

KENWOOD

HF TRANSCEIVER

TS-440S



TS-440S HF TRANSCEIVER

The TS-440S is an HF transceiver designed for SSB, CW, AM, FM and AFSK modes of operation on all Amateur bands including the new WARC bands. It is the ultimate in compact size with the automatic antenna tuner built-in and featuring a highly efficient final amplifier cooling system. It incorporates a 100 kHz to 30 MHz general coverage receiver having superior dynamic range.

Advanced digital technology controls the various functions, including dual digital VFOs, 100 memory channels, keyboard frequency selection, memory and programmable band scan, and RIT plus XIT. Additional operating features include full break-in CW (switchable to semi break-in), built-in automatic antenna tuner, IF shift, notch filter, IF filter selection, RF attenuator, speech processor, and other features for ease of operation and added versatility. The unit may be ordered with or without the antenna tuner installed. The antenna tuner may be installed later as a field modification.



FEATURES

160-m to 10-m Amateur Band Operation with 100 kHz to 30 MHz General Coverage Receiver

The TS-440S covers all Amateur bands from 160 to 10 meters, including the new WARC 30, 17, and 12 meter bands. Its superior dynamic range general coverage receiver provides reception on any frequency from 100 kHz to 30 MHz. An innovative triple conversion, digital PLL synthesized system provides outstanding frequency stability and accuracy.

All-Mode Operation

Modes of operation include USB, LSB, CW, AM, FM and AFSK (with AFSK audio in/out terminal). Mode selection is quickly accomplished through use of front panel mode keys. An adjacent LED confirms the selection. When a mode key is depressed, the first letter of the mode is announced in International Morse code, through the internal speaker.

Automatic Antenna Tuner (80-10 meters) Built-in

The TS-440S is available with a completely automatic antenna tuner covering all Amateur bands from 80 through 10 meters built-in, or may be ordered without the tuner installed.

100% Duty Cycle Transmitter

The 100 W final amplifier stage is mounted directly on its die-cast aluminium heat sink. RF power input rated 200 W PEP on SSB, 200 W DC on CW, AFSK and FM, 110 W DC on AM mode.

The high efficiency of the cooling system allows continuous transmission (Key Down) at full power output for periods exceeding one hour. (The PS-50 Heavy Duty Power Supply is required for full power key down transmission such as RTTY, SSTV or FM)

Compact and Lightweight

Designed with every conceivable feature plus an automatic antenna tuner built-in, the TS-440S measures only 270 (10.63) W x 96 (3.78) H x 313 (12.32) D, and weighs only 7.1 kg (15.65 lbs.), allowing expanded operation as a mobile, base, or on DX-peditions.



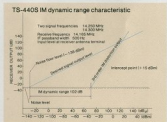
CW Full Break-In, Semi Break-In, and VOX Circuit

A full break-in capability allows the DX or contest operator to respond more quickly to the calling station. To the "ragchewer", it means a more natural conversation. This capability is made possible through the use of CMOS ICs in the timing logic circuit. The actual switching is accomplished electronically, with a receiver protection by high speed reed relay for almost silent operation. The system features semi break-in, side tone monitor on CW mode, and VOX controls for SSB operation. VOX controls are located on the top of the cabinet.



Super Receiver Dynamic Range with KENWOOD Dyna-Mix High Sensitivity Direct Mixing System

The receiver front end has been specifically designed to provide superior dynamic range. Use of 2SK125 junction-type FETs, in the high sensitivity direct balanced mixer circuit results in outstanding two-signal characteristics accompanied by a substantially improved noise floor level. The intermodulation dynamic range is 102 dB, with an overall intercept point of +15 dBm, noise floor level of -138 dBm. (An optional 500 Hz CW filter YK-88C installed)



Superb Interference Reduction

(1) Dual IF Crystal Filter Improves SSB Operation

The optional YK-88S or YK-88SN SSB filter, when inserted into the IF circuit that is common to both the transmitter and receiver sections, improves receiver the already excellent signal-to-noise ratio and selectivity.

(2) IF shift circuit

Allows the IF passband to be moved away from interfering signals while keeping the desired signal optimally placed for best gain and signal-to-noise ratio.

- (3) **Tunable NOTCH filter built-in**
A sharp notch filter is built into the audio circuit. The Kenwood notch filter is tunable, to permit adjustment of system for best interference rejection.

