RANGE EXTENSION CIRCUIT (SD-2H145)—TESTS
NO. 2/2B ELECTRONIC SWITCHING SYSTEM

CONTENTS PAGE

1. GENERAL

1.01 This section describes the method of testing the range extension (RE) circuit (SD-2H145) used in the No. 2/2B Electronic Switching System (ESS).

1.02 ▶This section is reissued to add a new test procedure for RE circuits that pass diagnostics but generate a noise level through the associated concentrator commonly referred to as "singing on the line." Revision arrows are used to emphasize the more significant changes. The Equipment Test List is not affected by this addition.◀

1.03 The RE circuit is used with the unigauge plan to increase the range of the central office to 2500-ohm loop resistance. The circuit provides the required voice amplification and increased battery voltage for the operation of such lines.

1.04 The following tests will be performed:

*A. **Battery Voltage Increase:*** This test checks the ability of the RE unit to provide increased battery voltage of 65.75 Vdc to 79.5 Vdc.

*B. **Voice Frequency Amplification and Bypass State:*** This test checks the RE unit for the proper voice frequency amplification of 5 dB in the active state and that minimum loss is present when the circuit is in the bypass state.

*C. ▶**Return Loss Test:*** This test is to be performed on those RE amplifiers that have been reported as having ***singing*** line conditions.◀

1.05 The RE tests are to be performed on a periodic basis in accordance with equipment test list procedures or when malfunction of the circuit is suspected.

1.06 The tests are performed from the trunk test panel (TTP). For more detailed information about the operation of the TTP, refer to Section 232-130-301, Trunk Test Panel—Method of Operation.

1.07 The keys on the TTP may be either a locking or a nonlocking type. In order to differentiate between the two types of keys, the use of a locking type key shall be identified by the words "operate" and "release," and the use of a nonlocking type key shall be identified by the word "depress" in the ACTION column.

Note: Nonlocking keys require a depression of at least one-half second to ensure a system recognition.

1.08 ***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

Note: Listed below is test equipment required to complete these tests although equivalent apparatus may be substituted. The test equipment in 2.01 and 2.02 will not be required if the TTP is equipped with this equipment.

2.01 Transmission measuring set (TMS), 23D

2.02 Variable frequency oscillator (VFO), KS-19353 L4

2.03 Two 2P4A cord assemblies consisting of a P2B cord 3 feet long with two 310 plugs

2.04 ▶Return Loss Test Set (WILTRON 9041), (BOMAR 481A) with appropriate test leads

2.05 Two KS-4096K (3000 ft. load line components)

2.06 Three KS-4096E (6000 ft. load line components)

2.07 One 500 Telephone Set with appropriate test leads.◀

3. PREPARATION

3.01 Refer to the office records to obtain the network number (NN), concentrator group (CG), concentrator (C), B link (B), and grid (G) of the RE circuit to be tested.

3.02 The following is a step-by-step procedure to make the circuit traffic busy and connect it to the TTP.

Note: Both sides of the RE unit to be tested are connected to the TTP. The connection must be initiated on access trunk (AT) 1, and AT2 must be idle. AT1 will control the peripheral decoder points of the RE unit, and AT2 will control the peripheral decoder points of the circuit junctor the RE unit is connected through to the TTP. (See Fig. 1.)

