

444 0090

**DATA SET 402C-TYPE
TRANSMITTER
TEST PROCEDURES**

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1. GENERAL

1.01 This section contains the procedures to be used for testing Data Set 402C-type at time of installation and on repair visits.

1.02 This section is reissued for the following reasons:

- (a) To provide local interface test using the 901B Data Test Set (DTS)
- (b) To provide improved end-to-DTC (data test center) interface tests using the 901B, 913A, and 914B DTS
- (c) To provide end-to-DTC dynamic tests using the 914B and 913A DTS.

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

1.03 Before proceeding with any tests of the data set, verify the following:

- (a) Data loop has been tested and meets requirements as specified in the section entitled Data Systems—DATA-PHONE® Service, Direct Distance Dialing Network—Test Requirements for Subscriber, Foreign Exchange, and Remote Exchange Lines (314-205-501).
- (b) Telephone portion of installation meets standard dc talk, signaling, and supervision requirements.
- (c) Data set strapping options agree with service order.



Take necessary steps to ensure that customer is not billed for test calls. Refer to the section entitled Crediting Charges on Test Calls (010-250-001).

1.04 A letter a, b, c, etc, added to a step number in Part 3 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 adjacent column, and all steps governed by the same condition are designated

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by the same letter within a test. Where a condition does not apply, all steps designated by that letter should be omitted.

1.05 Tests contained in this section are divided into two parts. Part 2 contains tests to be performed at the time of installation and Part 3 contains tests to be performed during maintenance visits.

2. INSTALLATION TEST PROCEDURES

2.01 Tests contained in this part should be performed immediately after the data set has been installed to ensure that the installation is ready to be placed in service. In addition to these tests, the installer should, whenever possible, observe to assure that data can be transmitted and/or received using the business machines and data sets at both the near- and far-end data terminals.

2.02 Although these tests are primarily for use at time of installation, consideration should be given to their use during maintenance visits if the nature of the trouble indicates that this type of test would be useful. The tests to be performed will be determined by the type of test equipment available.

A. Ground Noise Test (914B Data Test Set)

2.03 This test should be performed to eliminate the possibility of data errors caused by noise resulting from improper grounding arrangements. The A and B selector switches on the 914B DTS provide a connection point for the 6A impulse counter.

2.04 The test equipment required for this test is as follows:

- 6A impulse counter
- 914B Data Test Set.

STEP	PROCEDURE
1	<p>Establish test connections and perform test as shown in Fig. 1.</p> <p>Requirement: There should be no counts noted in a 15-minute period.</p> <p>Remedial Action: Should any counts be noted in a 15-minute period, grounding arrangements must be improved as described in the Section entitled Data Set 402C-Type, Transmitter, Installation and Connection (594-019-200).</p>
2	Remove all test connections and restore equipment to normal operating conditions.

B. Ground Noise Test (901B Data Test Set)

2.05 This test should be performed to detect noise resulting from improper grounding arrangements. This noise may be a source of data errors. The interface test adapter provides a connection point for the 6A impulse counter.

2.06 The test equipment required for this test is as follows:

- 6A impulse counter
- 901B Data Test Set.

STEP	PROCEDURE
1	Establish test connections and perform test as shown in Fig. 2.

