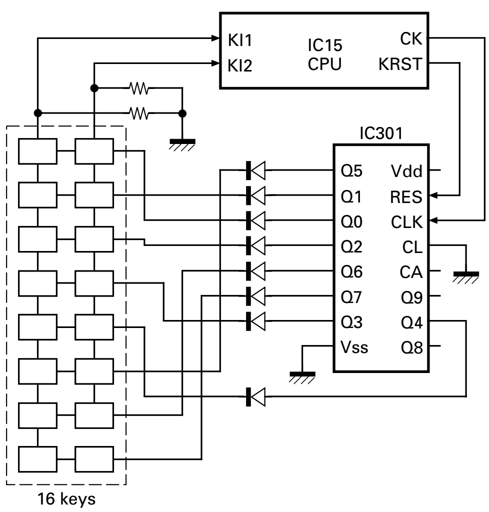


Fig. 10 Key input

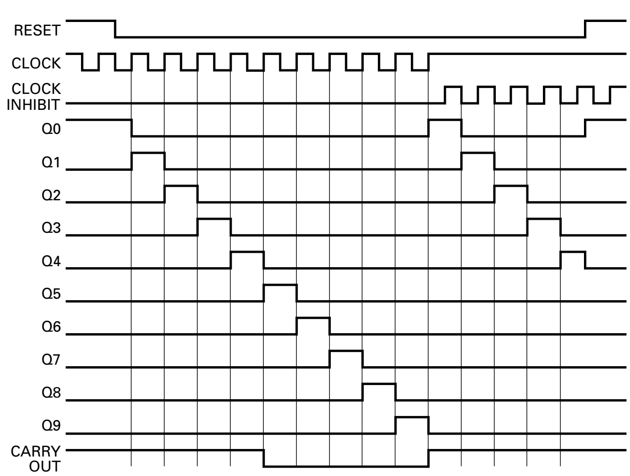


Fig. 11 Decade counter timing chart

7. Signalling Circuit

7-1. Encode

- **Low-speed data (QT,DQT,LTR)**

Low-speed data is output from pin 36 of the CPU. The signal passes through a low-pass CR filter, and goes to the summing amplifier (IC3 1/2). The signal is mixed with the audio signal and goes to the VCO (IC14) and VCXO (X2) modulation input after passing through the D/A converter (IC4) 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 IC23, 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 convertor (IC4) for DTMF deviation adjustment, and then applied to the audio processor (IC12).

The signal is mixed with the audio signal and goes to the VCO and VCXO. The RX DTMF tone is passed a summing amplifier (IC3 2/2), the D/A convertor (IC4) for audio control, audio power amplifier and then to the speaker.

- **MSK**

MSK signal is output from pin 6 of IC12. The signal passes through the D/A converter (IC4) for the MSK deviation adjustment, and is routed to the VCO. When encoding MSK, the microphone input signal is muted.

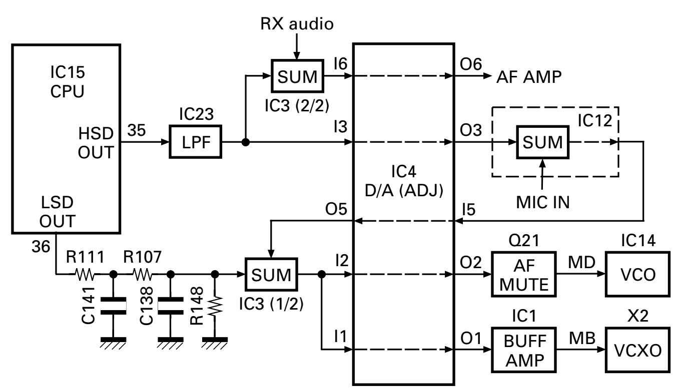


Fig. 12 Encode

CIRCUIT DESCRIPTION

7-2. Decode

- **Low-speed data (QT,DQT,LTR)**

The demodulated signal from the IF IC (IC9) is amplified by IC8 (1/2) and passes through a low-pass filter (IC10) to remove audio components. The signal is input to pin 23 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 IF IC is amplified by IC8 (1/2) and goes to IC13, 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 IC8 (1/2) and goes to pin 5 of IC12. The signal is demodulated by MSK demodulator in IC12. The demodulated data goes to the CPU for processing.

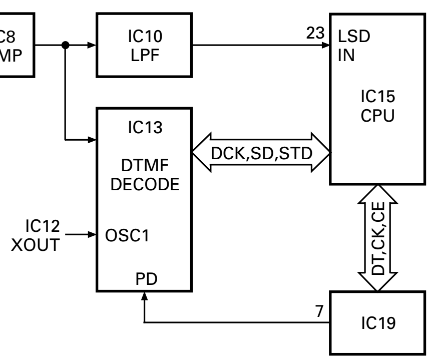


Fig. 13 Decode

8. 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 three AVRs. IC5 supplies 5V (5M) to the control circuit, and IC7 supplies 5V (5C) to common circuits. IC6 supplies to the TX circuit and the RX circuit. During transmission, 5TC becomes Low and Q2 is turned ON to supply 5V (5T) to the TX circuit. During reception, 5RC becomes Low and Q1 is turned ON to supply 5V (5R) to the RX circuit.

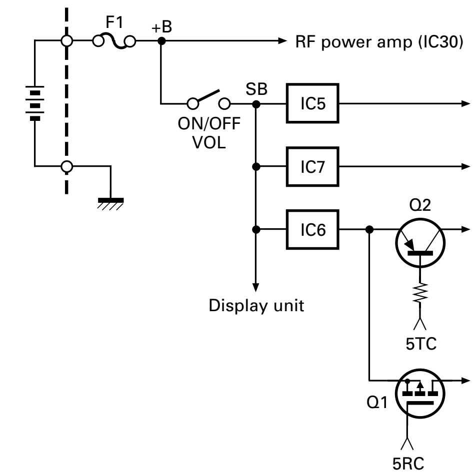


Fig. 14 Power supply circuit

9. Optional Board Terminal

Terminals for mounting the option board are provided at the bottom edge of the TX-RX unit. The table below shows the correspondence between the board and terminals. R422, R32, R250, R259, R147, R276, R421 may have to be removed depending on the type of option board being used.

Name	Function
SB	Battery (7.5V)
GND	Ground
TXD	Serial data
RXD	Serial data
SQ	Busy: high
LOK	Link acquired : low (TX mode)
DI/ANI	Modulation (ANI) input
DEO	Detect output
TXAI/MUTE	Modulation output from board or mic mute: low
TXAO	Modulation input to board
RXAI	Received signal input to board
RXAO	Received signal output from board
D1	Binary 1
D2	Binary 2
OPT	Scramble, Emergency: low
PTTIN	PTT switch signal input to board (TX: low)
5CNS	Battery (5V)
DI9	9600 bps data output
RXEMAO	Received signal output from board (after de-emphasis)
RXEMAI	Received signal input to board (after de-emphasis)
PTTOUT	PTT switch signal output from board (TX: low)
MONI	Busy: low
LAMP	Busy: low
AAC	Audio Amp Control signal output from board (Busy: high)
Audio Beep	Beep signal output from board
AUX TXD	Serial data
AUX RXD/EXTSW	Serial data/Option switch port

Table 1 Terminal name and function

SEMICONDUCTOR DATA

Microprocessor : 30622M8A-4F9GP (TX-RX Unit IC15)

■ **Pin function**

Pin No.	Port name	I/O	Function
1	LSDOUT	O	Low speed data output.
2	HSDOUT	O	High speed data output.
3	HSDIN	I	Not used.
4	DTMSTD	I	DTMF decode IC data detect input.
5	SELF	I	Not used.
6	BYTE	I	+5V.
7	CNVSS	I	GND.
8	SFTOE	O	Shift register output enable.
9	LCDCS	O	LCD driver chip select output.
10	RESET	I	Microcomputer reset input.
11	XOUT	-	9.8304MHz (System clock).
12	VSS	-	GND.
13	XIN	-	9.8304MHz (System clock).
14	VCC	-	+5V
15	AUX	I	AUX switch input.
16	AFTRD	I	MSK modulation data output timing pulse input.
17	AFRTM	I	MSK demodulation data input timing pulse input.
18	EN2	I	Encoder pulse input 2.
19	PLLCLK	O	PLL IC clock output.
20	BEEP	O	Beep data output.
21	AFRDT	I	MSK demodulation data input.
22	AFREG1	O	AF IC register switching data output 1.
23	AFREG2	O	AF IC register switching data output 2.
24	EEPDAT	O	EEPROM data output.
25	DACSTB	O	D/A converter IC data strobe output.
26	AFCLR	O	MSK flame reset output.
27	SAVE	O	Not used.
28	LAMP	I	LAMP switch input.
29	AUXTXD	O	External Serial interface output.
30	AUXRXD	I	External Serial interface input.
31	PLLUL	I	PLL unlock detect input.
32	AFMSKE	O	MSK modulation enable (Enable active “H”).
33	TXD	O	Serial interface output (ex. PC).
34	RXD	I	Serial interface input (ex. PC).
35	AFDAT	O	MSK data output.
36	PTT	I	PTT switch input.
37	RDY	-	Not used.
38	ALE	-	Not used.

Pin No.	Port name	I/O	Function
39	HOLD	-	Not used.
40	HLDA	-	Not used.
41	BLCK	-	Not used.
42	RD	-	Flash memory RD bus.
43	BHE	-	Not used.
44	WR	-	Flash memory WR bus.
45	DTMCLK	O	DTMF decode IC clock output.
46	CNTCLK	O	Common clock output.
47	PLLSTB	O	PLL IC data strobe output.
48	CS0	O	Flash memory chip enable.
49	A19	-	Not used.
50~59	A18~A9	-	Flash memory address bus.
60	VCC	-	+5V
61	A8	-	Flash memory address bus.
62	VSS	-	GND.
63~70	A7~A0	-	Flash memory address bus.
71	MONI	I	Monitor switch input.
72	EN4	I	Not used.
73	EN3	I	Not used.
74	EN1	I	Encoder pulse input 1.
75	MINDAT	O	Common data output.
76	KEY2	I	Key scan input 2.
77	KEY1	I	Key scan input 1.
78	RESET	O	Key scan IC reset output..
79~86	D7~D0	-	Flash memory data bus.
87	DTMDAT	I	DTMF decode IC data input.
88	PF	I	PF switch input.
89	VOL	I	Volume level input.
90	BATT	I	Battery voltage input.
91	ANLSQL	I	Squelch level input.
92	TEMP	I	Not used.
93	RSSI	I	Received signal strength indicator input (RSSI).
94	AVSS	-	GND.
95	LSDIN	I	Low speed data input.
96	VREF	-	+5V
97	AVCC	-	+5V
98	SFTSTB1	O	Shift register data strobe output.
99	W/N	O	Not used.
100	AFSTB	O	AF IC data strobe output.

SEMICONDUCTOR DATA

Shift Register 1 : BU4094BCFV (TX-RX Unit IC18)

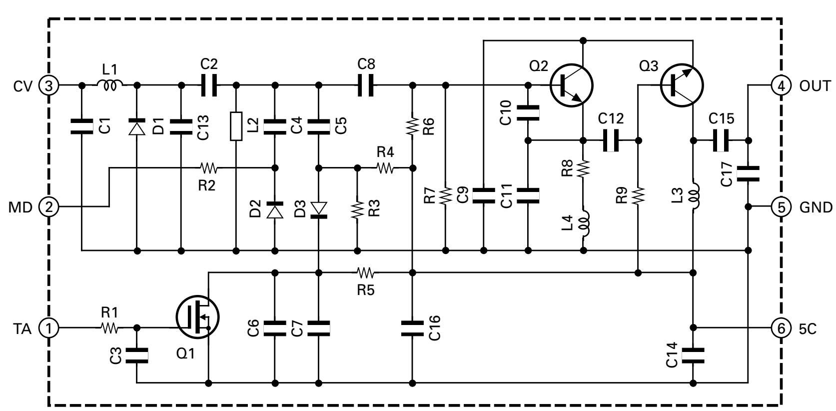
Pin No.	Port	Port name	Function
1	STRB	ES	Strobe
2	DATA	DAT	Data
3	CLK	CK	Clock
4	Q1	LEDR	Red LED. H : On, L : Off
5	Q2	LEDG	Green LED. H : On, L : Off
6	Q3	KEYBLT	Key backlight. H : On, L : Off
7	Q4	MMUTE	MIC mute. H : Unmute, L : Mute
8	VSS		GND.
9	QS		IC18 data output.
10	Q'S		NC
11	Q8	DTMPD	DTMF decode IC power down. H : Power down, L : Busy
12	Q7		Not used.
13	Q6	5TC	TX power control. H : RX, L : TX
14	Q5	5RC	RX power control. H : TX, L : RX
15	OE	OE	Output enable.
16	VDC	5M	+5V.

Shift Register 2 : BU4094BCFV (TX-RX Unit IC19)

Pin No.	Port	Port name	Function
1	STRB	ES	Strobe
2	DATA	DAT	Data
3	CLK	CK	Clock
4	Q1	AM1	Audio mute 1. H : Unmute, L : Mute
5	Q2	LOK	Link complete (Programmable active H/L).
6	Q3	TA	Talk around. H : Off, L : On
7	Q4		NC
8	VSS		GND
9	QS		NC
10	Q'S		NC
11	Q8	SQ	External squelch (Programmable active H/L).
12	Q7	CODE2	Option board data 2.
13	Q6	CODE1	Option board data 1.
14	Q5	OPT	Option board control. Please set option board type in the KPG-49D. H : On, L : Off Auxiliary signal outut. Please set key function in the KPG-49D (Programmable active H/L).
15	OE	OE	Output enable.
16	VDC	5M	+5V.

VCO System : KCH31, KCH32 (TX-RX Unit IC14)

■ Circuit diagram

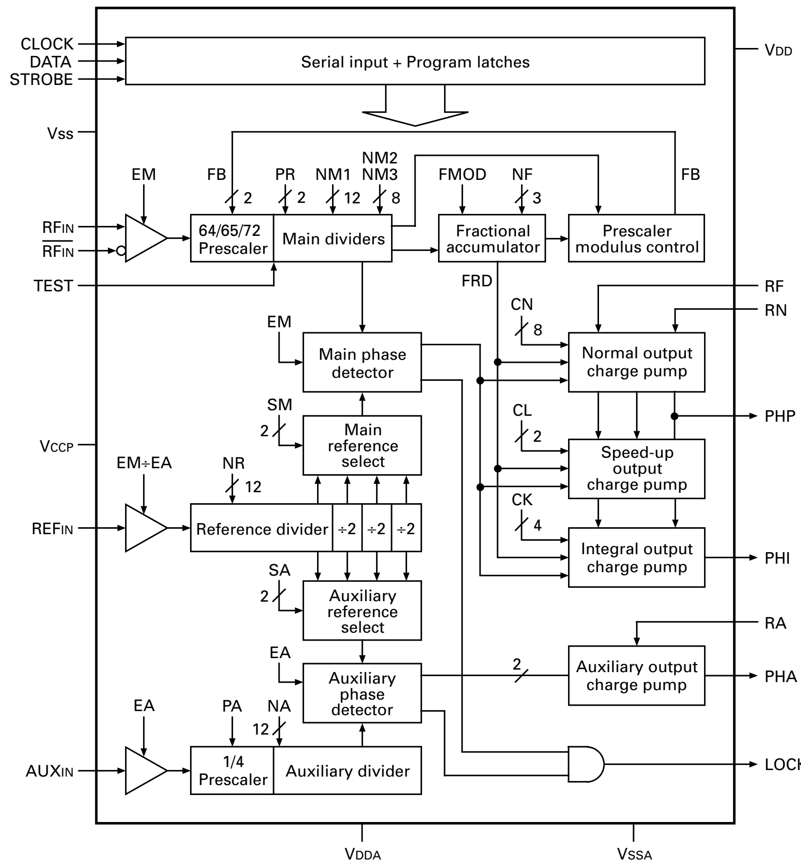


Q1 : 2SK1824
Q2 : 2SC4226(R25)
Q3 : 2SC5008
D1 : HVC350B
D2 : HVC202A
D3 : MA2S077

SEMICONDUCTOR DATA

PLL System : SA7025DK (TX-RX Unit IC11)

■ Block diagram



■ Pin description

Pin No.	Symbol	Description
1	CLOCK	Serial clock input.
2	DATA	Serial data input.
3	STROBE	Serial strobe input.
4	VSS	Digital ground.
5	RFIN	Prescaler positive input.
6	$\overline{\text{RF}}$IN	Prescaler negative input.
7	VCCP	Prescaler positive supply voltage. This pin supplies power to the prescaler and RF input buffer.
8	REFIN	Reference divider input.
9	RA	Auxiliary current setting; resistor to VSSA.
10	AUXIN	Auxiliary divider input.
11	PHA	Auxiliary phase detector output.
12	VSSA	analog ground.
13	PHI	Integral phase detector output.
14	PHP	Proportional phase detector output.
15	VDDA	Analog supply voltage. This pin supplies power to the charge pumps, Auxiliary prescaler, Auxiliary and Reference buffers.
16	RN	Main current setting; resistor to VSSA.
17	RF	Fractional compensation current setting; resistor to VSSA.
18	LOCK	Lock detector output.
19	TEST	Test pin; connect to VDD.
20	VDD	Digital supply voltage. This pin supplies power to the CMOS digital part of the device.