Selectable IF Filters

The TS-440S offers a fully flexible system of IF filter selection when optional filters are installed (YK-88S (2.4 kHz) or YK-88SN (1.8 kHz) for SSB, YK-88C (500 Hz) or YK-88CN (270 Hz) for CW). The front panel selectivity switch may be set to "AUTO", in which case the optimum filter bandwidth is automatically chosen for the mode selected, e.g. YK-88C for CW, YK-88S for SSB etc. or the selectivity switch (N, M₁, M₂ and W) may be used to select filters manually, thereby allowing the operator to choose an alternative bandwidths depending on QRM conditions for optimum reception.

MODE POSITION	SSB	CW	AM	FEB	FM
AUTO	"1.8 kHz" *YK-88S installed	"500 Hz" *YK-88C installed	6 kHz	"450 Hz" *YK-88CN installed	"270 Hz"
N	"1.8 kHz"	"500 Hz"	"270 Hz"	6 kHz	12 kHz
M ₁	"2.4 kHz"	"270 Hz"	6 kHz		
M ₂	"2.4 kHz"	6 kHz			

* option YK-88S installed ** option YK-88C installed
* option YK-88SN installed ** option YK-88CN installed

Frequency Control Function, using Digital VFO

- (1) **10 Hz step dual digital VFOs**
Built-in 10 Hz (100 Hz in AM, FM mode) step dual digital VFOs operate independently of each other, allowing for ease of split frequency or cross-band operation in different modes without the need to separate VFO.

An "A"=B switch makes it possible to quickly duplicate the tuning data (frequency, mode, RIT/XIT data) programmed into the active VFO, in the data banks of the inactive VFO. A "SPLIT" switch is available for split frequency operations. "T-F SET" switch is provided to permit reversal of transmit and receive frequencies during split frequency operations.

- (2) **UP/DOWN switches**

Front panel UP/DOWN band switches allow easy selection of the desired Amateur band. A 1 MHz step switch provides 1 MHz band steps across the entire 100 kHz–30 MHz coverage.

- (3) **100 memories store frequency, band and mode**

100 memory channels allow storage of frequency, band, and mode information, providing increased convenience with simplicity of operation. The 100 memory channels are divided into 10 groups of 10 channels each. 10 memory channels store transmit and receive frequencies independently, allowing repeater or split frequency operation.

- (4) **Keyboard frequency selection**

The VFO frequency may be directly entered using the front panel number keys. Simply press the "ENT" key, followed by the desired frequency.

- (5) **Memory Channel Selection**

The memory channel may be easily selected using the 10-key pad, VFO knob, or UP/DOWN switches on the microphone.

- (6) **Memory Scroll**

Depressing the "M IN" switch, a convenient function "memory scroll" may be used to check memory channel data or to find the vacant channel on the display without changing operating frequency and mode.

- (7) **Memory and dual programmable band scan**

• Memory scan

To permit adjustment of system for best scan, any or all 100 memory channels may be scanned.

• Programmable band scan

The front panel "PGS-1 (CH-6)" and "PGS-2 (CH-8)" switches allow selection of the desired frequency groups to be scanned. Scanning between memory channels 6 and 7, or between channels 8 and 9 is possible. Both groups may also be scanned, one after the other.

• Adjustable scanning speed

The scan speed may be changed by depressing the "SCAN" switch (FAST/SLOW) during scan. In addition, the scan direction may be changed by depressing the band UP/DOWN switches (in MS only). The microphone UP/DOWN switches may also be used.

The scan direction may also be changed by shifting the position of main VFO knob during scanning.

- (8) **Built-in RIT/XIT**

"RIT" (Receiver Incremental Tuning) shifts only the receiver frequency, to tune in stations slightly off frequency. "XIT" (Transmitter Incremental Tuning) shifts only the Transmitter frequency, when a DX station may be listening "off frequency".

- (9) **Optional TU-8 CTCSS encoder**

Channels 90 through 99 are used for split frequency memory. When the optional TU-8 CTCSS encoder is installed, the tone unit is automatically activated.

Microphone Controls and Functions

Using the UP/DOWN and P.T.T. switches on the microphone, the operating frequency, VFO shift, memory channel shift, or scan stop function may be controlled, depending on the setting of the appropriate front panel controls.

All-Mode Squelch Circuit

The squelch circuit is effective in suppressing background noise in all operating modes.

RF Attenuator

A 20 dB RF attenuator, which can be switched into the receiver's front end, provides optimum rejection of intermodulation distortion from extremely strong signals.

