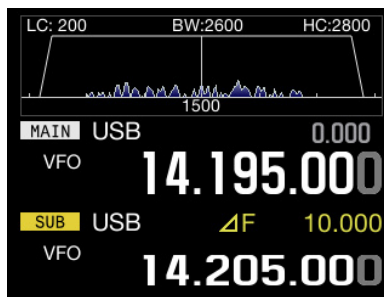# 5 ASSISTING YOUR SMOOTH QSO

SIMPLEX OPERATION

In most day to day operation, QSOs are Simplex operations using the same frequency for reception and transmission. For Simplex operation with this transceiver, you will transmit and receive in the main band.

Note:
◆ The reception capability for the main band cannot be disabled.

SPLIT OPERATION

You may use the Split function that allows you to transmit and receive using different frequencies when you make a QSO with the DX-pedition station. For Split operation using this transceiver, you can allocate different frequencies for the main band and sub band; one band is used for transmission and the other band for reception.
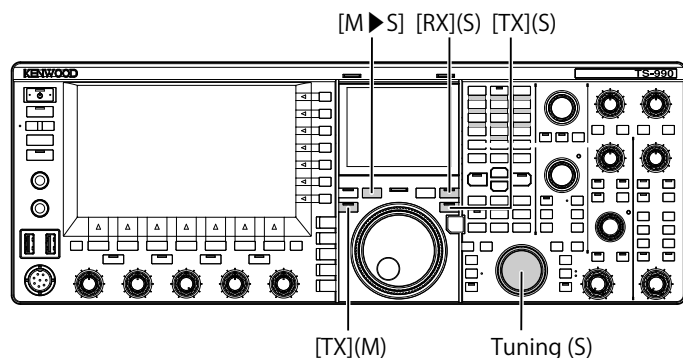
FINDING THE TX FREQUENCY BY ROTATING THE TUNING CONTROL (S)

To directly tune the transmit frequency, follow the instruction below during reception on the main band from the DXer.

[M▶S] [RX](S) [TX](S)

[TX](M)   Tuning (S)

1 Press **[M▶S]** to copy the operating frequency and mode for the main band to the sub band.

2 Press **[TX]** (S) to select the sub band enabling you to transmit.
   The "TX" (S) LED lights green and the "SPLIT" LED lights yellow, and you can start the split operation.

3 Tune the sub band frequency with a rotation of the **Tuning** (S) control to be the transmit frequency.
   The sub screen the frequency difference between the main band and sub band appears as ΔF.

Note:
◆ Pressing **[TX]** (M) finishes the split operation, and the transceiver reverts to simplex operation.
◆ To temporarily receive using the transmit frequency, use the TF-SET function.
◆ Refer to "SUB SCREEN" for details of the display method of the sub screen. {page 4-4}

DIRECTLY ENTERING THE FREQUENCY SPLIT SPECIFIED BY A DXER

To directly enter the difference between the TX and RX frequencies specified by a DXer, follow the instruction below during reception on the main band of a signal from the DXer.

[TX](S) [CLR]

[RX](M) [TX](M)
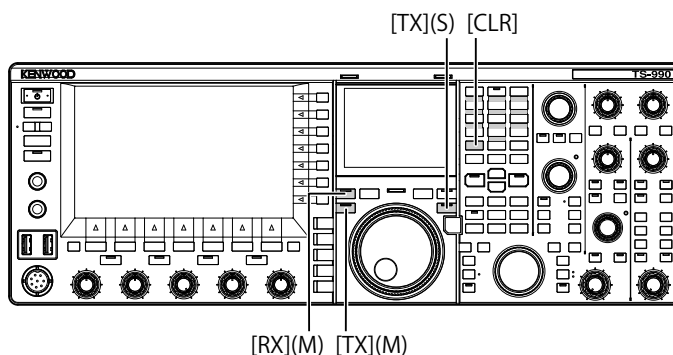
1 Press **[<MAIN]** to enter the main mode.

2 Press and hold **[TX]** (S).
   The "SPLIT" LED lights yellow, each LED on the numeric and band-select keypad also lights. An error will occur if the frequency for the sub band is locked. Do this operation after deactivating the frequency lock.

3 Enter the frequency difference (the "split") in the order of kHz as specified by the DX station.

- If the frequency specified by the DXer is higher than now, enter the specified frequency in the order of kHz using the numeric and band-select keypad. Conversely, if the specified frequency is lower, a value "0" must be prefixed to the frequency.
- For example, enter a value "5" if you need to increment the frequency by 5 kHz, and enter a value "05" if you need to decrement the frequency by 5 kHz.
- As a result, the "RX" (M) LED and "TX" (S) LED light green and "SPLIT" LED lights yellow, and you can start the split operation. Also, the offset frequency for the main band and sub band frequencies appears on the sub screen as the ΔF value.

Note:

♦ Pressing **[TX]** (M) switches from split operation to simplex operation.

♦ To temporarily receive using the transmit frequency, use the TF-SET function. {page 5-2}

ROTATE THE TUNING (M) CONTROL TO SEARCH FOR THE TRANSMIT FREQUENCY.

To directly search for the transmit frequency by rotating the **Tuning** control, follow the instruction below during the reception on the main band of a signal from the DX station.
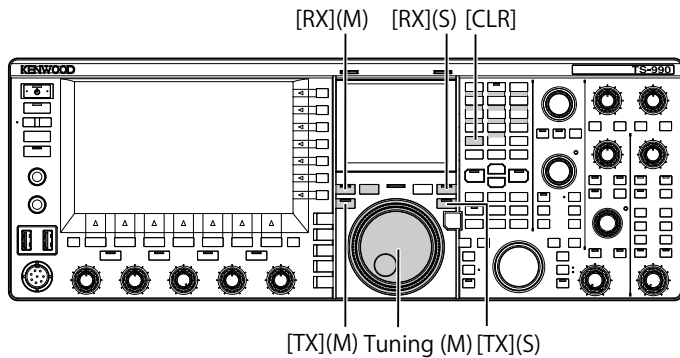
1 Press and hold **[TX]** (S).
The "SPLIT" LED blinks, each LED on the numeric and band-select keypad also lights. An error will occur if the frequency for the sub band is locked. Do this operation after deactivating the frequency lock.

2 Rotate the **Tuning** (M) control to search for the frequency.
The frequency can be changed even if the main band frequency has been locked.

3 Press **[TX]** (S) to end.

- The frequency configured for the main band is also applied to the transmit frequency of the sub band and you can start the split operation.
- The "RX" (M) LED and "TX" (S) LED light, and the "SPLIT" LED blinks. The offset frequency for the main band and sub band frequencies appears on the main screen as the ΔF value.

Note:

♦ If you wish to cancel the operation when the step 1 above has completed, press either of **[RX]** (M), **[TX]** (M), or **[CLR]**. Also, pressing **[TX]** (M) reverts the operating mode to simplex operation from the split operation.

♦ To temporarily receive using the transmit frequency, use the TF-SET function. {page 5-2}

SEARCHING WITH TF-SET ENABLED FOR THE TRANSMIT FREQUENCY DURING RECEPTION

While pressing down the **[TF-SET]** key during the Split operation using the sub band, the transmit frequency of the main band can be changed by rotating the **Tuning** (M) control. The status of the frequency can be monitored by changing the frequency to receive.

To facilitate your QSO using the Split operation with a DX station that has been piled up from many stations, use the bandscope and the TF-SET to enable your operation accurate and quick to tune the frequency used by the DX station and the frequency that other stations are not using.
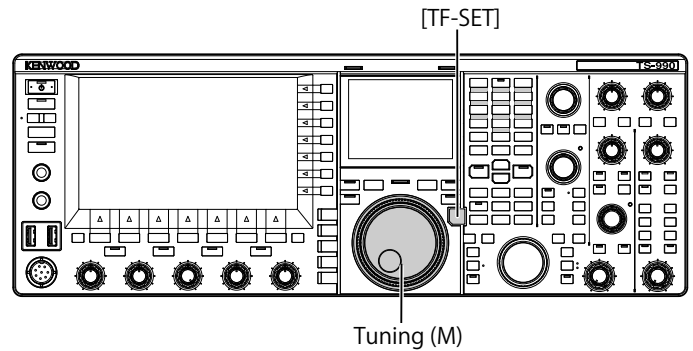
1 Press down **[TF-SET]**.
The status of the transmit frequency can be monitored using the main band.

2 While **[TF-SET]** is pressed down, rotate the **Tuning** (M) or **MULTI/CH** control to increment or decrement the frequency.

3 Release **[TF-SET]** to resume the reception using the main band.
The transceiver resumes reception using the receiving frequency configured for the main band.

Note:

♦ While you are pressing down **[TF-SET]**, the frequency displays for the main band and the sub band are reversed.

♦ You cannot change the frequency even with a rotation of the **Tuning** (S) control while **[TF-SET]** is being pressed down.

♦ Pressing down **[TF-SET]** while the XIT function for the sub band is active will add the XIT frequency to the displayed frequency for the main band.

♦ Even if the frequency has been locked, the transmit frequency displayed for the main band can be changed.

♦ While in Memory Channel Mode, and if a temporary change of a memory channel is enabled, the frequency can be changed by means of the TF-SET.

♦ While you are pressing down **[TF-SET]**, you cannot change the quick memory channel or clear the memory.

▶ **Index**   ▶ **Contents**

SIMULTANEOUS MAIN BAND AND SUB BAND RECEPTION

The transceiver has two independent receivers, so that the transceiver can receive on the main band and sub band using different frequencies. For example, while you have a QSO using the transceiver in simplex operation on the main band, you can tune into a sub band frequency that a DX-pedition operator has announced to work on and wait for the DX-pedition operator to come up.

Furthermore, if you wish to call a DX station using Split operation, with the reception in the main band using the frequency occupied by the DX station, you can monitor the transmitted signal by receiving the signal on the sub band.

[RX](S) [TX](S)

[TF-SET] Tuning (S) [AF](S)
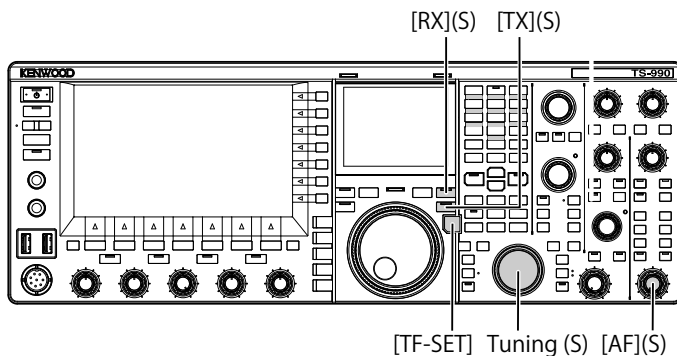
1 Press **[RX]** (S) to start receiving on two frequencies.
   The "RX" (S) LED lights, and the transceiver starts receiving on the sub band; now the transceiver receives using the dual frequencies.

2 Rotate the **AF** (S) control to adjust the AF gain.

3 Rotate the **Tuning** (S) control to tune the receive frequency.

4 Press **[RX]** (M) or **[RX]** (S) to finish the dual frequencies reception.

Note:

◆ Pressing **[TX]** (S) starts the Split operation allowing the transceiver to continue reception on the transmit frequency. While you press down **[TF-SET]**, you can monitor the transmit frequency. For reception using two frequencies, the transceiver can receive on the sub band using the transmit frequency while receiving on the main band.

FREQUENCY TRACKING

By rotating the **Tuning** (M) control with the frequency tracking function activated, you can change the main band and sub band frequencies with the difference between the frequencies maintained. Also, rotating the **Tuning** (S) control can change the sub band frequency without changing the main band frequency.

This frequency tracking will be useful, for instance, when different antennas are connected for the main band and sub band allowing you to measure the difference in the signal strengths. The tracking function is particularly effective on the low-frequency bands.

Frequency Tracking can be used while the main band and sub band are in VFO mode. If Frequency Tracking is enabled when the main band and sub band are in different modes, the sub band is placed in the same mode as the main band.

[TRACKING]

Tuning (M) Tuning (S)
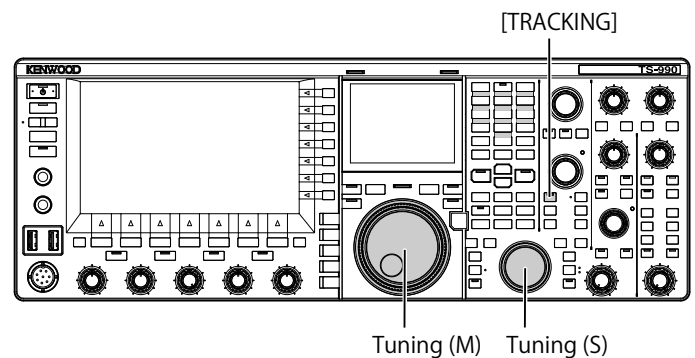
1 Press **[TRACKING]** to enable the Frequency Tracking.
   - The operating data of the main band is copied to the sub band, and the "TRACKING" LED lights green. Press **[TRACKING]** again to disable the Frequency Tracking, the "TRACKING" LED turns Off.
   - The operating data such as the frequency and the operating mode for the main band is copied to the sub band.
   - Rotating the **Tuning** (M) control when the sub band frequency is different from the main band frequency changes both main band and sub band frequencies and retains the same frequency differential.
   - If Fine Tuning is enabled in either of the bands, Fine Tuning for the other will also be enabled.
   - If the band is swapped, or if the VFO data is recalled from a Memory Channel while in VFO mode, Frequency Tracking will be disabled.
   - While Frequency Tracking is active, the scan does not start.

AGC (AUTOMATIC GAIN CONTROL)

AGC is a function that automatically controls the IF Gain so as to absorb variations in the received signal strength.

Following the receiving state or the operating mode (other than FM mode), FAST, MID, or SLOW can be configured for the AGC time constant.

The digital AGC circuit of the transceiver is adjustable to a SLOW, MID, or FAST value ranging from "1" (the quickest) to "20" (the slowest).

In general, a fast time constant is configured for CW and FSK modes where there is a rapid variation in the received signal strength, and a slow time constant is configured for SSB and AM mode where the variation is slower.

Fast time constant is effective for quick tuning when a weak signal is present.

Also, you can disable the AGC. As shown below, a default AGC time constant is set on a mode-by-mode basis.

■ DEFAULTS OF AGC TIME CONSTANT (COMMON TO MAIN BAND AND SUB BAND)

Mode	Time Constant	Display
SSB	SLOW	AGC-S
SSB-DATA	SLOW	
CW	FAST	AGC-F
FSK	FAST	
PSK	FAST	
AM	SLOW	AGC-S
AM-DATA	SLOW	

SELECTING THE AGC TIME CONSTANT

Following are the procedure to switch the AGC time constants of the main band and sub band to "FAST", "MID" or "SLOW".
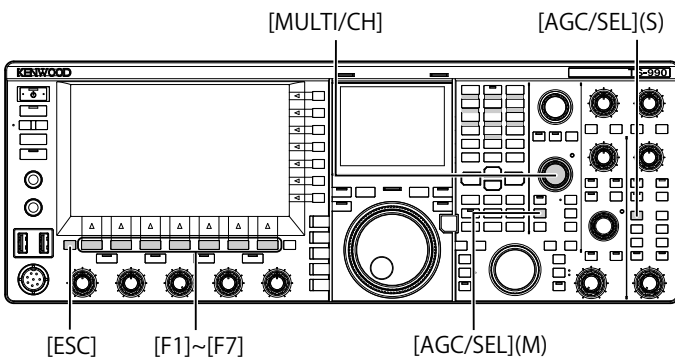
1 Press one of mode keys to select any mode other than FM mode.

2 Press **[AGC/SEL]** (M) or **[AGC/SEL]** (S) to select the AGC time constant.
Each time you press the key, the selection cycles as follows:
FAST > MID > SLOW > FAST

CHANGING THE AGC TIME CONSTANT

Time constant for the main band and sub band can be independently changed from the defaults.

1 Press one of the mode keys to select any mode other than FM mode.

2 Press and hold **[AGC/SEL]** (M) or **[AGC/SEL]** (S) to open the **AGC** screen.

3 Press **[AGC]** (F3), **[AGC/SEL]** (M), or **[AGC/SEL]** (S) to select "FAST", "MID", or "SLOW".

Pressing **[AGC]** (F3), **[AGC/SEL]** (M), or **[AGC/SEL]** (S) while the AGC is disabled for the main band and sub band enables the AGC.

4 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select the AGC time constant.
• Selecting "1" enables the slowest AGC time constant, and selecting "20" enables the fastest AGC time constant. The defaults of the AGC time constants for each operating modes are below.

| Mode	FAST	MID	SLOW
SSM	9	12	15
SSB-DATA	9	12	14
CW	9	12	14
FSK	7	11	14
PSK	7	11	14
AM	9	13	16
AM-DATA	9	13	16

• Press and hold **[(RESET)]** (F1) to reset the selected AGC time constant to the default.
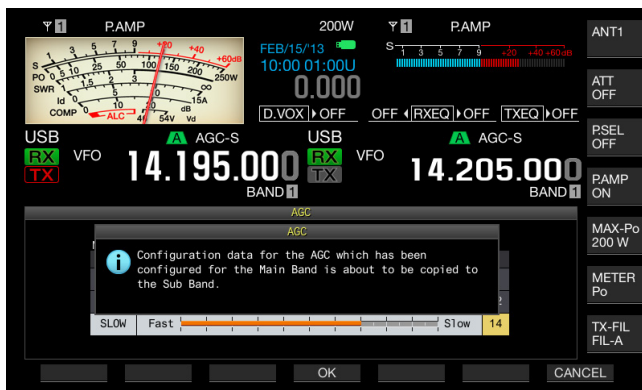
5 Press **[ESC]** to exit.
In FM mode, the **AGC** screen does not open even with a long press of either **[AGC/SEL]** (M) or **[AGC/SEL]** (S).

COPYING THE AGC TIME CONSTANT CONFIGURATIONS

The AGC time constants configured for "FAST", "MID" and "SLOW" of the main band can be copied to the sub band. Also, the AGC time constants configured for "FAST", "MID" and "SLOW" for the sub band can be copied to the main band.

[AGC OFF](S)
[AGC/SEL](S)

[ESC]   [F1]~[F7]   [AGC/SEL](M)   [AGC OFF](M)
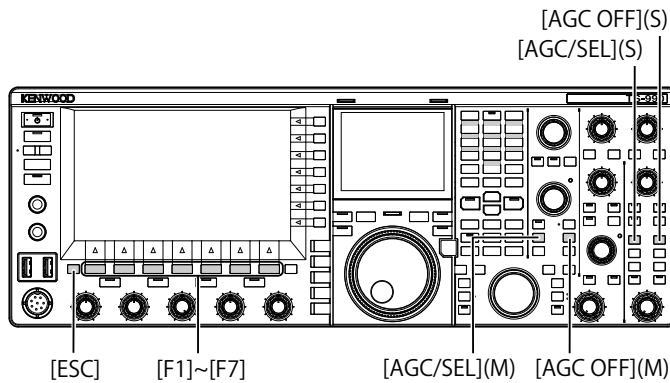
1   Press one of the mode keys to select the mode, other than FM mode, for the main band or sub band to be a copy source.

2   Press and hold **[AGC/SEL]** (M) or **[AGC/SEL]** (S) to open the **AGC** screen.

3   Press **[COPY]** (F7) to copy the parameter for the AGC time constant.
    The message prompting you to confirm that the AGC time constants, configured for "FAST", "MID" and "SLOW" of the main band or sub band can be copied to the other band will appear.

4   Press **[OK]** (F4).
    The AGC time constant is copied. Press **[CANCEL]** (F7) to finish the process without copying.

5   Press **[ESC]** to exit.

Note:

� Not only the time constant value but also the time constant value displayed on the **AGC** screen are copied.

DISABLING THE AGC

Following the received signal strength, you can disable the AGC. Disabling the AGC function fixes the RF gain; however, this may facilitate you listening the weak signal.

PRECAUTION

� Disabling the AGC function while the S meter is swinging will increase the RF gain level, causing the audio to sound in mega volume from a speaker or a set of headphones.

Fully rotate the **RF** volume counterclockwise and disable the AGC function, then you can rotate the **RF** volume to adjust the audio level.

Follow the procedure below to disable the AGC function for the main band and sub band independently.

1   Press **[AGC OFF]** (M) or **[AGC OFF]** (S) to disable the AGC.
    The message prompting you to disable the AGC appears.
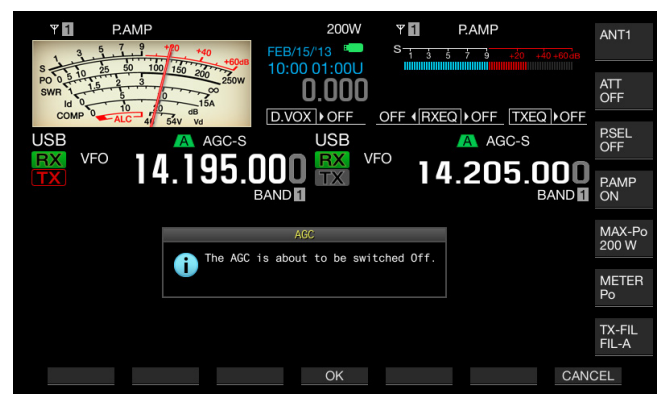
2   Press **[OK]** (F4) to disable the AGC.
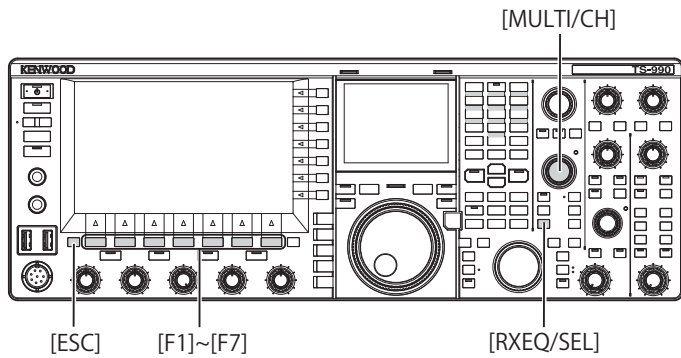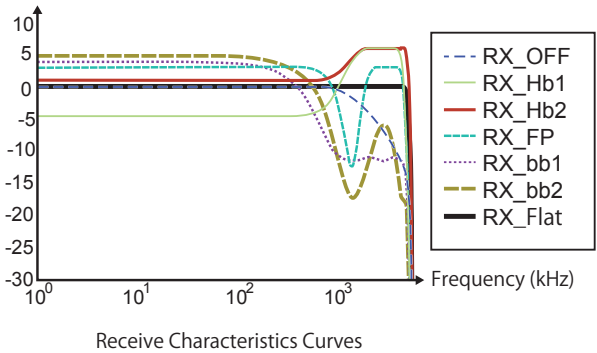   Pressing **[CANCEL]** (F7) to abort this operation

RX DSP EQUALIZER

RX DSP Equalizer allows you to change the desired sound quality by adjusting the frequency characteristics of the received audio. The desired sound quality can be selected from six types of RX DSP Equalizer profiles for the main band and sub band independently. The custom made equalizer characteristics can be configured for User 1 to User 3.

SWITCHING THE RX DSP EQUALIZER ON OR OFF

Each time you press **[RXEQ/SEL]**, you toggle the RX DSP Equalizer between active and inactive.

[MULTI/CH]

[ESC]   [F1]~[F7]   [RXEQ/SEL]

SELECTING THE EQUALIZER CHARACTERISTICS

1 Press and hold **[RXEQ/SEL]** to open the **RX Equalizer** screen.
The highlighted equalizer characteristics becomes active.

2 Press **[▲]** (F2) or **[▼]** (F3), or rotate the **MULTI/CH** control to select the desired equalizer characteristics.

■ AVAILABLE EQUALIZER CHARACTERISTICS

Effect	Purpose
High Boost 1	High-pass frequency components are emphasized. This configuration is effective for audio that contains low-pass frequency components.
High Boost 2	High-pass frequency components are emphasized. This configuration provides characteristics that halve the low-pass attenuation level of High Boost 1.
Formant Pass	This configuration attenuates frequency components outside the audio band, thus providing legible characteristics.

| Bass Boost 1	Low-pass frequency components are emphasized. This configuration is effective for audio that contains high-pass frequency components.
Bass Boost 2	Low-pass frequency components are emphasized. This configuration provides characteristics that further emphasize the low-passband, compared with Bass Boost 1.
Flat	The flat characteristics
User 1	You can save your preferred frequency characteristics as User 1, User 2 and User 3. The default characteristic is "Flat".
User 2	
User 3	

Receive Characteristics Curves

3 Press **[ESC]** to exit.
The selection of the characteristics of the RX DSP equalizer is complete. Pressing and holding **[RXEQ/RX]** also closes the **RX Equalizer** screen.

CUSTOMIZING THE EQUALIZER

You can customize the equalizer characteristics to your desired characteristics. Also, such customized characteristics can be stored as the User Configuration.

[MULTI/CH]

[ESC]   [F1]~[F7]   [RXEQ/SEL]
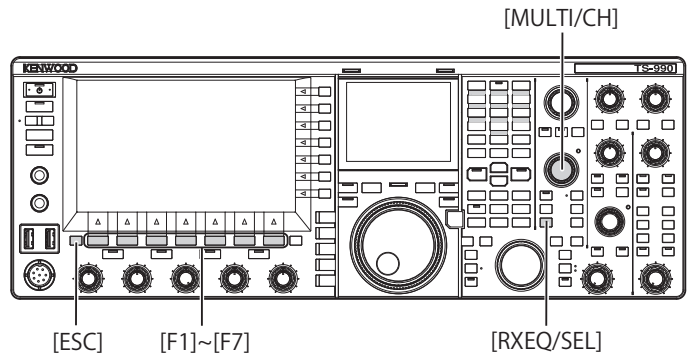
1 Press and hold **[RXEQ/SEL]** to open the **RX Equalizer** screen.

2 Select the target equalizer to be adjusted.

3 Press **[ADJ]** (F4) to open the **RX Equalizer Adjustment** screen.
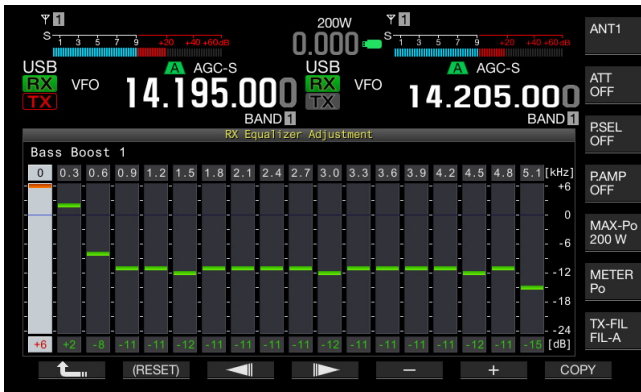
4 Press **[◀]** (F3) **[▶]** (F4) and select the target frequency to be adjusted.

5 Press **[-]** (F5) or **[+]** (F6), or rotate the **MULTI/CH** control to adjust the frequency level.

6 Press **[ESC]** to exit.
Pressing **[↰]** (F1) closes the individual **RX Equalizer Adjustment** screen and reverts to the **RX Equalizer** screen.

■ DEFAULT RX DSP EQUALIZER LEVELS [DB]

| Frequency [Hz]	HB1	HB2	FP	BB1	BB2	FLAT	U1	U2	U3
0	-5	+1	+3	+6	+6	0	0	0	0
300	-4	+1	+3	+2	+4	0	0	0	0
600	-5	+1	+3	-8	-1	0	0	0	0
900	-3	+1	+2	-11	-11	0	0	0	0
1200	+2	+3	-20	-11	-18	0	0	0	0
1500	+5	+5	-24	-12	-18	0	0	0	0
1800	+6	+6	-4	-11	-16	0	0	0	0
2100	+6	+6	+3	-11	-12	0	0	0	0
2400	+6	+6	+3	-11	-8	0	0	0	0
2700	+6	+6	+3	-11	-6	0	0	0	0
3000	+6	+6	+3	-12	-6	0	0	0	0
3300	+6	+6	+3	-11	-6	0	0	0	0
3600	+6	+6	+3	-11	-8	0	0	0	0
3900	+6	+6	+3	-11	-12	0	0	0	0
4200	+6	+6	+3	-11	-16	0	0	0	0
4500	+4	+6	+3	-12	-18	0	0	0	0
4800	-5	+6	-5	-11	-18	0	0	0	0
5100	-24	+6	-24	-11	-17	0	0	0	0

Note:

◆ Each default equalizer characteristics other than User 1 to User 3 can also be changed in the **RX Equalizer Adjustment** screen. Press and hold **[(RESET)]** (F2) on the **RX Equalizer Adjustment** screen to reset the equalizer characteristics to the defaults.

◆ If the configured levels for one frequency range of the receive DSP equalizer is widely different from the configured levels for the adjacent frequency ranges, the received audio may not be attenuated as configured.

COPYING CUSTOMIZED EQUALIZER DATA

You can edit the predetermined equalizer characteristics and copy the equalizer data to User 1 to User 3.

[USB]   [F1]~[F7]   [RXEQ/SEL]
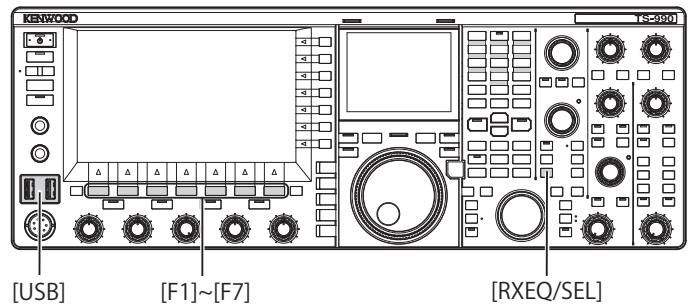
1 Press and hold **[RXEQ/SEL]**.
The **RX Equalizer** screen appears.

2 Press **[▲]** (F2) or **[▼]** (F3) to select the equalizer to be stored.
Pressing **[ADJ.]** (F4) on the **RX Equalizer** screen opens the **RX Equalizer Adjustment** screen. The equalizer data can be copied from either of the **RX Equalizer** and **RX Equalizer Adjustment** screens.

3 In the **RX Equalizer** screen, press **[COPY]** (F5) or in the **RX Equalizer Adjustment** screen, press **[COPY]** (F7).
A message prompting you to specify the destination to store the Equalizer Characteristics appears.

