HIGH SEAS AND OVERSEAS RADIO
LD-R1 RADIO RECEIVER
TESTS

This section contains the test procedures for the LD-R1 radio receiver. The tests are arranged so that the receiver may be checked and adjustments can be made to bring the operation of the receiver to its most efficient performance.

This section affects Equipment Test Lists.

The LD-R1 receives A3-b signals, ie, those with two independent sidebands and reduced carrier. This arrangement results in four independent voice circuits across the bandwidth of the combined upper and lower sidebands. The receiver may be in use for point-to-point long distance operation on a 24-hour basis.

The tests outlined in this section require that the receiver be removed from service. The proper precautions should be maintained so that there is no interruption of commercial service.

It is important that the power supply voltages be correct within limits before proceeding with any of the tests. The voltages are checked as a part of Chart 1 and should be checked in all instances, even if the remainder of Chart 1 is omitted.

CHART **PAGE**

APPARATUS:

The following test equipment is required for the performance of the tests in this section. Ensure that each item of test equipment is properly calibrated in accordance with the manufacturer's specifications.

Substitute test equipment may be used if it meets the requirements outlined in Section 403-351-500.

1—Signal Generator, Hewlett-Packard 606B in combination with an 8708A Synchronizer

APPARATUS (Cont):

1—Kay Mega Node Generator

1—Western Electric 21A Transmission Measuring Set (TMS)

1—368A 75-ohm Termination

1—Electronic Counter, Hewlett-Packard 5245L

1—Headset

2—217D 600-ohm Plugs

CHART 1

SENSITIVITY AND NOISE FIGURE

This test measures the sensitivity and the inherent noise of the receiver. The procedure uses the thermal noise generated in the RF stage of the receiver as a signal. The sensitivity of the receiver is determined by measuring the inherent noise and then comparing that noise with a calibrated external noise source.

STEP	PROCEDURE
1	Set the meter switch on the metering panel to the positions indicated in Table A. Adjust the corresponding controls on the power supplies fully counterclockwise and fully clockwise and note the meter indications. ***Requirement:*** The range of minimum and maximum indication must be at least the amount shown in Table A. A range that exceeds that shown does not necessarily indicate trouble.
2	If the requirements in Step 1 are met, proceed to Step 3. If the requirements are not met, consult Trouble Shooting Section 403-351-502.

TABLE A

PANEL SELECTOR POSITION	POWER SUPPLY CONTROL	METER INDICATION		ACTUAL VOLTAGE	
		MIN	MAX	MIN	MAX
6 (—130V)	ADJ VOLTS —130V	125	140	—125	—140
6 (+130V)	ADJ VOLTS +130V	125	140	+125	+140
7 (+250V)	ADJ VOLTS	110	145	+220	+290

CHART 1 (Cont)

STEP	PROCEDURE
3	Establish the test connections shown in Fig. 1.

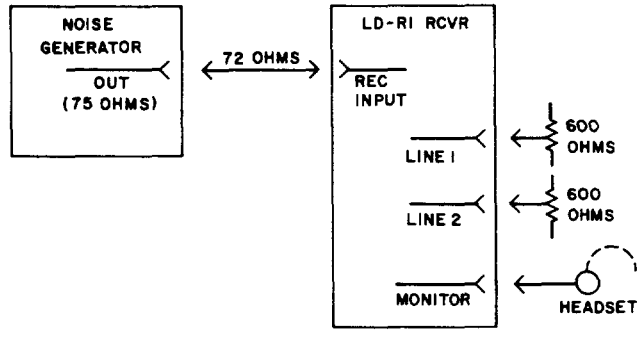


Fig. 1—Noise Test Setup

4 Set the receiver controls as follows:

CONTROL	LOCATION	POSITION
VOLUME CONTROL	Intermediate-Frequency Panel	MAN
CARRIER BRANCH GAIN	Intermediate-Frequency Panel	Max CW
MONITOR TRANSFER	Voice-Frequency Panel	A
VU METER TRANSFER	Voice-Frequency Panel	A
2ND BEAT OSCILLATOR TUNING	High-Frequency Panel	0
MAN VOL CONTROL	Intermediate-Frequency Panel	Max CW

