2600-Hz E1D, E2D, OR E3D SINGLE-FREQUENCY SIGNALING CIRCUIT OUT-OF-SERVICE TESTS USING TESTING CIRCUIT SD-96519-01 OR SD-96519-02 AND 4A SIGNALING TEST SET SD-1C244-01 (J94743A)

1. GENERAL

1.01 This section describes methods of making out-of-service tests of 2600-Hz single-frequency signaling circuits per SD-98087-01 or SD-98087-02 using testing circuit per SD-96519-01 or SD-96519-02 and 4A signaling test set SD-1C244-01. It 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 special techniques involved in testing and clearing trouble on some of the components.

Note: 291- and 303-type relays shall be maintained in an upright position not less than 1 minute before beginning any tests.

1.02 The tests covered are:

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

1.04 The J98613AY test panel (SD-96519-01 or SD-96519-02) is referred to in this section as test circuit.

1.05 The 4A signaling test set (SD-1C244-01) is referred to in this section as 4A test set.

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

1.07 ***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) including folding test fixture J98613AC.

2.03 4A test set, J94743A including the E&M J94743AD and SF, J94743AA interface units.

2.04 TMS J94021A.

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

2.06 Patching cord, P1P cord, 2 feet long, equipped with a KS-8585 L10 plug and a 347 plug.

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 725A tool, used to remove signaling units from bay jacks.

2.09 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 and set	

TABLE A

APPARATUS	TESTS						
	A	B	C	D	E	F	G
Test Circuit (2.02)	1	1	1	1	1	1	1
4A Test Set (2.03)	1				1	1	
TMS (2.04)	1	1	1	1			1
Cord (2.06)	2	1	1	1	1	1	1
Cord (2.07)	1						
Cord (2.08)						1	
258D (dummy) Plug	1				1		
Screwdriver, C	1		1	1	1		
Tool (2.09)	1	1	1	1	1	1	1
Blocking Tool (2.10)		√	√	√			

√ As required

STEP	ACTION	VERIFICATION
	attenuator controls to 0 before beginning any test.	
	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	Using 725A tool as shown in Fig. 1 or 2, remove signaling unit from its in-service position.	
4	Plug SF unit into folding test fixture of test circuit.	
5	Operate 2-WIRE key.	
6a	If test circuit is mounted in a REVERTIVE-TERMINATING bay, J98613AP— Operate CT key.	
Tests A, B, C, D, and G		
7	Set RECEIVER switch to position 2.	
8	Using P3N cord, connect DET IN jack of TMS to SF SUP jack of test circuit.	TMS indicates between −14.6 and −16.1 dB.
	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 the combined total of the DET INPUT switch setting and the meter indication. The TMS should be correctly calibrated before using.	
9	Disconnect cord from SF SUP jack, connect to AMP OUT jack.	TMS indicates 0 dB. See Step 10b.
10b	If requirement in Step 9 is not met— Adjust gain control of MON amplifier to obtain 0 dB.	
11	Disconnect cord from AMP OUT jack, connect to TMS jack.	

STEP	ACTION	VERIFICATION

Tests A, E, and F

12 Connect 4A test set to 110 volts ac power, operate POWER switch to ON.

13 Equip 4A test set with E&M and SF interface units.

14 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 of test circuit.

15 At 4A test set—
Set MS RANGE switch to 999.

16 Set SELECTOR switch to NORM.

17 Set FUNCTION switch to MSEC BK or MSEC MK.

Note: When verification calls for an indication in ms make or ms break, set the FUNCTION switch accordingly to obtain the proper indication.

