1600- OR 2000-CYCLE SINGLE FREQUENCY SIGNALING CIRCUITS

SD-55954-01 AND SD-55954-02

OUT-OF-SERVICE TESTS

1. GENERAL

1.01 This section describes a method of testing the 1600- or 2000-cycle single frequency signaling circuits SD-55954-01 and SD-55954-02, using the test circuit SD-56137-01.

1.02 This section is reissued for the following reasons:

(a) To revise the title of the section to include out-of-service tests.

(b) To remove former Tests K, N, and P, which are now combined with Tests J, L, and M respectively.

(c) On Tests I and J to include requirements when a blocking network is used.

(d) To add Paragraphs 1.04 and 1.05.

1.03 The tests covered are:

A. Sensitivity of Receiver: This test checks that:

(a) Ground is on the E lead when no signaling tone is being received.

(b) The receiver is not too sensitive.

(c) The receiver is sensitive enough.

(d) The saturation current of the V3 tube meets its requirement.

(e) The receiver sensitivity is properly reduced by operation of the S relay.

B. Pulsing Performance of Receiver: This test checks that:

(a) The receiver responds to long pulses.

(b) Short pulses are lengthened by the receiver.

(c) The receiver ignores speech currents or other currents which, for short intervals, simulate signaling tone.

(d) The receiver in the talking condition ignores signals lasting 100 milliseconds or less.

(e) The receiver in the talking condition responds to a rering signal lasting 120 milliseconds or more.

C. Guard Sensitivity: This test checks that the following conditions are obtained in the receiver:

(a) The guard prevents false operation on frequencies other than the signaling tone frequency, when the receiver is in the talking condition.

(b) The guard of the receiver at the originating end is removed and the receiver becomes sensitive to all frequencies while "on-hook" supervision is being received. This prevents speech from affecting the guard and, thereby, causing false release of the receiver while awaiting subscriber answer.

(c) The guard sensitivity of the receiver at the terminating end is reduced while awaiting subscriber answer. This causes the receiver to respond quickly to incoming dial

signals and yet remain relatively unaffected by noise and speech on an intercepted call.

(d) There is no guard action when the trunk is idle.

D. Transmitter Performance: This test checks that:

(a) The transmitter sends out low level signaling tone when ground is connected to the M lead.

(b) The transmitter does not send out signaling tone when battery connects to the M lead.

E. Momentary High Level Signaling Tone: This test checks that the HL relay operates properly to change the level of the transmitted signal.

F. Timing of CO Relay: This test checks that:
(a) The CO relay holds during the make interval of a slow dial with minimum per cent break.

(b) The CO relay releases when the make interval of the dial is sufficiently long.

G. Timing of T Relay: This test checks that the T relay holds, under control of its associated gas tube timing circuit, on 60 ipm supervisory signals and that it releases 1 to 2 seconds after 60 ipm is removed.

H. Timing of RR Relay: This test checks that when the signaling circuit is in the talking condition, the following occurs:

(a) The RR relay holds for 160 milliseconds. This extends the duration of the transmitted rering pulse.

(b) The RR relay releases within 190 milliseconds, which prevents undue lengthening of the rering pulse.

I. Gain of Voice Amplifier: This test checks that the voice amplifier has zero or 1.5 db gain at 1000 cycles depending on the use of a blocking network.

J. Voice Amplifier Network Insertion Loss: This test checks that the signaling frequency is properly blocked when the network associated with the voice amplifier is inserted in the transmission path.

K. Gain of Blocking Amplifier: This test checks that the blocking amplifier has zero gain at 1000 cycles.

L. Blocking Amplifier Network Insertion Loss: This test checks that the signaling tone is properly blocked when the blocking amplifier network is inserted in the transmission path. This test is required only where the blocking amplifier is equipped with an F or an OF relay and an N filter.

M. Blocking Network Insertion Loss: This test checks the loss at 1000 cycles. It also checks that the network can be inserted and removed from the transmission path. When the network is inserted, a check is made to determine that there is sufficient loss to block the signaling tone.

1.04 Potentiometer and filament resistor adjustments are covered in Section 179-215-701. Analysis and Clearance of Trouble Conditions are covered in Section 211-215-301.

1.05 In view of the growing importance of keeping over-all circuit net loss as close to the specified value as possible, the gain of the voice and blocking amplifiers should be accurately maintained at the specified value.

1.06 All relay covers should be in place during tests and during the heating periods specified in this section, unless otherwise specified.

1.07 Various values of signaling power or testing conditions are specified in this section. The value to be used is determined from the following, depending on the circuit transmission levels, and whether the circuit is four-wire (4W) or two-wire (2W). The value for the two-wire condition when a blocking amplifier per Fig. 3 of the circuit drawing is used, is designated (2W), and is the same as for four-wire. When a blocking network per Fig. 6 is used, different

values or settings to compensate for the insertion loss of the transformers are specified and designated (2W BLK NETW).

(a) *+4 Line, —13 Line*

"+4 Line" indicates that the signaling receiver connects to the circuit at a point where the transmission level is +4 db.

"—13 Line" indicates that the associated signaling transmitter connects to the circuit at a point where the transmission level is —13 db.

(b) *+7 Line, —16 Line*

"+7 Line" indicates that the signaling receiver connects to the circuit at a point where the transmission level is +7 db.

"—16 Line" indicates that the associated signaling transmitter connects to the circuit at a point where the transmission level is —16 db.