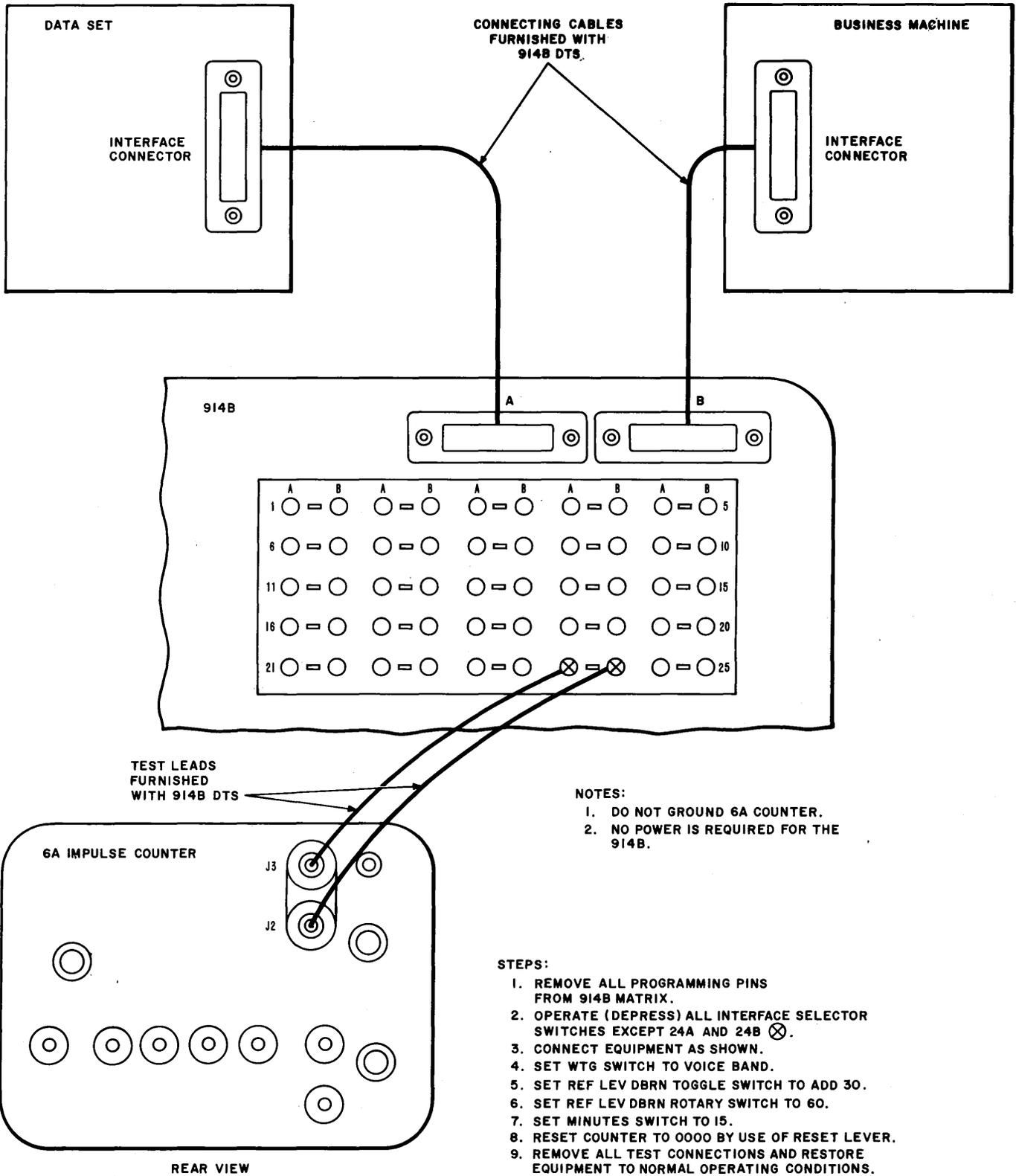


Fig. 1—Ground Noise Test Using 6A Impulse Counter and 914B Data Test Set

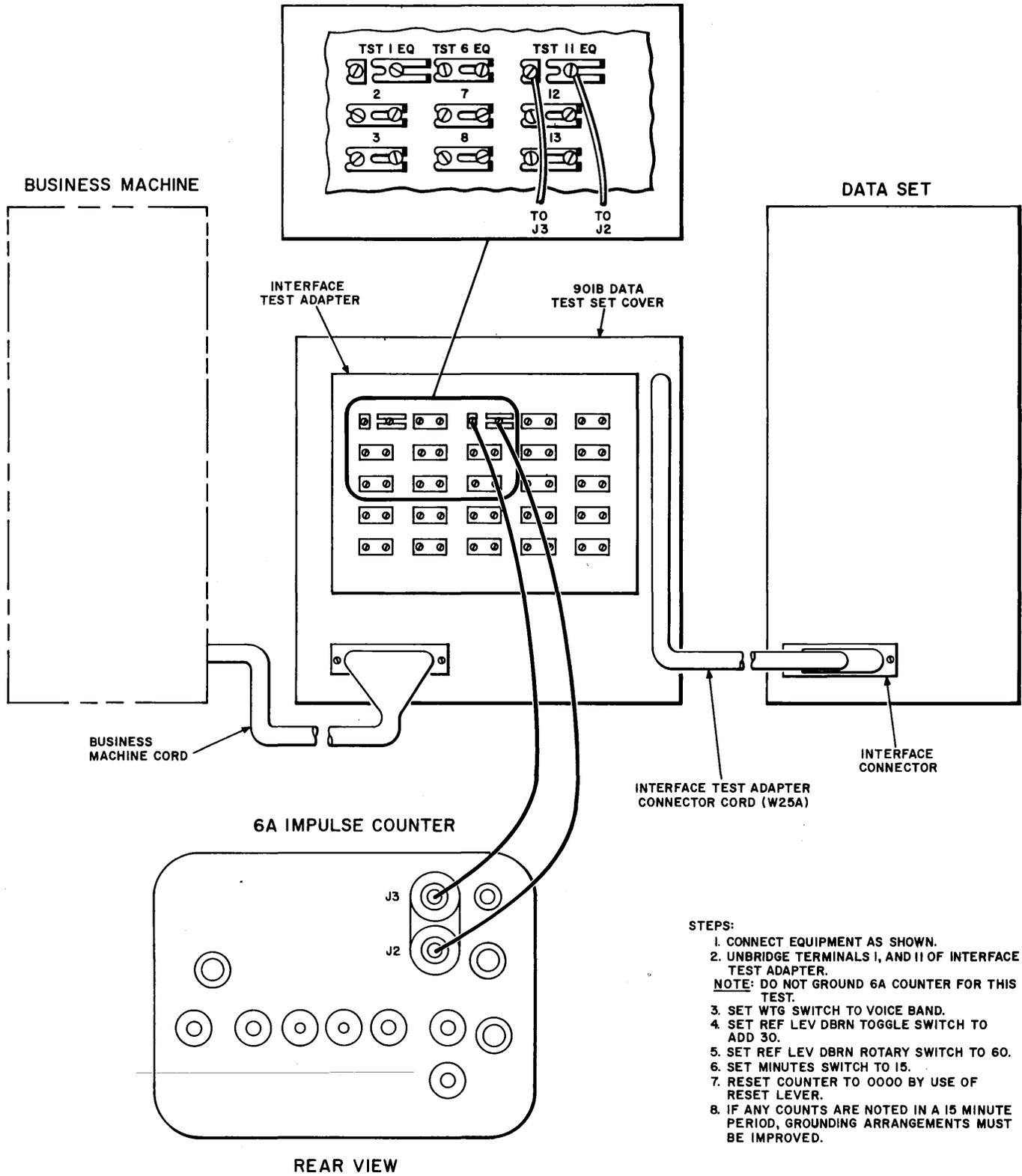


Fig. 2—Ground Noise Test Using 6A Impulse Counter and 901B Data Test Set Interface Test Adapter

STEP	PROCEDURE
2	<p>Requirement: There should be no counts noted in a 15-minute period.</p> <p>Remedial Action: Should any counts be noted in a 15-minute period, grounding arrangements must be improved as described in the section entitled Data Set 402C-Type, Transmitter, Installation and Connection (594-019-200).</p> <p>Remove all test connections and restore equipment to normal operating conditions.</p>

C. Remote Test (Data Test Center)

2.07 This test permits the data set to be tested from a remote data test center (DTC). The DTC is able to test the data set transmitter mark and space frequencies for level and frequency

deviation, answer-back, reverse-channel circuitry, and proper operation of line control circuits. This should be the first test performed when trouble is reported.

2.08 Since the DTC performs all test functions, no locally provided test equipment is required.

STEP	PROCEDURE
1	<p>Depress TALK key (TALK lamp lights) and call DTC. When instructed to do so, depress TEST key (TEST lamp lights) and hang up (TALK lamp extinguishes).</p> <p>Note 1: The test center now has complete control of the data set and can check operation of the following:</p> <ul style="list-style-type: none"> ● Line control ● Data transmitter frequencies. <p>Note 2: Table A may be used to identify the printed wiring board assembly associated with the data frequency that fails to meet requirements.</p> <ul style="list-style-type: none"> ● Answer-back receiver operation ● Reverse-channel receiver operation.