5 Adjust the receiver to a frequency of 16 MHz $\pm$250 kHz.

6 Adjust HF AMPLIFIER TUNING and INPUT TUNING for maximum receiver noise as indicated on the VU meter.

CHART 1 (Cont)

STEP	PROCEDURE
	Note: Listen for a beat note in both channels and make sure that no signal is being received. If there is an indication of a signal, change the operating frequency of the receiver slightly and repeat the adjustments.
7	Observe the average noise level indication on the VU meter for Channel A and Channel B. ***Requirement:*** The noise indicated for Channel A or Channel B exceeds −10 VU. The difference between the two channels does not exceed 2 VU.
8	Observe the average indication of the CARRIER RECT CURRENT meter. ***Requirement:*** The indication is in excess of 30.
9	If the requirements in Steps 6 and 7 cannot be met, low receiver sensitivity is indicated. Corrective steps should be taken as indicated in Section 403-351-502. If the requirements are met, proceed to Step 10.
10	Adjust the MAN VOL CONTROL for an average noise indication at midscale on the VU meter for Channel A.
11	Turn on the noise generator.
12	Adjust the output of the noise generator to produce an increase of 3 VU on the VU meter for Channel A.
13	Note the noise figure indication on the Mega Node meter. Allow a 2-dB correction for the mismatch between the noise generator and the receiver. ***Example 1:*** Mega Node indication +4 dB Correction +2 dB Generator setting 0 dB Noise figure +6 dB ***Example 2:*** Meter indication −1 dB Correction +2 dB Generator setting +10 dB Noise figure +11 dB

CHART 1 (Cont)

STEP	PROCEDURE
	Requirement: The corrected noise figure does not exceed 13 dB.
14	Repeat Steps 12 and 13 for Channel B. ***Note:*** An out-of-limit condition for the requirement of Step 13 is usually caused by excessive tube noise in tubes V201, V202, or V203.
15	Repeat Steps 6 through 14 for a received frequency of 7 MHz $\pm$250 kHz.
16	Remove the test equipment from the receiver.

CHART 2

CARRIER BRANCH GAIN CALIBRATION

This test calibrates the carrier branch gain control for 0-, 10-, and 20-dB carrier suppression. The procedure incorporates adjustments of the second beat oscillator frequency, the local carrier supply to the third demodulators, the automatic volume control delay, and the VF output level.

STEP	PROCEDURE
	Second Beat Oscillator Frequency
1	Establish the test connections as shown in Fig. 2.

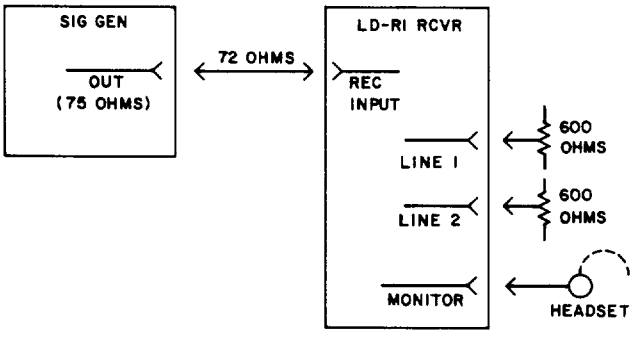


Fig. 2—Test Connections

	Note: Do not apply a signal to the receiver at this time.
2	Make the following settings on the receiver.