1.08 Where reference is made in this section to the 1600⌐ SEND or 2000⌐ SEND jacks, use whichever frequency corresponds to the receiver of the signaling unit under test, unless otherwise specified.

1.09 The No. 13A or 21A transmission measuring set and the 40B transmission measuring system are referred to in this section as TMS. ←

1.10 The No. 2A and No. 2B signaling test sets are referred to in this section as No. 2A test set and No. 2B test set, respectively.

1.11 Adjustments specified in this section should not be attempted during periods of power supply irregularities.

1.12 Adjustment of the signaling test set for increasing values of per cent break must be made ***slowly,*** otherwise the pulsing rate may drop suddenly to half that indicated by the PULSES PER SECOND meter. This condition will be indicated by the rate of vibration of the PER CENT BREAK meter pointer being half that of the pointer on the PULSES PER SECOND meter. When this occurs, normal operation is restored by turning the ADJ % BK control fully counterclockwise and then turning it ***slowly*** clockwise to produce the desired per cent break.

1.13 Lettered Steps: The letters a, b, c, etc, are added to a step number to indicate that the step covers an action which may or may not be required depending on local conditions. The condition under which a lettered step or series of steps are made is given in the ACTION column, and all steps in the same test governed by the same condition are designated by the same letter. Where a condition does not apply, the associated steps should be omitted.

1.14 In general, only those lamps, tones, signals, etc, necessary for verification, are mentioned in the VERIFICATION column.

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 No. 2A signaling test set — J64730A (SD-56134-01) or No. 2B signaling test set — J64730B (SD-56134-02).

2.03 No. 13A or 21A transmission measuring set, or 40B transmission measuring system. ←

2.04 Test equipment on bay, including voice amplifier, pads and attenuator, keyer circuit, and jacks as shown on SD-56137-01.

2.05 Patching cord, P4H cord, 6 feet long, equipped with two No. 327A plugs (No. 4P18D cord).

Note: Shorter cords such as the No. 4P18B cord (4 feet), and the No. 4P18A cord (2 feet), may be used where desired.

2.06 Patching cord, P2A cord, 6 feet long, equipped with two No. 347A plugs (red shells) (No. 2P1D cord). Omit one cord in Tests A, B, H, or J when 48V jack is not provided.

2.07 Patching cord, P2A cord, 6 feet long, equipped with two No. 347B plugs (No. 2P3B cord).

TABLE A

APPARATUS	TESTS												
	A	B	C	D	E	F	G	H	I	J	K	L	M
Signaling Test Set (2.02)	1	1	1	1	1	1	1	1	—	—	—	1	1
TMS (2.03)	1	1	—	1	—	—	—	—	1	1	1	1	1
Test Equipment (2.04)	1	1	—	1	1	1	1	1	1	1	1	1	1
Cord (2.05)	5	5	7	4	2	2	1	—	3	5	3	7	5
Cord (2.06)	2	2	1	1	1	1	1	2	—	1	—	1	1
Cord (2.07)	1	1	1	1	—	—	—	—	—	—	—	—	—
Cord (2.08)	1	—	—	—	—	—	1	1	—	—	—	—	—
Cord (2.09)	1	1	—	1	—	—	—	—	1	1	1	1	1
Cord (2.10)	1	1	—	—	—	—	—	1	—	1	—	—	—
Head Telephone Set (2.11)	—	—	—	—	1	1	1	—	—	—	—	—	—
No. 310 Plug with tip and ring short-circuited (2.12)	1	1	—	—	—	—	—	—	—	—	—	—	—
No. 258D (dummy) Plug (2.13)	—	—	—	—	—	•	—	—	—	1	—	—	—
No. 165D (dummy) Plug (2.14)	—	—	—	—	—	—	2	2	—	—	—	2	—
Tool (2.15)	—	—	—	1	—	—	—	—	—	—	—	—	—

2.08 Patching cord, P3K cord, 12 feet long, equipped with two No. 310 plugs (No. 3P15B cord).

2.09 Testing cord, W2CA cord, 5 feet 6 inches long, equipped with a No. 327A plug (No. 2W36A cord). Omit this cord when using No. 21A or 40B TMS.

2.10 Testing cord, W1H cord, 10 feet long, equipped with a No. 347B plug, and a No. 360A tool (No. 1W8A cord) and a KS-6278 tool. Omit this cord when 48V jack is provided.

2.11 No. 52A head telephone set.

2.12 No. 310 plug with tip and ring short-circuited.

2.13 No. 258D plug (red).

2.14 No. 165D plug (red).

→**2.15** Blocking and insulating tools as required.
→ Use and apply per Section 069-020-801.

3. PREPARATION

STEP	ACTION	VERIFICATION
No. 2A or No. 2B Signaling Test Set		
1	Set all lever keys to normal.	
2	Set SCALE SEL switch to PPS.	
3	At miscellaneous test equipment jacks — Plug TST BAT B (—24 +130) and TST BAT A (—48) cords into TST BAT B and TST BAT A jacks.	After 1 minute PULSES PER SECOND meter reads other than 0.
4a	If using No. 2B test set — Operate CONT PLS key to DIAL PLS.	PER CENT BREAK meter reads 0 on black scale. (See Step 6c.)
5b	If using No. 2A test set — Operate PPS key to DIAL SUPV.	PER CENT BREAK meter reads 0 on black scale. (See Step 6c.)