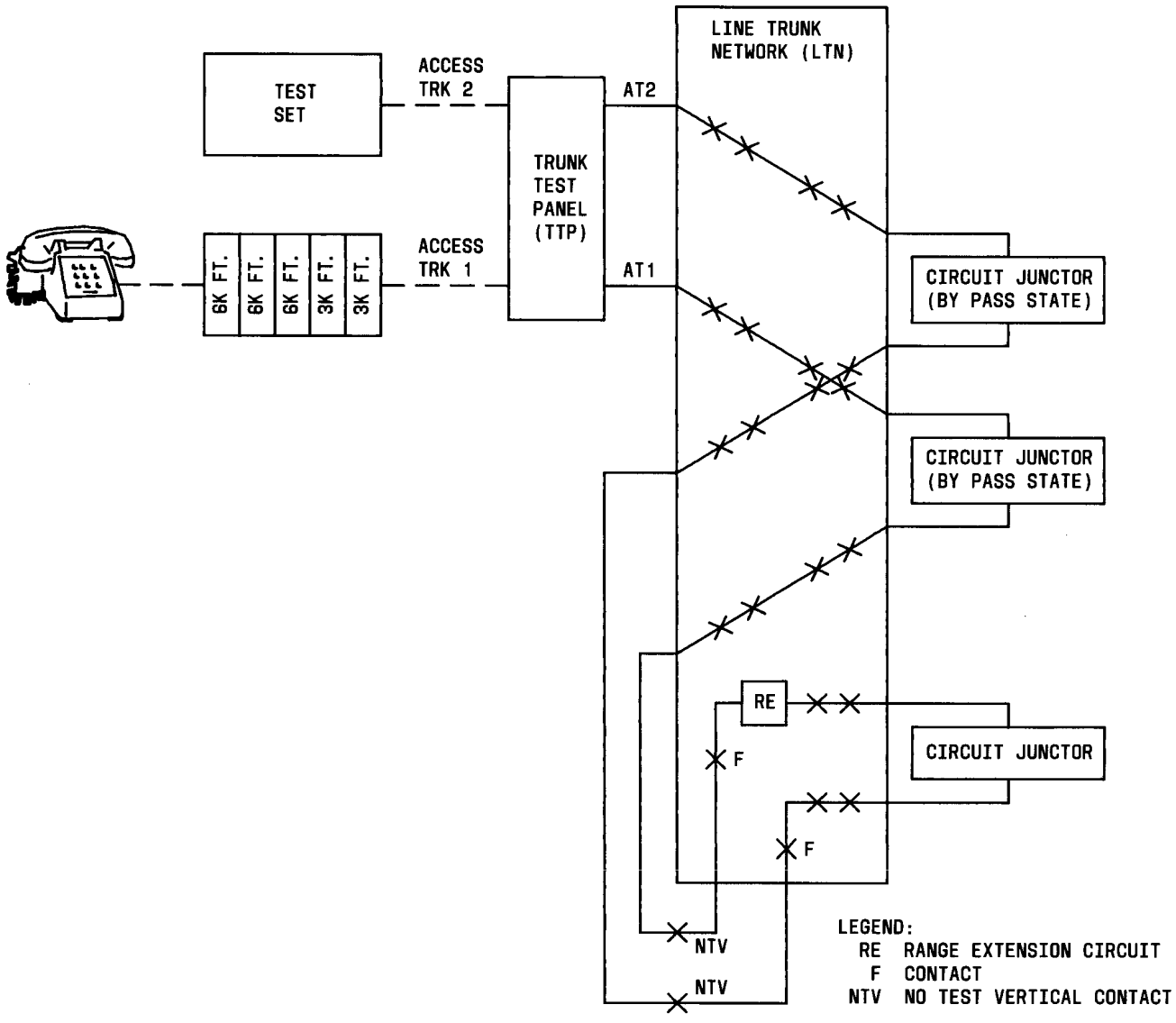

Fig. 1—Test Configuration Using Trunk Test Panel to Test a Range Extension Circuit

STEP	ACTION	VERIFICATION
All Tests		
1	At telephone set on TTP— Operate access trunk 1 key.	
2	Lift handset off-hook, or operate TRFR key at test and control unit if using headset.	Access trunk 1 key lamp lighted. Dial tone received. At ACCESS TRUNK 1 CONTROL— SUPV lamp lighted. TRFR lamp lighted if TRFR key is operated.
3	At TOUCH-TONE® dial— Dial 4 + NN + CG + C + B + G + ST. ▶***Note:*** The network number (NN) is a 2-digit number.◀	At ACCESS TRUNK 1 CONTROL— EQPT ST lamp lighted: Steady—circuit idle. 60 ipm—circuit traffic busy. 120 ipm—circuit maintenance busy. At ACCESS TRUNK 2 CONTROL— SUPV lamp lighted. At MISC TEST CONTROL— P&E lamp lighted if connection was successful. At TRANSMISSION MEASURING CONTROL— RET lamp lighted. ***Note:*** If the EQPT ST lamp is flashing at 60 ipm, the P&E lamp is not lighted and the TTP is not connected to the RE unit to be tested.
4	Place handset on-hook, or release TRFR key.	
5a	If P&E lamp is not lighted— Operate RLS key.	
6a	Repeat Steps 2 and 3 until connection is successful.	