4 Press **[USER1]** (F2), **[USER2]** (F3), **[USER3]** (F4) to specify the destination of the copy.
• Copy the equalizer data selected in step 1 to User 1, User 2, or User 3.
• After the copy has completed, the message prompting you to specify the destination to copy the Equalizer Characteristics disappears, and the **RX Equalizer** or **RX Equalizer Adjustment** screen reappears.
• Pressing **[CANCEL]** (F7) terminates the copy of the equalizer data (without copy) and reverts to the **RX Equalizer** or **RX Equalizer Adjustment** screen.
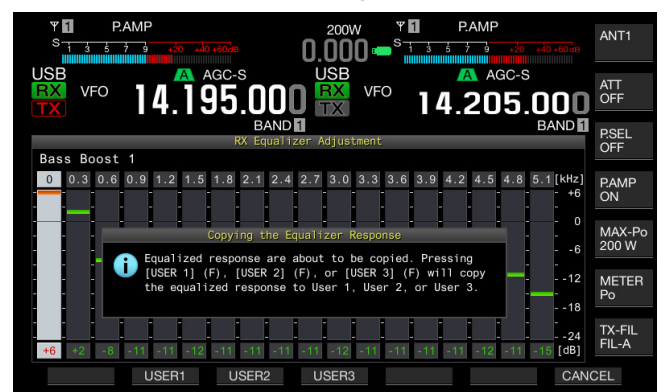
WRITING RX DSP EQUALIZER DATA TO A USB FLASH DRIVE

You can create and save a number of different data files for customized DSP equalizer configurations from which you can select and read your preferred data.

Note:

◆ Refer to "ABOUT THE USB FLASH DRIVE" for handling details of USB flash drive. {page 12-1}

1   Press and hold **[RXEQ/SEL]** to open the **RX Equalizer** screen.

2   Insert a USB flash drive into the ⚡(USB-A) connector on the front panel.
   • Use the USB flash drive which was formatted by this transceiver and have sufficient free memory area.
   • When the USB flash drive is recognized, "▨▨▨" appears in the main screen.

3   Press [▲] (F2) or [▼] (F3) to select the equalizer to be stored.

4   Press **[SAVE]** (F7) to save the RX DSP Equalizer data to the USB flash drive.

5   Press **[OK]** (F4).
   Remove the USB flash drive only after Safe Removal of USB Flash Drive is executed. {page 12-1}
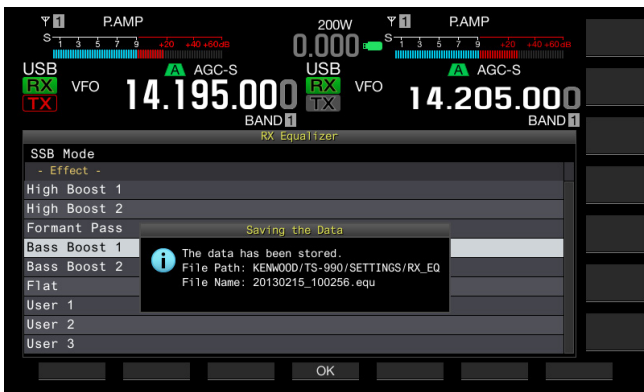

Note:

◆ The saved file is named with the year, month, day, hour, minute and second. The extension ".equ" is applied to the file.
   Example: February 15, 2013, 10:20:30AM: 20130215_102030.equ

◆ The name of the storage folder is as follows:
   KENWOOD/TS-990/SETTINGS/RX_EQ

## READING RX DSP EQUALIZER DATA FROM A USB FLASH DRIVE

Read the configuration data for the TX DSP equalizer from a USB flash drive.

Note:

◆ Refer to "USING USB FLASH DRIVE" for handling details of USB flash drives. {page 12-1}
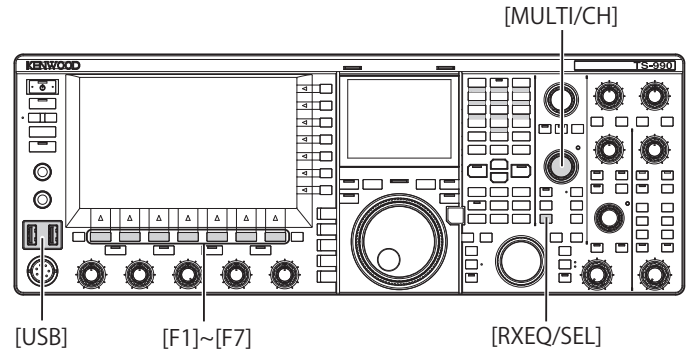
1   Press and hold **[RXEQ/SEL]** to open the **RX Equalizer** screen.

2   Insert the USB flash drive on which the Receive DSP Equalizer Data is stored into the ⚡ (USB-A) connector.
   When the USB flash drive is recognized, "▨▨▨" appears in the main screen.

3   Press [▲] (F2) or [▼] (F3) to select the preset to save the RX equalizer data.

4   Press **[READ]** (F7) to open the **File** screen.
   The **Read Configuration Data** screen opens. Pressing **[CANCEL]** (F7) reverts to the **RX Equalizer** screen without selecting the configuration data.
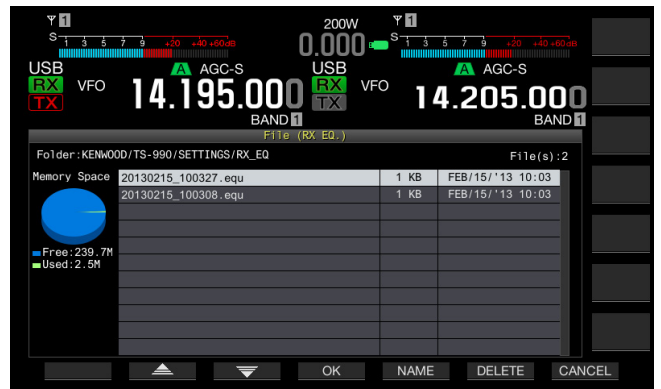
   • Also, on pressing **[DELETE]** (F6), a message prompting you to confirm the deletion of the file appears. Press **[CANCEL]** (F7) instead of **[OK]** (F4) to exit without starting the deletion of the configuration data.
   • Pressing **[NAME]** (F5) enables you to rename the data. {page 12-4} Pressing **[OK]** (F4) deletes the file.

5   Press [▲] (F2) or [▼] (F3) and select the RX equalizer data file to be read.
   The RX Equalizer data file can also be selected by a rotation of the **MULTI/CH** control.

▶ **Index**   ▶ **Contents**

6   Select **[OK]** (F4) from the **Read Configuration Data** screen.
- The reading of the RX equalizer data file from the USB flash drive will start. A message notifying you of the processing appears when the reading starts.
- If you press **[CANCEL]** (F7), the **Read Configuration Data** screen closes and the **RX Equalizer** screen appears again without reading the file data.
- A message notifying you of the completion of data reading appears when the RX equalizer data file has been read from the USB flash drive.

7   Press **[OK]** (F4) to end.
- The reading of the RX DSP equalizer data file from the USB flash drive has been completed.
- Remove the USB flash drive only after Safe Removal of USB Flash Drive is executed. {page 12-1}
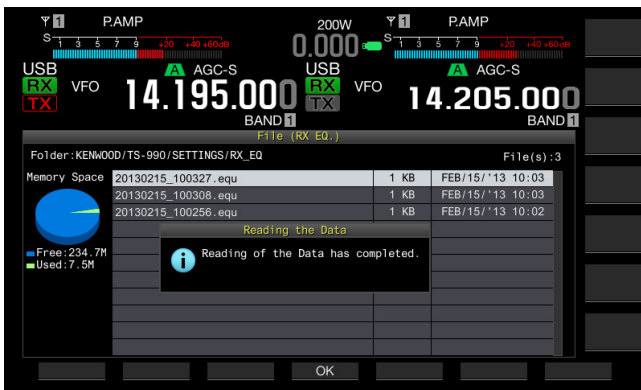

Note:
◆ Even if the type of the RX equalizer data selected at step 3 differs from the type of the RX equalizer data when it was saved, the RX equalizer data saved in the USB flash drive overwrites the selected RX equalizer data.

PREAMP

Preamp automatically switches at 21.5 MHz from a low-gain type preamp to a sensitivity-prioritized high-gain type preamp.

Pressing the **[P.AMP]** (F) key on the submenu located on the right side of the main screen toggles the preamp. Each key press toggles this function between active and inactive. While the preamp is active, "ON" appears on the lower line of the key guide.

F[P.AMP]
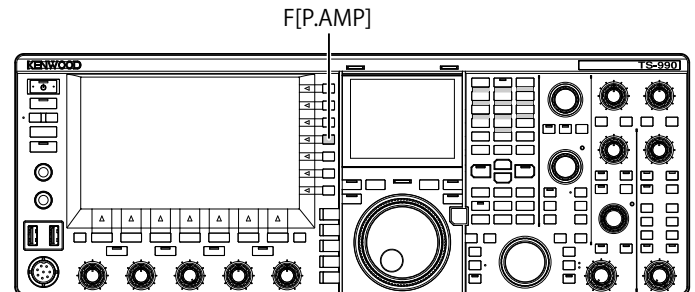
RX MONITOR

Weak signals may be interrupted by the squelch opening and closing. Also, you may occasionally wish to monitor the statuses of channels while you are waiting for a CTCSS tone. In such cases, use the RX monitor function to open the squelch temporarily.

You can assign the "RX Monitor" (In Menus 0-15 to 0-32) to a PF key. {page 16-6} While you press down the PF key to which "RX MONITOR" was assigned, the squelch opens and you can monitor the receive frequency. Releasing the PF key deactivates the RX monitor.
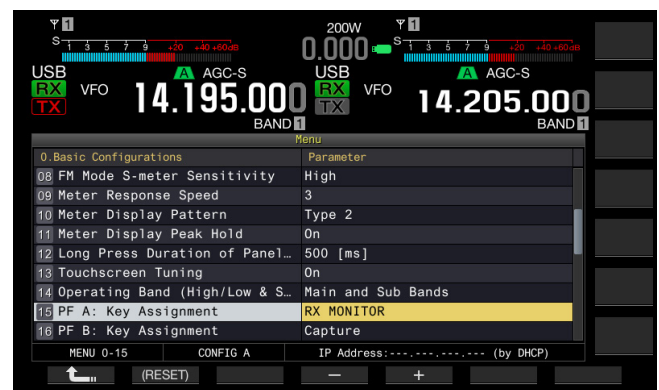
EMERGENCY CALL (K-TYPE ONLY)

Selection 97.401 (d) of the regulations governing amateur radio in the United States permit emergency amateur communications on 5467.5 kHz by stations in or within 92.6 km of the state of Alaska. This frequency is for use only when the immediate safety of human life and/ or property are threatened, and is never to be used for routine communications.

1 Select Group No. 0, "Basic Configurations", from the **Menu** screen.

2 Access Menu 15, "PF A: Key Assignment", to Menu 32, "Microphone UP: Key Assignment".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.
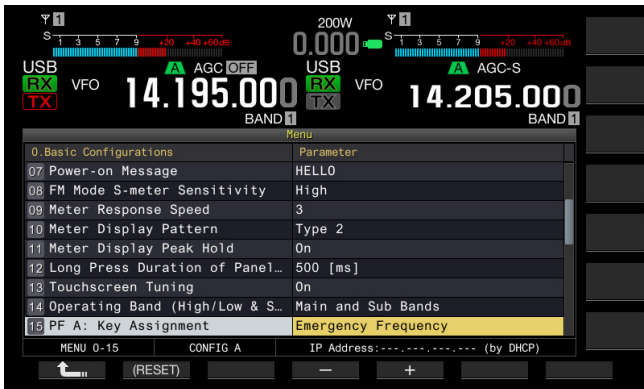
4 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select "Emergency Frequency".

**5** Press **[⬑]** (F1).

6 Press **[MENU]** to exit.

If "Emergency Frequency" is assigned to a PF key in Menus 0-15 to 0-32, you can access the Emergency frequency of 5467.5 kHz with a press of the PF key. {page 16-6}

Note:

♦ Pressing the PF key preprogrammed as "Emergency Frequency" disables the RIT/XIT functions.

♦ The transceiver will not access the Emergency Frequency while the transceiver is transmitting, is in use with Voice Message, Recording functions or a CW Message.

SWL MODE

The Trio 9R-59 is a communication-type receiver that took the world by storm in the 1960s. In this mode, a virtual dial pointer sliding horizontally in imitation of the ribbon dial of the 9R-59 appears in the TS-990S main display so that you can enjoy short wave listening in classic style. (SWL)
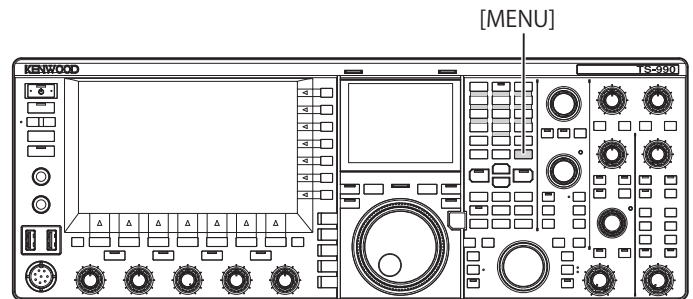
[MENU]

Follow the procedure below to enter SWL mode.

1 Press **[SWL]** (F) on the **Menu** screen to open the **SWL** screen.

Horizontal ribbon dials have red and yellow pointers.

Pointer (red): Represents the main band frequency.

Pointer (yellow): Represents the sub band frequency.

Note:

♦ The S-meter indicates the signal strength of the main band. Even if "Type 1" (digital meter) is selected in Menu 0-10, this does not apply to SWL mode.

♦ Press **[AGC]** (F) to change the AGC time constant value. {page 5-4}

Follow the procedure below to exit SWL mode.

2 Press **[MENU]** while the **SWL** screen is open to open the **Menu** screen.

3 Press **[SWL]** (F) to exit.
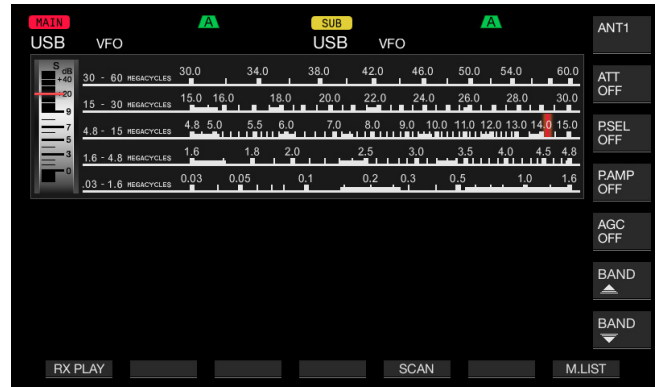
In SWL mode, the following functions are restricted.

Function	Status
Transmit	Disabled
Transmission of a voice message	Disabled
Encoding and decoding the RTTY/PSK message	Disabled
Transmission of a CW message	Disabled
Transmit Power Limiter	Disabled
Changing Meter	Disabled
Changing the TX filter type	Disabled
Transverter activation	Disabled
FM tone	Disabled
Antenna tuning	Disabled
Configurations associated with RX equalizer	Can toggle between active and inactive. However, the status, either active or inactive, does not appear.
Configurations associated with TX equalizer	Disabled
Meter display	Dedicated to the main band.

SWITCHING THE BAND WHILE IN SWL MODE

To change the broadcast band while the transceiver is in SWL mode, you can press **[BAND ▲]** (F) or **[BAND ▼]** (F). "nn m" appears while the frequency is within the range of the band. The following table shows broadcast bands that are preset in the transceiver.

| Broadcast and Meter Band	Lower limit [kHz]	Upper limit [kHz]	Default [kHz] and Mode	
LW	145	285	145	
MW	525	1705	525	
120 m	2300	2495	2300	
90 m	3200	3400	3200	
60 m	4750	5060	4750	
49 m	5900	6200	5900	
41 m	7200	7450	7200	
31 m	9400	9900	9400	AM
25 m	11600	12100	11600	
21 m	13570	13870	13570	
19 m	15100	15800	15100	
16 m	17480	17900	17480	
15 m	18900	19020	18900	
13 m	21450	21850	21450	
11 m	25670	26100	25670	

The band divisions configured in the transceiver in SWL mode may differ from general definitions of meter bands.

In SWL mode, you can operate the transceiver as follows:

- RX Play: Pressing **[RX PLAY]** displays the list of the stored audio files.
- Scan: Pressing **[SCAN]** starts a scan. When the scan stops at a frequency, the transceiver starts receiving signals on the frequency.
- Referring to the memory channel list: Pressing **[M.LIST]** displays the memory channel list.

AUDIO SOURCE LINES FOR TX AUDIO

The transceiver incorporates audio source lines, such as microphone, **OPTICAL**, **USB audio**, and **ACC 2** input lines, for a variety of audio signals. You can select one or more of the audio source lines depending on the mode or selected method for transmission.

[MULTI/CH]
[ESC]   [F1]~[F7]   [DATA]
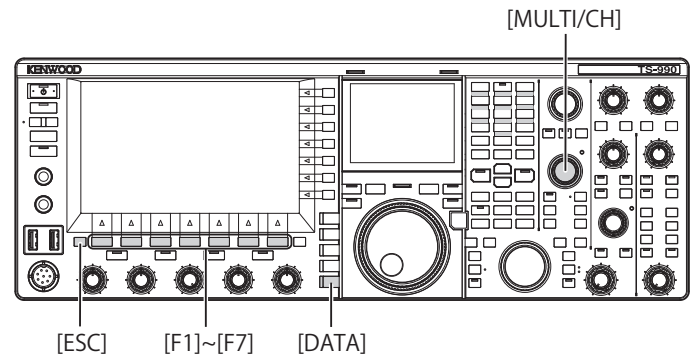
1 Press and hold **[DATA/SEL]** to open the **Modulation Source** screen.
In the list that appears on this screen, the "lines" represent methods to select the transmit mode and "rows" represents the audio input source.

2 Press **[▲]** (F2) or **[▼]** (F3) and select the desired method for transmit mode selection.

3 Press **[◀]** (F3) or **[▶]** (F5) to select the row for the audio source.

4 Press **[ON/OFF]** (F6) to toggle the selected audio source between On and Off.
- You can also rotate the **MULTI/CH** control to select "On" or "Off" for the audio source line selected at step 3. If "On" is configured, audio entered from the selected audio source will be transmitted, and if "Off" is configured, the audio from the selected audio source will be muted, and no audio signal will be transmitted.
- Pressing and holding **[(RESET)]** (F1) resets the configurations for the audio source for each transmitting method to the defaults.

5 Press **[⏎]** (F1).

6 Press **[ESC]** to exit.

Configuration for the transmit audio source line has been completed. Keep in mind that the transceiver may transmit unexpectedly depending on the combination of configurations. Furthermore, if the transceiver is connected to a PC or other audio source through the **USB Audio**, **Optical** or **ACC 2** line and while the DATA VOX is active, the transceiver may transmit triggered by audio emitted by the audio source.

Following are the defaults for DATA Off.

Key	MIC	ACC 2	USB Audio	Optical
SEND/PTT	On	Off	Off	Off
DATA SEND (PF)	Off	On	Off	Off

Following are the defaults for DATA 1 to DATA 3.

Key	MIC	ACC 2	USB Audio	Optical
SEND/PTT	On	Off	Off	Off
DATA SEND (PF)	Off	Off	On	On

Note:

◆ The Audio source for DATA 1 to DATA 3 can be configured individually.

◆ If audio from a source other than the microphone is enabled and if DATA VOX is enabled, that audio signal will be transmitted. {page 9-2}

◆ **USB Audio** and **ACC 2** cannot be enabled at the same time as the DATA TX source. When one of the lines is activated, the other line is deactivated.

DATA MODE CONFIGURATION

TRANSMISSION BY THE PTT SWITCH, SS PIN AND SEND

You can use the **[PTT]** switch of the microphone, the SS pin of the **REMOTE** connector, or **[SEND]** on the front panel to toggle between the transmit mode and receive mode. Usually, in this operation, audio input from the microphone is transmitted.

- The transceiver continues transmission while you press down the **[PTT]** switch of the microphone.
- The transceiver continues transmission while the SS pin of the **REMOTE** connector is connected the GND.
- Each time you press **[SEND]**, the selection toggles between the transmit mode and receive mode.
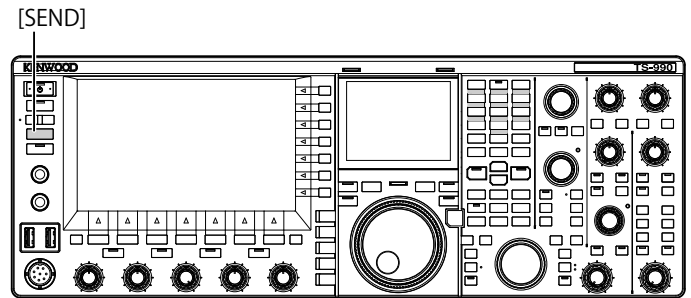
[SEND]

TRANSMISSION WITH DATA PTT OR DATA SEND

Use **[PF A]** or **[PF B]**, to which "DATA SEND" is assigned, or the DATA PTT (on the PKS pin of the ACC 2 connector) to toggle between the transmit mode and receive mode. Refer to "PF (Programmable Function" for further details. {page 16-6}

With this operation, usually audio signals on the **USB Audio** line or the ANI pin of the **ACC 2** connector are transmitted. Different audio source can be specified.

This function is convenient when you send audio or data from external devices.

- The transceiver continues transmission while the DATA PTT (the PKS pin of the **ACC 2** connector) is connected to the GND.
- Press a PF key, to which "DATA SEND" is assigned, to toggle between the transmit mode and receive mode.
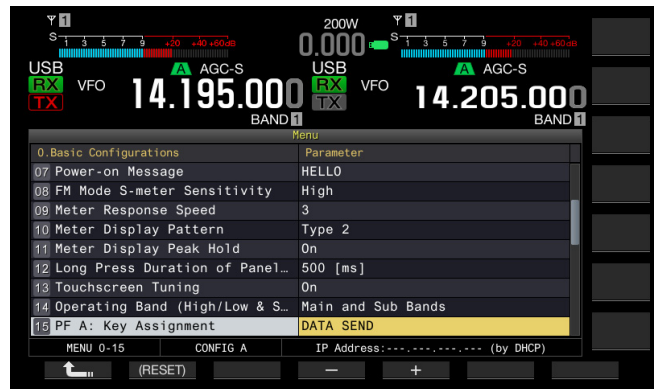

Note:

◆ If "On" is configured for DATA VOX, you can automatically transmit. {page 9-2}

RIT/XIT FUNCTIONS (FINE-TUNING FUNCTIONS FOR TRANSMIT AND RECEIVE FREQUENCIES)

RIT (FINE-TUNING OF RECEIVE FREQUENCIES)

RIT is a function that fine-tunes the receive frequency in steps of 10 Hz up to ±9.999 kHz without changing the transmit frequency. Use this function if the transmit frequency of the station with which you are working fluctuates.

If the FINE mode is active, the RIT offset frequency can be adjusted in steps of 1 Hz. RIT functions in the same manner on all modes while the VFO or memory channel mode is in use.
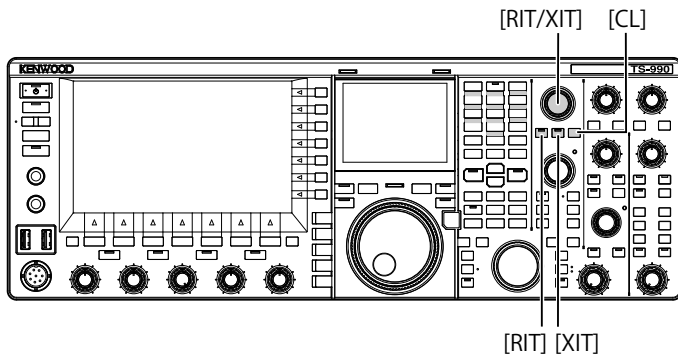
[RIT/XIT]   [CL]

[RIT] [XIT]

1   Press **[RIT]**.
The "RIT" LED lights, and the RIT offset frequency appears.

2   Rotate the **RIT/XIT** control.
The RIT receive frequency can be fine-tuned.

To clear the RIT offset frequency, press **[CL]**. The RIT offset frequency instantly reverts to zero.

3   Press **[RIT]** to exit.
You can disable the RIT. The current receive frequency reverts to the previous receive frequency in step 1.

Note:
◆ The **RIT** control operates on the receive frequency for the main band.

XIT (FINE-TUNING OF TRANSMIT FREQUENCIES)

XIT is a function that fine-tunes the transmit frequency in steps of 10 Hz up to ±9.999 kHz without changing the receive frequency. If the FINE mode is active, the XIT offset frequency is adjusted in steps of 1 Hz.

1   Press **[XIT]**.
The "XIT" LED lights, and the XIT offset frequency appears.

2   Rotate the **RIT/XIT** control.
• The XIT transmit frequency can be fine-tuned.
• To clear the XIT offset frequency, press **[CL]**. The XIT offset frequency instantly reverts to zero.

3   Press **[XIT]** to exit.
XIT is deactivated. The current transmit frequency reverts to the previous transmit frequency in step 1.

CONFIGURING THE CARRIER LEVEL

The carrier level for use in CW, FSK, PSK, or AM mode can be adjusted.
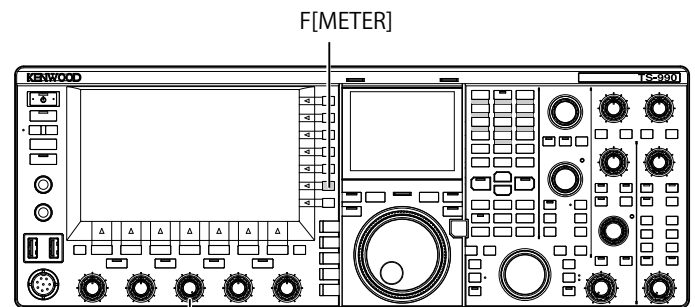
F[METER]

1   Press **[METER]** (F) to display the ALC meter.

2   Press one of the mode key to enter CW, FSK, PSK, or AM mode, then start transmitting.

3   While observing the ALC meter, rotate the **CAR** control to adjust the carrier level for use in CW, FSK, PSK, or AM mode.

Note:
◆ Adjust the carrier levels so that they will not exceed the zone of the ALC meter.
◆ For FSK mode, carrier level must be adjusted enabling the ALC to control. For use in AM and PSK modes, carrier level must be adjusted until a pointer in ALC meter starts swinging.
◆ For SSB and FM modes, the carrier level is fixed regardless of the position of the control.

ADJUSTING THE MICROPHONE GAIN

Microphone Gain for use in SSB and AM modes can be adjusted by observing the ALC meter.

[MIC]   [LSB/USB]
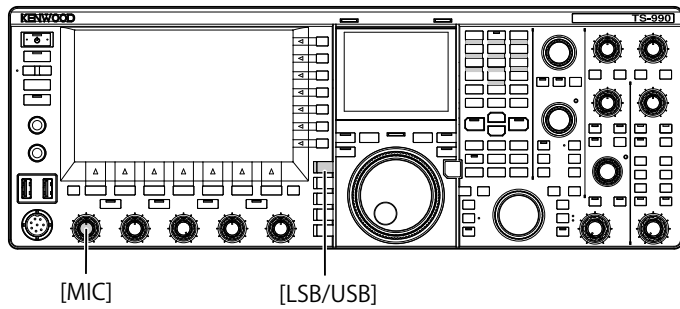
1 Select the desired band and frequency.
Selects the desired band and frequency.

2 Press **[LSB/USB]** to select LSB mode or USB mode, or press **[FM/AM/FM-N]** to select AM mode.

3 Press down the **PTT** (microphone).
The transceiver enters a transmit state.

4 Speak into the microphone in your normal voice.

5 Rotate the **MIC** control to adjust the microphone gain.
In SSB mode, Microphone Gain must be adjusted until the audio level does not exceed the ALC meter zone. In AM mode, microphone gain must be adjusted until the pointer in the ALC meter moves slightly on voice peaks.

6 Release **PTT** (microphone).
The transceiver reverts to the receive state.

Note:

♦ Speak into the microphone in your normal voice. If the microphone is too close to your mouth or your voice is too loud, signal distortion may occur and cause the received audio in receiving transceiver to be unclear.

♦ Refer to "Speech Processor" for the details of the speech processor. {page 9-6}

♦ If you use a microphone with a built-in AF amplifier, you must carefully adjust the output level of the microphone not to be too high.

♦ For use in FM mode, configure the microphone gain in Advanced Menu 13, "Microphone Gain (FM Mode)".

OPERATION IN CW MODE

CW mode ensures reliable communication even if the operating conditions are bad. Under Unfavorable conditions, CW communication is as reliable as communication in new digital modes.

The transceiver incorporates a multi-functional electronic keyer. Refer to "ELECTRONIC KEYER" for further details. {page 5-18}
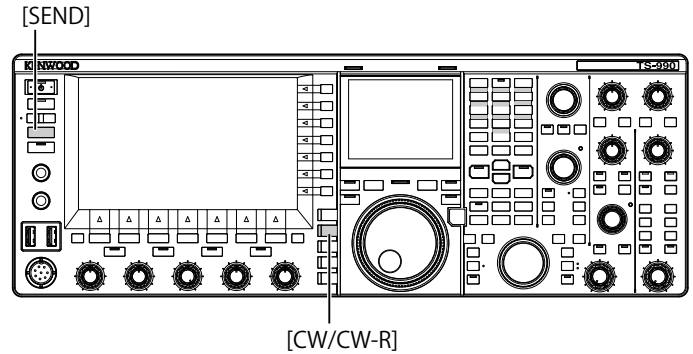
[SEND]

[CW/CW-R]

1 Select the desired band and frequency.
Selects the desired band and frequency.

2 Press **[CW/ CW-R]** to select CW mode.

3 Press **[SEND]** to transmit.

4 Manipulate the electronic keyer or paddle to send Morse code, and rotate the **MONITOR** control to adjust the sidetone volume, allowing you to monitor your CW signal while transmitting. You can adjust the sidetone pitch frequency.

5 Press **[SEND]**, after sending the Morse code, to finish.
The transceiver enters the receive mode.

Note:

♦ The sidetone volume can be fixed. {page 5-16}

CW BREAK-IN

Break-in is a convenient function in CW mode that places the transceiver into transmit when the key contacts close and reverts the transceiver to receive when the key contacts open. Two break-in modes are available, i.e., full break-in and semi break-in modes.

[VOX/SEL] [FBK]

[DELAY] [CW/CW-R]
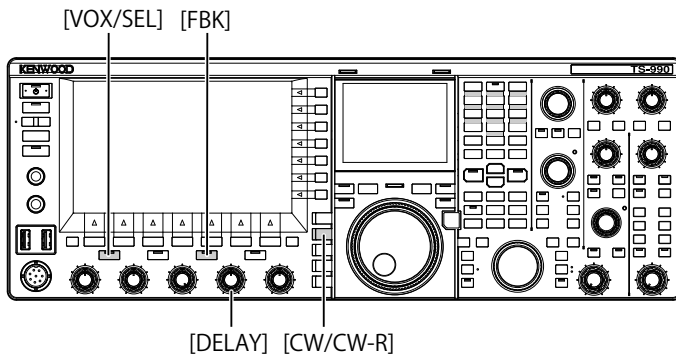
FULL BREAK-IN

The transceiver enters the receive mode simultaneously with the key released. The transceiver enters the receive mode even during the very short time between a dot and dash of Morse code. Therefore, for example, you will know the band condition immediately if there is sudden interference while transmitting.