18 Set READ switch to MSEC UPDATE.

19 Set RECEIVE switch to EM.

20 Set SEND switch to EM.

21 Set PULSE MODE switch to CONT.

22 Operate START-STOP key.

23 Operate 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.

4. METHOD

A. Operation of Transmitter CS Relay and Operation of CS1 and HL Relays in E2D and E3D Units

24 At test circuit—
Set KEYERS switch to position 7.

25 Set RECEIVER switch to position 1.

STEP	ACTION	VERIFICATION
26	At 4A test set— Set PULSE PERIOD switch to 100.	
27	Set PULSE WIDTH to switch to 55.	
28	Operate TWD DROP key to ON HK.	
29	Operate TWD LINE key to OFF HK.	
30	Operate PULSE/MEAS key to LINE.	
31	Set E&M/CX—S/R key to E&M/CX.	
32	Operate GEN SUPV key to OFF HK.	4A display indicates 55 ms make. See Step 33c.
33c	If requirement in Step 32 is not met— Adjust M potentiometer of test circuit to obtain 55 ms make.	
34	Set PULSE PERIOD key to 333.	
35	Set PULSE WIDTH key to 70.	
36	Using P1P cord, connect S jack of SF unit under test to M1 jack of test circuit.	
37	At test circuit— Set KEYERS switch to position 1.	
38	Operate E1D 1, E1D 2 keys.	At SF unit— CS relay pulses. If testing E2D or E3D unit— CS1 relay pulses. 4A display indicates between 66 and 97 ms make. See Step 39d.
39d	If requirement of Step 38 is not met— Check CS relay per circuit requirement table of SD-98087, then repeat Steps 33 through 36.	
40e	If testing E2D or E3D unit— At 4A test set— Set PULSE WIDTH switch to 266.	At SF unit— CS, CS1 relays pulse. HL relay operated.
41e	At 4A test set— Release OPERATE-CLEAR key.	CS, HL relays operated. CS1 relay released.
42e	Operate TWD LINE key to ON HK.	CS relay released. CS1 relay operated. HL relay released in less than one second.

STEP	ACTION	VERIFICATION
		Note: Operate TWD LINE key to OFF HK then ON HK as necessary for verification.
43e	At test circuit— Insert dummy plug into SF SUP jack.	
44e	Set KEYERS switch to position 2.	
45e	At 4A test set— Operate TWD LINE key to OFF HK.	
46e	Set PULSE WIDTH switch to 167.	
47e	Operate OPERATE-CLEAR key. Simultaneously depress TMS A, TMS B keys.	TMS indicates 10 to 20 dB and pointer pulsates at 3-pps rate. See note in Step 48e.
48e	At 4A test set— Raise PULSE WIDTH switch setting until TMS pointer just stops pulsating.	Setting on PULSE WIDTH switch is 266 or less. *Note:* If requirements of Steps 47e and 48e are not met, cut circuit is not operating properly and unit should be replaced.
49e	At test circuit— Release TMS A, TMS B keys.	
50e	Remove dummy plug from SF SUP jack.	
51	Restore E1D 1, E1D 2 keys.	
52	If no other tests are to be made— Remove all test cords, restore all circuits to normal.	
B. Transmitted Tone Level		
12	At test circuit— Operate E1D 1, E1D 2 keys.	
13	Set KEYERS switch to position 3.	
14	Set RECEIVER switch to position 1.	
15	Simultaneously depress TMS A, TMS B keys.	TMS indicates between −34.7 and −37.3 dB.
16	Set KEYERS switch to position 4.	At SF unit— CS relay operated. At E2D, E3D units— CS1 relay released. HL relay operated. TMS indicates less than −45 dBm of power.

STEP	ACTION	VERIFICATION
17	Release TMS A, TMS B keys.	
18c	If testing E1D-10 or higher, E2D, or E3D unit— Block operated CS relay.	
19c	Simultaneously depress TMS A, TMS B keys.	
20c	Set KEYERS switch to position 3.	
21c	Remove blocking tool from CS relay.	CS relay released. At E2D or E3D unit— CS1 relay operated. HL relay released. Peak TMS indicates between −22 and −27 dB. ***Note:*** Manually operate and release CS relay as necessary for verification.
22c	Release TMS A, TMS B keys.	
23	Restore E1D 1, E1D 2 keys.	
24d	If no other tests are to be made— Remove all test cords, restore all circuits to normal.	

