

**2600-CYCLE E1A 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 a method of making out-of-service tests of 2600-cycle single-frequency signaling circuits per SD-96499-01, using testing circuit SD-96519-01 or SD-96519-02. It also describes a method of making potentiometer adjustments to compensate for variations 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, since special techniques are 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 tests.*

**1.02** This section is reissued to:

- (a) Delete reference to the P-43C851 disengaging tool.
- (b) Add Fig. 1 and 2 illustrating the use of the 725A tool.
- (c) Incorporate changes in the pulsing tests of the receiver at 12 pps.

Since this reissue covers a general revision, arrows ordinarily used to indicate changes have been omitted.

**1.03** The tests covered are:

- A. Pulsing of Transmitter M Relay:** This test checks that the M relay is properly following pulses.
- B. Hold of HL Relay:** This test checks the HL relay release time.

**C. Transmitted Tone Level:** This test checks the level of the transmitted single-frequency tone.

**D. Bias of Transistor Q10:** This test checks the voltage at transistor Q10 with no signal input.

**E. Test of 4-Wire Terminating Circuit, Gain of Receiver Voice Amplifier, Blocking of Amplifier, and Insertion of Band-Elimination Network:** The following features are checked: (a) transmission loss from 2-wire or 4-wire transmit; (b) transmission loss from 4-wire receive to 2-wire and approximate adjustment of REC or RCV potentiometer; (c) trans-hybrid loss from 4-wire receive to 4-wire transmit; and (d) blocking of the voice amplifier by the received signal frequency and insertion of band-elimination network.

**F. Operate Sensitivity of Receiver Signaling Amplifier:** This test checks the receiver sensitivity and describes its adjustment by means of the SS potentiometer.

**G. Timing of Receiver R, RG, and G Relays:** This test checks the operate and release time of the R and RG relays and describes a method of adjusting the OT and RT potentiometers to meet requirements. It also provides a test to ensure proper limiting of the signal amplifier. The G relay is also tested.

**H. Receiver Guard Action:** This test checks the receiver guard circuit in limiting operation by voice signals.

**1.04** The transmission measuring set is referred to in this section as TMS.

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

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

**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 practice are part of the test panel unless otherwise specified.

**1.08** The LEV switch on the signaling unit, when in the +7 position, provides 7-db attenuation to the line receive level. The tests in this section are made with the LEV switch in the +7 position, except where noted. If the switch was in the 0 position when the unit was removed from service, return it to the 0 setting if the unit is to be placed in the same service as before.

**1.09** Since some steps in this section require different actions for talk-off improved and unmodified units, the following designations are used to identify the units.

DESIGNATION USED IN BSP	DESIGNATION ON SF UNIT
E1A	E1A
E1A-( )	All E1A units with series 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 Brief Tests for Units Modified or Repaired by WECO:** The steps listed below are to be used only when it is reasonably certain that the units have not suffered damage. Otherwise, the complete test must be performed. 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.

TEST FOR	TEST	STEPS
M Relay	A	Steps 27 to 33.
HL Relay	B	All steps.
REC or RCV Potentiometer	E	Steps 17, 18, 20, 25 through 28c, and 54.
SS Potentiometer	F	All steps.
OT and RT Potentiometers and G relay	G	Steps 27 through 40, 47 through 51g, 70 through 81, and 97.

**2. APPARATUS**

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

**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	-	1	-	-	1	-
TMS (2.04)	-	-	1	-	1	1	-	1
Cord (2.05)	1	1	-	-	-	-	1	-
Cord (2.06)	1	1	-	-	-	-	1	-
Cord (2.07)	-	-	1	-	1	1	-	1
Cord (2.08)	-	-	-	1	-	-	-	-
Tool (2.09)	1	1	1	1	1	1	1	1
258D (dummy) Plug Screwdriver, R-8210	1	1	-	-	-	-	1	-
Tool (2.10)	-	-	-	-	-	-	1	-
Tool (2.11)	-	-	√	-	√	-	-	-

√ As required.

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

**2.03** 2B test set J64730B (SD-56134-02) W option or later includes power cords and patch cords for E and M leads (2P1D and 2P3B cords).

**2.04** 13A or 21A TMS.

*Note:* If step calls for setting dial switch of TMS to odd number, use lower even-number setting for 21A TMS.

