LINE CONCENTRATOR NO. 2A

SYSTEM TESTS

1. INTRODUCTION

1.01 This is one of a group of sections pertaining to line concentrator No. 2A. This section contains tests to be made on concentrator systems after cutover when the system is in service.

1.02 This section is reissued to modify maintenance Tests A, C, D, G, H, and J, and Operational Tests A1, B, and add Table A.

1.03 The tests covered in this section are:

Maintenance Tests

Operational Tests

(4) Loop around call from control unit.

B. Service Request Call

C. Terminating Call

1.04 All maintenance tests except A should be made during light traffic conditions because these tests may prevent service calls from completing.

1.05 ***Lettered Steps:*** A letter a, b, c, etc, added to a step number in Part 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. REFERENCE MATERIALS AND APPARATUS

Reference Materials

2.01 The following reference material must be used with this section:

CD- and SD-94815-01, Common Systems, Line Concentrator No. 2A, Control Circuit

CD- and SD-94816-01, Common Systems, Line Concentrator No. 2A, Remote Circuit

CD- and SD-94817-01, Common Systems, Line Concentrator No. 2A, and ⧫No. 2B⧫ Circuit Pack Schematics

067-109-301 Line Concentrator No. 2A, Trouble Analysis

Apparatus

2.02 ⧫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.

2.03 Testing cord, 893 cord, 3 feet long, equipped with two 360A tools (1W13A cord) and two 624B (terminal connector) tools (for making test connection on terminal strip).

2.04 High impedance test receiver or hand test set.

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

2.06 Hewlett-Packard VTVM 412A, or equivalent, with a dc voltage range from 0.1 to 60 volts with accuracy in the range 10 to 14 volts within 0.5 volt.

2.07 A 908A logic circuit test set (J79908A). Use as covered in Section 100-171-101.

TABLE A

APPARATUS	TESTS									
	A	B*	C	D	E	F	G	H	I	J
Cord (2.03)	1		2	1			1	1	2	1
Test Receiver (2.04)			1	1						
Blocking and Insulating Tools (2.05)			√	√	√		√	√		√
DC Voltmeter (2.06)						1				
908A Test Set (2.07)							1	1	1	
AC Voltmeter (2.08)										1
Cord (2.09)				1						
Operated Fuses (2.10)			√	√						

√As required.

*See Section 067-109-302.

2.08 Hewlett-Packard 400H VTVM, or equivalent, capable of reading rms voltages in the range 0.010 to 15.0 volts, with a db scale calibrated to read dbm into 600-ohm circuits.

2.09 Testing cord, 893 cord, 3 feet long, equipped with two 360A tools (1W13A cord), one 624B tool and one 639A tool and one 651 type tool.

2.10 Operated (blown) fuses to be used in Tests C and D, as required, to be furnished by plant personnel.◀

3. PREPARATION AND PRECAUTIONS

3.01 A portion of the tests in this section will require testing at both the control unit and the remote units simultaneously.

3.02 A talking circuit will be required between units to coordinate testing. If possible, the talking circuit should use facilities other than those assigned for concentrator use.

3.03 Do not make any adjustments to relays or crossbar switches without consulting the appropriate requirement and adjusting procedure section for the particular relay or switch.

Dry-Reed Relays

3.04 Before testing on contacts of dry-reed relays refer to Section ▶040-275-301◀ entitled Dry-Reed-Type Relays, Precautions to Be Observed When Testing.

3.05 Contacts of reed relays may be damaged if test connections are made which cause these contacts to make or break 1/2 ampere or more of current. A high-impedance telephone test set or headset should be used when testing reed relay contacts and the circuits containing them.

Mercury Relays

3.06 Before testing mercury relays, refer to Section 040-263-501, Relays 275, 276, 291, 292, 301, and 303 Types Using Test Sets SD-95439-01 (J94725A).

Magnetic Latching Crossbar Switches

3.07 The hold magnets in both units are magnetic latching. These switches should not be operated or released electrically or manually during testing except by normal circuit operation or in strict accordance with approved procedures. Indiscriminate operation or release of these switches and relays will cause malfunctions of the system.

Diodes and Transistors

3.08 Before testing diodes or transistors or the circuits containing them, refer to Section 032-173-301 entitled ▶Testing, Replacing, and Handling of Circuit Packs and Semiconductor Devices.◀

3.09 Additional precautions should be taken to ensure that concentrator tests do not interfere with the normal progress of concentrator calls whenever possible.

3.10 Maintenance Tests G, H, and ▶I◀ use the 908A Test Circuit. Expected instrument error is included in the tolerances given for specified measurements. Since the accuracy of the 908A logic circuit test set in measuring frequencies is relatively low, a marginal trouble condition due to an out-of-limits operating frequency of an oscillator could exist and still be within tolerances specified. It is expected, however, that oscillators will operate within limits or not at all in the large majority of cases. If the tests do not indicate a trouble, but troubles are occurring, the use of more precise test equipment may be necessary. In particular, the use of an accurate counter to measure precisely the operating frequencies of the modulator oscillator and the 3200 cycle clock may be necessary.

3.11 To determine which trunk is connected to any line, the following procedure may be followed: At the control unit check for crosspoints closed on the line appearance.

(a) Customer line terminal appearances 00 through 77 and test line appearances 78 and 79 appear on verticals of the crossbar switches SWOA-D for group 0 and SWIA-D for group 1.

(b) Trunks 00 to 15 appear on the first 8 levels (0-7) of the crossbar switches, two trunks per level. Like numbered levels on each switch of the group are multipled. The top two levels (8-9) are used to steer to one of the two trunks on each level (0-7).

(c) Knowing a line number and using the following table, the trunk number of the trunk connected to that line can be determined.