Switchable AGC Circuit (FAST/SLOW)

The automatic gain control (AGC) is activated by a 2-position (FAST/SLOW) switch, to provide optimum receiver operation in CW, SSB and AM modes, and under all signal strength conditions.

Adjustable VFO Tuning Torque

The tuning control torque is adjustable using the outer ring of the main knob.

Non-Volatile Operating System with Lithium Battery Memory Back-up

All KENWOOD transceivers retain microcoded operating functions when the lithium memory cells fail. No factory re-programming is necessary! Memory and VFO information is backed-up by an internal lithium battery (estimated 5 year life).

Optional Personal Computer Control (IF-232C/IC-10)

The interface unit is compatible with computers with an accessible RS-232C port. Software is not available from KENWOOD.



Multi-function Meter, with SWR Circuit

New multi-function meter indicates signal strength during reception, RF power, ALC and auto-calibrated SWR on transmit.

Fluorescent Tube Digital Display

The fluorescent tube digital display indicates frequency, memory channel, scan, VFO A/B, SPLIT, RIT, XIT and RIT/XIT frequency (2 digit). The actual operating frequency, to 10 Hz (AM, FM: 100 Hz), on any band, and in any mode, is displayed, without need for re-calibration. The use of a fluorescent tube display makes reading easy, and minimizes eye fatigue.

LED Indicators for Miscellaneous Functions.

"ON AIR", "1 MHz", "F. LOCK", "NOTCH", "AT-TUNE", "M. SCR"

Optional Voice Synthesizer Unit

An optional VS-1 "Voice Synthesizer Unit", which announces the operating frequency on demand by depression of the front panel "VOICE" key, is available. Installation within the cabinet is simple and easy.

Additional Features, plus Accessory Terminals

• "F. LOCK" switch

An "F. LOCK" switch protects against accidental frequency shift that might occur if the tuning knob were accidentally bumped.

• Built-in noise blander

The noise blander eliminates pulse-type interference such as ignition noise.

• Built-in speech processor

A front panel switch activates the speech processor circuit, with an audio compression amplifier and change in ALC time constant, resulting in a marked improvement in intelligibility, and a substantial increase in average "talk-power".

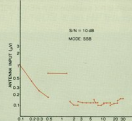
• Input/output terminals

Remote control terminal, accessory terminals 1 and 2, optional accessory terminal, audio in/out terminal for AFSK, key terminal.

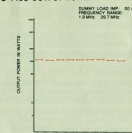
• Standard Accessories

- MC-425 UP/DOWN microphone (U.S.A. version only)
- DC cable with fuse
- CAL code
- 7 pin DIN plug
- Knob for vox control

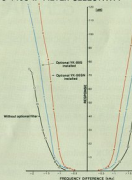
TS-440S SENSITIVITY



TS-440S OUTPUT POWER



TS-440S IF FILTER SELECTIVITY



IF unit

Compact, and stable VFO mechanism



The 10 Hz step, high stability dual digital VFOs are a pulse counting optical type designed to be compact and lightweight, using a new integrated phototransistor and module. By turning the silver outer-ring of the main VFO knob, tuning "feel" may be easily adjusted to the desired torque, coupled with a strong flywheel effect.

PLL circuit



The TS-440S uses a microcomputer controlled digital PLL circuit which controls frequency in 10 Hz steps using a single crystal oscillator to provide highly accurate and stable frequency control. This reference frequency (36 MHz) is accurate to ± 10 ppm between -10°C and $+50^{\circ}\text{C}$. This circuit consists of five PLL loops covering 100 kHz to 30 kHz.

PLL unit

Fan VS-1 (option)

RF unit
Filter unit



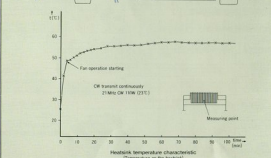
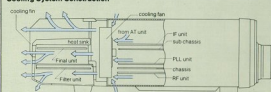
New highly efficient, cooling system

An improved cooling system allows operation on a 100% transmit duty cycle basis for periods exceeding one hour. The heat sink cooling fins are centrally located above the 100 watt final amplifier.

The low pass filter unit has a two-level partition with an air flow channel to ensure maximum cooling. This figure shows the heat sink temperature characteristic.



Cooling System Construction



IF unit



VOX switch

Digital control circuit

The TS-440S digital control circuit uses an 8-bit microprocessor with 16K of external ROM and 2K of external RAM. The common bus used for data exchange between the microprocessor and RAM, and between the microprocessor and ROM is also connected in parallel to the two ICs for extended I/O and IC kit. IC-10 (option) for interface to a personal computer through the use of optional level translator "IF-232C".

