WESTERN RADIO SERVICES LTD.

VANCOUVER, CANADA

WR-494 RECEIVER MODULE

9R90A-0

Specifications:

Power requirements 1W AF	13.6 VDC at 270 mA. typ.
Power requirements std. by	13.6 VDC at 95 mA. typ. (60 mA. speaker sw. opt.)
Frequency	406 to 512 MHz.
Sensitivity	0.30 uV for 12 dB SINAD
Selectivity EIA SINAD	75 dB at ±25 KHz.
Frequency stability	±0.0005%, -30 to +60 ^{o}C
Intermodulation EIA SINAD	65 dB
Spurious response	85 dB, (75 dB 470 to 512 MHz.)
Audio output	1 watt (8 ohms) at less than 5% THD
Audio response (low-level output)	±2 dB from 6dB/octave de-emphasis, 300 to 3000 Hz.
Hum and noise	-50 dB from 3 KHz. deviation at 1000 Hz.
Physical dimensions	260 mm x 60 mm x 108 mm

Description:

The WR-494 receiver is a single-conversion frequency-modulation receiver contained in a plug-in module. Power, control and audio connections are made through a rear-mounted 15-pin connector. The R.F. input is fed through a separate coaxial connector. A front-panel 14-pin metering receptacle is provided for test and alignment using a model M90 Test Set.

Functional Connections (by pin number):

1	+13.6V	+13.6 volt supply input.
2	+13.6V	+13.6 volt supply input.
3	SW +9.5V	+9.5V switched by the Line-Local channel selector switch, this output is used to enable line channel selection.

Functional Connections (by pin number) (cont.):

4	SPEAKER	Speaker AF out.
5	COS	Receiver squelch output.
8	RX MUTE	Muting input. With +9.5V applied to this pin, the receiver will be muted.
11	VOL. CONT. HIGH	Low-level receiver audio output. This output is used by external facilities.
12	OSC 1	Channel 1 oscillator control.
13	OSC 2	Channel 2 oscillator control.
14	GND	Common ground.
15	GND	Common ground.

Circuit Description:

1. Converter

The RF amplifier, Q1, amplifies the input signal to overcome the loss of the five helical resonators L1,2,4-6 and the noise level of the mixer, Q2. The mixer is a base-injected bipolar transistor mixer which heterodynes the signal down to the 10.7 MHz. IF.

Q6 (Q7) is the oscillator for channel 1 (2). The crystals Y1 and Y2 are third-overtone at a frequency of (channel-10.7 MHz.)/9. The channel switch S1 is installed in two-channel models. This switch has three positions and is located on the front-panel. In the center position, external channel selection is enabled through pin 3 of P1.

2. IF Amplifier

Filter FL1 provides the prime selectivity of the receiver. IF Amplifier-1 (Q3) sets the IF noise figure. IF Amplifier-2 (Q4,5) further amplifies the 10.7 MHz. signal for application to the Limiter, U1.

FM demodulation is carried out with CR4,5 with R28 and C42 removing 10.7 MHz. components from the demodulator output. The IF amplifier stages are contained in shielded compartments to ensure stability and reduce unwanted pick-up of extraneous signals.

Circuit Description (cont.):

3. Audio Amplifier

Audio Amplifier-1 (Q10,11) amplifies the low-level demodulator output for processing. C73,74 and CH11 form a 3 KHz. low-pass filter and R54, C75 form a de-emphasis network. Q12 is a buffer-amplifier whose output goes to the volume control, R59, as well as pin 11 of P1. After passing through the volume control, the signal is amplified by Audio Amplifier-2 (Q16,17). Q17 is the audio-driver. Q18,19 make up the final audio amplifier.

The speaker switch, S2, is an option which allows the reduction of stand by current drain by disabling the audio power stages when speaker operation is not required.

4. Squelch

The output of Audio Amplifier-1 is fed to a high-pass filter C79,81 and CH12 which removes voice-band components in the demodulator output. Q13 amplifies the remaining noise for detector Q14. The SQ-KEY control, R58, sets the gain of the noise amplifier and thus the unmuting SINAD.

