S/N 5120028

KENWOOD

SERVICE MANUAL

VC-10 VHF CONVERTER FOR THE R-2000

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 10μV
- **SSB/CW S+N/N=10dB**.. Less than or equal to 1μV
- **FM S+N/N=20dB**..... Less than or equal to 2μV
- **12dB SINAD**..... Less than or equal to 2μV

Open squelch sensitivity
- **AM, SSB, CW**..... Less than or equal to 5μV
- **FM**..... Less than or equal to 1μV

Antenna impedance..... 50 ohms

CONTENTS

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 μH 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.

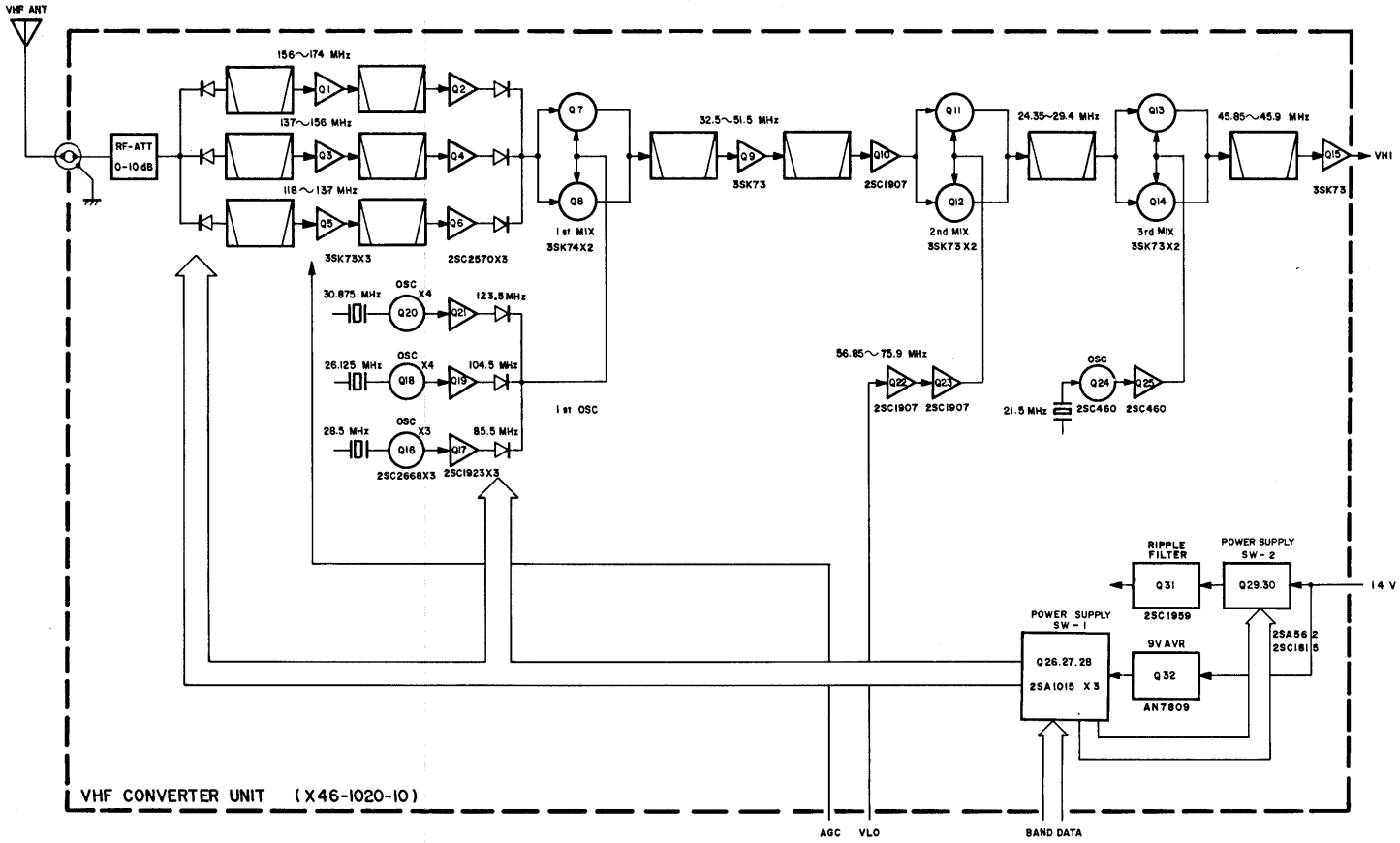
The 1st and 3rd IF amplifiers (Q9, Q15 (3SK73)) are gain compensate for sensitivity fluctuation due to temperature change by thermistor TH1 (D33A).

