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.

Caution: The 291- or 303-type relays shall be maintained in an upright position not less than 1 minute before beginning any test.

1.02 This section is reissued to:

(a) Revise note in Part 3, PREPARATION

(b) Add note in Test A

(c) Correct steps in Test C

(d) Correct step in Test D

(e) Correct step in Test E.

This reissue does not affect the Equipment Test List.

1.03 The tests covered are:

1.04 The 13A or the J94021A (21A) transmission measuring set is referred to in this section as the TMS.

1.05 The dial switch on the 13A TMS or the DET INPUT switch on the 21A TMS is referred to in this section as the TMS attenuator switch. The specific settings of the TMS attenuator switch are not given in the procedure unless necessary to prevent overload and possible damage to the instrument. The proper setting will be that which results in an on-scale reading on the TMS meter and will depend upon whether the 13A or 21A TMS is used and the specific value to be measured.

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

1.07 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.

1.08 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.

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

1.10 ***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.

1.11 A brief test may be used to check new or modified units prior to placing them in service. The brief test is to be used only when it is reasonably certain that units have not suffered damage. These limited tests are not extensive enough to ensure that a unit will meet all requirements; however, they provide a reasonable degree of assurance of proper operation. If the unit fails to meet these test requirements, a complete test must be performed. Brief test steps in this section are designated with a bullet mark •) preceeding the steps in Tests A, C, D, E, and PREPARATION.

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.

TABLE A

APPARATUS	TESTS					
	A	B	C	D	E	F
Test Circuit (2.02)	1	1	1	1	1	1
Test Set (2.03)	–	1	–	–	1	–
Cord (2.04)	1	1	–	–	–	–
TMS (2.05)	1	–	1	1	–	1
Cord (2.06)	1	–	1	1	–	1
Cord (2.07)	–	–	–	–	1	–
Cord (2.08)	–	–	–	–	1	–
Cord (2.09)	1	–	–	–	–	–
Tool (2.10)	1	1	1	1	1	1
Tool (2.11)	–	–	–	1	1	–
Tool (2.12)	√	√	√	√	√	√
Screwdriver, R-8210	–	–	1	1	1	–
258D (dummy) Plug	1	–	–	–	1	–

√ As required.

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

2.03 2B test set, J64730B (SD-5613-02), ***W*** option or later, including power cords and patch cords for E and M leads (2P1D and 2P3B cords).

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

2.05 The 13A or the J94021A (21A) transmission measuring set (TMS).

2.06 Testing cord: For 13A TMS, W2DL cord, 6 feet long, equipped with a 310 plug and two 35 cord tips (2W42A cord); for 21A TMS, P3N cord, 6 feet long, equipped with a 241A plug and a 310 plug (3P17B cord).

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

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

2.09 Monitoring cord, P8E cord, I2 feet long, equipped with one KS-8585 L10 plug and one KS-8586 L7 socket.

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

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

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

3. PREPARATION

STEP	ACTION	VERIFICATION
All Tests		
• 1	At test circuit— Set all keys to normal position 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	

STEP	ACTION	VERIFICATION
	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	Set SF key of testing circuit to 2600.	
• 6	Operate 2-WIRE key on test circuit.	
• 7a	If test circuit is mounted in a REVERTIVE-TERMINATING bay, J98613AP— Operate CT key.	
Tests A, C, D, E, and F		
• 8	Connect 2W42A cord to IN terminals of 13A TMS or 241A plug of 3P17B cord to DET IN jack of 21A TMS.	
• 9	TMS should be known to be correctly calibrated.	
• 10	Connect TMS cord to SF SUP jack of test circuit.	TMS indicates between -15.1 and -16.1 dB.
• 11	Set TMS attenuator switch to 0.	
• 12	Disconnect plug from SF SUP jack, connect to AMP OUT jack of test circuit.	
• 13	Set SW2 to position 2.	TMS indicates 0 dB. See Step 14b.
• 14l	If requirement of Step 13 is not met— Adjust gain control of MON AMPL to give reading of exactly 0 dB.	
• 15	Disconnect plug from AMP OUT jack, connect to TMS jack of test circuit.	

4. METHOD

STEP	ACTION	VERIFICATION
A. Transmitted Tone Level and 20-Hz Operation		
• 16	Set attenuator switch of TMS to 40.	
• 17	Set SW1 to position 3, SW2 to position 1.	TMS indicates -40 dBm or less power.