LINE NUMBER	SWITCH	VERTICAL
00-19	A	00-19
20-39	B	00-19
40-59	C	00-19
60-79	D	00-19

TRUNK NUMBER	SELECT LEVEL	STEERING LEVEL	
		EVEN NUMBER TRUNK	ODD NUMBER TRUNK
00-01	0	8	9
02-03	1	8	9
04-05	2	8	9
06-07	3	8	9
08-09	4	8	9
10-11	5	8	9
12-13	6	8	9
14-15	7	8	9

Example: Customer line 43 connected to trunk number 12 would have crosspoints closed on switch C vertical 03 and levels 6 and 8.

4. MAINTENANCES TESTS

STEP	ACTION	VERIFICATION
A.	**Service Denial Call and Release Service Denial Call**	
1	At control unit— Connect test terminal SD0/1 to sleeve terminal S- associated with line to be denied service.	
2	Operate SD0/1 key.	CC lamp lighted.
3	Within 2 seconds after CC lamp lights— Release SD0/1 key.	CC lamp extinguished. At both control unit and remote unit— Observe that hold magnet is operated for line under test but no select fingers are engaged.
4	At control unit— Remove connection between SD0/1 and S- terminals.	
5	When service is to be restored— Connect test terminal RSD0/1 to sleeve terminal S- associated with line being restored to service.	
6	Operate RSD0/1 key.	CC lamp lighted.
7	Within 2 seconds after CC lamp lights— Release RSD0/1 key.	CC lamp extinguished.

STEP	ACTION	VERIFICATION
8	Remove connection from RSD0/1 and S- terminals. To verify that customer's line is restored to service, a terminating test call is made to the line.	
9	Connect terminals TC0/1 to terminal S- of line restored to service.	
10	◗Set test 0/1 switch to position to select an idle trunk.◖	
11	Operate TC0/1 key.	
12	Operate TST0/1 key.	CC lamp lighted.
13	Within 2 seconds after CC lamp lights— Release TC0/1, TST0/1 keys.	CC lamp extinguished. Hold magnet operated and select fingers engaged for line under test.
14	Remove connection between TC0/1 and S- terminals.	

B. Permanent Signal Release

Refer to BSP 067-109-302 for steps to follow for releasing permanent signals. A permanent signal may be simulated by placing an off-hook signal on a line at the remote unit.

At conclusion of test remove off-hook signal from line at remote unit.

C. Alarm Circuits and Trouble Recording at Remote Circuit

Caution: These tests should be performed during light traffic conditions, since any call attempting to complete while relays are operated or fuses removed will fail.

Note: While performing these tests, service calls will be blocked. When this occurs the circuits should be restored to service by removing all blocking tools, connections, etc, and operating the AR, RR keys in the remote unit and the AR key in the control unit. Momentarily release the TK- relay that is operated in the control unit. When circuits are idle testing can be resumed by starting with Step 1, 13, 25, 36, 48, 59, or ◗67.◖

STEP	ACTION	VERIFICATION
1	At control unit— Block operated TA0/1 relay for the remote unit being tested.	At control unit— TRT, ◗SF0/1◖ lamps lighted.
2	At remote unit under test— Block nonoperated EP and TM5 relays.	
3	Connect ground to terminal A11.	
4	Connect ground to ring lead of an idle line not connected to a trunk. (Hold magnet not operated for that line).	TM1 relay released. AL relay operated. Central office alarms operated.
5	Remove ground from ring lead.	◗TM1 relay operated.◖
6	Momentarily operate RL1 relay.	
7	Remove blocking tools from EP, TM5 relays.	
8	Remove ground from terminal A11.	
9	Operate alarm release AR key.	AL relay released. Central office alarms retired.
10	At control unit— Remove blocking tool from TA0/1 relay.	
11	Operate alarm release AR key.	Central office alarms at control unit location retired.
12	Momentarily release the TK- relay that is operated in the control unit.	◗A disconnect call should be made to preselect a new trunk.◖
13	At the control unit— Block operated the TA0/1 relay of the remote unit under test.	◗At the control unit— TRT, SF0/1 lamps lighted.◖
14	At remote unit under test— Block nonoperated TM3, TM5 relays.	
15	Connect ground to terminal A11.	
16	Connect ground to ring lead of an idle line not connected to a trunk. (Hold magnet normal for that line).	Relays RC1, SF1, AL operated. Trouble record indicated on trouble lamps including SF lamp. Central office alarm operated.
17	Remove ground from ring lead.	
18	Remove blocking tools from TM3, TM5 relays.	
19	Momentarily operate RL1 relay.	RC1, SF1 relays released.
20	Remove ground from terminal A11.	

STEP	ACTION	VERIFICATION
21	At control unit— Remove blocking tool from TA0/1 relay.	
22	Operate alarm release AR key.	At control unit— Central office alarms, if operated, are retired at control unit office.
23	At remote unit under test— Operate AR, RR keys.	At remote unit— AL relay released. Central office alarm retired.
24	At control unit— Momentarily release the TK- relay that is operated.	▶A disconnect call should be made to preselect a new trunk.◀
25	At control unit— Block operated the TA0/1 relay of the remote unit NOT UNDER TEST.	At control unit— TRT, ▶SF0/1◀ lamps lighted.
26	Block nonoperated TM1, TM5 relays.	
27	At remote unit under test— Block nonoperated RT, TM3, TM5, RL1, TNK relays.	
28	Connect ground to ring of an idle line not connected to a trunk. (Hold magnet not operated for that line).	Relays TCF, AL operated. Central office alarms operated. Trouble record indicated or trouble lamps including TCF lamp.
29	Remove ground from ring lead.	
30	Remove blocking tool from RL1, TNK, RT, TM3, TM5 relays.	
31	At control unit— Remove blocking tool from TM1, TM5 relays.	
32	▶At remote unit under test— Operate AR, RR keys.	At remote unit— AL relay released. Central office alarms retired. Trouble indicating lamps extinguished.◀
33	▶At control unit— Remove blocking tool from TA0/1 relay.	
34	Operate AR key.	At control unit— Central office alarms, if operated, retired.◀
35	Momentarily release TK- relay that is operated in control unit ▶for group under test.	A disconnect call should be made to preselect a new trunk.◀

