2600-HZ E1L AND E2L SINGLE-FREQUENCY SIGNALING CIRCUIT OUT-OF-SERVICE TESTS USING TESTING CIRCUIT SD-96519-01 OR SD-96519-02

1. GENERAL

1.01 This section describes methods of making out-of-service tests on the 2600-Hz single-frequency signaling circuit SD-98137-01 or SD-98137-02 using testing circuit SD-96519-01 or SD-96519-02. This section also describes methods of making potentiometer adjustments to correct for changes in the characteristics of some circuit elements. If the requirements of this section cannot be met after readjustment of potentiometers or relays, the units should be returned to a repair center because of the special techniques involved in testing and clearing trouble on some of the components.

1.02 This section is reissued to revise Test D.

This reissue does not affect the Equipment Test List.

1.03 The tests covered are:

1.04 The J94021A (21A) transmission measuring set is referred to in this section as 21A.

1.05 The KS-14510 volt-ohm-milliammeter is referred to in this section as VOM.

1.06 The 4A signaling test set is referred to in this section as 4A test set.

1.07 The 2B signaling test set is referred to in this section as 2B test set.

1.08 The J98613AY test panel (SD-96519-01 or SD-96519-02) is referred to in this section as test circuit. KEYERS switch 1 and RECEIVER switch 2, on this panel are referred to as SW1 and SW2, respectively. Jacks and keys mentioned in this section are part of the test circuit, unless otherwise specified.

1.09 Adjust the 2B test set slowly to prevent pulsing out incorrect values, especially above 70 percent. Incorrect values will be obtained if the rate of vibration of the PERCENT BREAK meter pointer is not the same as the PULSES PER SECOND meter pointer. To restore correct percent break values, turn the ADJ % BK control counterclockwise until both pointers are vibrating at the same rate; then slowly turn the control clockwise until the desired percent break value is obtained. It may be necessary to change the coarse ADJ % BK switch from S, M, or L setting to obtain the desired range on the PERCENT BREAK meter.

1.10 The designation E2L-( ), when used in this section, applies to all E2L units with dash numbers.

1.11 ***Lettered Steps:*** A letter a, b, c, etc, added to a step number in Part 3 or 4 of this section, indicates an action which may or may not be required, depending on local conditions. The condition under which a lettered step or a series of lettered steps should be made is given in the ACTION column, and all steps governed by the same condition are designated by the same letter within a test. Where a condition does not apply, all steps designated by that letter should be omitted.

2. APPARATUS

2.01 The apparatus required for each test is shown in Table A. The details of each item are covered in the paragraph indicated by the number in parentheses.

2.02 Test circuit J98613AY (SD-96519-01 or SD-96519-02) includes folding fixture J98613AC.

2.03 2B test set, J64730B (SD-56134-01).

2.04 4A test set, J94743A, including the E&M J94743AD and SF J94743AA interface units.

2.05 Transmission measuring set (J94021A).

2.06 KS-14510 volt-ohm-milliammeter, including testing leads.

2.07 Testing cord, W2CF cord, 1 foot long, equipped with a 310 plug and one 360B tool and one 360C tool (2W17D cord assembly).

2.08 Patching cord, P3E cord, 6 feet long, equipped with two 310 plugs, (3P7A cord assembly).

2.09 Patching cord, P3N cord, 6 feet long, equipped with a 310 plug and a 241A plug (3P17B cord assembly).

2.10 Patching cord, P2A cord, 6 feet long, equipped with two 347A plugs (2P1D cord assembly).

2.11 Patching cord, P2A cord, 6 feet long, equipped with two 347B plugs (2P3B cord assembly).

2.12 Monitoring cord, P8E cord, 12 feet long, equipped with one KS-8585 L10 plug and one KS-8586 L7 socket.

2.13 725A tool, used to gain mechanical advantage in prying loose the signaling units from connectors.

2.14 603A tool for removing 291- or 303-type relays. Use in accordance with Section 040-263-501.