*Example:* Set dial switch of TMS to 15 (for 21A, set dial switch to 10).

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

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

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

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

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

**2.10** Tool, 603A, for removing 291- or 303-type relays. Use in accordance with Section 040-263-501.

**2.11** 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	Set all keys to normal position before starting any tests.	
---	------------------------------------------------------------	--

*Note:* The twist keys in the testing 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 725A tool, as shown in Fig. 1 or 2.	
---	-----------------------------------------------------------------------------------------------	--

4	Plug signaling unit into folding test fixture.	
---	------------------------------------------------	--

5	Set SF key of testing circuit to 2600.	
---	----------------------------------------	--

6	Operate 2-WIRE key.	
---	---------------------	--

**SECTION 179-318-502**

STEP	ACTION	VERIFICATION
7a	If test circuit is mounted in a REVERTIVE-TERMINATING bay, J98613AP — Turn CT key to operate position.	
8	Set LEV switch on signaling unit to +7 position if on 0 position.	
<b>Tests C, E, F, G, and H</b>		
9	Connect 2W42A cord to IN terminals of 13A TMS, 3P17B cord to IN terminals of 21A TMS.	
10	TMS should be known to be correctly calibrated.	
11	Connect TMS to SF SUP jack of test circuit.	TMS reads between -15.1 and -16.1 db.
12	Set TMS dial switch to 0.	
13	Disconnect TMS from SF SUP jack, connect to AMP OUT jack.	
14	Set SW2 to position 2.	TMS reads 0 db. See Step 15b.
15b	If requirement of Step 14 is not met — Adjust gain control of MON AMPL to exactly 0 db.	
16	Disconnect TMS from AMP OUT jack, connect to TMS jack of test circuit.	
<b>Tests A, B, D, and G</b>		
17	Patch E and M jacks of test circuit to E and M jacks of 2B test set, using 2P3B and 2P1D cords.	
18	On 2B test set — Set all keys to normal position.	
19	Set SCALE SEL switch to PPS.	
20	Plug power cords of 2B test set into A and B jacks of test circuit.	After 1 minute, PULSES PER SECOND meter reads other than 0.
21	Operate CONT PLS key to DIAL PLS.	PERCENT BREAK meter reads 0 on <i>black</i> scale. See Step 22c.
22c	If requirement of Step 21 is not met — Adjust pointer adjustment screw of PERCENT BREAK meter to 0.	

STEP	ACTION	VERIFICATION
23	Insert 258D plug into P jack.	PERCENT BREAK meter reads 100 on <i>black</i> scale. See Step 24d.
24d	If requirement of Step 23 is not met — Unlock CAL % BK control, adjust to 100, relock.	
25	Remove 258D plug.	
	<i>Note:</i> Repeat Steps 23, 24d, and 25 if test extends beyond 30 minutes.	
26	Restore CONT PLS key to normal.	
	<i>Note:</i> The proper performance of the tests covered in this section depends upon the correct pulse-per-second calibration and range of the 2B test set. See Section 100-263-501 for cali- bration if accuracy is not known.	