C. Test of 4-Wire Terminating Circuit, Gain o Receiver Voice Amplifier, and Blocking of Amplifier

2-Wire to 4-Wire Loss

12	Operate 1000 ∿A key.	
13	Set KEYERS switch to position 5.	
14	Set RECEIVER switch to position 2.	
15	Operate LP CUR 1 key.	At SF unit— CS relay operated. At E2D or E3D unit— CS1 relay released. HL relay operated.
16	Simultaneously depress TMS A, TMS B keys.	TMS indicates: −15 to −16.3 dB for E1D through E1D-19, E2D-10, E3D-10 units. −15.4 to −16.2 dB for E1D-20 or higher, E2D-15 or higher, E3D-15 or higher.
17c	If testing E2D or E3D unit— Restore LP CUR 1 key.	

STEP	ACTION	VERIFICATION
18c	Operate LP CUR 2 key.	TMS indication of Step 16 removed then reappears in about one second. ***Note:*** Repeat Steps 17c, 18c as necessary to recheck the requirement. If this requirement is not met, replace SF unit.
19c	Restore LP CUR 2 key, operate LP CUR 1 key.	
20	Release TMS A, TMS B keys.	
21	Restore 1000~A key.	
4-Wire to 2-Wire Loss		
22	Operate 1000~B key.	
23	At SF unit— Set REC or RCV potentiometer fully counterclockwise.	TMS indicates −39 dBm or less power.
24	Set REC or RCV potentiometer fully clockwise.	TMS indicates +1 dBm or greater power.
25	Adjust REC or RCV potentiometer to obtain 0 dB.	TMS indicates 0 dB.
2-Wire Hybrid Loss		
26	At test circuit— Simultaneously depress TMS A, TMS B keys.	TMS indicates −14 to −18 dB.
27	Operate 2W TER key.	TMS indicates at least 15 dB less power than in Step 26.
28	Release TMS A, TMS B keys.	
29	Restore 2W TER key.	
30	Restore LP CUR 1, 1000~B keys.	
31	Momentarily operate LP CUR 2 key.	At SF unit— CS relay released.
32	Set KEYERS switch to position 6.	
33	Set RECEIVER switch to position 4.	
34	Set attenuator to 10.	TMS indicates 0 dB. See Step 35d.

STEP	ACTION	VERIFICATION
35d	If requirement of Step 34 is not met— Adjust gain control of TST amplifier to obtain 0 dB.	
Electronic Cut		
36e	If testing E1D unit— Set KEYERS switch to position 5.	
37e	Set RECEIVER switch to position 3.	
38e	Operate LP CUR 1 key.	At SF unit— CS relay operated.
39e	Block nonoperated RG relay.	
40e	Set KEYERS switch to position 6.	TMS indicates −40 dBm or less power.
41e	Remove blocking tool from RG relay.	RG relay operated. CS relay released. ***Note:*** If RG relay does not operate, perform Test D, then repeat Steps 32 through 41.
42e	Restore LP CUR 1 key.	TMS indicates −45 dBm or less power.
43f	If testing E2D or E3D unit— Set KEYERS switch to position 5.	
44f	Set RECEIVER switch to position 2.	
45f	Operate 1000∼A key, LP CUR 1 key.	At SF unit— CS relay operated.
46f	Block nonoperated RG relay.	
47f	At test circuit— Simultaneously depress TMS A, TMS B keys.	At SF unit— CS relay released. TMS indicates −15.4 to −16.2 dB. See note in Step 48e.
48f	Set KEYERS switch to position 6.	TMS indicates −40 dBm or less power. ***Note:*** If requirements of Steps 47f, 48f are not met, replace SF unit.
49f	Release TMS A, TMS B keys.	
50f	Remove blocking tool from RG relay.	RG relay operated. ***Note:*** Operation of RG relay depends on sensitivity adjustment. If RG relay does not

STEP	ACTION	VERIFICATION
		operate, perform Test D, then repeat Steps 32 through 50f of this test.
51f	Restore 1000∿A key, LP CUR 1 key.	
52f	Set KEYERS switch to position 5.	TMS indicates −45 dBm or less power. At SF unit— RG relay released.
54f	Operate LP CUR 1 key.	CS relay operated.
55	Operate 1000∿B key.	TMS indicates 0 dBm.
56	At SF unit— Adjust REC or RCV potentiometer for 4-wire to 2-wire loss as specified on circuit layout record.	TMS indicates value specified on circuit layout record, plus 0.2 dB. (Additional 0.2 dB is caused by measuring a 900-ohm circuit using a 600-ohm TMS).
57	At test circuit— Restore LP CUR 1, 1000∿B keys.	
58	Momentarily operate LP CUR 2 key.	At SF unit— CS relay released.
59g	If no other tests are to be made— Remove all test cords, restore all circuits to normal.	