STEP	PROCEDURE																																								
2	<p style="text-align: center;">TABLE A</p> <p style="text-align: center;">DATA TRANSMITTER FREQUENCIES</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th data-bbox="527 411 688 543">CHANNEL</th> <th data-bbox="688 411 849 543">SPACE FREQUENCY</th> <th data-bbox="849 411 1010 543">MARK FREQUENCY</th> <th data-bbox="1010 411 1161 543">PRINTED WIRING BOARD ASSEMBLY NUMBER</th> </tr> </thead> <tbody> <tr> <td data-bbox="527 543 688 590">1</td> <td data-bbox="688 543 849 590">800</td> <td data-bbox="849 543 1010 590">730</td> <td data-bbox="1010 543 1161 590">AS17</td> </tr> <tr> <td data-bbox="527 590 688 625">2</td> <td data-bbox="688 590 849 625">970</td> <td data-bbox="849 590 1010 625">900</td> <td data-bbox="1010 590 1161 625">AS17</td> </tr> <tr> <td data-bbox="527 625 688 693">3</td> <td data-bbox="688 625 849 693">1140</td> <td data-bbox="849 625 1010 693">1070</td> <td data-bbox="1010 625 1161 693">AS18 or AS84</td> </tr> <tr> <td data-bbox="527 693 688 827">4 Timing</td> <td data-bbox="688 693 849 728">1310</td> <td data-bbox="849 693 1010 728">1240</td> <td data-bbox="1010 693 1161 728">AS17</td> </tr> <tr> <td data-bbox="527 728 688 764">5</td> <td data-bbox="688 728 849 764">1480</td> <td data-bbox="849 728 1010 764">1410</td> <td data-bbox="1010 728 1161 764">AS17</td> </tr> <tr> <td data-bbox="527 764 688 827">6</td> <td data-bbox="688 764 849 827">1650</td> <td data-bbox="849 764 1010 827">1580</td> <td data-bbox="1010 764 1161 827">AS18 or AS84</td> </tr> <tr> <td data-bbox="527 827 688 863">7</td> <td data-bbox="688 827 849 863">1820</td> <td data-bbox="849 827 1010 863">1750</td> <td data-bbox="1010 827 1161 863">AS17</td> </tr> <tr> <td data-bbox="527 863 688 898">8</td> <td data-bbox="688 863 849 898">1990</td> <td data-bbox="849 863 1010 898">1920</td> <td data-bbox="1010 863 1161 898">AS17</td> </tr> <tr> <td data-bbox="527 898 688 968">9</td> <td data-bbox="688 898 849 968">2160</td> <td data-bbox="849 898 1010 968">2090</td> <td data-bbox="1010 898 1161 968">AS18 or AS84</td> </tr> </tbody> </table> <p>The DTC can release the test mode after testing has been completed and restore the data set to the normal operating condition.</p> <p>Requirement: The data set should meet test requirements for the DTC specified in the section entitled Data Test Center—904A- and 804C-Types, Test Procedures—Data Set 402C-Type Remote Test (668-104-522).</p> <p>Remedial Action: If data set passes remote test requirements but fails interface test requirements described in Part 3 of this section, the internal wiring of the data set should be inspected for broken or loose connections.</p> <p>Note: The space frequencies specified in Table A are nominal frequencies with customer equipment connected. The space frequencies specified to the DTC are from 1 to 3 Hz higher.</p>	CHANNEL	SPACE FREQUENCY	MARK FREQUENCY	PRINTED WIRING BOARD ASSEMBLY NUMBER	1	800	730	AS17	2	970	900	AS17	3	1140	1070	AS18 or AS84	4 Timing	1310	1240	AS17	5	1480	1410	AS17	6	1650	1580	AS18 or AS84	7	1820	1750	AS17	8	1990	1920	AS17	9	2160	2090	AS18 or AS84
	CHANNEL	SPACE FREQUENCY	MARK FREQUENCY	PRINTED WIRING BOARD ASSEMBLY NUMBER																																					
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7	1820	1750	AS17																																						
8	1990	1920	AS17																																						
9	2160	2090	AS18 or AS84																																						

D. Local Interface Test (901B Data Test Set)

2.10 The following test equipment is required:

2.09 This test verifies that eight voice-frequency data signals and a timing channel signal are generated when the data set is placed in the data mode.

- 901B Data Test Set
- 1011-type handset or equivalent.

STEP	PROCEDURE
1	Set 901B DTS controls as follows:

STEP	PROCEDURE
2	<ul style="list-style-type: none"> ● SELECTOR switch to 8 ● A TEST switch to 2 ● B TEST switch to OFF ● UNATT—ATT switch to ATT.
2	Strap M option (TB2-17 to TB2-18) on data set.
3	Connect 901B DTS to interface test adapter (test set cover).
	Note: Verify that all test adapter captive shorting clips are closed.
4	Connect interface test adapter to data set interface connector.
5	Connect 1011-type handset to terminals C and D of 901B DTS (TALK—MON switch set to MON).
6	Set the A TEST switch through positions 2 through 10.
	Requirement: Tones ascending in frequency heard in handset
7	Depress and hold data set MON key.
	Requirement: Multiple tones heard in data set handset
8	Disconnect all test connections and restore equipment to normal operating condition.

3. MAINTENANCE TEST PROCEDURES

3.01 Tests contained in this part are intended to be used as troubleshooting aids during maintenance visits. Use of the interface tests in combination with the remote test contained in Part 2 should enable the tester to isolate the trouble to either the business machine or data set. Dynamic tests permit end-to-end or end-to-DTC testing of a data system allowing evaluation of data set performance using the normal transmission facility. However, end-to-end testing is so time consuming it should only be performed as a last resort. A dynamic test to the serving DTC from each remote data station will normally provide the degree of confidence needed. The tests to be performed will be determined by the kind of trouble encountered and the type of test equipment available. Data sets found to be defective should be returned to the Western Electric Company distributing houses for repair. Sets should be tagged to indicate the nature of the trouble.



Test set switches not shown on the 914B DTS test connection diagrams nor mentioned in text are not required for the test. Before making any test connections, ensure that all programming pins are removed from the 914B matrix. Insert only those pins shown in the appropriate test connection diagram.

A. End-to-DTC Interface Test (914B Data Test Set)

3.02 This test verifies that voice-frequency signals are transmitted in response to signals applied to the customer interface. The interface response to answer-back and reverse-channel signals and operation of the line control circuitry are also checked.

3.03 The following test equipment is required:

- 914B Data Test Set.