STEP	ACTION	VERIFICATION

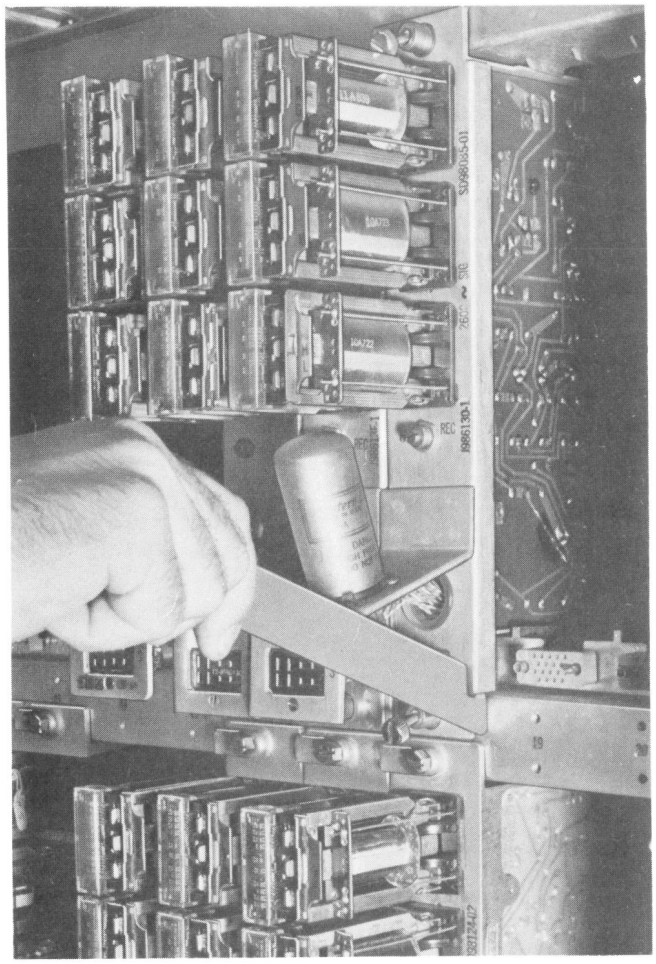

Fig. 1—Method of Removal of Fabricated Chassis

• 18	Set attenuator switch of TMS to 20.	
• 19	Operate E1C 2 key.	TMS indicates between –23 and –26 dB. ***Note:*** ◗This reading cannot be obtained if T option is furnished unless contact 12 break of RG relay is insulated.◖
• 20	Restore E1C 2 key to normal.	
21	Set SW1 to position 4.	
22	Restore 2-WIRE key to normal.	
23	Operate 2W TER key.	
24	Block RG relay operated.	B relay operates.

STEP	ACTION	VERIFICATION

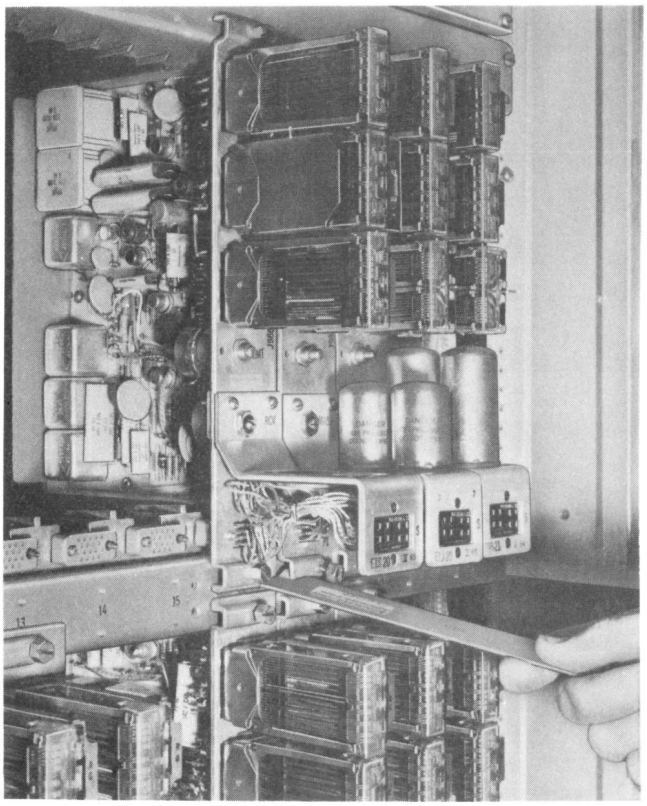

Fig. 2—Method of Removal of Die-Cast Chassis

25 Insert dummy plug into 1 MW TST jack.

26 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~ R jack.

