

# KENWOOD

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# SERVICE MANUAL

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## VC-10 VHF CONVERTER FOR THE R-2000

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### SPECIFICATIONS

VC-10 characteristics (measured after installation).

**Receive frequency range** . . . . . 118—174 MHz

#### Receive sensitivity

**AM S+N/N=10dB** . . . . . Less than or equal to 10 $\mu$ V

**SSB/CW S+N/N=10dB** . . . . . Less than or equal to 1 $\mu$ V

**FM S+N/N=20dB** . . . . . Less than or equal to 2 $\mu$ V

**12dB SINAD** . . . . . Less than or equal to 2 $\mu$ V

#### Open squelch sensitivity

**AM, SSB, CW** . . . . . Less than or equal to 5 $\mu$ V

**FM** . . . . . Less than or equal to 1 $\mu$ V

**Antenna impedance** . . . . . 50 ohms

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# VC-10

## CIRCUIT DESCRIPTION

### OUTLINE

The VC-10 is the companion converter unit to the R-2000 receiver, and allows reception in the VHF band within the range of 118—173.9995 MHz. R-2000 operation is identical for both the HF and VHF bands, excepting the RF ATT switch setting and ANT terminal connection, which appear on the VC-10 rear panel. The R-2000 and VC-10 are connected by a multiconductor cable from the rear panel of the VC-10. Control data and signals pass through this cable.

### CIRCUIT DESCRIPTION

The signal fed to the ANT terminal goes by the surge protection choke L30, through the RF ATT (attenuator: 0/10 dB) and then to the RF amplifier. L30 is a 1  $\mu$ H choke coil which protects the input circuits from a transient potential of up to approx. 6 k volts. RF attenuation can be set to either 0 or 10 dB by the slide switch on the rear panel. If an operation requires more attenuation than 10 dB, cutting R160 provides approx. 20 dB attenuation.

The RF amplifier consists of one of three 3SK73s FETs (Q1, 3, 5) and one of three 2SC2570As followers (Q2, 4, 6) and is divided into three subcircuits: H BAND (118—136.9995 MHz); I BAND (137—155.9995 MHz); J BAND (156—173.9995 MHz).

The signal goes to the 1st balanced mixer, 3SK74's (Q7, 8), and is converted to the 1st IF (32.5—51.5 MHz) by the 1st local oscillator. In this stage, the G2 switch bias for each band is adjusted for best spurious response, allowing wide range reception. Each band has its own 1st local oscillator

whose final output frequency is: H-85.5 MHz; I-104.5 MHz; J-123.5 MHz. X1 (30.875 MHz), X2 (26.125 MHz) and X3 (28.5 MHz) are third overtone crystals. Transistor oscillators (2SC2668Y) Q16, Q18, and Q20 triple the H BAND injection signal, and quadruple the I and J BAND signal to obtain final injection frequencies.

One of three 2SC1923s amplifiers (Q17, 19, 21) yield the required input level to the 1st mixer. The signal, now converted to the 1st IF, goes through the 24.375 MHz trap coil T49 to the 1st amplifier (32.5 MHz—51.5 MHz), consisting of Q9 (3SK73) and Q10 (2SC1907). T43 at Q10 emitter is the leakage trap for the H BAND 1st local oscillator (85.5 MHz). The signal is converted to the 2nd IF (24.4—24.35 MHz) at 50 kHz bandwidth by the 2nd mixer, consisting of two 3SK73s (Q11, 12). VCO injection (56.9—75.85 MHz) is fed from the R-2000.

The signal is converted to the 3rd IF (45.9—45.85 MHz) by the 3rd mixer Q13, 14 (3SK73), by the 3rd local oscillator (21.5 MHz). This 3rd IF signal goes through the 3rd IF amplifier and is then fed to the R-2000 1st IF filter.