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STEP	DATA STATION	DATA TEST CENTER
1	Establish test connections and set 914B controls as shown in Fig. 3.	
2	Program the 914B matrix by inserting 12 shorting pins (red) as shown in Fig. 3.	
3	Operate (depress) all A interface selector switches.	
4	Operate 914B POWER switch.	
5	Using the telephone portion of the data set, call serving DTC and request DTC to perform 402C interface test (Section 668-104-522). Inform DTC whether 402C under test is arranged: (a) attended (ZC option) (b) unattended (N option) (c) reverse channel (S option).	
6	Hang up.	DTC operator conditions test equipment to perform test.
7	Depress data set DATA key.	
8	Set switch S2 on 914B to ON.	
9	When station bell rings, DS1 lamp lights during ringing interval.	DTC calls data station.
10a	If data set is arranged for attended operation—Lift data set handset and depress TALK key. Requirement: TALK lamp lights. Voice communication satisfactory.	
11a	Momentarily depress DATA key. Requirement: DATA lamp lights. TALK lamp extinguishes. DS2 lamp lights after a brief pause.	
12b	If data set is arranged for unattended operation—Set S1 switch on 914B to ON.	

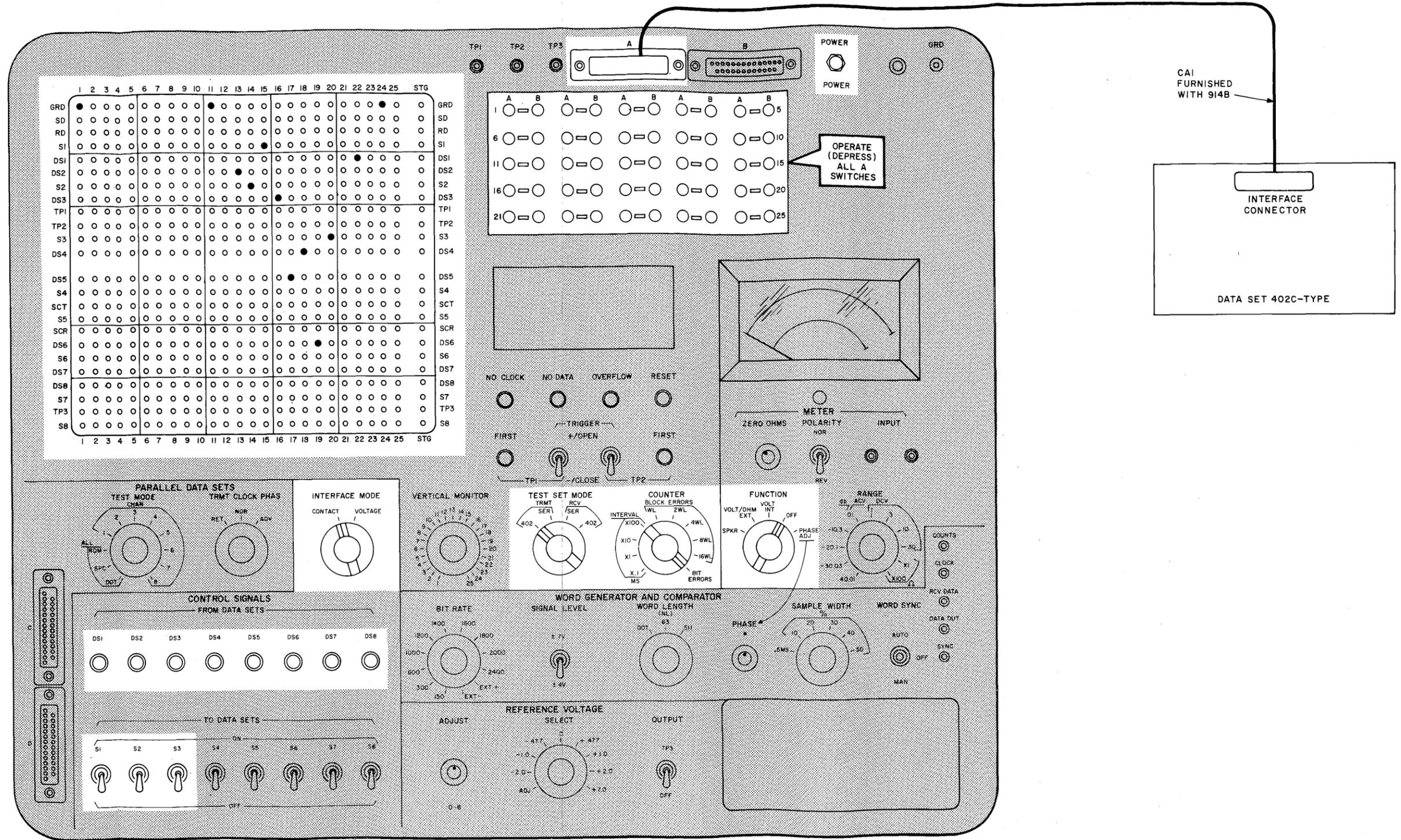


Fig. 3—End-to-DTC Interface Test—Test Connection Diagram

STEP	DATA STATION	DATA TEST CENTER
	Requirement: Data set answers on next ring. DATA lamp lights. DS2 lamp lights after brief pause. 2025-Hz answer tone sent.	DTC measures answer tone after ringing is tripped.
13b	Depress TALK key. Requirement: DATA lamp extinguished. TALK lamp lighted. Voice communication satisfactory.	DTC goes to talk mode and verifies results of answer-tone test.
14b	Depress DATA key.	DTC goes to test mode and transmits 387 Hz (if data set equipped with reverse channel), 1017 Hz, 1785 Hz, and 2025 Hz.
15	Depress and hold data set MON key. Requirement: Lamps on 914B light as corresponding frequencies are sent from DTC (heard in handset) as follows: DS3—387 Hz (if 402C2, C4, C6, or C8 with reverse channel) DS4—1017 Hz DS5—1785 Hz DS6—2025 Hz	
16	While DS6 is lit, set S3 switch to ON. Requirement: DS6 extinguishes. Data tones (transmitted from data set) heard in handset.	
17	Release MON key.	
18	Depress TALK key and inform DTC of answer-back and reverse-channel test results.	DTC goes to talk mode and logs test results.
19	Inform DTC ready to send data space and timing frequencies. Arrange time interval required to perform measurements. Note: If data set is equipped with reverse channel, DTC may send 387 Hz to signal station (DS3 lights) when measurements are complete.	
20	Depress DATA key.	DTC goes to test mode and measures data and timing frequencies.

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STEP	DATA STATION	DATA TEST CENTER																				
21	Depress TALK key at end of time interval or when DS3 lights.	DTC goes to talk mode when measurements are completed and informs telephone company employee of test results.																				