27 Using 3P7A patch cord—
First connect to 20~ R jack, then to 2W or EQ RCV jack.

STEP	ACTION	VERIFICATION
28	Simultaneously press TMS A, TMS B keys, also 20~ P key (when provided).	TMS indicates between -23 and -26 dB.
29	Release TMS A, TMS B, 20~ P keys.	
30	First remove the plug from the 2W or EQ RCV jack, then from the 20~ R jack.	
31	Remove dummy plug from 1 MW TST jack.	
32	Remove blocking tool from RG relay.	B relay releases.
33	Remove patch cord between S socket on unit and S1 socket on test circuit.	
34	Operate 2-WIRE key.	
35	Restore 2W TER key to normal.	
36c	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. Bias of Q6 Transistor		
8	Set SW1 to position 5, SW2 to position 1.	
9	On 2B test set— Set SCALE SEL switch to 20V.	
10	Using 3P7A cord— Patch between SENS 1 jack on test circuit and VM jack on 2B test set.	Voltmeter indicates as follows: E1L 1.4 to 1.6 volts; E2L-( ) 0.8 volts or less.
11	Remove patch cord between SENS 1 jack and VM jack.	
12	On 2B test set— Set SCALE SEL switch to PPS.	
13c	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. Four-Wire Terminating Circuit and Receiver Voice Amplifier		
• 16	Set attenuator switch of TMS to 0.	

STEP	ACTION	VERIFICATION
• 17	Operate 1000~ A key.	
• 18	Set SW1 to position 5, SW2 to position 2. ***Note:*** Verify that BAT LP key is in BAT position.	
• 19	Operate LP CUR 1 key.	CS relay operates.
• 20	Simultaneously press TMS A, TMS B keys.	TMS indicates between -16 and -15.6 dB when trunk layout record requires -16 dB for 2- to 4-wire transmit loss; otherwise, TMS reads ±0.2 dB of loss specified on trunk layout record.
• 21	Adjust XMT or TRMT potentiometer of unit under test to obtain TMS reading of -13 dB.	TMS indicates -13 dB.
• 22	Release TMS A, TMS B keys.	
• 23	Restore 1000~ A key to normal.	
• 24	Set attenuator switch of TMS to 5 or 10.	
• 25	Operate 1000~ B key. ***Note:*** Minor adjustments of the REC or RCV potentiometer of less than 1 dB may be made to meet overall trunk net loss requirements.	TMS indicates -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 TMS. ***Example:*** Specified loss shown for signaling unit on trunk layout record is -8.6 dB. TMS should read between -8.6 and -9.0 dB.
26	Adjust REC or RCV potentiometer fully counterclockwise.	TMS indicates -39 dBm or less power.
27	Set attenuator switch of TMS to 0 (***red*** scale).	
28	Adjust REC or RCV potentiometer to extreme clockwise position.	TMS indicates +1.5 dBm or more power.
29	Adjust REC or RCV potentiometer to exactly 0 dB.	TMS indicates 0 dB.
30	Simultaneously press TMS A, TMS B keys.	TMS reads between -11 and -15 dB. Note reading.
31	Operate 2W TER key.	TMS indicates at least 30 dB less power than reading noted in Step 30.

STEP	ACTION	VERIFICATION
32c	If testing E2L-( ) units— Restore LP CUR 1 key to normal.	
33c	Block CS relay nonoperated.	
34c	Operate LP CUR 1 key.	TMS 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, Step 3 of PREPARATION).
35	Remove blocking tool from CS relay.	CS relay operates.
36	Set attenuator switch of TMS to 0.	
37	Release TMS A, TMS B keys.	
• 38	Restore LP CUR 1, 2W TER, 1000~ B keys to normal.	CS relay releases.
39	Set SW1 to position 6, SW2 to position 4.	
40	Set ATT attenuator to 10.	TMS indicates 0 ±0.2 dB. See Step 41c.
41c	If requirement of Step 40 is not met— Adjust gain potentiometer of TEST AMPL to obtain 0 dB.	
42	Set SW1 to position 5, SW2 to position 3.	
43	Operate LP CUR 1 key.	CS relay operates.
44	Block RG relay nonoperated.	
45	Set SW1 to position 6.	TMS indicates -40 dBm or less power.
46	Remove blocking tool from RG relay. ***Note:*** If RG relay does not operate, perform Test D, then repeat Steps 39 through 46 of this test.	RG, B relays operate. CS relay releases.
47	Restore LP CUR 1 key to normal.	TMS indicates -45 dBm or less power.
48	Set SW1 to position 5, SW2 to position 2.	RG, B relays release.
49	Set attenuator switch of TMS to 0.	
50	Operate LP CUR 1 key.	CS relay operates.