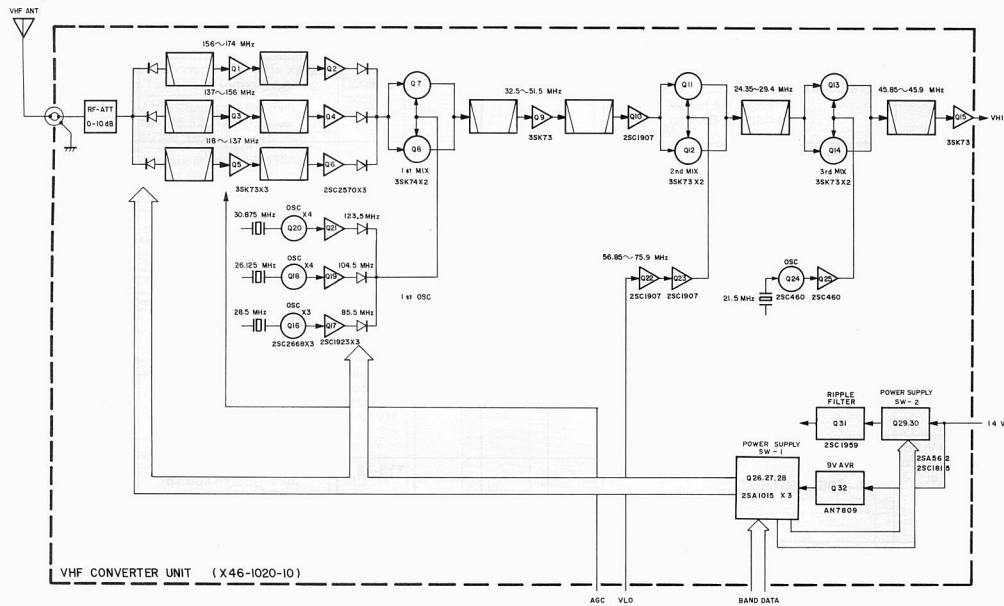
The 1st and 3rd IF amplifiers (Q9, Q15 (3SK73)) are gain compensate for sensitivity fluctuation due to temperature change by thermistor TH1 (D33A).

Q24 and Q25 (2SC460) are the 3rd local oscillator (21.5 MHz) and amplifier. Q22 and Q23 (2SC1907) are the 2nd local oscillator (VCO) injection amplifiers. The power supply consists of Q32 (AN7809), a 3-terminal 9 V regulator and Q31 (2SC1959) ripple filter for unregulated 13 V DC fed from the R-2000.

### TERMINAL DESCRIPTION

Connector	①	1	VBJ	VHF J-BAND information (ACTIVE LOW)
		2	VBI	VHF I-BAND information (ACTIVE LOW)
		3	VBH	VHF H-BAND information (ACTIVE LOW)
		4	AGC	AGC
	②	1	GND	
		2	14 V	Non-stabilized DC line (Always supplied unless the plug is disconnected)
	③	1	VLO	R-2000 VCO output (56.9 MHz—75.85 MHz)
		2	GND	
	④	1	GND	
		2	VHI	Converter signal output (45.9—45.85 MHz)

**BLOCK DIAGRAM**



**CONVERTER UNIT ALIGNMENT**

**Preparation:**

1. Remove the VC-10 from the main unit and take off the top cover. Then remove the two top covers from the shielded HET case.
2. Set the ATT switch (on the rear panel) to 0 dB.

Item	Condition	Measurement			Alignment/Check		Specifications		
		Test equipment	Unit	Terminal	Unit	Part		Method	
Voltage check	POWER switch: ON DIAL: f= 146.525 MHz SQUELCH control: MIN MODE: USB	DC Voltmeter	VC-10	14 V	VC-10		13 V	±0.5 V	
				VBH			8.2 V	±0.5 V	
				VBI			0.2 V	±0.2 V	
				VBJ			8.2 V	±0.5 V	
				AGC			3.2 V	±0.5 V	
				TP4			VR1	2.3 V	±0.05 V
				TP6			VR8	2.6 V	±0.05 V
				TP7			VR9	2.2 V	±0.05 V
				1st local oscillator			DIAL: f= 126.525 MHz	f. counter Oscillo- scope RF Voltmeter	VC-10
DIAL: f= 146.525 MHz	TC3	85.500,0 MHz	±100 Hz						
	T36-38	MAX (repeat 3 times)	(0.3 Vrms ±3 dB)						
	TC2	104.500,0 MHz	±100 Hz						
DIAL: f= 165.525 MHz	T33-35	MAX (repeat 3 times)	(0.25 Vrms ±3 dB)						
	TC1	123.500,0 MHz	±100 Hz						