Q15 is a buffer for the detector output. Q15 is used to gate on Q17, the audio-driver. The output of Q15 is also connected to pin 5 of P1 where it is available for external circuits that utilize a carrier-operated switch or COS. CR9,13 will mute the receiver and disable the channel oscillator when +9.5 V is applied to pin 8 of P1, RX MUTE. This connection is used for simplex operation.

5. Power Supply

U2 generates the +9.5 volt supply which powers all circuits except the final audio amplifier. This amplifier is powered directly from the 13.6 volt input.

Adjustments:

1. Equipment

The following test equipment and tools are recommended for performing the various adjustments.

-RF signal generator	-127 dBm to -27 dBm
-AF distortion analyser	1000 Hz. 8 ohm term.
-power supply	11 to 16 VDC at 0.5 A.
-IF marker generator	10.7 MHz. crystal control
-test set	WR M90 Test Set
-tuning tools	insulated
-screw drivers	slot and phillips head

Adjustments (cont.):

2. Alignment

Set the power supply voltage to 13.6 volts. Connect the power supply and RF signal generator to the receiver module at P1 and J1 respectively. Connect the speaker output, pin 4 of P1, to the AF distortion analyser. Plug the Test Set into the front-panel connector and follow the instructions of Table 1 :- Receiver Alignment.

Table 1 :- Receiver Alignment

Test Point	Test Set Range uA	Typical Reading uA	Align	Set to
1	50	20	L16	Note 1
2	100	55	L17	max.
3	50	12 Note 2	C2,3,5,8, 9,13,64	max.
			L8-11	max. Note 3
4	50	0	L12,13	Note 4

Note 1. Tune to a peak then decrease to 80% of the peak by increasing the inductance of L16. The final reading of the test point should be about 20 uA.

Note 2. 12 uA reading is for 20 uV at J1 after alignment.

Note 3. -Before tuning L8-13, the crystal Y1 (Y2) must be set on frequency.

-Set the RF generator exactly on frequency and to a level that does not saturate the IF.

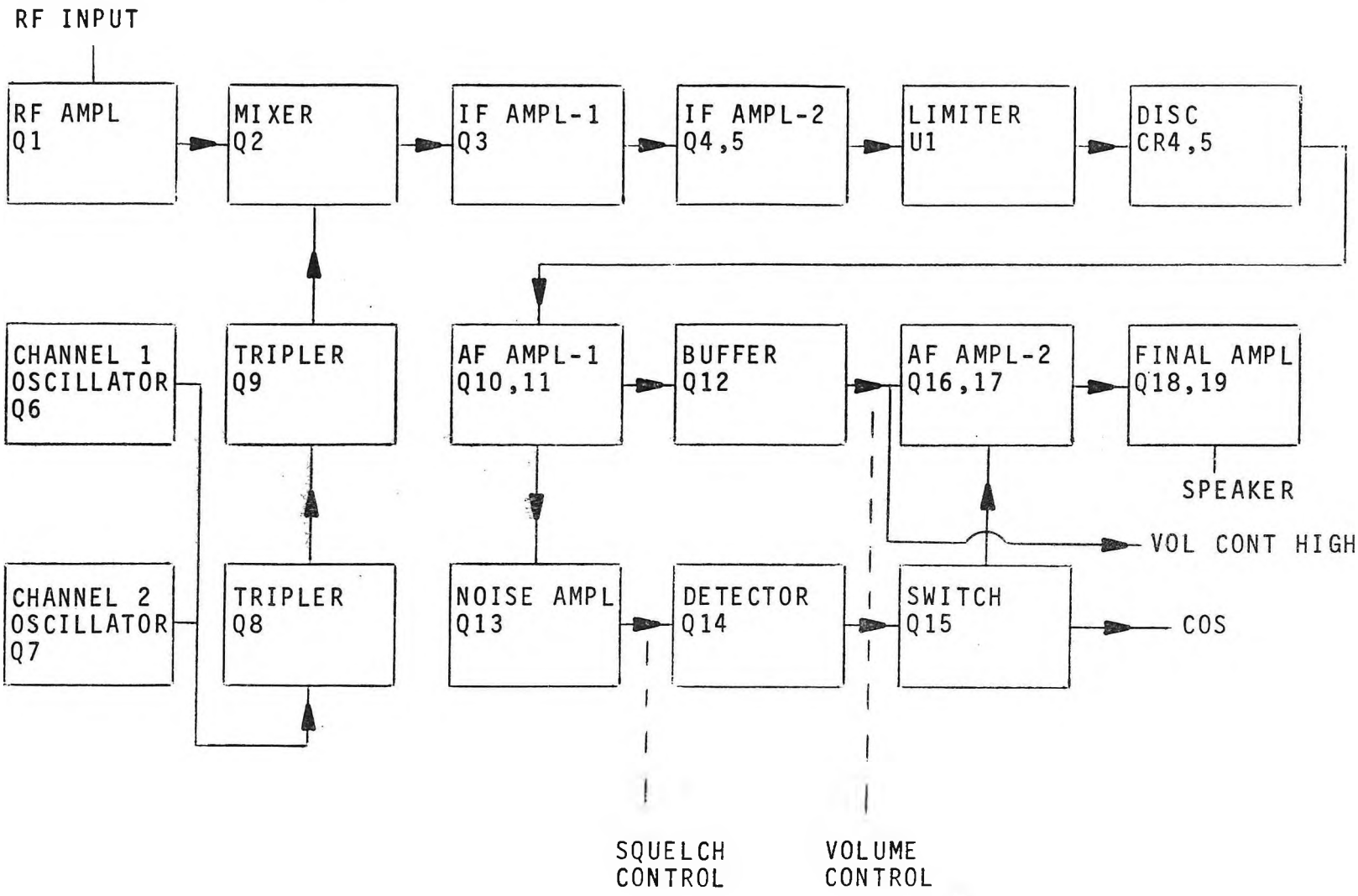
-Couple the IF marker to the IF for a beat note.