DESCRIPTION OF COMPONENTS

DISPLAY UNIT (X54-3210-XX)

Ref. No.	Use/ Function	Operation/Condition
IC300	IC	Audio power amplifier
IC301	IC	Counter / Key scan
Q300	FET	DC switch / INT MIC on/off
Q301	FET	DC switch
Q302	Transistor	DC switch / LED (Red) driver
Q303	Transistor	DC switch / LED (Green) driver
Q304	Transistor	DC switch
Q305	Transistor	Current driver / Audio amp AVR
Q306	Transistor	DC switch
Q307	Transistor	Current driver / LCD back light LED AVR
Q308	FET	DC switch / SP INT/EXT
Q309	Transistor	Temperature compensation
Q310	FET	Mute switch
D300	Zener diode	Surge absorption
D301	LED	LED / Red, Green
D302	Diode	Quick discharge / AF mute
D303	Zener diode	Voltage reference
D304	Diode	Voltage reference
D305~310	LED	LCD back light
D315~318	Diode	Reverse current prevention
D319~321	Zener diode	Surge absorption

TX-RX UNIT (X57-5630-XX)

Ref. No.	Use/ Function	Operation/Condition
IC1	IC	Buffer amplifier
IC2	IC	Voltage detector / Reset
IC3	IC	Summing amplifier
IC4	IC	D/A converter (Adjustment)
IC5	IC	Voltage regulator / 5M
IC6	IC	Voltage regulator / 5V
IC7	IC	Voltage regulator / 5C
IC8	IC	Buffer amplifier
IC9	IC	FM IF system
IC10	IC	Active filter / For LSDin
IC11	IC	PLL system
IC12	IC	Audio processor
IC13	IC	DTMF decoder
IC14	IC	VCO system
IC15	IC	Microprocessor / 16-bit+1M flash
IC16	IC	EEPROM
IC17	IC	AND gate
IC18,19	IC	Shift register / Output expander
IC21	IC	Comparator (APC)
IC23	IC	Active filter / For HSDout
IC30	IC	Power module
Q1	FET	DC switch / 5R
Q2	Transistor	DC switch / 5T
Q3	Transistor	Ripple filter / 5CV
Q4	Transistor	TX/RX switch
Q5	Transistor	IF amplifier
Q6	FET	Mixer
Q7	FET	Mute switch / MIC line mute
Q8	Transistor	RF amplifier
Q9	FET	RF amplifier
Q10	Transistor	Buffer amplifier
Q11,12	Transistor	RF amplifier / TX driver
Q13	FET	DC switch
Q14,15	Transistor	DC switch
Q16	Transistor	AF mute switch
Q17	Transistor	RF amplifier
Q18	FET	DC switch
Q19	Transistor	Noise amplifier / Squelch
Q20	Transistor	Switch
Q21	FET	AF mute switch
Q22	FET	DC switch
Q23	FET	Mute switch
D1	Diode	Reverse protection
D2	Diode	Overload protection
D3	Diode	Noise detection
D4,5	Diode	TX/RX switch
D6	Diode	Overload protection
D7	Diode	ANT switch
D8	Diode	Reverse current prevention
D9,10	Diode	ANT switch
D11	Diode	Voltage clamp
D12	Diode	DC switch
D17,18	Diode	Surge absorption

PARTS LIST

✻ New Parts. ⚠ indicates safety critical components.
Parts without **Parts No.** are not supplied.
Les articles non mentionnes 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-480/481
DISPLAY UNIT (X54-3210-XX)

Ref. No.	Address	New parts	Parts No.	Description	Desti-nation
TK-480/481					
1	1A	✻	A02-3658-03	CABINET ASSY (4KEY)	A,B-K
1	1A	✻	A02-3659-03	CABINET ASSY (16KEY)	A,B-K2
2	2B	✻	A62-0981-04	PANEL ASSY	
4	2C		B09-0363-03	CAP (SP/MIC) ACSY	
5	2A		B38-0810-05	LCD ASSY	
6	1B	✻	B43-1139-04	BADGE (KENWOOD)	
7	1C		B46-0470-00	WARRANTY CARD	
9	2C	✻	B62-1483-00	INSTRUCTION MANUAL	
10	3A	✻	B72-1968-04	MODEL NAME PLATE	A-K,K2
10	3A	✻	B72-1969-04	MODEL NAME PLATE	B-K,K2
12	3B		E04-0406-05	RF COAXIAL RECEPTACLE (SMA)	
15	2B		E23-1049-04	TERMINAL (ANT)	
51	3A	✻	E23-1166-04	RELAY TERMINAL	
16	2A		E37-0672-05	FLAT CABLE (C0NT-TX-RX)	
17	3A		E37-0673-05	LEAD WIRE WITH CONNECTOR (PTT)	
18	1A		E37-0674-15	LEAD WIRE WITH CONNECTOR (SP)	
19	3B		E58-0440-05	SQUARE SOCKET (SP/MIC)	
52	3A		E72-0412-13	TERMINAL BLOCK	
54	2A		F10-2248-13	SHIELDING CASE (VC0)	
55	2A		F10-2253-03	SHIELDING PLATE (BAND PASS)	
56	2A		F10-2255-04	SHIELDING PLATE (P-MODULE)	
57	2A		F10-2310-03	SHIELDING PLATE (LCD)	
-			F20-1192-04	INSULATING SHEET	
-			F20-3303-04	INSULATING SHEET (MIC/GND)	
21	1A		G01-0881-04	COIL SPRING	
22	1B		G09-0418-05	KNOB SPRING (VOL,ENC)	
23	1B		G10-0799-04	FIBROUS SHEET (SP)	
24	3A		G11-0800-04	SHEET (PTT)	
61	3A		G11-2544-04	SHEET (CHASSIS)	
62	2A		G13-1731-04	CUSHION (LCD)	
63	3A,3B		G13-1762-04	CUSHION (VOL/CHASSIS)	
64	3A	✻	G13-1834-04	CUSHION (TERMINAL)	
26	3B		G53-0811-03	PACKING (TOP)	
25	1A		G53-0840-02	PACKING (4KEY)	A,B-K
25	1A		G53-0841-02	PACKING (16KEY)	A,B-K2
65	3A	✻	G53-1510-04	PACKING (BATT+)	
66	3A	✻	G53-1520-24	PACKING (TERMINAL)	
28	2D		H12-3014-02	PACKING FIXTURE	
29	3D	✻	H52-1096-12	ITEM CARTON CASE	A-K,K2
29	3D	✻	H52-1097-12	ITEM CARTON CASE	B-K,K2
31	1A		J19-1572-04	HOLDER	
68	2A		J21-8321-03	HARDWARE FIXTURE (P-MODULE)	
32	2C		J29-0658-05	HOOK ACSY	
33	3B		J82-0045-05	FPC (VOL,ENC)	
34	3B		J82-0046-05	FPC (SOCKET)	
38	1B		K29-5157-03	KNOB (PTT)	
39	1B		K29-5158-03	KEY TOP (PTT)	
40	1A		K29-5165-03	LEVER KNOB	
36	1B		K29-5231-03	KNOB (VOL)	
37	1B		K29-5232-03	KNOB (ENC)	
A	2B		N14-0569-04	CIRCULAR NUT (VOL,ENC)	
B	3B		N30-2605-46	PAN HEAD MACHINE SCREW (ANT)	
C	3A		N30-2610-46	PAN HEAD MACHINE SCREW (CASE)	
D	2A		N67-2606-46	PAN HEAD SEMS SCREW W (P-MODULE)	
F	3A	✻	N79-2025-46	PAN HEAD TAPTITE SCREW (TERMINAL)	
E	2A,1B		N83-2005-46	PAN HEAD TAPTITE SCREW (UNIT)	
42	2C		N99-2004-05	SCREW SET ACSY	
44	3B		R31-0617-05	VARIABLE RESISTOR (POWER SW/VOL)	
S300	-		S70-0414-05	TACT SWITCH	
46	1A		T07-0714-05	SPEAKER	
47	2C	✻	T90-0636-25	WHIP ANTENNA (800MHZ) ACSY	A-K,K2
47	2C	✻	T90-0640-25	WHIP ANTENNA (900MHZ) ACSY	B-K,K2
MIC300	1A		T91-0579-05	MIC ELEMENT	
49	2B		W02-1814-05	ENCODER	
50	1D	✻	W09-0900-35	BATTERY ASSY ACSY	
DISPLAY UNIT (X54-3210-XX) -10 : K -11 : K2					
D301			B30-2019-05	LED (RE/GR) (BUSY/TX)	
D305-310			B30-2171-05	LED (BACKLIGHT)	A,B-K2
D305,306			B30-2171-05	LED (BACKLIGHT)	
C301			CC73GCH1H470J	CHIP C 47PF J	
C302			C92-0560-05	CHIP-TAN 10UF 6.3WV	
C304			CK73FB1C474K	CHIP C 0.47UF K	
C305			CC73GCH1H101J	CHIP C 100PF J	
C307			CK73GB1C104K	CHIP C 0.10UF K	
C308			CC73GCH1H101J	CHIP C 100PF J	
C309			CK73FB1C474K	CHIP C 0.47UF K	
C310			CK73GB1C104K	CHIP C 0.10UF K	
C311			CC73GCH1H470J	CHIP C 47PF J	
C312			CK73GB1C104K	CHIP C 0.10UF K	
C313			C92-0628-05	CHIP-TAN 10UF 10WV	
C314			C92-0647-05	CHIP-TAN 3.3UF 4WV	
C315			CC73GCH1H101J	CHIP C 100PF J	
C316,317			CC73GCH1H470J	CHIP C 47PF J	
C318			CC73GCH1H101J	CHIP C 100PF J	
C321-333			CC73GCH1H470J	CHIP C 47PF J	
C335-339			CC73GCH1H470J	CHIP C 47PF J	
C340			CK73GB1E153K	CHIP C 0.015UF K	
C341-344			CC73GCH1H470J	CHIP C 47PF J	
CN300			E40-5891-05	FLAT CABLE CONNECTOR (24P)	
CN301			E40-5892-05	FLAT CABLE CONNECTOR (14P)	
CN302			E40-5662-05	PIN ASSY SOCKET (SP)	
CN303			E40-5887-05	PIN ASSY (PTT)	
CN304			E40-5823-05	FLAT CABLE CONNECTOR (LCD)	
L300,301			L92-0141-05	FERRITE CHIP	
L302,303			L92-0138-05	FERRITE CHIP	
L304,305			L92-0141-05	FERRITE CHIP	
L306,307			L92-0138-05	FERRITE CHIP	
L308,309			L92-0141-05	FERRITE CHIP	
CP300,301			R90-0723-05	MULTI-COMP 47K X2	
CP302			R90-0724-05	MULTI-COMP 1K X4	A,B-K2
CP303			R90-0724-05	MULTI-COMP 1K X4	

A : TK-480 (K,K2)
B : TK-481 (K,K2)

PARTS LIST

Ref. No.	Address	New parts	Parts No.	Description	Desti-nation
R300			RK73GB1J103J	CHIP R 10K J 1/16W	
R301			RK73FB2A101J	CHIP R 100 J 1/10W	
R302			RK73GB1J470J	CHIP R 47 J 1/16W	
R303			RK73GB1J471J	CHIP R 470 J 1/16W	
R304			RK73GB1J182J	CHIP R 1.8K J 1/16W	
R305			RK73GB1J104J	CHIP R 100K J 1/16W	
R306			R92-1252-05	CHIP R 0 OHM	
R307			RK73GB1J821J	CHIP R 820 J 1/16W	
R308			RK73GB1J153J	CHIP R 15K J 1/16W	
R309			R92-1252-05	CHIP R 0 OHM	
R310			RK73GB1J331J	CHIP R 330 J 1/16W	
R311			RK73GB1J102J	CHIP R 1.0K J 1/16W	
R312			RK73GB1J104J	CHIP R 100K J 1/16W	
R313,314			RK73GB1J102J	CHIP R 1.0K J 1/16W	
R315			RK73GB1J104J	CHIP R 100K J 1/16W	
R316			RK73GB1J473J	CHIP R 47K J 1/16W	
R317			RK73GB1J472J	CHIP R 4.7K J 1/16W	
R318			RK73GB1J104J	CHIP R 100K J 1/16W	
R319			RK73GB1J820J	CHIP R 82 J 1/16W	
R320,321			RK73GB1J820J	CHIP R 82 J 1/16W	A,B-K2
R324			RK73GB1J102J	CHIP R 1.0K J 1/16W	
R325			RK73GB1J102J	CHIP R 1.0K J 1/16W	A,B-K2
R326			RK73GB1J124J	CHIP R 120K J 1/16W	
R327			RK73GB1J563J	CHIP R 56K J 1/16W	
R328			RK73GB1J124J	CHIP R 120K J 1/16W	
R331			RK73GB1J103J	CHIP R 10K J 1/16W	
R332			RK73GB1J272J	CHIP R 2.7K J 1/16W	
R333			RK73GB1J103J	CHIP R 10K J 1/16W	
R336			R92-1252-05	CHIP R 0 OHM	
R337			RK73GB1J472J	CHIP R 4.7K J 1/16W	
R338-341			RK73GB1J101J	CHIP R 100 J 1/16W	
S301-303			S70-0457-05	TACT SWITCH (PTT)	
D300			NNCD6.8G	ZENER DIODE	
D302			1SS373	DIODE	
D303			015AZ2.4-X	ZENER DIODE	
D304			MA2S111	DIODE	
D315			IMN10	DIODE	A,B-K2
D316			MA2S111	DIODE	A,B-K2
D317			MA2S111	DIODE	
D318			IMN10	DIODE	
D319-321			015AZ6.8	ZENER DIODE	
IC300			TDA7053AT	IC (AUDIO AMP)	
IC301		*	TC74HC4017AF	IC (COUNTER)	
Q300			2SJ243	FET	
Q301			UPA672T	FET	
Q302-304			2SC4617(S)	TRANSISTOR	
Q305			2SB798(DL,DK)	TRANSISTOR	
Q306			2SC4617(S)	TRANSISTOR	
Q307			2SB1132(Q,R)	TRANSISTOR	
Q308			UPA672T	FET	
Q309			2SC4617(S)	TRANSISTOR	
Q310			2SK1824	FET	
TH300			TN10-3S154JT	THERMISTOR	

TX-RX UNIT (X57-5630-XX) -10 : TK-480 -11 : TK-481

Ref. No.	Address	New parts	Parts No.	Description	Desti-nation
C1,2			CK73GB1E103K	CHIP C 0.010UF K	
C3,4			CC73GCH1H101J	CHIP C 100PF J	
C5			CK73GB1E103K	CHIP C 0.010UF K	
C6			C92-0507-05	CHIP-TAN 4.7UF 6.3WV	
C7			CC73GCH1H101J	CHIP C 100PF J	
C8			CK73GB1E223K	CHIP C 0.022UF K	
C9			CK73GB1C104K	CHIP C 0.10UF K	
C10			C92-0507-05	CHIP-TAN 4.7UF 6.3WV	
C11			CK73GB1C104K	CHIP C 0.10UF K	
C12,13			C92-0507-05	CHIP-TAN 4.7UF 6.3WV	
C14			C92-0576-05	CHIP-TAN 1.0UF 6.3WV	
C15			CC73GCH1H100D	CHIP C 10PF D	
C16,17			CC73GCH1H101J	CHIP C 100PF J	
C18			CK73GB1C104K	CHIP C 0.10UF K	
C19-23			CC73GCH1H101J	CHIP C 100PF J	
C24			C92-0507-05	CHIP-TAN 4.7UF 6.3WV	
C25			CK73FB1A105K	CHIP C 1.0UF K	
C26			CK73GB1E123K	CHIP C 0.012UF K	
C27			CK73GB1C104K	CHIP C 0.10UF K	
C28-30			CC73GCH1H101J	CHIP C 100PF J	
C31			CK73GB1C104K	CHIP C 0.10UF K	
C32			CK73GB1H472K	CHIP C 4700PF K	
C33			CK73GB1H471K	CHIP C 470PF K	
C34			C92-0560-05	CHIP-TAN 10UF 6.3WV	
C35			CK73GB1C333K	CHIP C 0.033UF K	
C36			CC73GCH1H820J	CHIP C 82PF J	
C37			C92-0560-05	CHIP-TAN 10UF 6.3WV	
C38			CC73GCH1H101J	CHIP C 100PF J	
C39			CC73GCH1H221J	CHIP C 220PF J	
C40			CC73GCH1H101J	CHIP C 100PF J	
C41			CK73FB1C334K	CHIP C 0.33UF K	
C42			CK73GB1E103K	CHIP C 0.010UF K	
C43			C92-0513-05	CHIP-TAN 3.3UF 6.3WV	
C44			C92-0662-05	CHIP-TAN 15UF 6.3WV	
C45			CC73GCH1H220J	CHIP C 22PF J	
C46			CC73GCH1H221J	CHIP C 220PF J	
C47			CK73GB1E223K	CHIP C 0.022UF K	
C48			CC73GCH1H220J	CHIP C 22PF J	
C49,50			CK73GB1H102K	CHIP C 1000PF K	
C51			CK73GB1E223K	CHIP C 0.022UF K	
C52-54			CK73GB1H102K	CHIP C 1000PF K	
C55			CC73GCH1H150J	CHIP C 15PF J	
C56			CK73GB1H222K	CHIP C 2200PF K	
C57			CK73GB1E153K	CHIP C 0.015UF K	
C58			CK73GB1C104K	CHIP C 0.10UF K	
C59			CC73GCH1H101J	CHIP C 100PF J	
C60			CC73GCH1H100D	CHIP C 10PF D	
C61			CC73GCH1H040C	CHIP C 4.0PF C	B-K,K2
C62			CK73GB1E103K	CHIP C 0.010UF K	
C63			CC73GCH1H101J	CHIP C 100PF J	
C64			CC73GCH1H271J	CHIP C 270PF J	
C65			CK73GB1H103K	CHIP C 0.010UF K	
C66			CK73GB1C104K	CHIP C 0.10UF K	
C67			CK73GB1H122J	CHIP C 1200PF J	
C68			CC73GCH1H040C	CHIP C 4.0PF C	B-K,K2
C69			C92-0559-05	CHIP-TAN 6.8UF 6.3WV	
C70-72			CK73GB1E103K	CHIP C 0.010UF K	
C73			CC73GCH1H101J	CHIP C 100PF J	

A : TK-480 (K,K2)
B : TK-481 (K,K2)

PARTS LIST

TX-RX UNIT (X57-5630-XX)