1 Press **[CW/ CW-R]** to select CW mode.

2 Press **[FBK]** to enable the Full Break-in.
The "FBK" LED lights.

3 Manipulate the electronic keyer or paddle.
The transceiver alternates between transmission and reception automatically between dots and dashes.

Note:

◆ If you use a linear amplifier in combination with the transceiver, be sure that the linear amplifier is capable of full break-in. If you do not know whether the linear amplifier is capable of the function or if the linear amplifier does not correspond to the function, operate the transceiver in semi break-in mode.

◆ Full Break-in and Semi Break-in cannot be used at the same time.

SEMI BREAK-IN

The transceiver does not revert to a receive state immediately after the key is released. Instead, the transceiver remains in a transmit for a configured delay time before reverting to the receive state. Semi break-in is useful to prevent the sound of reception immediately after the key is released, or to connect a linear amplifier to the transceiver.

1 Press **[CW/ CW-R]** to select CW mode.

2 Press **[VOX/SEL]** to enable the Semi Break-in.
The "VOX" LED lights.

3 Manipulate the electronic keyer or paddle.
The transceiver enters the transmit mode on the first key-down and doesn't revert to receive on key-up until the configured delay time has passed.

4 Rotate the **DELAY** control to adjust the delay time after a key-up.
Rotating the **DELAY** control counterclockwise reduces the delay time and clockwise increases the delay time.

Note:

◆ Use Semi Break-in if the linear amplifier connected to the transceiver is not capable of Full Break-in.

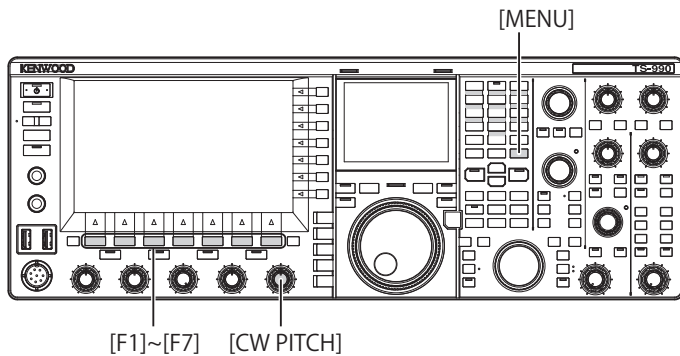## ADJUSTING THE SIDETONE AND PITCH FREQUENCY

You can hear the tone from the speaker of the transceiver when you press down the key while in CW mode. This tone is called sidetone. You can monitor your Morse code transmission by listening to the tone. While Break-in or other transmit capabilities are disabled, you can use the tone to practice keying.

In CW mode that require the direct keying of the carrier, a BFO (beat frequency oscillator) is required to convert the carrier into audible sound. The difference in frequency between the BFO and carrier is audible as a beat sound. The difference in frequency is called receive pitch.

The sidetone and receive pitch are the same in frequency.

You can turn the **CW PITCH** control to adjust the frequency of the sidetone to your preference.
The adjustable frequency range is between 300 and 1100 Hz, and turning the **CW PITCH** control clockwise increases the frequency and counterclockwise decreases the frequency.

[MENU]

[F1]~[F7]   [CW PITCH]

ADJUSTING THE SIDETONE VOLUME

1 Select Group No. 1, "Audio Performance", from the **Menu** screen.

2 Access Menu 02, "Sidetone Volume".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.

4 Press **[–]** (F4) or **[+]** (F5) to select "Linked with Monitor Control", "Off", or "1" to "20".

5 Press **[⬑]** (F1).

6 Press **[MENU]** to exit.

Note:

◆ The sidetone volume is used to adjust the playback sound level of CW messages, and neither the sidetone level nor playback sound level can be changed with the **AF** control.

CW RISE TIME

The CW signal rise time is a period required for the output waveform of the CW signal to reach its maximum from when the key is pressed down. The default value (6 [ms]) is suitable to low- to mid-speed keying. Select "4 [ms]", "2 [ms]", or "1 [ms]" for high-speed keying.

1 Select Group No. 5, "CW Configurations", from the **Menu** screen.

2 Access Menu 14, "CW Rise Time".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.
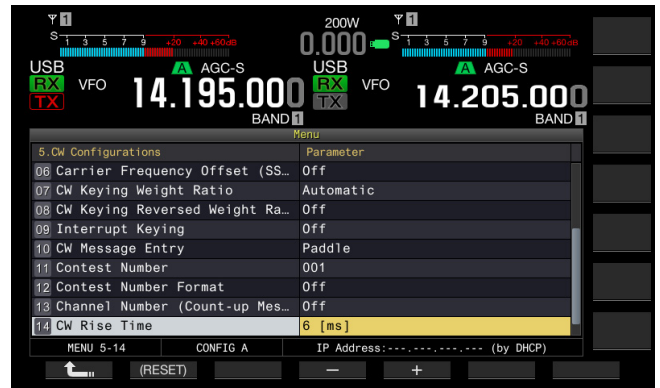
4 Press **[–]** (F4) or **[+]** (F5) to select "1 [ms]", "2 [ms]", "4 [ms]", or "6 [ms]".
The default is "6 [ms]".

5 Press **[⬑]** (F1).

6 Press **[MENU]** to exit.

AUTO ZERO-IN (CW AUTO TUNE)

If you wish to have a QSO in CW mode with another CW station, use this function so that the transmit frequency of your station will automatically be tuned to the receive frequency of the other station.

[CW T.](M)   [CW T.](S)

Tuning (M)   Tuning (S)
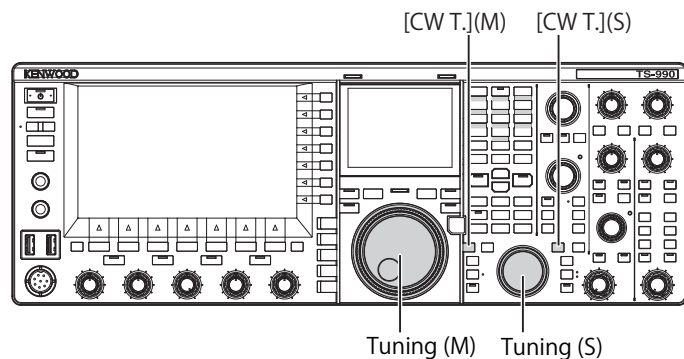
1   Rotate the **Tuning** control and make rough adjustments so that you can hear the received CW.

2   Press **[CW T]** (M) or **[CW T]** (S) to enable the Auto Zero-in (CW Auto Tune).

   • "CW TUNE" blinks on the main screen.

   • The transmit frequency is automatically tuned to the receive frequency, and the receive signal pitch is tuned to the sidetone and receive pitch frequency.

   • The Auto Zero-in (CW Auto Tune) disappears from the main screen when the transmit frequency has zeroed in on the receive frequency. If the transmit frequency cannot automatically be zeroed in (CW Auto Tune), the frequency reverts to the previous frequency.


Note:

♦ If you use the Auto Zero-in (CW Auto Tune), you can tune into a frequency within ±50 Hz of the receive frequency from the station you wish to call.

♦ The transceiver may not be able to zero in automatically (CW Auto Tune) if the CW keying speed of the station you are communication to is too slow or the signal strength of the station is weak or if there is interference.

♦ If RIT is active, the Auto Zero-in (CW Auto Tune) works on the frequency shifted with RIT.

♦ The range where the Auto Zero-in (CW Auto Tune) functions varies depending on the receive conditions.

♦ While the **Bandscope** or **Waterfall** screen is open, Auto Zero-in (CW Auto Tune) can function by touching the screen longer than the time configured in Menu 0-12, "Long Press Duration of Panel Keys".

CARRIER FREQUENCY OFFSET WHEN CHANGING FROM SSB MODE TO CW MODE

If you receive a CW signal from a station and you wish to have a QSO with the station while you are operating the transceiver in SSB mode, you have to change the mode to CW. In that case, you need to rotate the **Tuning** control slightly for a carrier frequency offset. Using this function will automatically correct the frequency.

[MENU]

[F1]~[F7]   Tuning (M)   Tuning (S)
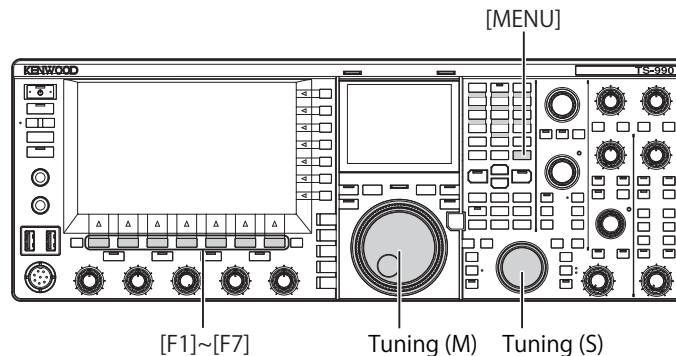
1   Select Group No. 5, "CW Configurations", from the **Menu** screen.

2   Access Menu 06, "Carrier Frequency Offset (SSB Mode to CW Mode)".

3   Press **[SELECT]** (F4) to allow editing of the parameter box.
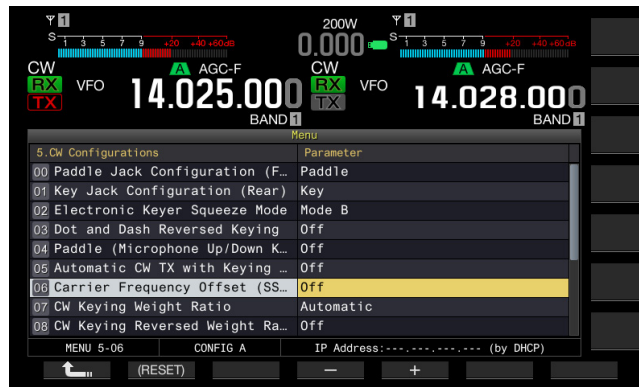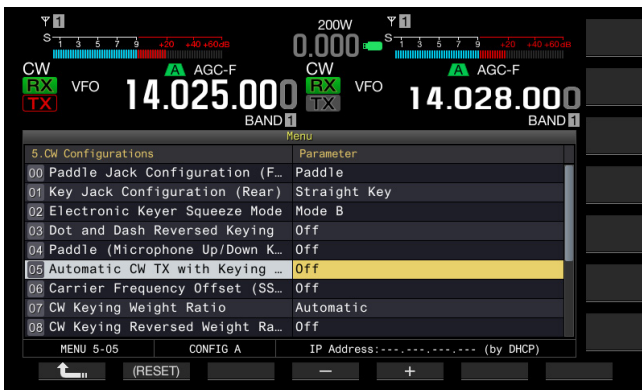

4   Press **[-]** (F4) or **[+]** (F5) to select "On" or "Off".
   The default is "Off" (not correcting the frequency). Selecting "On" allows the transceiver to correct the frequency.

5   Press **[⬆]** (F1).

6   Press **[MENU]** to exit.

AUTOMATICALLY CHANGING MODE FROM SSB FOR CW TRANSMISSION

When you key your straight key, paddle or electronic keyer while in SSB mode, the transceiver changes to CW mode automatically. The transceiver automatically changes from USB to CW or from LSB to CW-R.

When the transceiver enters CW mode from SSB mode, a carrier frequency offset remains active regardless of whether "Frequency Offset (SSB Mode to CW Mode)" is disabled. Therefore, if you receive a CW signal from a station while you are in SSB mode and you wish to have a QSO with that station, you can call the station in CW mode by just manipulating the paddle or electronic keyer.

1   Select Group No. 5, "CW Configurations", from the **Menu** screen.

2   Access Menu 05, "Automatic CW TX with Keying in SSB Mode".

3   Press **[SELECT]** (F4) to allow editing of the parameter box.

4   Press **[-]** (F4) or **[+]** (F5) to select "On" or "Off".
The default is "Off" (not automatically sending a CW). Selecting "On" allows the transceiver to automatically send a CW.

5   Press **[⬆]** (F1).

6   Press **[MENU]** to exit.

Note:

◆ If the transceiver is in Split operation it cannot automatically transmit while in SSB mode.

◆ If Break-in (VOX) is enabled in CW mode, key-down with an electronic keyer or paddle automatically transmits a CW message in SSB mode.

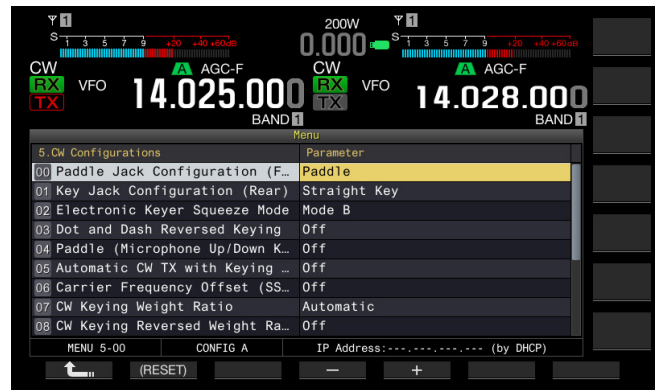## ELECTRONIC KEYER

The transceiver incorporates an electronic keyer that can be operated by connecting a paddle to the **PADDLE** jack on the front panel. Depending on how you configure the menu, you can use the electronic keyer like a bug key (semi-automatic electronic keyer). You can connect a straight key (electronic straight keyer) to the **PADDLE** jack as well.

SELECTING THE KEYER TYPE FOR THE PADDLE JACK

You can select the device to be connected to the PADDLE jack.

1   Select Group No. 5, "CW Configurations", from the **Menu** screen.

2   Access Menu 00, "Paddle Jack Configuration (Front)".

3   Press **[SELECT]** (F4) to allow editing of the parameter box.

4   Press **[-]** (F4) or **[+]** (F5) to select "Straight Key", "Paddle", or "Paddle (Bug Key Mode)".
The default is "Paddle".

5   Press **[⬆]** (F1).

6   Press **[MENU]** to exit.

SELECTING THE KEYER TYPE FOR THE KEY JACK

For CW operation without using the built-in electronic keyer, connect a straight key, a bug key, an external electronic keyer or a PC keyer to the **KEY** jack. Depending on how you configure the menu, you can connect a paddle to the **KEY** jack and use the built-in electronic keyer instead.

Follow the procedure below to select the device connected to the **KEY** jack on the rear panel.

> **Note:**
> ♦ If you connect an external electronic keyer or PC keyer to the Transceiver, ensure that it has a shielded cable with the positive polarity on the cable inner.

1 Select Group No. 5, "CW Configurations", from the **Menu** screen.

2 Access Menu 01, "Key Jack Configuration (Rear)".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.

4 Press **[-]** (F4) or **[+]** (F5) to select "Straight Key", "Paddle", or "Paddle (Bug Key Mode)".
The default is "Straight Key".

5 Press **[⬆]** (F1).

6 Press **[MENU]** to exit.

MICROPHONE PADDLE MODE

You can send CW by using the **[UP]** and **[DOWN]** (microphone) keys as a paddle.

[F1]~[F7] [KEY SPEED] [CW/CW-R]
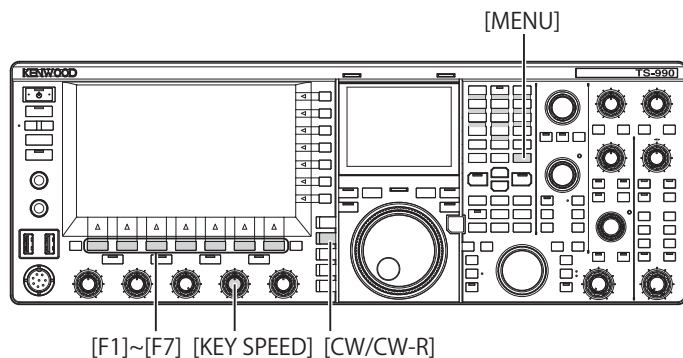
1 Select Group No. 5, "CW Configurations", from the **Menu** screen.

2 Access Menu 04, "Paddle (Microphone Up/Down Keys)".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.

4 Press **[-]** (F4) or **[+]** (F5) to select "On" or "Off".
The default is "Off" (not paddling using a microphone). Selecting "On" allows you to paddle using the microphone.

5 Press **[⬆]** (F1).

6 Press **[MENU]** to exit.

> **Note:**
> ♦ In Microphone Paddle mode, the paddling response slows down compared with normal paddling.

ADJUSTING THE KEYING SPEED

You can adjust the keying speed of the electronic keyer as you wish.

In order to transmit accurate CW messages, it is necessary to adjust the speed appropriately according to your own capability. It is recommended that if possible you adjust your keying speed as close as possible to that of the station you wish to have a QSO with.

1 Press **[CW/ CW-R]** to select CW mode.

2 Rotate the **KEY SPEED** control to adjust the keying speed.
- The keying speed can be adjusted in a range from 4 wpm to 60 wpm (20 letters to 300 letters per minute).
- Rotating the **KEY SPEED** control clockwise increases the speed and rotating the **KEY SPEED** control counterclockwise decreases the speed.
- The keying speed appears in place of the transmit power on the main screen for two seconds after the **KEY SPEED** control is operated.
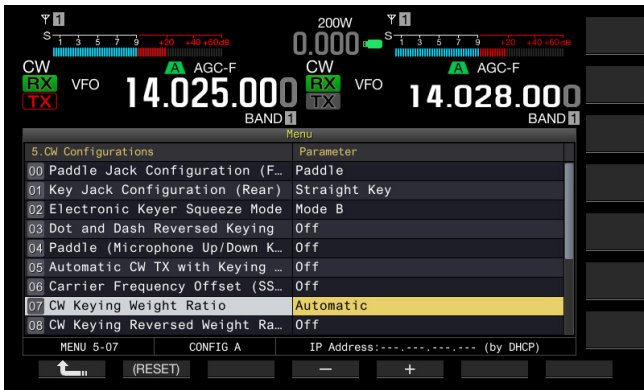
> **Note:**
> ♦ While rotating the **KEY SPEED** control, the keying speed appears on the main screen. {page 2-12}
> ♦ The bug key mode completes the dot.

CHANGING THE WEIGHTING

The electronic keyer allows automatic changing of the dot and dash weighting. Weighting represents the ratio of the dash time against the dot time.

You can select "Auto Weight", which automatically changes the ratio in response to the keying speed, or "Manual Weighting", which fixes the ratio regardless of the keying speed. If you select a speed in a range from "2.5" (1:2.5) to "4.0" (1:4), the ratio of dot time to dash time will be fixed regardless of the keying speed.

1   Select Group No. 5, "CW Configurations", from the **Menu** screen.

2   Access Menu 07, "CW Keying Weight Ratio".

3   Press **[SELECT]** (F4) to allow editing of the parameter box.

4   Press **[-]** (F4) or **[+]** (F5) to select "Automatic" or the fixed rations from "2.5" to "4.0".
The default is "Automatic".

5   Press **[🔼]** (F1).

6   Press **[MENU]** to exit.

> **Note:**
> ◆ If "Automatic" is selected for the weighting, the following weight ratios apply.

KEYING SPEED [WPM]	Weight
4 to 24	1:2.8
25 to 44	1:3.0
45 to 60	1:3.2

WEIGHT REVERSE

If "Automatic" is selected for the weighting, increasing the keying speed also extends the weight ratio. The Weighting ratio can be reduced according to the configuration in the Menu.

1   Select Group No. 5, "CW Configurations", from the **Menu** screen.

2   Access Menu 08, "CW Keying Reversed Weight Ratio".

3   Press **[SELECT]** (F4) to allow editing of the parameter box.
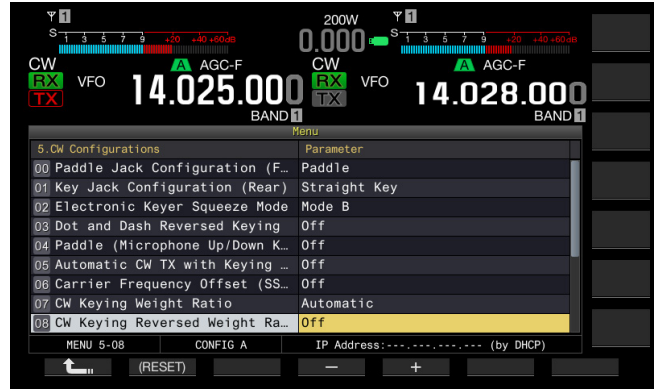
4   Press **[-]** (F4) or **[+]** (F5) to select "On" or "Off".
The default is "Off" (disabling the Weight Reverse). Selecting "On" allows the transceiver to reduce the weighting ratio.

5   Press **[🔼]** (F1).

6   Press **[MENU]** to exit.

> **Note:**
> ◆ If "Automatic" is selected for the weighting, the following weight ratios apply.

KEYING SPEED [WPM]	Weight
4 to 24	1:3.2
25 to 44	1:3.0
45 to 60	1:2.8

REVERSING THE DOT AND DASH KEYING

Without rewiring the electronic keyer, you can swap the paddle dot and dash generation to suit the preference or dominant hand of the operator.

1 Select Group No. 5, "CW Configurations", from the **Menu** screen.

2 Access Menu 03, "Dot and Dash Reversed Keying".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.

4 Press **[-]** (F4) or **[+]** (F5) to select "On" or "Off".
The default is "Off" (not Reversing the dot and dash).
Selecting "On" allows the transceiver to Reverse the dot and dash.

5 Press **[   ]** (F1).

6 Press **[MENU]** to exit.

> **Note:**
> ◆ This configuration will apply to the paddle connected to the **PADDLE** and **KEY** jack and to the microphone paddle mode.

OPERATING MODES OF ELECTRONIC KEYER

You can select the desired operating mode (Iambic A or Iambic B) of the electronic keyer.

MODE A
If both paddles are open, the paddles terminate code generation after generating a code element (dot or dash). The memory for dots and dashes are is in the static state.

MODE B
If both paddles are open, the transceiver sends an additional dash after the last dot or an additional dot after the last dash sent by the operator. The memory for dots and dashes is in the dynamic state.

1 Select Group No. 5, "CW Configurations", from the **Menu** screen.

2 Access Menu 02, "Electronic Keyer Squeeze Mode".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.
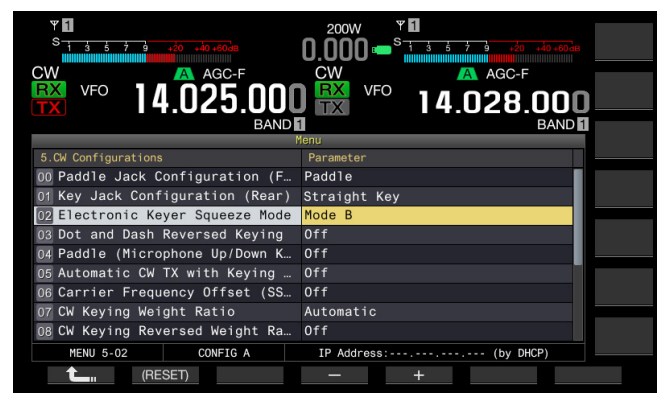
4 Press **[-]** (F4) or **[+]** (F5) to select "Mode A" or "Mode B".
The default is "Mode B".

5 Press **[   ]** (F1).

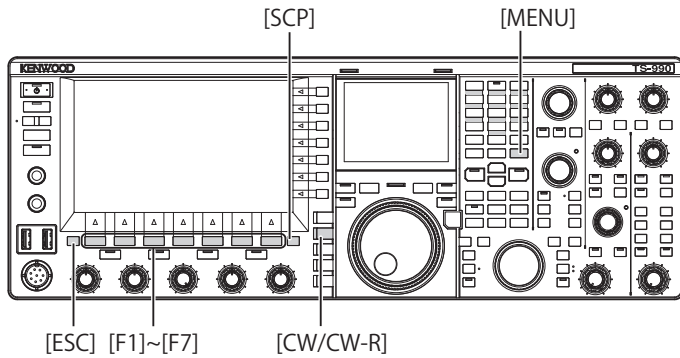6 Press **[MENU]** to exit.

CW MESSAGE MEMORY

The transceiver has eight memory channels in which CW messages can be stored. The message text can be entered not only by manipulating the paddle but also by operating the transceiver or with the USB keyboard.

You can store text strings that can be repeatedly transmitted in contests or other occasions.

CHANGING THE ENTRY METHOD OF CW MESSAGES

You can select the desired entry method of CW messages (i.e., paddle keying or text entry).

[SCP]   [MENU]

[ESC] [F1]~[F7]   [CW/CW-R]

1   Select Group No. 5, "CW Configurations", from the **Menu** screen.

2   Access Menu 10, "CW Message Entry".

3   Press **[SELECT]** (F4) to allow editing of the parameter box.
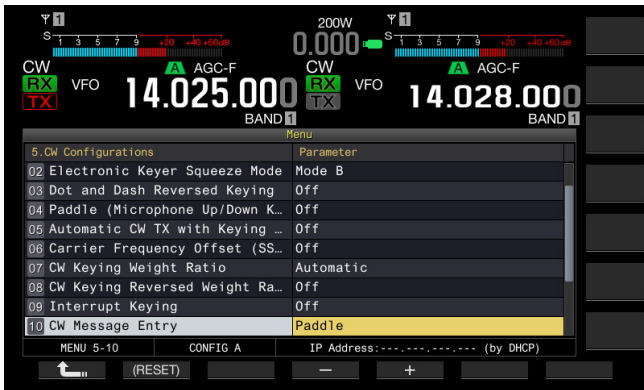
4   Press **[-]** (F4) or **[+]** (F5) to select "Text String" or "Paddle".
    The default is "Paddle".

5   Press [⬒] (F1).

6   Press **[MENU]** to exit.

STORING CW MESSAGES WITH TEXT ENTRY

After reviewing the status of Menu 5-10 to confirm "Text String" has been selected for the entry method of CW messages, you can follow the procedure below to store each CW message. You can store CW messages in channel 1 through channel 8.

Be sure that the transceiver is in CW mode.
The **Bandscope** screen must be closed with a press of **[SCP]** if the **Bandscope** screen opens.

[SCP/SWL]

[ESC] [F1]~[F7]
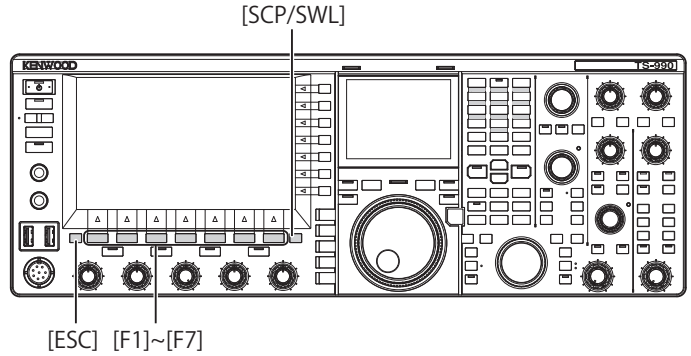
1   Press **[CW/ CW-R]** to select CW mode.
    The **Bandscope** screen must be closed with a press of **[SCP]** if the **Bandscope** screen opens.

2   Press **[KEYER]** (F2) to open the **CW Message** screen.
    While the "TX" (M) LED is unlit, **[KEYER]** (F2) does not appear in the Key Guide. Press **[CW/ CW-R]**.

3   Press and hold **[CH1]** (F2), **[CH2]** (F3), **[CH3]** (F4), **[CH4]** (F5), **[CH5]** (F2). **[CH6]** (F3). **[CH7]** (F4), or **[CH8]** (F5) to select the channel to which a CW message will be stored.

   • Each time you press **[MORE]** (F1), the key guide for **[MORE]** (F1), **[CH1]** (F2), **[CH2]** (F3), **[CH3]** (F4) and **[CH4]** (F5), and the key guide for **[MORE]** (F1), [⬆] (F2), [⬇] (F3), **[REPEAT]** (F4), **[DELETE]** (F5) and **[NAME]** (F6) alternately appears.

   • Each time you press **[NEXT]** (F7), a key guide for **[MORE]** (F1), **[CH1]** (F2), **[CH2]** (F3), **[CH3]** (F4) and **[CH4]** (F5), and the key guide for **[MORE]** (F1), **[CH5]** (F2), **[CH6]** (F3), **[CH7]** (F4), **[CH8]** (F5) and **[NEXT]** (F7) alternately appears.

▶ **Index**   ▶ **Contents**

4 Use the function keys, the **MULTI/CH** control or a USB keyboard to enter a CW message.
- A maximum of 50 alphanumeric characters and symbols can be configured. The default is "On".
  [SPACE] (F1): Press to enter a space.
  [-] (F2)/**[+]** (F3): Displays the previous character or the next character.
  [◁] (F4) and **[▷]** (F5): Press to move the cursor to the left or right.
  [BACK SPACE] (F): Press to delete the character to the left of the cursor.
  [DEL] (F): Press to delete the character to the right of the cursor.
  [CHAR] (F): Press to change the character type. Each time you press **[CHAR]** (F), the character type cycles through the following sequence:
  ABC (upper case) > abc (lower case) > !"# (symbols) > ABC (upper case)
- Pressing **[CANCEL]** (F7) reverts to the **CW Message** screen without storing the message.

Note:
♦ If "%N" is entered and stored as a part of CW message, this will be substituted with the contest number and sent.
♦ The continual code such as "A̅R̅" or "B̅T̅" will be a text string from the character entered subsequent to "~" to a space.
♦ The following alphanumeric characters and symbols can be entered.

| A	B	C	D	E	F	G	H	I	J	K	L	M
N	O	P	Q	R	S	T	U	V	W	X	Y	Z
0	1	2	3	4	5	6	7	8	9			
/	?	.	,	'	(	)	:	=	+	-	_	"
@	~	%	<	>						Space		

5 Press **[SAVE]** (F6) to store a CW message.

6 Press **[ESC]** to exit.

MANIPULATING THE PADDLE TO STORE CW MESSAGES

After reviewing the status of Menu 5-10 whether "Paddle" has been selected for the entry method of CW messages, you can follow the procedure below to store each CW message.

You can store CW messages in channel 1 through channel 8.

1 Press **[CW/ CW-R]** to select CW mode.
The **Bandscope** screen must be closed with a press of **[SCP]** if the **Bandscope** screen opens.

2 Press **[KEYER]** (F2) to open the **CW Message** screen.
In any transmit mode other than CW mode, **[KEYER]** (F2) does not appear in the key guide. Press **[CW/CW-R]**.