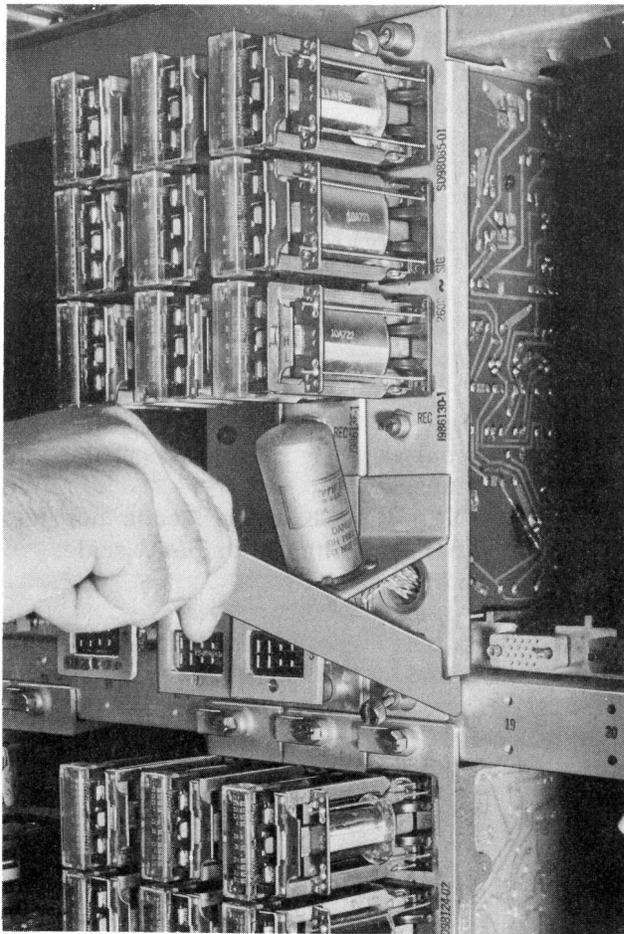


Fig. 1 — Method of Removal of Fabricated Chassis

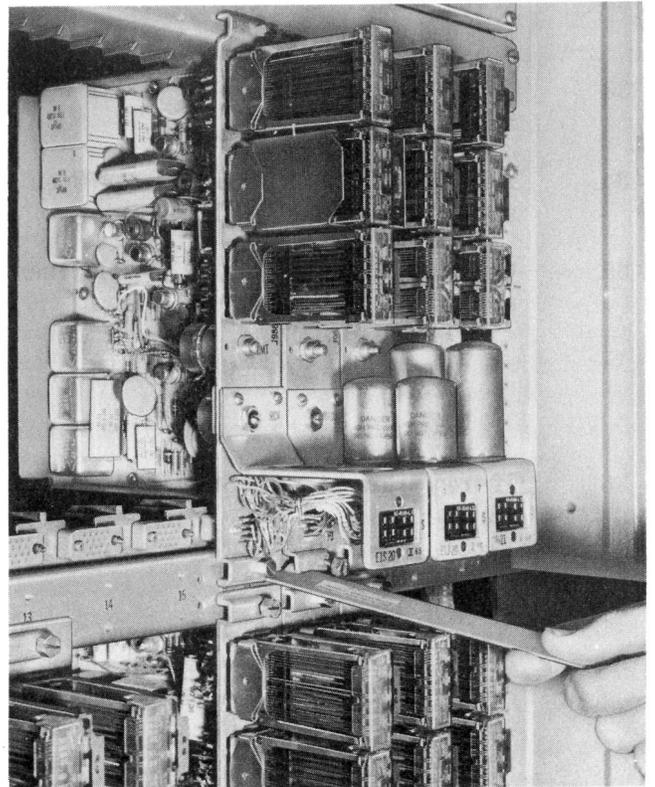


Fig. 2 — Method of Removal of Die-Cast Chassis

## 4. METHOD

STEP	ACTION	VERIFICATION
<b>A. Pulsing of Transmitter M Relay</b>		
27	On 2B test set — Adjust ADJ PPS control to 10 pps on PULSES PER SECOND meter (0 to 20 scale).	
28	With coarse ADJ % BK switch on M — Adjust ADJ % BK control to minimum, then to 45 on <i>black</i> scale of PERCENT BREAK meter.	
29	On test circuit — Set SW1, and SW2 to position 1.	
30	Operate M key.	
31	On 2B test set — Operate TWD L key to OFF HK, then PLS and MEAS % BK keys to LINE.	On SF unit — M relay pulses while HL relay operates and remains operated. PERCENT BREAK meter reads not less than 43 nor more than 53 on <i>black</i> scale. See Step 32e.
32e	If requirement of Step 31 is not met — Proceed to Step 36f.	
33	On 2B test set — Set all keys to normal.	M and HL relays release.
34	Adjust ADJ % BK control to 70 on <i>black</i> scale of PERCENT BREAK meter.	
35	Operate TWD L key to OFF HK, then PLS and MEAS % BK keys to LINE.	On SF unit — M relay pulses while HL relay operates and remains operated. PERCENT BREAK meter reads not less than 65 nor more than 73 on <i>black</i> scale. See Step 36f.
36f	If requirements of Steps 31 and 35 are met — Proceed to Step 43, otherwise proceed with the following.  <i>Note:</i> An increase or decrease in percent break can be obtained by increasing or decreasing the armature back tension of the M relay on unit under test. If the relay has been changed in any way, the mechanical and electrical requirements must still be met, and Steps 37f through 42f must be performed.	