Ref. No.	Address	New parts	Parts No.	Description	Desti-nation
C74			CK73GB1C104K	CHIP C 0.10UF K	
C75			CK73GB1C333K	CHIP C 0.033UF K	
C76			CK73GB1C104K	CHIP C 0.10UF K	
C77			CK73GB1H562J	CHIP C 5600PF J	
C78			CK73GB1E103K	CHIP C 0.010UF K	
C79			CC73GCH1H121J	CHIP C 120PF J	
C80			CK73GB1C683K	CHIP C 0.068UF K	
C81			CC73GCH1H101J	CHIP C 100PF J	
C82,83			CK73GB1H562J	CHIP C 5600PF J	
C84			CC73GCH1H150J	CHIP C 15PF J	
C85			CK73GB1H272J	CHIP C 2700PF J	
C86			CK73GB1C333K	CHIP C 0.033UF K	
C87			CC73GCH1H030C	CHIP C 3.0PF C	
C88			CC73GCH1H101J	CHIP C 100PF J	
C89,90			CK73GB1H272J	CHIP C 2700PF J	
C91			CK73GB1E103K	CHIP C 0.010UF K	
C92			CK73GB1C104K	CHIP C 0.10UF K	
C93			CC73GCH1H151J	CHIP C 150PF J	
C94			CC73GCH1H101J	CHIP C 100PF J	
C95			C92-0504-05	CHIP-TAN 0.68UF 20WV	A-K,K2
C95			C92-0003-05	CHIP-TAN 0.47UF 25WV	B-K,K2
C96			CK73GB1H122K	CHIP C 1200PF K	A-K,K2
C96			CK73GB1H102K	CHIP C 1000PF K	B-K,K2
C97			CK73GB1H102K	CHIP C 1000PF K	
C98			CC73GCH1H030C	CHIP C 3.0PF C	
C99			CC73GCH1H1R5B	CHIP C 1.5PF B	
C100			CC73GCH1H391J	CHIP C 390PF J	A-K,K2
C100			CK73GB1H821K	CHIP C 820PF K	B-K,K2
C101			C92-0560-05	CHIP-TAN 10UF 6.3WV	
C102			CK73GB1C104K	CHIP C 0.10UF K	
C103,104			CC73GCH1H101J	CHIP C 100PF J	
C105			CK73GB1C473K	CHIP C 0.047UF K	
C106-108			CK73GB1C104K	CHIP C 0.10UF K	
C109			C92-0507-05	CHIP-TAN 4.7UF 6.3WV	
C110			CC73GCH1H1R5B	CHIP C 1.5PF B	
C111,112			CK73GB1C104K	CHIP C 0.10UF K	
C113			CK73GB1C473K	CHIP C 0.047UF K	
C114,115			CK73GB1H472K	CHIP C 4700PF K	A-K,K2
C114,115			CK73GB1H332K	CHIP C 3300PF K	B-K,K2
C116			CK73GB1H102K	CHIP C 1000PF K	
C117			CC73GCH1H470J	CHIP C 47PF J	
C118			CK73GB1E103K	CHIP C 0.010UF K	
C119			CC73GCH1HR75C	CHIP C 0.75PF C	
C120			CC73GCH1H101J	CHIP C 100PF J	
C121			CK73GB1E153K	CHIP C 0.015UF K	
C122			CC73GCH1H1R5C	CHIP C 1.5PF C	A-K,K2
C122			CC73GCH1H030C	CHIP C 3.0PF C	B-K,K2
C123			C92-0507-05	CHIP-TAN 4.7UF 6.3WV	
C124			CK73GB1E103K	CHIP C 0.010UF K	
C125			CK73GB1H102K	CHIP C 1000PF K	
C126			CK73GB1C104K	CHIP C 0.10UF K	
C127-129			CC73GCH1H101J	CHIP C 100PF J	
C130			CC73GCH1H100D	CHIP C 10PF D	
C131			CC73GCH1H101J	CHIP C 100PF J	
C132			CC73GCH1H010C	CHIP C 1.0PF C	A-K,K2
C132			CC73GCH1HR75C	CHIP C 0.75PF C	B-K,K2
C133			CC73GCH1H101J	CHIP C 100PF J	
C134			CC73GCH1H010B	CHIP C 1.0PF B	A-K,K2
C135			CC73GCH1H101J	CHIP C 100PF J	
C136			CC73GCH1H030C	CHIP C 3.0PF C	
C137			CC73GCH1H101J	CHIP C 100PF J	
C138			CK73GB1E103K	CHIP C 0.010UF K	
C139			CC73GCH1H030C	CHIP C 3.0PF C	A-K,K2
C139			CC73GCH1H020C	CHIP C 2.0PF C	B-K,K2
C140			CK73FB1A105K	CHIP C 1.0UF K	
C141			CK73GB1H472K	CHIP C 4700PF K	
C142,143			CC73GCH1H101J	CHIP C 100PF J	
C144			CK73GB1C273K	CHIP C 0.027UF K	
C145,146			CC73GCH1H101J	CHIP C 100PF J	
C147,148			CK73HB1C103K	CHIP C 0.010UF K	
C149			CC73GCH1H040C	CHIP C 4.0PF C	
C150,151			CC73GCH1H101J	CHIP C 100PF J	
C152			CC73GCH1H020C	CHIP C 2.0PF C	
C153			CC73GCH1H101J	CHIP C 100PF J	
C154			CK73GB1C104K	CHIP C 0.10UF K	
C155			CC73GCH1H101J	CHIP C 100PF J	
C156			C92-0507-05	CHIP-TAN 4.7UF 6.3WV	
C157			CC73GCH1H680J	CHIP C 68PF J	
C158			CC73GCH1H270J	CHIP C 27PF J	
C159			CK73FB1H563K	CHIP C 0.056UF K	
C160,161			CC73GCH1H101J	CHIP C 100PF J	
C162			CC73GCH1H270J	CHIP C 27PF J	
C163			CK73FB1C474K	CHIP C 0.47UF K	
C164,165			CC73GCH1H101J	CHIP C 100PF J	
C166			CC73GCH1H010C	CHIP C 1.0PF C	A-K,K2
C166			CC73GCH1HR75C	CHIP C 0.75PF C	B-K,K2
C167			CC73GCH1H101J	CHIP C 100PF J	
C168			CC73GCH1H020C	CHIP C 2.0PF C	
C169-172			CC73GCH1H101J	CHIP C 100PF J	
C173			CC73GCH1H020C	CHIP C 2.0PF C	
C174			CC73GCH1H1R5C	CHIP C 1.5PF C	
C175			CC73GCH1H030C	CHIP C 3.0PF C	
C176			CC73GCH1H010C	CHIP C 1.0PF C	A-K,K2
C176			CC73GCH1HR75C	CHIP C 0.75PF C	B-K,K2
C177			CK73GB1C473K	CHIP C 0.047UF K	
C178-180			CC73GCH1H101J	CHIP C 100PF J	
C181,182			CK73GB1E103K	CHIP C 0.010UF K	
C183			CC73GCH1H101J	CHIP C 100PF J	
C184			CC73GCH1H030C	CHIP C 3.0PF C	
C185			CC73GCH1H101J	CHIP C 100PF J	
C186			CC73GCH1H1R5C	CHIP C 1.5PF C	
C187			CC73GCH1H101J	CHIP C 100PF J	
C188-191			CC73GCH1H470J	CHIP C 47PF J	
C192			CC73GCH1H101J	CHIP C 100PF J	
C193			CC73GCH1H020C	CHIP C 2.0PF C	A-K,K2
C193			CC73GCH1H1R5C	CHIP C 1.5PF C	B-K,K2
C194-199			CC73GCH1H101J	CHIP C 100PF J	
C200			CK73GB1E103K	CHIP C 0.010UF K	
C201			CC73GCH1H470J	CHIP C 47PF J	
C202			CK73GB1E103K	CHIP C 0.010UF K	
C203			CC73GCH1H470J	CHIP C 47PF J	
C204			C92-0003-05	CHIP-TAN 0.47UF 25WV	
C205,206			CK73HB1C103K	CHIP C 0.010UF K	
C207			CK73GB1C104K	CHIP C 0.10UF K	
C208,209			CC73GCH1H101J	CHIP C 100PF J	
C261,262			CK73HB1C103K	CHIP C 0.010UF K	
C263			C92-0628-05	CHIP-TAN 10UF 10WV	
CN1			E40-5823-05	FLAT CABLE CONNECTOR (10P)	
CN2			E40-9517-05	PIN ASSY SOCKET (4P)	

A : TK-480 (K,K2)
B : TK-481 (K,K2)

PARTS LIST

TX-RX UNIT (X57-5630-XX)

Ref. No.	Address	New parts	Parts No.	Description	Desti-nation
CN3			E40-5890-05	FLAT CABLE CONNECTOR (24P)	
CN4-9			E23-1002-05	TERMINAL	
CN10			E23-0342-05	TEST TERMINAL	
CN11,12			E23-1002-05	TERMINAL	
F1			F53-0130-05	FUSE (3A)	
F1			F53-0217-05	FUSE (3A)	
CD1			L79-1072-05	TUNING COIL	
CF1,2			L72-0924-05	CERAMIC FILTER (455KHZ)	A-K,K2
CF1,2			L72-0939-05	CERAMIC FILTER (455KHZ)	B-K,K2
L1			L92-0149-05	FERRITE CHIP	
L3			L40-1095-34	SMALL FIXED INDUCTOR (1UH)	
L4			L40-4791-37	SMALL FIXED INDUCTOR (4.700UH)	
L5			L92-0138-05	FERRITE CHIP	
L6,7			L40-3985-45	SMALL FIXED INDUCTOR (0.39UH)	
L8			L92-0138-05	FERRITE CHIP	
L9			L40-1075-92	SMALL FIXED INDUCTOR (10NH)	A-K,K2
L9			L40-6865-92	SMALL FIXED INDUCTOR (6.8NH)	B-K,K2
L10			L40-8265-92	SMALL FIXED INDUCTOR (8.2NH)	A-K,K2
L10			L40-6865-92	SMALL FIXED INDUCTOR (6.8NH)	B-K,K2
L11			L79-1464-05	DIELECTRIC FILTER (860MHZ)	A-K,K2
L11			L79-1466-05	DIELECTRIC FILTER (938MHZ)	B-K,K2
L12			L92-0138-05	FERRITE CHIP	
L13,14			L40-1075-92	SMALL FIXED INDUCTOR (10NH)	
L15			L40-5663-92	SMALL FIXED INDUCTOR (5.6NH)	A-K,K2
L15			L40-2763-92	SMALL FIXED INDUCTOR (2.7NH)	B-K,K2
L16			L92-0138-05	FERRITE CHIP	
L17			L40-1075-92	SMALL FIXED INDUCTOR (10NH)	A-K,K2
L17			L40-8265-92	SMALL FIXED INDUCTOR (8.2NH)	B-K,K2
L18			L40-2275-92	SMALL FIXED INDUCTOR (22NH)	A-K,K2
L18			L40-6865-92	SMALL FIXED INDUCTOR (6.8NH)	B-K,K2
L19			L40-1075-92	SMALL FIXED INDUCTOR (10NH)	A-K,K2
L19			L40-1275-92	SMALL FIXED INDUCTOR (12NH)	B-K,K2
L20			L79-1465-05	DIELECTRIC FILTER (860MHZ)	A-K,K2
L20			L79-1467-05	DIELECTRIC FILTER (938MHZ)	B-K,K2
L21			L40-6865-92	SMALL FIXED INDUCTOR (6.8NH)	A-K,K2
L21			L40-5663-92	SMALL FIXED INDUCTOR (5.6NH)	B-K,K2
L22,23			L92-0138-05	FERRITE CHIP	
L24			L40-6865-92	SMALL FIXED INDUCTOR (6.8NH)	A-K,K2
L24			L40-5663-92	SMALL FIXED INDUCTOR (5.6NH)	B-K,K2
L25			L92-0149-05	FERRITE CHIP	
L26			L92-0138-05	FERRITE CHIP	
L27			L40-6875-54	SMALL FIXED INDUCTOR (68NH)	
L28			L33-0761-05	SMALL FIXED INDUCTOR	
L29			L40-1075-92	SMALL FIXED INDUCTOR (10NH)	
L30			L79-1468-05	FILTER MODULE (870MHZ)	A-K,K2
L30			L79-1469-05	FILTER MODULE (960MHZ)	B-K,K2
L31			L33-0760-05	SMALL FIXED INDUCTOR	
L32			L40-6875-54	SMALL FIXED INDUCTOR (68NH)	
L34			L40-8265-92	SMALL FIXED INDUCTOR (8.2NH)	A-K,K2
L34			L40-1075-92	SMALL FIXED INDUCTOR (10NH)	B-K,K2
L35			L92-0138-05	FERRITE CHIP	
L53-56			L92-0138-05	FERRITE CHIP	
X1			L77-1760-15	CRYSTAL RESONATOR (44.395MHZ)	
X2			L77-1699-15	VCXO (16.8MHZ)	
X3			L77-1708-05	CRYSTAL RESONATOR (3.579545MHZ)	
X4			L78-0462-05	RESONATOR (9.8304MHZ)	
XF1			L71-0501-05	MCF (44.85MHZ)	A-K,K2
XF1			L71-0502-05	MCF (44.85MHZ)	B-K,K2

Ref. No.	Address	New parts	Parts No.	Description	Desti-nation
CP1			R90-0718-05	MULTI-COMP 4.7K X4	
CP3			R90-0743-05	MULTIPLE RESISTOR	
CP5			R90-0743-05	MULTIPLE RESISTOR	
CP6-21			R90-0741-05	MULTIPLE RESISTOR	
CP22			R90-0743-05	MULTIPLE RESISTOR	
CP24			R90-0743-05	MULTIPLE RESISTOR	
R1,2			RK73GB1J104J	CHIP R 100K J 1/16W	
R3			RK73GB1J473J	CHIP R 47K J 1/16W	
R4			RK73GB1J154J	CHIP R 150K J 1/16W	
R5			RK73GB1J104J	CHIP R 100K J 1/16W	
R6			RK73GB1J184J	CHIP R 180K J 1/16W	
R7			RK73GB1J104J	CHIP R 100K J 1/16W	
R8			RK73GB1J183J	CHIP R 18K J 1/16W	A-K,K2
R8			RK73GB1J273J	CHIP R 27K J 1/16W	B-K,K2
R9			RK73GB1J154J	CHIP R 150K J 1/16W	
R10			RK73GB1J103J	CHIP R 10K J 1/16W	
R11			RK73GB1J473J	CHIP R 47K J 1/16W	A-K,K2
R11			RK73GB1J223J	CHIP R 22K J 1/16W	B-K,K2
R12			RK73GB1J104J	CHIP R 100K J 1/16W	
R13			RK73GB1J683J	CHIP R 68K J 1/16W	
R14			RK73GB1J394J	CHIP R 390K J 1/16W	
R15			RK73GB1J472J	CHIP R 4.7K J 1/16W	
R16			RK73GB1J104J	CHIP R 100K J 1/16W	
R17			RK73GB1J473J	CHIP R 47K J 1/16W	
R18			RK73GB1J332J	CHIP R 3.3K J 1/16W	
R19			RK73GB1J152J	CHIP R 1.5K J 1/16W	
R20			RK73GB1J683J	CHIP R 68K J 1/16W	
R21			RK73GB1J154J	CHIP R 150K J 1/16W	
R22			RK73GB1J182J	CHIP R 1.8K J 1/16W	
R23			RK73GB1J563J	CHIP R 56K J 1/16W	A-K,K2
R23			RK73GB1J124J	CHIP R 120K J 1/16W	B-K,K2
R24			RK73GB1J274J	CHIP R 270K J 1/16W	
R25			RK73GB1J473J	CHIP R 47K J 1/16W	
R26			RK73GB1J332J	CHIP R 3.3K J 1/16W	
R27			RK73GB1J222J	CHIP R 2.2K J 1/16W	
R28			RK73GB1J220J	CHIP R 22 J 1/16W	
R29			RK73GB1J183J	CHIP R 18K J 1/16W	A-K,K2
R29			RK73GB1J123J	CHIP R 12K J 1/16W	B-K,K2
R31			RK73GB1J472J	CHIP R 4.7K J 1/16W	
R32			R92-1252-05	CHIP R 0 OHM	
R33			RK73GB1J123J	CHIP R 12K J 1/16W	
R34			RK73GB1J334J	CHIP R 330K J 1/16W	
R35			RK73GB1J101J	CHIP R 100 J 1/16W	
R36			RK73GB1J472J	CHIP R 4.7K J 1/16W	
R37			RK73GB1J104J	CHIP R 100K J 1/16W	
R38			RK73GB1J151J	CHIP R 150 J 1/16W	
R39			RK73GB1J560J	CHIP R 56 J 1/16W	
R40			RK73GB1J272J	CHIP R 2.7K J 1/16W	
R41			RK73GB1J471J	CHIP R 470 J 1/16W	
R42,43			RK73GB1J102J	CHIP R 1.0K J 1/16W	
R44			R92-0670-05	CHIP R 0 OHM	
R45			RN73GH1J913D	CHIP R 91K D 1/16W	
R46			RN73GH1J683D	CHIP R 68K D 1/16W	
R47			RN73GH1J913D	CHIP R 91K D 1/16W	
R48			RN73GH1J333D	CHIP R 33K D 1/16W	
R49			RK73GB1J684J	CHIP R 680K J 1/16W	
R50			RK73GB1J564J	CHIP R 560K J 1/16W	
R51			RK73GB1J331J	CHIP R 330 J 1/16W	
R53			RN73GH1J274D	CHIP R 270K D 1/16W	
R54			RK73GB1J334J	CHIP R 330K J 1/16W	

A : TK-480 (K,K2)
B : TK-481 (K,K2)

PARTS LIST

TX-RX UNIT (X57-5630-XX)

Ref. No.	Address	New parts	Parts No.	Description	Desti-nation
R55			RN73GH1J913D	CHIP R 91K D 1/16W	
R56			RK73GB1J223J	CHIP R 22K J 1/16W	
R57			RK73GB1J334J	CHIP R 330K J 1/16W	
R58			RN73GH1J682D	CHIP R 6.8K D 1/16W	
R59			RK73GB1J154J	CHIP R 150K J 1/16W	
R60			RK73GB1J101J	CHIP R 100 J 1/16W	
R61			RK73GB1J155J	CHIP R 1.5M J 1/16W	
R62			RK73GB1J101J	CHIP R 100 J 1/16W	
R63			RN73GH1J683D	CHIP R 68K D 1/16W	
R64			RK73GB1J474J	CHIP R 470K J 1/16W	
R65			RK73GB1J560J	CHIP R 56 J 1/16W	
R66			RN73GH1J682D	CHIP R 6.8K D 1/16W	
R67,68			RK73GB1J101J	CHIP R 100 J 1/16W	
R69			RK73GB1J153J	CHIP R 15K J 1/16W	A-K,K2
R69			RK73GB1J223J	CHIP R 22K J 1/16W	B-K,K2
R70			RK73GB1J153J	CHIP R 15K J 1/16W	
R71			RK73GB1J224J	CHIP R 220K J 1/16W	
R72			RK73GB1J152J	CHIP R 1.5K J 1/16W	A-K,K2
R72			RK73GB1J222J	CHIP R 2.2K J 1/16W	B-K,K2
R73			RK73GB1J103J	CHIP R 10K J 1/16W	
R74			RK73GB1J223J	CHIP R 22K J 1/16W	
R75			RK73GB1J152J	CHIP R 1.5K J 1/16W	
R76			RK73GB1J103J	CHIP R 10K J 1/16W	
R77			RK73GB1J153J	CHIP R 15K J 1/16W	
R78			RK73GB1J102J	CHIP R 1.0K J 1/16W	
R79			RK73GB1J473J	CHIP R 47K J 1/16W	
R80			RK73GB1J394J	CHIP R 390K J 1/16W	A-K,K2
R80			RK73GB1J684J	CHIP R 680K J 1/16W	B-K,K2
R81			RK73GB1J102J	CHIP R 1.0K J 1/16W	
R82			RK73GB1J333J	CHIP R 33K J 1/16W	A-K,K2
R82			RK73GB1J393J	CHIP R 39K J 1/16W	B-K,K2
R83			R92-1252-05	CHIP R 0 OHM	
R84			RK73GB1J473J	CHIP R 47K J 1/16W	
R85			RK73GB1J681J	CHIP R 680 J 1/16W	
R86			RK73GB1J154J	CHIP R 150K J 1/16W	
R87			RK73GB1J470J	CHIP R 47 J 1/16W	
R88			RK73GB1J220J	CHIP R 22 J 1/16W	
R89			RK73GB1J103J	CHIP R 10K J 1/16W	
R90			RK73GB1J104J	CHIP R 100K J 1/16W	
R91			RK73GB1J100J	CHIP R 10 J 1/16W	
R92,93			RK73GB1J150J	CHIP R 15 J 1/16W	
R94			RK73GB1J272J	CHIP R 2.7K J 1/16W	
R95			RK73GB1J150J	CHIP R 15 J 1/16W	
R96			RK73GB1J223J	CHIP R 22K J 1/16W	
R97			RK73GB1J104J	CHIP R 100K J 1/16W	
R98			RK73GB1J184J	CHIP R 180K J 1/16W	
R99			RK73GB1J121J	CHIP R 120 J 1/16W	A-K,K2
R100			RK73GB1J820J	CHIP R 82 J 1/16W	A-K,K2
R100			RK73GB1J221J	CHIP R 220 J 1/16W	B-K,K2
R101			RK73GB1J223J	CHIP R 22K J 1/16W	
R102			RK73GB1J182J	CHIP R 1.8K J 1/16W	
R103			RK73GB1J102J	CHIP R 1.0K J 1/16W	
R104			RK73HB1J102J	CHIP R 1.0K J 1/16W	
R105			RK73GB1J122J	CHIP R 1.2K J 1/16W	
R106			RK73GB1J473J	CHIP R 47K J 1/16W	
R107			RK73GB1J103J	CHIP R 10K J 1/16W	
R108			RK73GB1J682J	CHIP R 6.8K J 1/16W	
R109			RK73GB1J470J	CHIP R 47 J 1/16W	
R110			RK73GB1J473J	CHIP R 47K J 1/16W	
R111			RK73GB1J223J	CHIP R 22K J 1/16W	
R112			RK73GB1J103J	CHIP R 10K J 1/16W	
R113			RK73GB1J101J	CHIP R 100 J 1/16W	A-K,K2
R113			RK73GB1J220J	CHIP R 22 J 1/16W	B-K,K2
R114			RK73GB1J152J	CHIP R 1.5K J 1/16W	
R115			RK73GB1J681J	CHIP R 680 J 1/16W	
R116			R92-1368-05	CHIP R 0 OHM	
R117			RK73GB1J470J	CHIP R 47 J 1/16W	
R118			R92-1252-05	CHIP R 0 OHM	
R120			RK73HB1J102J	CHIP R 1.0K J 1/16W	
R121			RK73GB1J473J	CHIP R 47K J 1/16W	
R122			R92-1252-05	CHIP R 0 OHM	
R123			RK73HB1J102J	CHIP R 1.0K J 1/16W	
R124,125			RK73HB1J473J	CHIP R 47K J 1/16W	
R126			RK73GB1J103J	CHIP R 10K J 1/16W	
R127-129			RK73EB2ER39K	CHIP R 0.39 K 1/4W	
R130-135			RN73GH1J154D	CHIP R 150K D 1/16W	
R136,137			RK73GB1J271J	CHIP R 270 J 1/16W	
R138			RK73HB1J103J	CHIP R 10K J 1/16W	
R139			R92-1368-05	CHIP R 0 OHM	
R140			RK73GB1J103J	CHIP R 10K J 1/16W	
R141,142			RK73GB1J104J	CHIP R 100K J 1/16W	
R143			RK73GB1J105J	CHIP R 1.0M J 1/16W	
R144			RK73GB1J473J	CHIP R 47K J 1/16W	
R145			R92-1252-05	CHIP R 0 OHM	
R146			RK73GB1J222J	CHIP R 2.2K J 1/16W	
R147			R92-1252-05	CHIP R 0 OHM	
R148			RK73GB1J223J	CHIP R 22K J 1/16W	
R149			RK73HB1J473J	CHIP R 47K J 1/16W	
R150			RK73HB1J102J	CHIP R 1.0K J 1/16W	
R151			RK73GB1J102J	CHIP R 1.0K J 1/16W	
R152			RK73GB1J332J	CHIP R 3.3K J 1/16W	
R153			RK73GB1J123J	CHIP R 12K J 1/16W	
R154			RK73GB1J221J	CHIP R 220 J 1/16W	
R155			RK73GB1J101J	CHIP R 100 J 1/16W	
R156			RK73GB1J103J	CHIP R 10K J 1/16W	
R157			RK73GB1J102J	CHIP R 1.0K J 1/16W	
R158			RK73GB1J223J	CHIP R 22K J 1/16W	
R159,160			RK73GB1J102J	CHIP R 1.0K J 1/16W	
R161,162			RK73GB1J184J	CHIP R 180K J 1/16W	
R163			RK73GB1J104J	CHIP R 100K J 1/16W	
R164			RK73GB1J473J	CHIP R 47K J 1/16W	
R165			RK73GB1J150J	CHIP R 15 J 1/16W	A-K,K2
R165			R92-1252-05	CHIP R 0 OHM	B-K,K2
R166			RK73GB1J103J	CHIP R 10K J 1/16W	B-K,K2
R167			RK73GB1J123J	CHIP R 12K J 1/16W	
R168			RK73GB1J333J	CHIP R 33K J 1/16W	
R169			RK73GB1J223J	CHIP R 22K J 1/16W	
R170			RK73GB1J473J	CHIP R 47K J 1/16W	
R171			RK73GB1J823J	CHIP R 82K J 1/16W	
R200-207			RK73HB1J102J	CHIP R 1.0K J 1/16W	
R211			RK73HB1J103J	CHIP R 10K J 1/16W	
R218			RK73HB1J473J	CHIP R 47K J 1/16W	
R248			R92-1252-05	CHIP R 0 OHM	
R250			R92-1252-05	CHIP R 0 OHM	
R259			R92-1252-05	CHIP R 0 OHM	
R276			R92-1252-05	CHIP R 0 OHM	
R297,298			RK73HB1J473J	CHIP R 47K J 1/16W	
R408			RK73HB1J473J	CHIP R 47K J 1/16W	
R417			RK73GB1J474J	CHIP R 470K J 1/16W	
R418			RK73GB1J104J	CHIP R 100K J 1/16W	