STEP	ACTION	VERIFICATION
36	At control unit— Block operated TA0/1 relay of the remote unit NOT UNDER TEST.	At control unit— SF0/1 and TRT lamps lighted.
37	Block nonoperated TM5 relay.	
38	At remote unit under test— Block nonoperated ABK, RL1, TM3, TM5 relays.	
39	Connect ground to ring lead of an idle line not connected to a trunk. (Hold magnet not operated for that line.)	AL, RT, SF2 relays operated. Trouble indicated on trouble lamps including SF lamp.
40	Remove ground from ring lead.	
41	Remove blocking tools from ABK, RL1, TM3, TM5 relays.	
42	Momentarily operate RL1 relay.	RT, SF2 relays released.
43	At control unit— Remove blocking tool from TM5 relay.	
44	▶Remove blocking tool from TA0/1 relay.◀	
45	▶Operate alarm release AR key.	TRT and SF0/1 lamp extinguished. Central office alarms retired, if operated.◀
46	At remote unit under test— Operate AR, RR keys.	AL relay released. Central office alarms retired. Trouble indicating lamp extinguished.
47	At control unit— Momentarily release the TK- relay that is operated in the control unit ▶for a group under test.	A disconnect call should be made to preselect a new trunk.◀
48a	If line 79 is connected to a trunk. (Hold magnet operated)— Perform Steps 2, 5 through 10 of test A1 operational tests.	
49	Operate TST0/1 switch to position to select an idle trunk (TB- relay normal).	
50	Block operated TA0/1 relay for the remote unit NOT UNDER TEST.	▶TRT and SF0/1 lamps lighted.◀
51	At remote unit under test— Block nonoperated TRL, TM5, SQ2 relays.	

STEP	ACTION	VERIFICATION
52	At control unit— Block nonoperated TM5 relay.	
53	When trunk selected in Step 49 is idle (TB- relay nonoperated)— Operate TST0/1 key.	
54	▶Within 2 seconds— Release TST0/1 switch.◀	At remote unit under test— TM3 relay operated. Trouble record indicated of trouble lamps including TM3 lamp.
55	At remote unit under test— Remove blocking tools from SQ2, TM5, TRL relays.	AL relay operated. TM3 relay released. Central office alarms operated.
56	At control unit— Remove blocking tools from TM5, TA0/1 relays.	
57	Operate AR keys.	Central office alarms retired if operated.
58	At remote unit under test— Operate AR, RR keys.	Central office alarms retired. Trouble indicating lamps extinguished.
59	At control unit— Momentarily release the TK- relay that is operated in the control unit ▶for a group under test.	A disconnect call should be made to preselect a new trunk.◀
60	At the control unit— Block operated TA0/1 relay for remote unit NOT UNDER TEST.	
61	Block nonoperated ABK, RL2, TM5 relays.	
62	Operate and release TST0/1 key, for remote unit under test as follows: Operate TST0/1 key until TM1 relay operates and releases— When TM1 relay releases, release TST0/1 key.	At remote unit under test— AL relay operated. Trouble record indicated on trouble lamps including CF lamp. Central office alarms operated.
63	At the control unit— Remove blocking tools from ABK, TA0/1, TM5, RL2 relays.	
64	Operate AR key.	Central office alarms retired, if operated.
65	At remote unit— Operate AR, RR keys.	AL relay released. Central office alarms retired. Trouble indicating lamps extinguished.

STEP	ACTION	VERIFICATION
66	▶At control unit— Momentarily release the TK relay that is operated in the control circuit for the group under test.	A disconnect call should be made to preselect a new trunk.◀
67	Test remote unit fuse alarm. Insert an operated fuse in each fuse location, one at a time.	Alarm relay FA operated. FA lamp lighted. Central office alarms operation.

D. Alarm Circuits and Trouble Recording at Control Unit

Note: While performing these tests, service calls will be blocked. When this occurs the circuit should be restored to service by removing all blocking tools, connections, etc, and operating the alarm release key AR in the control unit and AR and RR keys in the remote units. When circuits are idle, testing can be resumed by starting with Step 1, 9, 21, 33, 46, 58, 69, 82, ▶93, 97, 109, 116, or 127.◀

1	At control unit— Block nonoperated TM5, ▶RL1,◀ TM4, TA0/1 relays.	
2	Connect TC0/1 terminal to S- terminal of an idle line not connected to a trunk. (Hold magnet of that line released).	
3	Set TST0/1 switch to position to select an idle trunk.	
4	When trunk is idle (TB- relay released)— Operate and hold TC0 key.	
5	Operate TST0/1 key.	Trouble record taken. RLT, TRT, ▶SF0/1◀ lamps lighted. Central office alarms operated.
6	Release TC0, TST0/1 keys.	
7	Remove blocking tools from TM5, TM4, TA0/1, RL1, relays.	
8	Operate AR key.	TRT, ▶SF0/1,◀ RLT lamps extinguished. Central office alarm retired.
9	At control unit— Connect TC0/1 terminal to S- terminal of an idle line not connected to a trunk. (Hold magnet of that line released).	

STEP	ACTION	VERIFICATION
10	Set TST0/1 switch to position to select an idle trunk. (TB- relay released).	
11	Block nonoperated TCK, TM5, RLS relays.	
12	At remote unit 0/1— Block nonoperated RT, TM5 relays.	
13	At control unit— Operate and hold TC0/1 key.	
14	Operate TST0/1 key.	Trouble record perforated. TCF, ALM1 relays operated. TRT lamp lighted. Central office alarms operated.
15	Release TC0/1, TST0/1 keys.	
16	Remove connection from TC0/1 and S- terminals.	
17	Remove blocking tools from TCK, TM5, RLS relays.	TCF relay released.
18	Operate alarm release AR key.	ALM1 relay released. TRT lamp extinguished. Central office alarms retired.
19	At remote unit 0/1— Remove blocking tools from RT, TM5 relays.	
20	Operate AR, RR keys.	Central office alarms retired, if operated.
21	At control unit— Connect TC0/1 terminal to S- terminal of an idle line not connected to a trunk. (Hold magnet of that line released).	
22	Set TST0/1 switch to position to select an idle trunk. (TB- relay released).	
23	Block nonoperated TA0/1, TM5, RLS relays for one group.	
24	At remote unit 0/1— Block nonoperated RT, TM5 relays.	
25	At control unit— Operate and hold TC0/1 key.	
26	Operate TST0/1 key.	Trouble record perforated. ALM1, TM6 relays operated. TRT, ◗SF0/1◖ lamps lighted. Central office alarms operated.