-Set C44 (C51) to mid range, set coarse L14 (L15) and fine C44 (C51) controls for zero beat. Note, later tuning of L16 pulls frequency slightly.

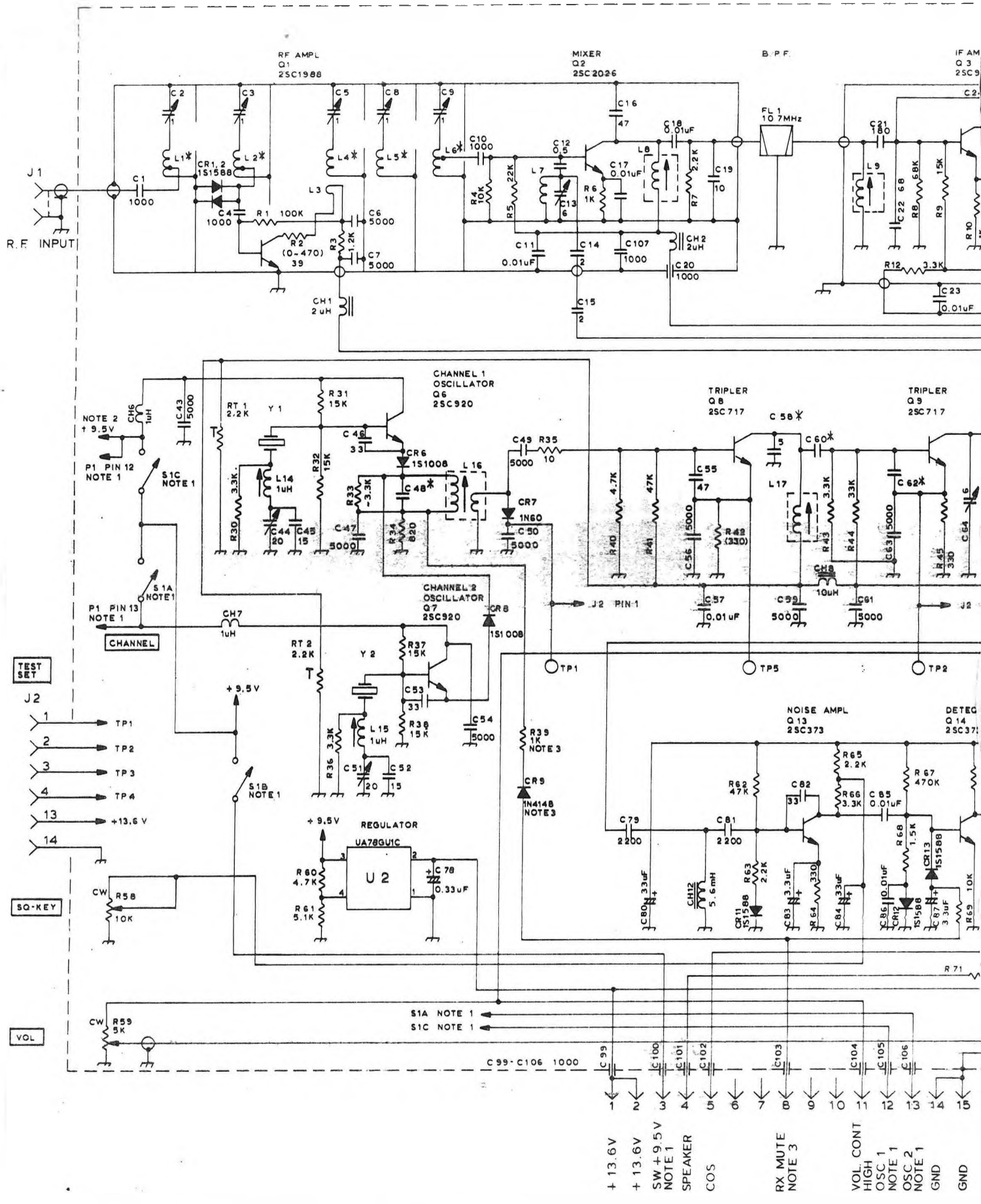
Note 4. -Set the volume for 1 Vrms at the speaker for a 1 mV, 3 KHz. deviation 1 KHz. tone signal at J1.