A : TK-480 (K,K2)
B : TK-481 (K,K2)

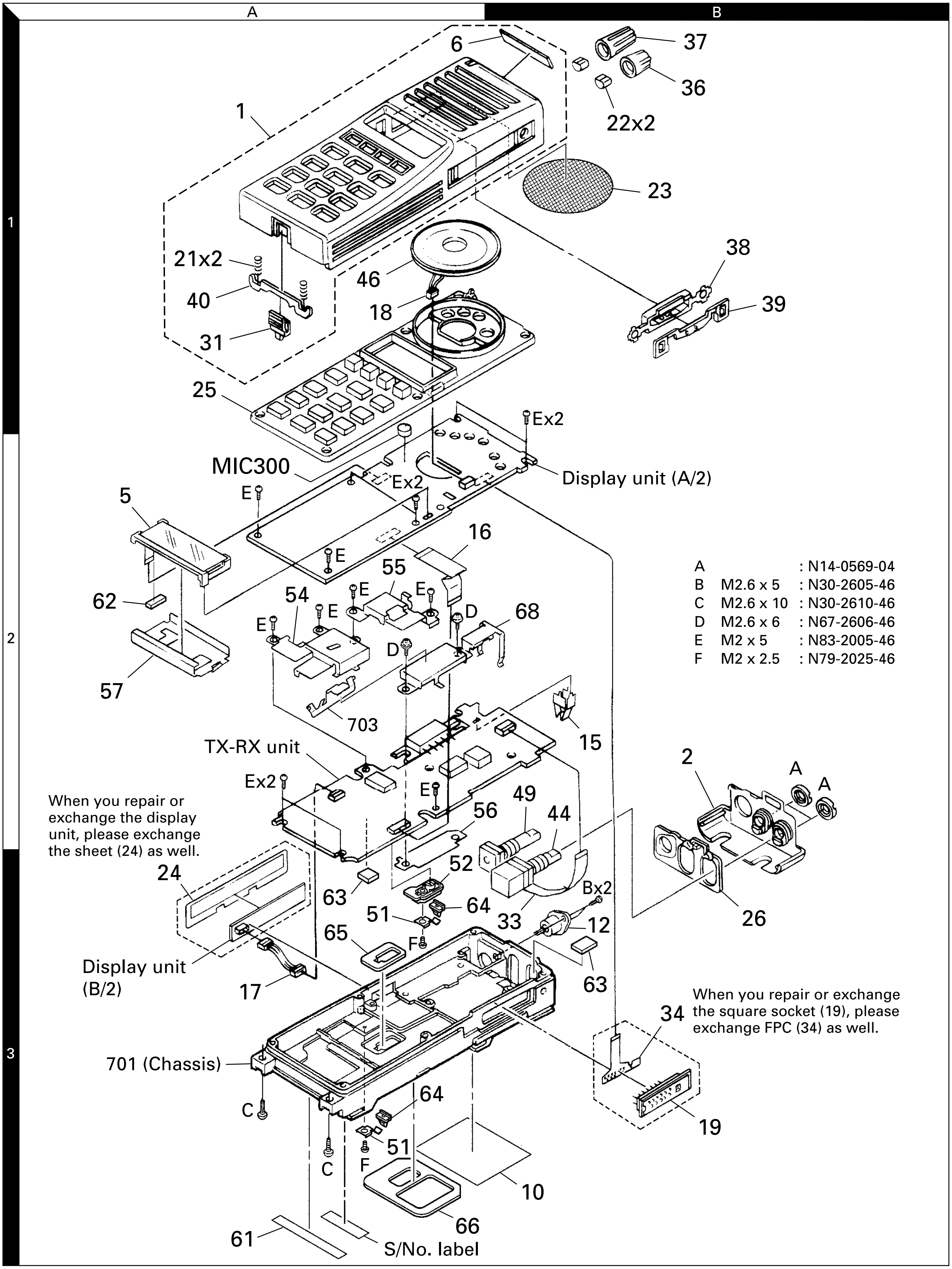
PARTS LIST

TX-RX UNIT (X57-5630-XX)

Ref. No.	Address	New parts	Parts No.	Description	Desti- nation
R419-422			R92-1252-05	CHIP R 0 OHM	
R423			RK73GB1J473J	CHIP R 47K J 1/16W	
D1			1SR154-400	DIODE	
D2			MA2S111	DIODE	
D3			MA742	DIODE	
D4,5			MA2S077	DIODE	
D6		✻	UDZS4.7B	ZENER DIODE	
D7			HVU131	DIODE	
D8			MA2S111	DIODE	
D9,10			MA2S077	DIODE	
D11			MA742	DIODE	
D12			MA2S111	DIODE	B-K,K2
D17,18			DA221	DIODE	
IC1			TA75W01FU	IC (BUFFER AMP)	
IC2			RN5VL42C	IC (VOLTAGE DETECTOR/RESET)	
IC3			TC75W51FU	IC (SUMMING AMP)	
IC4			M62364FP	IC (D/A CONVERTER)	
IC5			S-81350HG-KD	IC (VOLTAGE REGULATOR/5M)	
IC6			NJU7201U50	IC (VOLTAGE REGULATOR/5V)	
IC7			TK11250BM	IC (VOLTAGE REGULATOR/5C)	
IC8			TC75W51FU	IC (BUFFER AMP)	
IC9			TA31136FN	IC (FM IF SYSTEM)	
IC10			TA75W01FU	IC (ACTIVE FILTER)	
IC11			SA7025DK	IC (PLL SYSTEM)	
IC12			TC35453F	IC (AUDIO PROCESSOR)	
IC13			LC73872M	IC (DTMF DECODER)	
IC14			KCH31	HIC (VCO SYSTEM)	A-K,K2
IC14			KCH32	HIC (VCO SYSTEM)	B-K,K2
IC15		✻	30622M8A-4F9GP	IC (MICROPROCESSOR)	
IC16			AT2408N10SI2.5	IC (EEPROM)	
IC17			AT29C020-90TI	IC (AND GATE)	
IC17		✻	W29C020C90	IC (AND GATE)	
IC18,19			BU4094BCFV	IC (SHIFT REGISTER)	
IC21			NJM2904V	IC (COMPARATOR)	
IC23			TA75S01F	IC (ACTIVE FILTER)	
IC30			M68757L	IC (POWER MODULE)	A-K,K2
IC30			M68757H	IC (POWER MODULE)	B-K,K2
Q1			2SJ243	FET	
Q2			2SA1832(GR)	TRANSISTOR	
Q3,4			2SC4617(S)	TRANSISTOR	
Q5			2SC4619	TRANSISTOR	A-K,K2
Q5			2SC5108(Y)	TRANSISTOR	B-K,K2
Q6		✻	3SK318	FET	
Q7			2SK1824	FET	
Q8			2SC5108(Y)	TRANSISTOR	
Q9			3SK274	FET	
Q10,11			2SC5108(Y)	TRANSISTOR	
Q12			2SC4988	TRANSISTOR	
Q13			2SK1824	FET	
Q14			DTC114EE	DIGITAL TRANSISTOR	
Q15			DTA144EE	DIGITAL TRANSISTOR	
Q16			DTC114EE	DIGITAL TRANSISTOR	
Q17			2SC5108(Y)	TRANSISTOR	
Q18			2SK1824	FET	
Q19			2SC4617(S)	TRANSISTOR	
Q20			DTC144EE	DIGITAL TRANSISTOR	
Q21-23			2SK1824	FET	
TH2			157-503-65001	THERMISTOR	

A : TK-480 (K,K2)
B : TK-481 (K,K2)

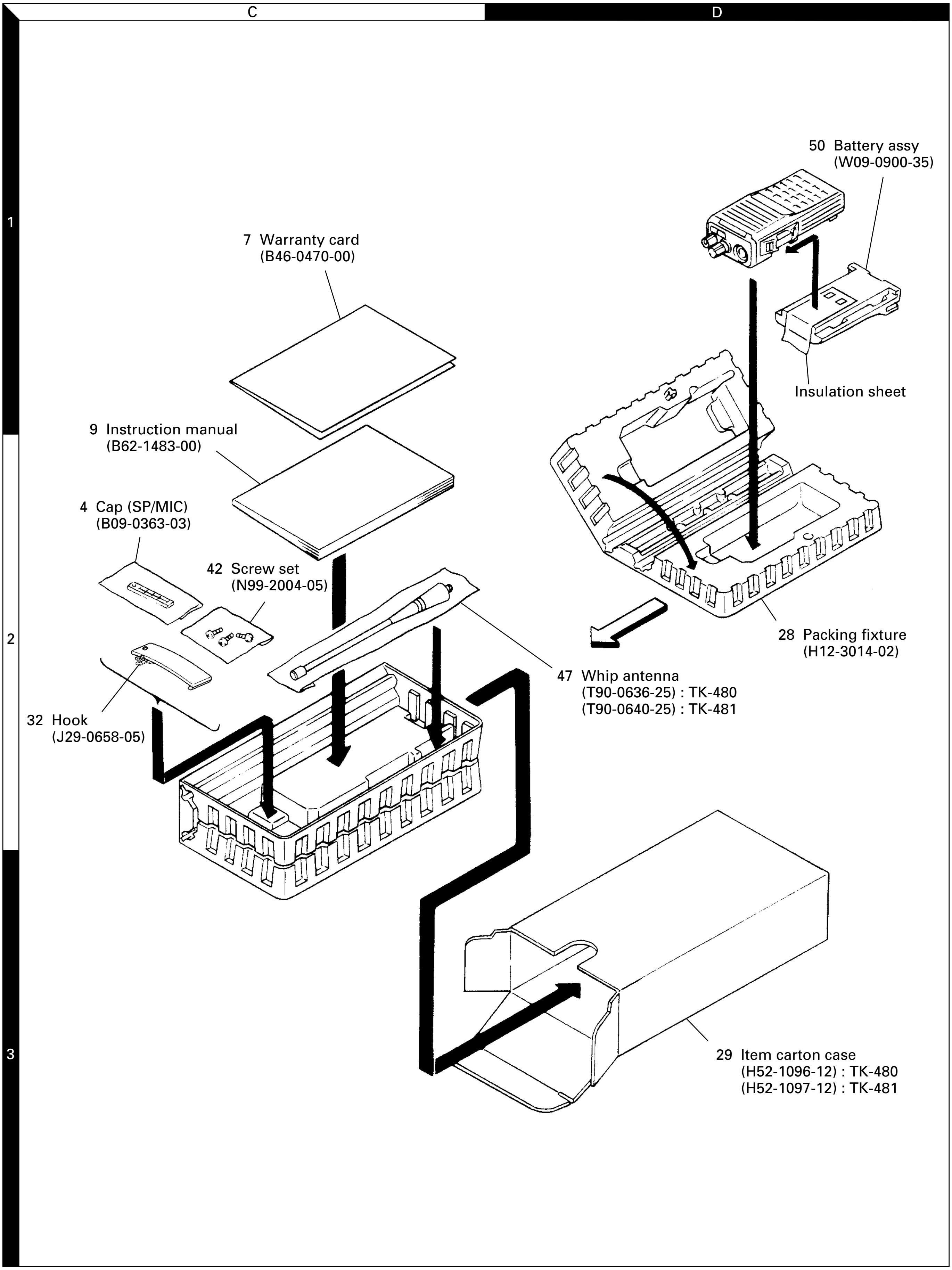
EXPLODED VIEW



A		:	N14-0569-04
B	M2.6 x 5	:	N30-2605-46
C	M2.6 x 10	:	N30-2610-46
D	M2.6 x 6	:	N67-2606-46
E	M2 x 5	:	N83-2005-46
F	M2 x 2.5	:	N79-2025-46

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

PACKING


C
D
1
2
3
50 Battery assy
(W09-0900-35)
7 Warranty card
(B46-0470-00)
Insulation sheet
9 Instruction manual
(B62-1483-00)
4 Cap (SP/MIC)
(B09-0363-03)
42 Screw set
(N99-2004-05)
28 Packing fixture
(H12-3014-02)
47 Whip antenna
(T90-0636-25) : TK-480
(T90-0640-25) : TK-481
32 Hook
(J29-0658-05)
29 Item carton case
(H52-1096-12) : TK-480
(H52-1097-12) : TK-481

ADJUSTMENT

Test Equipment Required for Alignment

Test Equipment	Major Specifications	
1. Standard Signal Generator (SSG)	Frequency Range Modulation Output	800 to 950MHz Frequency modulation and external modulation 0.1μV to greater than 1mV
2. Power Meter	Input Impedance Operation Frequency Measurement Capability	50Ω 800 to 950MHz or more Vicinity of 10W
3. Deviation Meter	Frequency Range	800 to 950MHz
4. Digital Volt Meter (DVM)	Measuring Range Input Impedance	10mV to 10V DC High input impedance for minimum circuit loading
5. Oscilloscope		DC through 30MHz
6. High Sensitivity Frequency Counter	Frequency Range Frequency Stability	10Hz to 1000MHz 0.2ppm or less
7. Ammeter		5A
8. AF Volt Meter (AF VTVM)	Frequency Range Voltage Range	50Hz to 10kHz 1mV to 10V
9. Audio Generator (AG)	Frequency Range Output	50Hz to 5kHz or more 0 to 1V
10. Distortion Meter	Capability Input Level	3% or less at 1kHz 50mV to 10Vrms
11. Voltmeter	Measuring Range Input Impedance	10mV to 10V DC or less 50kΩ/V or greater
12. 16Ω Dummy Load		Approx. 16Ω, 3W
13. Regulated Power Supply		5V to 10V, approx. 5A Useful if ammeter requipped

■ 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

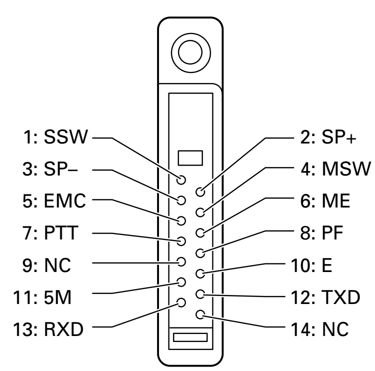
Use the interface cable (KPG-36) for PC tuning or the lead wire with plug (E30-3287-18) and screw (N08-0535-08) for panel tuning. Connct the plug to the universal connector of the radio and tighten the screw.

The lead wire with plug (E30-3287-18) and screw (N08-0535-08) terminals are as follows. Numbers are universal connector terminal numbers.

Caution

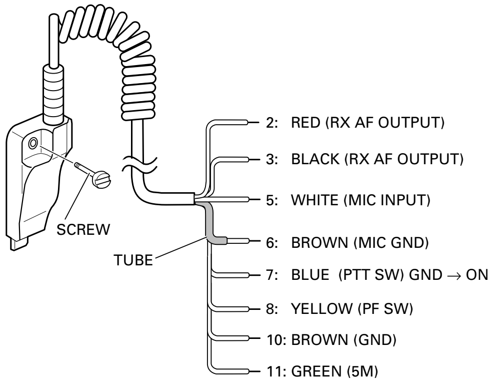
1. When connecting the plug to the universal connector of the radio, a short circuit may occur. To prevent this, be sure to turn the radio POWER switch off.
2. Since the RX AF output is a BTL output, there is a DC component. Isolate this with a capacitor or transformer as shown in the figure.
3. Do not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

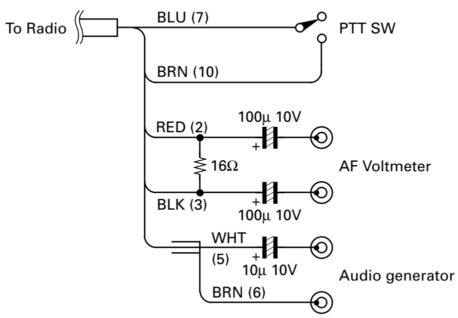
- **Universal connector**



ADJUSTMENT

- **Panel tuning**

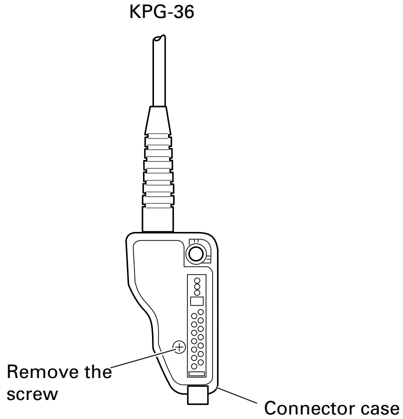


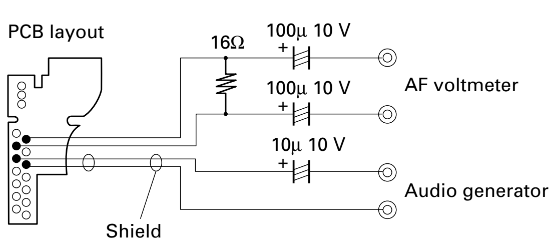


- **PC tuning**

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.