Control servo motors

Display unit



Automatic Antenna Tuner

Forward and reflected waves are detected by a directional coupler. Signals proportional to the antenna line voltage and current are processed for phase comparison. The control servo motors turn two variable capacitors for minimum SWR. When SWR is minimized, the motors stop automatically. Worm gear drive is used to minimize noise.

VOICE switch:

Announces the frequency when an optional VS-1 is installed inside the cabinet.

NB (Noise Blanker) switch**ATT (RF Attenuator) (-20 dB)****VOX control**

VOX GAIN/DELAY/ANTI-VOX control

Multi-Function Meter**MODE/Ten keys**

- **MODE:** Mode selection accomplished through use of mode keys, with an adjacent LED. International Morse Code confirms the selected mode.
- **PG.S1:** Programmable band scan 1.
- **PG.S2:** Programmable band scan 2. Depress the PG.S1 to scan from the frequency stored in CH-6 to CH-7. Depress the PG.S2 to scan from CH-8 to CH-9.
- **Ten keys:** Direct keyboard frequency entry.

FUNCTION switches

- **RIT:** Receiver Incremental Tuning.
- **XIT:** Transmitter Incremental Tuning.
- **T-F SET:** Depress this switch to "SPLIT" or momentarily interchange reception frequency with transmission frequency. Frequency "SPLITTING" is possible only in receive and in ineffective during transmission.
- **A/B:** Selects the VFO A or VFO B.
- **SPLIT:** For split frequency operations.
- **A=B:** During VFO operation, press this switch to equalize the frequency and mode of the idle VFO to that of the active VFO.



MIC → CAR
(Carrier level) control

SQ → NOTCH
control

Meter Switch (ALC/RF/SWR)

Used to select the meter function.

AT TUNER (Antenna tuner tuning) switch

Used when operating the transceiver in conjunction with the built-in antenna tuner.

AUTO/THRU switch

AUTO: Antenna tuner is on, THRU: Antenna tuner is off

Stand-by switch

SEND: Transmit, REC: Receive.

Program switches

- Used to select memory scan, programmable band scan, VFO or memory function.
- **M>V:** Used to transfer memory data to the active VFO.
- **SCAN:** Used to activate or stop scan (Programmable band scan: VFO operation/memory scan: memory channel operation)

1 MHz step switch

ON: 1 MHz steps
OFF: Band steps the Amateur band.

Band switch

Used to select the Amateur band or 1 MHz frequency step.

F. LOCK switch

Press this switch to lock the VFO and BAND switches.

- **CLEAR**
- **VFO/M:** Used to switch alternately between VFO and memory channel.
- **M.IN:** Used to store data in memory channel.
- **ENT:** Directly entered frequency using the front panel number keys.

AF GAIN
(Audio Frequency)
→ RF control

RIT → IF SHIFT control

SELECTIVITY switch

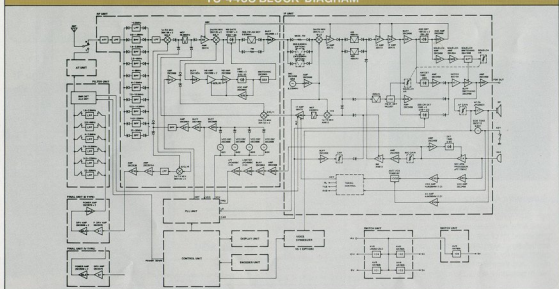
Used to select a combination of IF filter, "AUTO": Automatically change the selectivity, depending on each mode.

AGC switch

Used to select time constant for AGC circuit.

NOTCH switch

PROC (Speech processor) switch
Used during SSB, AM and FM modes.

TS-440S BLOCK DIAGRAM

OPTIONAL ACCESSORIES

AT-440: Automatic Antenna Tuner Unit

The AT-440 is an optional automatic antenna tuner that can be installed in the TS-440S.

[FEATURES]

- Coverage of 80 through 10 meters, including the new WARC bands
- Automatic motor speed control. The motors automatically stop when the SWR drops to its minimum value.
- The AUTO-THRU circuit is disabled during transmission to protect the fine transistors in case the AUTO-THRU switch is accidentally operated.
- The "tune" condition for automatic antenna tuning remains unchanged during transmission when the "AT" switch is depressed.