CHART 2 (Cont)

STEP	PROCEDURE

CONTROL	PANEL	SETTING
PANEL SELECTOR	Meter	4
2ND BEAT OSCILLATOR TUNING	HF	0
1ST BEAT OSCILLATOR	HF	CRYSTAL
AFC ZERO ADJ	HF	0
MAN VOL CONTROL	IF	7.5
VOLUME CONTROL	IF	MAN
CARRIER BRANCH GAIN	IF	5
MONITOR TRANSFER	VF	B
CARRIER SUPPLY	VF	LOCAL
VU METER TRANSFER	VF	B
AFC	VF	OFF
PANEL 4 VT CURRENTS	VF	CAR VOLT D3 V403A 4V

3 Operate the pushbutton 2ND OSCILLATOR ZERO ADJ.

4 Listen for a tone in the headset while adjusting slotted shaft 2ND BEAT OSCILLATOR ZERO ADJ control. Adjust for a zero beat in the headset. This results in a peak indication on the CARRIER RECT CURRENT meter. If more than one heterodyne is heard, adjust the MAN VOL CONTROL until only one is heard.

Note: Do not readjust the 2ND BEAT OSCILLATOR ZERO ADJ control during the remainder of the test.

Local Carrier Adjustment to 3rd Demodulators

5 Use a screwdriver and adjust the DEM CAR GAIN control (on the voice frequency panel) for an indication of 80 on the DC METERING meter.

CHART 2 (Cont)

STEP	PROCEDURE
	Automatic Volume Control Delay Adjustment
6	Supply a signal from the signal generator to the receiver. Set the signal generator to approximately 7 MHz and adjust the signal generator output so that a signal of 5000-μV amplitude enters the receiver.
7	Set the receiver controls as follows:

CONTROL	SETTING
MONITOR TRANSFER	A
VU METER TRANSFER	A
PANEL 4 VT CURRENTS	SB VOLT HYB V401 A 20V

8	Make a standard receiver lineup on the signal (Section 403-351-300).
9	Adjust MAN VOL CONTROL for an indication of 30 on the DC METERING meter.
10	Adjust CARRIER BRANCH GAIN control for an indication of 130 on the CARRIER RECT CURRENT meter.
11	Set the VOLUME CONTROL switch to AUTO.
12	Adjust slotted shaft of AUTO VOL CONTROL—DELAY for an indication of 130 on the CARRIER RECT CURRENT meter.
	Note: Allow time for the circuits to stabilize between adjustments.
	VF Output and Carrier Branch Gain Calibration
13	Adjust signal generator output for a 50-microvolt input to the receiver.
14	Set VOLUME CONTROL switch to MAN.
15	Adjust the AFC ZERO ADJ control until a tone of approximately 1000 Hz is heard in the headset.
	Note: If the tone is low, adjust the MAN VOL CONTROL for a satisfactory level.
16	Adjust the MAN VOL CONTROL for an indication of 30 on the DC METERING meter and leave at this setting for the remainder of the test.

CHART 2 (Cont)	
STEP	**PROCEDURE**
17	Adjust the slotted shaft VF GAIN A control for an indication of 0 VU on the VOLUME INDICATOR meter. ***Note:*** It is important that the receiver outputs be terminated with 600-ohm plugs (Fig. 2).
18	Set MONITOR TRANSFER switch to B and VU METER TRANSFER switch to B.
19	Adjust the frequency of the signal generator until a tone of approximately 1000 Hz is heard in the headset connected to monitor Channel B.
20	Adjust slotted shaft VF GAIN B control for an indication of 0 VU on the VOLUME INDICATOR meter.
21	Line up the signal using the signal generator or the AFC ZERO ADJ control.
22	Set the VOLUME CONTROL switch to AUTO and note the indication on the CARRIER RECT CURRENT meter.
23	Set the VOLUME CONTROL switch to MAN and adjust the CARRIER BRANCH GAIN control until the CARRIER RECT CURRENT meter indicates as in Step 22.
24	Record the setting of the CARRIER BRANCH GAIN control. This setting corresponds to 0-dB suppression. Note the indication on the CARRIER RECT CURRENT meter. This is the reference value to be used when obtaining other carrier branch gain dial calibration settings. Post the control setting on or near the receiver.
25	On the high-frequency panel, set the INPUT ATTENUATION DB switch to 10.
26	Adjust the CARRIER BRANCH GAIN control to obtain the same indication of carrier rectifier current as in Step 24.
27	Record the setting of the CARRIER BRANCH GAIN control. This corresponds to 10-dB suppression. Post the control setting on or near the receiver.
28	Set the INPUT ATTENUATION DB control to 20.
29	Adjust the CARRIER BRANCH GAIN control to obtain the same indication of carrier rectifier current as in Step 24.
30	Record the setting of the CARRIER BRANCH GAIN control. This corresponds to 20-dB suppression. Post the control setting on or near the receiver.
31	Return the INPUT ATTENUATION DB switch to 0 position. ***Note:*** The chart that follows uses the same test setup.