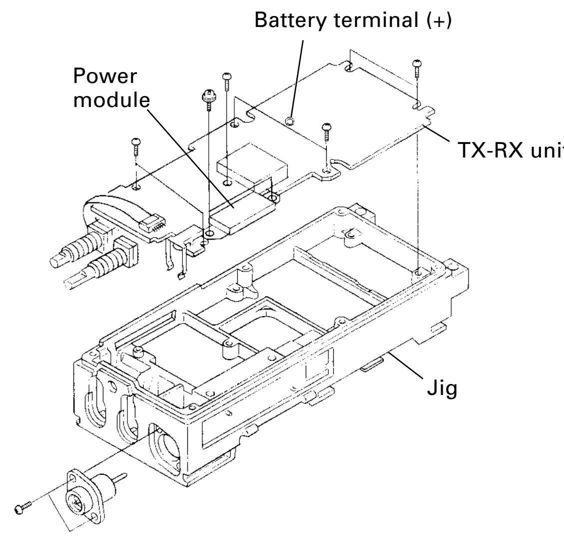




Repair Jig (Chassis)

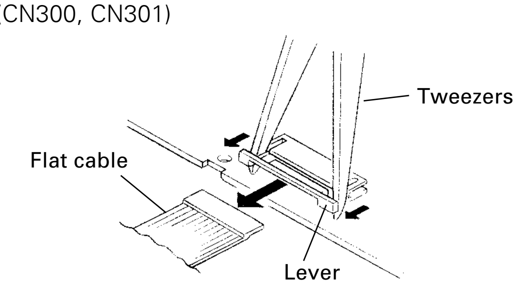
Use jig (part No. : W05-0825-00) for repairing the TK-480/481.

The jig facilitates the voltage check and protects the module when the voltage on the flow side of the TX-RX unit is checked during repairs.

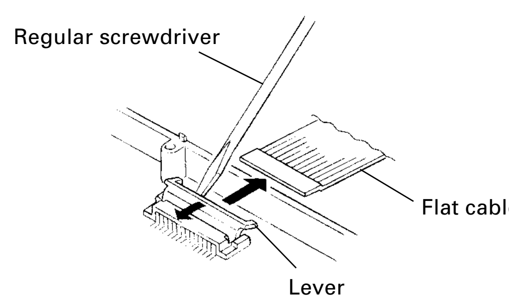


How to Remove the Flat Cable

1. Gently draw out both sides of the connector lever uniformly in the direction of the arrow with tweezers. (CN300, CN301)



2. Gently prise up the connector lever in the direction of the arrow with a fine regular screwdriver or tweezers. (CN1, CN3, CN304)



ADJUSTMENT

Test Mode

■ Test mode operating features

This transceiver has a test mode. ***To enter test mode, press [A] key and turn power on. Hold [A] key until test channel No. and test signalling No. appears on LCD.*** Test mode can be inhibited by programming. To exit test mode, switch the power on again. The following functions are available in test mode.

• Controls

Controls	"FCN" appears	"FCN" not appears
[PTT]	Used when making a transmission.	Used when making a transmission.
[AUX]	Unused	Unused.
[MON]	Monitor ON and OFF.	Monitor ON and OFF.
[LAMP]	Lights the lamp for five seconds. Lighting is extended for a further five seconds by pressing any key while the lamp is lit.	Unused.
[S]	MSK 1200 bps and 2400 bps	Sets to the Tuning mode.
[A]	Function OFF	Function ON.
[B]	Compander function ON and OFF.	RF power HIGH and LOW.
[C]	Beat shift ON and OFF	Changes group.
[0] to [9], and [#], [*]	Used as the DTMF keypad. If a key is pressed during transmission, the DTMF corresponding to the key that was pressed is sent. (keypad model)	Used as the DTMF keypad. If a key is pressed during transmission, the DTMF corresponding to the key that was pressed is sent. (keypad model)
[ENCODER]	Changes system.	Changes system.

Note : If a [S], [A], [B], [C] key is pressed during transmission, the DTMF corresponding to the key that was pressed is sent.

• LCD indicator

"SCN" Unused
"♪" Lights at Compander ON.
"LO" Lights at RF Power Low.
"P" Unused
"MON" Lights at moniter ON.
"SVC" Unused
"M" Lights at MSK 2400 bps.

• LED indicator

Red LED Lights during transmission. Blinks at the low battery voltage warning.
Green LED Lights when there is a carrier.

• Sub LCD indicator

"FCN" Appears at Function ON.

■ Frequency and signalling

The set has been adjusted for the frequencies shown in the following table. When required. re-adjust them following the adjustment procedure to obtain the frequencies you want in actual operation.

Frequency (MHz)

SYS No.	TK-480		TK-481	
	RX (TX : TA)	TX	RX (TX : TA)	TX
1	851.0500	806.0500	935.0250	896.0250
2	851.5500	806.5500	935.0500	896.0500
3	860.0000	815.0000	938.0000	899.0000
4	860.5000	815.5000	938.0250	899.0250
5	865.9875	820.9875	939.9875	900.9875
6	869.4000	824.4000	940.4000	901.4000
7	869.9000	824.9000	940.9000	901.9000
8	855.4000	810.4000	936.2500	897.2500
9	865.6000	820.6000	939.3000	900.3000
10	867.5000	822.5000	936.7500	897.7500
11~16	–	–	–	–

Signalling

Group No.	RX	TX
1	None	None
2	None	100Hz square
3	LTR data	LTR data
4	QT 67.0Hz	QT 67.0Hz
5	QT 151.4Hz	QT 151.4Hz
6	QT 210.7Hz	QT 210.7Hz
7	QT 250.3Hz	QT 250.3Hz
8	DQT D023N	DQT D023N
9	DQT D754I	DQT D754I
10	DTMF DEC, (159D)	DTMF DEC, (159D)
11	None	DTMF tone 9
12	None	None
13	Single tone 1200Hz	Single tone 1200Hz
14	None	MSK
15	MSK code	MSK code

• Preparations for tuning the transceiver

Before attempting to tune the transceiver, connect the unit to a suitable power supply.

Whenever the transmitter is turned, the unit must be connected to a suitable dummy load (i.e. power meter).

The speaker output connector must be terminated with a 16Ω dummy load and connected to an AC voltmeter and an audio distortion meter or a SINAD measurement meter at all times during tuning.

ADJUSTMENT

- **Transceiver tuning**
  (To place transceiver in tuning mode)

System appears on LCD. Set system according to tuning requirements.

LCD display (Test mode)

1␣–␣␣1

System No. Group No.

Press [S], now in tuning mode. Use [◀B] button to write tuning data through tuning modes, and channel selector knob to adjust tuning requirements (1 to 256 appears on LCD).

Use [C▶] button to select the adjustment item through tuning modes. Use [A] button to adjust 3 point tuning.

LCD display (Tuning mode)

FREQ␣␣␣1

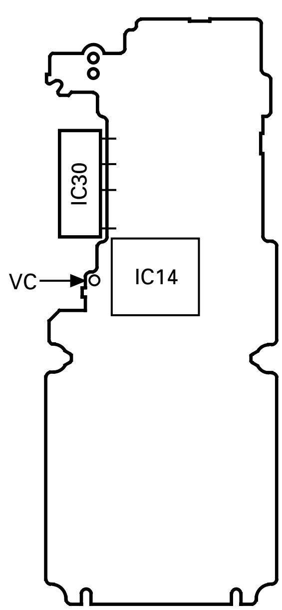
Adjustment item Adjustment (1~256)

3-point tuning frequency (MHz)

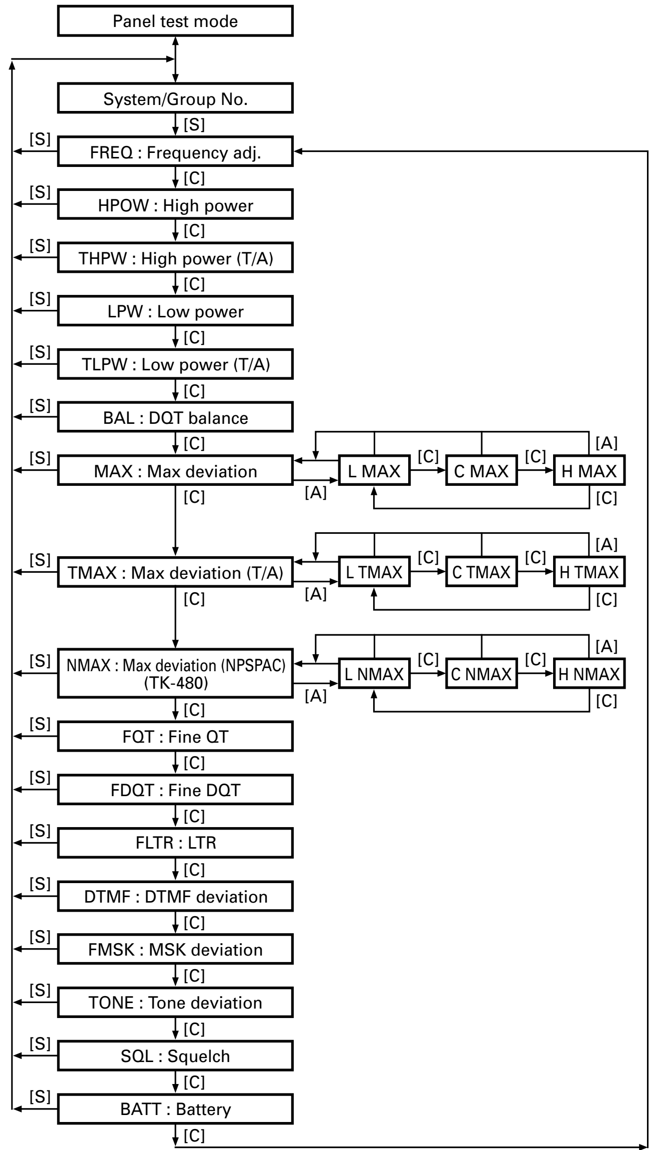
Test CH	TK-480		TK-481	
	RX	TX	RX	TX
Low	851.05000	806.05000	935.02500	896.02500
Center	860.50000	815.50000	938.02500	899.02500
High	869.90000	824.90000	940.90000	901.90000

Adjustment Points

TX-RX unit (X57-5630-XX) Component side view



■ Tuning mode



ADJUSTMENT

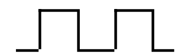
Common Section

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
1. Setting	1) BATT terminal voltage : 7.5V Standard modulation MOD : 1kHz DEV : ±3kHz (TK-480) ±1.5kHz (TK-481)							
2. VCO lock voltage	1) SYS – GRP : 1 – 1	Power meter DVM	TX-RX	VC			Check	0.5V or more.
	2) SYS – GRP : 7 – 1 PTT : ON							4.3V or less.
	3) SYS – GRP : 7 – 1 TA mode : ON PTT : ON							

Transmitter Section

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
1. Frequency adjustment	1) SYS – GRP : 4 – ✻ Select FREQ ✻✻✻ in tuning mode. PTT : ON	f. counter	Panel	ANT	Panel	Encoder knob	TK-480 : 815.500MHz TK-481 : 899.025MHz	±100Hz
2. Maximum power check	1) SYS – GRP : 4 – ✻ Select HPOW 256 in tuning mode. PTT : ON	Power meter Ammeter	Panel	ANT			Check	3.0W or more
3. TX high power adjustment	1) SYS – GRP : 4 – ✻ Select HPOW ✻✻✻ in tuning mode. PTT : ON				Panel	Encoder knob	2.5W	±0.1W 1.7A or less
4. TX T/A high power adjustment	1) SYS – GRP : 4 – ✻ Select THPW ✻✻✻ in tuning mode. PTT : ON							
5. TX high power check	1) SYS – GRP : 1 – ✻, 7 – ✻ TA mode : OFF and ON (Press [A] key, then [C] key) PTT : ON						Check	2.0~3.0W 1.7A or less
6. TX low power adjustment	1) SYS – GRP : 4 – ✻ Select LPW ✻✻✻ in tuning mode. PTT : ON				Panel	Encoder knob	1.0W	±0.1W 1.2A or less
7. TX T/A low power adjustment	1) SYS – GRP : 4 – ✻ Select TLPW ✻✻✻ in tuning mode. PTT : ON							
8. TX low power check	1) SYS – GRP : 1 – ✻, 7 – ✻ Low power (Press [B] key) TA mode : OFF and ON (Press [A] key, then [C] key) PTT : ON						Check	0.5~1.5W 1.2A or less

ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
9. DQT BAL adjustment	1) SYS – GRP : 4 – ✻ Select BAL ✻✻✻ in tuning mode. Deviation meter filter setting LPF : 3kHz HPF : OFF PTT : ON	Power meter Deviation meter Oscilloscope AG AF VTVM	Panel	ANT	Panel	Encoder knob	Make the demodulation waves into square waves.	
10. MAX DEV adjustment	1) SYS – GRP : 4 – ✻ Select MAX ✻✻✻ in tuning mode. AG : 1kHz/150mV Deviation meter filter setting LPF : 15kHz HPF : OFF Adjustment item L MAX ✻✻✻→C MAX ✻✻✻ →H MAX ✻✻✻ PTT : ON			Universal			TK-480 : 3.8kHz TK-481 : 1.75kHz (According to the larger +, –.)	±50Hz
11. T/A MAX DEV adjustment	1) SYS – GRP : 4 – ✻ Select TMAX ✻✻✻ in tuning mode. AG : 1kHz/150mV Deviation meter filter setting LPF : 15kHz HPF : OFF Adjustment item L TMAX ✻✻✻→C TMAX ✻✻✻ →H TMAX ✻✻✻ PTT : ON							
12. NPSPAC MAX DEV adjustment	1) SYS – GRP : 10 – ✻ Select NMAX ✻✻✻ in tuning mode. AG : 1kHz/150mV Deviation meter filter setting LPF : 15kHz HPF : OFF Adjustment item L NMAX ✻✻✻→C NMAX ✻✻✻ →H NMAX ✻✻✻ PTT : ON						TK-480 : 2.9kHz (According to the larger +, –.)	±50Hz
13. MIC sensitivity check	1) SYS – GRP : 4 – 1 AG : 1kHz/15mV (TK-480) AG : 1kHz/8mV (TK-481) Deviation meter filter setting LPF : 15kHz HPF : OFF PTT : ON						Check	TK-480 : 2.2~3.6kHz TK-481 : 0.6~1.0kHz
14. T/A MIC sensitivity check	1) SYS – GRP : 4 – 1 TA mode : ON (Press [A] key, then [C] key) AG : 1kHz/15mV (TK-480) AG : 1kHz/8mV (TK-481) Deviation meter filter setting LPF : 15kHz HPF : OFF PTT : ON							

ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
15. QT DEV adjustment	1) SYS – GRP : 4 – ✻ MIC input : OFF Select FQT ✻✻✻ in tuning mode. Deviation meter filter setting LPF : 3kHz HPF : 50Hz De-emphasis : 750µs PTT : ON	Power meter Deviation meter Oscilloscope AG AF VTVM	Panel	ANT	Panel	Encoder knob	TK-480 : 0.75kHz TK-481 : 0.45kHz	±0.05kHz
16. DQT DEV adjustment	1) SYS – GRP : 4 – ✻ Select FDQT ✻✻✻ in tuning mode. Deviation meter filter setting LPF : 3kHz HPF : OFF PTT : ON							
17.LTR DEV adjustment	1) SYS – GRP : 4 – ✻ Select FLTR ✻✻✻ in tuning mode. Deviation meter filter setting LPF : 3kHz HPF : OFF PTT : ON						TK-480 : 1.00kHz TK-481 : 0.75kHz	±0.10kHz : TK-480 ±0.05kHz : TK-481
18. DTMF DEV adjustment	1) SYS – GRP : 4 – ✻ Select DTMF ✻✻✻ in tuning mode. Deviation meter filter setting LPF : 15kHz HPF : OFF PTT : ON						TK-480 : 3.00kHz TK-481 : 1.50kHz	±0.15kHz : TK-480 ±0.10kHz : TK-481
19. MSK DEV adjustment	1) SYS – GRP : 4 – ✻ Select FMSK ✻✻✻ in tuning mode. Deviation meter filter setting LPF : 15kHz HPF : OFF PTT : ON							
20. TONE DEV adjustment	1) SYS – GRP : 4 – ✻ Select TONE ✻✻✻ in tuning mode. Deviation meter filter setting LPF : 15kHz HPF : OFF PTT : ON						2.5kHz	±0.1kHz
21. BATT detection writing	1) SYS – GRP : 4 – ✻ Select BATT ✻✻✻ in tuning mode. PTT : ON						After pressing the PTT switch, confirm that one predetermined numeric in the range 1 to 256 appears and then press [B] key. That numeric will be stored in memory.	BATT terminal voltage : 6.2V

ADJUSTMENT

Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
22. BATT detection check	1) SYS – GRP : 4 – 1 BATT terminal voltage : 5.7V PTT : ON	Power meter Deviation meter Oscilloscope	Panel	ANT	Panel	Encoder knob	Check	Can not transmit. LED (TX) blinks.
	2) BATT terminal voltage : 6.5V PTT : ON	AG AF VTVM						Transmit

Note : When the CPU is changed these adjustment values will become suitable values for NPSPAC, the deviations except MAX DEV in NPSPAC band are automatically adjusted.