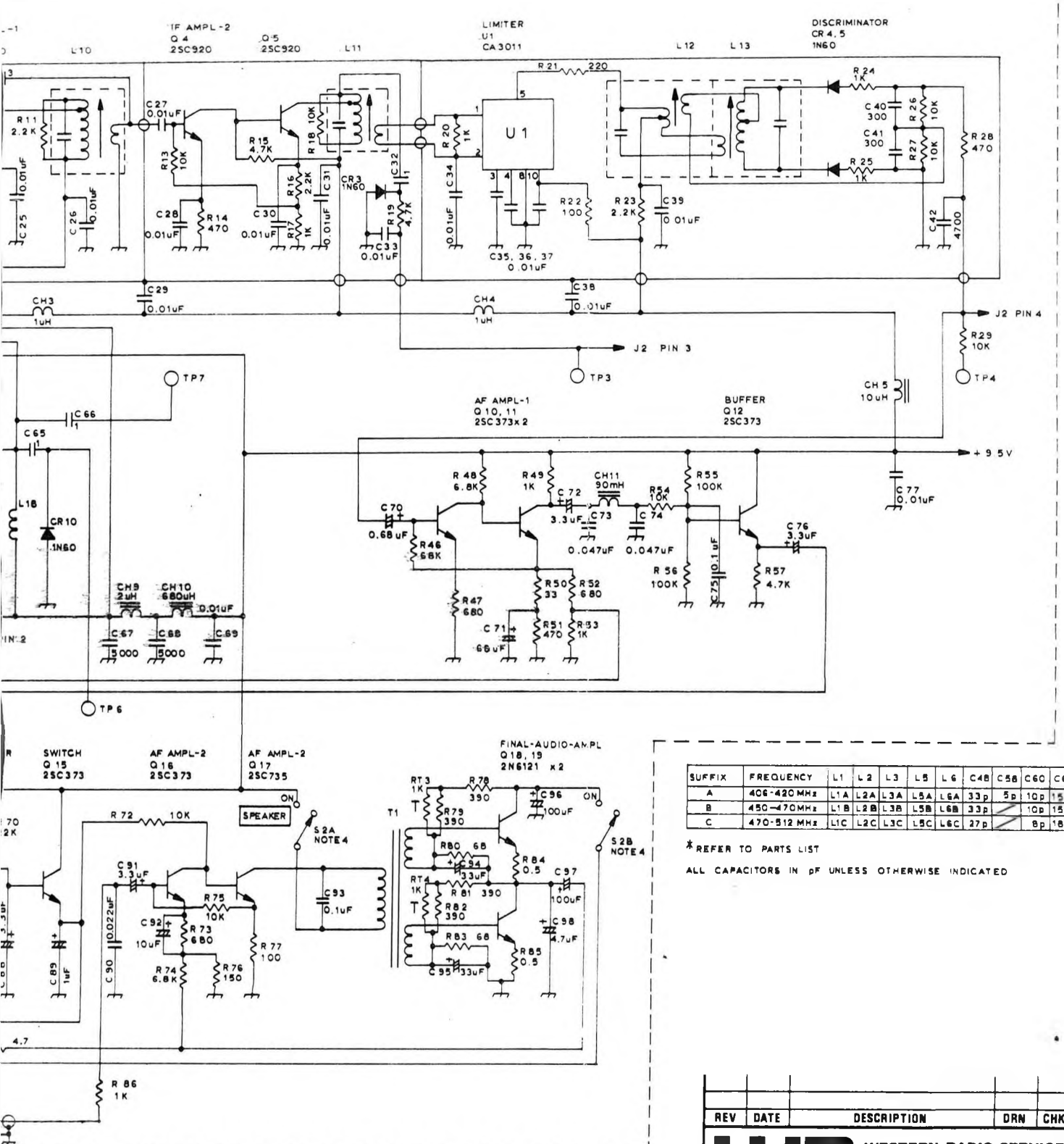
-Tune L12 for a peak at the speaker output.

-Tune L13 for a reading of 0 uA at test point 4.



WR-494 Receiver Module Block Diagram


RF AMPL
Q1
2SC1988
MIXER
Q2
2SC2026
B.P.F.
IF AM
Q 3
2SC9
FL 1
10.7MHz
J1
R.F. INPUT
CR1, 2
1S1588
L1*
L2*
L3
L4*
L5*
L6*
L7
L8
L9
C1 1000
C2
C3
C4 1000
C5
C6 5000
C7 5000
C8
C9
C10 1000
C11 0.01uF
C12 0.5
C13 6
C14 2
C15 2
C16 47
C17 0.01uF
C18 0.01uF
C19 10
C20 1000
C21 180
C22 68
C23 0.01uF
C107 1000
R1 100K
R2 (0~470) 39
R3 1.2K
R4 10K
R5 22K
R6 1K
R7 2.2K
R8 68K
R9 15K
R10
R12 3.3K
CH1 2uH
CH2 2uH
CHANNEL 1 OSCILLATOR
Q6
2SC920
CHANNEL 2 OSCILLATOR
Q7
2SC920
TRIPLER
Q8
2SC717
TRIPLER
Q9
2SC717
NOTE 2
+ 9.5V
CH6 1uH
C43 5000
RT 1 2.2K
Y 1
R31 15K
R32 15K
R33 3.3K
R34 820
R30 3.3K
C44 20
C45 15
C46 33
C47 5000
C48*
CR6 1S1008
L14 1uH
L16
C49 5000
R35 10
CR7 1N60
C50 5000
P1 PIN 12
NOTE 1
S1C
NOTE 1
S1A
NOTE 1
P1 PIN 13
NOTE 1