CONVERTER UNIT ALIGNMENT

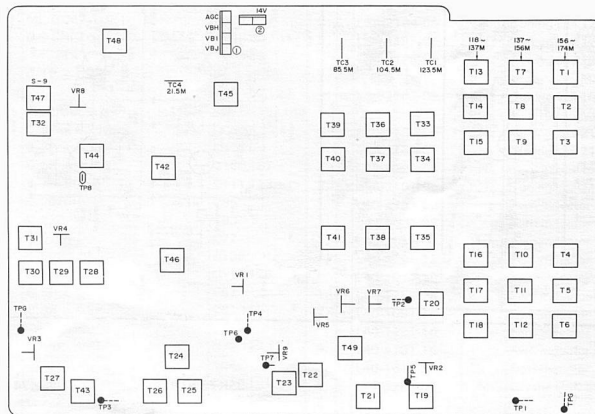
Item	Condition	Measurement			Alignment/Check		Specifications	
		Test equipment	Unit	Terminal	Unit	Part		Method
Third local oscillator	DIAL: f= 146.525 MHz	f. counter Oscilloscope RF Voltmeter	VC-10	TP8	VC-10	T42, 44 TC4	MAX 21.500,0 MHz	(0.42 Vrms ±3 dB) ±30 Hz
	Replace the two top covers to the HET shielded case.							
RF BPF	ANT: Connect sweep output. (Sweep output impedance should be 50 ohms.) MODE: FM Sweep f.: Any point within the band.	Oscilloscope		TP1				Ripple within 2 dB
	J-BAND: 156—173.9995 MHz					T1-6	Obtain the wave form shown below. 	
	I-BAND: 137—155.9995 MHz					T7-12		
	H-BAND: 118—136.9995 MHz					T13-18		
IF BPF	TP5: Connect sweep output. MODE: FM DIAL: f= 146.525 MHz T49 Core: Level the core with the top of the tuning coil.	Oscilloscope	VC-10	TP3	VC-10	VR6 T21-26		Ripple within 2 dB
Sensitivity	ANT: Connect to the SSG. f= 146.525 MHz, 6 dBμ (Japanese SSG) MODE: USB < REFERENCE > Japanese "SG" American "SG" -6 dB      0.25 μV 0 dB      0.5 μV 6 dB      1 μV 12 dB      2 μV 24 dB      8 μV 30 dB      15.8 μV 40 dB      50 μV 50 dB      158 μV 60 dB      500 μV 70 dB      1.58 mV 80 dB      5 mV 90 dB      15.8 mV 100 dB      50 mV 120 dB      0.5 V	SSG Oscilloscope AF VTVM		EXT.SP		VR6 T28-32 T44, 47, 48	AF MAX  AF MAX (repeat 3 times) AF MAX (repeat 3 times)	S/N: 10 dB or more at 6 dBμ SSG input
	Adjust SSG output for 30 dBμ.	S. meter				T47	Set to S-9 by adjusting the core into the form.	30 dB ±15 dB  Note: The receiver S meter should be correctly calibrated.