2.15 Blocking and insulating tools as required. Use tools and apply as covered in Section 069-020-801.

TABLE A

APPARATUS	TESTS							
	A	B	C	D	E	F	G	H
Test Circuit (2.02)	1	1	1	1	1	1	1	1
2B Test Set (2.03)		1			1			
4A Test Set (2.04)						1		
TMS (2.05)	1		1	1			1	1
KS-14510 VOM (2.06)*		1						
Cord (2.07)		1						
Cord (2.08)	1	1						
Cord (2.09)	1		1	1		1	1	1
Cord (2.10)					1			
Cord (2.11)					1			
Cord (2.12)	1							
Tool (2.13)	1	1	1	1	1	1	1	
Tool (2.14)				1	1			
Tool (2.15)	√	√	√	√	√	√	√	√
Screwdriver, C			1	1	1	1		
258D (dummy) Plug	1				1			

√ As required
* If 4A test set is used in this section use the KS-14510 VOM in Test B.

3. PREPARATION

STEP	ACTION	VERIFICATION
All Tests		
	Caution: The 291- or 303-type relays shall be maintained in an upright position not less than 1 minute before beginning any test.	
1	At test circuit— Set all keys to normal position and attenuator	

STEP	ACTION	VERIFICATION
	switches to 0 before starting any tests and check test circuit per Section 179-315-501 if calibration is unknown. ***Note:*** The twist keys in the test circuit are operated when the white line is in the vertical position and normal when the white line is in the horizontal position.	
2	Obtain release of signaling circuit in accordance with approved procedures.	
3	Remove signaling unit from its in-service position, using disengaging tools. (See Fig. 1 and 2.) ***Note:*** If signaling unit is not provided with J or Y wiring option, strap terminals 2 to 8, and 3 to 7 on the GS connector. Strap terminal 25 to 26 on the printed board. Also for SD-98137-01 units, strap terminal 17 to 45 on the printed board; for SD-98137-02 units, strap B relay terminal 10 to 11. An adapter plug can be made up using a Cinch-Jones plug, type 8PB, and steel snap-on shield, type F16. Strap pins 2 to 8 and 3 to 7. Stencil E2L on shield. When testing units not provided with J or Y wiring, plug the adapter into the GS socket. Clip leads can be used to provide connections between terminals on the printed board and relay.	
4	Plug signaling unit into folding test fixture.	
5	Operate 2-WIRE key.	
6a	If test circuit is mounted in a REVERTIVE-TERMINATING bay, J98613AP— Operate CT key.	
Tests A, C, D, E, F, G, and H		
7	Connect 241A plug of 3P17B cord to DET IN jack of 21A TMS.	
8	Connect 310 plug of same cord to SF SUP jack of test circuit. ***Note:*** The 21A TMS requires that the DET INPUT switch be set to the proper position for each measurement. The TMS indications called for as verification in this section are	At 21A— Meter indicates between −15.1 and −16.2 dB.

STEP	ACTION	VERIFICATION
	the combined total of the DET INPUT switch setting and the meter indication.	
9	Disconnect plug from SF SUP jack; connect to AMP OUT jack of test circuit.	
10	Set SW2 to position 2.	At 21A— Meter indicates 0 dB. See Step 11b.
11b	If requirement of Step 10 is not met— Adjust gain control of MON amplifier to give indication of exactly 0 dB.	
12	Disconnect plug from AMP OUT jack, connect to TMS jack of test circuit.	