3 Press and hold **[CH1]** (F2), **[CH2]** (F3), **[CH3]** (F4), **[CH4]** (F5), **[CH5]** (F2), **[CH6]** (F3), **[CH7]** (F4), or **[CH8]** (F5) to select the channel to which a CW message will be stored.
- A message notifying you of the storing of the CW message appears.
- If no channel to which a CW message will be stored appears on the key guide, press **[MORE]** (F1). An alternate key guide will appear.
- Each time you press **[NEXT]** (F7), a key guide for **[MORE]** (F1), **[CH1]** (F2), **[CH2]** (F3), **[CH3]** (F4) and **[CH4]** (F5), and the key guide for **[MORE]** (F1), **[CH5]** (F2), **[CH6]** (F3), **[CH7]** (F4), **[CH8]** (F5) and **[NEXT]** (F6) alternately appears.
- Pressing **[CANCEL]** (F7) during the standby state reverts to the CW Message screen without storing the message.
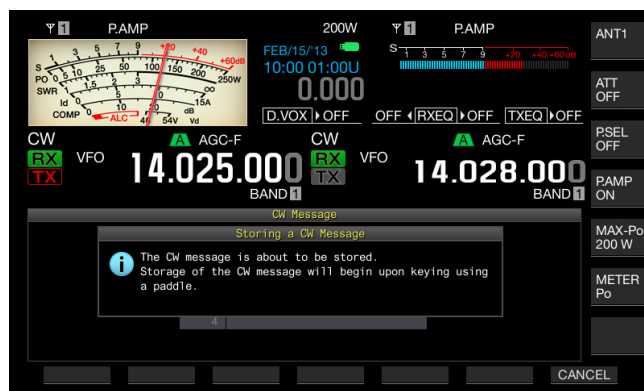
4 Key the paddle and store the CW messages.
During the paddle keying, a screen displays the progress of CW message entry. Continue paddle keying and store the CW messages. While storing the CW messages, the percentage memory usage appears the main screen.

5 Press **[STOP]** (F4) to finish storing a CW message.
- The **CW Message** screen reappears.
- If the memory becomes full while storing the CW messages and the memory usage reaches 100%, the entry of the CW messages in progress ends.

6 Press **[ESC]** to exit.

Note:
♦ In a channel where no CW message is stored, the channel number will be grayed out.
♦ If you do not manipulate a paddle after the editing of a CW message begins, nothing will be stored in that channel.
♦ If "Straight Key" is selected for the **PADDLE** or **KEY** jack, no CW message can be stored. A CW message must be stored by manipulating a paddle.

NAMING THE CW MESSAGES (WITH PADDLE KEYING ONLY)

If you store CW messages by means of paddle keying, you do not know the contents of the CW messages stored in the respective channels. Therefore, naming each message stored enables you to distinguish the contents of the entry.

After reviewing the status of Menu 5-10 whether "Paddle" has been selected for the entry method of CW messages, you can follow the procedure below to name each CW message. The names of CW messages are given to channel 1 through channel 8.
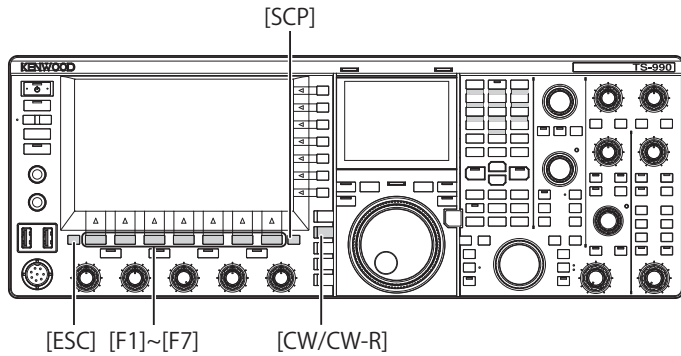
[SCP]

[ESC] [F1]~[F7]   [CW/CW-R]

1 Press **[CW/ CW-R]** to select CW mode.
The **Bandscope** screen must be closed with a press of **[SCP]** if the **Bandscope** screen opens.

2 Press **[KEYER]** (F2) to open the **CW Message** screen.
In any transmit mode other than CW mode, **[KEYER]** (F2) does not appear in the key guide. Press **[CW/CW-R]**.

3 Press **[⬆]** (F2) or **[⬇]** (F3), or rotate the **MULTI/CH** control to select a channel to which a CW message is stored.
If **[⬆]** (F2) and **[⬇]** (F3) are unavailable in the key guide, press **[MORE]** (F1). An alternate key guide will appear.

4 Press **[NAME]** (F6) to allow editing of the parameter box.

5 Use the function keys, the **MULTI/CH** control or a USB keyboard to enter a name of the CW message.
   • A maximum of 20 alphanumeric characters and symbols can be configured.
   [SPACE] (F1): Press to enter a space.
   [-] (F2) and **[+]** (F3): Press to display the previous character or the next character.
   [◀] (F4) and **[▶]** (F5): Press to move the cursor to the left or to the right.
   [BACK SPACE] (F): Press to delete the character to the left of the cursor.
   [DEL] (F): Press to delete the character to the right of the cursor.
   [CHAR] (F): Press to change the character type. Each time you press **[CHAR]** (F), the character type cycles through the following sequence:
   ABC (upper case) > abc (lower case) > ÀÁÂ (upper case) > àáâ (lower case) > !"# (symbols) > ABC (upper case)

   • Pressing **[CANCEL]** (F7) reverts to the **CW Message** screen without storing the name of the CW message.

6 Press **[SAVE]** (F6) to store the name of the CW message.

7 Press **[ESC]** to exit.

SELECTING THE CHANNEL NUMBER TO SAVE THE CONTEST NUMBER FORMAT (TEXT ENTRY ONLY)

The channel number where you wish to save the contest number while in CW mode can be selected. If the contest number format consists of a three-digit sequential number starting with 001, the contest number increases by 1 each time you transmit a fixed phrase from the channel that you have selected.

Be sure that the transceiver is in CW mode, and you can follow the procedure below. The **Bandscope** screen must be closed with a press of **[SCP]** if the **Bandscope** screen opens.

[SCP]   [MENU]

[F1]~[F7]
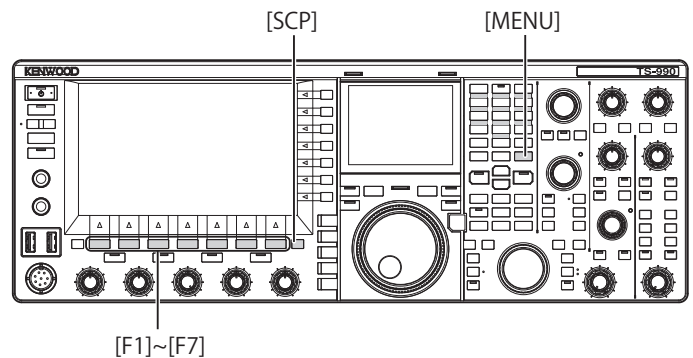
1 Select Group No. 5, "CW Configurations", from the **Menu** screen.

2 Access Menu 13, "Channel Number (Count-up Message)".

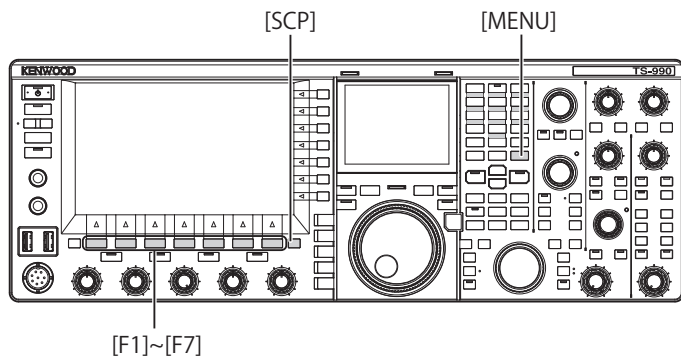**3** Press **[SELECT]** (F4) to allow editing of the parameter box.
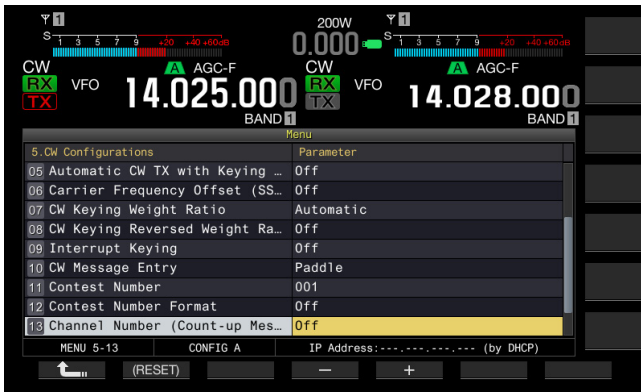
4 Press **[-]** (F4) or **[+]** (F5) to select "Off", or "Channel 1" to "Channel 8".
The default is "Off".

5 Press **[⬑]** (F1).
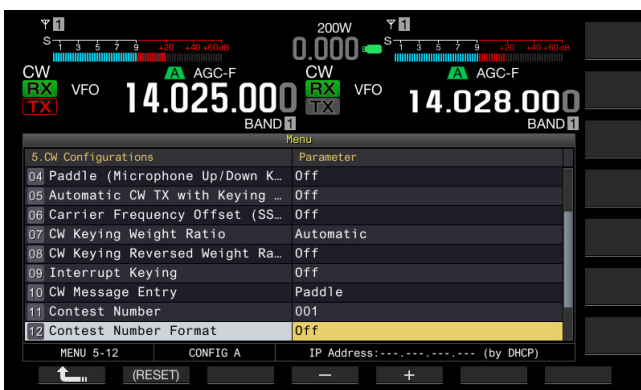
6 Press **[MENU]** to exit.

SELECTING THE CONTEST NUMBER FORMAT (TEXT ENTRY ONLY)

If a CW message containing "%N" is sent, it is possible to replace numbers such as "1", "9", "0" with alphabetical letters such as "A", "N", "O" (or "T") to send the contest number in the Morse code format.

Be sure that the transceiver is in CW mode, and you can follow the procedure below. The **Bandscope** screen must be closed with a press of **[SCP]** if the **Bandscope** screen opens.
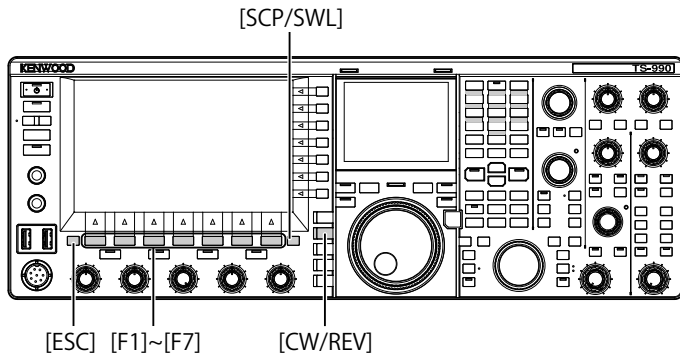
[SCP]   [MENU]

[F1]~[F7]

1 Select Group No. 5, "CW Configurations", from the **Menu** screen.

2 Access Menu 12, "Contest Number Format".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.

4 Press **[–]** (F4) or **[+]** (F5) to select "Off", "190 to ANO", "190 to ANT, "90 to NO", or "90 to NT".
The default is "Off".

Example of Coding

Parameters	Text String to be sent as a Contest Number	Output code
190 to ANO	190	ANO (•− −• −−−)
190 to ANT		ANT (•− −• −)
90 to NO	90	NO (−• −−−)
90 to NT		NT (−• −)

5 Press **[⬑]** (F1).

6 Press **[MENU]** to exit.

CONFIGURING THE FIRST CONTEST NUMBER (TEXT ENTRY ONLY)

If the contest number format consists of a three-digit sequential number (the 001 format), you can configure the first contest number to start from.

Be sure that the transceiver is in CW mode, and you can follow the procedure below. The **Bandscope** screen must be closed with a press of **[SCP]** if the **Bandscope** screen opens.

[SCP]   [MENU]

[F1]~[F7]
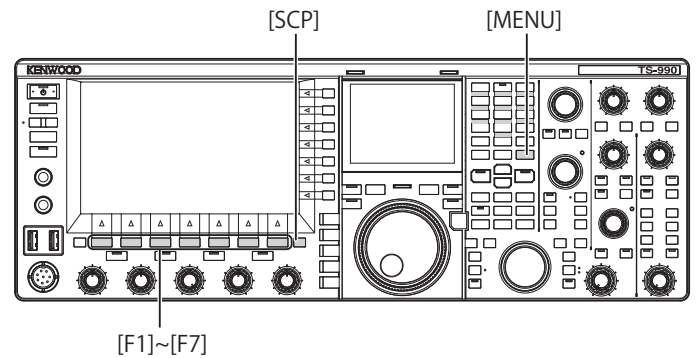
1 Select Group No. 5, "CW Configurations", from the **Menu** screen.

2 Access Menu 11, "Contest Number".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.

4 Press **[-]** (F4) or **[+]** (F5) to select the contest number from "001" to "9999".

- While you press down **[-]** (F4) or **[+]** (F5) for 2 seconds or more, the contest number continuously increases or decreases at high speed.
- You can rotate the **MULTI/CH** control to increase or decrease the contest number.
- The default is "001".

5 Press **[⬑]** (F1).

6 Press **[MENU]** to exit.

Note:

◆ 0s presenting in the first and second digits may not be deleted even when the contest number from 001 to 099 is displayed, or during the playback or transmission.

DECREMENTING THE CONTEST NUMBER (TEXT ENTRY ONLY)

If a contest QSO fails even if you have sent the contest number, the next contest number that you will send will be decremented by 1.

[SCP/SWL]

[ESC] [F1]~[F7]   [CW/REV]

Note:

◆ If "Off" is configured for Menu 5-13, "Channel Number (Count-up Message" of if a CW message is entered with a paddle, **[-1]** does not appear on the key guide.

1 Press **[CW/ CW-R]** to select CW mode.
   The **Bandscope** screen must be closed with a press of **[SCP]** if the **Bandscope** screen opens.

2 Press **[KEYER]** (F2) to open the **CW Message** screen.

3 Press **[NEXT]** to select a channel group containing a channel to decrement (-1) the contest number.
   - " 🔢 " appears for the channel number to which the contest number is stored.
   - Each time you press **[NEXT]** (F7), a key guide for **[MORE]** (F1), **[CH1]** (F2), **[CH2]** (F3), **[CH3]** (F4) and **[CH4]** (F5), and the key guide for **[MORE]** (F1), **[CH5]** (F2), **[CH6]** (F3), **[CH7]** (F4), **[CH8]** (F5) and **[NEXT]** (F6) alternately appears.
   - For the selection method of a channel group, refer to step 3 of "CHANGING THE ENTRY METHOD OF CW MESSAGES". {page 5-22}

4 Press **[-1]** (F6) to decrement the contest number by 1.

5 Press **[ESC]** to exit.

PLAYING AND TRANSMITTING A CW MESSAGE

You can play and transmit the stored CW message .

The displays on the **CW Message** screen and the key guide for function keys **[F1]** to **[F7]** for a case when "Paddle" has been configured for Menu 5-10, "CW Message Entry", are different from those for a case when "Text String" has been configured. This manual describes the case if "Paddle" has been configured; however, the operating procedure is identical. You must first store a CW message before you can play or transmit it.
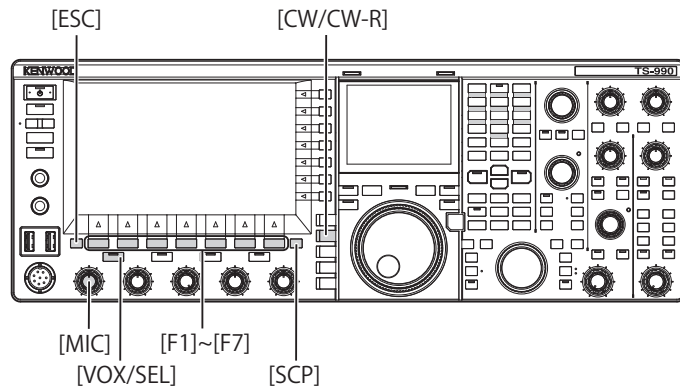
1 Press **[CW/ CW-R]** to select CW mode.
   The **Bandscope** screen must be closed with a press of **[SCP]** if the **Bandscope** screen opens.

2 Press **[KEYER]** (F2) to open the **CW Message** screen.

   If the key guides for **[F1]** to **[F7]** appear as **[MORE]** (F1), **[▲   ]** (F2), **[▼   ]** (F3), **[REPEAT]** (F4), **[DELETE]** (F5) and **[NAME]** (F6), press **[MORE]** (F1) to alternate the key guide between the key guide for **[MORE]** (F1), **[CH1]** (F2), **[CH2]** (F3), **[CH3]** (F4), **[CH4]** (F5) and **[NEXT]** (F7) and the key guide for **[MORE]** (F1), **[CH5]** (F2), **[CH6]** (F3). **[CH7]** (F4), **[CH8]** (F5) and **[NEXT]** (F7)**.**

3 Press **[VOX/SEL]** or **[FBK]** to disable the Break-in so as to play a CW message.
   To transmit a CW message, you must enable the Break-in. The "VOX/SEL" or "FBK" LED lights while Break-in is active, and turns off while Break-in is inactive.

4 Press one of **[MORE]** (F1), **[CH1]** (F2), **[CH2]** (F3), **[CH3]** (F4), **[CH4]** (F5),**[CH5]** (F3). **[CH6]** (F4), **[CH7]** (F5) and **[CH8]** (F6) to select the desired CW message.
   The transceiver starts playing or transmitting. To terminate the operation, press **[STOP]** (F5).

5 Press **[ESC]** to exit.

Note:

♦ If anything other than "Off" has been configured for Menu 5-13 "Channel Number (Count-up Message)", the contest number increments as soon as the playback or transmission of a CW message of the selected channel ends.

♦ If "On" has been configured for Menu 5-09 "Interrupt Keying", paddling pauses the playback or transmission of a CW message. When you finish paddling, the transceiver resumes the playback or transmission of the CW message from the portion where the playback or transmission has paused.

♦ If "Off" has been configured for Menu 5-09 "Interrupt Keying", paddling pauses the playback or transmission of a CW message.

♦ To transmit without using the Break-in, press **[SEND]** at step 3 alternately.

INTERRUPTING THE KEYING

If you paddle during the playback or transmission of the CW message, the transceiver stops playing or transmitting the CW message and you can insert your own CW text.

1 Select Group No. 5, "CW Configurations", from the **Menu** screen.

2 Access the menu 09 "Interrupt Keying".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.
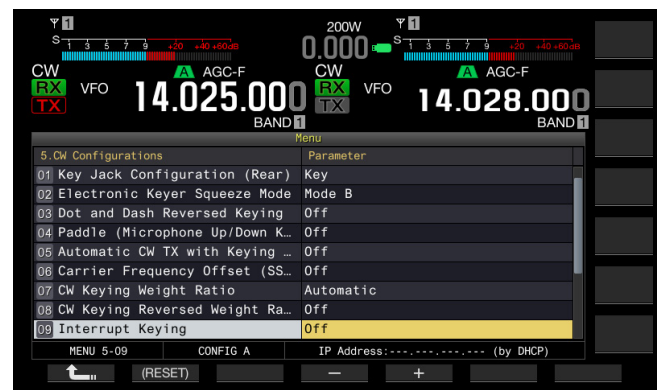
4 Press **[-]** (F4) or **[+]** (F5) to select "On" or "Off"
   The default is "Off" (not interrupting the keying). Selecting "On" allows you to interrupt the keying.

5 Press **[⬑   ]** (F1).

6 Press **[MENU]** to exit.

Note:

♦ When you stop sending your own text, the paused transmission of the CW message resumes.

DELETING CW MESSAGES

Follow the procedure below to delete the CW messages stored in Channel 1 through Channel 8.


[ESC] [F1]~[F7]   [CW/CW-R]
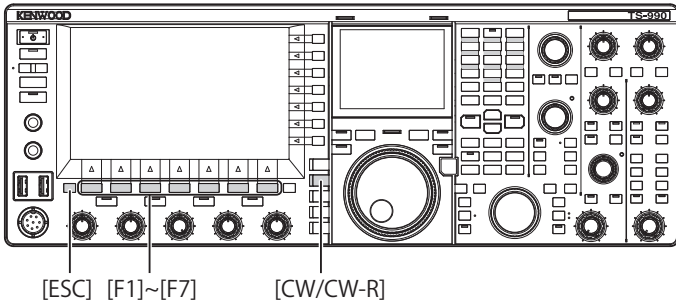
1 Press **[CW/ CW-R]** to select CW mode.

2 Press **[KEYER]** (F2) to open the **CW Message** screen.

3 Select the target channel to delete the CW message.
For the selection method of channel numbers, refer to step 3 in "CHANGING THE ENTRY METHOD OF CW MESSAGES". {page 5-23}

4 Press and hold **[(DELETE)]** (F5) to delete the CW message.

5 Press **[ESC]** to exit.

ADJUSTING THE MICROPHONE GAIN FOR FM MODE OPERATION

High quality audio and less interference from noise are the advantages of FM operation. The TS-990S enables you to communicate in FM mode on the 29 MHz and 50 MHz bands in both simplex and, over longer distances, in repeater modes.

[SEND]   [MENU]

[F1]~[F7] [FM/AM/FM-N]
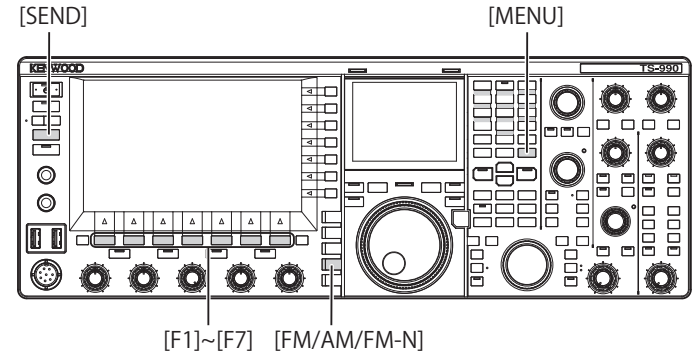
1 TUNING THE FREQUENCY

2 Press **[FM/AM/FM-N]** to enter FM mode.

3 Press **[ADJ.]** (F) from the **Menu** screen.

4 Access the Advanced Menu 13 "Microphone Gain (FM Mode)".

5 Press **[SELECT]** (F4) to allow editing of the parameter box.
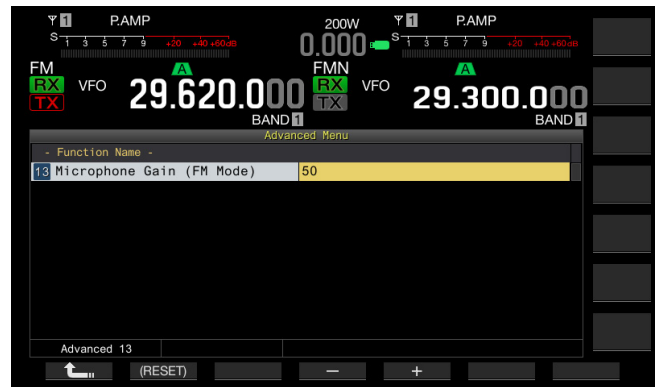
6 Press **[SEND]** or press down the **[PTT]** (microphone).
The transceiver enters the transmit mode, and the level meter appears.

7 Speak into the microphone in your normal voice.

8 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to adjust the microphone gain.
• You should adjust the peak value of the level meter not to exceed the zone.
• Available range is "1" to "100". The default is "50".

9 Press **[SEND]** or release the **PTT** (microphone).
The transceiver is placed into the receive state.

10 Press **[   ]** (F1).

11 Press **[MENU]** to exit.

Note:
◆ If you use a low-sensitive microphone such as the MC-90, you should increase the microphone gain.
◆ If you use a low-sensitive microphone, enabling the Speech Processor may increase the modulation level.

FM NARROW OPERATION

While operating in FM mode, you can change the bandwidth to narrow. The following table shows the occupied frequency bandwidth and the maximum modulation level. Selecting FM Narrow to match the deviation level of other stations can avoid or eliminate any distortion of the received audio and any deterioration of the communication legibility.

Mode	Occupied Frequency Bandwidth	Maximum Modulation Level
FM Wide	16 kHz or lower	±5 kHz or lower
FM Narrow	10 kHz or lower	±2.5 kHz or lower
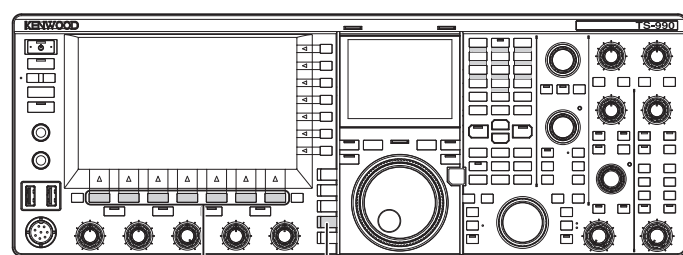
[F1]~[F7]   [FM/AM/FM-N]

1 Press **[FM/AM/FM-N]** to enter FM mode.

2 Press and hold **[FM/AM/FM-N]** to enter the FM Narrow mode.

REDUCING THE DEFLECTIONS OF THE S-METER FOR USE IN FM-MODE

You can configure the sensitivity of the S-meter to be used in FM mode by selecting either "High", allowing the S-meter to function in the same manner as that for past HF transceivers, or "Low", which reduces the S-meter sensitivity by an expansion of the dynamic range. Selecting "Low" to reduce the S-meter sensitivity enables the deflection of the S-meter to be as the same deflection as the S-meter used in other modes.

1 Select Group No. 0, "Basic Configurations", from the **Menu** screen.

2 Access Menu 08, "FM Mode S-meter Sensitivity".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.
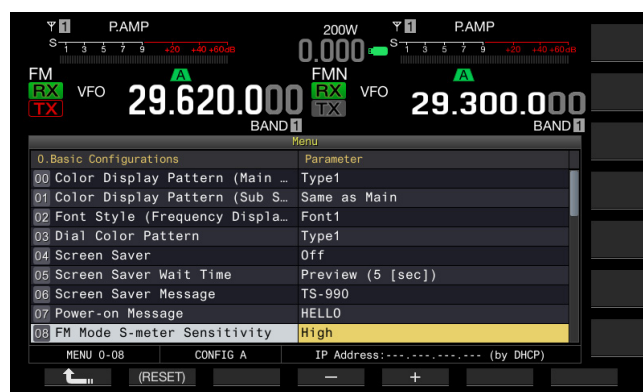
4 Press **[–]** (F4) or **[+]** (F5) to select "Low".
The default is "High"

5 Press **[🔼]** (F1).
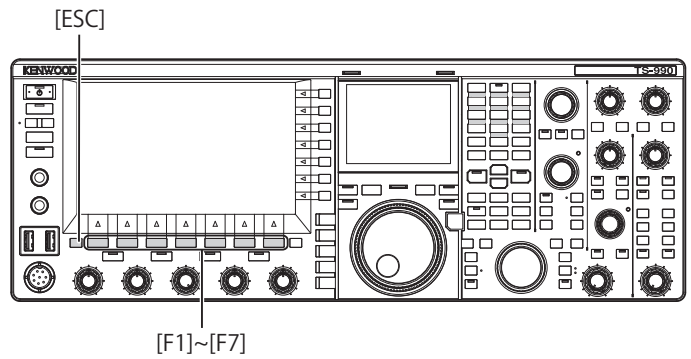
6 Press **[MENU]** to exit.

FM REPEATER OPERATION

To operate the transceiver in repeater mode, set the transceiver to Split mode for use in FM mode and set the tone signal to ON.
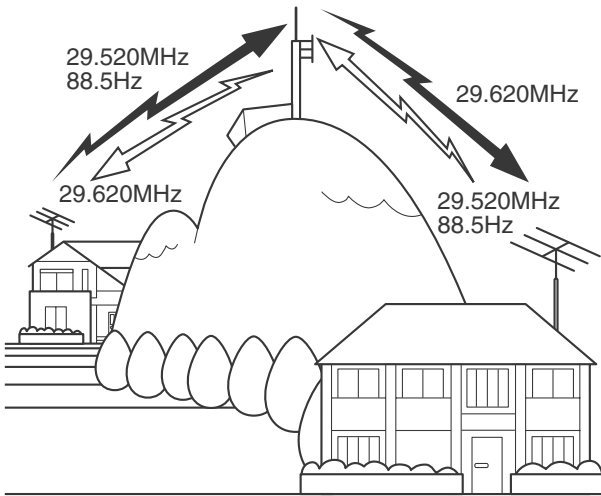
CONFIGURING THE TONE FREQUENCY

You can change the tone frequency.

1 Press and hold **[TONE]** (F4) while in FM mode to open the **FM Tone Frequency** screen.

2 Press **[M/S]** (F6) to select either main band or sub band.
The parameter box for the frequency (FREQ. [Hz]) is activated.

3 Press **[▲]** (F2) or **[▼]** (F3) to select "TONE".

4 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select the tone frequency.

5 Press **[ESC]** to exit.

Note:

♦ If you press and hold **[(RESET)]** (F1), the selected tone frequency reverts to the default (88.5 Hz).

Tone Frequency						
67.0	88.5	114.8	151.4	177.3	203.5	250.3
69.3	91.5	118.8	156.7	179.9	206.5	254.1
71.9	94.8	123.0	159.8	183.5	210.7	1750.0
74.4	97.4	127.3	162.2	186.2	218.1	
77.0	100.0	131.8	165.5	189.9	225.7	
79.7	103.5	136.5	167.9	192.8	229.1	
82.5	107.2	141.3	171.3	196.6	233.6	
85.4	110.9	146.2	173.8	199.5	241.8	

SELECTING THE TONE

Follow the procedure below to change the type of tone signal after selecting the main band or sub band.

[F1]~[F7]   [FM/AM/FM-N]
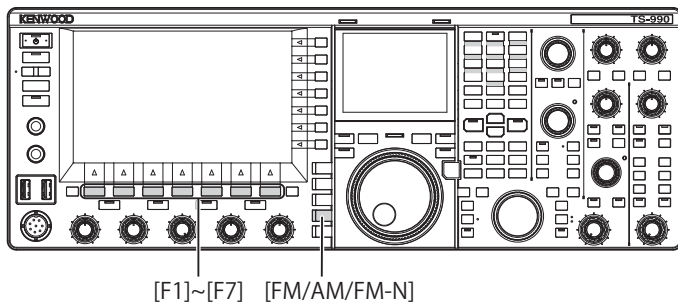
1   Press **[FM/AM/FM-N]** to enter FM mode.

2   Press **[TONE]** (F4) to select the tone.
    Each time you press the key, the tone signal display cycles as follows: CT (CTCSS) > CROSS > deselected; the main screen display varies as follows: "TONE" > "CT" > "CROSS" > blank (deselected) > "TONE".


Note:

♦ If the selected band is dedicated for reception ("TX" LED is unlit), "TONE" is grayed out.

♦ If the "TX" LED and "RX" LED for the sub band turn Off, "TONE", "CT", and "CROSS" will also be grayed out.