[SPECIFICATIONS]

- Frequency Range: 3.5 MHz—29.7 MHz
- Input Impedance: 50 Ω unbalanced
- Output Impedance: 200—150 Ω unbalanced
- Insertion Loss: Less than 1 dB
- Through Power: 100 W
- Maximum Tuning Time: Less than 30 seconds



AT-250: Automatic Antenna Tuner (160—10-m bands)

The AT-250 features an AC power supply with DC terminals, a built-in SWR/POWER meter, and four separate antenna connectors.



AT-130: Antenna Tuner (80—10-m bands)

A compact and lightweight antenna tuner designed for base or mobile use.



SP-430: External Speaker

It is an attractive, compact and low-distortion external speaker designed for base station use.



SP-40 Compact Mobile Speaker (4 Ω)



Compact and smart, high quality external speakers, provide flexibility of installation for maximum convenience.

SP-50B Mobile Speaker (8 Ω)



PS-50: Heavy Duty Power Supply

Designed to match the TS-440S in size, color and appearance. Supplies regulated 13.8 VDC at 20 A with built-in cooling fan and protection circuits for maximum reliability. (A 120/220/240 VAC line voltage selector provided.)

[SPECIFICATIONS]

- Power Requirements: 120/220/240 VAC \pm 10%, 50/60 Hz
- Power Consumption: 20 A continuous
- Output Voltage: 13.8 VDC (standard voltage)
- Output current: 20 A continuous
- Continuous load current: 20 A max.
- Ripple Component: Less than 20 mV (rms) at 13.8 VDC, output current 20 A
- Dimensions: 173 (6.8) W x 96 (3.8) H x 329 (13.0) D mm (inch)
- Weight: 7.1 kg (15.7 lbs) approx.



PS-430: DC Power Supply

Supplies regulated 13.8 VDC at 10 A continuous with built-in cooling fan and protection circuits for maximum reliability.



PG-2S: DC Cable



MB-430: Mobile Mount

Allows easy installation and removal of the TS-440S



MC-60A (8 pin) Deluxe Desk-Top Microphone

With built-in Pre-Amplifier

Unidirectional dynamic microphone



MC-80 (8 pin) Desk-Top Microphone

With built-in Pre-Amplifier (700 Ω)

Omnidirectional electret condenser microphone



MC-85 (8 pin) Deluxe Desk-Top Microphone

With built-in Audio Level Compensation (700 Ω)

Unidirectional electret condenser microphone



MC-55 (8 pin) Mobile Microphone

with time-out-timer (700 Ω)

Electret condenser microphone.



MC-43S (8 pin) UP/DOWN Microphone

(500 Ω)



YK-88C

500 Hz CW Filter



YK-88CN

270 Hz CW Narrow Filter



YK-88SN

1.8 kHz SSB Narrow Filter



YK-88S

2.4 kHz SSB Filter



HS-4

Headphones (8 Ω)



HS-5

Deluxe Headphones (8 Ω)



HS-6

Small-sized Headphones (12.5 Ω)



HS-7

Micro Headphones (16 Ω)



PC-1A: Phone Patch

(Available only where phone patch operation is legal)



SW-100A: SWR/POWER Meter

(1.8—150 MHz) for mobile use. (0—150 W)



SW-200A, 2000: SWR/POWER Meter

for base station use
200A: 1.8—150 MHz (0—20/200 W)
2000: 1.8—54 MHz (0—200/2000 W)



MA-5: 5 Band Helical Type HF Mobile Antenna

covers 10, 15, 20, 40, 75 m



(VP-1: Bumper Mount for MA-5)

IF-232C/IC-10: Interface unit



VS-1: Voice Synthesizer Unit



TU-8: CTCSS Encoder unit



Some accessories may not be available in your area.



TL-922/922A (for USA) HF Linear Amplifier

TL-922/922A are class AB grounded grid linear amplifiers developed by KENWOOD through advanced high power technology two high-performance EIMAC 3-500 Z power tubes. TL-922A covers 160-m~15-m, TL-922 covers 180-m~10-m

* The model TL-922A with tubes is available only in U.S.A.



SM-220: Station Monitor



TS-440S SPECIFICATIONS

[GENERAL]

Transmitter

Frequency Range 160, 80, 40, 30, 20, 17, 15, 12, 10 meter
Amateur bands

Receiver Frequency

Range 100 kHz~30 MHz

Mode A3J [J3E] (USB, LSB), A1 [A1A] (CW),
F1 [F1B] (FSK), F3 [F3E] (FM), A3 [A3E] (AM).