CONVERTER UNIT ALIGNMENT

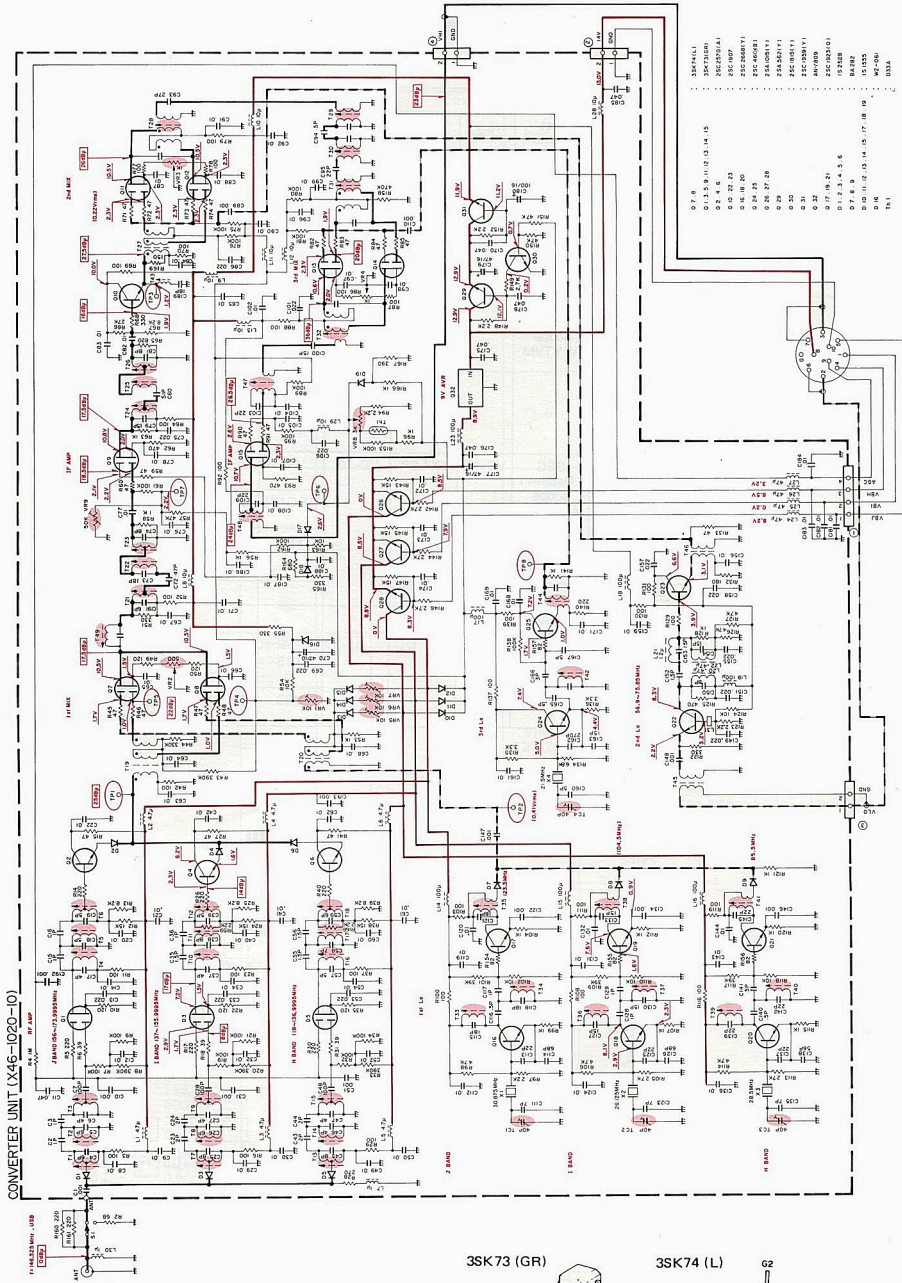
Item	Condition	Measurement			Alignment/Check		Specifications	
		Test equipment	Unit	Terminal	Unit	Part		Method
GAIN	ANT: Connect to the SSG. f= 165.525 MHz, 6 dB $\mu$	SSG Oscilloscope AF VTVM	VC-10	EXT.SP	VC-10	VR7	AF MAX	
IF TRAP	1) ANT: Connect to the SSG. f= 146.525 MHz, 0 dB $\mu$ MODE: USB					AF GAIN	Adjust AF output for 0.63 V/8 ohms.	
	2) Without changing the DIAL setting, retune the SSG f. to 128.875 MHz, 60 dB $\mu$ .					T49	Set for MIN AF output by adjusting the core into the form.	40 dB or more attenuation from 146.525 MHz.
Spurious	MODE: USB	SSG Oscilloscope AF VTVM				VR5	AF MAX	
	1-1) ANT: Connect to the SSG. f= 126.525 MHz, 6 dB $\mu$					AF GAIN	Set AF output to 0.63 V/8 ohms.	
	1-2) Set SSG output to 0 dB $\mu$ .					VR2, VR5	Alternately adjust for MIN AF output.	40 dB or more attenuation from 126.525 MHz.
	1-3) Without changing the DIAL setting, retune the SSG f. to 129.973 MHz, 40 dB $\mu$ .							
Spurious	2-1) SSG f= 155.995 MHz, 6 dB $\mu$	SSG Oscilloscope AF VTVM	VC-10	EXT.SP	VC-10	VR6	AF MAX	
	2-2) Set SSG output to 0 dB $\mu$ .					AF GAIN	Set AF output to 0.63 V/8 ohms.	
	2-3) Without changing the DIAL setting, retune the SSG f. to 157.503 MHz, 40 dB $\mu$ .					VR6	AF MIN	40 dB or more attenuation from 155.995 MHz.
	Replace the top cover.							
Internal spurious	ANT: Connect a 50-ohm output impedance SSG. MODE: USB DIAL: Receive internal beat in the vicinity of 122.199 MHz.	SSG AF VTVM		EXT.SP		T43	AF MIN	
	DIAL: Receive internal beat in the vicinity of 128.499 MHz.					VR3	AF MIN	