22	Insert nine additional programming pins in 914B matrix as follows:																					
	<table><thead><tr><th>ROW</th><th>COLUMN</th></tr></thead><tbody><tr><td>GRD</td><td>2</td></tr><tr><td>GRD</td><td>3</td></tr><tr><td>GRD</td><td>4</td></tr><tr><td>GRD</td><td>5</td></tr><tr><td>GRD</td><td>6</td></tr><tr><td>GRD</td><td>7</td></tr><tr><td>GRD</td><td>8</td></tr><tr><td>GRD</td><td>9</td></tr><tr><td>GRD</td><td>10</td></tr></tbody></table>	ROW	COLUMN	GRD	2	GRD	3	GRD	4	GRD	5	GRD	6	GRD	7	GRD	8	GRD	9	GRD	10	
ROW	COLUMN																					
GRD	2																					
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GRD	4																					
GRD	5																					
GRD	6																					
GRD	7																					
GRD	8																					
GRD	9																					
GRD	10																					
23	Inform DTC ready to send data mark and timing frequencies. Arrange time interval as in Step 19.																					
24	Depress DATA key.	DTC goes to test mode and measures data mark and timing frequencies.																				
25	Depress TALK key at end of interval.	DTC goes to talk mode when measurements are completed and informs telephone company employee of test results.																				
26	Depress DATA key.																					
27	Set S2 switch on 914B to OFF. <i>Requirement:</i> Data set times out and disconnects from telephone line.																					
28	Remove all test connections and restore equipment to normal operating conditions.																					

B. End-to-DTC Interface Test (913A Data Test Set)

3.04 This test verifies that voice-frequency signals are transmitted in response to signals applied to the customer interface. The interface response to answer-back and reverse-channel signals and operation of the line control circuitry are also checked.

3.05 The following test equipment is required:

- 913A Data Test Set.

STEP	DATA STATION	DATA TEST CENTER
1	Set 913A DTS controls as follows: MODEL switch to 402C/D MODE switch to ANS BACK DATA SET switch to 402 REMOTE OPR switch to OFF TEST MODE switch to CH 1.	
2	Remove data set cover (Section 594-019-300).	
3	Connect data set interface cord to the 402A/C connector on 913A DTS.	
4	Set 913A DTS PWR switch to ON.	
5	Using telephone portion of data set, call <i>servicing</i> DTC and request DTC to perform an interface test (Section 668-104-522). Inform DTC whether 402C under test is arranged: (a) attended (ZC option) (b) unattended (N option) (c) reverse channel (S option).	
6	Hang up.	DTC operator conditions test equipment to perform test.
7	Depress data set DATA key.	
8	When station bell rings, RING IND lamp lights during ringing interval.	DTC calls data station.
9a	If data set is arranged for attended operation— Lift data set handset and depress TALK key. Requirement: TALK lamp lights. Voice communication satisfactory.	
10a	Momentarily depress DATA key. Requirement: DATA lamp lights. TALK lamp extinguishes. INTLK lamp lights after a brief pause.	