Receiver Section

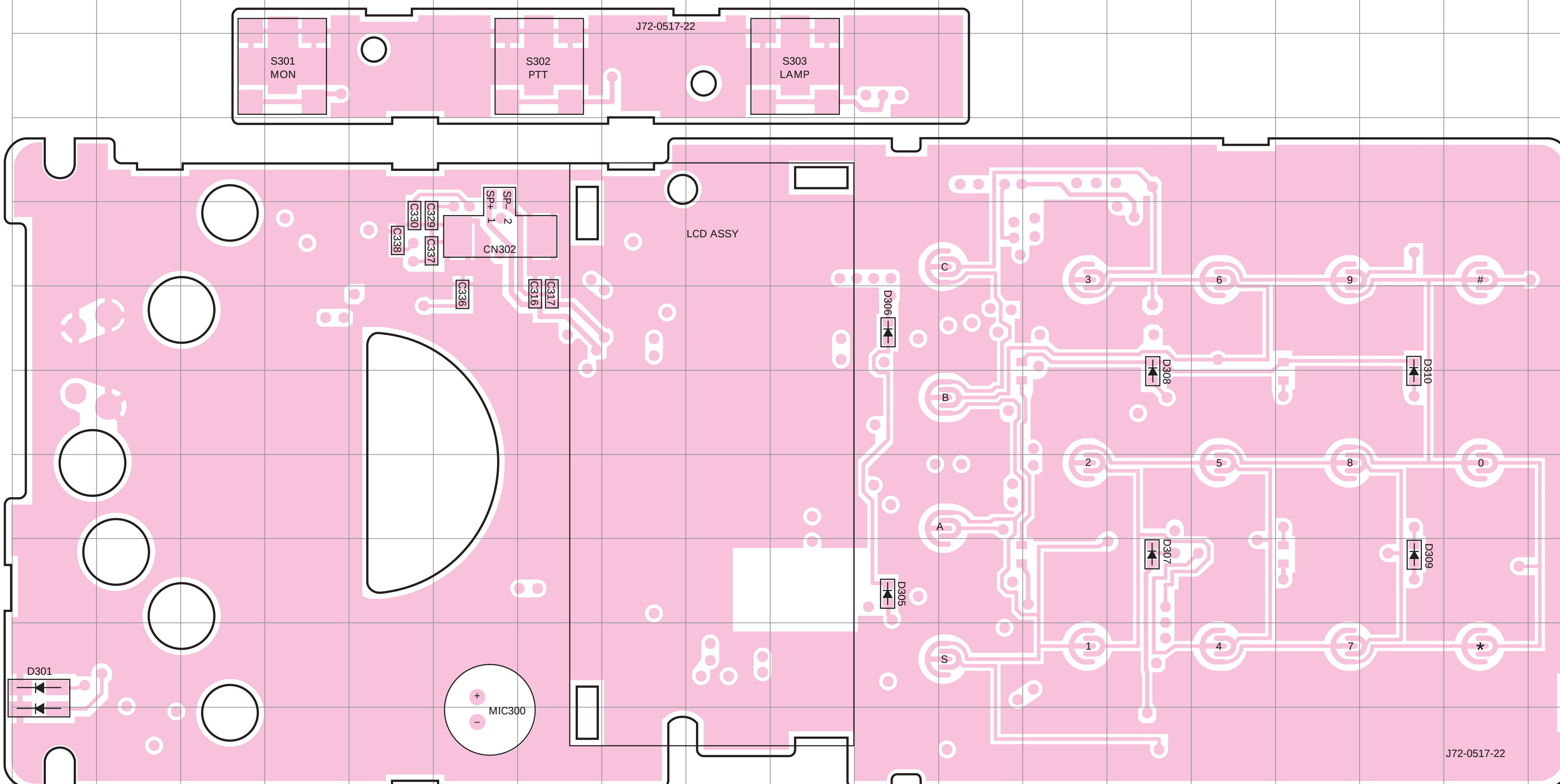
Item	Condition	Measurement			Adjustment			Specifications/Remarks
		Test-equipment	Unit	Terminal	Unit	Parts	Method	
1. Sensitivity check	1) SYS – GRP : 1 – 1 SSG output : –116dBm MOD : 1kHz DEV : ±3kHz (TK-480) :±1.5kHz (TK-481)	SSG AF VTVM Oscilloscope Distortion meter	Panel	ANT			Check	12dB SINAD or more.
2. Squelch adjustment	1) SYS – GRP : 4 – ✻ Select SQL ✻✻✻ in tuning mode. SSG output : 3dB below to 12dB SINAD level				Panel	Encoder knob	Adjust to point of closing squelch.	
3. Squelch check	1) SYS – GRP : 4 – 1 SSG output : 12dB SINAD level						Check	Squelch must be opened.
See Note.	2) SSG output : OFF							Squelch must be closed.

Note : When squelch is adjusted, the microcomputer simultaneously reads and writes the RSSI level. Do not write adjustment values without the SSG connected.

TERMINAL FUNCTION

CN No.	Pin No.	Name	I/O	Function
TX-RX UNIT (X57-5630-XX) : TX-RX section				
CN1	1	B	O	Power input after passing through the fuse.
	2	B	O	Power input after passing through the fuse.
	3	SB	I	Power output after power switch.
	4	SB	I	Power output after power switch.
	5	5M	O	5V.
	6	VOL	I	Volume level input for audio control.
	7	E	–	GND
	8	EN2	I	Encoder pulse input.
	9	E	–	GND
	10	EN1	I	Encoder pulse input.
CN2	1	MON	I	Normally;5V, MON when connected GND.
for X54-	2	LAMP	I	Normally;5V, LAMP when connected GND.
SW	3	PTT	I	Normally;5V, transmit when connected GND.
section	4	GND	–	GND
CN3	1	AF	O	Audio output.
	2	AFE	–	Audio GND.
for	3	NC	–	Not use.
X54-	4	PF	I	External PF signal input.
Display	5	CK	O	Clock data output.
unit	6	RXD	I	Serial control signal input.
	7	TXD	O	Serial control signal output.
	8	DT	O	Data output for LCD driver/decade counter.
	9	KRS	O	Key scan IC reset output.
	10	KI1	I	KEY input
	11	KI2	I	KEY input
	12	GND	-	GND
	13	5M	O	5V.
	14	AM	O	Audio mute signal output. Mute:"L", Unmute:"H"
	15	CS	O	LCD driver chip select output.
	16	NC	–	Not use.
	17	PTT	I	PTT signal input.
	18	AUX	I	AUX key input.
	19	LR	O	TX LED control. Normally:0V, lighting:5V.
	20	LG	O	RX LED control. Normally:0V, lighting:5V.
	21	LBL	O	Backlight LED control. Normally:0V, lighting:5V.
	22	ME	–	MIC GND.
	23	MIC	I	MIC signal input.
	24	SB	O	Power output after power switch.
DISPLAY UNIT (X54-3210-XX A/2) : DISPLAY section				
CN300	1	SB	I	Power input after power switch.
	2	MIC	O	MIC signal output.
for	3	ME	–	MIC GND.
X57-	4	LBL	I	Backlight LED control. Normally:0V, lighting:5V.
TX-RX unit	5	LG	I	RX LED control. Normally:0V, lighting:5V.
	6	LR	I	TX LED control. Normally:0V, lighting:5V.
	7	AUX	O	AUX key output.
	8	PTT	O	PTT signal output.
	9	NC	–	Not use.
	10	CS	I	LCD driver chip select input.
	11	AM	I	Audio mute signal input. Mute:"L", Unmute:"H"
	12	5M	I	5V.
	13	GND	–	GND
	14	KI2	O	KEY output
	15	KI1	O	KEY output
	16	KRS	I	Key scan IC reset input
	17	DT	I	Data input for LCD driver/decade counter.
	18	TXD	I	Serial control signal input.
	19	RXD	O	Serial control signal output.
	20	CK	I	Clock data input.
	21	PF	O	External PF signal output.
	22	NC	–	Not use.
	23	AFE	–	Audio GND.
	24	AF	I	Audio input.
CN301	1	SSW	I	EXT/INT speaker switch input.
	2	SP+	O	BTL output + for external speaker.
	3	SP-	O	BTL output - for external speaker.
	4	MSW	I	EXT/INT MIC switch input.
	5	EMC	I	External microphone input.
	6	ME	–	External microphone ground.
	7	PTT	I	External PTT input.
	8	PF	I	Programmable function key input.
	9	NC	–	Not use.
	10	E	–	GND
	11	5M	O	5V output
	12	TXD	O	Serial data output.
	13	RXD	I	Serial data input.
	14	NC	–	Not use
CN302	1	SP	O	Output for internal speaker.
	2	E	–	GND
CN304	1	NC	–	Not use.
	2	LEDK	I	Backlight LED control.
	3	LEDA	O	Backlight LED control.
	4	VCI	O	LCD power supply.
	5	SOD	O	Serial data output for LCD driver.
	6	SID	I	Serial data input for LCD driver.
	7	SCLK	O	Clock data output for LCD driver.
	8	CS	O	LCD driver chip select output.
	9	Vcc	O	5V
	10	GND	–	GND
DISPLAY UNIT (X54-3210-XX B/2) : SW section				
CN303	1	MON	O	Normally;5V, MON when connected GND.
for x57-	2	LAMP	O	Normally;5V, LAMP when connected GND.
TX-RX	3	PTT	O	Normally;5V, transmit when connected GND.
unit	4	GND	–	GND

DISPLAY UNIT (X54-3210-XX) -10 : K -11 : K2 Component side view

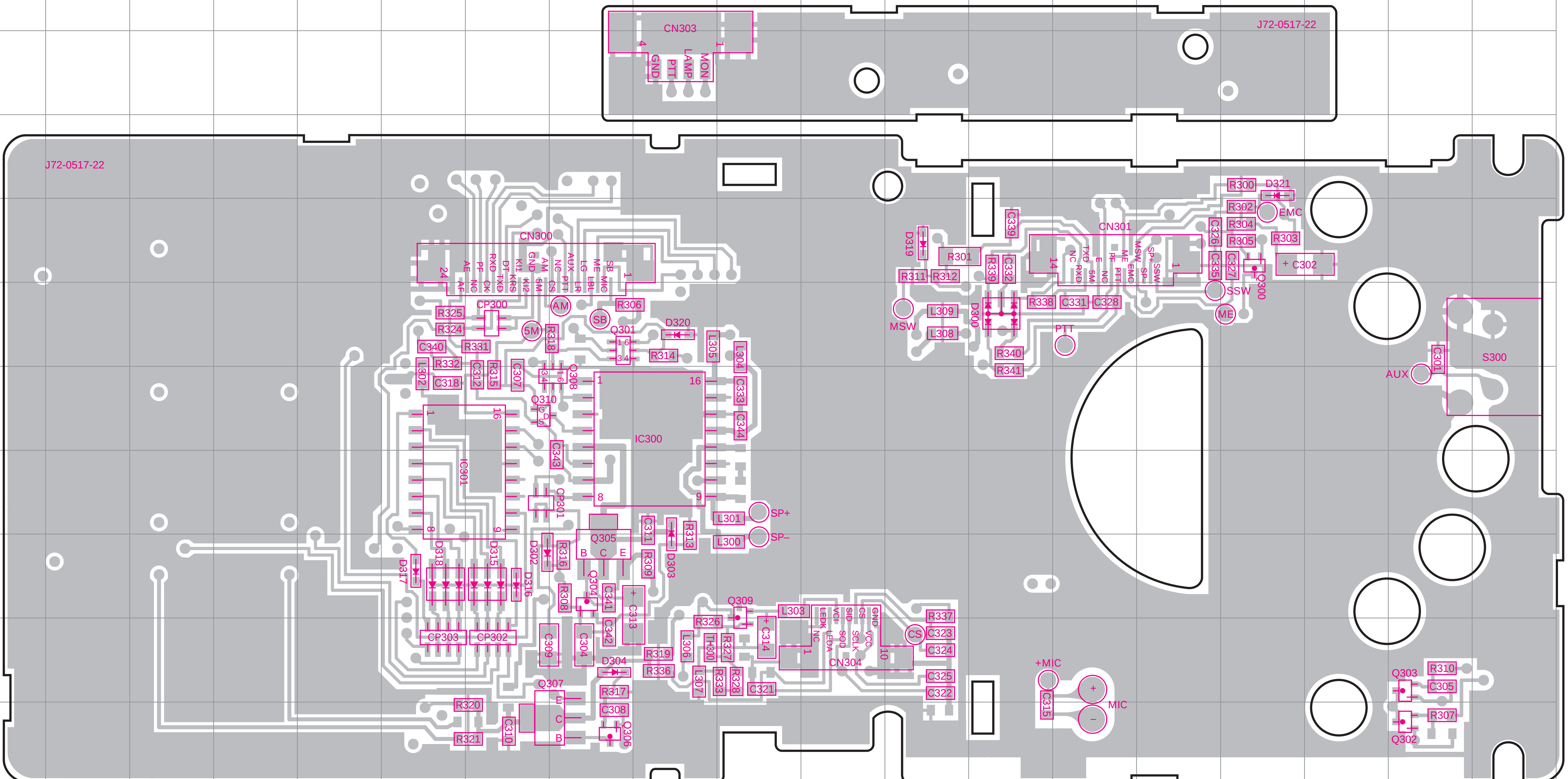


Ref No.	Address
D301	10A
D305	9K
D306	6K
D307	9N
D308	7N
D309	9Q
D310	7Q

Component side
Pattern 1
Pattern 2
Pattern 3
Pattern 4
Foil side

TK-480/481 PC BOARD VIEWS

DISPLAY UNIT (X54-3210-XX) -10 : K -11 : K2 Foil side view



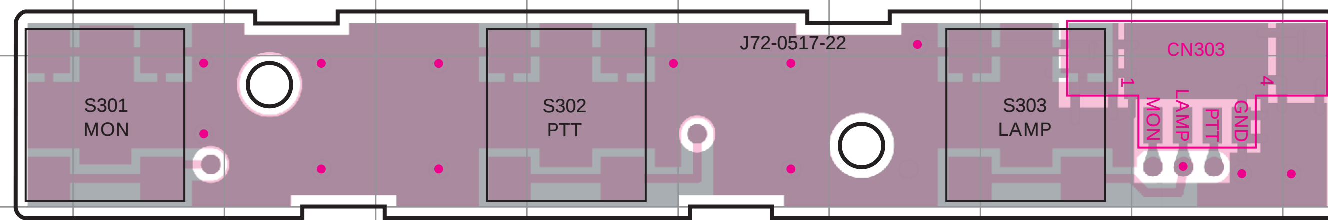
Ref No.	Address	Ref No.	Address	Ref No.	Address
IC300	7I	Q306	11H	D304	10H
IC301	8G	Q307	11H	D315	9G
Q300	5P	Q308	7H	D316	9G
Q301	6H	Q309	9J	D317	9F
Q302	11R	Q310	7G	D318	9F
Q303	10R	D300	6M	D319	5L
Q304	9H	D302	9G	D320	6I
Q305	9H	D303	9I	D321	4P

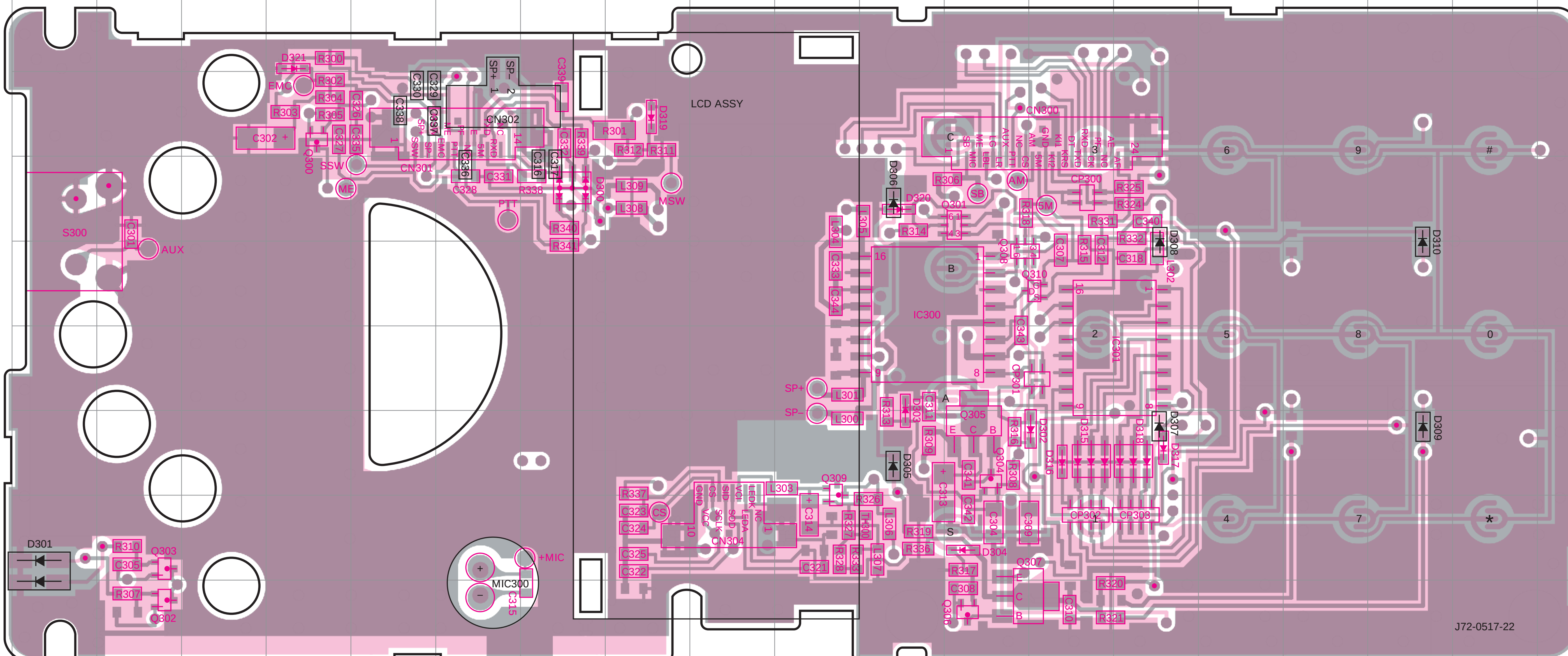
Component side

Pattern 1
Pattern 2
Pattern 3
Pattern 4

Foil side

DISPLAY UNIT (X54-3210-XX) -10 : K -11 : K2 Component side view + Foil side





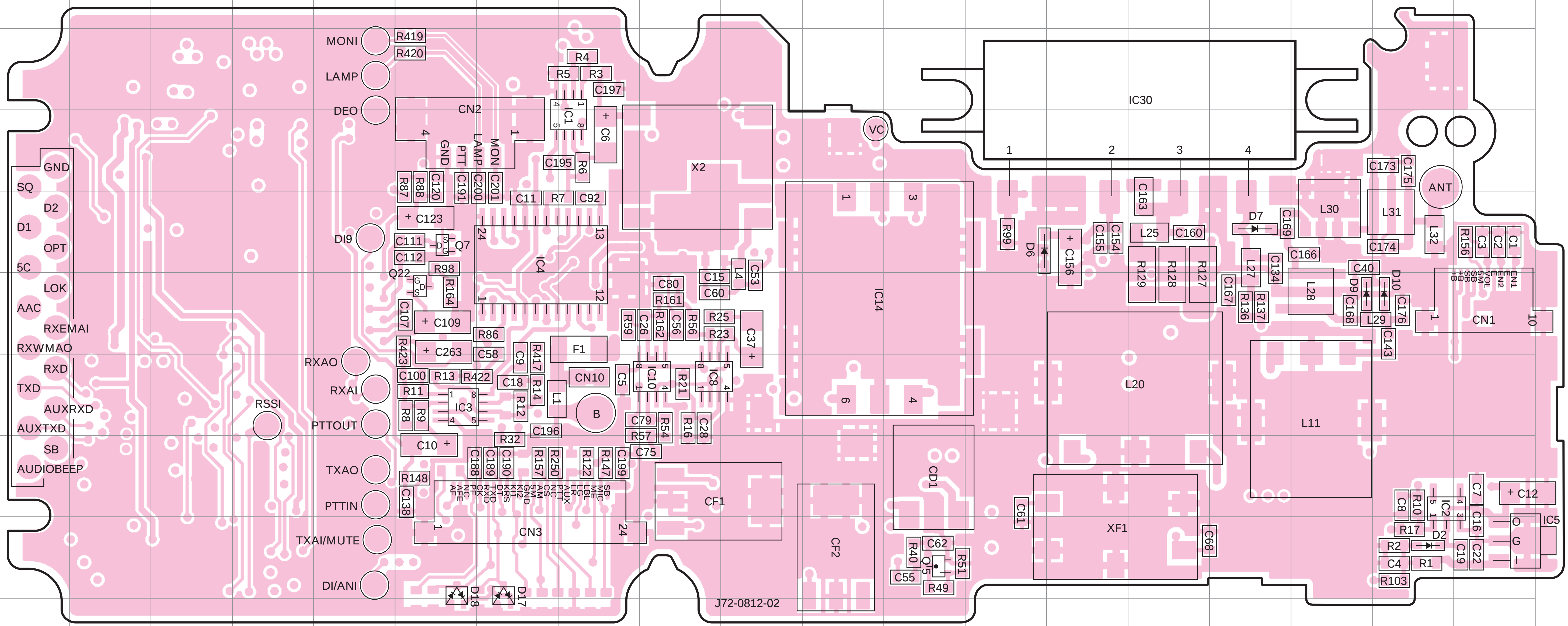
Ref No.	Address	Ref No.	Address	Ref No.	Address	Ref No.	Address
IC300	7K	Q306	11L	D303	9K	D315	9M
IC301	8N	Q307	11L	D304	10L	D316	9M
Q300	5D	Q308	7L	D305	9K	D317	9N
Q301	6L	Q309	9J	D306	6K	D318	9N
Q302	11B	Q310	7M	D307	9N	D319	5H
Q303	10B	D300	6G	D308	7N	D320	6K
Q304	9L	D301	10A	D309	9Q	D321	4D
Q305	9L	D302	9M	D310	7Q		