STEP	ACTION	VERIFICATION
6c	If requirement of Step 4a or 5b is not met — Adjust pointer adjustment screw of PER CENT BREAK meter to obtain 0 reading.	
7	Insert No. 258D plug into P jack of test set. ***Note:*** Repeat Steps 7, 8d, and 9 if test extends beyond 30 minutes.	PER CENT BREAK meter reads 100 on black scale. (See Step 8d.)
8d	If requirement of Step 7 is not met — Unlock CAL % BK control and adjust to obtain reading of 100. Relock CAL % BK control, taking care not to change 100 reading.	
9	Remove No. 258D plug.	
10a	If using No. 2B test set — Restore CONT PLS key.	
11b	If using No. 2A test set — Restore PPS key.	
	Transmission Measuring Set	
→ 12e	If using No. 13A or 21A TMS — Connect power and calibrate TMS in accordance with Section 103-213-100 or 103-221-100 respectively.	
13e	At miscellaneous test equipment jacks in signaling bays nearest signaling equipment involved — Connect TMS to left-hand vertical jacks of MISC E TST, M TST jacks using 2W36A or 4P18D cord as appropriate. ***Note:*** If using No. 21A TMS patch to DET IN 600Ω jack.	
14f	If using 40B TMS — Calibrate TMS in accordance with appropriate section.	
15f	At toll test board — Patch TMS to REC jack of testing trunk which terminates at miscellaneous test equipment jacks nearest signaling equipment involved.	

STEP	ACTION	VERIFICATION
All Tests		
16	Remove signaling circuit from service.	
→ **Tests A, B, C, D, J, L, M (Adjustment of Test Amplifier)**		
→ 17e	If using No. 13A or 21A TMS — At miscellaneous test equipment jacks — Patch MISC 1600⌐ SEND or 2000⌐ SEND jack to MISC E and M jacks using 4P18D cord. Record TMS reading.	
18e	Remove cord from MISC E and M jacks and insert in MISC ATTEN IN jack.	
19f	If using 40B TMS — At miscellaneous test equipment jacks — Patch MISC 1600⌐ SEND or 2000⌐ SEND jack to MISC REC jack of testing trunk using 4P18D cord. Record TMS reading.	
20f	Remove cord from MISC REC jack and insert in MISC ATTEN IN jack.	
21	Set attenuator to 30 db.	
22	Patch MISC ATTEN OUT jack to MISC AMP IN jack using 4P18D cord.	
→ 23e	If using No. 13A or 21A TMS — Patch MISC AMP OUT jack to MISC E and M jacks using 4P18D cord.	
24f	If using 40B TMS — Patch MISC AMP OUT jack to MISC REC jack of testing trunk using 4P18D cord.	
→ 25	Adjust test amplifier to obtain reading on TMS within 0.1 db of that recorded in Step 17e or 19f. *Note:* If difficulty is experienced on tests using test amplifier, noise level of amplifier should be checked in accordance with the section covering test methods for the repeater. Noise level of amplifier should be lower than −85 db when input is terminated in 600 ohms.	

STEP	ACTION	VERIFICATION
26	Remove cord from MISC 1600⌐ SEND or 2000⌐ SEND, ATTEN IN, ATTEN OUT, AMP IN, AMP OUT, and E and M, or REC jacks.	
	A. Sensitivity of Receiver	
27	At test jacks — Patch E jack of No. 2A or No. 2B test set to EQ E jack using 2P3B cord.	
28	At miscellaneous test equipment jacks — Patch M jack of No. 2A or No. 2B test set to MISC M (keyer) jack using 2P1D cord.	
29	Patch MISC 1600⌐ SEND or 2000⌐ SEND jack to MISC KEYER IN jack using 4P18D cord.	
30	Patch MISC KEYER OUT jack to MISC ATTEN IN jack using 4P18D cord.	
31	Patch MISC ATTEN OUT jack to MISC AMP IN jack using 4P18D cord.	
→ 32e	If using No. 13A or 21A TMS — Patch MISC AMP OUT jack to MISC E and M jacks using 4P18D cord.	
33f	If using 40B TMS — Patch MISC AMP OUT jack to MISC REC jack using 4P18D cord.	
34	On No. 2A or No. 2B test set — Operate TWD L key to ON HK.	
35	At miscellaneous test equipment — Adjust attenuator controls to obtain reading on TMS of −27 ±0.1 db for +4 Line (4W-2W), −24 ±0.1 db for +7 Line (4W-2W), −28.5±0.1 db for +4 Line (2W BLK NETW), or −25.5±0.1 db for +7 Line (2W BLK NETW).	
	Nonoperate, High Sensitivity	
36	On No. 2A or No. 2B test set — Operate TWD L key to OFF HK.	