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STEP	DATA STATION	DATA TEST CENTER
11b	If data set is arranged for unattended operation— Set REMOTE switch on 913A to OPR.	
	Requirement:	
	Data set answers on next ring. DATA lamp lights. INTLK lamp lights after a brief pause. 2025-Hz answer tone sent.	DTC measures answer tone after ringing is tripped.
12b	Depress TALK key.	
	Requirement:	
	DATA lamp extinguished. TALK lamp lighted. Voice communication satisfactory.	DTC goes to talk mode and verifies results of answer tone test.
13b	Depress DATA key.	DTC goes to test mode and transmits 387 Hz (if data set equipped with reverse channel), 1017 Hz, 1785 Hz, and 2025 Hz.
14	Depress and hold data set MON key.	
	Requirement: Lamps on 913A light as corresponding frequencies are sent from DTC (heard in handset using MON key) as follows:	
	RC— 387 Hz (if 402C2, C4, C6, or C8 with reverse channel) ANS BACK A—1017 Hz ANS BACK AB—1785 Hz ANS BACK B—2025 Hz.	
15	While ANS BACK B lamp is lit, set MODE switch to DATA.	
	Requirement:	
	ANS BACK B lamp extinguishes. Data tones (transmitted from data set) heard in handset.	
16	Release MON key.	
17	Depress TALK key and inform DTC of answer-back and reverse-channel test results.	DTC goes to talk mode and logs test results.
18	Inform DTC ready to send space frequencies. Arrange time interval required to perform measurements.	

STEP	DATA STATION	DATA TEST CENTER
	<i>Note:</i> If data set is equipped with reverse channel, DTC may send 387 Hz to signal (RC lamp lights) when measurements are complete.	
19	Depress DATA key.	DTC goes to test mode and measures data frequencies.
20	Depress TALK key at end of time interval or when RC lamp lights.	DTC goes to talk mode when measurements are complete and informs telephone company employee of test results.
21	Connect a test cord between TB4-6 (+18 vdc) on the data set and the red DATA IN jack on the 913A DTS.	
22	At 913A DTS, set TEST MODE switch to ALL RDM.	
23	Inform DTC ready to send data mark frequencies. Arrange time interval as in Step 18.	
24	Depress DATA key.	DTC goes to test mode and measures data mark frequencies.
25	Depress TALK key at end of interval.	DTC goes to talk mode when measurements are completed and informs telephone company employee ready to go to talk mode.
26	Set REMOTE switch to RLS.	
	<i>Requirement:</i> Data set times out and disconnects from telephone line.	
27	Remove all test connections and restore equipment to normal operating conditions.	

C. End-to-DTC Interface Test (901B Data Test Set)

3.06 This test verifies that voice-frequency data signals are transmitted in response to signals applied to the customer interface. The interface response to answer-back and reverse-channel signals and operation of the line control circuitry are also checked.

3.07 The following test equipment is required:

- 901B Data Test Set
- KS-14510 or KS-16979-L1 Volt-ohm-milliammeter.

STEP	DATA STATION	DATA TEST CENTER
1	Connect 901B interface test adapter to interface connector of data set.	

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STEP	DATA STATION	DATA TEST CENTER
	<p><i>Note:</i> Verify that all test adapter shorting clips are closed.</p>	
2	Connect a test lead between terminals 11 and 14 on the interface test adapter.	
3	Using the telephone portion of the data set, call the serving DTC and request DTC to perform 402C interface test (Section 668-104-522). Inform DTC whether 402C under test is arranged: (a) attended (ZC option) (b) unattended (N option) (c) reverse channel (S option).	
4	Hang up.	DTC operator conditions test equipment to perform test.
5	Depress data set DATA key.	
6	Condition meter to measure resistance (R x 10,000) and connect meter leads across terminals 22 and 24 of the interface test adapter.	
7	When station bell rings, meter indicates approximately 0 ohms during ring interval.	DTC calls data station.
8	Disconnect meter leads.	
9a	If data set is arranged for attended operation— Lift data set handset and depress TALK key. Requirement: TALK lamp lights. Voice communication satisfactory.	
10a	Connect meter leads across terminals 13 and 24 of interface test adapter. Requirement: Meter indicates open circuit.	
11a	Momentarily depress DATA key. Requirement: DATA lamp lights. TALK lamp extinguishes. Meter indicates 0 ohms after a brief pause.	
12a	Disconnect meter leads.	