CH7 1uH
CHANNEL
RT 2 2.2K
Y 2
R37 15K
R38 15K
C53 33
C54 5000
L15 1uH
R36 3.3K
C51 20
C52 15
CR8 1S1008
R39 1K
NOTE 3
CR9 1N4148
NOTE 3
C58*
C60*
C62*
L17
R40 4.7K
R41 47K
R42 (330)
R43 3.3K
R44 33K
R45 330
C55 47
C56 5000
C57 0.01uF
C59 5000
C61 5000
C63 5000
C64
CH8 10uH
J2 PIN 1
J2
TP1
TP5
TP2
TEST SET
J2
1 TP1
2 TP2
3 TP3
4 TP4
13 +13.6 V
14
+9.5V
S1B
NOTE 1
SQ-KEY
CW R58 10K
REGULATOR
UA78GU1C
U 2
R60 4.7K
R61 5.1K
C78 0.33uF
NOISE AMPL
Q13
2SC373
DETEC
Q14
2SC371
R62 47K
R63 2.2K
R64 330
R65 2.2K
R66 3.3K
R67 470K
R68 1.5K
R69 10K
R71
C79 2200
C80 33uF
C81 2200
C82 33
C83 3.3uF
C84 33uF
C85 0.01uF
C86 0.01uF
C87 3.3uF
CH12 5.6mH
CR11 1S1588
CR12 1S1588
CR13 1S1588
VOL
CW R59 5K
S1A NOTE 1
S1C NOTE 1
C99~C106 1000
C99
C100
C101
C102
C103
C104
C105
C106
1 + 13.6V
2 + 13.6V
3 SW + 9.5V NOTE 1
4 SPEAKER
5 COS
6
7
8 RX MUTE NOTE 3
9
10
11 VOL. CONT HIGH
12 OSC 1 NOTE 1
13 OSC 2 NOTE 1
14 GND
15 GND