STEP	ACTION	VERIFICATION
→ 37e	If using No. 13A or 21A TMS — Remove cord from MISC E and M jacks and patch MISC AMP OUT jack to LINE REC jack.	L lamp extinguished on No. 2B test set, or lighted on No. 2A test set.
38f	If using 40B TMS — Remove cord from MISC REC jack and patch AMP OUT jack to LINE REC jack.	L lamp extinguished on No. 2B test set, or lighted on No. 2A test set.
39	On No. 2A or No. 2B test set — Operate TWD L key to ON HK.	L lamp extinguished on No. 2B test set, or lighted on No. 2A test set. ***Note:*** If requirements of 37e, 38f, or 39 are not met— Adjust potentiometers P2 and P4 in accordance with Section 179-215-701.
Operate, High Sensitivity		
40	At miscellaneous test equipment — Reduce attenuator setting obtained in Step 35 by 3 db.	
41	Set SCALE SEL key to 20MA.	
42	Insert short-circuited No. 310 plug into R jack of signaling unit.	
43	On No. 2A or No. 2B test set — Patch MA jack to DC jack of signaling unit using 3P15B cord.	MILLIAMPERES DC meter of No. 2A or No. 2B test set reads between 6 and 8 ma on 0-20 scale. ***Note:*** If requirement of Step 43 is not met— Adjust potentiometers P2 and P4 in accordance with Section 179-215-701.
44	Reduce attenuator setting used in Step 40 by 1 db.	L lamp lighted on No. 2B test set, or extinguished on No. 2A test set.
Maximum Saturation Current of Receiver		
45	Reduce attenuator setting of Step 44 by 21 db.	MILLIAMPERES DC meter reads between 9.7 and 11.0 on 0-20 scale. ***Note:*** If requirement of Step 45 is not met— Adjust potentiometers P2 and P4 in accordance with Section 179-215-701.
46	Restore SCALE SEL switch to PPS.	

STEP	ACTION	VERIFICATION
	Operate, Low Sensitivity	
47	Remove patching cord from MA and DC jacks.	
48	Remove No. 310 plug from R jack.	
49	Set attenuator to 30 db, with 0.1 DB ATTEN set on 2 db and 2 DB control on 28 db.	
→ 50g	If 48V jack is provided — Patch EQ M jack to MISC 48V jack using 2P1D cord. *Note:* Connect cord to EQ M jack first to avoid blowing fuse.	L lamp extinguished on No. 2B test set or lighted on No. 2A test set.
→ 51h	If 48V jack is not provided — Connect EQ M jack to source of —48 volt battery using 1W8A cord. *Note:* See note in Step 50g.	Same as Step 50g.
52	Reduce attenuator setting slowly in 0.1 db steps using alternately 0.1 DB and 2 DB ATTEN controls as required, until L lamp lights on No. 2B test set, or is extinguished on No. 2A test set.	
→ 53e	If using No. 13A or 21A TMS — Remove cord from LINE REC jack and patch MISC AMP OUT jack to MISC E and M jacks.	TMS reads —12 ±2.0 db for +4 Line (4W-2W), — 9 ±2.0 db for +7 Line (4W-2W), —13.5±2.0 db for +4 Line (2W BLK NETW), or —10.5±2.0 db for +7 Line (2W BLK NETW).
54f	If using 40B TMS — Remove cord from LINE REC jack and patch MISC AMP OUT to MISC REC jack.	TMS reads —12 ±2.0 db for +4 Line (4W-2W), — 9 ±2.0 db for +7 Line (4W-2W), —13.5±2.0 db for +4 Line (2W BLK NETW), or —10.5±2.0 db for +7 Line (2W BLK NETW).
55	Remove cord first from 48V jack or from —48 volt battery and then from EQ M jack.	
56	Remove patches and restore keys.	

STEP	ACTION	VERIFICATION
	B. Pulsing Performance of Receiver	
27	At test jacks — Patch E jack of No. 2A or No. 2B test set to EQ E jack using 2P3B cord.	
28	At miscellaneous test equipment jacks — Patch M jack of test set to MISC M jack (keyer) using 2P1D cord.	
29	Patch MISC 1600⌐ SEND or 2000⌐ SEND jack to MISC KEYER IN jack using 4P18D cord.	
30	Patch MISC KEYER OUT to MISC ATTEN IN jack using 4P18D cord.	
31	Patch MISC ATTEN OUT jack to MISC AMP IN jack using 4P18D cord.	
→ 32e	If using No. 13A or 21A TMS — Patch MISC AMP OUT jack to MISC E and M jacks using 4P18D cord.	
33f	If using 40B TMS — Patch MISC AMP OUT jack to MISC REC jack using 4P18D cord.	
34	On No. 2A or No. 2B test set — Operate TWD L key to ON HK.	
35	Insert short-circuited No. 310 plug into R jack of signaling unit.	
36	At test equipment in signaling bays — Adjust attenuator controls to obtain reading on TMS of -2 ± 0.2 db for +4 Line, or $+1\pm0.2$ db for +7 Line.	
37	Operate TWD L key of No. 2A or No. 2B test set to OFF HK.	
38	Remove patching cord from MISC E and M jacks or MISC REC jack and patch MISC AMP OUT jack to LINE REC jack.	

STEP	ACTION	VERIFICATION
39	On No. 2A or No. 2B test set — Adjust ADJ PPS control to obtain reading of 10 on 0-20 scale of PULSES PER SECOND meter.	
40	Set ADJ % BK switch to M.	
Operate, Long Pulses		
41	Adjust ADJ % BK control to obtain reading of 70 on black scale of PER CENT BREAK meter.	
42	Operate PLS key to LINE.	
43	Operate MEAS % BK key to LINE.	PER CENT BREAK meter reads between 57 and 70 on red scale. ***Note:*** If requirement of Step 43 is not met— Adjust potentiometer P5 in accordance with Section 179-215-701.
44	Restore PLS and MEAS % BK keys.	
Operate, Short Pulses		
45	Adjust ADJ % BK control to obtain reading of 45 on black scale of PER CENT BREAK meter.	
46	Operate PLS key to LINE.	
47	Operate MEAS % BK key to LINE.	PER CENT BREAK meter reads between 48 and 63 on red scale. ***Note:*** If requirement of Step 47 is not met— Adjust potentiometer P5 in accordance with Section 179-215-701.
48	Restore PLS and MEAS % BK keys. Remove plug from R jack.	
Nonoperate, Short Pulses		
49	Adjust ADJ % BK control to obtain reading of 25 on black scale of PER CENT BREAK meter. ***Note:*** On certain test sets, it may be necessary to set ADJ % BK switch to S instead of M, in order to read 25 per cent break.	