STEP	ACTION	VERIFICATION
37f	On 2B test set — Set all keys to normal.	M and HL relays release.
38f	Adjust ADJ % BK control to 45 on <i>black</i> scale of PERCENT BREAK meter.	
39f	Operate TWD L key to OFF HK, then PLS and MEAS % BK keys to LINE.	On SF unit — M relay pulses while HL relay operates and remains operated. PERCENT BREAK meter reads not less than 44 nor more than 53 on <i>black</i> scale.
40f	On 2B test set — Set all keys to normal.	
41f	Adjust ADJ % BK control to 70 on <i>black</i> scale of PERCENT BREAK meter.	
42f	Operate TWD L key to OFF HK, then PLS and MEAS % BK keys to LINE.	On SF unit — M relay pulses while HL relay operates and remains operated. PERCENT BREAK meter reads not less than 65 nor more than 72 on <i>black</i> scale.
43	When requirements of Steps 31 and 35 or Steps 39f and 42f have been met — Restore all keys on 2B test set to normal.	M and HL relays release.
44	On test circuit — Restore M key to normal.	
45g	If no other tests are to be made — Remove all cords, restore all keys to normal, set LEV switch to proper position (Step 8), and return SF unit to service or spare position.	

#### B. Hold of HL Relay

27	On 2B test set — Adjust ADJ PPS control to 10 pps on PULSES PER SECOND meter.	
28	With coarse ADJ % BK switch on M — Adjust ADJ % BK control to 66.5 on <i>black</i> scale of PERCENT BREAK meter.	
29	Adjust ADJ PPS control for lower PPS reading to 20 on <i>black</i> scale of PERCENT BREAK meter.	PPS meter reads between 2.5 and 3.5 pps.

**SECTION 179-318-502**

<b>STEP</b>	<b>ACTION</b>	<b>VERIFICATION</b>
30	For E1A — With ADJ % BK switch on M — Adjust ADJ % BK control to 30 on the <i>black</i> scale of PERCENT BREAK meter.  For E1A-( ) — With ADJ % BK switch on L — Adjust ADJ % BK control to 80 on the <i>black</i> scale of PERCENT BREAK meter.	
31	On test circuit — Set SW1 to position 2, SW2 to position 1.	
32	Operate M key.	
33	On 2B test set — Operate TWD L key to OFF HK.	M and HL relays operate.
34	Operate PLS key to LINE.	M relay pulses. HL relay should remain operated.
35	Restore PLS key to normal.	M and HL relays operated steadily.
36	Restore TWD L key to normal.	M relay releases, and HL relay releases in less than 1 second.
37	Restore M key to normal.	
38f	If no other tests are to be made — Remove all cords, restore all keys to normal, set LEV switch to proper position (Step 8), and return SF unit to service or spare position.	

**C. Transmitted Tone Level**

17	Operate M key.	
18	Set SW1 to position 3, SW2 to position 1.	
19	Set dial switch of TMS to 30.	
20	Press TMS A and TMS B keys simultaneously.	TMS reads between -32.5 and -35.5 db.
21	Release TMS A and TMS B keys.	
22	Set dial switch of TMS to 20.	
23	Block HL relay of SF unit operated.	

STEP	ACTION	VERIFICATION
24	Press TMS A and TMS B keys simultaneously.	TMS reads between $-18.5$ and $-21.5$ db.
25	Release TMS A and TMS B keys.	
26	Set SW1 to position 4.	TMS reads less power than $-45$ dbm after M relay operates.
27	Remove blocking tool from HL relay.	HL relay remains operated, same reading as in Step 26.
28	Set dial switch of TMS to 0.	
29	Restore M key to normal.	M and HL relays release.
30c	If no other tests are to be made — Remove all cords, restore all keys to normal, set LEV switch to proper position (Step 8), and return SF unit to service or spare position.	

#### D. Bias of Transistor Q10

27	On 2B test set — Set SCALE SEL switch to 20 volts.	
28	Patch SENS 1 jack to VM jack of 2B test set.	
29	Set SW1 to position 5.	On 2B test set — VOLTS meter reads less than 0.4 volt for E1A-( ) and between 1.2 and 1.7 volts for E1A.
30	Remove patch cord.	
31	On 2B test set — Set SCALE SEL switch to PPS.	
32e	If no other tests are to be made — Remove all cords, restore all keys to normal, set LEV switch to proper position (Step 8), and return SF unit to service or spare position.	