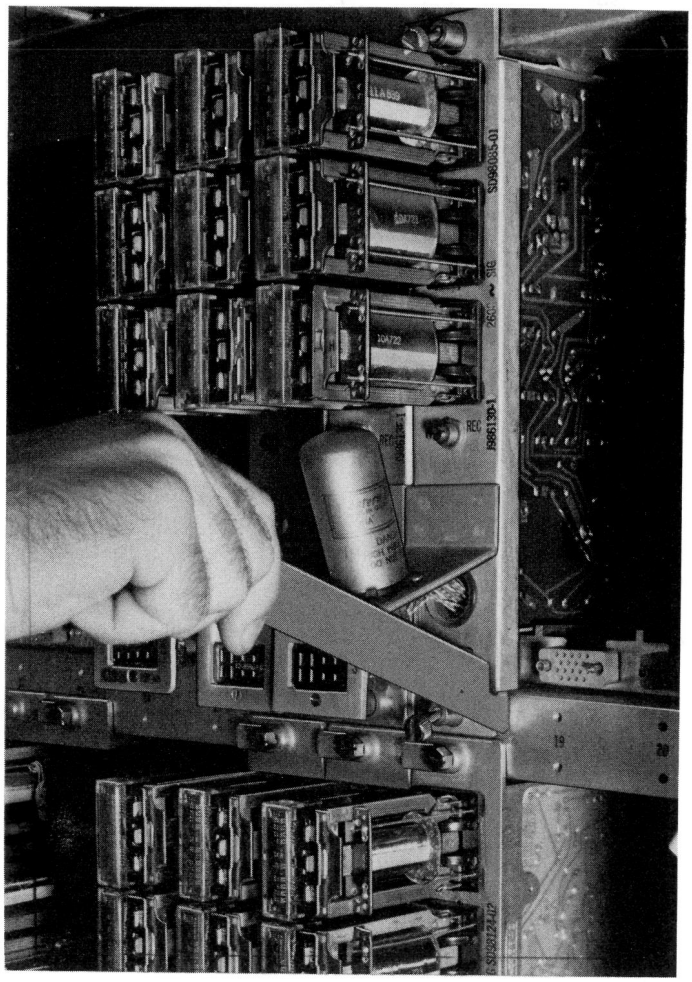

Fig. 1—Method of Removal of Fabricated Chassis

STEP	ACTION	VERIFICATION

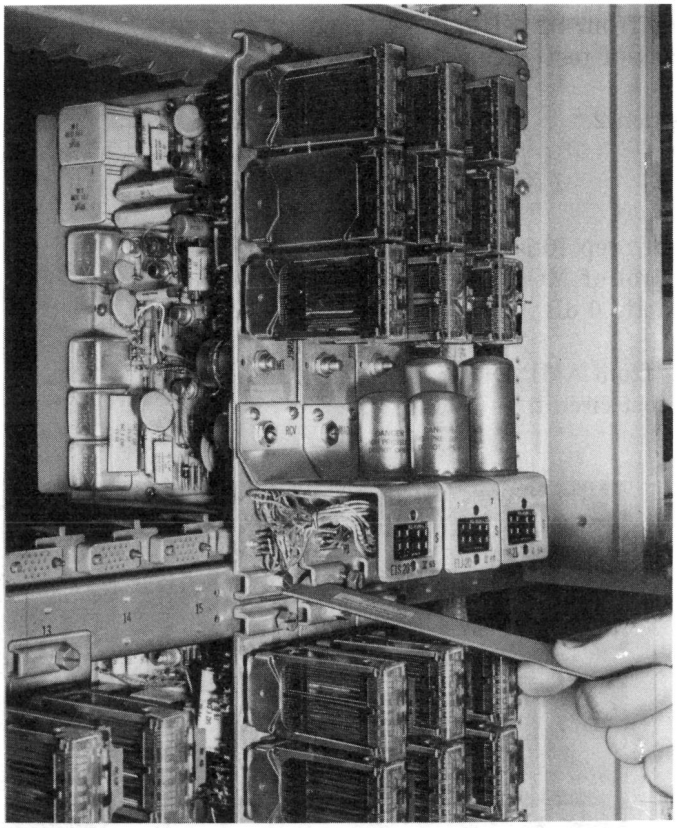

Fig. 2—Method of Removal of Die-Cast Chassis

Tests C and G

13	Connect 4A test set to 110 volts ac.	
14	Operate POWER switch to ON.	
15	Equip 4A test set with E&M and SF units.	
16	Using P3N cord, connect LINE/R jack of 4A test set to E jack and M jack of test circuit, with notched side of 241 plug toward E jack.	
17	At 4A test set— Set FUNCTION switch to MSEC BK or MSEC MK. ***Note:*** When verification calls for an indication in ms break or ms make, set the FUNCTION switch accordingly to obtain the proper indication.	

STEP	ACTION	VERIFICATION
18	Set SELECTOR switch to NORM.	
19	Set READ switch to MSEC UPDATE.	
20	Set SEND switch to EM.	
21	Set PULSE MODE switch to CONT.	
22	Set MS RANGE switch to 999.	
23	Operate GEN SUPV key to OFF HK.	
24	At 4A E&M interface unit— Operate PULSE/MEAS key to LINE.	
25	Operate TWD DROP key to ON HK.	
26	Operate TWD LINE key to OFF HK.	
27	Set E&M/CX—S/R switch to E&M/CX.	