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



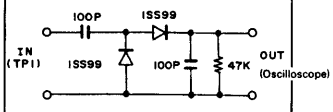
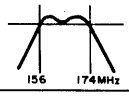
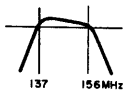
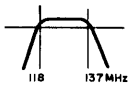
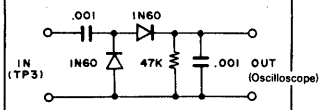
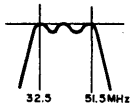
CONVERTER UNIT ALIGNMENT

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 Oscilloscope RF Voltmeter		TP2		T39-41	MAX (repeat 3 times)	(0.25 Vrms ±3 dB)
						TC3	85.500,0 MHz	±100 Hz
	DIAL: f=146.525 MHz					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

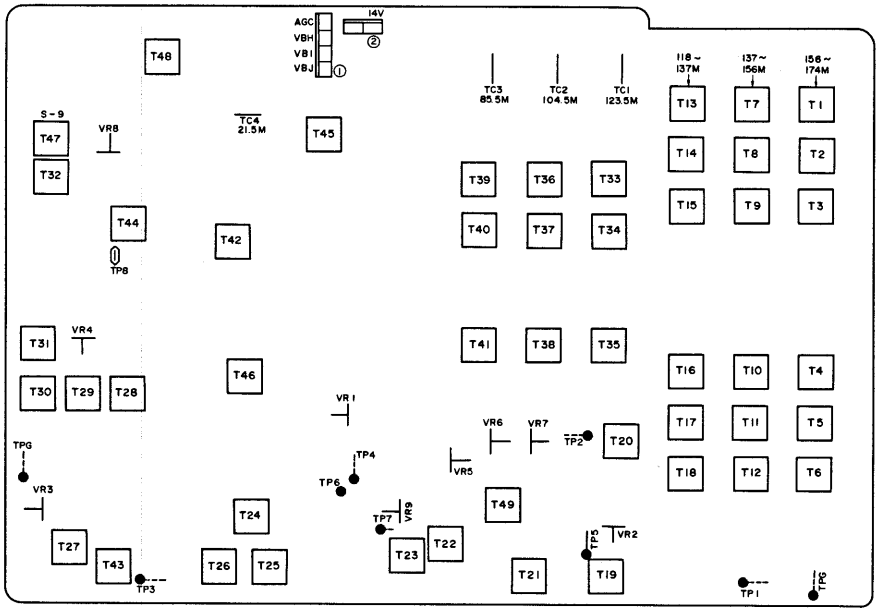
CONVERTER UNIT ALIGNMENT

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				
	J-BAND: 156—173.9995 MHz					T1-6	Obtain the wave form shown below. 	Ripple within 2 dB
	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	Obtain the max. output by adjusting VR6, and then obtain the wave form shown below by adjusting T21-T26. 	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 dBμ	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 dBμ 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 dBμ.					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 1-1) ANT: Connect to the SSG. f=126.525 MHz, 6 dBμ	SSG Oscilloscope AF VTVM				VR5	AF MAX	
	1-2) Set SSG output to 0 dBμ.					AF GAIN	Set AF output to 0.63 V/8 ohms.	
	1-3) Without changing the DIAL setting, retune the SSG f. to 129.973 MHz, 40 dBμ.					VR2, VR5	Alternately adjust for MIN AF output.	40 dB or more attenuation from 126.525 MHz.
Spurious	2-1) SSG f= 155.995 MHz, 6 dBμ	SSG Oscilloscope AF VTVM	VC-10	EXT.SP	VC-10	VR6	AF MAX	
	2-2) Set SSG output to 0 dBμ.					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 dBμ.					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)



: Signal Line
: Control Line
: Common DC Line

: Test Point
: Adjust Point