CHART 3

AVC ACTION AND ADJUSTMENT

STEP	PROCEDURE
1	Connect the signal generator as in Fig. 2.
2	Set the signal generator frequency to approximately 4.8 MHz.
3	Set the output to deliver 50,000 μV at the input of the receiver.
4	On the receiver, set the INPUT ATTENUATION DB control to 20.
5	Set the MONITOR TRANSFER switch and the VU METER TRANSFER switch to position A.
6	Make an operation lineup on the signal (Section 403-351-300).
7	On the receiver set the controls as follows: PANEL SELECTOR to 4 PANEL 4 VT CURRENTS to SB VOLT HYB VOLUME CONTROL to MAN
8	Adjust the MAN VOL CONTROL for an indication of 30 on the DC METERING meter.
9	Adjust CARRIER BRANCH GAIN control for an indication of 130 on the CARRIER RECT CURRENT meter.
10	Remove signal generator cable from REC INPUT jack.
11	Terminate the REC INPUT jack with a 368A 75-ohm termination plug.
12	Set VOLUME CONTROL to the AUTO position.
13	Turn slotted shaft of AUTO VOL CONTROL—DELAY fully clockwise.
14	Turn slotted shaft of AUTO VOL CONTROL—MAX GAIN for a noise indication of -10 VU on the VU meter.
15	Turn the slotted shaft of AUTO VOL CONTROL—DELAY to the approximate midposition.
16	Remove the 368A termination plug from REC INPUT.
17	Return the signal generator connecting cable to REC INPUT.
18	Make an operation lineup on the signal.

CHART 3 (Cont)

STEP	PROCEDURE
	Note: Be especially critical when tuning the HF AMPLIFIER TUNING and INPUT TUNING controls.
19	Readjust slotted shaft of AUTO VOL CONTROL—DELAY control for an indication of 130 on the CARRIER RECT CURRENT meter.
	Note: Allow an 8- or 10-second delay between adjustments for stabilization of the circuits.
20	Set the PANEL SELECTOR control to 5 and the PANEL 5 VT CURRENTS control to AFC RECT V507 40 MA.
21	Adjust the output of the signal generator for receiver inputs shown in Table B.

TABLE B

RECEIVER INPUT (MICROVOLTS)	CARRIER RECT CURRENT	VU METER
50,000	130	−18
5,000	115	−18
500	100	−18
50	85	−18
5	70	−17
2	60	−11
1	50	−6

Requirement: The CARRIER RECT CURRENT should rise to the approximate values indicated. The VU meter indications should not exceed the values given. (***Example:*** −17 VU for a requirement of −18 VU is out of limits.)

Note: Watch the DC METERING meter, especially when the input signal is below 50 microvolts, to be sure the receiver maintains control of the signal.

22 If the requirements are met, proceed to Chart 4. If the requirements are not met, check V307 and V308A. If an out-of-limit condition still exists, check V201, V203, V301, V302, and V303. Consult Section 403-351-502.

CHART 4

IF AND VF CHARACTERISTICS AND INTERCHANNEL CROSSTALK

This test checks the overall frequency characteristics of the 2800-kHz and 100-kHz IF amplifiers, the channel filters, and the VF group amplifiers. Interchannel crosstalk of the channel filters is also measured.