D. Operate Sensitivity of Receiver Signaling Amplifier

12	Set KEYERS switch to position 6.	
13	Set RECEIVER switch to position 4.	
14	Set attenuator to 10.	TMS indicates 0 dB. See Step 15c.
15c	If requirement of Step 14 is not met— Adjust gain control of TST amplifier to obtain 0 dB.	
16	Set attenuator to 34.	
17	Set RECEIVER switch to position 3.	At SF unit— RG relay released. See Step 18d.
18d	If RG relay operated— Adjust SS potentiometer of SF unit slightly counterclockwise until RG relay releases.	

STEP	ACTION	VERIFICATION
19	At test circuit— Set attenuator to 32.	At SF unit— RG relay operated. See Step 20e.
20e	If RG relay did not operate— Adjust SS potentiometer of SF unit slightly clockwise until RG relay operates.	
21e	Repeat Steps 16 through 20e until requirements of Steps 17 and 19 are met, starting with RECEIVER switch in position 4.	
22	Set attenuator to 40.	At SF unit— RG relay released.
23f	If testing E1D-( ), E2D, or E3D unit— Set KEYERS switch to position 5.	
24f	Set RECEIVER switch to position 3.	
25f	Operate LP CUR 1 key.	At SF unit— CS relay operated.
26f	Set attenuator to 26.	
27f	Set KEYERS switch to position 6.	At SF unit— RG relay remains released.
28f	Set Attenuator to 20.	RG relay operated. CS relay released.
29f	Set RECEIVER switch to position 1.	RG relay released.
30g	If no other tests are to be made— Remove all cords, restore all circuits to normal.	

E. Timing of Receiver R and RG Relays

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

24	At 4A test set— Set PULSE PERIOD switch to 100.	
25	Set PULSE WIDTH switch to 55.	
26	Operate TWD LINE key to OFF HK.	
27	Operate TWD DROP key to ON HK.	
28	Operate PULSE/MEAS key to LINE.	

STEP	ACTION	VERIFICATION
29	Set E&M/CX-S/R switch to E&M/CX.	
30	Operate GEN SUPV key to OFF HK.	
31	Set FUNCTION switch to MSEC BK.	
32	Set test circuit— Set KEYERS switch to position 7.	4A display indicates 45 ms break. See Step 33c.
33c	If requirement of Step 32 is not met— Adjust M potentiometer of test circuit to obtain 45 ms break.	
34	Set attenuator to 11.	
Check Operate Time		
35d	If testing E1D, E1D List 1 or E2D unit— At 4A test set— Set PULSE PERIOD switch to 333.	
36d	Set PULSE WIDTH switch to 31.	
37d	At test circuit— Set KEYERS switch to position 8.	
38d	Set RECEIVER switch to position 3.	At SF unit— RG relay not operated. 4A display indicates 0 to 20 ms break. See Steps 40e and 41e.
39d	At 4A test set— Set PULSE WIDTH switch to 35.	At SF unit— RG relay operated. 4A display indicates 26 ms break or more. See Steps 40e and 41e.
40e	If requirement of Step 38d or 39d is not met— Set PULSE WIDTH switch to 33.	
41e	At SF unit— Adjust OT potentiometer until RG relay pulses uniformly and 4A display indicates 26 ms break or more.	4A display indicates 26 ms break or more.
Check Release Time		
42d	Set PULSE PERIOD switch to 100.	
43d	Set PULSE WIDTH switch to 45.	4A display indicates 48 to 50 ms break. See Step 44f.