4. METHOD

STEP	ACTION	VERIFICATION
A. Transmitted Tone Level and 20-Hz Operation		
13	At test circuit— Set SW1 to position 3, SW2 to position 1.	At 21A— Meter indicates −40 dBm or less power.
14	At test circuit— Operate E1C 2 key.	At 21A— Meter indicates between −23 and −26 dB. ***Note:*** This indication cannot be obtained if T option is furnished unless contact 12 break of RG relay is insulated.
15	At test circuit— Restore E1C 2 key to normal.	
16	Set SW1 to positon 4.	
17	Restore 2-WIRE key to normal.	
18	Operate 2W TER key.	
19	Block RG relay operated.	At SF unit— B relay operated.
20	At test circuit— Insert dummy plug into 1 MW TST jack.	

STEP	ACTION	VERIFICATION
21	Using P8E cord, patch from S socket on unit being tested to S1 socket on testing circuit. ***Caution: To avoid blowing the 20 ~ fuse when the 20 ~ P key is not provided, follow sequence exactly as stated. Never leave one end of a cord hanging loose while the other end is plugged into the 20 ~ R jack, because the loose end may touch frame ground. Also be sure to hold the plugs of the cord by insulating shell to avoid shock when inserting into or removing from the 20 ~ jack.***	
22	At test circuit— Using 3P7A patch cord, first connect to 20~ R jack, then to 2W or EQ RCV jack.	
23	Simultaneously depress TMS A, TMS B keys, also 20 ~ P key (when provided).	At 21A— Meter indicates between −23 and −26 dB.
24	At test circuit— Release TMS A, TMSB, 20 ~ P keys.	
25	First remove the plug from the 2W or EQ RCV jack, then from the 20 ~ R jack.	
26	Remove dummy plug from 1 MW TST jack.	
27	At SF unit— Remove blocking tool from RG relay.	B relay releases.
28	Remove patch cord from S socket on SF unit and S1 socket on test circuit.	
29	At test circuit— Operate 2-WIRE key.	
30	Restore 2W TER key to normal.	
31c	If no other tests are to be made— Remove all cords, restore all keys to normal, remove loop start wiring ***only if added for this test.*** Return signaling unit to service or spare position.	
B. Voice Amplifier Cutoff Transistor—Using 2B Test Set		
7b	If using voltmeter of 2B test set— At test circuit— Set SW1 to position 5, SW2 to position 1.	

STEP	ACTION	VERIFICATION
8b	At 2B test set— Set SCALE SEL switch to 20V.	
9b	Using 3P7A cord, patch between SENS 1 jack on test circuit and VM jack on 2B test set.	At 2B test set— Voltmeter indicates as follows: E1L 1.4 to 1.6 volts; E2L-( ) 0.8 volts or less.
10b	Remove patch cord between SENS 1 jack on test circuit and VM jack on 2B test set.	
11c	If KS-14510 VOM is used— At test circuit— Set SW1 to position 5, SW2 to position 1.	
12c	Set scale selector switch of VOM to 3 volts dc.	
13c	Connect 310 plug of 2W17D cord to SENS 1 jack of test circuit.	
14c	Connect positive (+) lead of VOM to 360C (white) tool of 2W17D cord.	
15c	Connect negative (−) lead of VOM to 360B (black) tool of 2W17D cord.	VOM indicates 1.4 to 1.6 for E1L unit or 0.8 volt or less for E2L-( ) unit.
16c	At test circuit— Remove cord from SENS 1 jack.	
17d	If no other tests are to be made— Remove all cords, restore all keys to normal, remove loop start wiring ***only if added for this test.*** Return signaling unit to service or spare position.	

C. Voice Amplifier Cutoff Transistor—Using 4A Test Set

28	Disconnect cord from DET IN jack of 21A, connect to FORM LINE jack of SF interface unit.	
29	At 4A test set— Operate PULSE/MEAS key of SF interface unit to LINE.	
30	Operate TWD EQPT key of SF interface unit to MON.	
31	Operate TWD LINE key of SF interface unit to MON.	

STEP	ACTION	VERIFICATION
32	Set NB-BB switch on SF interface unit to NB.	
33	Set RECEIVE switch to SF.	
34	Set PULSE PERIOD switch to 500.	
35	Set PULSE WIDTH switch to 50.	
36	At test circuit— Set SW 1 to position 8.	
37	Set SW 2 to position 3.	
38	At 4A test set— Depress START-STOP key.	
39	Depress OPERATE-CLEAR key.	Display indicates 5 to 20 ms break.
40c	If no other tests are to be made— Restore all keys, remove all cords, restore all circuits to normal.	