STEP	ACTION	VERIFICATION
27	Release TC0/1, TST0/1 keys.	
28	Remove connection from TC0/1 and S- terminals.	
29	Remove blocking tools from TA0/1, TM5, RLS relays.	TM6 relay released.
30	Operate alarm release AR key.	ALM1 relay released. TRT, ▸SF0/1◂ lamps extinguished. Central office alarms retired.
31	At remote unit 0/1— Remove blocking tools from RT, TM5 relays.	
32	Operate AR, RR keys.	Central office alarms retired, if operated.
33	At control unit— Connect TC0/1 terminal to S- terminal of an idle line not connected to a trunk. (Hold magnet of that line released).	
34	Set TST0/1 switch to position to select an idle trunk. (TB- relay released).	
35	Block nonoperated ABK, TM5, RLS relays.	
36	At remote unit 0/1— Block nonoperated TM5 relay.	
37	At control unit— Operate and hold TC0/1 key.	
38	Operate TST0/1 key.	Trouble record perforated. ALM1, TM1 relays operated. TRT lamp lighted. Central office alarms operated.
39	Release TC0/1, TST0/1 keys.	
40	Remove connection from TC0/1 and S- terminals.	
41	Remove blocking tools from ABK, TM5, RLS relays.	TM1 relay released.
42	Operate alarm release AR key.	ALM1 relay released. TRT lamp extinguished. Central office alarms retired.
43	At remote unit 0/1— Remove blocking tool from TM5 relay.	
44	Operate AR, RR keys.	Central office alarms retired, if operated.

STEP	ACTION	VERIFICATION
45	At control unit— Connect TC0/1 terminal to S- terminal of an idle line not connected to a trunk. (Hold magnet of that line released).	
46	Set TST0/1 switch to position to select an idle trunk. (TB- relay released).	
47	Block nonoperated RL1 relay.	
48	At remote unit 0/1— Block nonoperated RT, TM5 relays.	
49	At control unit— Operate and hold TC0/1 key.	
50	Operate TST0/1 key.	Within 12-14 seconds— Trouble record perforated. ALM1, TM5 relays operated. TM5, TRT lamps lighted. Central office alarms operated.
51	Release TC0/1, TST0/1 keys.	
52	Remove connection from TC0/1 and S- terminals.	
53	Remove blocking tool from RL1 relay.	TM5 relay released.
54	Operate alarm release AR key.	ALM1 relay released. TRT lamp extinguished. Central office alarms retired.
55	At remote unit 0/1— Remove blocking tools from RT, TM5 relays.	
56	Operate AR, RR keys.	Central office alarms retired, if operated.
57	At control unit— Connect TC0/1 terminal to S- terminal of an idle line not connected to a trunk. (Hold magnet of that line released).	
58	Set TST0/1 switch to position to select an idle trunk. (TB- relay released).	
59	Block nonoperated TM5, RLS, RL1, TCF relays.	
60	At remote unit 0/1— Block nonoperated ABK, TM5 relays.	
61	At control unit— Operate and hold TC0/1 key.	

STEP	ACTION	VERIFICATION
62	Operate TST0/1 key.	Trouble record perforated. ALM1, RF relays operated. TRT lamp lighted. Central office alarms operated.
63	Release TC0/1, TST0/1 keys.	
64	Remove connection from TC0/1 and S- terminals.	
65	Remove blocking tools from TM5, RLS, RL1, TCF relays.	
66	Operate alarm release AR key.	ALM1 relay released. TRT lamp extinguished. Central office alarms retired.
67	At remote unit 0/1— Remove blocking tools from TM5, ABK relays.	
68	Operate AR, RR keys.	Central office alarms retired, if operated.
69	At control unit— Connect TC0/1 terminal to S- terminal of an idle line not connected to a trunk. (Hold magnet for that line released.)	
70	Set TST0/1 switch to position to select an idle trunk. (TB- relay released).	
71	Block nonoperated RL2, TM5 relays.	
72	At remote unit 0/1— Block nonoperated TM5 relay.	
73	At control circuit— Operate and hold TC0/1 key.	
74	Operate TST0/1 key.	ALM2, TM2 relays operated. RLT lamp lighted. Central office alarms operated.
75	Release TC0/1, TST0/1 keys.	
76	Remove connection from TC0/1 and S- terminals.	
77	Remove blocking tools from RL2, TM5 relays.	TM2 relay released.
78	Operate AR key.	ALM2 relay released. RLT lamp extinguished. Central office alarms retired.

STEP	ACTION	VERIFICATION
79	At remote unit 0/1— Remove blocking tool from TM5 relay.	
80	Operate AR, RR keys.	Central office alarms retired, if operated.
81	At control unit— Connect TC0/1 terminal to S- terminal connected to a trunk. (Hold magnet for that line released).	
82	Set TST0/1 switch to position to select an idle trunk. (TB- relay released).	
83	⧫Remove relay cover of NK relay and replace with 651 type tool.⧫	
84	⧫Using 893 cord, connect 624B tool to ground and 639A tool to fixed contact 6 of NK relay.⧫	
85	Operate and hold TC0/1 key.	
86	Operate TST0/1 key.	ALM2 relay operated. TM3 relay released and reoperated. RLT lamp lighted. Central office alarms operated.
87	Release TC0/1, TST0/1 keys.	
88	Remove ground from 6 (NK) relay.	
89	⧫Remove 651 type tool and replace relay cover on NK relay.⧫	
90	Remove connection from TC0/1 and S- teminals.	
91	Operate AR key.	ALM2 relay released. RLT lamp extinguished. Central office alarms retired.
92	⧫At control unit—⧫ Block nonoperated OP relay.	
93	Block operated TA0/1 relay.	⧫SF0/1⧫ , TRT lamps lighted. ALM1 relay operated. Central office alarms operated.
94	Remove blocking tools from OP, TA0/1 relays.	
95	Operate AR key.	⧫SF0/1⧫ , TRT lamps extinguished. ALM1 relay released. Central office alarms retired.