STEP	ACTION	VERIFICATION
44f	If requirement of Step 43d is not met— Adjust RT potentiometer fully counterclockwise, then clockwise until 49 ms break is obtained.	4A display indicates 49 ms break.
45g	If testing E1D-( ) List 1, or E2D unit— At 4A test set— Set PULSE PERIOD switch to 83.	
46g	Set PULSE WIDTH switch to 62.	4A display indicates 47 to 57 ms break. For E1D unit, 47 to 60 ms break.
Rering Response		
47d	Set PULSE PERIOD switch to 250.	
48d	Set PULSE WIDTH switch to 55.	
49d	At test circuit— Operate LP CUR 1 key.	At SF unit— CS, RG relays pulse. 4A display indicates 50 to 75 ms break.
50d	Change attenuator in 2 dB steps from 5 to 17.	4A display indication same as in Step 49d, $\pm$5 ms.
51d	Set attenuator to 11.	
52d	At 4A test set— Set PULSE WIDTH switch to 125.	4A display indicates 98 to 135 ms break.
53d	At test circuit— Restore all keys.	
54h	If testing E1D List 2 or E3D unit— At SF unit— Set OT potentiometer fully clockwise.	
55h	At 4A test set— Set PULSE PERIOD switch to 250.	
56h	Set PULSE WIDTH switch to 80.	
57h	At test circuit— Operate LP CUR 1 key.	
58h	Set KEYERS switch to position 8.	
59h	Set RECEIVER switch to position 3.	At SF unit— CS relay operated. 4A display indicates 0 ms break.
60h	Set KEYERS switch to position 7.	

STEP	ACTION	VERIFICATION
61h	At 4A test set— Set PULSE WIDTH switch to: 150 for E1D to E1D-11, E1D-20-21 units. 188 for E1D-12-19, E3D unit.	
62h	At test circuit— Set KEYERS switch to position 8.	At SF unit— For units with 150 input— RG, CS relas pulse, 4A display indicates 38 ms break or more. For units with 188 input— RG relay operated. CS relay released.
63i	If no other tests are to be made— Remove all test cords, restore all circuits to normal.	

F. Voice Amplifier Cutoff Transistor

24	Disconnect cord from DET IN jack of TMS, connect to FROM LINE jack of SF interface unit.	
25	At 4A test set— Set MS RANGE switch to 99.9.	
26	Set RECEIVE switch to SF.	
27	Set PULSE PERIOD switch to 500.	
28	Set PULSE WIDTH switch to 50.	
29	At SF interface unit— Operate PULSE/MEAS key to LINE.	
30	Operate TWD EQPT key to MON.	
31	Operate TWD LINE key to MON.	
32	Set NB-BB switch to NB.	
33	At E&M interface unit— Operate TWD LINE key to OFF HK.	
34	At test circuit— Set KEYERS switch to position 8.	
35	Set RECEIVER switch to position 3.	
36	Set attenuator to 11	

STEP	ACTION	VERIFICATION
37	At 4A test set— Operate START-STOP key.	
38	Operate OPERATE-CLEAR key.	4A display indicates 5 to 25 ms break.
39c	If no other tests are to be made— Restore all keys, remove all cords, restore all circuits to normal.	
G. Receiver Guard Action		
12	Set KEYERS switch to position 5.	
13	Set RECEIVER switch to position 6.	TMS indicates −18.5 to −19.5 dB.
14	Set attenuator to 32 for E1D unit or 26 for E1D-( ), E2D or E3D unit.	
15	Set RECEIVER switch to position 5.	At SF unit— RG relay released.
16	Set KEYERS switch to position 6.	RG relay remains released.
17	Set KEYERS switch to position 5.	
18	Set attenuator to 27 for E1D unit or 21 for E1D-( ), E2D or E3D unit.	
19	Set KEYERS switch to position 6.	RG relay operated.
20	Set KEYERS switch to position 5.	RG relay released.
21	Operate LP CUR 1 key.	CS relay operated.
22	Set attenuator to 28 for E1D unit or 22 for E1D-( ), E2D or E3D unit.	
23	Set KEYERS switch to position 6.	RG relay remains released.
24	Set attenuator to 18 for E1D unit or 16 for E1D-( ), E2D or E3D unit.	RG relay operated. CS relay released.
25	Remove all test cords, restore all keys, restore all circuits to normal.	