D. Four-Wire Terminating Circuit and Receiver Voice Amplifier

13	At test circuit— Operate 1000 ~ A key.	
14	Set SW1 to position 5, SW2 to position 2. ***Note:*** Verify that BAT LP key is in BAT position (released).	
15	Operate LP CUR 1 key.	At SF unit— CS relay operated.
16	▶At test circuit— Simultaneously depress TMS A, TMS B keys.◀	
17	Adjust XMT or TRMT potentiometer of SF unit under test to obtain 21A indication of ▶−16.0◀ dB.	▶At 21A— Meter indicates −16 dB when trunk layout record requires −16 dB for 2- to 4-wire transmit loss; otherwise, 21A indicates ±0.2 dB of loss specified on trunk layout record.◀
18	At test circuit— Release TMS A, TMS B keys.	
19	Restore 1000 ~ A key to normal.	
20	Operate 1000 ~ B key.	

STEP	ACTION	VERIFICATION
21	At SF unit— Adjust REC or RCV potentiometer fully counterclockwise.	At 21A— Meter indicates −39 dBm or less power.
22	At SF unit— Adjust REC or RCV potentiometer to extreme clockwise position.	At 21A— Meter indicates +1.5 dBm or more power.
23	At SF unit— Adjust REC or RCV potentiometer ▶for 21A meter indication of −8.8 ±0.2 plus (−0.2) dB or specified loss shown on trunk layout record ±0.2 plus (−0.2) dB. Additional 0.2 dB is caused by measuring a 900-ohm circuit using a 600-ohm 21A.◀	At 21A— Meter indicates ▶between −8.6 dB and 9.0 dB.◀
24	At test circuit— Simultaneously deprees TMS A, TMS B keys.	At 21A— Meter indicates between ▶−22.8 and −26.8 dB.◀ Note indication.
25	At test circuit— Operate 2W TER key.	At 21A— Meter indicates at least 30 dB less power than noted in Step 24.
26	At test circuit— Restore LP CUR 1 key to normal.	
27	At SF unit— Block CS relay nonoperated.	
28	At test circuit— Operate LP CUR 1 key. ▶Simultaneously depress TMS A, TMS B keys.◀	At 21A— Meter indicates more power than −30 dBm for ground start units or less power than −41 dBm for loop start units. ***Note:*** If requirement is not met, verify that appropriate service options are provided (See Note in Step 3 of PREPARATION).
29	▶At test circuit— Release TMS A, TMS B keys.	
30	At SF unit— Remove blocking tool from CS relay.◀	CS relay operated.
31	Restore LP CUR 1, 2W TER, 1000 ~ B keys to normal.	At SF unit— CS relay released.
32	At test circuit— Set SW1 to position 6, SW2 to position 4.	

STEP	ACTION	VERIFICATION
33	Set attenuator to ▸11.◂	At 21A— Meter indicates ▸−1.0◂ ±0.2 dB. See Step 34.
34	If requirement of Step 33 is not met— Adjust gain potentiometer of TEST amplifier to obtain▸−1.0 dB.◂	
35	At test circuit— Set SW1 to position 5, SW2 to position 3.	
36	Operate LP CUR 1 key.	At SF unit— CS relay operated.
37	At SF unit— Block RG relay nonoperated.	
38	At test circuit— Set SW1 to position 6.	At 21A— Meter indicates ▸−44◂ dBm or less power.
39	At SF unit— Remove blocking tool from RG relay. ***Note:*** If RG relay does not operate, perform Test E then repeat Steps 32 through 39 of this test.	RG, B relays operated. CS relay releases.
40	At test circuit— Restore LP CUR 1 key to normal.	At 21A— Meter indicates −55 dBm or less power.
41	At test circuit— Set SW1 to position 5, SW2 to position 2.	At SF unit— RG, B relays released.
42	At test circuit— Operate LP CUR 1 key.	At SF unit— CS relay operated.
43	At test circuit— Operate 1000 ~ B key.	At 21A— Meter indicates ▸between −8.6 and 9.0 dB.◂
44	At test circuit— Restore 1000 ~ B key to normal.	
45	Operate 1000 ~ A key.	
46	Depress TMS A, TMS B keys simultaneously.	At 21A— Meter indicates ▸−16 dB.◂
47	At test circuit— Release TMS A, TMS B keys.	
48	Restore LP CUR 1, 1000 ~ A keys to normal.	At SF unit— CS relay releases.