USING THE SCAN TO SEARCH FOR THE TONE FREQUENCY

A tone frequency scan makes it possible to detect the tone frequency contained in the receive signal in FM mode. This function is convenient if you wish to know the tone frequency of a repeater. Follow the procedure below after selecting the main band or sub band.

[F1]~[F7]   [FM/AM/FM-N]
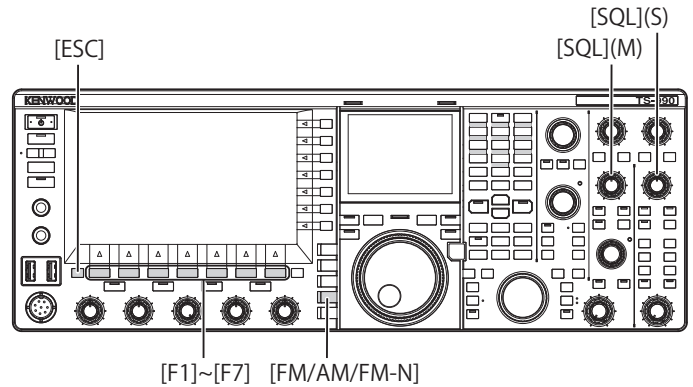
1   Press **[FM/AM/FM-N]** to enter FM mode.

2   Press and hold **[TONE]** (F4) to open the **FM Tone Frequency** screen.

3   Press **[▲]** (F2) or **[▼]** (F3) to select "TONE" as a tone type.
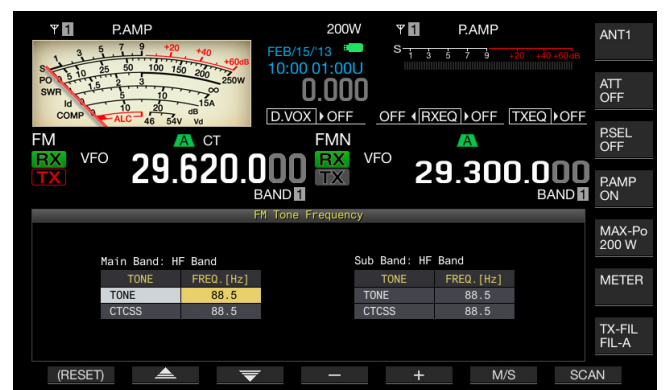
4 Press **[SCAN]** (F7) to scan the tone frequency.
- Until the scan ends, "SCAN" appears on the right of the tone frequency.
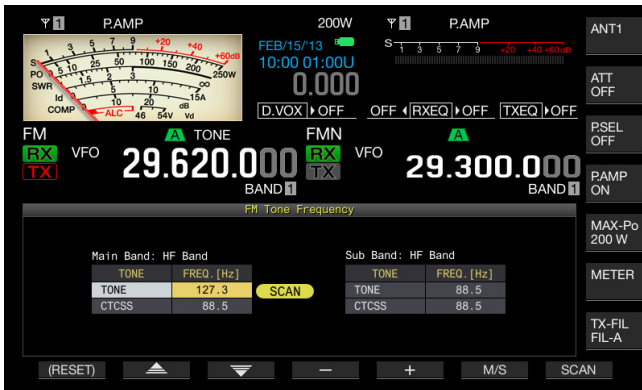
- As soon as the tone frequency is detected, the scan stops and the frequency appears in the FREQ. [Hz] box.
- The scan starts with a press of **[M/S]** (F6) while the transceiver is in reception in the selected band (the "MAIN BUSY/TX" LED or the "SUB BUSY/TX" LED lights). If the "MAIN BUSY/TX" LED or "SUB BUSY/TX" LED is unlit, rotate the **SQL** control to receive so that the transceiver will be placed in receive mode.
- Press **[M/S]** (F6) if you wish to change the current band (main band or sub band).
- The scan pauses by pressing **[SCAN]** (F7) while scanning the tone frequency. The scan resumes by pressing **[SCAN]** (F7) again.
- The scan pauses if the receive signal breaks off while scanning the tone frequency. The scan automatically restarts when the transceiver detects the receive signal.

5 Press **[ESC]** to exit.

CTCSS OPERATION (FM MODE)

The CTCSS stands for Continuous Tone Coded Squelch System. Add your audio signal with the CTCSS tone frequency predetermined with the station with which you wish to have a QSO. When the CTCSS tone frequency in the receive signal from the other station coincides with the CTCSS tone frequency of your station, the squelch opens and you can hear the audio received.

You can select a desired CTCSS tone frequency and the tone frequency independently, but cannot use the CTCSS and tone simultaneously.

CTCSS Tone Frequency: The squelch opens when the transceiver receives the CTCSS tone to which the same CTCSS tone frequency as that is configured for the transceiver is superimposed A CTCSS tone frequency scan makes it possible to detect the CTCSS tone frequency contained in the receive signal. If the transceiver receives the signal while the CTCSS tone frequency scan is in operation, you will hear the audio of the receive signal regardless of whether the CTCSS tone frequency coincides or not.

Cross tone: The squelch opens when the CTCSS tone frequency matches during the reception and the tone is transmitted at the configured tone frequency at the time of signal transmission. Different tone can be used for transmission and reception.

Note:
- ◆ The squelch opens and you can hear the audio received only if the CTCSS tone frequency in the receive signal coincides with the CTCSS tone frequency configured in the transceiver. Use this function to single out the receive signal from the other station so that unnecessary signals will not be received. Therefore, the use of the CTCSS frequency does not prevent the contents of your call from being monitored by other stations.
- ◆ You do not need to configure the tone frequency if you store the configuration for CTCSS tone frequency in a memory channel and retrieve the frequency and operating information from the memory channel. For memory channel configuration, refer to "MEMORY CHANNEL". {page 10-1} If you use this transceiver as the amateur radio base station of the VoIP, you can configure the received audio to sound from the speaker even if the CTCSS tone frequency does not match. {page 16-23}
- ◆ To use a CTCSS tone, the RX Monitor must be assigned to a PF key allowing you to monitor the status of the transmit frequency. {page 16-6}

CONFIGURING THE CTCSS TONE FREQUENCY

You can configure the desired CTCSS tone frequency.
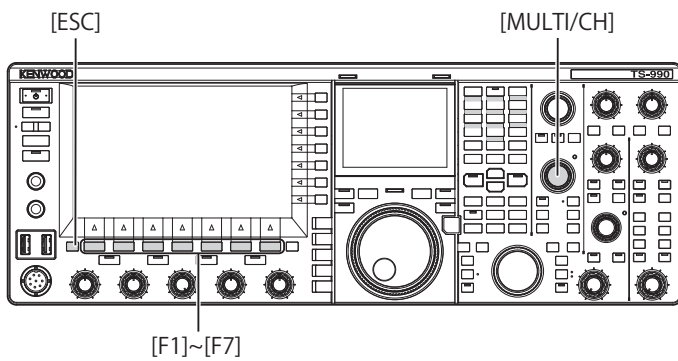
[ESC]   [MULTI/CH]

[F1]~[F7]

1   Press and hold **[TONE]** (F4) to open the **FM Tone Frequency** screen.

2   Press **[M/S]** (F6) to select either main band or sub band.
    Parameter box for frequency (FREQ. [Hz] allows you to edit.

3   Press **[⬆]** (F2) or **[⬇]** (F3) to select "CTCSS".

4   Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select the CTCSS tone frequency.

5   Press **[ESC]** to exit.

Note:

◆ If you press and hold **[(RESET)]** (F1), the selected CTCSS tone frequency reverts to the default (88.5 Hz).

CTCSS Tone Frequency (Hz)						
67.0	88.5	114.8	151.4	177.3	203.5	250.3
69.3	91.5	118.8	156.7	179.9	206.5	254.1
71.9	94.8	123.0	159.8	183.5	210.7	
74.4	97.4	127.3	162.2	186.2	218.1	
77.0	100.0	131.8	165.5	189.9	225.7	
79.7	103.5	136.5	167.9	192.8	229.1	
82.5	107.2	141.3	171.3	196.6	233.6	
85.4	110.9	146.2	173.8	199.5	241.8	

SELECTING THE CTCSS TONE

Follow the procedure below to change the type of tone signal after selecting the main band or sub band.

[F1]~[F7]   [FM/AM/FM-N]
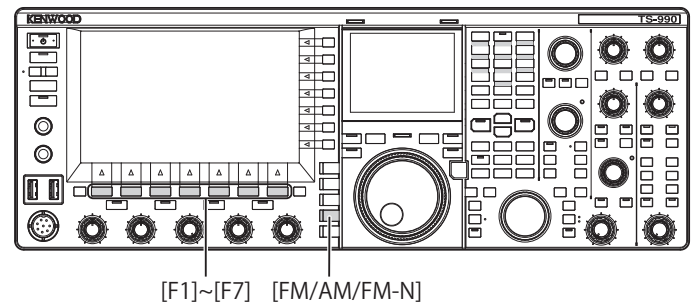
1   Press **[FM/AM/FM-N]** to enter FM mode.

2   Press **[TONE]** (F4) to select CTCSS tone.
    Each time you press the key, the tone signal display cycles as follows: CT (CTCSS) > CROSS > deselected; the main screen display varies as follows: "TONE" > "CT" > "CROSS" > blank (deselected) > "TONE".

Note:

◆ If the selected band is dedicated for reception ("TX" LED is unlit), "CT" will be grayed out.

◆ If the "TX" LED and "RX" LED for the sub band turn Off, "TONE", "CT", and "CROSS" will also be grayed out.

USING THE SCAN TO SEARCH FOR THE CTCSS TONE FREQUENCY

A tone frequency scan makes it possible to detect the CTCSS tone frequency contained in the receive signal in FM mode. This function is convenient if you wish to know the CTCSS tone frequency of a repeater.

Follow the procedure below after selecting the main band or sub band.


[ESC] [SQL](M) [SQL](S)
[F1]~[F7] [FM/AM/FM-N]
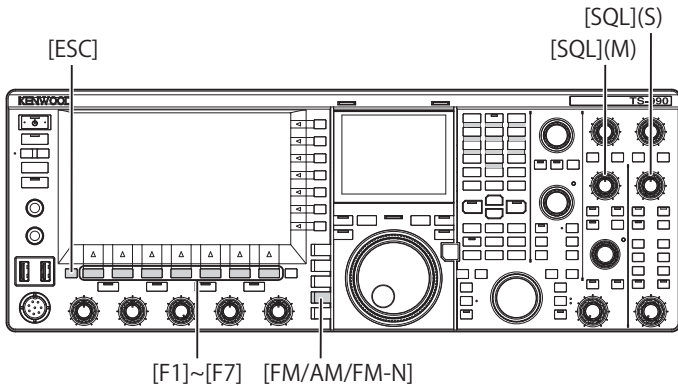
1 Press **[FM/AM/FM-N]** to enter FM mode.

2 Press and hold **[TONE]** (F4) to open the **FM Tone Frequency** screen.

3 Press [▲] (F2) or [▼] (F3) to select "CTCSS" as a tone type.

4 Press **[SCAN]** (F7) to scan the CTCSS tone frequency.

   • Until the scan ends, "SCAN" appears on the right of the CTCSS tone frequency.

   • As soon as the CTCSS tone frequency is detected, the scan stops and the frequency appears in the FREQ. [Hz] box.

   • The scan starts with a press of **[M/S]** (F6) while the transceiver is in reception in the selected band (the "MAIN BUSY/TX" LED or the "SUB BUSY/TX" LED lights).

   • If the "MAIN BUSY/TX" LED or "SUB BUSY/TX" LED is unlit, rotate the **SQL** control to receive so that the transceiver will be placed in receive mode.

   • Press **[M/S]** (F6) if you wish to change the current band (main band or sub band).

   • The scan pauses by pressing **[SCAN]** (F7) while scanning the CTCSS tone frequency. The scan resumes by pressing **[SCAN]** (F7) again.

   • The scan pauses if the receive signal breaks off while scanning the CTCSS tone frequency. The scan automatically restarts when the transceiver detects the receive signal.

5 Press **[ESC]** to exit.

SELECTING THE CROSS TONE

"Cross Tone" is a function used when you are communicating via a repeater that requires different tones for your transmission (uplink) to the repeater and for your reception (downlink) from the repeater.

Cross tone uses the tone frequency for the transmission and the CTCSS frequency for the reception. The CTCSS frequency activates the tone squelch at the time of signal reception and the tone is sent at the preset tone frequency at the time of signal transmission.

Follow the procedure below to change the type of tone signal after selecting the main band or sub band.

[F1]~[F7] [FM/AM/FM-N]
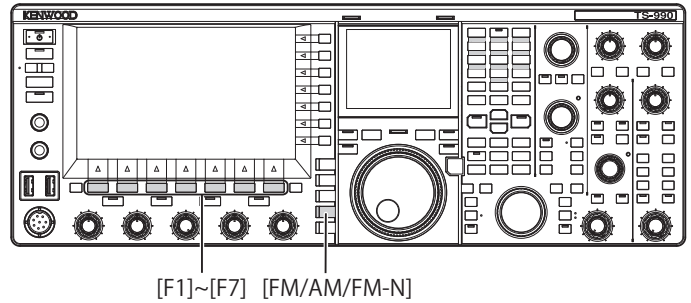
1 Press **[FM/AM/FM-N]** to enter FM mode.

2 Press **[TONE]** (F4) to select CROSS.
   Each time you press the key, the tone signal display cycles as follows: CT (CTCSS) > CROSS > deselected; the main screen display varies as follows: "TONE" > "CT" > "CROSS" > blank (deselected) > "TONE".

Note:

◆ If the "TX" LED and "RX" LED for the sub band turn Off, "TONE", "CT", and "CROSS" will also be grayed out.

RTTY OPERATION

The transceiver is equipped with an encoder/decoder for RTTY operation. You can use a commercially available USB keyboard in combination with the transceiver in RTTY mode without using any other device. You can also connect an external device, such as a TNC or PC, and operate the transceiver in RTTY mode.

PRECAUTION

♦ Prior to operation in RTTY mode, you must adjust the carrier level by observing of the ALC meter.
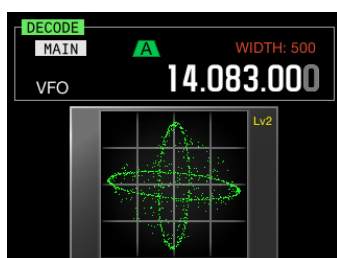
OPENING THE RTTY ENCODE/DECODE SCREEN
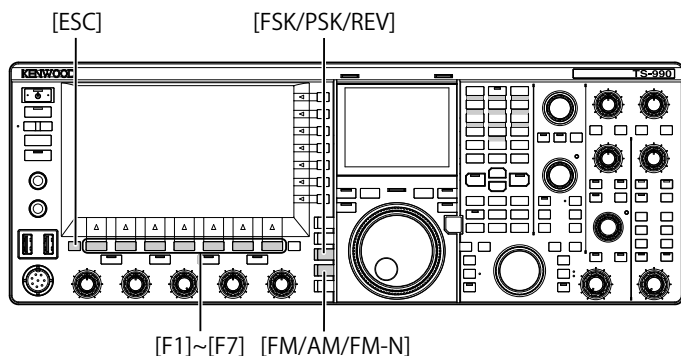
[ESC]   [FSK/PSK/REV]

[F1]~[F7] [FM/AM/FM-N]

1 Press **[FSK/ PSK/ REV]** to enter RTTY (FSK) mode.

2 Press **[DECODE]** (F3) to open the **RTTY Encode/ Decode** screen.

Pressing **[XY LEV.]** (F7) changes the refreshing frequency of the Lissajous curve. Changing the refreshing frequency also change the density of the Lissajous curve.

MAIN SCREEN

SUB-SCREEN

3 Press **[ESC]** to exit.

Note:

♦ If a value other than "170 [Hz]" is selected in Menu 2-06, "FSK Spacing", the **RTTY Encode/Decode** screen does not open. {page 5-46}

♦ Noise Reduction 1, Noise Reduction 2, Beat Cancel 1, Beat Cancel 2, Audio Peak Filter and the RX DSP equalizer do not function for RTTY message decoding.

The **RTTY Encode/Decode** screen has the following layout.

TX and RX Transcript   Status Bar   FFT Scope

Text String Buffer   Waterfall   Threshold Level
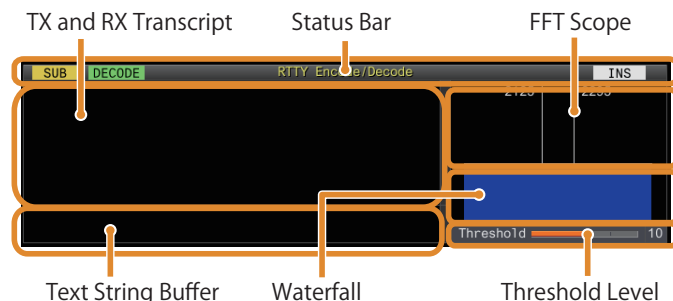
- Status bar: The band name and encode or decode in use appear on the left side and the status (overwriting or insertion) of the text string entry at the time of pressing **[Insert]** on the USB keyboard appears on the right.
- Contents of transmission or reception: The text string transmitted or received appears. Press and hold **[(CLEAR)]** (F4) to delete the text string.
- Buffer of TX text string: The text string to be transmitted appears. Pressing **[PAUSE]** pauses the reception.
- FFT scope: The audio FFT scope is used to check the tuning state visually.
- Waterfall: The spectrum of the receive audio signal is displayed.
- Threshold: Displays the threshold level of the receive signal.

OPERATIONS ON THE RTTY ENCODE/DECODE SCREEN

You can operate the transceiver using the following procedure while the **RTTY Encode/Decode** screen is open.

- Pressing the **[Page Up]** or **[Page Down]** key on the USB keyboard scrolls the contents of transmission and reception.
- Press **[EXTEND]** (F7) extends the **RTTY Encode/Decode** screen; it expands vertically.
- The analog meter, if displayed on the main band, changes to the digital meter.
- If you press the key again, the display of the **RTTY Encode/ Decode** screen and meter reverts to the previous display.
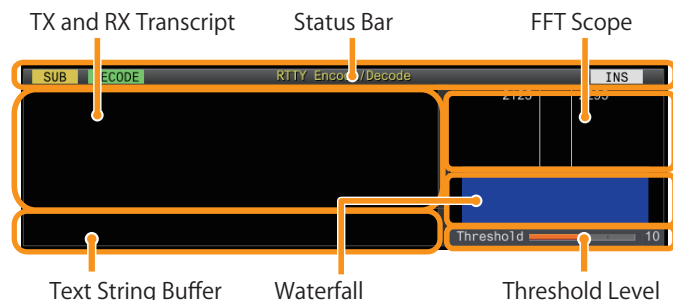
TX and RX Transcript   Status Bar   FFT Scope

Text String Buffer   Waterfall   Threshold Level

- Pressing **[PAUSE]** (F3) pauses the text displayed in the **RTTY Encode/Decode** screen. Pressing the key again releases the pausing of the text.
- The text received while pausing is not processed.
- Pressing and holding **[(CLEAR)]** (F4) clears the text displayed in the TX text string.
- Pressing **[MORE]** (F1) alternates the function key guide to another one.

SELECTING MAIN BAND AND SUB BAND FOR RECEPTION (FSK)

You can select decoding either on the main band or on the sub band.
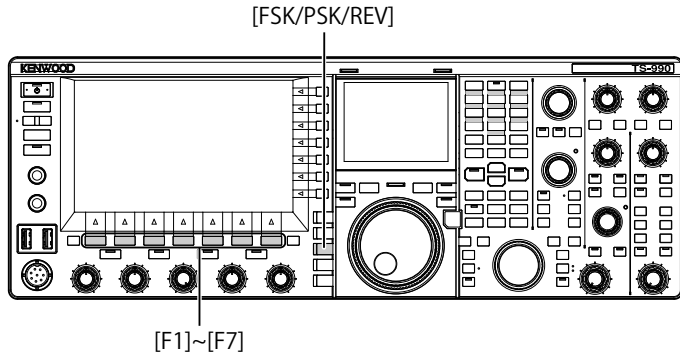
[FSK/PSK/REV]

[F1]~[F7]

1 Press **[FSK/ PSK/ REV]** to enter RTTY (FSK) mode.

2 Press **[DECODE]** (F3) to open the **RTTY Encode/ Decode** screen.

**3** Press **[M/S]** (F2) to select either main band or sub band.

Note:

◆ If the selected decoding object falls under either one of the following conditions, "RX: Reselect FSK" appears in the **RTTY Encode/Decode** screen.
A mode other than RTTY (FSK) is selected.
The receive capability for the sub band is disabled when the sub band is selected.

◆ If the transceiver is in any mode other than RTTY (FSK) mode, "TX: Reselect FSK" appears in the **RTTY Encode/Decode** screen.
Press **[FSK/PSK/REV]**.

SAVING THE CONTENTS OF RTTY COMMUNICATION

You can save the contents of the communication displayed in the **RTTY Encode/Decode** screen in a USB flash drive.
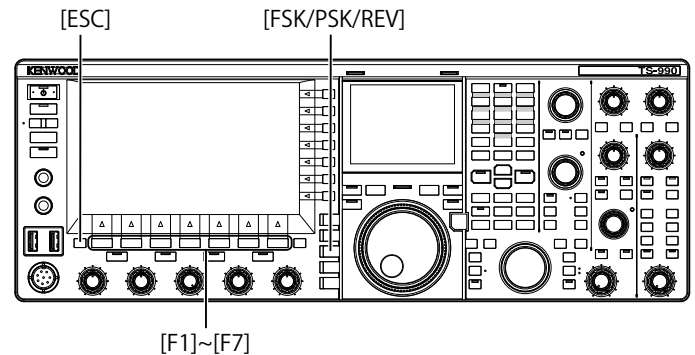
[ESC]   [FSK/PSK/REV]

[F1]~[F7]

1 Press **[FSK/ PSK/ REV]** to enter RTTY (FSK) mode.

2 Press **[DECODE]** (F3) to open the **RTTY Encode/ Decode** screen.

3 Insert a USB flash drive into the ⛯(USB-A) connector.
Use a USB flash drive which was formatted by the transceiver.

4 Press **[SAVE]** (F4) to store the contents of QSO.
A message notifying you of the completion of the data saving appears.
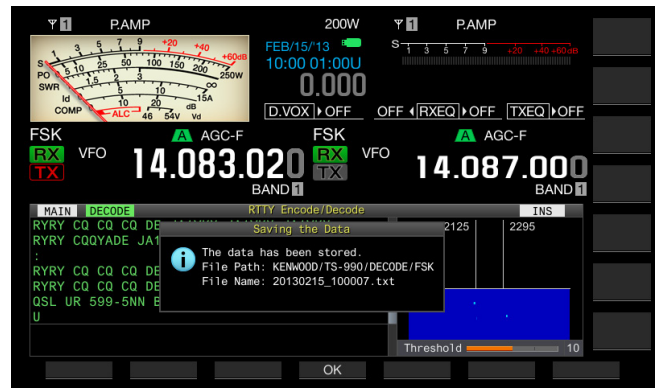
If **[SAVE]** (F4) is unavailable in the function key guide, press **[MORE]** (F1). An alternate key guide will appear.

5 Press **[OK]** (F4) to end.

Note:

◆ The file name is given using the numbers and underscores representing the time and date, and the extension selected in Menu 2-12, "RTTY/PSK Log File Format", is also added. The data is displayed in the order of the year, underscore, hour, minute, and second.
Example:
Example: In the case of 10:20:30, February 15, 2013:
20130215_102030.txt

◆ A file be saved in the following folder.
KENWOOD/TS-990/DECODE/FSK

◆ Remove the USB flash drive only after Safe Removal of USB Flash Drive is executed. {page 12-1}

SELECTING THE FILE FORMAT AT THE TIME OF SAVING DATA

You can select the data saving format, either the html format or text format.

1 Select Group No. 2, "Decoding & Encoding", from the **Menu** screen.

2 Access Menu 12, "RTTY/PSK Log File Format".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.
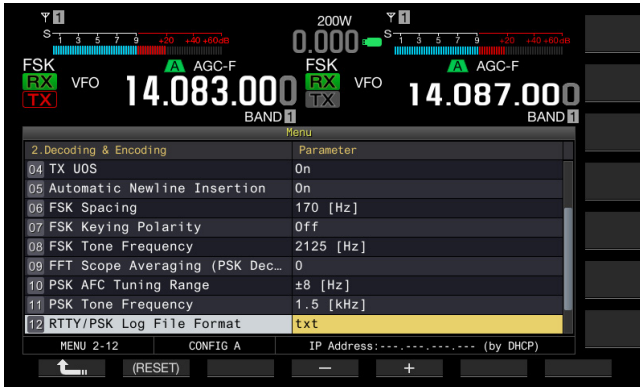
4 Press **[–]** (F4) or **[+]** (F5) to select "html" or "txt".
   • The extension is either ".html" or ".txt".
   • The default is "txt".

5 Press **[⬑]** (F1).

6 Press **[ESC]** to exit.

ADJUSTING THE RTTY THRESHOLD LEVEL OF RTTY DECODING

The received noise while no signal is present may occasionally be erroneously recognized as a valid character, decoded and displayed. The threshold level should be adjusted to reduce or eliminate this symptom. If there are many erroneous detections due to noise, increment the threshold level.

[FSK/PSK/REV]   [MULTI/CH]

[F1]~[F7]
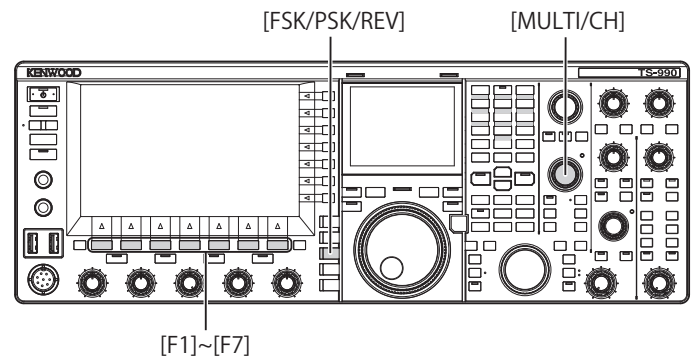
1 Press **[FSK/ PSK/ REV]** to enter RTTY (FSK) mode.

2 Press **[DECODE]** (F3) to select either main band or sub band.

3 Press **[THLD]** (F5) to allow editing of the threshold level.
   The threshold level configuration below the Waterfall display can be changed.
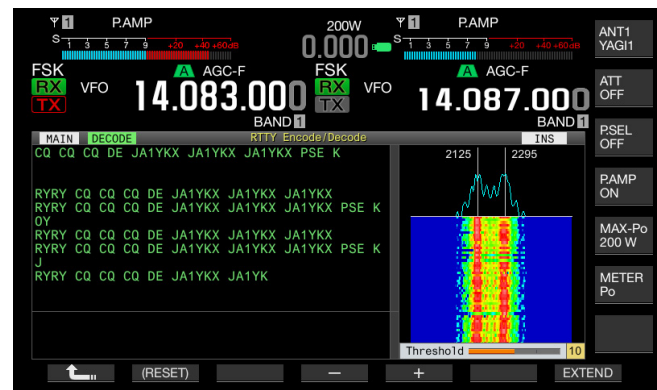
If **[THLD]** (F5) is unavailable in the function key guide, press **[MORE]** (F1). An alternate key guide will appear.

4 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to adjust the level.
   Pressing and holding **[(RESET)]** (F1) resets the configured parameter to the default. The default is "10".

5 Press **[⬑]** (F1) to exit.

# DISPLAYING THE SCOPE TO CHECK RTTY TUNING

FFT SCOPE

The transceiver is provided with an audio FET scope to observe the tuning condition of the transceiver in RTTY (FSK) mode. The audio FET scope appears in the **RTTY Encode/Decode** screen.

The two vertical lines on the left and right indicate mark and space frequencies. While receiving the signal, adjust the tuning frequency so that the two peaks overlaps the two lines equally.

AVERAGING THE WAVEFORM IN THE FFT SCOPE

The waveform to be displayed on an FFT scope can be averaged. Waveform averaging will reduce the random noise, allowing you to observe the target signal.
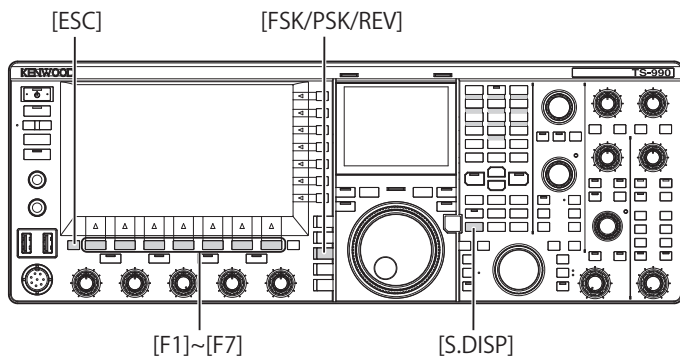
1 Select Group No. 2, "Decoding & Encoding", from the **Menu** screen.

2 Access Menu 00, "FFT Scope Averaging (RTTY Decode)".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.
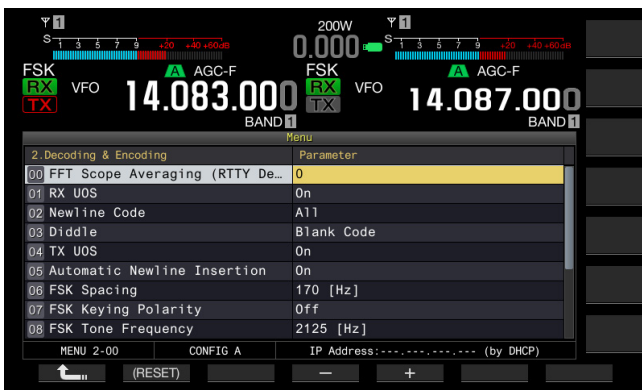
4 Press **[-]** (F4) or **[+]** (F5) to select the desired value from "0" to "9" in the parameter box.
Selecting the larger parameter will display the spectra with the noise component reduced. The default is "0".

5 Press **[⬑]** (F1).

6 Press **[ESC]** to exit.

Note:
◆ Use Fine Tuning if it is not easy to tune. {page 4-14}

WATERFALL

In linking with the audio FFT scope, transition of the frequency components contained in the received audio signal can be displayed.
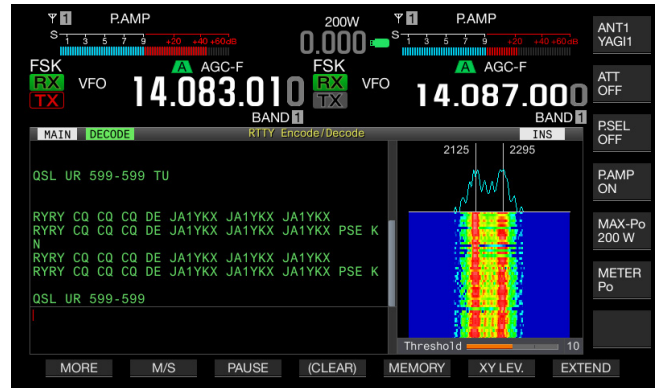
X-Y SCOPE (SUB-SCREEN)

The tuned status of the signal in RTTY (FSK) mode is displayed as a cross pattern (90 degrees) on the X-Y scope. The cross patterns bisect at right angles when the transceiver is correctly tuned into the signal.