SUFFIX	FREQUENCY	L1	L2	L3	L5	L6	C48	C58	C60	C62
A	406-420 MHz	L1A	L2A	L3A	L5A	L6A	33p	5p	10p	15p
B	450-470 MHz	L1B	L2B	L3B	L5B	L6B	33p		10p	15p
C	470-512 MHz	L1C	L2C	L3C	L5C	L6C	27p		8p	18p

*REFER TO PARTS LIST

ALL CAPACITORS IN pF UNLESS OTHERWISE INDICATED

NOTE 1: CONNECTION FOR TWO-CHANNEL RECEIVER

NOTE 2: CONNECTION FOR SINGLE-CHANNEL RECEIVER

NOTE 3: USED FOR SIMPLEX STATION

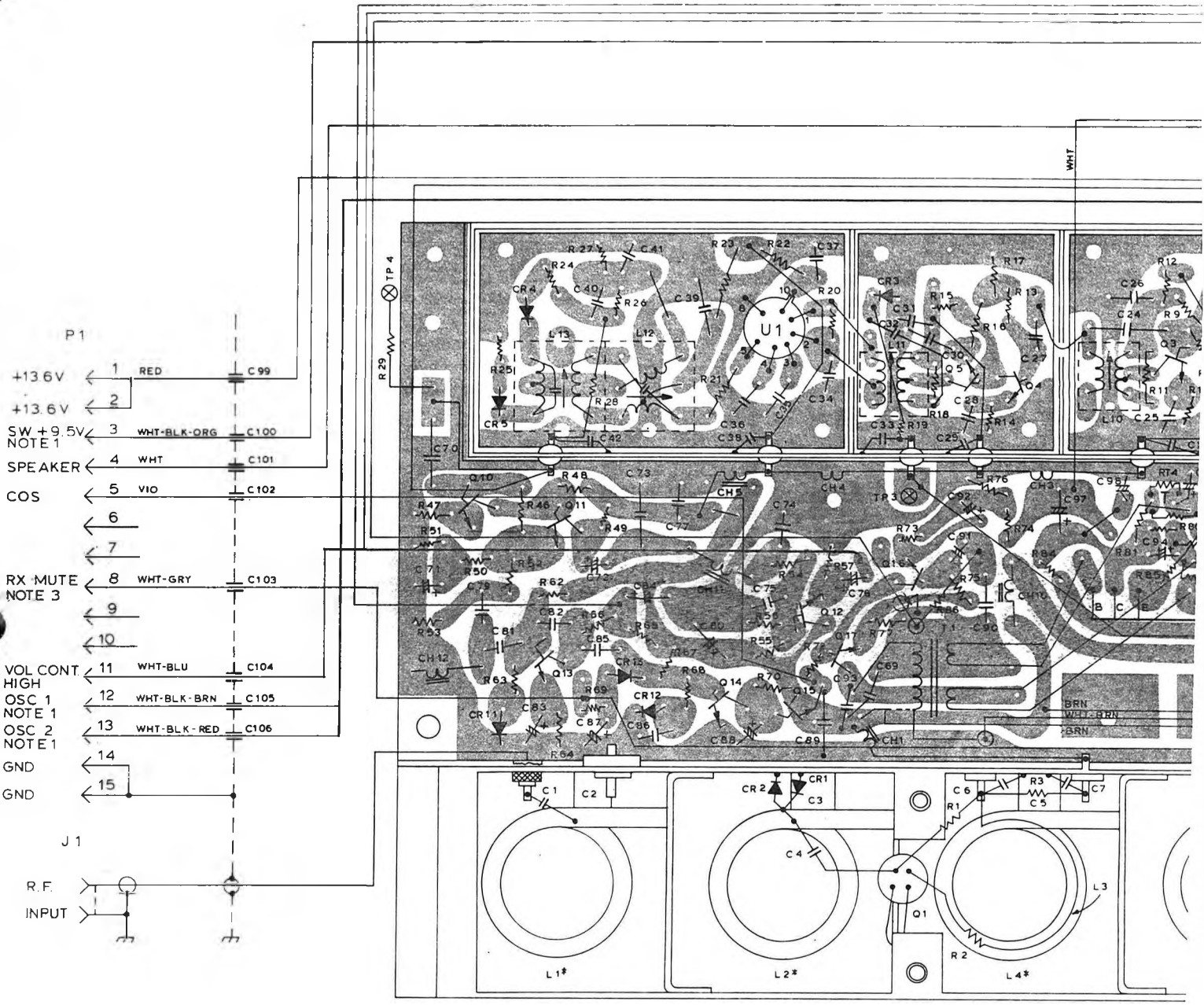
NOTE 4: SPEAKER ON-OFF SWITCH USED FOR LOW STANDBY DRAIN APPLICATIONS