CONVERTER UNIT (X46-1020-10)



# VC-10

○ : Test Point  
 ○ : Adjust Point  
 --- : Signal Line  
 --- : Control Line  
 --- : Common DC Line

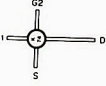


CONVERTER UNIT (X46-020-10)

35K73 (GR)



35K74 (L)



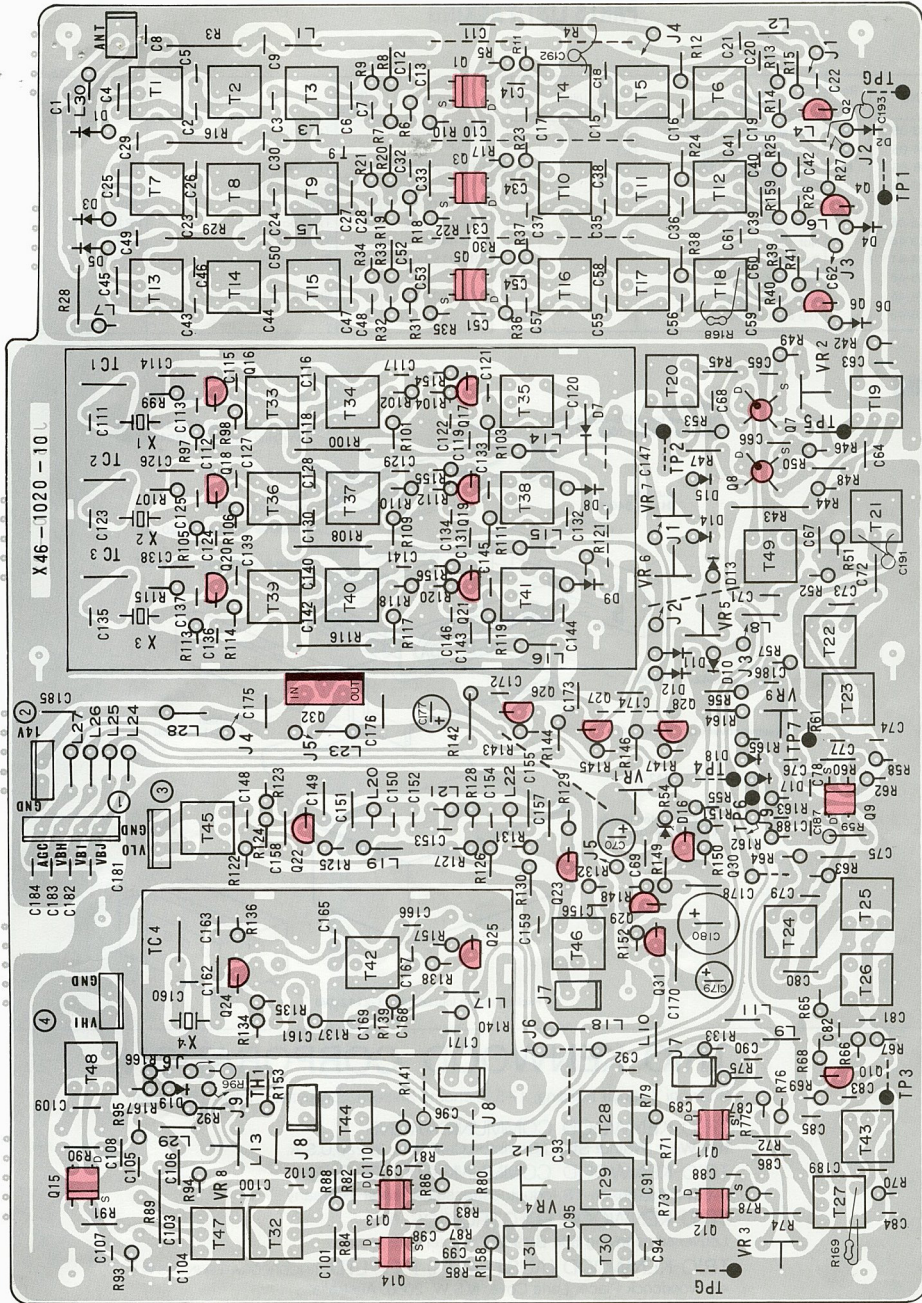
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# PC BOARD VIEW