In this test, a frequency sweep is made through the receiver bandpass to determine the upper and lower limits of the channel filters. An electronic counter is used for accuracy.

STEP	PROCEDURE
1	Establish the test connections as shown in Fig. 3.
2	Adjust the signal generator frequency to approximately 7 MHz.
3	Set the output to deliver 50 μV at the input to the receiver.
4	On the receiver, set the INPUT ATTENUATION DB to 0, the MONITOR TRANSFER switch to position A and the VU METER TRANSFER switch to position A.
5	Make an operation lineup on the signal (Section 403-351-300).
6	With the headset in the monitor jacks, adjust the frequency of the signal generator so that a 1000-Hz tone is heard in MONITOR jacks (Channel A).
7	On the receiver, set MAN VOL CONTROL to 0 and VOLUME CONTROL to MAN.

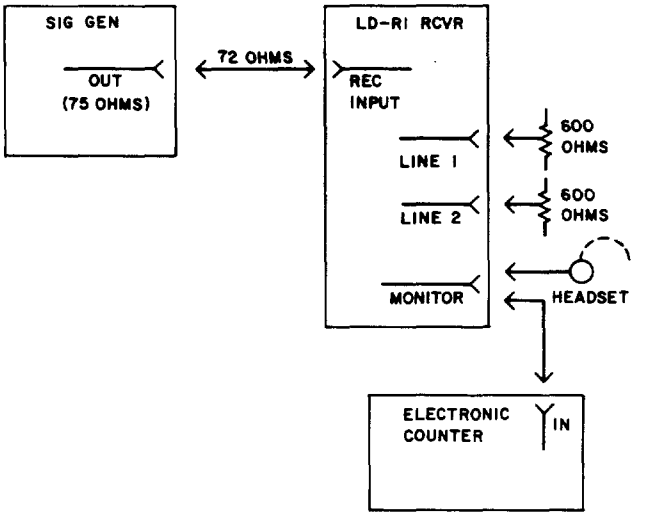


Fig. 3—Test Connections for Crosstalk Test

CHART 4 (Cont)

STEP	PROCEDURE
8	Adjust the MAN VOL CONTROL until the VU meter indicates 0.
9	Patch the electronic counter to the MONITOR jacks.
	Note: The electronic counter may be patched to the level jacks on the testboard if it is more convenient.
10	Vary the frequency of the signal generator so that the audio output, as counted by the electronic counter, ranges from 100 to 6000 Hz. At the same time, observe the VU meter.
	Requirement: See Table C.

TABLE C

VF FREQUENCY (HZ)	VU METER INDICATION (VU)
100	−1.5 to +1.5
300	−1 to +1
500	0
1000	−1 to +1
2000	−1 to +1
3000	−1 to +1
4000	−1 to +1
5000	−1.2 to +1.2
6000	−4 to +4

	Note: It is not necessary to stop the frequency change of the signal generator as it is swept through the testing range. It is critical that the sweep begin at 100 Hz and end at 6000 Hz. If the VU meter indicates a flat response over the entire testing range, there is no need to determine the output at each frequency.
11	At the testboard level jacks or the receiver MONITOR jacks (whichever is more convenient), measure the output levels of Channel A and Channel B with a 21A TMS.
	Requirement: Channel B is at least 30 dB lower than Channel A.
12	If the requirement is met, repeat Steps 6 through 11 for Channel B. If the requirement is not met, check channel filters YF401 and YF402 and Section 403-351-502.

CHART 5

INPUT LEVELS TO THE AFC AMPLIFIERS

This procedure sets the gain of the 100-kHz oscillator amplifier (V501) and the 100-kHz carrier amplifier (V502). These two independent sources of 100-kHz energy are the determining factors that control the movement of the automatic frequency control motor.