#### E. Test of 4-Wire Terminating Circuit, Gain of Receiver Voice Amplifier, Blocking of Amplifier, and Insertion of Band-Elimination Network

17	Set dial switch of TMS to 0.
18	Set SW1 to position 5, SW2 to position 2.

SECTION 179-318-502

STEP	ACTION	VERIFICATION
19	Operate 1000~ A key.	
20	Operate M key.	
21	Set dial switch of TMS to 15.	
22	Press TMS A and TMS B keys simultaneously.	TMS reads between -15 and -16.3 db.
23	Release TMS A and TMS B keys.	
24	Restore 1000~ A key to normal.	
25	Set dial of TMS to 5 or 10 depending on value specified in Step 27.	
26	Operate 1000~ B key.	
27	Set LEV switch of signaling unit to position as found in Step 8.  <i>Note:</i> Minor readjustment of the REC potentiometer of less than 1 db may be necessary to meet overall trunk net loss requirements.	TMS reads specified value for signaling unit shown on trunk circuit layout record plus 0.2 db (additional 0.2 db is caused by measuring a 900-ohm circuit using a 600-ohm TMS).  <i>Example:</i> Specified value shown for signaling unit is 8.8 db, $8.8 \text{ db} + 0.2 \text{ db} = 9 \text{ db}$ . See Step 28c.
28c	If requirement of Step 27 is not met, and if no tests of the 4-wire terminating circuit return loss (Steps 29 through 34) or voice amplifier blocking and band-elimination network insertion (Steps 35 through 46) are to be made — Proceed to Step 52.	
29	With LEV switch in +7 position — Adjust REC potentiometer of signaling unit under test to full clockwise position.	TMS reads -6 dbm or greater power.
30	Set LEV switch on signaling unit to 0 position.	TMS reads $7 \pm 0.3$ db more power than reading in Step 29.
31	Adjust REC potentiometer to obtain 0 db.	TMS reads 0 db.
32	Press TMS A and TMS B keys simultaneously.	TMS reading drops to between -14 and -18 db.
33	Operate 2 W TER key.	

STEP	ACTION	VERIFICATION
34	Set dial switch of TMS to 30.	TMS reads between $-29$ and $-39$ db. <i>Note:</i> This reading obtained when build-out capacitor C86 (3900 uuf) is wired in by strapping terminal A to C on printed wiring board.
35	Set dial switch of TMS to 0.	
36	Release TMS A and TMS B keys.	
37	Restore 2 W TER and 1000~ keys to normal.	
38	Return LEV switch to $+7$ position.	
39	Set SW1 to position 6, SW2 to position 4.	
40	Set ATT attenuator to 10.	TMS reads between $+0.2$ and $-0.2$ db. See Step 41d.
41d	If requirement of Step 40 is not met — Adjust gain potentiometer of TEST AMPL to obtain 0.	
42	Set SW1 to position 5, SW2 to position 3.	
43	Set dial switch of TMS to 40.	
44	Block RG relay nonoperated.	
45	Set SW1 to position 6.	TMS reads $-40$ dbm or less power.
46	Remove blocking tool from RG relay.	RG relay operates. TMS reads $-35$ dbm or less power.
		<i>Note:</i> Operation of RG relay depends upon sensitivity adjustment. If RG relay does not operate, perform Test F, then repeat Steps 42 through 46 of this test.
47e	If the test circuit is in a REVERTIVE-TERMINATING bay and the CT key is operated (see Step 7a), but the requirement of Step 46 is not met — A TMS reading of $-33$ dbm or less power is satisfactory.	
48f	If the requirement of Step 47e is not met — Adjust the oscillator of the 21A TMS to $2600 \pm 10$ cycles, at a level of $-15.6$ db, and connect it to the SF TST jack.	TMS reads $-35$ dbm or less power.
49	Set dial switch of TMS to 5.	
50	Set SW1 to position 5, SW2 to position 2.	RG relay releases.
51	Operate 1000~ B key.	TMS reads between $-6.7$ and $-7.3$ db.