STEP	ACTION	VERIFICATION
96	At control unit— Connect TC0/1 terminal to S- terminal of an idle line not connected to a trunk. (Hold magnet for that line released.)	
97	Set TST0/1 switch to position to select an idle trunk. (TB- relay released.)	
98	Block nonoperated HMK, RLS, TM5 relays.	
99	At remote unit 0/1— Block nonoperated TM5, RT relays.	
100	AT control unit— Operate and hold TC0/1 key.	
101	Operate TST0/1 key.	◗Trouble record perforated. HMF1, ALM1 relays operated. TRT lamp lighted. Central office alarm operated.◖
102	Release TC0/1, TST0/1 keys.	
103	Remove connection from TC0/1 and S- terminals.	
104	Remove blocking tools from HMK, RLS, TM5 relays.	HMF1 relay released.
105	Operate AR key.	◗ALM1 relay released. TRT lamp extinguished. Central office alarms retired.◖
106	At remote unit 0/1— Remove blocking tools from TM5, RT relays.	
107	Operate AR, RR keys.	Central office alarms retired, if operated.
108	At control unit— ◗Block nonoperated HMK, RL1, TM2, TM5 relays. Block operated the TM3 relay.◖	
109	At remote unit 0/1— Block nonoperated TM5 relay.	
110	Connect ground to ring lead of an idle line not connected to a trunk. (Hold magnet released for that line.)	At control unit— Trouble record perforated. HMF2, ALM1 relays operated. TRT lamp lighted. Central office alarms operated.
111	At remote unit 0/1— Remove ground from ring lead.	

STEP	ACTION	VERIFICATION
112	At control unit— ▶Remove blocking tools from HMK, RL1, TM2, TM3, TM5, relays.◀	HMF2 relay released.
113	Operate AR key.	ALM1 relay released. TRT lamp extinguished. Central office alarms retired.
114	At remote unit 0/1—	Central office alarms retired, if operated.
115	At control unit— Connect TC0/1 terminal to S- terminal of an idle line not connected to a trunk. (Hold magnet for that line released.)	
116	Set TST0/1 switch to select an idle trunk. (TB- relay released.)	
117	Block nonoperated ABK, TM5, RLS, LA, TRC relays.	
118	At remote unit— Block nonoperated TM5 relay.	
119	Operate and hold TC0/1 key.	
120	Operate TST0/1 key.	TR1 relay operated. 2-3 seconds later TM4 relay operates. Trouble record perforated. TRT lamp lighted. Central office alarms operated.
121	Release TC0/1, TST0/1 keys.	
122	Remove connection from TC0/1 and S- terminals.	
123	Remove blocking tools from ABK, TM5, RLS, LA, TRC relays.	TR1, TM4 relays released.
124	Operate AR key.	TRT lamp extinguished. Central office alarms retired.
125	At remote unit 0/1— Remove blocking tool from TM5 relay.	
126	Operate AR, RR keys.	Central office alarms retired, if operated.
127	Test control unit fuse alarm. Insert an operated fuse in each fuse location, one at a time.	Alarm relay FA operated. FA lamp lighted. Central office alarms operated.

STEP	ACTION	VERIFICATION
E. Dial Tone Speed Register		
	Note: The dial tone speed register circuit must be started when this test is performed. Since one terminal on an arc of the dial tone speed register is assigned to each group of trunks of the control circuit, and the dial tone register circuit will test many terminals not associated with the concentrator and other arcs during one cycle of testing, it will be necessary to cause the dial tone speed register circuit to make a cycle for each step shown below.	
1	Insulate 5B of the TGB0 relay in control unit.	One registration on the dial tone delay and dial tone attempt register associated with Group 0 when the dial tone speed register circuit is testing the associated arc and terminal.
2	Remove the insulator from the TGB0 relay. (The TGB0 relay should not be operated.)	One registration on the dial tone attempt register associated with Group 0 when dial tone speed register circuit is testing the associated arc and terminal.
3	Insulate 5B of the TGB1 relay in the control circuit.	Verification will be the same as Step 1 except the registers, arc, and terminal will be associated with Group 1.
4	Remove insulator from the TGB1 relay. (The TGB1 relay should not be operated.)	Verification will be the same as Step 2 except the register, arc, and terminal will be associated with Group 1.
F. Twelve Volt Power Supply (Control or Remote Unit)		
1	Measure dc voltage at 12 volt power supply across terminals +12 and GRD.	Voltage reads between 10.8 and 13.2 (12 volts ±10%).
G. Modulator Analog Frequency Measurement (Control Unit)		
	Caution: These tests should be performed during light traffic conditions, since any service call attempting to complete may fail. In addition alarms and trouble indications will occur. It will be necessary to release alarms and trouble indications in both the remote and control units at completion of these tests.	