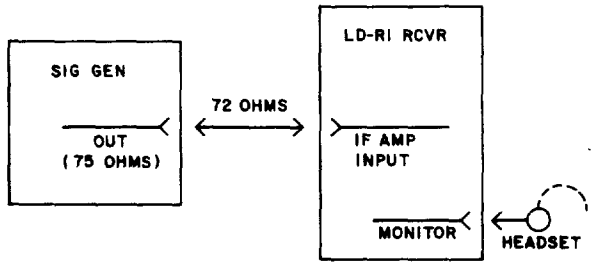
STEP	PROCEDURE
1	Establish the test connections shown in Fig. 4.
	
	Fig. 4—Test Connections for AFC Amplifiers
2	Adjust the signal generator for a frequency of 100 kHz and an output of 5000 μV.
3	On the receiver, set: VOLUME CONTROL to MAN PANEL SELECTOR to 4 PANEL 4 VT CURRENTS to SB VOLT HYB
4	Adjust the MAN VOL CONTROL for an indication of 30 on the DC METERING meter.
5	Set the CARRIER BRANCH GAIN control to the position corresponding to a carrier suppression of 0 dB. Refer to Chart 2, Step 24. Post the control settings on or near the receiver.
6	Readjust the signal generator frequency for a peak indication on the CARRIER RECT CURRENT meter. Maintain this adjustment throughout this chart.
7	Reset the CARRIER BRANCH GAIN control for an indication of 100 on the CARRIER RECT CURRENT meter.
8	Set the AFC switch to the ON position.
9	On the AUTO FREQ CONTROL panel, adjust slotted shaft AUTO FREQ CONTROL —OSC GAIN control fully counterclockwise.
10	Set PANEL SELECTOR switch to position 5, and set PANEL 5 VT CURRENTS to position AFC RECT V507 40 MA.

CHART 5 (Cont)

STEP	PROCEDURE
11	Adjust slotted shaft AUTO FREQ CONTROL—CAR GAIN control for an indication of 70 on the DC METERING meter. ***Note:*** If an indication of 70 cannot be obtained, check V502, V503, and V507.
12	Set the AFC control to the OFF position.
13	Adjust slotted shaft control AUTO FREQ CONTROL—OSC GAIN for an indication of 70 on the DC METERING meter. ***Note:*** If an indication of 70 cannot be obtained, check V501, V512, and V511.
14	Note the indication on the DC METERING meter while switching PANEL 5 VT CURRENTS to the following positions: AFC RECT V508 40 MA AFC RECT V509 40 MA AFC RECT V510 40 MA ***Requirement:*** The indication is between 65 and 75.
15	If the requirement is met, proceed to Step 16. If the requirement is not met, check V504, V508; V505, V509; and V506, V510.
16	Set the AFC switch to the ON position.
17	Note that the indication on the DC METERING meter varies between 10 and 100 as the PANEL 5 VT CURRENTS switch is set in the three AFC RECT positions. ***Note:*** The limits of this condition are not critical. The purpose of this observation is to make sure that the AFC rectifiers are functioning in relation to a changing frequency from the signal source. It may be necessary to adjust the signal generator slightly so that a change in frequency produces a change in current. If there is no variation with input signal frequency change, recheck the steps in this chart and the circuits involved.

CHART 6

ALARM SYSTEM AND AFC SQUELCH PERFORMANCE

STEP	PROCEDURE
1	Set the receiver controls as follows: AFC to ON CARRIER SUPPLY to LOCAL

CHART 6 (Cont)

STEP	PROCEDURE
	MAN VOL CONTROL to 0 VOLUME CONTROL to MAN EXTERNAL ALARM to ON
2	On the 130V panel, operate the PWR switch to OFF for approximately 3 seconds and then return to the ON position. ***Requirement:***

Indicator	PWR switch OFF	PWR switch ON
Green lamp	Lamp extinguishes immediately and major office alarm sounds.	Lamp lights again within 10 seconds after power is restored. Major alarm clears.
Amber lamp	Lamp lights immediately.	Lamp extinguishes after green lamp relights.
Red lamp	Lamp lights immediately and, if connected, minor office alarm sounds.	Lamp extinguishes after green lamp relights and minor alarm clears.