STEP	ACTION	VERIFICATION
50	Operate PLS key to LINE.	L lamp extinguished on No. 2B test set, or lighted on No. 2A test set.
51	Restore PLS key.	
Nonoperate, Rering Condition		
52	Adjust ADJ PPS control to obtain reading of 4 on 0-20 scale of PULSES PER SECOND meter.	
53	Set ADJ % BK switch to L.	
54	Adjust ADJ % BK control to obtain reading of 40 on black scale of PER CENT BREAK meter.	
55g	If 48V jack is provided — Patch EQ M jack (sig) to MISC 48V jack using 2P1D cord. *Note:* Connect cord to EQ M jack first to avoid blowing fuse.	
56h	If 48V jack is not provided — Connect EQ M jack to source of —48 volt battery using 1W8A cord. *Note:* See note in Step 55g.	
57a	If using No. 2B test set — Operate CONT PLS key to DIAL PLS, PLS key to LINE, and MEAS % BK key to LINE.	
58b	If using No. 2A test set — Operate PPS key to DIAL SUPV, PLS key to LINE, and MEAS % BK key to LINE.	
59	Wait 3 seconds, then dial digit 1.	Pointer of PER CENT BREAK meter does not kick.
60	Repeat Step 59 at least 3 times, allowing minimum of 3 seconds between steps.	Same as Step 59. *Note:* If requirements of Steps 59 and 60 are not met— Adjust P7 potentiometer in accordance with Section 179-215-701.
61	Restore PLS, MEAS % BK, and CONT PLS or PPS keys.	

STEP	ACTION	VERIFICATION
Operate, Rering Condition		
62	Adjust ADJ % BK control to obtain reading of 48 on black scale of PER CENT BREAK meter.	
63a	If using No. 2B test set — Operate CONT PLS key to DIAL PLS, PLS key to LINE, and MEAS % BK key to LINE.	
64b	If using No. 2A test set — Operate PPS key to DIAL SUPV, PLS key to LINE, and MEAS % BK key to LINE.	
65	Wait 3 seconds, then dial digit 1.	Needle of PER CENT BREAK meter kicks.
66	Repeat Step 65 at least 3 times, allowing minimum of 3 seconds between steps.	Same as Step 65. *Note:* If requirements of Steps 65 and 66 are not met— Adjust P7 potentiometer in accordance with Section 179-215-701.
67	Remove cord first from 48V jack or —48 volt battery and then cord from EQ M jack.	
68	Remove patches and restore keys.	

C. Guard Sensitivity

Talking Condition

27	At miscellaneous test equipment jacks — Patch MISC 1600¬ SEND or 2000¬ SEND jack to MISC KEYER IN jack using 4P18D cord.	
28	Patch MISC KEYER OUT jack to MISC PAD IN A jack in all cases except that of +7 Line in combined +4 Line and +7 Line offices, in which case patch to MISC PAD IN B jack using 4P18D cord.	
29	Patch MISC 8 or 14 db OUT jack to MISC AMP IN jack using 4P18D cord.	
30	Patch MISC SEND 1MW jack to MISC ATTEN IN jack using 4P18D cord.	

STEP	ACTION	VERIFICATION
31	Patch LINE REC jack to MISC MIX C jack using 4P18D cord.	
32	Patch EQ E jack to E jack of No. 2A or No. 2B test set using 2P3B cord.	
33	Patch EQ M jack to M jack of No. 2A or No. 2B test set using 2P1D cord.	
34	Operate TWD L key of No. 2A or No. 2B test set to OFF HK.	
35	At miscellaneous test equipment — Turn attenuator controls fully clockwise.	
36	Patch MISC ATTEN OUT jack to MISC MIX A jack using 4P18D cord.	L lamp extinguished on No. 2B test set, or lighted on No. 2A test set.
37	Patch MISC AMP OUT jack to MISC MIX B jack using 4P18D cord.	L lamp remains extinguished on No. 2B test set, or lighted on No. 2A test set.
38	Turn 2 DB ATTEN control slowly counter-clockwise until L lamp is lighted on No. 2B test set, or extinguished on No. 2A test set.	Attenuator controls read: 20.5±5.5 db for +4 Line, or 17.5±5.5 db for +7 Line.
Awaiting Subscriber Answer — Receiver at Originating End		
39	Turn both controls of attenuator fully clockwise.	L lamp remains lighted on No. 2B test set, or extinguished on No. 2A test set.
40	Remove cord from AMP OUT and MIX B jacks.	Same as Step 39.
Awaiting Subscriber Answer — Receiver at Terminating End		
41	Operate TWD L key of No. 2A or No. 2B test set to ON HK.	
42	At miscellaneous test equipment jacks — Remove cord from MISC MIX A jack.	L lamp extinguished on No. 2B test set, or lighted on No. 2A test set.
43	Insert cord in MISC MIX A jack.	L lamp remains extinguished on No. 2B test set, or lighted on No. 2A test set.
44	Remove cord from MISC 8 or 14 db OUT jack and insert into MISC 20 or 26 db OUT jack.	
45	Patch MISC AMP OUT jack to MISC MIX B jack using 4P18D cord.	L lamp remains extinguished on No. 2B test set, or lighted on No. 2A test set.