STEP	ACTION	VERIFICATION
51	Operate 1000~ B key.	TMS indicates 0 dB.
52	Adjust REC or RCV potentiometer for specified 4- to 2-wire loss.	See Verification of Step 25.
53	Restore 1000~ B key to normal.	
54	Operate 1000~ A key.	
55	Press TMS A, TMS B keys simultaneously.	TMS indicates -13 dB. See Step 56d.
56d	If overall trunk net loss does not require -13 dB from 2- to 4-wire transmit— Adjust XMT or TRMT potentiometer of signaling unit under test to obtain -16 dB or loss specified on trunk layout record.	
57	Release TMS A, TMS B keys.	
58	Restore LP CUR 1, 1000~ A keys to normal.	CS relay releases.
59	Set SW2 to position 4.	
60f	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.	

D. Operate Sensitivity of Receiver Amplifier

• 16	Set attenuator switch of TMS to 0.	
• 17	Set SW1 to position 6, SW2 to position 4.	
• 18	Set ATT attenuator to 33.	
• 19	Set attenuator switch of TMS to 20.	TMS indicates between -22.8 and -23.2 dB.
• 20	Set SW2 to position 3.	RG relay should not operate. See Step 21c.
• 21c	If RG relay operates— Adjust SS potentiometer of signaling unit slightly counterclockwise until RG relay releases.	RG relay remains released.
• 22	Set ATT attenuator to 32.	RG and B relays operate. See Steps 23d through 25d.

STEP	ACTION	VERIFICATION
23d	If RG relay does not operate— Adjust SS potentiometer clockwise until RG and B relays just operate.	
24d	Set SW2 to position 4.	
25d	Repeat Steps 17 through 24d until requirements of Steps 20 and 22 are met.	
26	Set ATT attenuator to 38.	RG, B relays release.
27	Set ATT attenuator to 10.	RE, B relays operate.
28	Set SW2 to position 4.	RG, B relays release.
29	Operate E1D 1, E1D 2 keys.	CS relay operates.
30	Set SW2 to position 3.	RG, B relays operate, releasing CS relay.
31	Restore E1D 1, E1D 2 keys to normal.	
32	Set SW2 to position 4.	RG, B relays release.
33e	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.	

E. Timing of Receiver R and RG Relays

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

• 16	Patch E, M jacks of test circuit to E, M jacks of 2B test set, using 2P3B, 2P1D cords.	
• 17	On 2B test set— Set all keys to normal position.	
• 18	Set SCALE SEL switch to PPS.	
• 19	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.
20	Operate CONT PLS key to DIAL PLS.	PERCENT BREAK meter indicates 0 on ***black*** scale. See Step 21c.

STEP	ACTION	VERIFICATION
21c	If requirement of Step 20 is not met— adjust pointer adjustment screw of PERCENT BREAK meter to obtain 0 reading.	
	Note: Repeat Steps 22 through 24, if test extends beyond 30 minutes.	
22	On 2B test set— Insert 258D plug into P jack.	PERCENT BREAK meter indicates 100 on ***black*** scale. See Step 23d.
23d	If requirement of Step 22 is not met— Unlock CAL % BK control, adjust to obtain 100, relock control taking care not to change 100 reading.	
24	On 2B test set— Remove 258D plug.	
25	Restore CONT PLS key to normal.	
• 26	Adjust ADJ PPS control to 10 PPS on PULSES PER SECOND meter (0 to 20 scale).	
27	With coarse ADJ % BK switch on M— Adjust ADJ % BK control for 55 on ***black*** scale of PERCENT BREAK meter.	
• 28	Set SW1 to position 7, SW2 to position 4.	
• 29	On 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 30e.
30e	If requirement of Step 29 is not met— Adjust M potentiometer of testing circuit to 55 on ***black*** scale of PERCENT BREAK meter.	
• 31	Set ATT attenuator to 11.	
• 32	Block B relay operated.	
• 33	On 2B test set— Adjust ADJ % BK control to 31 on ***black*** scale of PERCENT BREAK meter.	
• 34	Turn ADJ PPS control counterclockwise to 3 pps on PULSES PER SECOND meter.	
• 35	Set SW1 to position 8, SW2 to position 3.	RG relay should not operate, as indicated by a reading of between 0 and 6 on the PER