STEP	ACTION	VERIFICATION
49	At test circuit— Set SW2 to position 4.	
50c	If no other tests are to be made— Remove all cords, restore all keys to normal, remove loop start wiring ***only if added for this test,*** and return signaling unit to service or spare position.	
E. Operate Sensitivity of Receiver Amplifier		
13	At test circuit— Set SW1 to position 6, SW2 to position 4.	
14	Set attenuator to 33.	At 21A— Meter indicates between −22.8 and −23.2 dB.
15	At test circuit— Set SW2 to position 3.	At SF unit— RG relay not operated. See Step 16c.
16c	If RG relay operates— Adjust SS potentiometer of signaling unit slightly counterclockwise until RG relay releases.	
17	At test circuit— Set attenuator to 32.	At SF unit— RG and B relays operated. See Steps 18d through 20d.
18d	If RG relay does not operate— Adjust SS potentiometer clockwise until RG and B relays just operate.	
19d	Repeat Steps 13 through 19d until requirements of Step 15 and 17 are met.	
20	At test circuit— Set attenuator to 38.	At SF unit— RG, B relays released.
21	At test circuit— Set attenuator to 10.	At SF unit— RG B relays operated.
22	At test circuit— Set SW2 to position 4.	At SF unit— RG, B relays released.
23	At test circuit— Operate E1D 1, E1D 2 keys.	At SF unit— CS relay operated.
24	At test circuit— Set SW2 to position 3.	At SF unit— RG, B relays operated, releasing CS relay.

STEP	ACTION	VERIFICATION
25	At test circuit— Restore E1D 1, E1D 2 keys to normal.	
26	Set SW2 to position 4.	At SF unit— RG, B relays release.
27e	If no other tests are to be made— Remove all cords, restore all keys to normal, remove loop start wiring ***only if added for this test,*** and return signaling unit to service or spare position.	

F. Timing of Receiver R and RG Relays Using 2B Signaling Test Set (J64730)

Note: It is important to have the TST amplifier and the SS potentiometer properly adjusted for this test. If any doubt exists, perform Test E before performing Test F.

13	Using 2P3B, 2P1D cords, patch E, M jacks of test circuit to E, M jacks of 2B test set.	
14	At 2B test set— Set all keys to normal position.	
15	Set SCALE SEL switch to PPS.	
16	Plug power cord of 2B test set into A, B jacks of test circuit.	After 1 minute, PULSES PER SECOND meter indicates other than 0.
17	Operate CONT PLS key to DIAL PLS.	PERCENT BREAK meter indicates 0 on ***black*** scale. See Step 18c.
18c	If requirement of Step 17 is not met— Adjust pointer adjustment screw of PERCENT BREAK meter to 0. ***Note:*** Repeat Steps 19 through 21 if test extends beyond 30 minutes.	
19	At 2B test set— Insert 258D plug into P jack.	PERCENT BREAK meter indicates 100 on ***black*** scale. See Step 20d.
20d	If requirement of Step 19 is not met— Unlock CAL % BK control, adjust to obtain 100, relock control taking care not to change 100 reading.	

STEP	ACTION	VERIFICATION
21	At 2B test set— Remove 258D plug.	
22	Restore CONT PLS key to normal.	
23	Adjust ADJ PPS conrol to 10 PPS on PULSES PER SECOND meter (0 to 20 scale).	
24	With coarse ADJ % BK switch on M— Adjust ADJ % BK control for 55 on ***black*** scale of PERCENT BREAK meter.	
25	At test circuit— Set SW1 to position 7, SW2 to position 4.	
26	At 2B test set— Operate TWD L key to OFF HK; PLS, MEAS % BK keys to LINE.	PERCENT BREAK meter indicates 55 on ***black*** scale. See Step 27e.
27e	If requirement of Step 26 is not met— Adjust M potentiometer of testing circuit to 55 on ***black*** scale of PERCENT BREAK meter.	
28	At test circuit— Set attenuator to 11.	
29	At SF unit— Block B relay operated.	
30	At 2B test set— Adjust ADJ % BK control to 31 on ***black*** scale of PERCENT BREAK meter.	
31	Turn ADJ PPS control counterclockwise to 3 PPS on PULSES PER SECOND meter.	
32	At test circuit— Set SW1 to position 8, SW2 to position 3.	RG relay on SF unit should not operate when indication of between 0 and 6 is shown on the PER CENT BREAK meter ***red*** scale. See Steps 38f through 43f.
33	At test circuit— Set SW1 to position 7.	
34	At 2B test set— Adjust ADJ PPS control to 10 PPS on PULSES PER SECOND meter.	
35	Adjust ADJ % BK control to 35 on ***black*** scale of PERCENT BREAK meter.	