STEP	ACTION	VERIFICATION
1	At control unit— Connect GRD and +12 terminals of 908A Test Circuit to GRD and +12 test terminals respectively of the 12 volt power supply.	
2	Connect 908A Test Circuit input lead to terminal ▸13 of the OLA0 relay.◂	
3	Set selector switch to (2500 CPS) and slide switch to (AF).	
4	Block nonoperated OL0 relay.	
5	Connect ground to terminal A11.	Scale reading 40.5 ±2.0 on 908A test set.
6	Remove ground from terminal A11.	
7	Connect ground to terminal C45.	Scale reading 44.5 ±2.0 on 908A test set.
8	Remove ground from terminal C45.	
9	Remove input lead of 908A test set from terminal ▸13 of the OLA0 relay.◂	
10	Remove blocking tool from OL0 relay.	
11	Block nonoperated OL1 relay.	
12	Connect 908A input lead to terminal ▸23 of the OLA1 relay.◂	
13	Connect ground to terminal A11.	Scale reading 40.5 ±2.0 on 908A test set.
14	Remove ground from terminal A11 and connect ground to terminal C45.	Scale reading 44.5 ±2.0 on 908A test set.
15	Remove blocking tool from OL1 relay.	
16	Remove ground from terminal C45.	
17	Remove 908A test set from terminals ▸23 of the OLA1 relay◂ GRD, and +12.	
18	Retire alarms in control and remote units if activated.	

STEP	ACTION	VERIFICATION
H.	**Modulator Analog Frequency Measurement (Remote Unit)**	
	Caution: These tests should be performed during light traffic conditions since any call attempting to complete may fail. In addition alarms and trouble indication will occur. It will be necessary to release alarming and trouble indications in both the remote and control circuits at completion of these tests.	
1	At remote unit— Connect GRD and +12 terminals of 908A Test Circuit to GRD and +12 test terminals respectively, at the 12 volt power supply.	
2	Connect 908A Test Circuit input lead to terminal ▶1 of the FS filter.◀	
3	Set selector switch to (2500 CPS) and slide switch to (AF).	
4	Block nonoperated OL relay.	
5	Connect ground to terminal A11.	Scale reading 21.4 ±2.0 on 908A Test Circuit.
6	Remove ground from terminal A11.	
7	Connect ground to terminal B23.	Scale reading 25.4 ±2.0 on 908A Test Circuit.
8	Remove ground from terminal B23.	
9	Remove 908A Test Circuit leads from terminals ▶1 of the FS filter◀ , GRD and +12.	
10	Remove blocking tool from OL relay.	
11	Retire alarms in control and remote circuits if activated.	
I.	**Clock Digital Frequency Measurement (Control or Remote Circuit)**	
	Caution: These tests should be performed during light traffic conditions since any call attempting to complete may fail. In addition alarms and trouble indications may occur. It will be necessary to retire alarms and trouble indications in both the remote and control circuits at completion of tests.	

STEP	ACTION	VERIFICATION
1	Connect GRD and +12 terminals of 908A Test Circuit to GRD and +12 test terminals respectively, at the 12 volt power supply.	
2	Set selector switch of 908A Test Circuit to (5000 CPS) and slide switch to (DF).	
3a	If remote circuit clock is being tested— At remote circuit— Connect grounds to terminals B36 and B55.	
4a	Connect input lead of 908A Test Circuit to terminal B34.	Scale reading 32 ±1.5 on 908A Test Circuit.
5b	If control circuit clock is being tested— At control circuit— Connect grounds to terminals C52 and C23.	
6b	Connect input lead of 908A Test Circuit to terminal C13.	Scale reading 32 ±1.5 on 908A Test Circuit.
7	Remove grounds from terminals B36, B55, or C52, C23.	
8	Remove 908A Test Circuit leads from concentrator.	
9	Retire alarms in control and remote units if activated.	

J. Transmission Level Measurement (Control or Remote Unit)

Caution: These tests should be performed during light traffic conditions since any call attempting to complete may fail. In addition alarms and trouble indications may occur. It will be necessary to retire alarms and trouble indications in both the remote and control circuits at completion of tests.

1	At control unit— Block nonoperated OL0 and OL1 relays.	
2	Connect ground to terminal A11.	
3	Measure ac voltage level across terminals E22 and E12.	The ac voltage level reads (-18DBM ±7DB) ± measured loss (DBM) or transmission facilities. Consult office records for value of measured transmission loss.

STEP	ACTION	VERIFICATION
4	Measure ac voltage level across terminals E14 and E24.	Verification same as Step 3.
5	At remote unit 0— Measure ac voltage level across terminals E14 and E24.	ac level reads -18DBM ±7DB.
6	At remote unit 1— Measure ac voltage level across terminals E14 and E24.	ac level reads -18DBM ±7DB.
7	♦At control unit—♦ Remove ground from terminal A11 and connect ground to terminal C45.	
8	Measure ac voltage level across terminals E14 and E24.	Verification same as Step 3.
9	Measure ac voltage level across terminals E12 and E22.	Verification same as Step 3.
10	At remote unit 0— Measure ac level across terminals E14 and E24.	ac level reads -18DBM ±7DB.
11	At remote unit 1— Measure ac level across terminals E14 and E24.	ac level reads -18DBM ±7DB.
12	At control unit— Remove blocking tools from OL0, OL1 relays.	
13	Remove ground from terminal C45.	
14	Retire alarms in control and remote units if activated.	
15	At remote unit 0— Block nonoperated OL relay.	
16	Connect ground to terminal A11.	
17	Measure ac voltage level across terminals E12 and E22.	Verification same as Step 3.
18	At control unit— Measure ac level across terminals E17 and E27.	ac level reads -18DBM ±7DB.
19	At remote unit 0— Remove ground from terminal A11 and connect to terminal B23.	

STEP	ACTION	VERIFICATION
20	Measure ac voltage level across terminals E12 and E22.	Verification same as Step 3.
21	At control unit— Measure ac level across terminals E17 and E27.	ac level reads -18DBM ±7DB.
22	◗AT remote unit 0—◖ Remove ground from terminal B23.	
23	Remove blocking tool from OL relay.	
24	At remote unit 1— Block nonoperated OL relay.	
25	Connect ground to terminal A11.	
26	Measure ac level across terminals E12 and E22.	Verification same as Step 3.
27	At control unit— Measure ac level across terminals E15 and E25.	ac level reads -18DBM ±7DB
28	At remote unit 1— Remove ground from terminal A11 and connect ground to terminal B23.	
29	Measure ac level across terminals E12 and E22.	Verification same as Step 3.
30	At control unit— Measure ac level across terminals E15 and E25.	ac level reads -18DBM ±7DB
31	At remote unit 1— Remove ground from terminal B23.	
32	Remove blocking tool from OL relay.	
33	Retire alarms in remote and control units if activated.	