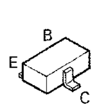
Component side
Pattern 1
Pattern 2
Pattern 3
Pattern 4
Foil side

● Connect 1 and 4

TK-480/481 PC BOARD VIEW

TX-RX UNIT (X57-5630-XX) -10 : TK-480 -11 : TK-481 Component side view

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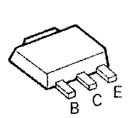
DTC114EE
DTC144EE
2SA1832
2SC4617
2SC4619
2SC5108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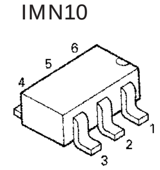
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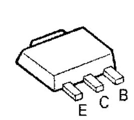
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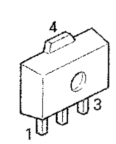
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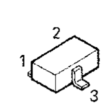
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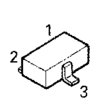
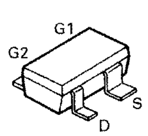

MA742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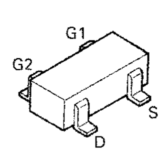
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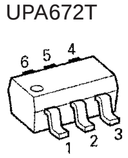
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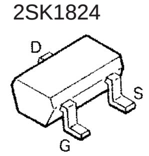
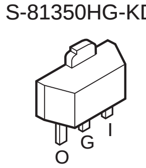

2SJ243
2SK1824


S-81350HG-KD

Ref No.	Address	Ref No.	Address	Ref No.	Address
IC1	4H	IC14	6K	D7	5P
IC2	8R	IC30	3O	D9	6Q
IC3	7F	Q5	9L	D10	6R
IC4	5G	Q7	5F	D17	9G
IC5	9S	Q22	6F	D18	9F
IC8	7I	D2	9R		
IC10	7I	D6	5M		

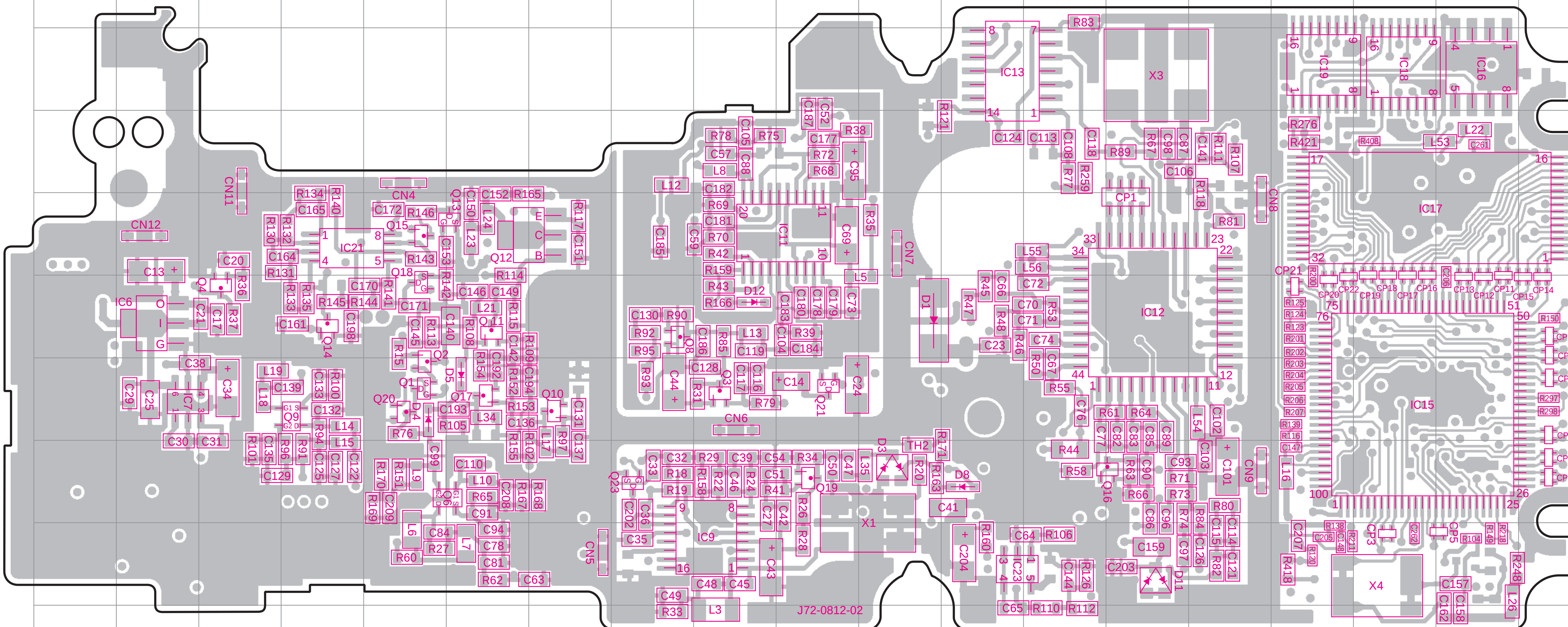
Component side

Pattern 1
Pattern 2
Pattern 3
Pattern 4
Pattern 5
Pattern 6

Foil side

PC BOARD VIEW TK-480/481

TX-RX UNIT (X57-5630-XX) -10 : TK-480 -11 : TK-481 Foil side view



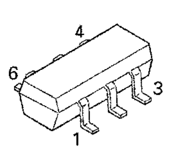
Ref No.	Address	Ref No.	Address	Ref No.	Address
IC6	6B	Q2	7E	Q18	6E
IC7	7B	Q3	7I	Q19	8J
IC9	9I	Q4	6C	Q20	7E
IC11	5J	Q6	8F	Q21	7J
IC12	6N	Q8	6H	Q23	8H
IC13	3L	Q9	7D	D1	6K
IC15	7Q	Q10	7G	D3	8K
IC16	3R	Q11	6F	D4	7E
IC17	5Q	Q12	5F	D5	7F
IC18	3Q	Q13	5F	D8	8L
IC19	3P	Q14	6D	D11	9N
IC21	5D	Q15	5E	D12	6I
IC23	9L	Q16	8N		
Q1	7E	Q17	7F		

Component side

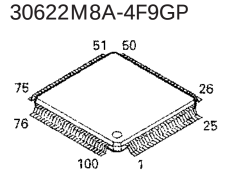
Pattern 1
Pattern 2
Pattern 3
Pattern 4
Pattern 5
Pattern 6

Foil side

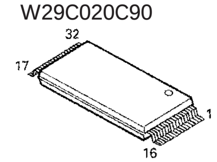
TK11250BM



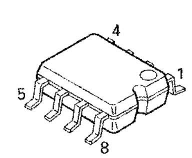
30622M8A-4F9GP



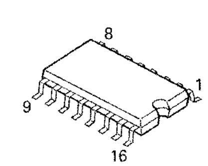
AT29C020-90TI
W29C020C90



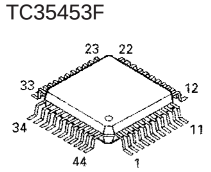
AT2408N10SI2.5



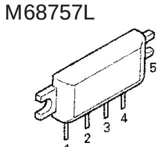
TC74HC4017AF



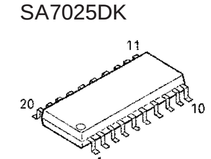
TC35453F



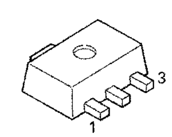
M68757H
M68757L



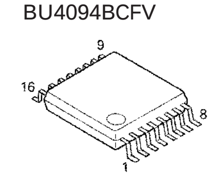
SA7025DK



NJU7201U50

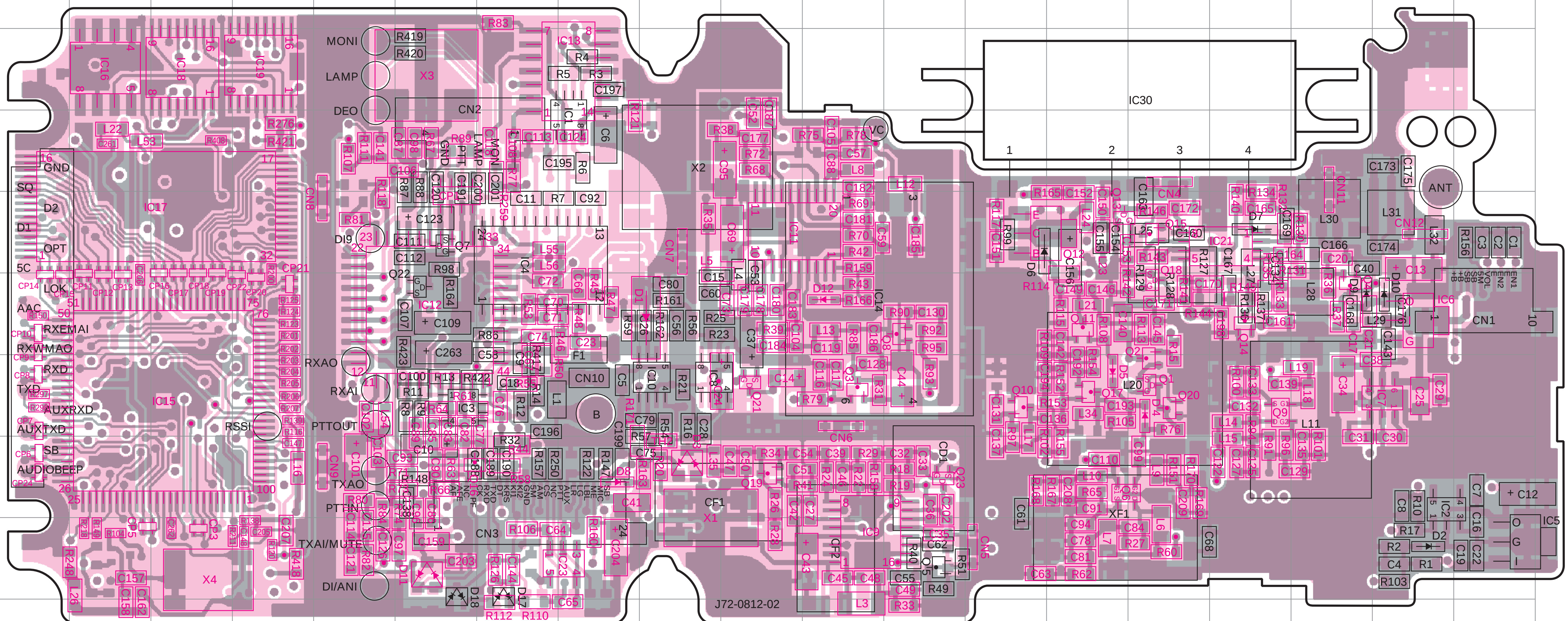


BU4094BCFV

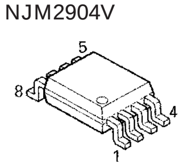


TK-480/481 PC BOARD VIEW

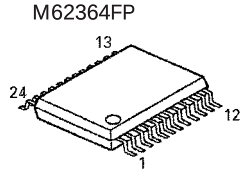
TX-RX UNIT (X57-5630-XX) -10 : TK-480 -11 : TK-481 Component side view + Foil side



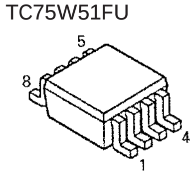
NJM2904V



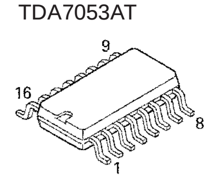
M62364FP



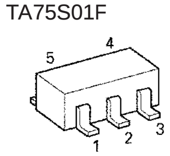
TA75W02FU
TC75W51FU



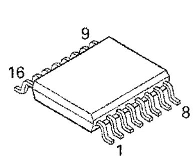
TDA7053AT



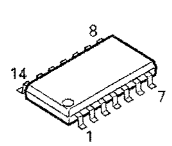
RN5VL42C
TA75S01F



TA31136FN



LC73872M



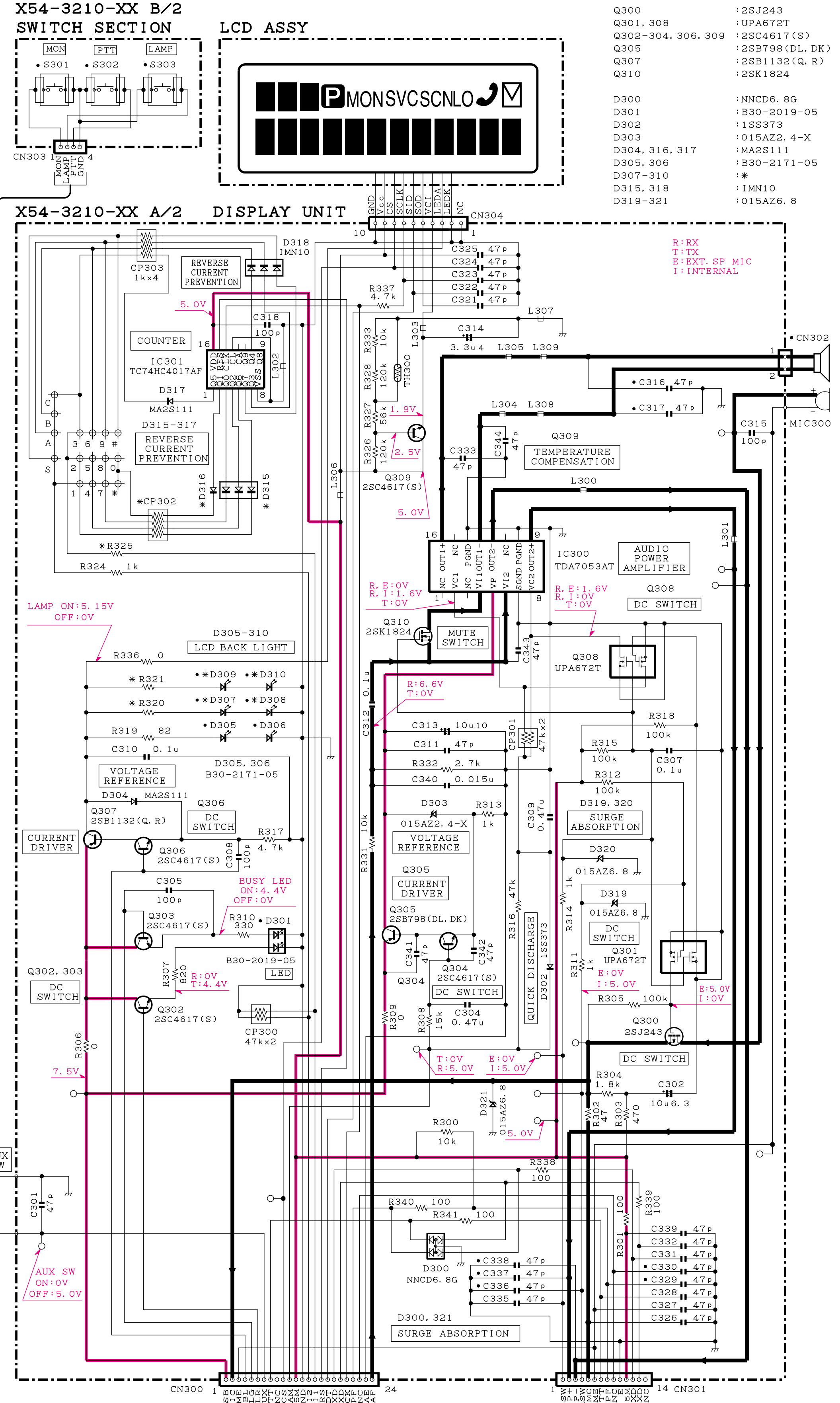
Ref No.	Address	Ref No.	Address	Ref No.	Address	Ref No.	Address
IC1	4H	IC16	3B	Q9	7P	D1	6I
IC2	8R	IC17	5C	Q10	7M	D2	9R
IC3	7F	IC18	3C	Q11	6N	D3	8I
IC4	5G	IC19	3D	Q12	5N	D4	7O
IC5	9S	IC21	5P	Q13	5N	D5	7N
IC6	6R	IC23	9H	Q14	6P	D6	5M
IC7	7R	IC30	3O	Q15	5O	D7	5P
IC8	7I	Q1	7O	Q16	8F	D8	8H
IC9	9K	Q2	7O	Q17	7N	D9	6Q
IC10	7I	Q3	7K	Q18	6O	D10	6R
IC11	5J	Q4	6Q	Q19	8J	D11	9F
IC12	6F	Q5	9L	Q20	7O	D12	6K
IC13	3H	Q6	8N	Q21	7J	D17	9G
IC14	6K	Q7	5F	Q22	6F	D18	9F
IC15	7C	Q8	6L	Q23	8L		

Component side
Pattern 1
Pattern 2
Pattern 3
Pattern 4
Pattern 5
Pattern 6
Foil side

● Connect 1 and 6

SCHEMATIC DIAGRAM TK-480/481

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



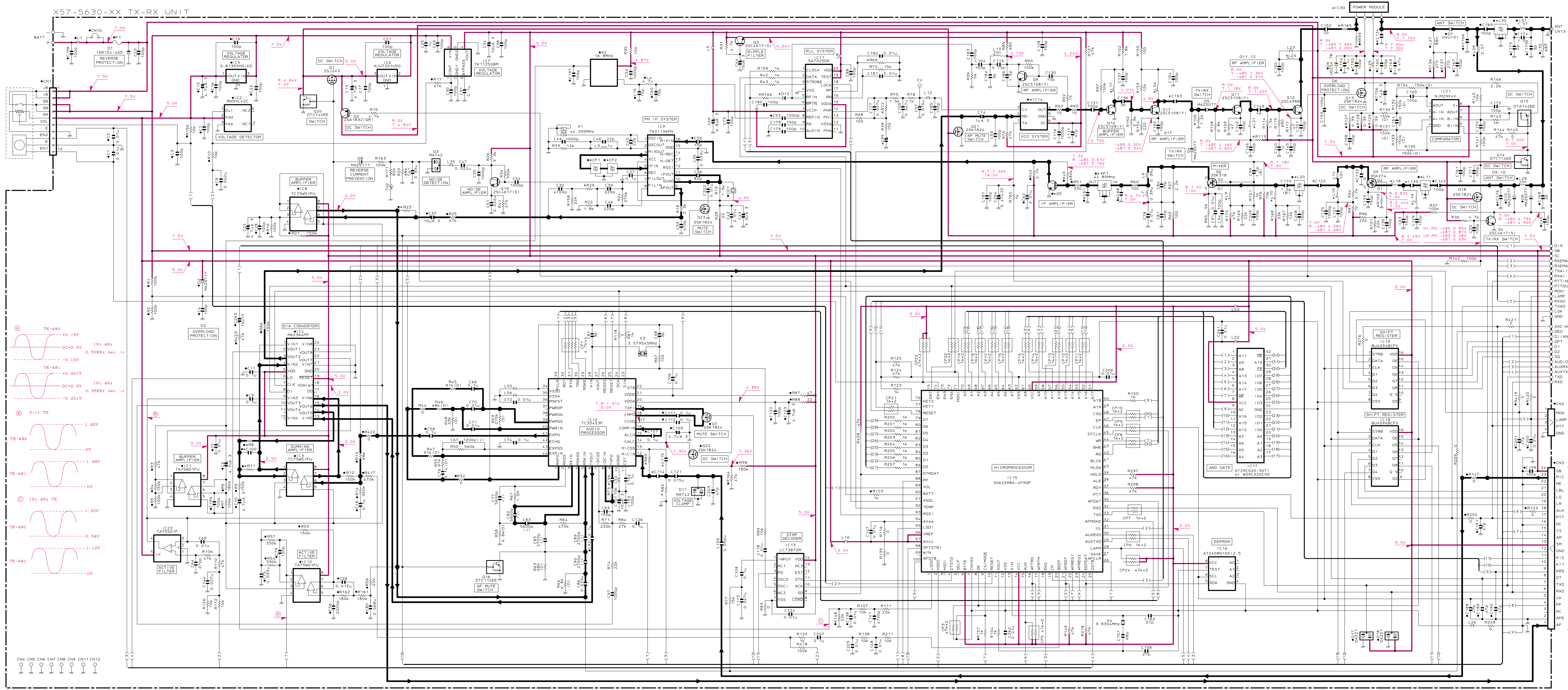
X54-3210-XX			16KEY	R320, R321	R325	D307-D310	D315	D316	CP302
-10	TK-480/481	K	NO	NO	NO	NO	NO	NO	NO
-11	TK-480/481	K2	YES	82	1k	B30-2171-05	IMN10	MA2S111	R90-0724-05(1kX4)