1 Press **[FSK/ PSK/ REV]** to enter RTTY (FSK) mode.

2 Press **[DECODE]** (F3) to open the **RTTY Encode/ Decode** screen.
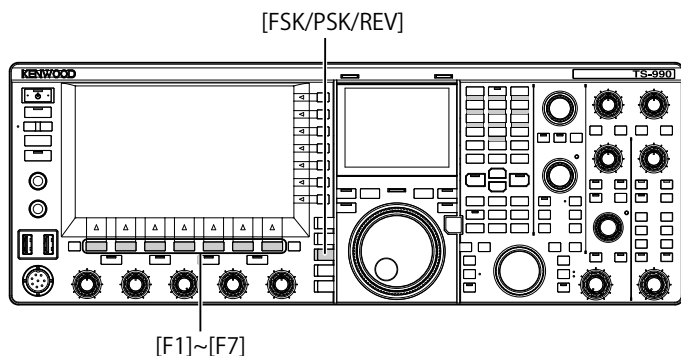
3 Press **[S.DISP/ SEL]** to display the X-Y Scope.
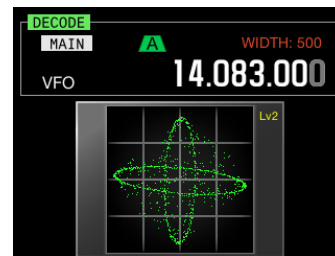
Note:
◆ The X-Y scope appears only if the **RTTY Encode/Decode** screen appears on the main screen.

USING THE USB KEYBOARD TO TRANSMIT A TEXT STRING

You can connect a commercially available USB keyboard to the transceiver to enter and transmit a text string.

TRANSMITTING THE ENTERED TEXT STRING AS ENTERED

[FSK/PSK/REV]

[F1]~[F7]

1 Connect a USB keyboard to the •⛢(USB-A) connector.

2 Press **[FSK/ PSK/ REV]** to enter RTTY (FSK) mode.

3 Press **[DECODE]** (F3) to open the **RTTY Encode/ Decode** screen.

4 Press **[F12]** on the USB keyboard to start to transmit.

The "BUSY/TX" LED lights red and "ENCODE" appears on the status bar.

5 Enter the text strings using the USB keyboard.
   • The entered text string is placed and displayed in the text string buffer and transmitted as entered.
   • Each letter in the text string buffer changes its color in sequence when the letter is transmitted.
   • Text strings transmitted are displayed in sequence in the TX and RX Transcript.

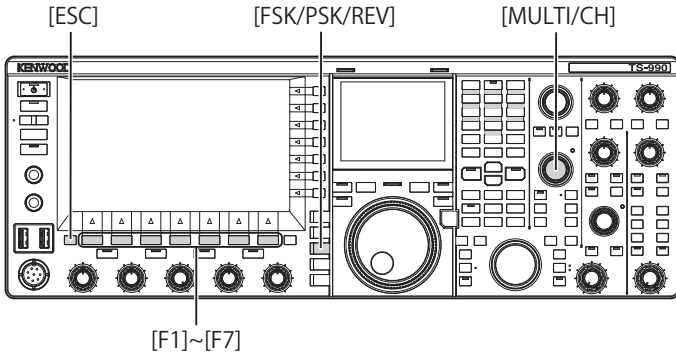6 Press **[F12]** on the USB keyboard to stop transmission.

Note:
♦ If letters not transmitted yet remain in the text string buffer when **[F12]** is pressed at step 6, "WAIT" appears on the status bar. When the entire text string is transmitted, the transceiver enters the receive mode and the "BUSY/TX" LED and "WAIT" are unlit.

STORING TEMPORARILY AND TRANSMITTING THE TEXT STRING IN THE BUFFER

1 Connect a USB keyboard to the •⛢(USB-A) connector.

2 Press **[FSK/ PSK/ REV]** to enter RTTY (FSK) mode.

3 Press **[DECODE]** (F3) to open the **RTTY Encode/ Decode** screen.

4 Enter the text strings using the USB keyboard.
The entered text string is placed and displayed in the text string buffer.

5 Press **[F12]** of the USB keyboard to send a text string.
   • The transceiver transmits the text string accumulated in the text string buffer.
   • The "BUSY/TX" LED lights red and "ENCODE" appears on the status bar when the transceiver is in a transmit state.
   • Each letter in the text string buffer changes its color in sequence when the letter is transmitted. Each letter transmitted appears sequentially the TX and RX Transcript.

6 Press **[F12]** of the USB keyboard to receive.

Note:
♦ If letters not transmitted yet remain in the text string buffer when **[F12]** is pressed at step 6, "WAIT" appears on the status bar. When the entire text string is transmitted, the transceiver enters the receive mode and the "BUSY/TX" LED and "WAIT" are unlit.

♦ The transceiver enters the receiving mode if **[ESC]** on the USB keyboard is pressed while the text string is being transmitted. Transmission of the text string ends, and any text waiting for transmission in the text string buffer is deleted.

♦ You can add time stamp and frequency information in the transmit and receive data displayed in the TX and RX Transcript.

♦ You can pause the transmission of the text string using the USB keyboard by pressing **[PAUSE]** (F3). Another press of **[PAUSE]** (F3) releases the pause.

♦ The text string temporarily stored in the text string buffer can contain a maximum of 4,300 characters.

♦ The following alphanumeric characters and signs can be entered from the USB keyboard.

A	B	C	D	E	F	G	H	I	J	K	L	M	N
O	P	Q	R	S	T	U	V	W	X	Y	Z	0	1
2	3	4	5	6	7	8	9	!	"	#	$	&	'
(	)	.	,	-	?	:	;	/	Space		Line Break		

UTILIZING AN RTTY MESSAGE MEMORY

You can save frequently used fixed phases commonly used in RTTY (FSK) mode as RTTY messages in the RTTY message memory. If you configure automatic TX and RX triggers in your messages, you can transmit the RTTY messages with ease. You can store a maximum of eight RTTY messages in channel 1 through channel 8.

STORING MESSAGES

[ESC]   [FSK/PSK/REV]   [MULTI/CH]

[F1]~[F7]

1 Press **[FSK/ PSK/ REV]** to enter RTTY (FSK) mode.

2 Press **[DECODE]** (F3) to open the **RTTY Encode/ Decode** screen.

3 Press **[MEMORY]** (F5) to open the **RTTY Message** screen.

If **[MEMORY]** (F5) is unavailable in the function key guide, press **[MORE]** (F1). An alternate key guide will appear.

4 Press **[▲]** (F3) or **[▼]** (F4), or rotate the **MULTI/CH** control to select a channel to which a CW message will be stored.

If **[▲]** (F3) and **[▼]** (F4) are unavailable in the key guide, press **[MORE]** (F2).

5 Press **[MSG]** (F5) to allow editing of the message for the selected channel.

6 Use functions keys, the **MULTI/CH** control, or a USB keyboard to enter a text string.

[SPACE] (F1): Press to enter one space.

[-] (F2) and **[+]** (F3): Press to display the previous or next character.

[◀] (F4) and **[▶]** (F5): Press to move the cursor to the left and right.

[SAVE] (F6): Press to store the selected characters.

[BACK SPACE] (F): Press to delete the character to the left of the cursor.

[DEL] (F): Press to delete the character to the right of the cursor.

[CHAR] (F): Changes the character type. Each time you press **[CHAR]** (F), the character type cycles through the following sequence:

ABC (upper case) > abc (lower case) > !"# (symbols) > ABC (upper case)

Available alphanumeric characters and symbols (a maximum of 70 characters)

A	B	C	D	E	F	G	H	I	J	K	L	M	N
O	P	Q	R	S	T	U	V	W	X	Y	Z	0	1
2	3	4	5	6	7	8	9	!	"	#	$	&	'
(	)	.	,	-	?	:	;	/	Space	Line Break			

7 Press **[SAVE]** (F6) to store the edited message.
Pressing **[CANCEL]** (F7) deletes the contents being edited and ends the character entry.

8 Press **[↰]** (F1).

**9** Press **[ESC]** to exit.

CONFIGURING THE AUTOMATIC TRANSMISSION AND RECEPTION FOR THE RTTY MESSAGE MEMORY

If you select an RTTY message memory channel, you can configure independently for each RTTY message memory channel whether or not the RTTY message is transmitted automatically and whether or not the transceiver enters receive after it's been sent.

Automatic transmit sends the RTTY message as soon as the channel where a RTTY message is stored is selected. The transmit state is maintained even after the entire message is transmitted. Therefore, this function is convenient if you wish to transmit your own text string using a USB keyboard after the RTTY message is transmitted using the RTTY message memory.

Automatic receive is a function to revert to the receive mode after an RTTY message has been sent. Selecting the channel number, that contains an RTTY message to be sent, automatically starts transmitting the RTTY message, or the RTTY message temporarily stored in the buffer for the text string can be sent with a press of **[F12]** of a USB keyboard. The transceiver can automatically enter the receive mode when the RTTY message is transmitted.

A combination of automatic transmission and automatic reception makes it possible to transmit and receive messages automatically.

[ESC]   [FSK/PSK/REV]   [MULTI/CH]

[F1]~[F7]
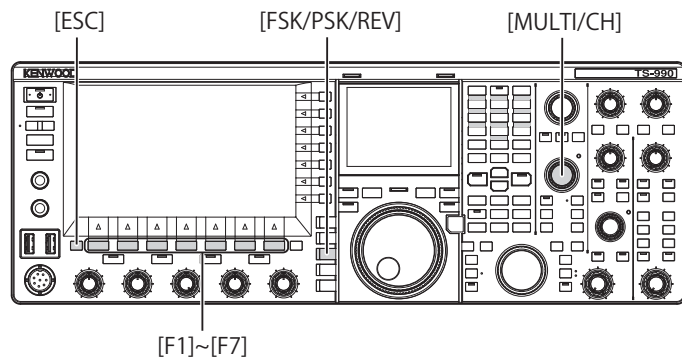
1   Press **[FSK/ PSK/ REV]** to enter RTTY (FSK) mode.

2   Press **[DECODE]** (F3) to open the **RTTY Encode/ Decode** screen.

3   Press **[MEMORY]** (F5) to open the **RTTY Message** screen.

If **[MEMORY]** (F5) is unavailable in the function key guide, press **[MORE]** (F1). An alternate key guide will appear.

4   Press **[▲]** (F3) or **[▼]** (F4), or rotate the **MULTI/CH** control to select a message to be sent automatically.
If **[▲]** (F3) and **[▼]** (F4) are unavailable in the key guide, press **[MORE]** (F1).

5   Press **[AUTO.TX]** (F6) to enable the automatic transmission.
Configures the transceiver so that an RTTY message will be automatically transmitted from the corresponding channel when "AUTO TX" appears on the right side of the RTTY message. Even if the "AUTO TX" disappears, the RTTY message for that channel is temporarily stored in the buffer of a text string and will not automatically be sent.

6   Press **[AUTO.RX]** (F7) to enable the automatic transmission.
Configures the transceiver so that the transceiver will revert to a receive state after an RTTY message is transmitted from the corresponding channel when "AUTO RX" appears on the right side of the RTTY message. Even if "AUTO RX" disappears, the transceiver does not revert to the receive mode after the RTTY message for that channel is sent.
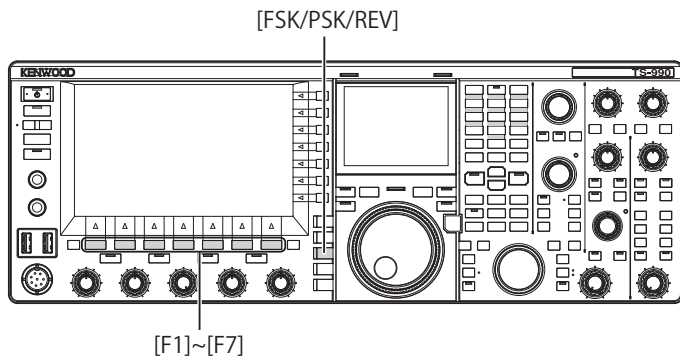

7   Press **[⬑]** (F1).

8   Press **[ESC]** to exit.

Note:
◆ To send the RTTY message for which automatic transmission is enabled, select the channel where the RTTY message is stored. After you confirm that a text string (RTTY message) has been transferred to the buffer of a text string, press **[F12]** of the USB keyboard.
◆ To place the transceiver in the receive mode after the RTTY message for which automatic reception is disabled, press **[F12]** of the USB keyboard.

CONFIGURING THE AUTOMATIC TRANSMISSION AND RECEPTION USING THE RTTY MESSAGE MEMORY

You can transmit messages entered in the RTTY message memory.

[FSK/PSK/REV]

[F1]~[F7]

1 Press **[FSK/ PSK/ REV]** to enter RTTY (FSK) mode.

2 Press **[DECODE]** (F3) to open the **RTTY Encode/ Decode** screen.

3 Press **[MEMORY]** (F5) to open the **RTTY Message** screen.

4 Press **[CH1]** (F3), **[CH2]** (F4), **[CH3]** (F5), **[CH4]** (F6), **[CH5]** (F3), **[CH6]** (F4), **[CH7]** (F5), or **[CH8]** (F6) to select the channel for which the message to be sent has been stored.

- The RTTY message in the channel corresponding to the function key is transmitted automatically. The RTTY message will not automatically be transmitted from the channel for which automatic transmission is disabled.

- The key guide for **[F1]** through **[F7]** are the key guide for configuration, including [⬆] (F1), **[MORE]** (F2), [⏏] (F3), [⏬] (F4), **[MSG]** (F5), **[AUTO.TX]** (F6), and **[AUTO.RX]** (F7). In this case, press **[MORE]** (F2) so that the key guide will alternate between the key guide for [⬆] (F1), **[MORE]** (F2), **[CH1]** (F3), **[CH2]** (F4), **[CH3]** (F5), **[CH4]** (F6), and **[NEXT]** (F7) and the key guide for [⬆] (F1), **[MORE]** (F2), **[CH5]** (F3), **[CH6]** (F4), **[CH7]** (F5), **[CH8]** (F6), and **[NEXT]** (F7).

- The transceiver enters the receive mode after the RTTY message displayed along with "AUTO RX" on the right side.

CONFIGURATION FOR RTTY ENCODING AND DECODING

ENABLING THE UOS (UNSHIFT ON SPACE)

If the received RTTY signal contains a space, use this function to decode the letter next to the space forcibly as a letter code (alphabetical letter).

In RTTY, the influence of signal strength or noise causes letter corruption. In order to avoid this problem as much as possible, the function makes it possible to decode the letter after the space as a more frequently used letter code (alphabetical letter).

To receive a test string containing numbers and symbols subsequent to a space, you can disable the UOS function.
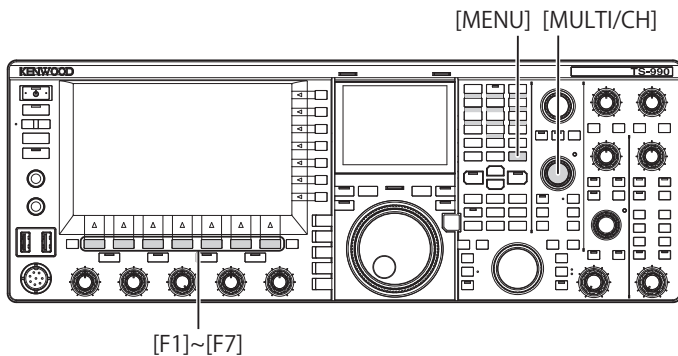
[MENU] [MULTI/CH]

[F1]~[F7]
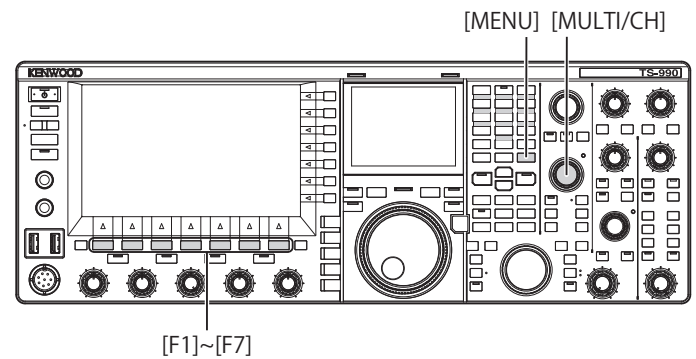
1 Select Group No. 2, "Decoding & Encoding", from the **Menu** screen.

2 Access Menu 01, "RX UOS".

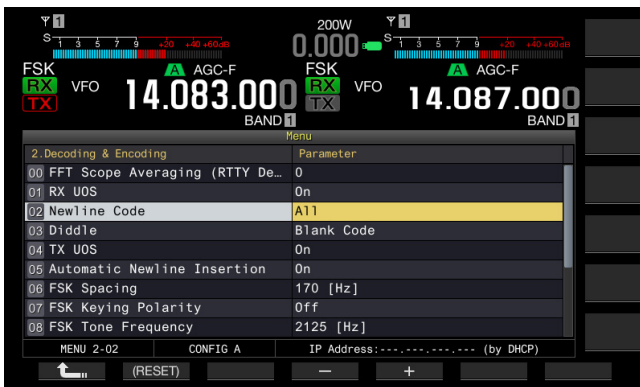**3** Press **[SELECT]** (F4) to allow editing of the parameter box.
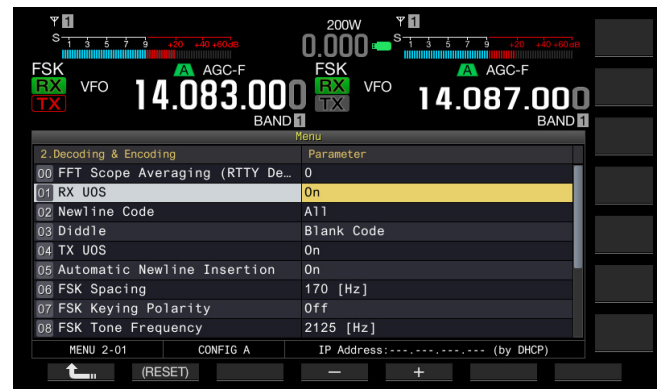
4 Press **[-]** (F4) or **[+]** (F5) to select "On" or "Off".
The default is "On" (encoding a blank letter). Selecting "Off" does not allow the transceiver to encode the blank letter.

5 Press [⬆] (F1).

6 Press **[MENU]** to exit.

CONFIGURING THE NEWLINE CODE

You can configure the newline code used to receive RTTY signals. If "All" is selected, a new line starts whenever the newline code is received. If "CR+LF" is selected, a new line starts only when the CR+LF code is received.
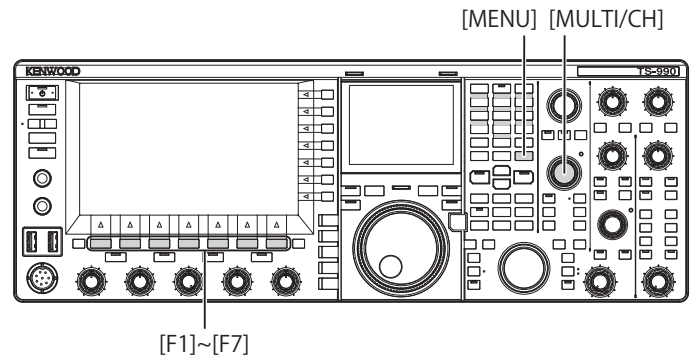
[MENU] [MULTI/CH]

[F1]~[F7]

1 Select Group No. 2, "Decoding & Encoding", from the **Menu** screen.

2 Access Menu 02, "Newline Code".

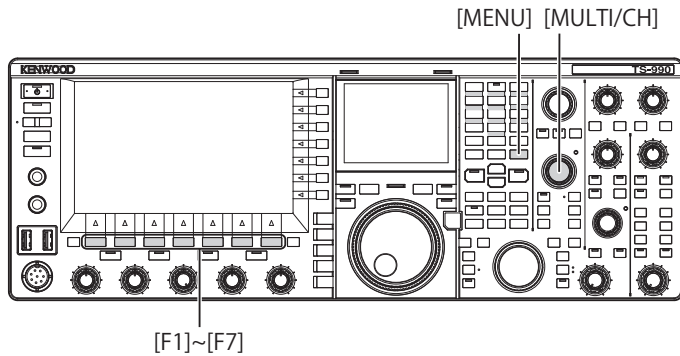3 Press **[SELECT]** (F4) to allow editing of the parameter box.

4 Press **[–]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select "All" or "CR+LF".
The default is "All".

5 Press **[↰]** (F1).

6 Press **[MENU]** to exit.

DIDDLE OPERATION

This function is used to select what code is transmitted when all characters being entered by the operator, or transmitted from a message memory, have been transmitted in RTTY (FSK) mode. You can select to transmit a space or a letter code (alphabetical letter), or no letter will be transmitted.

[MENU] [MULTI/CH]

[F1]~[F7]

1 Select Group No. 2, "Decoding & Encoding", from the **Menu** screen.

2 Access Menu 03, "Diddle".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.
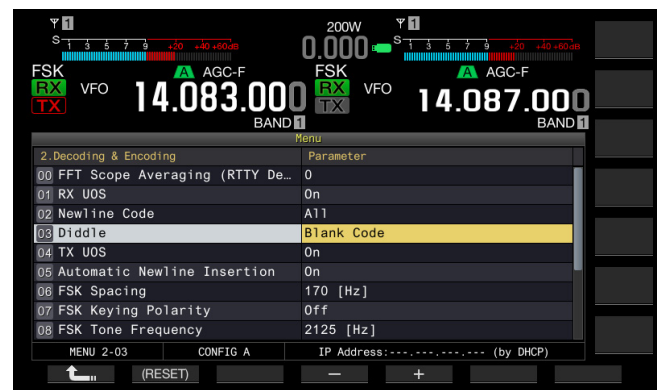
4 Press **[-]** (F4) or **[+]** (F5) to select "Off" (do not send the character code), "Blank Code" (send a blank code), or "Letters Code" (send a letter code).
The default is "Blank Code".

5 Press **[↰]** (F1).

6 Press **[MENU]** to exit.

ENABLING THE ENCODE UOS

Use this function to transmit a number or symbol following a space during the transmission in RTTY (FSK) mode. Then the receive station recognizes the number or symbol following the space, thus reducing the letter corruption.
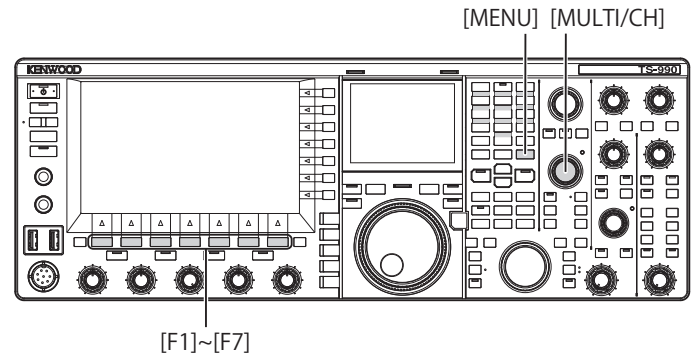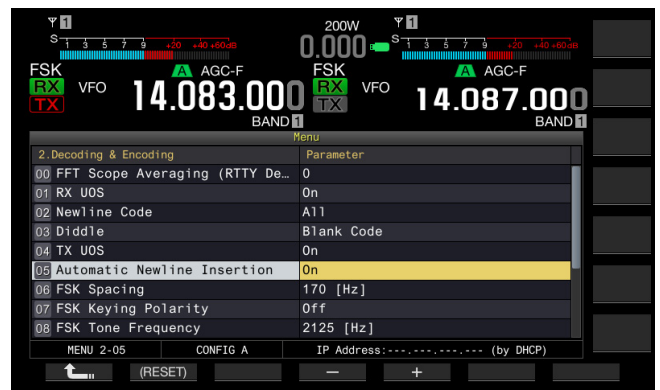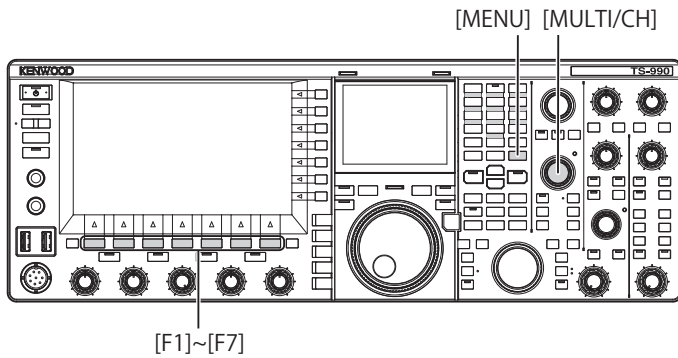
[MENU] [MULTI/CH]

[F1]~[F7]

1 Select Group No. 2, "Decoding & Encoding", from the **Menu** screen.

2 Access Menu 04, "TX UOS".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.
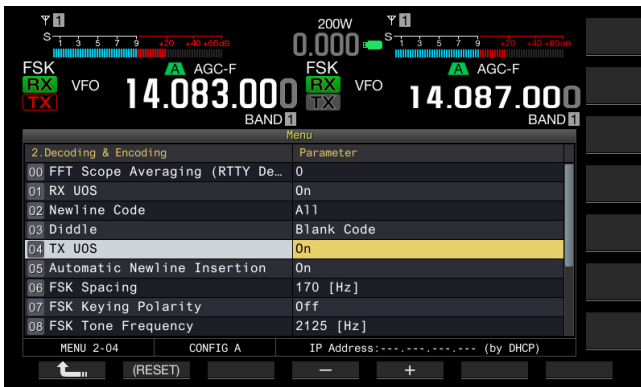
4 Press **[-]** (F4) or **[+]** (F5) to select "On" or "Off".
The default is "On" (use with Encode UOS). Selecting "Off" disables the Encode UOS.

5 Press **[⬆]** (F1).

6 Press **[MENU]** to exit.

SENDING THE NEWLINE CODE AT THE START AND END OF TRANSMISSION

The new line code (CR+LF) can be transmitted when the RTTY communication begins and ends. The RTTY message begins and ends with a new line in the decode display of the receiving station making it easier to view the transmitted RTTY message.

[MENU] [MULTI/CH]

[F1]~[F7]

1 Select Group No. 2, "Decoding & Encoding", from the **Menu** screen.

2 Access Menu 05, "Automatic Newline Insertion".

**3** Press **[SELECT]** (F4) to allow editing of the parameter box.

4 Press **[-]** (F4) or **[+]** (F5) to select "On" or "Off".
The default is "On" (sending a newline code). Selecting "Off" does not allow the transceiver to send a newline code.

5 Press **[⬆]** (F1).

6 Press **[MENU]** to exit.

▶ Index   ▶ Contents

DISPLAYING THE TIME STAMP

You can display the timestamp whenever transmission and reception alternate. You can display frequency information as well as the timestamp.
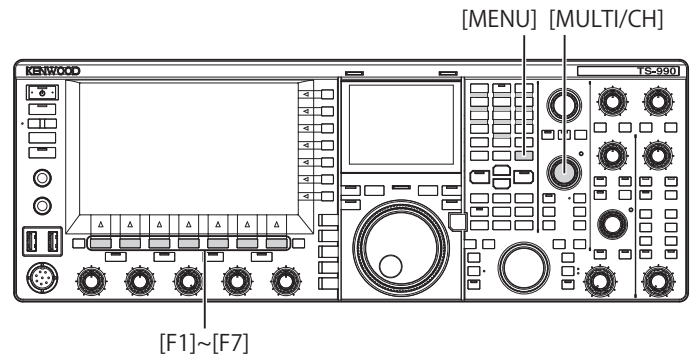
[MENU] [MULTI/CH]

[F1]~[F7]

1 Select Group No. 2, "Decoding & Encoding", from the **Menu** screen.

2 Access Menu 13, "RTTY/PSK Time Stamp".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.
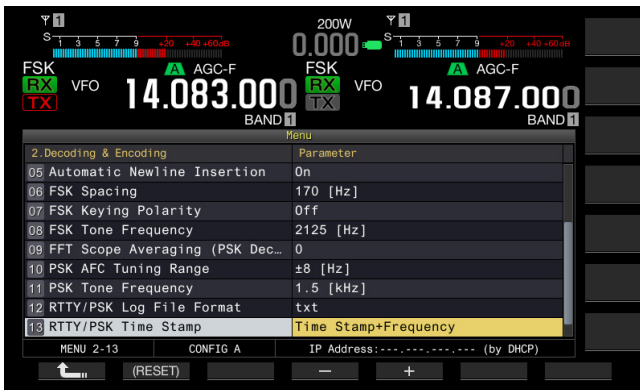
4 Press **[-]** (F4) and **[+]** (F5) to select "Off" (do not display), "Time Stamp" (display the time only), or "Time Stamp + Frequency" (display the time and frequency). The default is "Time Stamp + Frequency".

5 Press **[⬆]** (F1).

6 Press **[MENU]** to exit.

SELECTING THE TIMESTAMP TIME

You can select whether the time configured for the Local Clock or the Secondary Clock is applied to the time displayed for the timestamp.

[MENU] [MULTI/CH]

[F1]~[F7]

1 Select Group No. 2, "Decoding & Encoding", from the **Menu** screen.

2 Access Menu 14, "Clock (RTTY/PSK Time Stamp)".

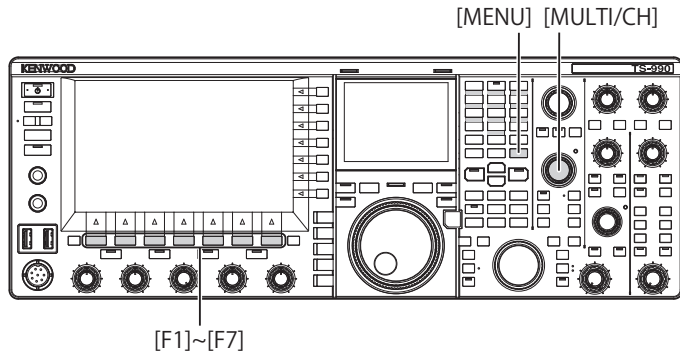3 Press **[SELECT]** (F4) to allow editing of the parameter box.
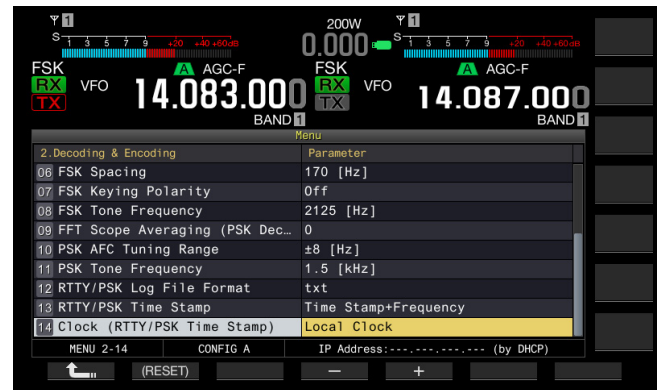
4 Press **[-]** (F4) and **[+]** (F5) to select "Local Clock" (use the local clock for time stamp) or "Secondary Clock" (use the secondary clock for time stamp).