STEP	ACTION	VERIFICATION
52	Adjust REC potentiometer of signaling unit under test to specific 4-wire to 2-wire loss with LEV switch of signaling unit set to position required for proper circuit requirements.  <i>Note:</i> Minor readjustment of the REC potentiometer of less than 1 db may be necessary to meet overall trunk net loss requirements.	TMS reads specified value for signaling unit shown on trunk layout record plus 0.2 db (additional 0.2 db is caused by measuring a 900-ohm circuit using a 600-ohm TMS).  <i>Example:</i> Specified value shown for signaling unit is $8.8 \text{ db} + 0.2 \text{ db} = 9 \text{ db}$ .
53	Set SW2 to position 4.	
54	Restore M and 1000~ B keys to normal.	
55g	If no other tests are to be made — Remove all cords, restore all keys to normal, set LEV switch to proper position (Step 8), and return SF unit to service or spare position.	
<b>F. Operate Sensitivity of Receiver Signaling Amplifier</b>		
<i>Note:</i> The operation and release of the G relay, in those units having one, depend upon the release and operation of the RG relay. See Test G for checking the G relay.		
17	Set ATT attenuator to 33.	
18	Set SW1 to position 6, SW2 to position 4.	
19	Set dial switch of TMS to 20.	TMS reads between $-22.8$ and $-23.2$ db.
20c	If reading in Step 19 is not met — Adjust gain control of TEST AMPL in test panel for $-23$ db.	
21	Set SW2 to position 3.	RG relay should not operate. See Step 22d.
22d	If RG relay does operate — Adjust SS potentiometer slightly counterclockwise until RG relay releases.	RG relay releases.
23	Set ATT attenuator to 32.	RG relay should operate. See Step 24e.
24e	If RG relay does not operate — Adjust SS potentiometer slightly clockwise until it just operates.	
25e	Repeat Steps 17 through 23, until requirements of these steps are met.	
26	Set ATT attenuator to 40.	RG relay should release.
27f	If no other tests are to be made — Remove all cords, restore all keys to normal, set LEV switch to proper position (Step 8), and return SF unit to service or spare position.	

STEP	ACTION	VERIFICATION
<b>G. Timing of Receiver R and RG Relays</b>		
<i>Note:</i> The requirements of this test depend upon the setting of the SS potentiometer. Perform Test F first, if setting is unknown. The G relay, in those units having one, is operated when the RG relay is released or pulsing. See Steps 70 through 81 inclusive, for test of its operate and release time.		
27	On 2B test set — Adjust ADJ PPS control to 10 pps on PULSES PER SECOND meter (0 to 20 scale).	
28	With coarse ADJ % BK switch to M — Adjust ADJ % BK control to 55 on <i>black</i> scale of PERCENT BREAK meter.	
29	Set SW1 to position 7, SW2 to position 4.	
30	On 2B test set — Set TWD L key to OFF HK, then PLS and MEAS % BK keys to LINE.	M relay of test circuit pulses. PERCENT BREAK meter reads 55 on <i>black</i> scale. See Step 31e.
31e	If requirement of Step 30 is not met — Adjust M potentiometer of test circuit to 55 on <i>black</i> scale of PERCENT BREAK meter.	
32	Set ATT attenuator to 11.	
33	On 2B test set — Adjust ADJ % BK control to 31 on <i>black</i> 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 pulse, as indicated by a reading of between 0 and 6 on PERCENT BREAK meter <i>red</i> scale. See Steps 41f through 46f.
36	Set SW1 to position 7.	
37	On 2B test set — Adjust ADJ PPS control clockwise to 10 pps on PULSES PER SECOND meter.	
38	Adjust ADJ % BK control to 35 on <i>black</i> 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 8 or more on PERCENT BREAK meter <i>red</i> scale. See Steps 41f through 46f.