CONVERTER UNIT (X46-1020-10)

[Component Side View]



PARTS LIST

CAPACITORS

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

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

● Temperature coefficient

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

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

Example CC45TH = -470 ± 60 ppm/°C

● Tolerance

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

Less than 10 pF

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

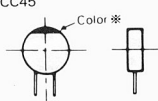
Abbreviation		Abbreviation	
Cap	Capacitor	ML	Mylar
C	Ceramic	S	Styren
E	Electrolytic	T	Tantalum
MC	Mica		

● Rating voltage

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

● Capacitor value

- 0 1 0 = 1pF
  - 1 0 0 = 10pF
  - 1 0 1 = 100pF
  - 1 0 2 = 1000pF = 0.001μF
  - 1 0 3 = 0.01μF
  - 2 2 0 = 22pF
- 1st number    Multiplier  
2nd number



Resistors not listed in this parts list are standard, fixed carbon composition, 1/4W or 1/8W. The resistance values, in ohms, are indicated on the schematic diagram.

SEMICONDUCTOR

Item	Name	Re- marks
Diode	1S1555	
	1S2588	
	BA282	
Zener diode	WZ-061	
Thermistor	D33A	
TR	2SA562(Y)	
	2SA1015(Y)	
	2SC460(B)	
	2SC1815(Y)	
	2SC1907	
	2SC1923(O)	
	2SC1959(Y)	
	2SC2570(A)	
2SC2668(Y)		
FET	3SK73(GR)	
	3SK74(L)	
IC	AN7809	N

- K: USA MARKET
- N: New parts
- Δ: Please note that parts are some times not in stock and it takes much time to deliver.

Part No.	Re- marks	Description	Ref. No.
<b>GENERAL</b>			
B42-1799-04	ΔN	FCC seal K	
B46-0404-00		Warranty card K	
B50-4058-00	N	Operating manual	
H01-4504-03	ΔN	Packing carton (inside)	
H03-2142-04	ΔN	Packing carton (outside)	
H12-1340-04	ΔN	Cushion × 2 (L, R)	
H12-1342-04	ΔN	Cushion × 2 (upper, lower)	
H21-0704-04		Protective cover ACC plug	
H25-0029-04		Protective bag 60 × 110 mm Accessory	
H25-0162-04		Protective bag Unit	
N35-3006-41		Bind screw × 2 Accessory	
T90-0331-05		Rod antenna	