3	Push in and slowly turn AFC ZERO ADJ control, moving the scale first to the red 4-3/4 position and then to the black 4-3/4 position. ***Requirement:*** The buzzer or the minor office alarm (whichever is used) operates and the red lamp AFC lights at each scale limit.
4	Establish test connections shown in Fig. 2.
5	Adjust the signal generator to provide a 7-MHz 50-μV signal at the receiver input.
6	Set MONITOR TRANSFER switch to position A and VU METER TRANSFER switch to position A.
7	Make a standard operational lineup on the signal.
8	Adjust the output of the signal generator for an input level at the receiver of 0.5 μV.
9	On the receiver, adjust the MAN VOL CONTROL for an indication of 50 on the CARRIER RECT CURRENT meter.
10	Set the AFC switch to the SQUELCH position.

CHART 6 (Cont)

STEP	PROCEDURE
11	At the receiver, slowly turn the CARRIER BRANCH GAIN control toward zero (counterclockwise). Watch the CARRIER RECT CURRENT meter and the CARRIER OFF—FAST lamp (amber). ***Requirement:*** The amber lamp lights when the CARRIER RECT CURRENT meter indicates between 20 and 30. From 2 to 5 seconds later the red CARRIER OFF—SLOW lamp lights.
12	If the requirements in Step 11 are met, the AFC squelch circuit is in adjustment. Return the receiver to standby service condition. If the requirements in Step 11 are not met, complete Steps 13 through 31.
13	Terminate the receiver input at the REC INPUT jack with a 368A plug (75 ohms).
14	Set the receiver controls as follows: PANEL SELECTOR to 5 PANEL 5 VT CURRENTS to CAR AMP V502 20 MA MAN VOL CONTROL to 0 VOLUME CONTROL to MAN AFC to ON CARRIER BRANCH GAIN to 20 EXTERNAL ALARM (if used) to OFF
15	Turn the MAN VOL CONTROL to the maximum clockwise position.
16	Observe the indication of the DC METERING meter. ***Requirement:*** 85 minimum. ***Note:*** If the requirement cannot be met, check V502.
17	Set PANEL 5 VT CURRENTS switch to CAR ALM SLOW V513 20 MA.
18	Observe the indication on the DC METERING meter. ***Requirement:*** 85 minimum. ***Note:*** If the requirement cannot be met, check V513.
19	Set the AFC switch to OFF; note the indication on the DC METERING meter.

CHART 6 (Cont)

STEP	PROCEDURE
	Requirement: The indication drops to zero within 2 to 5 seconds.
	Note: If the requirement is not met, check V513 circuitry.
20	Set PANEL 5 VT CURRENT to CAR AMP V502 20 MA and AFC to SQUELCH.
21	Set slotted shaft SQUELCH CONTROL CAR GAIN control to its maximum clockwise position.
22	Rotate slotted shaft SQUELCH CONTROL NOISE GAIN control to its maximum counterclockwise position.
23	Adjust the MAN VOL CONTROL for an average indication of −10 VU on the VU meter.
24	Adjust the SQUELCH CONTROL NOISE GAIN control to obtain an indication that slowly fluctuates (about 2-second intervals) between zero and 80 to 100 on the DC METERING meter.
25	Set MAN VOL CONTROL to 0.
26	Make an operational lineup using the test setup described in Steps 4 and 5.
27	Set VOLUME CONTROL to MAN.
28	Adjust the MAN VOL CONTROL for an indication of 25 on the CARRIER RECT CURRENT meter.
29	Turn slotted shaft SQUELCH CONTROL CAR GAIN control for an indication of 25 on the DC METERING meter.
30	Adjust the MAN VOL CONTROL for an indication of 50 on the CARRIER RECT CURRENT meter.
31	Observe the DC METERING meter.
	Requirement: Between 85 and 125.
32	Repeat Steps 8 through 11.