**SECTION 179-318-502**

<b>STEP</b>	<b>ACTION</b>	<b>VERIFICATION</b>
41f	If requirements of Steps 35 and 40 are not met — Set SW1 to position 7.	
42f	On 2B test set — Adjust ADJ PPS control clockwise to 10 pps on PULSES PER SECOND meter.	
43f	Adjust ADJ % BK control to 33 on <i>black</i> 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 SF unit first fully clockwise and then counterclockwise, until RG relay just pulses uniformly.	RG relay pulses uniformly as indicated by 8 or more on PERCENT BREAK meter <i>red</i> scale.
47	Set SW1 to position 7.	
48	On 2B test set — Adjust ADJ PPS control clockwise to 10 pps on PULSES PER SECOND meter.	
49	Adjust ADJ % BK control to 45 on <i>black</i> scale of PERCENT BREAK meter.	
50	On test circuit — Set SW1 to position 8.	PERCENT BREAK meter reads between 48 and 50 on <i>red</i> scale.
51g	If requirement of Step 50 is not met — Turn RT potentiometer of SF unit fully counterclockwise, then rotate clockwise until reading of 49 is obtained.	
52	Set SW1 to position 7.	
53	On 2B test set — Adjust ADJ % BK control to 70 on <i>black</i> scale of PERCENT BREAK meter.	
54	Set SW1 to position 8.	PERCENT BREAK meter reads between 55 and 70 on <i>red</i> scale.
55	Set SW1 to position 7.	
<i>Note:</i> The following Steps 56 through 81 are to be performed for E1A-( ) units only. For E1A units proceed directly to Step 82.		
56	On 2B test set — Adjust ADJ PPS control to 12 pps on PULSES PER SECOND meter (0 to 20 scale).	
57	Adjust ADJ % BK control to 75 on <i>black</i> scale of PERCENT BREAK meter.	

STEP	ACTION	VERIFICATION
58	On test circuit — Set SW1 to position 8.	Unit pulses uniformly with PERCENT BREAK meter reading between 59 and 72 on <i>red</i> scale.  <i>Note:</i> The total excursion of meter needle should not exceed one-half division during 5-second observation interval. Look for momentary upward or downward needle deflections. If such deflections are observed, the requirement is <i>not</i> met.
59h	If requirement of Step 58 is not met — On test circuit — Set SW1 to position 7.	
60h	On 2B test set — Adjust ADJ % BK control to 76 on <i>black</i> scale of PERCENT BREAK meter.	
61h	On test circuit — Set SW1 to position 8.	Unit pulses uniformly (see note — Step 58) with PERCENT BREAK meter reading between 59 and 72 on <i>red</i> scale.
62i	If the requirement of Step 61h is not met — Adjust OT potentiometer slightly clockwise until unit just begins to pulse uniformly with PERCENT BREAK reading between 59 and 72 on <i>red</i> scale. (See note — Step 58).	
63	Set SW1 to position 7.	
64	On 2B test set — Adjust ADJ % BK control to minimum and then to 50 on <i>black</i> scale of PERCENT BREAK meter.	
65	On test circuit — Set SW1 to position 8.	Unit pulses uniformly (see note — Step 58) with PERCENT BREAK meter reading between 54 and 64 on <i>red</i> scale.
66j	If requirement of Step 65 is not met — Adjust OT potentiometer slightly counter-clockwise until unit just begins to pulse uniformly with PERCENT BREAK meter reading between 54 and 64 on <i>red</i> scale.	
67k	If any adjustment was made to the OT potentiometer — Repeat Steps 33 through 40 beginning with SW1 in position 7 and PULSES PER SECOND meter reading 10 pps.	Same as Steps 33 through 40.

STEP	ACTION	VERIFICATION
68l	<p>If the OT potentiometer was adjusted and the requirements of Steps 33 through 40 are not met —</p> <p>Adjust the RG relay to meet electrical and mechanical requirements as follows:</p> <p>If there is a momentary downward deflection of the meter needle, adjust the armature back tension toward the minimum. If there is an upward deflection of the meter needle, adjust the armature back tension toward the maximum. After readjusting the RG relay, return to Step 33 and complete the test.</p>	
69m	<p>If uniform pulsing cannot be achieved by re-adjustment of the RG relay, replace the R relay; return to Step 33 and complete test.</p>	
70	<p>Set SW1 to position 7.</p>	
71	<p>On 2B test set —</p> <p>Adjust ADJ PPS control to 10 on PULSES PER SECOND meter.</p>	
72	<p>Adjust ADJ % BK control to 80 on <i>black</i> scale of PERCENT BREAK meter.</p>	
73	<p>Set SW1 to position 8.</p>	<p>RG relay pulses with G relay operated.</p>
74	<p>Release G relay by hand.</p>	<p>RG relay stops pulsing and should remain in operated position.</p>
75	<p>Set SW1 to position 7.</p>	
76	<p>On 2B test set —</p> <p>Adjust ADJ % BK control to 66.5 on <i>black</i> scale of PERCENT BREAK meter.</p>	
77	<p>Adjust ADJ PPS control counterclockwise to 20 on <i>black</i> scale of PERCENT BREAK meter.</p>	<p>PULSES PER SECOND meter reads between 2.5 and 3.5 pps.</p>
78	<p>Set SW1 to position 8.</p>	<p>RG relay pulses while G relay remains operated.</p>
79	<p>On 2B test set —</p> <p>With coarse ADJ % BK switch on L —</p> <p>Adjust ADJ % BK control clockwise to 40 on <i>red</i> scale of PERCENT BREAK meter.</p>	<p>RG relay pulses while G relay remains operated.</p>
80	<p>Adjust ADJ % BK control clockwise to 70 on <i>red</i> scale of PERCENT BREAK meter.</p>	<p>RG and G relays both pulse.</p>
81	<p>With ADJ % BK switch on M —</p> <p>Adjust ADJ % BK control to 20 on <i>red</i> scale of PERCENT BREAK meter.</p>	<p>RG relay pulses while G relay remains operated.</p>