PARTS LIST

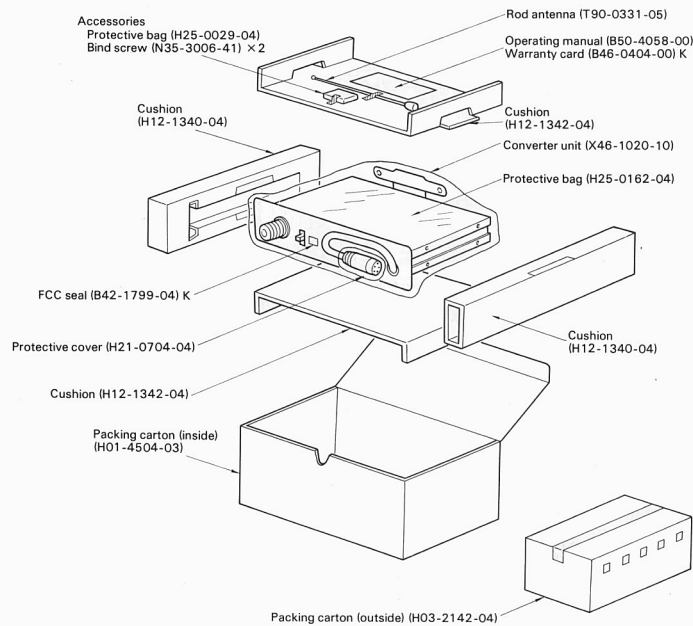
Part No.	Re- marks	Description	Ref. No.	Q'ty	Part No.	Re- marks	Description	Ref. No.	Q'ty
<b>CONVERTER UNIT (X46-1020-10)</b>					CC45SL1H271J		C, 270P	C162	1
					CK45B1H102K		C, 0.001	C1,10,31,51, 146 ~ 148	7
C05-0309-05		Ceramic trimmer 40P	TC1 ~ 4	4					
CC45RH1H040C		C, 4P ± 0.25P	C6,17,27,37, 46,47	6					
CC45RH1H050C		C, 5P ± 0.25P	C18,19,39	3	E04-0152-05		M type receptacle		1
CC45RH1H060D		C, 6P ± 0.5P	C4,5,26,59, 191	5	E30-1742-05	N	Connecting cable		1
CC45RH1H070D		C, 7P ± 0.5P	C58	1	E07-1051-05	N	10P plug		1
CC45RH1H080D		C, 8P ± 0.5P	C25,38,45,74	4	E23-0512-05		Test terminal		1
CC45RH1H150J		C, 15P	C130	1	E40-0273-05		Mini connect wafer 2P		3
CC45RH1H180J		C, 18P	C73,118,189	3	E40-0473-05		Mini connect wafer 4P		1
CC45RH1H220J		C, 22P	C103,109,142	3	F19-0626-04	N	Rear cover		1
CK45B1H102K		C, 0.001	C89,110,122, 134,192,193	6	G02-0518-04		Earth spring		1
C91-0131-05		C, 0.01	C8,9,12,14,20,21,22,29,30 32,34,40,41,42,49,50,52, 54,60,61,62,63,64,65,66, 67,68,71,76,77,78,82,83 84,85,87,88,90,91,92,96, 97,98,99,102,104,105,107, 108,112,119,120,124,131, 132,136,143,144,156,159, 161,168,169,171,172,173, 174,181,182,183,184,186, 187,188	74	J32-0777-04	N	Round boss 16.5 mm		1
C91-0456-05		C, 0.047	C11,170,178,185	4	J32-0778-04	N	Hex. boss 6 mm		1
C91-0457-05		C, 0.022	C13,33,53,69,75,86,101,106, 149,151,155,157,158	13	J32-0779-04	N	Round boss 17.5 mm		1
CC45CH1H010C		C, 1P ± 0.25P	C15	1	L19-0346-05	N	Wide band transformer	T19	1
CC45CH1H1R5C		C, 1.5P ± 0.25P	C35	1	L19-0347-05	N	Wide band transformer	T27	1
CC45CH1H150J		C, 15P	C100, 163	2	L19-0348-05	N	Wide band transformer	T45, 46	2
CC45CH1H220J		C, 22P	C113,125,137	3	L19-0350-05	N	Wide band transformer	T20	1
CC45CH1H510J		C, 51P	C80	1	L33-0025-05		Choke coil 1μH	L30	1
CC45SL1H101J		C, 100P	C7, 28, 48	3	L34-2150-05		Tuning coil 45.9 MHz	T32	1
CE04W1C101M		E, 100 16V	C180	1	L34-2168-05	N	Tuning coil	T1, 6	2
CE04W1C470M		E, 47 16V	C177, 179	2	L34-2169-05	N	Tuning coil J. BPF	T2,4,5	3
CE04W1A470M		E, 47 10V	C90	1	L34-2170-05	N	Tuning coil	T3	1
CQ92M1H473K		ML, 0.047	C175,176	2	L34-2171-05	N	Tuning coil	T7,9	2
CC45CH1HOR5C		C, 0.5P ± 0.25P	C94,140,141, 165,116	5	L34-2172-05	N	Tuning coil I. BPF	T8,10,11	3
CC45CH1H010C		C, 1P ± 0.25P	C2,3,16,36, 117,128,129	7	L34-2173-05	N	Tuning coil	T12	1
CC45CH1H1R5C		C, 1.5P ± 0.25P	C55,56,152,153	4	L34-2174-05	N	Tuning coil	T13,15	2
CC45CH1H020C		C, 2P ± 0.25P	C23,24,43,44	4	L34-2175-05	N	Tuning coil H. BPF	T14,16,17	3