STEP	ACTION	VERIFICATION
36	Turn ADJ PPS control counterclockwise to 3 PPS on PULSES PER SECOND meter.	
37	At test circuit— Set SW1 to position 8.	RG relay on SF unit should pulse uniformly as indicated by reading on PERCENT BREAK meter of 8 or more on ***red*** scale. See Steps 38f through 43f.
38f	If requirement of Step 32 or 37 is not met— At test circuit— Set SW1 to position 7.	
39f	At 2B test set— Adjust ADJ PPS control to 10 PPS on PULSES PER SECOND meter.	
40f	Adjust ADJ % BK control to 33 on ***black*** scale of PERCENT BREAK meter.	
41f	Turn ADJ PPS control counterclockwise to 3 PPS on PULSES PER SECOND meter.	
42f	At test circuit— Set SW1 to position 8.	
43f	Adjust OT potentiometer of signaling unit until RG relay just pulses steadily.	At 2B test set— PERCENT BREAK meter indicates approximately 8 or more on red scale.
44	At test circuit— Set SW1 to position 7.	
45	At 2B test set— Adjust ADJ PPS control to 10 PPS on PULSES PER SECOND meter.	
46	At SF unit— Remove blocking tool from B relay.	
47	At 2B test set— Adjust ADJ % BK control to 45 on ***black*** scale of PERCENT BREAK meter.	
48	At test circuit— Set SW2 to position 8.	PERCENT BREAK meter indicates 48 to 50 on red scale. See Step 49g.
49g	If requirement of Step 48 is not met— Turn RT potentiometer on signaling unit to extreme counterclockwise position; then, rotate clockwise until PERCENT BREAK meter indicates 49 on ***red*** scale.	

STEP	ACTION	VERIFICATION
50	At test circuit— Set SW1 to position 7.	
51	At 2B test set— Adjust ADJ % BK control to 80 on ***black*** scale of PERCENT BREAK meter.	
52	At test circuit— Set SW1 to position 8.	At 2B test set— PERCENT BREAK meter indicates less than 71 on ***red*** scale.
53	At test circuit— Set SW1 to position 7.	
54	At 2B test set— Adjust ADJ PPS control to 12 PPS on PULSES PER SECOND meter.	
55	Adjust ADJ % BK control to 50 on ***black*** scale of PERCENT BREAK meter.	
56	At test circuit— Set SW1 to position 8.	RG relay on SF unit pulses uniformly with PERCENT BREAK meter indication between 54 and 64 on red scale. See Step 57h.
57h	If requirement of Step 56 is not met— Adjust OT potentiometer on SF unit slightly counterclockwise until RG relay just begins to pulse uniformly. See Step 61i.	
58	At test circuit— Set SW1 to position 7.	
59	At 2B test set— Adjust ADJ % BK control to 75 on ***black*** scale of PERCENT BREAK meter.	
60	At test circuit— Set SW1 to position 8.	RG relay on SF unit pulses uniformly with PERCENT BREAK meter indication between 59 and 72 on ***red*** scale.
61i	If any adjustment is made to the OT potentiometer— Repeat Steps 30 through 37, beginning with SW1 in position 7 and PULSES PER SECOND meter on 10 PPS.	
62	At test circuit— Set SW1 to position 7.	