5. OPERATIONAL TESTS

General

5.01 The following tests describe the action required to make operational tests. When trouble is experienced, it will be necessary to analyze the trouble to determine which tests to perform and what equipment should be tested to minimize testing effort. It is imperative that a thorough knowledge of the circuit functions, the result of wrong signaling, and the effects of latching equipment by magnetic circuits be known.

5.02 Section 067-109-301 Line Concentrator, No. 2A, Trouble Analysis should be read for method of locating trouble and causes of troubles, analysis of trouble record cards for line concentrator punches, and trouble indicating lamps in remote unit.

5.03 Most trouble reports can be classified as originating or terminating service denials. Originating service denial classification would include no dial tone, cannot call out, cannot break dial tone, denied service, or other similar reports. Terminating service denial classification would be—reached wrong party, cannot trip ringing, cannot reach party, and other similar reports.

Selection of Test Calls

5.04 Basically, there are three types of test calls that can be initiated from the control unit: Terminating test call to either remote unit; request either remote unit to make a service request call from test line 78; and loop around test call.

5.05 A terminating test call can be made to any line in either remote unit. If it is made to test line 79 the remote unit supplies tone as an indication of successful completion; if made to a customer's line no tone will be returned.

5.06 The control unit can request either remote unit to make a service request call from test line 78. The remote unit also supplies tone over this line.

5.07 The control unit can also cause a loop around connection to be made. Test lines 78 and 79 are connected together in either remote unit. Transmission tests can be made over this connection.

5.08 The remote unit can request the control unit to make a terminating call to test line 79. The control unit supplies tone over this connection.

5.09 Service request calls may be made from the remote units on a service basis by bridging a telephone set on tip and ring.

5.10 ▶A high impedance telephone test set or headset should be used when testing reed relay contacts and the circuits containing them.

5.11 Testing cord, 893 cord, 3 feet long, equipped with two 360A tools (1W13A cord) and two 624B tools (for making test connections on terminal strips).◀

Use of Test Lines

5.12 Tests ▶A1, A2, A3, A4◀ indicate that the concentrator is capable of completing a call on one line only in each group of the control unit and can be used to test that a connection can be made on each trunk to the test line by selecting each trunk as shown below. It must be remembered that other lines may fail due to circuit troubles or apparatus failures when connected to these trunks. The test line may complete a call to a particular trunk but another line may fail because of bent select fingers. Therefore, test lines may be used to determine if the concentrator system is operative. However, if trouble continues or analysis shows that a trouble is associated with certain lines it will be necessary to make the associated service test calls.

Caution: It is preferable to test all trunks during light load period.

STEP	ACTION	VERIFICATION
A1.	**▶Terminating Test Call From Control Unit◀**	
1	At control unit— Plug headset into TL00/TL10 Jack.	
2	Operate TST0/1 switch to position required to select trunk to be used on this call.	
3	When trunk is idle (TB- relay normal)— Operate TST0/1 key.	CC lamp lighted. 1000 cycle tone heard in headset.
4	Within 2 seconds after CC lamp lights— Release TST0/1 key.	CC lamp extinguished. 1000 cycle tone heard in headset.
	Note: Steps 1 through 4 cause a terminating call to be set up to test line 79 over a selected trunk. The test line sends back tone. To check other trunks on this call it is necessary to release the trunk selected in Steps 1 through 4. This is accomplished by making a terminating test call to an idle customer's line (which is not connected to a trunk) using the trunk selected in Step 2. ▶It is necessary to always disconnect test line 79 when testing is completed.◀	
5	Connect terminal TC0/1 to terminal S- of an idle line that is not connected to a trunk. (Hold magnet of that line released.)	
6	Operate TC0/1 key.	
7	Operate TST0/1 key.	Tone removed from headset. CC lamp lighted.
8	Within 2 seconds after CC lamp lights— Release TST0/1 key.	CC lamp extinguished.
9	Release TC0/1 key.	
10	Remove connection from TC0/1 and S- terminals.	
	Note: Steps 5 through 10 have caused the trunk connected to test line 79 to be connected to a different line. Test line 79 is now free to be set up again using a different trunk.	
11	Repeat Steps 1 through 4 selecting a different trunk.	Same as Steps 1 through 4.
12	Repeat Steps 5 through 10 to release trunk from test line 79.	Same as Steps 5 through 10.

STEP	ACTION	VERIFICATION
13	Repeat Steps 11 through 12 until all trunks have been used.	
14	Remove headset from TL00/TL10 jack.	

A2. Terminating Test Call Request From Remote Unit

1	At remote unit— Plug headset into jack 79.	
2	Place headset in off-hook condition.	
3	Determine which trunk is preselected by observing relays TK0-7 and TK8-9.	
4	Operate TER key.	TCR lamp lighted.
5	Within 2 seconds after TCR lamp lights— Release TER key.	1000 cycle tone heard in headset.
6	Place headset in on-hook condition.	1000 cycle tone not heard.
	Note: Steps 1 through 5 cause the control unit to set up a terminating test call to line 79 over the preselected trunk and to send a 1000 cycle tone. To test line 79 for other trunks it is necessary to wait until the trunk connected to line 79 is used on a service call. Then Steps 2 through 6 are repeated when a different trunk is preselected.	
7	When hold magnet of line 79 is released— Repeat Steps 2 through 6 when trunk required is preselected.	Same as Steps 2 through 6.
8	Repeat Step 7 until all trunks have been used.	