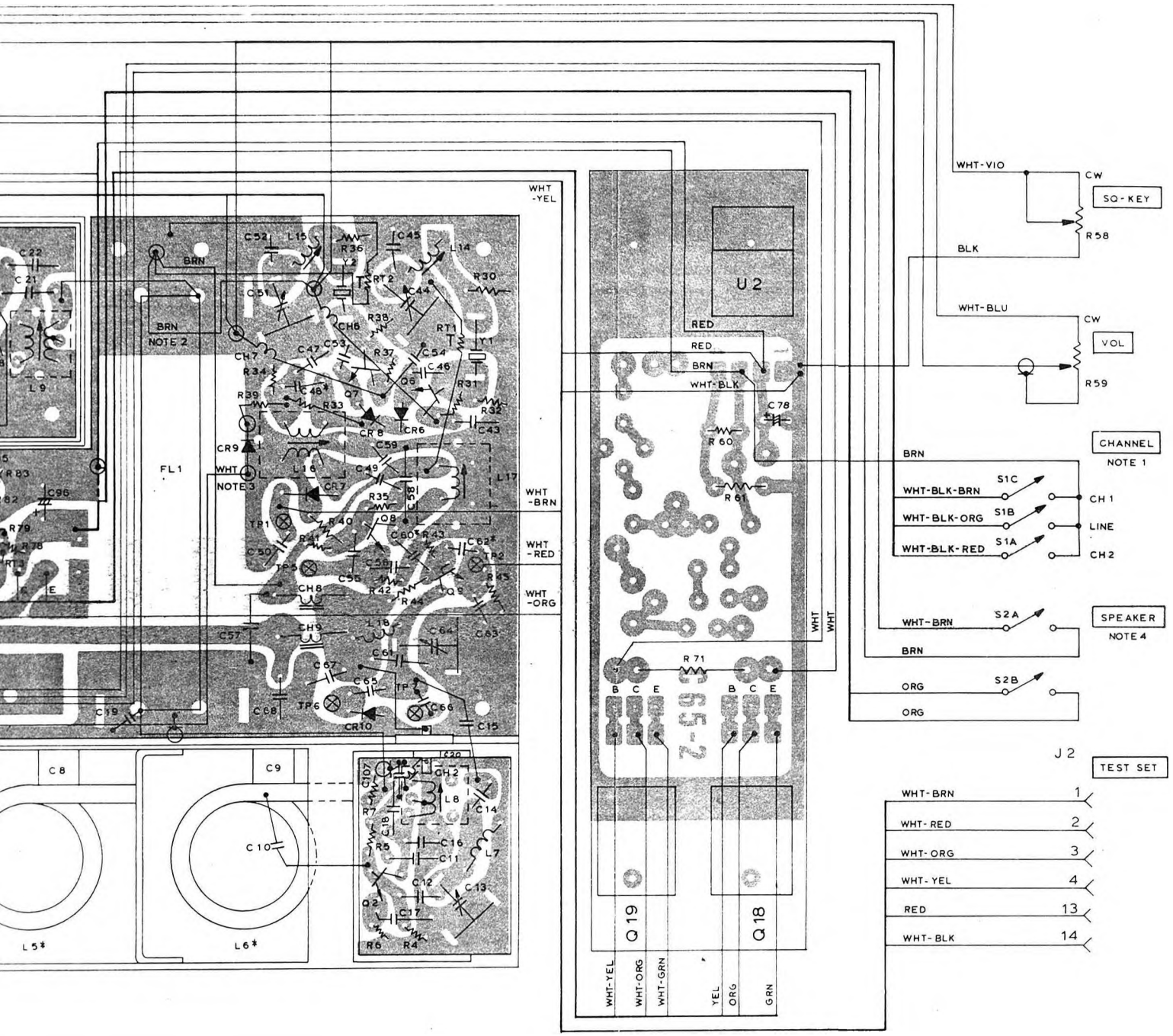
REV	DATE	DESCRIPTION	DRN	CHKD	APPVD

WESTERN RADIO SERVICES LTD.
VANCOUVER B.C., CANADA

TITLE: WR-494 RECEIVER MODULE SCHEMATIC DIAGRAM

DRAWN T.A.	DATE FEB 28, 1978	DRAWING NUMBER 65.-34
CHECKED AC	SCALE	
APPROVED		


P1
+13.6V
1
RED
C99
+13.6V
2
SW +9.5V
NOTE 1
3
WHT-BLK-ORG
C100
SPEAKER
4
WHT
C101
COS
5
VIO
C102
6
7
RX MUTE
NOTE 3
8
WHT-GRY
C103
9
10
VOL CONT
HIGH
11
WHT-BLU
C104
OSC 1
NOTE 1
12
WHT-BLK-BRN
C105
OSC 2
NOTE 1
13
WHT-BLK-RED
C106
GND
14
GND
15
J1
R.F.
INPUT
TP4
U1
L1*
L2*
L4*
Q1
L3
R2
WHT
BRN
WHT-BRN
BRN



NOTE 1 CONNECTION FOR TWO-CHANNEL RECEIVER

NOTE 2 CONNECTION FOR SINGLE-CHANNEL RECEIVER

NOTE 3. USED FOR SIMPLEX STATION

NOTE 4 SPEAKER ON-OFF SWITCH USED FOR LOW STANDBY DRAIN APPLICATIONS

REV	DATE	DESCRIPTION	DRN	CHKD	APPVD

WESTERN RADIO SERVICES LTD.
VANCOUVER B.C., CANADA

TITLE: WR-494 RECEIVER MODULE
WIRING AND ASSEMBLY DIAGRAM

DRAWN T.R.	DATE NOV. 30, 1977	DRAWING NUMBER
CHECKED fc	SCALE	65-61
APPROVED		