STEP	ACTION	VERIFICATION
63	At 2B test set— Adjust ADJ PPS control to 10 PPS on PULSES PER SECOND meter (0 to 20 scale).	
64	Adjust ADJ % BK control to 41 on ***black*** scale of PERCENT BREAK meter.	
65	Operate CONT PLS key to DIAL PLS.	
66	At test circuit— Set SW1 to position 8.	
67	At 2B test set— Dial digit 1. ***Note:*** This step may be repeated while observing RG and B relays.	At SF unit— RG, B relays operate on dialed digit; then, RG releases first, and the B relay releases less than 1 second later.
68	At 2B test set— Restore all keys to normal.	
69j	If no other tests are to be made— Remove all cords, restore all keys to normal, remove loop start wiring ***only if added for this test,*** and return signaling unit to service or spare position.	

G. Timing of Receiver R and RG Relays Using 4A Signaling Test Set (J94743)

Note: Test E should be performed before beginning Test G.

28	At 4A Test set— Set RECEIVE switch to EM.	
29	Depress START-STOP key.	
30	Depress OPERATE-CLEAR key. ***NOTE:*** The OPERATE-CLEAR and START-STOP keys are operated when the lamps behind the keys are lighted and released when the lamps are extinguished.	
31	Set PULSE PERIOD switch to 100.	
32	Set PULSE WIDTH switch to 55.	
33	At test circuit— Set SW1 to position 7.	

STEP	ACTION	VERIFICATION
34	Set SW2 to position 4.	4A display indicates 45 ms break. See Step 35c.
35c	If requirement of Step 34 is not met— Adjust M potentiometer of test circuit to obtain 45 ms break.	
36	At test circuit— Set attenuator to 11.	
37	At SF unit— Block operated B relay.	
38	At 4A test set— Set PULSE PERIOD switch to 333.	
39	Set PULSE WIDTH switch to 31.	
40	At test circuit— Set SW1 to position 8.	
41	Set SW2 to position 3.	At SF unit— RG relay released. At 21A— Meter indicates 0 to 20 ms break. See Step 43d.
42	At 4A test set— Set PULSE WIDTH switch to 35.	At SF unit— RG relay pulses. 4A display indicates 26 ms break or more. See Step 43d.
43d	If requirements of Steps 41 and 42 are not met— At 4A test set— Set PULSE WIDTH switch to 33.	
44	At SF unit— Adjust OT potentiometer until RG relay just pulses.	4A display indicates 26 ms break or more.
45	At 4A test set— Set PULSE PERIOD switch to 100.	
46	Set PULSE WIDTH switch to 45.	
47	At SF unit— Remove blocking tool from B relay.	4A display indicates 48 to 50 ms break. See Step 48e.
48e	If requirement of Step 47 is not met— At SF unit—	

STEP	ACTION	VERIFICATION
	Adjust RT potentiometer to obtain 49 ms break.	
49	At 4A test set— Set PULSE WIDTH switch to 80.	4A display indicates 71 ms break or less.
50	Set PULSE PERIOD switch to 83.	
51	Set PULSE WIDTH switch to 42.	4A display indicates 45 to 70 ms break. See Step 52f.
52f	If requirement of Step 51 is not met— At SF unit— Adjust OT potentiometer to obtain 49 ms break.	
53	At 4A test set— Set PULSE WIDTH switch to 62.	4A display indicates 40 to 60 ms break.
54g	If any adjustment of OT potentiometer was made— At SF unit— Repeat Steps 36 through 39.	
55	At 4A test set— Release OPERATE-CLEAR key.	At SF unit— RG relay released. B relay released in less than one second. (Operate and release the OPERATE-CLEAR key as necessary to obtain verification.)
56h	If no other tests are to be made— Remove all cords, restore all keys, restore all circuits to normal.	

H. Receiver Guard Action

	Note: If any doubt exists as to the setting of the SS potentiometer, Test E should be performed before proceeding with this test.	
13	At test circuit— Set SW1 to position 5, SW2 to position 6.	At 21A— Meter indicates -19 ± 0.5 dB.
14	At test circuit— Set attenuator to 32 for E1L or 24 for E2L-( ).	
15	Set SW2 to position 5.	
16	Set SW1 to position 6.	At SF unit— RG relay remains released.

STEP	ACTION	VERIFICATION
17	At test circuit— Set attenuator to 20 for E1L or 16 for E2L-( ).	At SF unit— RG, B relays operated.
18	At test circuit— Set SW1 to position 5.	At SF unit— RG, B relays release.
19	Remove all cords, restore all keys to normal, remove loop start wiring ***only if added for this test.*** Return signaling unit to service or spare position.	