4. METHOD

4.01 If the verification procedure fails or if a malfunctioning circuit is indicated during any part of these tests, proceed as follows:

(1) Discontinue the test.

(2) Troubleshoot the circuit which failed.

(3) Replace faulty circuit components using standard repair procedures.

(4) Repeat the test that failed. If verification is successful, continue the test.

A. Battery Voltage Increase

STEP	ACTION	VERIFICATION
7	At ACCESS TRUNK 1 CONTROL— Depress VM key.	VM lamp lighted. At VOLTMETER CONTROL— 100K lamp lighted.
8	At VOLTMETER CONTROL— Operate MET VM key.	MET VM lamp lighted. 100K lamp extinguished.
9	At STATE CHANGE CONTROL— Set PD GROUP switch to 0-5 position.	
10	At PERIPHERAL DECODER POINTS— Operate 0 and 1 keys.	At PERIPHERAL DECODER POINTS— 0 and 1 lamps lighted.
11	Depress AT2 Key.	At circuit junctor— Relays A and B operated.
12	At TRANSMISSION MEASURING CONTROL— Depress and hold RET key.	At VOLTMETER— Meter indicates between 42.75V and 52.5V volts. Record this reading for reference use.
13	Release RET key.	At VOLTMETER— Meter indicates 0.
14	At PERIPHERAL DECODER POINTS— Release 1 key.	At PERIPHERAL DECODER POINTS— 1 lamp extinguished.
15	Depress AT1 key.	RE unit under test activated.
16	At TRANSMISSION MEASURING CONTROL— Depress and hold RET key. ***Note:*** This reading is the increased battery provided by the RE unit.	At VOLTMETER— Meter indicates 25V ±2V higher than in Step 12.
17	Release RET key.	At VOLTMETER— Meter indicates 0.
18	At PERIPHERAL DECODER POINTS— Release 0 key.	At PERIPHERAL DECODER POINTS— 0 lamp extinguished.
19	Depress AT1 and AT2 keys.	At circuit junctor— Relays A and B released. RE unit under test is in the bypass state.
20	At ACCESS TRUNK 1 CONTROL and ACCESS TRUNK 2 CONTROL— Depress RLS keys.	At ACCESS TRUNK 1 CONTROL— VM lamp extinguished. SUPV lamp extinguished. At ACCESS TRUNK 2 CONTROL— SUPV lamp extinguished. At MISC TEST CONTROL— P&E lamp extinguished.

B. Voice Frequency Amplification and Bypass

STEP	ACTION	VERIFICATION
7b	If TTP is equipped with a VFO and TMS— Set SEND switch to VFO position; set MEASURE switch to MEAS 2 position; set TEST SET switch to TMS position.	
8c	If the TTP is not equipped with a VFO and TMS— Connect the 23D TMS to the TM2 jack using the appropriate cable and plugs. Set INPUT switch to 900 position; set DIAL MEAS EXT switch to MEAS position; the ADD DBM switch will be set as applicable.	
9c	Connect the KS-19353 L4 VFO to the TM1 jack using the appropriate cable and plugs. Set OUTPUT LEVEL DBM switches to 0 positions; set the FUNCTION switch to 900 position; set POWER switch to ON position.	
10	At ACCESS TRUNK 1 and 2 CONTROL on TTP— Depress XMSN keys.	XMSN lamps lighted.
11	At TTP or portable instruments— Set ADD DBM switch on TMS to -5 position. Adjust output vernier of VFO for an indication of -6 dB at TMS. ▶***Note:*** The setting of the ADD DBM switch (-5 dB) plus the meter reading (-1 dB) will total -6 dB.◀	At TMS— Meter indicates -6dB.
12	At STATE CHANGE CONTROL— Set PD GROUP switch to 0-5 position.	
13	At PERIPHERAL DECODER POINTS— Operate 0 and 1 keys.	At PERIPHERAL DECODER POINTS— 0 and 1 lamps lighted.
14	Depress AT2 key.	Circuit junctor connected to RE unit in talk state. Relays A and B operated. At TMS— Meter indicates between -6 and -6.4 dB. Record this reading for reference use.
15	▶Release 1 key.	At PERIPHERAL DECODER POINTS— 1 lamp extinguished. 0 lamp remains lighted.◀