CC45CH1H030C		C, 3P ± 0.25P	C166	1	L34-2176-05	N	Tuning coil	T18	1
CC45CH1H050C		C, 5P ± 0.25P	C160,167	2	L34-2177-05	N	Tuning coil	T21,23	2
CC45CH1H070D		C, 7P ± 0.5P	C111,123,135	3	L34-2178-05	N	Tuning coil IF. BPF	T22	1
CC45CH1H220J		C, 22P	C95	1	L34-2179-05	N	Tuning coil	T24,26	2
CC45CH1H270J		C, 27P	C93	1	L34-2180-05	N	Tuning coil	T25	1
CC45CH1H470J		C, 47P	C72	1	L34-2181-05	N	Tuning coil 24.4 MHz	T28,31	2
CC45CH1H560J		C, 56P	C138	1	L34-2182-05	N	Tuning coil 24.4 MHz	T29,30	2
CC45CH1H680J		C, 68P	C114,126	2	L34-2183-05	N	Tuning coil 85.5 MHz	T43	1
CC45RH1H050C		C, 5P ± 0.25P	C57	1	L34-2184-05	N	Tuning coil 123.5 MHz	T33,34	2
CC45RH1H080D		C, 8P ± 0.5P	C81,150	2	L34-2185-05	N	Tuning coil 123.5 MHz	T35	1
CC45RH1H150J		C, 15P	C79,127,133, 154	4	L34-2186-05	N	Tuning coil 104.5, 85.5 MHz	T36,37,39,40	4
CC45RH1H180J		C, 18P	C115,121	2	L34-2187-05	N	Tuning coil 104.5, 85.5 MHz	T38,41	2
CC45RH1H220J		C, 22P	C139,145	2	L34-2188-05	N	Tuning coil 21.5 MHz	T42	1
					L34-2189-05	N	Tuning coil 21.5 MHz	T44	1
					L34-2190-05	N	Tuning coil 45.9 MHz	T47,48	2
					L34-2191-05	N	Tuning coil 24.4 MHz	T49	1
					L40-4791-02		Ferri inductor 4.7μH	L1 ~ 6	6
					L40-1001-03		Ferri inductor 10μH	L8 ~ 13,29	7
					L40-1011-03		Ferri inductor 100μH	L17	1
					L40-1001-12		Ferri inductor 10μH	L28	1
					L40-1011-12		Ferri inductor 100μH	L23	1
					L40-4782-14		Ferri inductor 0.47μH	L20,22	2
					L40-1091-14		Ferri inductor 1μH	L7	1
					L40-1291-14		Ferri inductor 1.2μH	L21	1
					L40-4701-14		Ferri inductor 47μH	L24 ~ 27	4
					L40-1011-14		Ferri inductor 100μH	L14 ~ 16,18,19	5
					L77-1202-05	N	Crystal OSC 30.875 MHz	X1	1

# VC-10

## PARTS LIST/PACKING

Part No.	Re- marks	Description	Ref. No.	Q'ty	Part No.	Re- marks	Description	Ref. No.	Q'ty
L77-1203-05	N	Crystal OSC 26.125 MHz	X2	1	N88-3006-41		Tap tight screw		4
L77-1204-05	N	Crystal OSC 28.5 MHz	X3	1					
L77-1205-05	N	Crystal OSC 21.5 MHz	X4	1	R12-0420-05		Trim. pot 500Ω	VR2	1
L92-0110-05		Bead core	L31	1	R12-1414-05		Trim. pot 1kΩ	VR3,4	2
N09-0256-05		GND screw ANT		1	R12-1415-05		Trim. pot 3kΩ	VR8	1
N10-2030-46		Nut IC		1	R12-3430-05		Trim. pot 10kΩ	VR1,5 ~ 7	4
N30-2004-41		Pan head screw RF ATT		2	R12-4408-05		Trim. pot 50kΩ	VR9	1
N30-3006-46		Pan head screw IC		1	R92-0150-05		Short jumper		11
N35-2604-46		Bind screw Boss		8					
N87-3006-46		Tap tight screw		19	S31-1407-05		Slide switch RF ATT		1

## PACKING



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