STEP	ACTION	VERIFICATION
46	Turn 2 DB ATTEN control slowly counterclockwise until L lamp is lighted on No. 2B test set, or extinguished on No. 2A test set.	Attenuator controls read: 25.5±5.5 db for +4 Line, or 22.5±5.5 db for +7 Line.
→ 47	Turn attenuator controls fully clockwise.	L lamp remains lighted on No. 2B test set, or extinguished on No. 2A test set. *Note:* For circuit using A option omit verification in Step 47.
48	Remove cord from AMP OUT and MIX B jacks.	L lamp remains lighted on No. 2B test set, or extinguished on No. 2A test set, unless option A is used, in which case L lamp is extinguished on No. 2B or lighted on No. 2A.
49	Remove patches and restore keys.	

D. Transmitter Performance

Low Level Signaling Tone

27	At test jacks — Patch M jack of No. 2A or No. 2B test set to EQ M jack using 2P1D cord.	
28	Patch LINE TRS jack of signaling circuit to MISC AMP IN jack using 4P18D cord.	
29	Remove relay cover and block CO relay operated.	
→ 30e	If using No. 13A or 21A TMS — Patch MISC AMP OUT jack to MISC E and M jacks using 4P18D cord.	
31f	If using 40B TMS — Patch MISC AMP OUT jack to MISC REC jack using 4P18D cord.	
32	Operate TWD L key of No. 2A or No. 2B test set to ON HK.	TMS reads: −2.8±1.0 db for −13 Line, or −5.9±1.0 db for −16 Line.

Suppressed Signaling Power

→ 33	Operate TWD L key to OFF HK.	No. 13A or 21A TMS reads −45 db or lower power. 40B TMS reads lower power than −35 db.

STEP	ACTION	VERIFICATION
34	Remove patches, restore keys, unblock CO relay, and replace cover.	
	E. Momentary High Level Signaling Tone	
17	At test jacks — Patch M jack of No. 2A or No. 2B test set to EQ M jack using 2P1D cord.	
18	Patch LINE TRS jack to MISC MON IN jack using 4P18D cord.	
19	Plug telephone set in MISC MON OUT jack.	Listen for tone in receiver.
20	Operate TWD L key of No. 2A or No. 2B test set to OFF HK.	Tone heard in receiver is greatly reduced.
21	Operate TWD L key to ON HK.	Tone in receiver increases momentarily and then decreases noticeably in loudness.
22	Remove patches, telephone set, and restore keys.	
	F. Timing of CO Relay	
17	At test jacks — Patch M jack of No. 2A or No. 2B test set to EQ M jack using 2P1D cord.	
18	Patch LINE TRS jack to MISC MON IN jack using 4P18D cord.	
19	Plug head telephone set in MISC MON OUT jack.	
20	Patch MISC 1600¬ SEND or 2000¬ SEND jack to LINE REC jack using 4P18D cord.	
Hold		
21	On No. 2A or No. 2B test set — Adjust ADJ PPS control to obtain reading of 8 on 0-20 scale of PULSES PER SECOND meter.	
22	Set ADJ % BK switch to M.	
23	Adjust ADJ % BK control to obtain reading of 32 on black scale of PER CENT BREAK meter.	

STEP	ACTION	VERIFICATION
24	Operate TWD L key to OFF HK.	
25	Operate PLS key to LINE.	Listen in receiver for "clean" pulses of tone.
Release		
26	On No. 2A or No. 2B test set — Turn ADJ PPS control slowly counterclockwise to reduce reading of PULSES PER SECOND meter until tone pulses heard in receiver are no longer clean but have slight irregularity at beginning of each pulse.	PULSES PER SECOND meter reads 7.5 or lower on 0-20 scale.
27	Remove patches, telephone set, and restore keys.	

G. Timing of T Relay

17	At test jacks — Insert No. 165D plugs in both LINE REC jacks.	
18	Patch M jack of No. 2A or No. 2B test set to EQ M jack using 2P1D cord.	
19	Patch LINE TRS jack to MISC MON IN jack using 4P18D cord.	
20	Connect head telephone set to MISC MON OUT jack.	
21	On No. 2A or No. 2B test set — Operate TWD L key to OFF HK.	
22	Adjust ADJ PPS control to obtain reading of 10 on 0-20 scale of PULSES PER SECOND meter.	
23	Set ADJ % BK switch on M.	
24	Adjust ADJ % BK control to obtain reading of 50 on black scale of PER CENT BREAK meter.	
Hold and Release		
25	Operate PLS key to LINE.	Pulses heard in receiver are at rate of about 5 per second.

STEP	ACTION	VERIFICATION
26	Patch 60 ipm jack to R jack of signaling unit using 3P15B cord.	Pulses heard in receiver are at rate of about 10 per second. *Note:* Pulses will be at rate of 5 per second if T relay fails to hold over 60 ipm.
27	Remove cord from 60 ipm jack.	After about 2 seconds, pulses heard in receiver change to rate of about 5 per second.
28	Remove patches and plugs, telephone set, and restore keys.	

H. Timing of RR Relay

17	At test jacks — Insert No. 165D plugs in both LINE REC jacks.	
18g	If 48V jack is provided — Patch EQ M jack to MISC 48V jack using 2P1D cord. *Note:* Connect to EQ M jack first to avoid blowing fuse.	
19h	If 48V jack is not provided — Connect EQ M jack to —48 volt battery using 1W8A cord. *Note:* See Note in Step 18g.	
20	Wait 6 minutes for RR relay to warm.	
21	Remove cord first from 48V jack or —48 volt battery and then from EQ M jack.	
22	Patch M jack of No. 2A or No. 2B test set to EQ M jack using 2P1D cord.	
23	Patch RR jack of test set to DC jack of signaling unit using 3P15B cord.	