STEP	ACTION	VERIFICATION
16	At PERIPHERAL DECODER POINTS— Depress AT1 key.	At TMS— Meter indicates +5dB±1dB higher than in Step 14. RE unit is activated. ***Note:*** The difference between this reading and that in Step 14 is the gain of the RE unit.
17	Release 0 key.	At PERIPHERAL DECODER POINTS— 0 lamp extinguished.
18	Depress AT1 key.	RE unit in bypass state.
19	At TMS— Set ADD DBM switch to -5 position.	At TMS— Meter indicates between -6 and -6.4 dB. ***Note:*** The setting of the ADD DBM switch (-5 dB) plus the meter reading (-1 dB) totals -6 dB.
20	At TRANSMISSION MEASURING CONTROL— Operate REV TEST key.	REV TEST lamp lighted. At TMS— Meter indicates between -6 and -6.4 dB.
21	At PERIPHERAL DECODER POINTS— Operate 0 key.	
22	Repeat Step 15 through 18.	Same as for Steps 15 through 18 except TMS meter indicates +5dB±1dB higher than in Step 19 as a verification for Step 15. ***Note:*** The difference between the reading in Steps 15 and 19 is the gain of the RE unit in the opposite direction from that of the first gain measurement.
23	At PERIPHERAL DECODER POINTS— Depress AT2 key.	Circuit junctor connected to RE unit in bypass state. At TMS— Meter indicates -6 dB.
24	At TRANSMISSION MEASURING CONTROL— Release REV TEST key.	REV TEST lamp extinguished.
25	At ACCESS TRUNK 1 CONTROL and ACCESS TRUNK 2 CONTROL— Operate RLS keys.	XMSN lamps extinguished. SUPV lamps extinguished. At MISC TEST CONTROL— P&E lamp extinguished.
26c	Remove all external test equipment connections.	

C. ▶Return Loss Test

STEP	ACTION	VERIFICATION
1	Repeat Steps 1 through 6a.	Same as Steps 1 through 6a.
2	At STATE CHANGE CONTROL— Set PD GROUP switch to 0-5 position.	
3	Make up artificial load-line cable by connecting the following components: (a) Two 26 gauge 3-Kft load-line components (b) Three 26 gauge 6-Kft load-line components (c) One 500 telephone set with receiver on-hook (see Fig. 1).	
4	At front of writing shelf on TTP— Plug artificial load-line components into AT1 jack.	
5	Plug the 2-wire TRMT-RCV side of the Return Loss Test Set into AT2 jack.	
6	At Return Loss Test Set— (a) Set TEST TYPE switch to SRL-HI position. (b) Set TEST MODE switch to 900 2-wire position. (c) Set NETWK switch to INT position.	
7	At PERIPHERAL DECODER POINTS— Operate 0 and 1 keys.	At PERIPHERAL DECODER POINTS— 0 and 1 lamps lighted.
8	Depress AT2 key.	At circuit junctor— Relays A and B operated.
9	At PERIPHERAL DECODER POINTS— Release 1 key.	At PERIPHERAL DECODER POINTS— 1 lamp extinguished.
10	Depress AT1 key.	RE unit under test activated.
11	Depress and hold RET key.	At Return Loss Test Set— Meter indicates +10 dB or greater.
12	Release RET key.	
13b	If reading is under +10 dB, replace RE unit under test and repeat test procedure. Return the failing RE unit to WECo for repair.	
14	At PERIPHERAL DECODER POINTS— Release 0 key.	At PERIPHERAL DECODER POINTS— 0 lamp extinguished.
15	Depress AT1 and AT2 keys.	At circuit junctor— Relays A and B released. RE unit in bypass state.

STEP	ACTION	VERIFICATION
16	At ACCESS TRUNK 1 CONTROL and ACCESS TRUNK 2 CONTROL— Depress RLS keys.	At ACCESS TRUNK 1 CONTROL and ACCESS TRUNK 2 CONTROL— SUPV lamps extinguished. At MISC TEST CONTROL— P&E lamp extinguished.
17	At front of writing shelf on TTP— Remove all external test connections.	