STEP	ACTION	VERIFICATION
<b>Rering Response</b>		
82	Set SW1 to position 7.	
83	On 2B test set — With PULSES PER SECOND meter read- in 10 — Adjust ADJ % BK control to 70 on <i>black</i> scale of PERCENT BREAK meter.	
84	Adjust ADJ PPS control until 28 on <i>black</i> scale of PERCENT BREAK meter is ob- tained.	PULSES PER SECOND meter reads be- tween 3.5 and 4.5 pps.
85	Operate M key.	
86	Set SW1 to position 8, SW2 to position 2.	PERCENT BREAK meter reads between 26 and 34 on <i>red</i> scale.
87	Change ATT attenuator setting in 2-db in- crements from 5 to 17.	Reading in Step 86 should not change more than $\pm 2$ percent break.
88	Set ATT attenuator to 11.	
89	Set SW1 to position 7.	
90	On 2B test set — Adjust ADJ % BK control to 50 on <i>black</i> scale of PERCENT BREAK meter.  <i>Note:</i> On some 2B sets it may not be pos- sible to obtain 50 with coarse ADJ % BK switch on M. Therefore, change it to L and readjust for reading of 50.	
91	Set SW1 to position 8.	PERCENT BREAK meter reads between 42 and 56 on <i>red</i> scale.
	<i>Note:</i> Steps 92 through 94 are to be performed only when testing E1A-( ) units.	
92	Set SW1 to position 7.	
93	On 2B test set — Adjust ADJ % BK control to 16 on <i>black</i> scale of PERCENT BREAK meter.	
94	Set SW1 to position 8.	RG relay remains released as indicated by a reading of 0 on <i>red</i> scale of PERCENT BREAK meter.
95	Restore M key to normal.	
96	Set SW2 to position 4.	

STEP	ACTION	VERIFICATION
97	On 2B test set — Restore keys to normal and set coarse ADJ % BK switch to M if it was changed in Step 90.	
98r	If no other tests are to be made — Remove all cords, restore all keys to normal, set LEV switch to proper position (Step 8), and return SF unit to service or spare position.	

#### H. Receiver Guard Action

*Note:* The requirements of this test depend upon the setting of the SS potentiometer. Test F should be performed first, if setting is unknown.

17	Set SW1 to position 5, SW2 to position 6.	
18	Set dial switch of TMS to 15.	TMS reads between -18.5 and -19.5 db.
19	Set ATT attenuator to 31 for E1A and 26 for E1A-( ).	
20	Set SW2 to position 5.	RG relay should be released.
21	Set SW1 to position 6.	RG relay remains released.
22	Set SW1 to position 5.	
23	Set ATT attenuator to 26 for E1A and 21 for E1A-( ).	
24	Set SW1 to position 6.	RG relay operates.
25	Set SW1 to position 5.	RG relay releases.
26	Set SW2 to position 7.	
27	Operate M key.	M and HL relays operate.
28	Set ATT attenuator to 28 for E1A and 24 for E1A-( ).	
29	Set SW1 to position 6.	RG relay remains released.
30	Set SW1 to position 5.	
31	Set ATT attenuator to 20 for E1A and 17 for E1A-( ).	
32	Set SW1 to position 6.	RG relay operates.
33	Set SW1 to position 5, SW2 to position 4.	RG, M, and HL relays release.
34	Restore M key to normal.	
35	Remove all cords, restore all keys to normal, set LEV switch to proper position (Step 8), and return SF unit to service or spare position.	