STEP	ACTION	VERIFICATION
		CENT BREAK meter ***red*** scale. See Steps 41f through 46f.
•36	Set SW1 to position 7.	
•37	On 2B test set— Adjust ADJ PPS control to 10 pps on PULSES PER SECOND meter.	
•38	Adjust ADJ % BK control to 35 on ***black*** scale of PERCENT BREAK meter.	
•39	Turn ADJ PPS control counterclockwise to 3 pps on PULSES PER SECOND meter.	
•40	Set SW1 to position 8.	RG relay should pulse uniformly as indicated by reading on PERCENT BREAK meter of 8 or more on ***red*** scale. See Steps 41f through 46f.
41f	If requirement of Step 35 or 40 is not met— Set SW1 to position 7.	
42f	On 2B test set— Adjust ADJ PPS control to 10 pps on PULSES PER SECOND meter.	
43f	Adjust ADJ % BK control to 33 on ***black*** scale of PERCENT BREAK meter.	
44f	Turn ADJ PPS control counterclockwise to 3 pps on PULSES PER SECOND meter.	
45f	Set SW1 to position 8.	
46f	Adjust OT potentiometer of signaling unit until RG relay just pulses steadily.	PERCENT BREAK meter indicates approximately 8 or more on ***red*** scale.
•47	Set SW1 to position 7.	
•48	On 2B test set— Adjust ADJ PPS control to 10 pps on PULSES PER SECOND meter.	
•49	Remove blocking tool from B relay.	
•50	Adjust ADJ % BK control to 45 on ***black*** scale of PERCENT BREAK meter.	
•51	Set SW1 to position 8.	PERCENT BREAK meter indicates 48 to 50 on red scale. See Step 52g.

STEP	ACTION	VERIFICATION
52g	If requirement of Step 51 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.	
53	Set SW1 to position 7.	
54	On 2B test set— Adjust ADJ % BK control to 80 on ***black*** scale of PERCENT BREAK meter.	
55	Set SW1 to position 8.	PERCENT BREAK meter indicates less than 71 on ***red*** scale.
56	Set SW1 to position 7.	
57	On 2B test set— Adjust ADJ PPS control to 12 pps on PULSES PER SECOND meter.	
58	Adjust ADJ % BK control to 50 on ***black*** scale of PERCENT BREAK meter.	
59	Set SW1 to position 8.	RG relay pulses uniformly with PERCENT BREAK meter reading between 54 and 64 on ***red*** scale. See Step 60h.
60h	If requirement of Step 59 is not met— Adjust OT potentiometer slightly counterclockwise until RG relay just begins to pulse uniformly. See Step 64i.	
61	Set SW1 to position 7.	
62	On 2B test set— Adjust ADJ % BK control to 75 on ***black*** scale of PERCENT BREAK meter.	
63	Set SW1 to position 8.	RG relay pulses uniformly with PERCENT BREAK meter reading between 59 and 72 on ***red*** scale.
64i	If any adjustment is made to the OT potentiometer— Repeat Steps 33 through 40, beginning with SW1 in position 7 and PULSES PER SECOND meter on 10 PPS.	
65	Set SW1 to position 7.	

STEP	ACTION	VERIFICATION
66	On 2B test set— Adjust ADJ PPS control to 10 pps on PULSES PER SECOND meter (0 to 20 scale).	
67	Adjust ADJ % BK control to 41 on ***black*** scale of PERCENT BREAK meter.	
68	Operate CONT PLS key to DIAL PLS.	
69	Set SW1 to position 8.	
70	Dial digit 1. ***Note:*** This step may be repeated while observing RG and B relays.	RG, B relays operate on dialed digit; then, RG releases first, and the B relay releases less than 1 second later.
● 71	On 2B test set— Restore all keys to normal.	
72j	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.	

F. Receiver Guard Action

Note: If any doubt exists as to the setting of the SS potentiometer, Test D should be performed before proceeding with this test.

16	Set attenuator switch of TMS to 10 or 15.	
17	Set SW1 to position 5, SW2 to position 6.	TMS indicates −19 ±0.5 dB.
18	Set ATT attenuator to 32 for E1L or 24 for E2L-( ).	
19	Set SW2 to position 5.	
20	Set SW1 to position 6.	RG relay remains released.
21	Set ATT attenuator to 20 for E1L or 16 for E2L-( ).	RG, B relays operate.
22	Set SW1 to position 5.	RG, B relays release.
23	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.	