Frequency Stability Better than $\pm 10 \times 10^{-4}$

Frequency Accuracy Better than $\pm 10 \times 10^{-6}$ (—10°C—+50°C)

(RIT/XIT: OFF)

Antenna Impedance 50 Ω (20—150 Ω with the antenna tuner
installed, transmitter only)

External Speaker

Impedance 4—16 Ω

Power Requirement 12.0 to 16.0 VDC

Power Consumption Max. transmit 20A, Receive (no signal) 1.9A

Dimensions 270 (10.63) W x 96 (3.78) H x 313 (12.32)
D mm (inch) (Projections not included)

Weight 7.3 kg (16.09 lbs) approx. (with antenna
tuner) 6.3 kg (13.89 lbs) approx.

[Transmitter]

Final Power Input SSB/CW/FM/AFSK=200 W, AM=110 W

Modulation SSB=Balanced Modulation
FM=Reactance Modulation
AM=Low Level Modulation

FM Maximum

Frequency Deviation ± 5 kHz

Carrier Suppression Less than —40 dB (Modulation frequency:
1.5 kHz)

Spurious Response Less than —40 dB (CW)

Unwanted Sideband

Suppression Better than 50 dB
(Modulation frequency: 1.5 kHz)

Third Harmonic

Intermodulation Better than —26 dB
Distortion

Microphone 500 Ω ~50 k Ω

Impedance 500 Ω ~50 k Ω

Frequency Response 400—2600 Hz (—6 dB) (SSB)

[Receiver]

Circuitry Triple conversion system

Intermediate

Frequency 1st IF = 45.05 MHz, 2nd IF = 8.83 MHz

Frequency

Sensitivity at 10 dB (S+N/N) (0 dB μ =1 μ V)

Frequency Mode	100—150 kHz	150 kHz—500 kHz	500 kHz—1.6 MHz	1.6—30 MHz
SSB, CW, FSK	Less than 2.5 μ V	Less than 1 μ V	Less than 4 μ V	Less than 0.25 μ V
AM	Less than 25 μ V	Less than 13 μ V	Less than 40 μ V	Less than 2.5 μ V
FM (SINAD 12 dB)	—	—	—	Less than 0.7 μ V

Squelch Sensitivity SSB/CW/FM/AFSK=Less than 20 μ V
(100—150 kHz, 0.5—1.6 MHz)
Less than 10 μ V (150—500 kHz)
Less than 2 μ V (1.6—30 MHz)
FM: Less than 0.32 μ V (1.6—30 MHz)

Image Ratio

More than 70 dB (1.6—30 MHz)
More than 50 dB (100 kHz—1.6 MHz)

IF Rejection

More than 70 dB (1.6—30 MHz)
More than 50 dB (100 kHz—1.6 MHz)

Selectivity

SSB/CW/FSK=2.2 kHz (—6 dB)

4.4 kHz (—80 dB)

AM=6 kHz (—6 dB),

18 kHz (—50 dB)

FM=12 kHz (—6 dB),

25 kHz (—50 dB)

RIT/XIT Variable

Range More than ± 1 kHz

Notch Filter

Attenuation More than 20 dB (Audio frequency 1.5 kHz)

IF Shift Variable

Range More than ± 0.9 kHz

Audio Output

Impedance 4—16 Ω

Audio Output Power 1.5 W (8 Ω at 10% distortion)

The equipment meets or exceeds published specifications.

Specifications are subject to change without notice due to advance in technology.

KENWOOD CORPORATION

Shinjo Shinwa Building, 17-6, 2-chome Shinwa, Shibuya-ku, Tokyo 150, Japan

KENWOOD U.S.A. CORPORATION

COMMUNICATIONS & TEST EQUIPMENT GROUP

P.O. BOX 22745, 2201 East Dominguez St., Long Beach, CA 90801-5745, U.S.A.

KENWOOD ELECTRONICS DEUTSCHLAND GMBH

Helmholtz Str. 15, 6956 Heusenstamm, West Germany

KENWOOD ELECTRONICS BENELUX N.V.

Mechatrasseweg 48 B-1930 Zaventem, Belgium

KENWOOD ELECTRONICS AUSTRALIA PTY. LTD.

PO BOX 111, NSW

4E Woodcock Place, Lane Cove NSW 2066, Australia

KENWOOD & LEE ELECTRONICS, LTD.

Wing Kee Building, 4th Floor, 34-37, Connaught Road Central, Hong Kong