The default is "Local Clock".

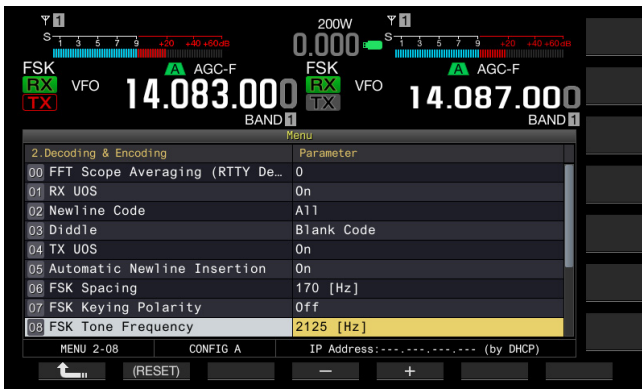5 Press **[⬆]** (F1).

6 Press **[MENU]** to exit.

RTTY PARAMETERS

CONFIGURING THE MARK FREQUENCY

You can configure the mark signal frequency used for communication in RTTY (FSK) mode. The tone at 1275 Hz is called low tone and the tone at 2125 Hz is called high tone. High tone is commonly used nowadays.
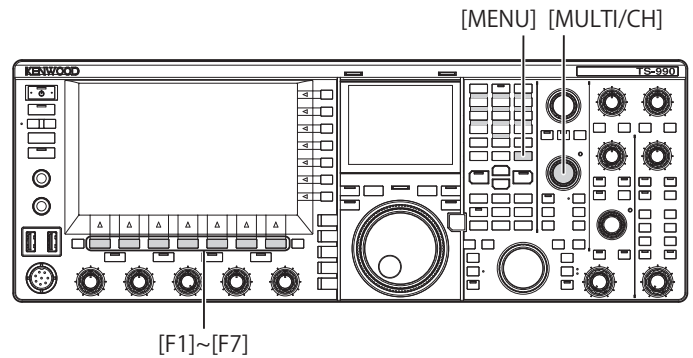
[MENU] [MULTI/CH]

[F1]~[F7]

1 Select Group No. 2, "Decoding & Encoding", from the **Menu** screen.

2 Access Menu 08, "FSK Tone Frequency".

**3** Press **[SELECT]** (F4) to allow editing of the parameter box.

4 Press **[-]** (F4) or **[+]** (F5) to select "1275 [Hz]" or "2125 [Hz]".

The default is "2125 [Hz]" (high tone).

5 Press **[⬆]** (F1).

6 Press **[MENU]** to exit.

CONFIGURING THE RTTY SHIFT WIDTH

The difference in frequency between the mark signal and the space signal is called shift width. You can configure the shift width for communication in RTTY mode.

[MENU] [MULTI/CH]

[F1]~[F7]

1 Select Group No. 2, "Decoding & Encoding", from the **Menu** screen.

2 Access Menu 06, "FSK Spacing".

**3** Press **[SELECT]** (F4) to allow editing of the parameter box.
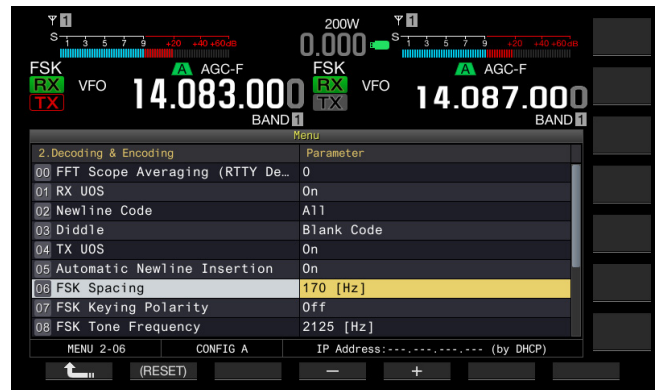
4 Press **[-]** (F4) or **[+]** (F5) to select "170 [Hz]", "200 [Hz]", "425 [Hz]", or "850 [Hz]".
The default is "170 [Hz]".

5 Press **[⬆]** (F1).

6 Press **[MENU]** to exit.

Note:

♦ You cannot change the RTTY shift width while the **RTTY Encode/ Decode** screen is open.

♦ To operate in RTTY mode using the built-in demodulator, encoder and decoder, configure "170 [Hz]" for Menu 2-06, "FSK Spacing".

REVERSING THE FREQUENCY IN RTTY MODE

If the receive RTTY signal is reversed (the mark and shift signal frequencies are reversed), the RTTY signal cannot be decoded properly. In that case, press and hold **[FSK/PSK/REV]** to reverse the RTTY signal so as to decode the reversed signal.


• Normal   • Reverse
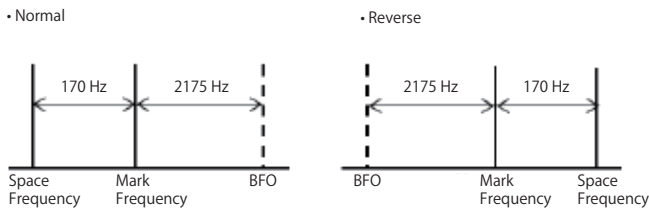
KEYING POLARITY

CONFIGURING THE POLARITY FOR ACC 2 KEYING

If you use an external device for communication in RTTY (FSK) mode, connect its keying signal into pin 2 of the **ACC 2** connector. You can configure the polarity for keying pin 2 (RTK) according to the specifications of the external device.

If you configure "Off" for Menu 2-07, "FSK Keying Polarity", and short-circuit pin 2 (RTK) to the GND, the transceiver transmits the signal at the mark frequency configured for Menu 2-08, "FSK Tone Frequency".

If "On" is configured for Menu 2-07, "FSK Keying Polarity", the space signal is transmitted and the space signal is shifted from the mark frequency by the shift frequency configured in Menu 2-06 "FSK Spacing".

[FSK/PSK/REV]   [MENU] [MULTI/CH]

[F1]~[F7]
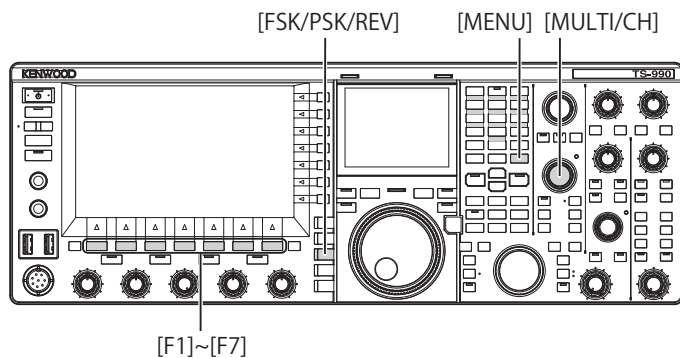
1   Select Group No. 2, "Decoding & Encoding", from the **Menu** screen.

2   Access Menu 07, "FSK Keying Polarity".

3   Press **[SELECT]** (F4) to allow editing of the parameter box.
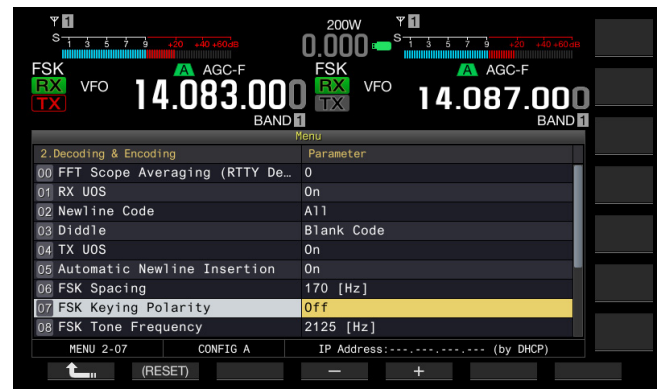
4   Press **[-]** (F4) or **[+]** (F5) to select "On" or "Off".
The default is "Off" (transmitting at the mark frequency by shorting pin 2 to GND). Selecting "On" allows the transceiver to transmit the space signal shifted for the mark frequency.

5   Press **[⤴]** (F1).

6   Press **[MENU]** to exit.

USING AN EXTERNAL DEVICE FOR RTTY MODE OPERATION

You can use an external device and operate the transceiver in RTTY (FSK) mode without using the built-in demodulator, encoder or decoder built in the transceiver. Connect to the transceiver a TNC suitable for RTTY communication or a PC that allows the use of applications for RTTY communication so that you can operate the transceiver in RTTY (FSK) mode.

Refer to the following page for operation examples.

Note:

◆ If the shift width for RTTY mode exceeds 170 Hz, the audio peak filter for the selected band cannot be enabled

AUDIO PEAK FILTER

For operation in RTTY mode with an external device connected to the transceiver, this filter will improve the readability of the RTTY message.

1 Press **[FSK/ PSK/ REV]** to enter RTTY (FSK) mode.

2 Press **[APF]** to enable the Audio Peak Filter.
The "APF" LED lights.

Note:

◆ You cannot enable the Audio Peak Filter until "170 [Hz]" is configured for Menu 2-06, "FSK Spacing".

◆ Even if Audio Peak Filter becomes active, the Audio Peak Filter does not apply to the internal demodulator.

PSK OPERATION

The transceiver incorporates a demodulator, encoder and decoder for PSK31 or PSK63 operation. You can use a commercially available USB keyboard in combination with the transceiver for operation in PSK31 or PSK63 mode. You can also use a PC and software for operation with the transceiver.

PRECAUTION

◆ For transmission in PSK mode, adjust the drive until the ALC meter just begins to swing. If you use an external device, adjust the audio signal level of the external device so that the ALC meter just begins to swing.

OPENING THE PSK ENCODE/DECODE SCREEN
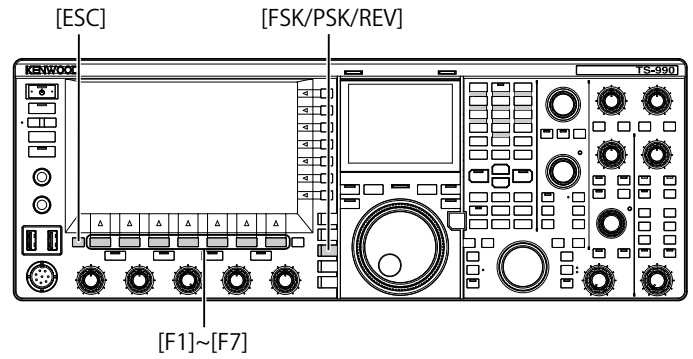
1 Press **[FSK/ PSK/ REV]** to enter PSK mode.

2 Press **[DECODE]** (F3) to open the **PSK Encode/ Decode** screen.

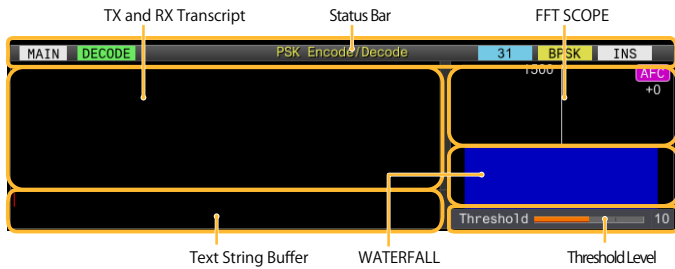**3** Press **[ESC]** to exit.

MAIN SCREEN

SUB-SCREEN

Note:

◆ Noise Reduction 1, Noise Reduction 2, Beat Cancel 1, Beat Cancel 2, Audio Peak Filter and the RX DSP equalizer do not function for PSK message decoding.

The **PSK Encode/Decode** screen has the following layout.

- Status bar: The band name and encode or decode in use appear on the left side. The status of operation appears on the right side with "31" or "63", "BPSK" or "QPSK". In addition, the status (overwriting or insertion) of the text string entry at the time when **[Insert]** of the USB keyboard is pressed appears.
- Contents of transmission or reception: The text string transmitted or received appears.
- Buffer of TX text string: The text string to be transmitted appears.
- FFT scope: The audio FFT scope is used to check the tuning state visually.
- Waterfall: The spectra transition of the receive audio signal is displayed.
- Threshold: The input level threshold of the receive signal is displayed.

You can operate the transceiver as shown below while the **PSK Encode/Decode** screen is open.

- Pressing the **[Page Up]** or **[Page Down]** key on the USB keyboard scrolls the contents of transmission and reception.
- Pressing **[EXTEND]** (F7) extends the **PSK Encode/Decode** screen vertically.
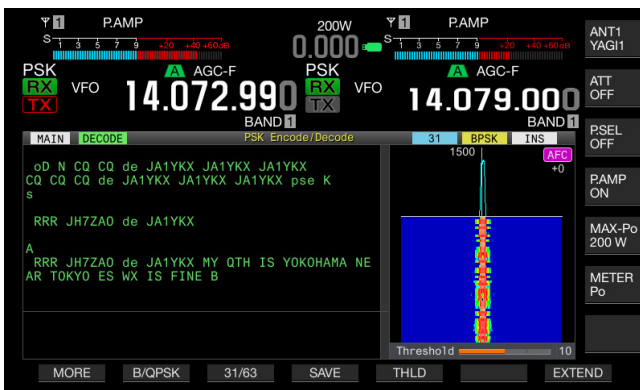

The analog meter, if displayed on the main band, changes to the digital meter.

If you press the key again, the displayed **PSK Encode/Decode** screen and the meter revert to the previous display.

- Pressing **[PAUSE]** (F3) pauses the text displayed in the **RTTY Encode/Decode** screen. Pressing the key again releases the pausing of the text.
- The text received while paused is not processed.
- Pressing and holding **[(CLEAR)]** (F4) deletes the text for transmission and reception displayed in the PSK Encode/Decode screen.
- Pressing **[MORE]** (F1) alternates the function key guide to another one.

SELECTING MAIN BAND AND SUB BAND FOR RECEPTION (PSK)

You can select decoding either on the main band or on the sub band.
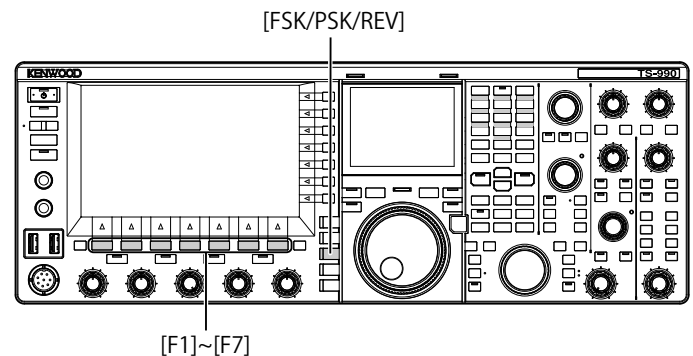
1 Press **[FSK/ PSK/ REV]** to enter PSK mode.
2 Press **[DECODE]** (F3) to open the **PSK Encode/ Decode** screen.
3 Press **[M/S]** (F2) to select either main band or sub band.
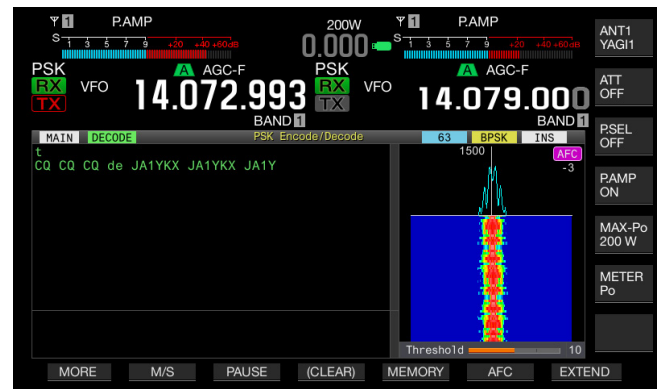
Note:

◆ If either of the following is the target for decoding you have selected, "RX: Reselect PSK" appears on the **PSK Encode/ Decode** screen.
If any mode other than PSK is selected.
If the receive capability for the sub band is disabled when the sub band is selected.

◆ If the transceiver is in any mode other than PSK mode, "TX: Reselect PSK" appears in the **RTTY Encode/Decode** screen. Press **[FSK/PSK/REV]**.
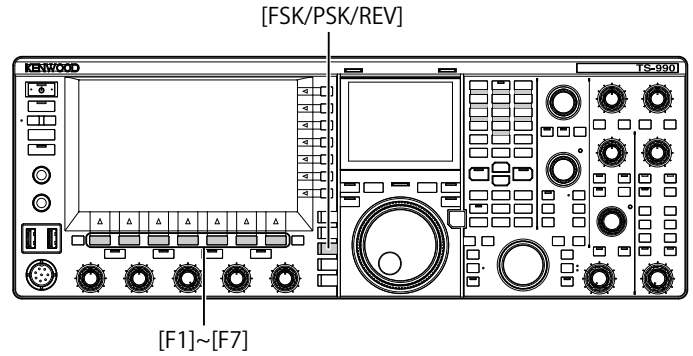

SAVING THE CONTENTS OF PSK COMMUNICATION

You can save the contents of the communication displayed in the **PSK Encode/Decode** screen in a USB flash drive.

Note:

◆ Refer to "USING USB FLASH DRIVE" for handling details of a USB flash drive. {page 12-1}

1 Press **[FSK/ PSK/ REV]** to enter PSK mode.

2 Press **[DECODE]** (F3) to open the **PSK Encode/ Decode** screen.

3 Insert a USB flash drive onto the ⟵(USB-A) connector.
Use a USB flash drive which was formatted by the transceiver.

4 Press **[SAVE]** (F4) to store the contents of QSO.
A message notifying you of the completion of the data saving appears.
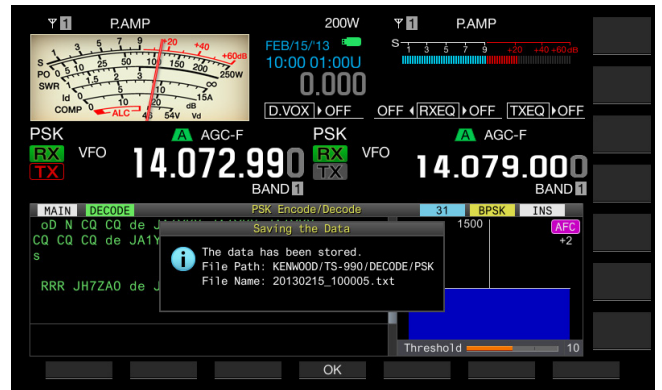
If **[SAVE]** (F4) is unavailable in the function key guide, press **[MORE]** (F1). An alternate key guide will appear.

5 Press **[OK]** (F4) to end.
Remove the USB flash drive only after Safe Removal of USB Flash Drive is executed. {page 12-1}

Note:

◆ The file name is given using the numbers and underscores representing the time and date, and the extension selected in Menu 2-12, "RTTY/PSK Log File Format", is also added. The data is displayed in the order of the year, underscore, hour, minute, and second.
Example:
Example: In the case of 10:20:30, February 15, 2013:
20130215_102030.txt

◆ The name of the storage folder is as follows:
KENWOOD/TS-990/DECODE/PSK

SELECTS THE FILE FORMAT AT THE TIME OF SAVING DATA

You can select whether the file is saved in the html format or text format.
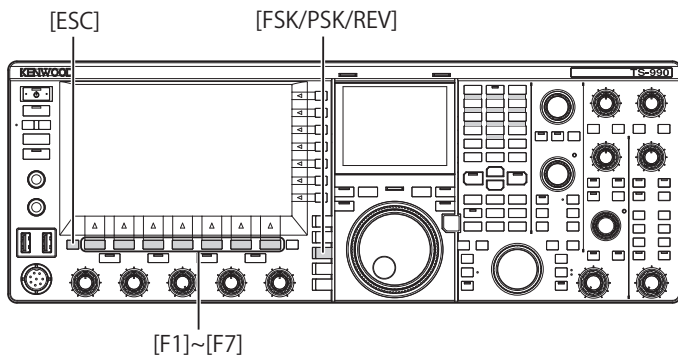
[ESC]   [FSK/PSK/REV]

[F1]~[F7]

1 Select Group No. 2, "Decoding & Encoding", from the **Menu** screen.

2 Access Menu 12, "RTTY/PSK Log File Format".

**3** Press **[SELECT]** (F4) to allow editing of the parameter box.
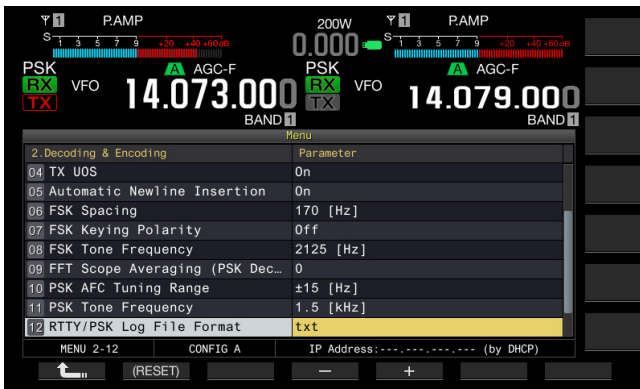
4 Press **[-]** (F4) or **[+]** (F5) to select "html" or "txt".
- The extension is either ".html" or ".txt".
- The default is "txt".

5 Press **[⬆]** (F1).

6 Press **[ESC]** to exit.

ADJUSTING THE RTTY THRESHOLD LEVEL OF PSK DECODING

The background noise on a signal when no RTTY data is being received may be erroneously recognized as a letter, causing unnecessary text to be displayed. The threshold level should be adjusted to reduce or eliminate this symptom. If there are many erroneous detections due to noise, increase the threshold level.
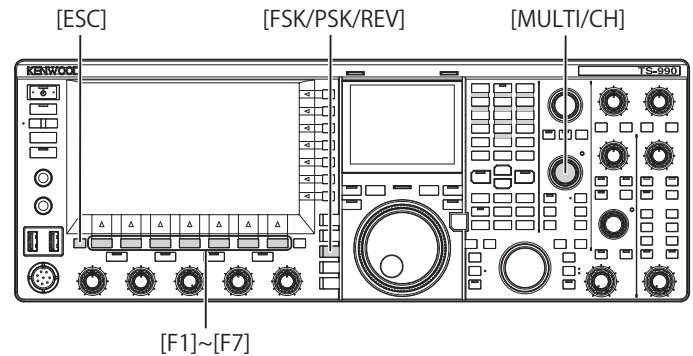
[ESC]   [FSK/PSK/REV]   [MULTI/CH]

[F1]~[F7]

1 Press **[FSK/ PSK/ REV]** to enter PSK mode.

2 Press **[DECODE]** (F3) to open the **PSK Encode/ Decode** screen.

3 Press **[THLD]** (F5) to allow editing of the threshold level.
- The threshold level configuration below the Waterfall display can be changed.
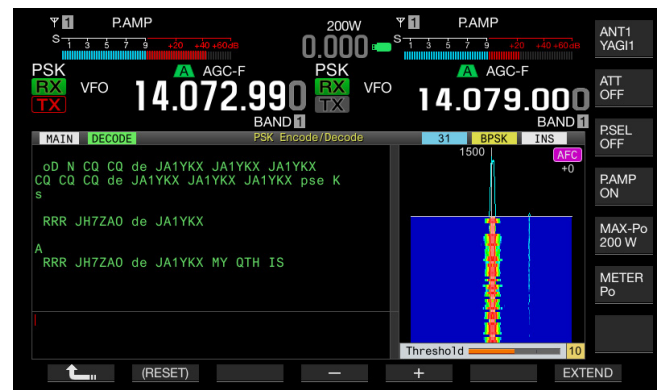
- If **[THLD]** (F5) is unavailable in the function key guide, press **[MORE]** (F1). An alternate key guide will appear.

4 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to adjust the level.
Pressing and holding **[(RESET)]** (F1) resets the configured parameter to the default. The default is "10".

5 Press **[⬆]** (F1).

6 Press **[ESC]** to exit.

# DISPLAYING THE SCOPE TO CHECK PSK TUNING

FFT SCOPE

The transceiver is equipped with an audio FET scope allowing you to observe the tuned status of the transceiver in PSK (FSK) mode. The audio FET scope appears in the **PSK Encode/Decode** screen.

If there are multiple signals present in the band, you can tune the target signal to be a 1500 Hz tone.

In PSK mode, you need to make an accurate zero-in. The vector scope appears on the sub screen. By observing the FFT scope and vector scope, you can zero-in on the target signal.

AVERAGING THE WAVEFORM IN THE FFT SCOPE

The waveform to be displayed on an FFT scope can be averaged. Waveform averaging reduces the effects of random noise, allowing you to observe the target signal.


[ESC]   [FSK/PSK/REV]

[F1]~[F7]   [S.DISP]
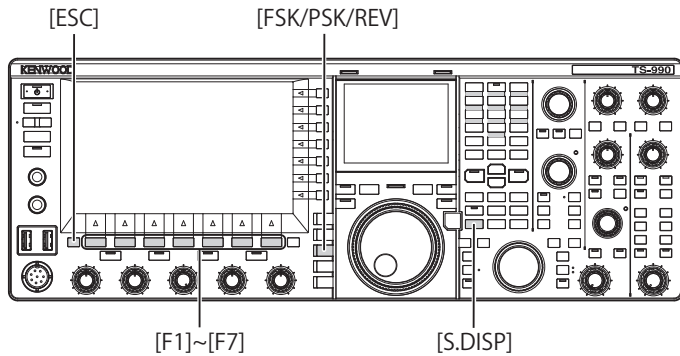
1   Select Group No. 2, "Decoding & Encoding", from the **Menu** screen.

2   Access Menu 09, "FFT Scope Averaging (PSK Decode)".

3   Press **[SELECT]** (F4) to allow editing of the parameter box.
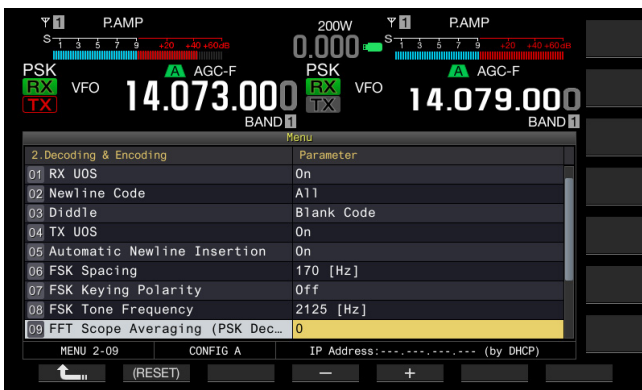
4   Press **[-]** (F4) or **[+]** (F5) to select one from "0" to "9".
    Increasing the parameter maximizes the noise component. The default is "0".

5   Press **[🔙]** (F1).

6   Press **[ESC]** to exit.

WATERFALL

The **Waterfall** screen uses spectrum linking with the audio FFT scope and displays the transition of frequency components contained in the received audio signal.
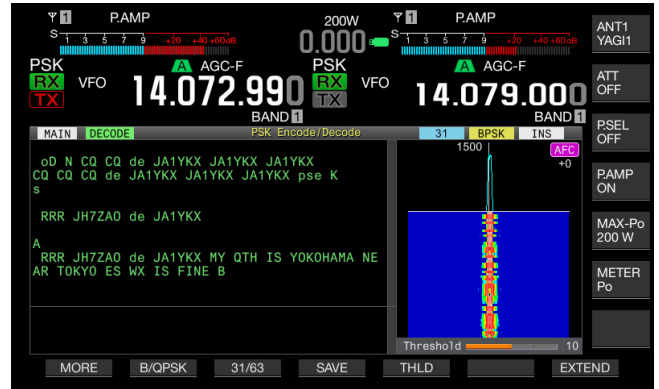
VECTOR SCOPE (SUB-SCREEN)

The vector scope displays how the received PSK signal is tuned. This allows you to tune the signal from the station you are in QSO with by observing their waveform on the vector scope.

Follow the procedure below to open the vector scope.

1   Press **[FSK/ PSK/ REV]** to enter PSK mode.

2   Press **[DECODE]** (F3) to open the **PSK Encode/ Decode** screen.

3   Press **[S.DISP/ SEL]** to display the vector scope.
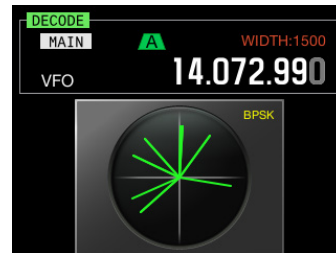
The sub-screen cycles as follows: Vector scope > Main band frequency and dial > Main band frequency and sub band frequency > Vector scope

4   Rotate the **Tuning** control to tune the signal until the traces displayed on the vector scope will be radiate in the correct directions from the center.
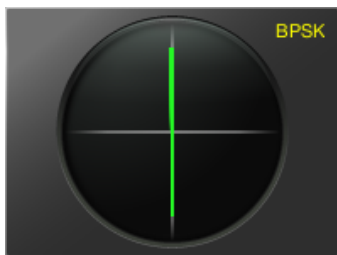
Tuned Correctly (BPSK Mode)

Tuned Correctly (QPSK Mode)

BPSK and QPSK "idle" Signal

Non-modulated Carrier Signal

Note:

◆ If the **PSK Encode/Decode** screen is open on the main screen, the **Vector Scope** screen opens by pressing **[S.DISP/SEL]**.

◆ Use Fine Tuning if it is not easy to tune. {page 4-14}

AFC (AUTOMATIC FREQUENCY CONTROL)

You can use the AFC (automatic frequency control) function to tune the PSK signal you are receiving. The tuning amount can be configured in Menu 2-10, "PSK AFC Tuning Range".

[ESC]   [FSK/PSK/REV]

[F1]~[F7]
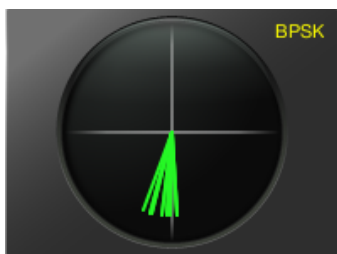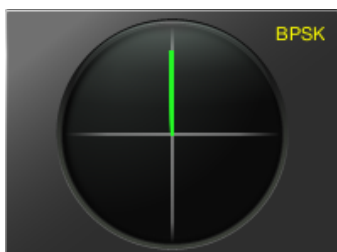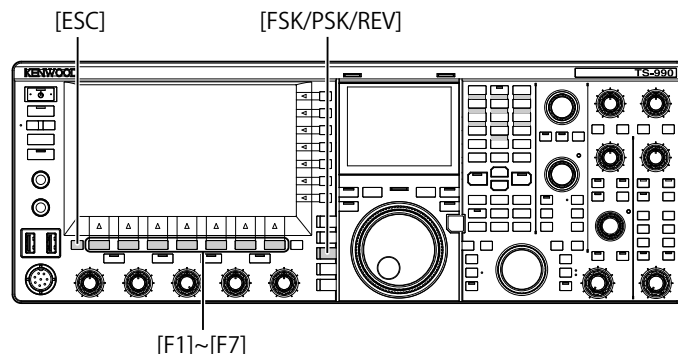
1   Press **[FSK/ PSK/ REV]** to enter PSK mode.