A3. Service Request Test Call at Control Unit

1	At control unit— Plug headset into TL01/TL11 jack.	SRC0/1 lamp lighted.
2	Place headset in off-hook condition.	
3	Operate SRT0/1 key.	SRT0/1 lamp lighted.
4	Within 2 seconds after SRT0/1 lamp lights— Release SRT0/1 key.	SRT0/1 lamp extinguished. 1000 cycle tone heard in headset.

STEP	ACTION	VERIFICATION
5	Place headset in on-hook condition. ***Note:*** To make further service request test calls using different trunks it is necessary to release the trunk attached to line 78 and (if a different trunk is required) cause it to be connected to an idle line. The trunk can be released by making a terminating test call to an idle line (not connected to a trunk) and selecting the trunk used in Steps 1 through 5 of Test C. Alternative way is to wait until service calls have caused the trunk to be disconnected from line 78 and reconnected to another customer.	1000 cycle tone not heard in headset.
6	When trunk desired is preselected as explained in above note— Repeat Steps 2 through 5.	Same as Steps 2 through 5.
7	Repeat Step 6 until all trunks have been used.	Same as Step 6.
8	Remove headset from TL01/TL11 jack.	SRC0/1 lamp extinguished.
A4.	**Loop Around Test at Control Unit**	
1	At control unit— Plug headset into TL01/TL11 jack.	SRC0/1 lamp lighted.
2	Place headset in off-hook condition when the trunk desired is preselected.	
3	Operate SRT0/1 key.	SRT0/1 lamp lighted.
4	Within 2 seconds after SRT0/1 lamp lights— Release SRT0/1 key.	SRT0/1 lamp extinguished. 1000 cycle tone heard.
5	Operate TST0/1 switch to position required to select trunk to be used on this call.	
6	When trunk is idle (TB- relay normal)— Operate TST0/1 key.	CC lamp lighted. 1000 cycle tone not heard.
7	Within 2 seconds after CC lamp lights— Release TST0/1 key.	CC lamp extinguished. 1000 cycle tone not heard.

STEP	ACTION	VERIFICATION
8	Manually operate S0/S1 relay. *Note:* The 1000 cycle tone heard in Step 8 is transmitted from the control unit over the trunk set up in Step 3 and looped back in the remote unit over the trunk selected in Step 5. Line 78 (TL01/TL11 jacks) is now connected to line 79 (TL00/TL10 jacks) through the remote unit. Transmission measuring equipment may be plugged into TL01/TL11 and TL00/TL10 jacks for transmission measurement. To release trunks set up on this call in order to make further loop around test call, consult Tests A and C. It is accomplished by making terminating test calls to idle lines not connected to trunks and selecting the two trunks used in Steps 1 through 8.	1000 cycle tone heard.
B.	**Service Request Call From Lines in Remote Unit**	
1	At remote unit— Place an off-hook signal on line to be tested.	Dial tone heard.
2	Determine that correct crosspoints have closed.	Observe that line being tested is connected to same trunk in remote and control unit.
3	At remote unit— Dial first digit of terminating test line code in the control circuit office.	At remote office— Dial tone not heard. At control unit— TB- relay (corresponding to trunk used) remains operated.
4	At remote unit— Dial remaining digits of terminating test line code in the control circuit office. These digits should be dialed within 15 seconds after Step 3 to prevent the originating register in the control unit office from timing out.	
5	At control unit office— Dial associated office code and directory number of line under test.	Busy tone heard.
6	At control unit office— Disconnect call to line under test.	
7	At remote unit— Replace off-hook signal with on-hook signal.	At control unit— TB- relay (from Step 3) released.

STEP	ACTION	VERIFICATION
8	At control unit— Set the TST0/1 to position of trunk connected to line under test. Connect terminal TC0/1 to SL- of idle line not connected to a trunk. (Hold magnet of that line released.)	
9	Operate TC0/1 key.	
10	Operate TST0/1 key.	CC lamp lighted.
11	Within 2 seconds after CC lamp lights— Release TST0/1 key.	CC lamp extinguished. Hold magnet of line under test released.
12	When trunk to be connected to line under test is preselected— Repeat Steps 1 through 7.	Same as Steps 1 through 7.
13	Repeat Steps 8 through 11 to release trunk used in Step 12.	Same as Steps 8 through 12.
14	Repeat Steps 12 and 13 until all trunks have been connected one at a time to line under test.	Same as Steps 12 and 13.
C. Terminating Call to Remote Line		
1a	If line under test is connected to a trunk (operated hold magnet)— Release the trunk as follows in Steps 2a through 7a.	
2a	Connect terminals TC0/1 to SL- of an idle line that is not connected to a trunk (released hold magnet).	
3a	Operate TST0/1 switch to position of trunk connected to line under test.	
4a	Operate TC0/1 key.	
5a	Operate TST0/1 key.	CC lamp lighted.
6a	Within 2 seconds after CC lamp lights— Release TC0/1, TST0/1 keys.	CC lamp extinguished.
7a	Remove connection from TC0/1 and S- terminals.	
8	Connect terminals TC0/1 to SL- of line under test.	
9	Operate TST0/1 switch to position of trunk required for this test.	

STEP	ACTION	VERIFICATION
10	Operate TC0/1 key. When trunk selected in Step 9 is idle (TB-relay normal).	
11	Operate TST0/1 key.	CC lamp lighted.
12	Within 2 seconds after CC lamp lights— Release TC0/1, TST0/1 keys.	CC lamp extinguished.
13	Remove connector from terminals TC0/1 and SL- of line under test.	
14	Observe that line under test is connected to same trunk in remote and control units.	Hold magnet and select magnet indicate same trunk on same line in remote unit and control unit.
15	Repeat Steps 2a through 7a.	Same as Steps 2a through 7a.
16	Repeat Steps 8 through 14 selecting a different trunk in Step 9.	Same as Steps 8 through 14.
17	Repeat Steps 15 and 16 until all trunks have been used on line under test.	Same as Steps 15 and 16.