RR Relay Holds Over 160 Millisecond Break

24	On signaling test set — Adjust ADJ PPS control to obtain reading of 4 on 0-20 scale of PULSES PER SECOND meter.	
25	Set ADJ % BK switch to L.	

STEP	ACTION	VERIFICATION
26	Adjust ADJ % BK control to obtain reading of 64 on black scale of PER CENT BREAK meter.	
27	Turn ADJ PPS control fully counterclockwise. *Note:* Disregard change in reading of PER CENT BREAK meter.	
28	Set SCALE SEL control to 20V.	
29	Operate PLS key to LINE.	Pointer of VOLTS DC meter kicks regularly. *Note:* If requirement of Step 29 is not met— Adjust RR relay by means of potentiometer P6 in accordance with Section 179-215-701.
	RR Relay Releases on 190 Millisecond Break	
30	Set SCALE SEL control to PPS.	
31	Restore PLS key.	
32	Adjust ADJ PPS control to obtain reading of 4 on 0-20 scale of PULSES PER SECOND meter.	
33	Adjust ADJ % BK control to obtain reading of 76 on black scale of PER CENT BREAK meter.	
34	Turn ADJ PPS control fully counterclockwise. *Note:* Disregard change in reading of PER CENT BREAK meter.	
35	Set SCALE SEL switch to 20V.	
36	Operate PLS key to LINE.	Pointer of PULSES PER SECOND meter remains steadily near 0 on 0-20 scale. *Note:* If requirement of Step 36 is not met— Adjust RR relay by means of potentiometer P6 in accordance with Section 179-215-701.
37	Remove patches and restore keys.	

STEP	ACTION	VERIFICATION
	I. Gain Test of Voice Amplifier	
17	At test jacks — Patch M jack of No. 2B or No. 2A test set to EQ M jack using 2P1D cord.	
18	On No. 2A or No. 2B test set — Operate TWD L key to OFF HK.	
→ 19e	If using No. 13A or 21A TMS — At miscellaneous test equipment jacks — Patch MISC SEND 1MW jack to MISC E and M jacks using 4P18D cord.	TMS reads 0±1.0 db. Record actual reading.
20e	Remove cord from MISC E and M jacks and insert in LINE REC jack.	
→ 21e	Patch EQ REC jack to MISC E and M jacks.	4W-2W units TMS reads within 0.1 db of value recorded in Step 19e. 2W BLK NETW units TMS indicates a gain of 1.5 ± 0.1 db above value recorded in Step 19e. (See 1.05.) ***Note 1:*** On circuit order tests or reline-up of a circuit, amplifier should be adjusted to exact specified value. ***Note 2:*** If requirement of Step 21e is not met— Adjust potentiometer P1 in accordance with Section 179-215-701.
22f	If using 40B TMS — At miscellaneous test equipment jacks — Patch MISC SEND 1MW jack to MISC REC jack using 4P18D cord.	TMS reads 0±1.0 db. Record actual reading.
23f	Remove cord from MISC REC jack and insert in LINE REC jack.	
→ 24f	Patch EQ REC jack to MISC REC jack.	4W-2W units TMS reads within 0.1 db of value recorded in Step 22f. 2W BLK NETW units TMS indicates a gain of 1.5 ± 0.1 db above value recorded in Step 22f. (See 1.05 and Note 1 in Step 21e.) ***Note:*** If requirement of Step 24f is not met— Adjust potentiometer P1 in accordance with Section 179-215-701.
25f	Remove patches.	

STEP	ACTION	VERIFICATION
→	**J. Voice Amplifier Network Insertion Loss**	
27	At miscellaneous test equipment jacks — Patch MISC 1600⌐ SEND or 2000⌐ SEND jack to MISC ATTEN IN jack using 4P18D cord.	
28	Patch MISC ATTEN OUT jack to MISC AMP IN jack using 4P18D cord.	
→ 29	Patch MISC AMP OUT jack to MISC E and M jacks if using No. 13A or 21A TMS, or to MISC REC jack if using No. 40B TMS using 4P18D cord.	
30g	If 48V jack is provided — Patch EQ M jack to MISC 48V jack using 2P1D cord. *Note:* Connect to EQ M jack first to avoid blowing fuse.	
31h	If 48V jack is not provided — Connect EQ M jack to —48 volt battery using 1W8A cord. *Note:* See Note in Step 30g.	
32	Adjust attenuator controls to obtain a reading of +4 ± 0.1 db on the TMS. Record actual reading.	
Filter Out		
33	Remove cord from MISC E and M jacks or MISC REC jack and insert in LINE REC jack.	
34	Insert No. 258D plug in DC jack of signaling unit.	
→ 35	Patch EQ REC jack to MISC E and M jacks or to MISC REC jack as appropriate using 4P18D cord.	4W-2W units TMS reads within 0.1 db of value recorded in Step 32. 2W BLK NETW units TMS indicates a gain of 1.5±0.1 db above value recorded in Step 32.
Filter In		
→ 36	Remove No. 258D plug from DC jack of signaling unit.	4W-2W units TMS reads lower power than —30 db. 2W BLK NETW units TMS reads lower power than —28.5 db.