2   Press **[DECODE]** (F3) to open the **PSK Encode/ Decode** screen.

3   Press **[AFC]** (F6) to enable the AFC function.
   • "AFC" appears on the upper right side of the **PSK Encode/ Decode** screen. The frequency being corrected with the automatic frequency control appears below "AFC" on the screen.

   • If **[AFC]** (F6) is unavailable in the function key guide, press **[MORE]** (F1). An alternate key guide will appear.
   • Each time you press this key, the FET scope display cycles as follows: Blank > AFC > AFC and NET > Blank

Note:

◆ If you press and hold **[AFC]** (F6), the difference in frequency between the displayed frequency and the frequency of the PSK signal is added to or subtracted from the displayed frequency.

◆ If a PSK signal is outside the operating range of the AFC function, the AFC function does not function correctly.

◆ Even if the PSK signal is present in the operating range of the AFC function, the target signal, if it is weak, may not be correctly tuned.

◆ The AFC function can be used only with the PSK demodulator.

CONFIGURING THE AFC TUNING RANGE

You can use the AFC (automatic frequency control) function to configure the AFC's tuning range.

[ESC]

[F1]~[F7]
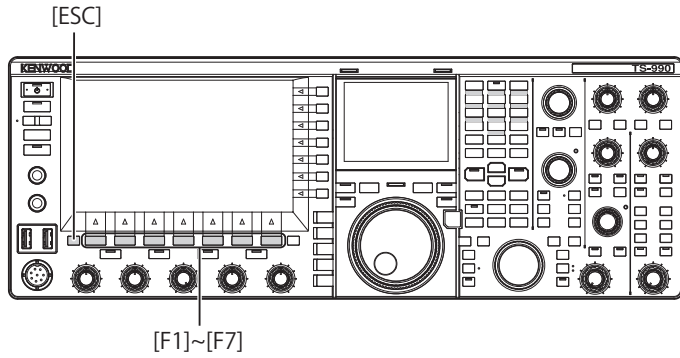
1 Select Group No. 2, "Decoding & Encoding", from the **Menu** screen.

2 Access Menu 10, "PSK AFC Tuning Range".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.
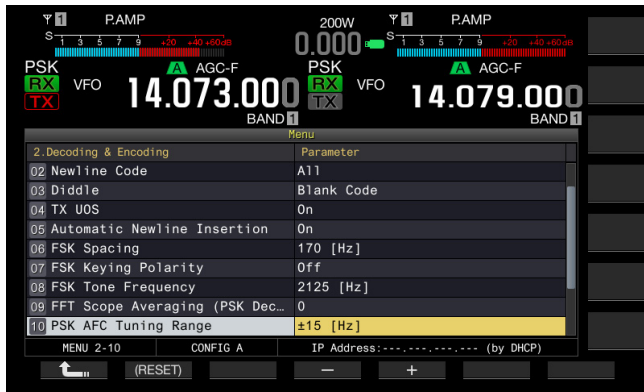
4 Press **[-]** (F4) or **[+]** (F5) to select "±8 [Hz]", or "±15 [Hz]".
   The default is "±15 [Hz]".

5 Press **[⬆]** (F1).

6 Press **[ESC]** to exit.

NET

You can transmit by applying the frequency that was automatically tuned with the AFC function while receiving.
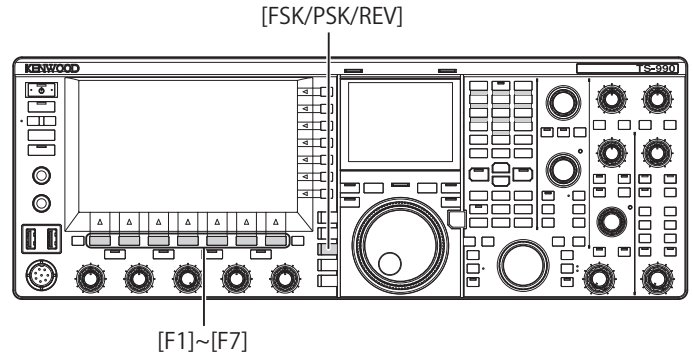
[FSK/PSK/REV]

[F1]~[F7]

1 Press **[FSK/ PSK/ REV]** to enter PSK mode.

2 Press **[DECODE]** (F3) to open the **PSK Encode/ Decode** screen.

3 Press **[AFC]** (F6) to select "AFC&NET".
   • "AFC" and "NET" light in the FFT scope.

   • If **[AFC]** (F5) is unavailable in the function key guide, press **[MORE]** (F1). An alternate key guide will appear.

SELECTING BPSK OR QPSK

PSK communication is made in either BPSK mode or QPSK mode. The BPSK mode is usually used, but the error correction capability available in QPSK mode enables a higher readability than that for BPSK.

[FSK/PSK/REV]

[F1]~[F7]

1   Press **[FSK/ PSK/ REV]** to enter PSK mode.
2   Press **[DECODE]** (F3) to open the **PSK Encode/ Decode** screen.
3   Press **[B/QPSK]** (F2).
    • Toggles between BPSK and QPSK. Toggles the display between "BPSK" and "QPSK" on the right of the status bar.

    • If **[B/QPSK]** (F5) is unavailable in the function key guide, press **[MORE]** (F1). An alternate key guide will appear.

Note:

◆ In PSK63 mode, the operation is fixed to BPSK.

SELECTING PSK31 OR PSK63

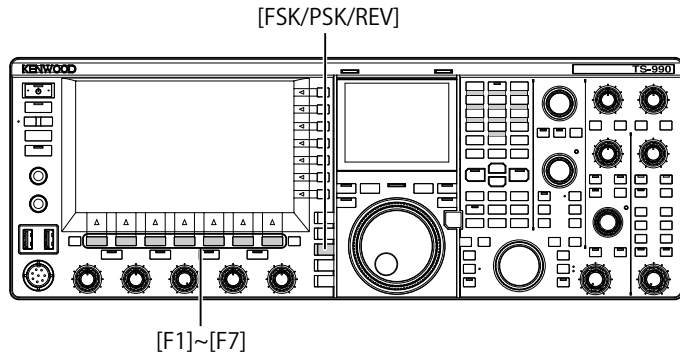The transceiver can operate in PSK31 and BPSK modes as well as in PSK63, which offers double the transfer rate. Follow the procedure below to select one of them.

[FSK/PSK/REV]

[F1]~[F7]

1   Press **[FSK/ PSK/ REV]** to enter PSK mode.
2   Press **[DECODE]** (F3) to open the **PSK Encode/ Decode** screen.
3   Press **[31/63]** (F3).
    • Toggles between BPSK31 and BPSK63 or QPSK31 and BPSK63. Toggles the display between "31" and "63" on the right of the status bar.
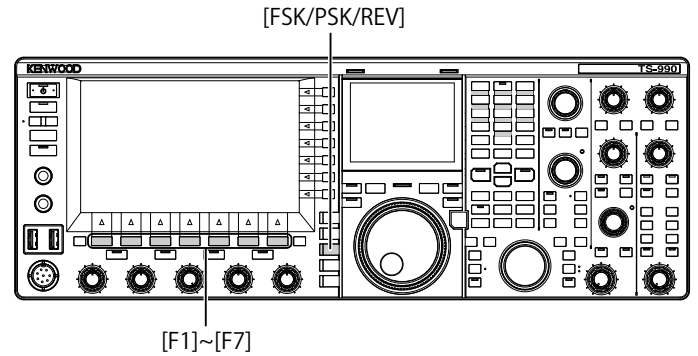

    • If **[31/63]** (F3) is unavailable in the function key guide, press **[MORE]** (F1). An alternate key guide will appear.
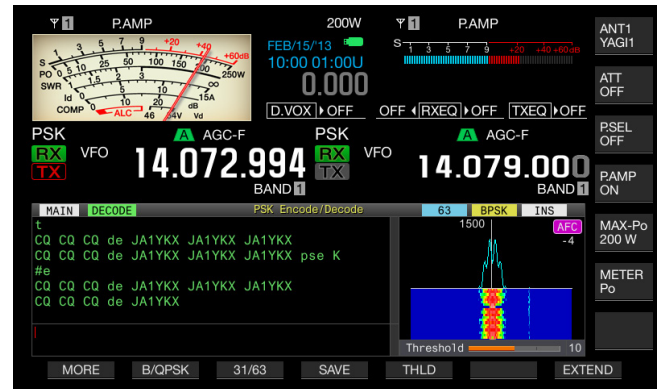
Note:

◆ PSK63 offers you the high speed transmission ratio; however, there is less tolerance of incorrect phase in the carrier wave. Hence, you need to accurately tune.

USING THE USB KEYBOARD TO TRANSMIT A TEXT STRING

You can connect a commercially available USB keyboard to the transceiver to enter and transmit a text string.

TRANSMITTING THE ENTERED TEXT STRING AS ENTERED

[FSK/PSK/REV]

[F1]~[F7]
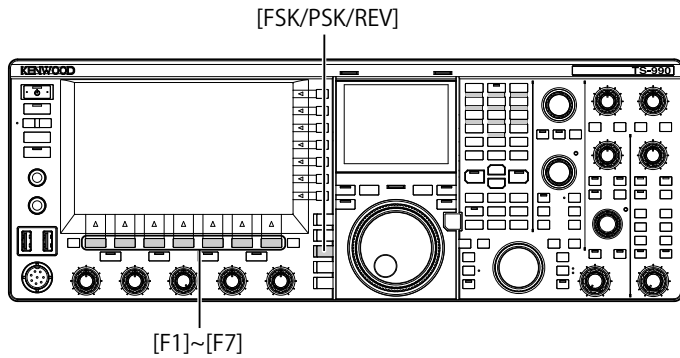
1   Connect a USB keyboard to the ⌁(USB-A) connector.

2   Press **[FSK/ PSK/ REV]** to enter PSK mode.

3   Press **[DECODE]** (F3) to open the **PSK Encode/ Decode** screen.

4   Press **[F12]** of a USB keyboard to transmit.
The "BUSY/TX" LED lights red and "ENCODE" appears on the status bar.

5   Enter the text strings using the USB keyboard.
   • The entered text string is placed and displayed in the text string buffer and transmitted as entered.
   • Each letter in the text string buffer changes its color in sequence when the letter is transmitted.
   • Each letter transmitted appears sequentially in the TX and RX Transcript.

6   Press **[F12]** of a USB keyboard to receive.

Note:
◆ If letters not transmitted yet remain in the text string buffer when **[F12]** is pressed at step 6, "WAIT" appears on the status bar. When the entire text string is transmitted, the transceiver enters the receive mode and the "BUSY/TX" LED and "WAIT" are unlit.

TEMPORARILY STORING AND TRANSMITTING THE TEXT STRING IN THE BUFFER
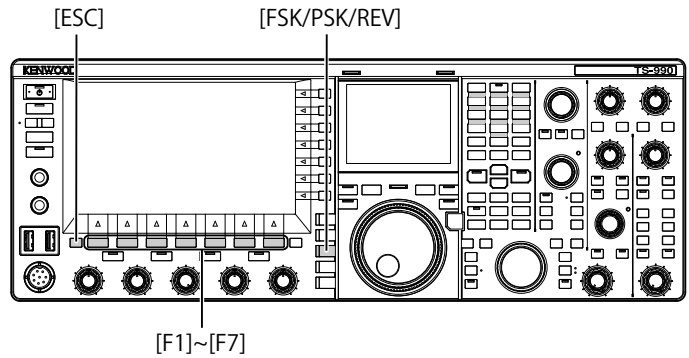
[ESC]   [FSK/PSK/REV]

[F1]~[F7]

1   Connect a USB keyboard to the ⌁ (USB-A) connector.

2   Press **[FSK/ PSK/ REV]** to enter PSK mode.

3   Press **[DECODE]** (F3) to open the **PSK Encode/ Decode** screen.

4   Enter the text strings using the USB keyboard.
The entered text string is temporarily stored in the text buffer.

5   Press **[F12]** on the USB keyboard to send the text string stored in the buffer.
   • The "BUSY/TX" LED lights red and "ENCODE" appears on the status bar when the transceiver is in a transmit state.
   • Each letter in the text string buffer changes its color in sequence when the letter is transmitted.

6   Press **[F12]** on the USB keyboard to receive.

Note:

◆ If letters not transmitted yet remain in the text string buffer when **[F12]** is pressed at step 6, "WAIT" appears on the status bar. When the entire text string is transmitted, the transceiver enters the receive mode and the "BUSY/TX" LED and "WAIT" are unlit.

◆ The transceiver enters the receiving mode if the **[ESC]** on the USB keyboard is pressed while the text string is being transmitted. The transmission of the text string ends, and any text waiting for transmission in the text string buffer is deleted.

◆ You can add time stamp and frequency information to the transmit and receive data displayed in the contents of transmission and reception.

◆ Transmitting the text string using the USB keyboard while the display of transmission and reception can be paused by a press of **[PAUSE]** (F3), another press of **[PAUSE]**(F3) will release it.

◆ The text string temporarily stored in the text string buffer can contain a maximum of 4,300 characters.

◆ Following are the available characters and symbols with "English" selected in Menu 9-01. If you wish to enter the Japanese characters, download the Japanese instruction manual to refer to the available characters and symbols for the Japanese characters.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
P	Q	R	S	T	U	V	W	E	X	Y	Z			
0	1	2	3	4	5	6	7	8	9					
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
p	q	r	s	t	u	v	w	x	y	z				
À	Á	Â	Ã	Ä	Å	Æ	Ç	È	É	Ê	Ë	Ì	Í	Î
Ï	Ð	Ñ	Ò	Ó	Ô	Õ	Ö	Ø	Ù	Ú	Û	Ü	Ý	Þ
à	á	â	ã	ä	å	æ	ç	è	é	ê	ë	ì	í	î
ï	ð	ñ	ò	ó	ô	õ	ö	ø	ù	ú	û	ü	ý	þ
ÿ	ß													
!	"	#	$	%	&	'	(	)	*	+	,	-	.	/
:	;	<	=	>	?	@	[	\	]	^	_	`	{	|
}	~	¡	¢	£	¤	¥	¦	§	¨	©	ª	«	¬	®
¯	°	±	²	³	´	µ	¶	•	¸	¹	º	»	¼	½
¾	¿	No	÷					Space		Line Break				

UTILIZING AN PSK MESSAGE MEMORY

You can save frequently used fixed phases as PSK messages in the memory. If you employ the automatic transmit and receive functions in the message, it can be sent very easily. You can store up to eight messages.
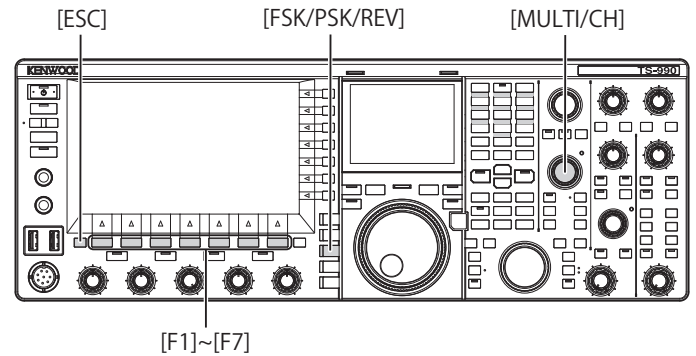
STORING MESSAGES

[ESC]   [FSK/PSK/REV]   [MULTI/CH]

[F1]~[F7]

1 Press **[FSK/ PSK/ REV]** to enter PSK mode.

2 Press **[DECODE]** (F3) to open the **PSK Encode/ Decode** screen.

3 Press **[MEMORY]** (F5) to open the **PSK Message** screen.

If **[MEMORY]** (F5) is unavailable in the function key guide, press **[MORE]** (F2). An alternate key guide will appear.

4 Press **[▲]** (F3) or **[▼]** (F4), or rotate the **MULTI/CH** control to select a channel to which a CW message will be stored.
If **[▲]** (F3) and **[▼]** (F4) are unavailable in the key guide, press **[MORE]** (F2).

5 Press **[MSG]** (F5) to allow editing of the message for the selected channel.

6 Use functions keys, the **MULTI/CH** control, or a USB keyboard to enter a text string.
[SPACE] (F1): Press to enter one space.

[-] (F3) or **[+]** (F2): Press to scroll through available letters.

[◀] (F4) and [▶] (F5): Press to move the cursor to the left and right.

[SAVE] (F6): Press to store the selected characters.

[BACK SPACE] (F): Press to delete the character to the left of the cursor.

[DEL] (F): Press to delete the character to the right of the cursor.

[CHAR] (F): Changes the character type.

Each time you press **[CHAR]** (F), the character type cycles through the following sequence:

ABC (upper case) > abc (lower case) > ÀÁÂ (upper case) > àáâ (lower case) > !"# (symbols) > ABC (upper case)

■ Available alphanumeric characters and symbols (a maximum of 70 characters)

Following are the available characters and symbols with "English" selected in Menu 9-01. If you wish to enter the Japanese characters, download the Japanese instruction manual to refer to the available characters and symbols for the Japanese characters.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
P	Q	R	S	T	U	V	W	E	X	Y	Z			
0	1	2	3	4	5	6	7	8	9					
a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
p	q	r	s	t	u	v	w	x	y	z				
À	Á	Â	Ã	Ä	Å	Æ	Ç	È	É	Ê	Ë	Ì	Í	Î
Ï	Ð	Ñ	Ò	Ó	Ô	Õ	Ö	Ø	Ù	Ú	Û	Ü	Ý	Þ
à	á	â	ã	ä	å	æ	ç	è	é	ê	ë	ì	í	î
ï	ð	ñ	ò	ó	ô	õ	ö	ø	ù	ú	û	ü	ý	þ
ÿ	ß													
!	"	#	$	%	&	'	(	)	*	+	,	-	.	/
:	;	<	=	>	?	@	[	\	]	^	_	`	{	|
}	~	¡	¢	£	¤	¥	¦	§	¨	©	ª	«	¬	®
¯	°	±	²	³	´	µ	¶	•	¸	¹	º	»	¼	½
¾	¿	No	÷									Space	Line Break	

- Pressing **[CANCEL]** (F7) deletes the contents being edited and ends the character entry.

7 Press **[SAVE]** (F6) to store the edited message.

8 Press **[⬒]** (F1).

9 Press **[ESC]** to exit.

CONFIGURING AUTOMATIC TRANSMISSION AND RECEPTION FOR THE PSK MESSAGE MEMORY

If you select an PSK message memory channel, you can configure independently for each message memory channel whether or not the PSK message is transmitted automatically and whether or not the transceiver enters receive after it's been sent.

Automatic Transmit sends the PSK message as soon as the channel where a PSK message is stored is selected. The transmit state is maintained even after the entire message is transmitted. Therefore, this function is convenient if you wish to transmit your own text string using a USB keyboard after a PSK message is transmitted using the message memory.

Automatic Receive is a function to revert to the receive mode after an PSKY message has been sent.

Selecting the channel number, that contains a PSK message to be sent, automatically starts transmitting the message, or the message temporarily stored in the buffer for the text string can be sent with a press of [F12] of a USB keyboard. The transceiver can automatically enter the receive mode after the PSK message is transmitted.

A combination of automatic transmission and automatic reception makes it possible to transmit and receive messages automatically.

[ESC]   [FSK/PSK/REV]   [MULTI/CH]

[F1]~[F7]
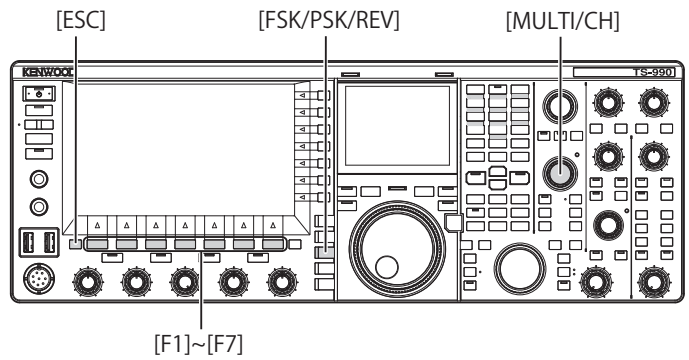
1 Press **[FSK/ PSK/ REV]** to enter PSK mode.

2 Press **[DECODE]** (F3) to open the **PSK Encode/ Decode** screen.

3 Press **[MEMORY]** (F5) to open the **PSK Message** screen.

If **[MEMORY]** (F5) is unavailable in the function key guide, press **[MORE]** (F1). An alternate key guide will appear.

4 Press **[⬆]** (F3) or **[⬇]** (F4), or rotate the **MULTI/CH** control to select a channel where a CW message to be sent automatically is stored.

5 Press **[AUTO.TX]** (F6) to enable automatic transmission.

The transceiver can be configured to allow an RTTY message to be transmitted automatically from the corresponding channel when "AUTO TX" appears on the right side of the RTTY message. Even if the "AUTO TX" disappears, the PSK message for that channel is temporarily stored in the buffer for a text string and will not automatically be sent.

6 Press **[AUTO.RX]** (F7) to enable automatic transmission.

You can configure the transceiver so that the transceiver will revert to a receive state after an PSK message is transmitted from the corresponding channel when "AUTO RX" appears on the right side of the PSK message. Even if "AUTO RX"

disappears, the transceiver does not revert to the receive mode after the PSK message for that channel is sent.
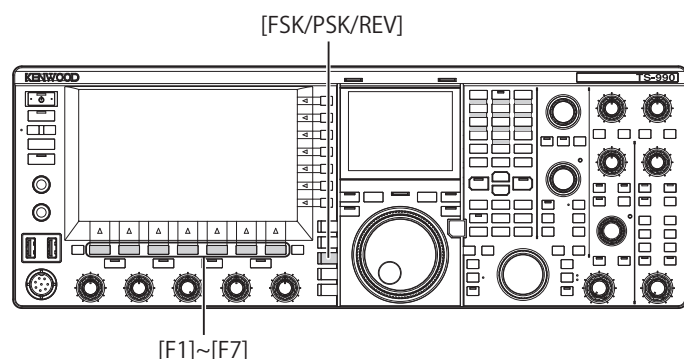
7 Press **[🔺]** (F1).

8 Press **[ESC]** to exit.

Note:

◆ Select the channel where the PSK message is stored. After you confirm that a text string (PSK message) has been transferred to the buffer of a text string, press **[F12]** of the USB keyboard.

◆ To place the transceiver in the receive mode after the PSK message for which automatic reception is disabled, press **[F12]** of the USB keyboard.

SENDING A TEXT STRING STORED IN PSK MESSAGE MEMORY

You can transmit messages entered in the PSK message memory.

[FSK/PSK/REV]

[F1]~[F7]

1 Press **[FSK/ PSK/ REV]** to enter PSK mode.

2 Press **[DECODE]** (F3) to open the **PSK Encode/ Decode** screen.

3 Press **[MEMORY]** (F5) to open the **PSK Message** screen.
If **[MEMORY]** (F5) is unavailable in the function key guide, press **[MORE]** (F1). An alternate key guide will appear.

4 Press **[CH1]** (F3), **[CH2]** (F4), **[CH3]** (F5), **[CH4]** (F6), **[CH5]** (F3), **[CH6]** (F4), **[CH7]** (F5), or **[CH8]** (F6) to select the channel for which the message to be sent has been stored.

- The PSK message will not automatically be transmitted from the channel for which automatic transmission of the PSK message is disabled

- The key guide for **[F1]** through **[F7]** are the key guide for configuration, including **[🔺]** (F1), **[MORE]** (F2), **[⏏]** (F3), **[⏬]** (F4), **[MSG]** (F5), **[AUTO.TX]** (F6), and **[AUTO.RX]** (F7). In this case, press **[MORE]** (F2) so that the key guide will alternate between the key guide for **[🔺]** (F1), **[MORE]** (F2), **[CH1]** (F3), **[CH2]** (F4), **[CH3]** (F5), **[CH4]** (F6), and key guide for **[NEXT]** (F7) and the key guide for **[🔺]** (F1), **[MORE]** (F2), **[CH5]** (F3), **[CH6]** (F4), **[CH7]** (F5), **[CH8]** (F6), and **[NEXT]** (F7).

- The transceiver enters the receive mode after the PSK message displayed along with "AUTO RX" on the right side is sent.

CONFIGURATION FOR PSK ENCODING AND DECODING

DISPLAYING THE TIME STAMP

You can display the timestamp whenever transmission and reception alternate. You can display frequency information as well as the timestamp.

[MENU] [MULTI/CH]

[F1]~[F7]
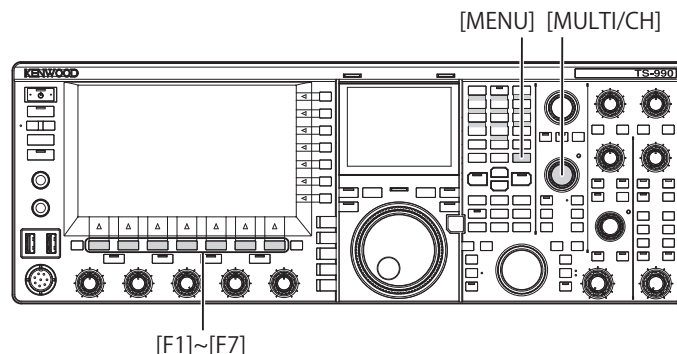
1 Select Group No. 2, "Decoding & Encoding", from the **Menu** screen.

2 Access Menu 13, "RTTY/PSK Time Stamp".

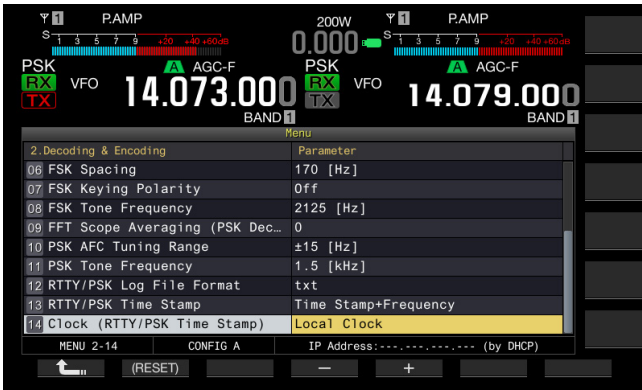**3** Press **[SELECT]** (F4) to allow editing of the parameter box.
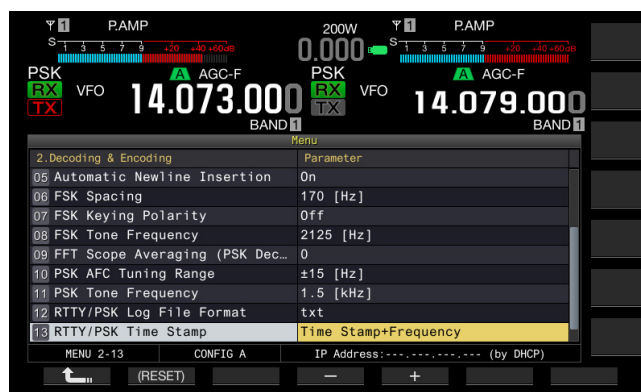
4 Press **[–]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select either "Off", "Time Stamp", or "Time Stamp + Frequency".
The default is "Time Stamp + Frequency".

5 Press **[🔺]** (F1).

6 Press **[MENU]** to exit.

SELECTING THE TIMESTAMP TIME

You can select whether the time configured for the Local Clock or the Secondary Clock is applied to the time displayed for the timestamp. Refer to "CLOCK DISPLAY AND TIMER".

1 Select Group No. 2, "Decoding & Encoding", from the **Menu** screen.

2 Access Menu 14, "Clock (RTTY/PSK Time Stamp)".

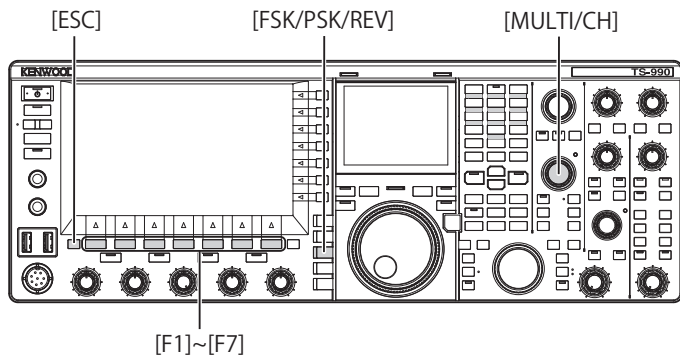**3** Press **[SELECT]** (F4) to allow editing of the parameter box.

4 Press **[–]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select "Local Clock" or "Secondary Clock". The default is "Lock Clock".

5 Press **[⬑]** (F1).

6 Press **[MENU]** to exit.

PSK-RELATED CONFIGURATION

CONFIGURING THE PSK TONE FREQUENCY

You can configure the tone frequency for reception in PSK mode.

[ESC]   [FSK/PSK/REV]   [MULTI/CH]

[F1]~[F7]

1 Select Group No. 2, "Decoding & Encoding", from the **Menu** screen.

2 Access Menu 11, "PSK Tone Frequency".

3 Press **[SELECT]** (F4) to allow editing of the parameter box.

4 Press **[-]** (F4) or **[+]** (F5), or rotate the **MULTI/CH** control to select "1.0 [kHz]", "1.5 [kHz]", or "2.0 [kHz]". The default is "1.5 [kHz]"

5 Press **[⬑]** (F1).

6 Press **[ESC]** to exit.

REVERSING THE PHASE CHANGE DIRECTION IN QPSK

If the received PSK signal is not decoded properly, switch the BFO frequency on the LSB side to that on the USB side and try decoding the signal.

If the BFO frequency for the received PSK signal is Reversed (the lower sideband and upper sideband frequencies are Reversed), the PSK signal cannot be decoded properly.

Pressing and holding **[FSK/PSK/REV]** allows the decoding of the Reverse signal.

USING A PC TO COMMUNICATE IN PSK MODE

This is the method of operation in PSK mode using a PC, instead of using the demodulator, encoder, and decoder built in to the transceiver. Connect the transceiver and a PC running applications supporting PSK communication so that you can operate the transceiver in SSB or SSB-DATA mode.

Refer to the following page for operation examples.

- CONNECTION TO A PC

Note:

◆ In the case of operation in the digital mode such as PSK31 using a PC, you must adjust the audio output level from PC until the ALC meter of the transceiver begins to swing.
  Also, you must disable the speech processor.

▶ **Index**   ▶ **Contents**