X54-3210-XX
IC300 :TDA7053AT
IC301 :TC74HC4017AF

Q300 :2SJ243
Q301, 308 :UPA672T
Q302-304, 306, 309 :2SC4617(S)
Q305 :2SB798(DL, DK)
Q307 :2SB1132(Q, R)
Q310 :2SK1824

D300 :NNCD6. 8G
D301 :B30-2019-05
D302 :1SS373
D303 :015AZ2. 4-X
D304, 316, 317 :MA2S111
D305, 306 :B30-2171-05
D307-310 :*
D315, 318 :IMN10
D319-321 :015AZ6. 8

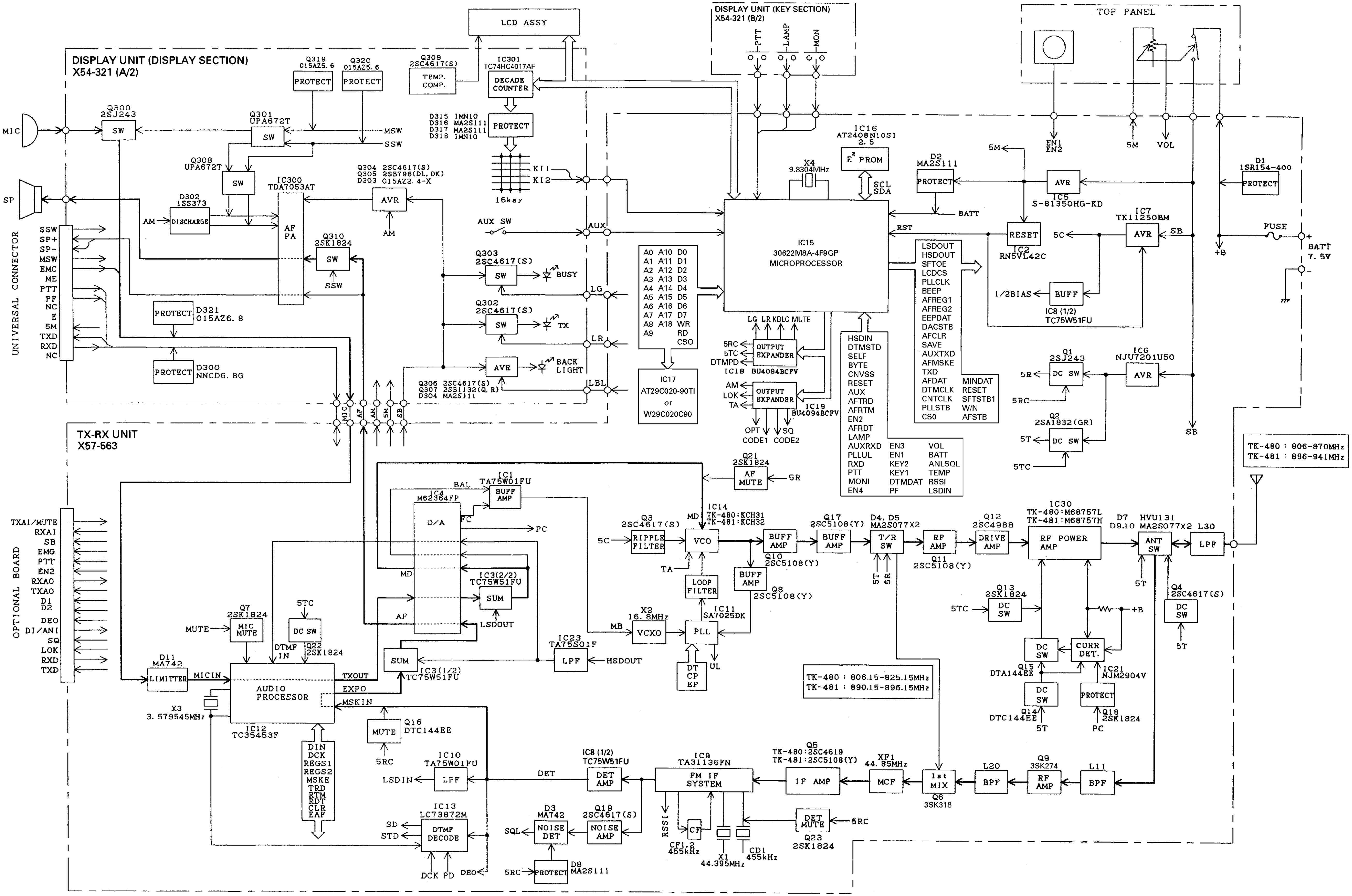
R:RX
T:TX
E:EXT. SP MIC
I:INTERNAL



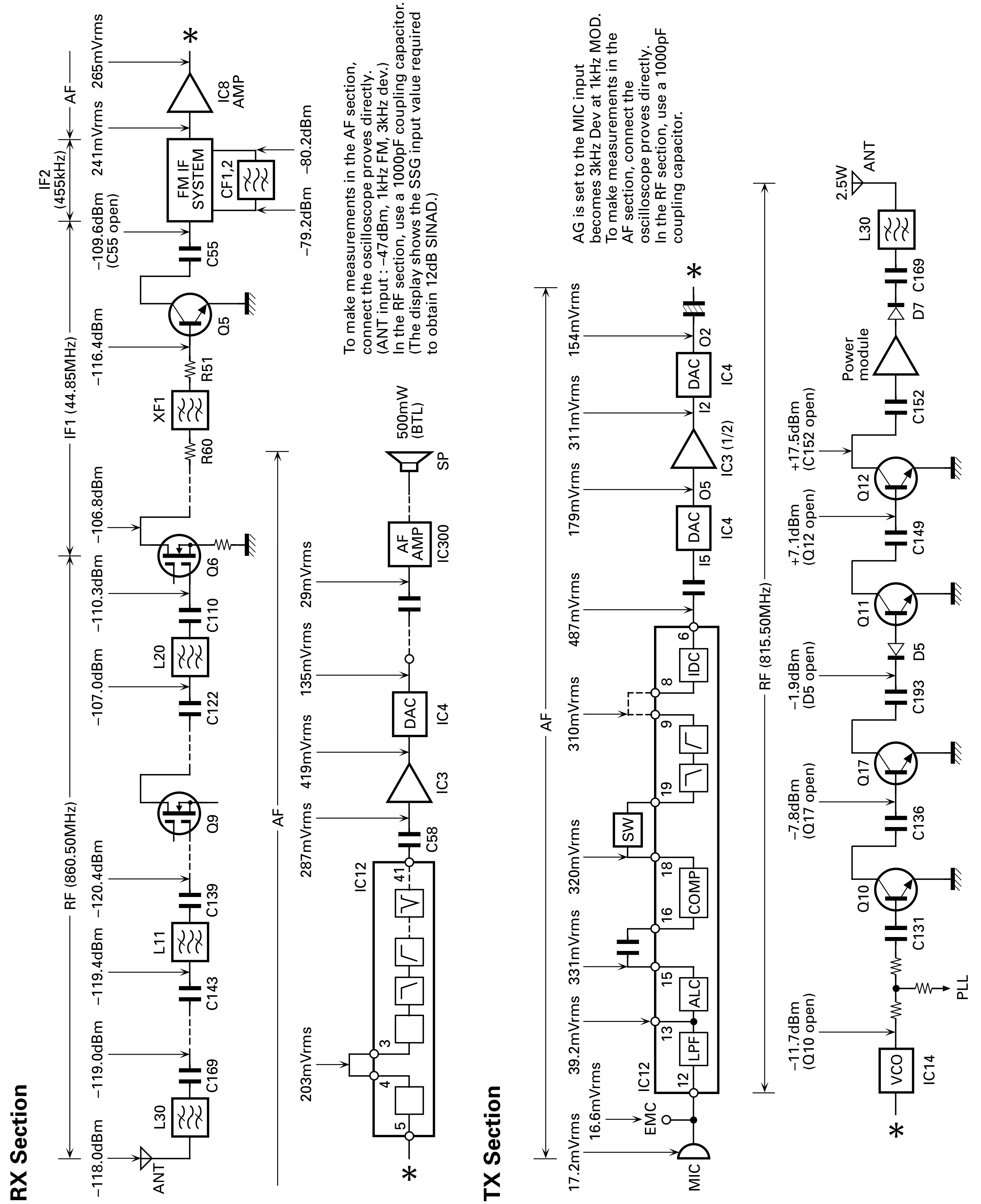
X57-5630-XX			C61	C68	C95	C96	C100	C114	C115	C122	C132	C134	C136	C166	C176	C193	L8	L10	L11	L15	L17	L18	L19	L20	L21	L24	L30	L34	R8	R11	R23	R69	R72	R80	R82	R99	R100	R113	R165	R166	CF1	CF2	D12	IC14	IC30	Q5	XF1
-10	TK-480	K, K2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	L71-0501-05
-11	TK-481	K, K2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	L71-0502-05

D1 :1SR154-400
D2, 8 :MA2S111
D3, 11 :MA742
D4, 5, 9, 10 :MA2S077
D6 :UBZS4.7B
D7 :HVU131
D12 :*
D17, 18 :DA221
Q1 :2SJ243
Q2 :2SA1832(GR)
Q3, 4, 19 :2SC4617(S)
Q5 :*
Q6 :3SK318
Q7, 13, 18, 21-23 :2SK1824
Q8, 10, 11, 17 :2SC5108(Y)
Q9 :3SK274
Q12 :2SC4988
Q14, 16 :DTC114EE
Q15 :DTA144EE
Q20 :DTC144EE
IC1, 10 :TA75W01FU
IC2 :RN5VL42C
IC3, 8 :TC75W51FU
IC4 :M62364FP
IC5 :S-81350HG-KD
IC6 :NJU7201U50
IC7 :TK11250BM
IC9 :TA31136FN
IC11 :SA7025DK
IC12 :TC35453F
IC13 :LC73872M
IC14 :*
IC15 :30622M8A-4F9GP
IC16 :AT2408N10SI2.5
IC17 :AT29C020-90TI or W29C020C90
IC18, 19 :BU4094BCFV
IC21 :NJM2904V
IC23 :TA75S01F
IC30 :*

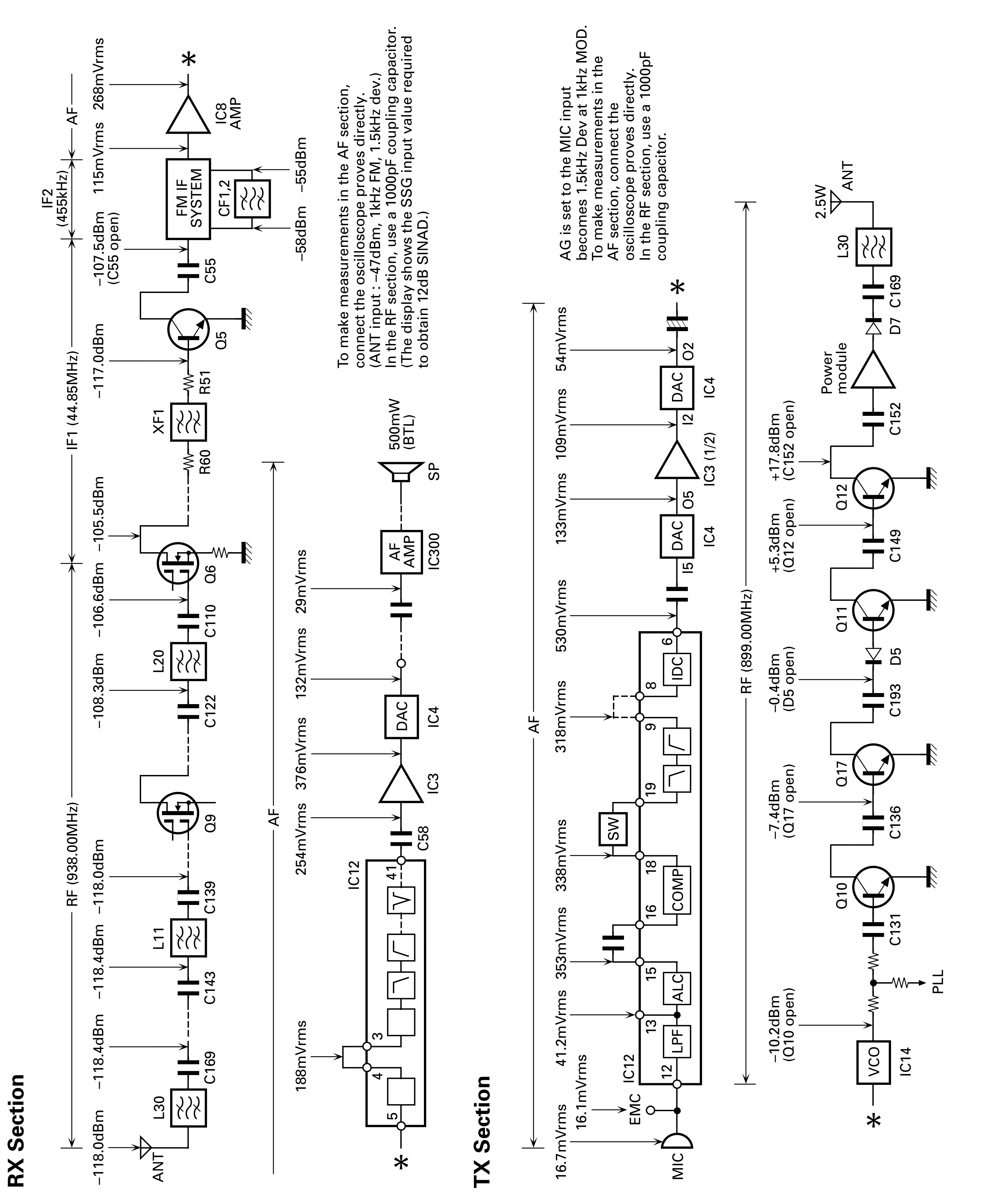
BLOCK DIAGRAM



LEVEL DIAGRAM (TK-480)

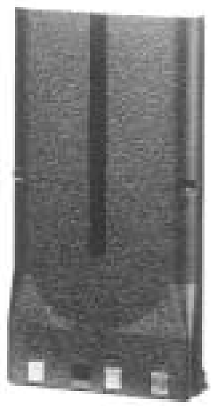


LEVEL DIAGRAM (TK-481)



KNB-16A/17A (Ni-Cd BATTERY) / KPG-36 (PROGRAMMING INTERFACE CABLE) / KSC-19 (CHARGER)

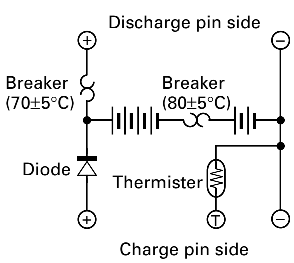
KNB-16A External View



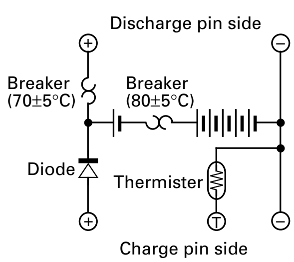
KNB-17A External View

KPG-36 External View

KNB-16A Circuit Diagram



KNB-17A Circuit Diagram



KSC-19 External View

KNB-16A Specifications

Voltage	7.2V (1.2V x 6)
Charging current	1100mAh
Dimensions (mm) (Projections included)	58 W x 110.8 H x 17.2 D
Charger and charging time	
KSC-19 (Normal Charger)	Approx. 8 hours
KSC-20 (Rapid charger)	Approx. 1 hour
Weight	180g

KNB-17A Specifications

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

KSC-19 Charging

KNB-16A	
Voltage	7.2V
Battery capacity	1100mAh
Charging time	Approx. 8 hours
KNB-17A	
Voltage	7.2V
Battery capacity	1500mAh
Charging time	Approx. 8 hours

SPECIFICATIONS

General

Frequency Range

RX	TK-480 : 851 to 870MHz TK-481 : 935 to 941MHz
TX	TK-480 : 806 to 825MHz (851 to 870MHz : Talk-Around)
	TK-481 : 896 to 902MHz (935 to 941MHz : Talk-Around)
Systems	Maximum 32
Groups	Maximum 250
Conventional Channels	Maximum 600
Channel Spacing	TK-480 : 25kHz (PLL channel step 12.5kHz)
	TK-481 : 12.5kHz (PLL channel step 12.5kHz)
Battery Voltage	DC 7.5V
Battery Life	More than 8 hours at 5-5-90 duty cycle with KNB-16A battery
Temperature Range	–30°C to +60°C (–22°F to +140°F)

Dimensions and Weight

With KNB-16A (1100mAh battery)	135 (5.33) H x 58 (2.29) W x 34 (1.34) D mm (inch) 1.01lbs (460g)

(Dimensions not including protrusions, weight includes antenna and belt hook)

Receiver (Measurements made per TIA/EIA-603)

RF Input Impedance	50Ω
Sensitivity	
12dB SINAD*	0.30μV
Selectivity*	TK-480 : 70dB±25kHz TK-481 : 63dB±12.5kHz
Intermodulation*	TK-480 : 65dB±25/50kHz TK-481 : 60dB±12.5/25kHz
Spurious (Except for IF 1/2)*	70dB
Frequency Stability	TK-480 : ±0.00025% (–30°C to +60°C)
	TK-481 : ±0.00015% (–30°C to +60°C)
Channel Spread	TK-480 : 19MHz TK-481 : 6MHz
Audio Power Output	500mW at 16Ω less than 5% distortion

* : Typical specifications

Transmitter (Measurements made per TIA/EIA-603)

RF Power Output	
High	2.5W
Low	1W
RF Output Impedance	50Ω
Spurious	–60dB
Modulation	TK-480 : 16K0F3E, 16K0F1D, 15K0F2D, 14K0F3E, 14K0F1D, 13K0F2D
	TK-481 : 11K0F3E, 11K0F1D, 10K5F2D
FM Noise	TK-480 : –45dB TK-481 : –40dB
Audio Distortion	5.0% or less
Frequency Stability	TK-480 : ±0.00025% (–30°C to +60°C)
	TK-481 : ±0.00015% (–30°C to +60°C)
Channel Spread	TK-480 : 64MHz TK-481 : 45MHz

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