STEP	ACTION	VERIFICATION
37	Remove cord first from 48V jack, or disconnect it first from —48 volt battery and then remove cord from EQ M jack.	
38	Remove patches and restore keys.	

K. Gain Test of Blocking Amplifier

STEP	ACTION	VERIFICATION
→ 17e	If using No. 13A or 21A TMS — At blocking amplifier bay — Patch MISC SEND 1MW jack to TMS using a 2W36A or 4P18D cord as appropriate.	TMS reads 0 ± 1.0 db. Record actual reading.
18e	Remove patch between TMS and SEND 1MW jack.	
19e	Connect TMS to BLKG AMP OUT jack using same cord as Step 17e.	
20f	If using 40B TMS — At blocking amplifier bay — Patch MISC SEND 1MW jack to MISC REC jack using 4P18D cord.	TMS reads 0 ± 1.0 db. Record actual reading.
21f	Remove cord from SEND 1MW jack and insert it in BLKG AMP OUT jack.	
→ 22	Patch MISC SEND 1MW jack to BLKG AMP IN jack using 4P18D cord.	TMS reads within 0.1 db of value recorded in Step 17e or 20f. (See 1.05.) *Note:* If requirement of Step 22 is not met— Adjust P potentiometer in accordance with Section 179-215-701.
23	Remove patches.	

L. Blocking Amplifier Network Insertion Loss

Note: This test required only where blocking amplifier is equipped with an F or an OF relay and an N filter.

STEP	ACTION	VERIFICATION
27	At test jacks of signaling unit associated with blocking amplifier — Patch M jack of No. 2A or No. 2B test set to EQ M jack using 2P1D cord.	

STEP	ACTION	VERIFICATION
28	Patch MISC ATTEN IN jack to MISC 1600⌐ SEND jack when 200F blocking network is used, or to MISC 2000⌐ SEND jack when 200 E network is used, using 4P18D cord.	
29	Patch MISC ATTEN OUT jack to MISC AMP IN jack using 4P18D cord.	
→ 30	Patch MISC AMP OUT jack to MISC SEND jack terminating at blocking amplifier bay using 4P18D cord.	
→ 31	Connect TMS to MISC REC jack at blocking amplifier bay using 2W36A or 4P18D cord as appropriate. *Note:* If direct test trunks between signaling and amplifier bays are not provided, place additional patch cords as required to connect to blocking amplifier bay.	
32	Insert No. 165D plugs in both LINE REC jacks.	
33	At jacks in blocking amplifier bay — Patch MISC SEND jack to MISC REC jack using 4P18D cord.	
34	On No. 2A or No. 2B test set — Operate TWD L key to OFF HK.	
35	At miscellaneous test equipment of signaling circuit associated with blocking amplifier — Adjust attenuator controls to obtain reading of +4 ± 0.1 db on TMS. Record actual reading.	
Filter Out		
36	At jacks in blocking amplifier bay — Remove cord from MISC REC jack and insert in BLKG AMP IN jack	
37	Patch BLKG AMP OUT jack to MISC REC jack.	TMS reads within ±0.1 db of value recorded in Step 35.

STEP	ACTION	VERIFICATION
Filter In		
38	On No. 2A or No. 2B test set — Operate TWD L key to ON HK.	TMS reads —30 db or lower value of power.
39	Remove patches and restore keys.	

M. Blocking Network Insertion Loss

1000-Cycle Power		
27	At jacks in blocking network bay — Connect MISC SEND 1MW jack to TMS using 2W36A or 4P18D cord as appropriate.	TMS reads 0 ± 1.0 db. Record actual reading.
28	Remove cord from MISC SEND 1MW jack and insert in BLKG NET OUT jack.	
29	Patch MISC SEND 1MW jack to BLKG NET IN jack using 4P18D cord.	TMS reads 1.5 ± 0.2 db lower power than recorded in Step 27.
30	Remove patches.	
Signaling Power — Filter Out		
31	At test jacks of signaling unit associated with blocking network — Patch M jack of No. 2A or 2B test set to EQ M jack using 2P1D cord.	
32	Patch MISC ATTEN IN jack to MISC 1600⁻ SEND jack when 200F blocking network is used, or to MISC 2000⁻ SEND jack when 200E network is used, using 4P18D cord.	
33	Patch MISC ATTEN OUT jack to MISC AMP IN jack using 4P18D cord.	
→ 34	Patch MISC AMP OUT jack to MISC SEND jack terminating at blocking network bay using 4P18D cord.	
	Note: If direct test trunks between signaling and blocking network bays are not provided, place additional patch cords as required to connect to blocking network bay.	

STEP	ACTION	VERIFICATION
35	At jacks in blocking network bay — Connect MISC SEND jack to TMS using 2W36A or 4P18D cord as appropriate.	
36	On No. 2A or 2B test set — Operate TWD L key to OFF HK.	
37	At miscellaneous test equipment of signaling unit associated with blocking network — Adjust attenuator controls to obtain reading of +4 ± 0.1 db on TMS.	
38	At jacks in blocking network bay — Remove cord from MISC SEND jack and insert in BLKG NET OUT jack.	
39	Patch MISC SEND jack to BLKG NET IN jack using 4P18D cord.	TMS reads +2.5 ± 0.2 db.
Signaling Power — Filter In		
40	On No. 2A or No. 2B test set — Operate TWD L key to ON HK.	TMS reads −31.5 db or lower power.
41	Remove patches and restore keys.	