STEP	DATA STATION	DATA TEST CENTER
13b	If data set is arranged for unattended operation— Connect meter leads across terminals 13 and 24 of interface test adapter. Requirement: Meter indicates open circuit.	
14b	Connect a test lead across terminals 11 and 15 of interface test adapter. Requirement: Data set answers on next ring. Meter indicates 0 ohms after a brief pause. 2025-Hz answer tone sent.	DTC measures answer tone after ringing is tripped.
15b	Disconnect meter leads.	
16b	Depress TALK key. Requirement: DATA lamp extinguished. TALK lamp lighted. Voice communication satisfactory.	DTC goes to talk mode and verifies results of answer-tone test.
17b	Depress DATA key.	DTC goes to test mode and transmits 387 Hz (if data set equipped with reverse channel), 1017 Hz, 1785 Hz, and 2025 Hz.
18	Depress and hold MON key for indications in Steps 19 through 22.	
19c	When 387-Hz tone is heard, connect meter leads across interface test adapter terminals 16 and 24. Requirement: Meter indicates 0 ohms while tone is heard.	DTC transmits 387 Hz.
20	When 1017 Hz is heard, connect meter leads across terminals 18 and 24, 17 and 24, and 19 and 24 in turn. Requirement: Meter indicates 0 ohms for terminals 18 and 24; open circuit for terminals 17, 24 and 19, 24.	DTC transmits 1017 Hz.
21	When 1785-Hz tone is heard, repeat Step 20. Requirement: Meter indicates 0 ohms for terminals 17 and 24; open circuit for terminals 18, 24 and 19, 24.	DTC transmits 1785 Hz.

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STEP	DATA STATION	DATA TEST CENTER
22	When 2025-Hz tone is heard, repeat Step 20. <i>Requirement:</i> Meter indicates 0 ohms for terminals 19 and 24; open circuit for terminals 17, 24 and 18, 24.	DTC transmits 2025 Hz.
23	Connect a test lead between terminals 11 and 20. <i>Requirement:</i> Data frequencies heard in handset	
24	Depress TALK key and inform DTC of answer-back and reverse-channel test results.	DTC goes to talk mode and logs results.
25	Inform DTC ready to send space frequencies. Arrange time interval required to perform measurements. <i>Note:</i> If data set is equipped with reverse channel, DTC may send 387 Hz to signal when measurements are complete. (Connect meter across terminals 16 and 24 for an indication of 0 ohms when reverse channel is received.)	
26	Depress DATA key.	DTC goes to test mode and measures frequencies.
27	Depress TALK key at end of time interval or when reverse-channel indication is received.	DTC goes to talk mode and informs telephone company employee of test results.
28	Using suitable test cords, strap terminals 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11 on interface test adapter.	
29	Inform DTC ready to send data mark frequencies. Arrange time interval as in Step 25.	
30	Depress DATA key.	DTC goes to test mode and measures data mark frequencies.
31	Depress TALK key at end of time interval and verify mark frequency test results with DTC.	DTC goes to talk mode when measurements are completed and informs telephone company employee of test results.
32	Momentarily disconnect test lead between terminals 14 and 11. <i>Requirement:</i> Data set times out and disconnects from telephone line.	
33	Remove all test connections and restore all equipment to normal operating conditions.	

D. End-to-DTC Dynamic Test (914B Data Test Set)

3.08 This test should be made, after the remote test, when it is necessary to identify transmission facility troubles which the data set occasionally experiences. A DTC equipped for testing 402-type data sets is used as a substitute for the receiving station if it can be assured that the faulty facilities will be encountered. A number of calls may be required to obtain the connection involving the trouble.

3.09 Detailed test instructions are provided for the Telco employee in the left column. A summary of associated actions performed at the DTC is shown in the right column to provide coordination and to minimize testing time.

3.10 The following test equipment is required.

- 914B Data Test Set.

STEP	DATA STATION	DATA TEST CENTER
1	Establish test connections and set switches for the transmitting setup shown in Fig. 4.	
2	Program the 914B matrix using seven shorting pins (red) as shown in Fig. 4.	
3	Operate the 914B POWER switch.	
4	Using the telephone portion of the data set, call the <i>servicing</i> DTC and request a dynamic test using Section 668-104-522. Inform DTC whether 402C under test is equipped with reverse channel (402C2, 402C4, 402C6, 402C8).	DTC operator conditions test equipment to perform test and informs station when ready to perform first error run test.
5	Depress data set DATA key. Set S1 switch on 914B to ON.	
6	Five seconds after DATA key is depressed (or DS1 on 914B lights, if reverse channel is used), set TEST MODE switch to ALL RDM.	
7	Transmit data for 6 minutes.	DTC totalizes errors for 5-minute error run.
8	After 6-minute transmission, set S1 switch to OFF. Set TEST MODE switch to ALL SPC. Set TRMT CLOCK PHASE switch to ADV.	DTC logs results of error run.
9	When DS2 lights (indicates completion of first error test), set S1 switch to ON. After five seconds, set TEST MODE switch to ALL RDM.	DTC sends answer-back A to indicate first error test complete and ready to start second test.
10	Transmit data for 6 minutes.	DTC totalizes errors for 5-minute error run.
11	After 6-minute transmission, set S1 switch to OFF. Set TEST MODE switch to ALL SPC and TRMT CLOCK PHASE switch to RET.	DTC logs results of error run.
12	When DS4 lights, set S1 switch to ON. After five seconds, set TEST MODE switch to ALL RDM.	DTC sends answer-back B to indicate second error run complete and ready to start third test.

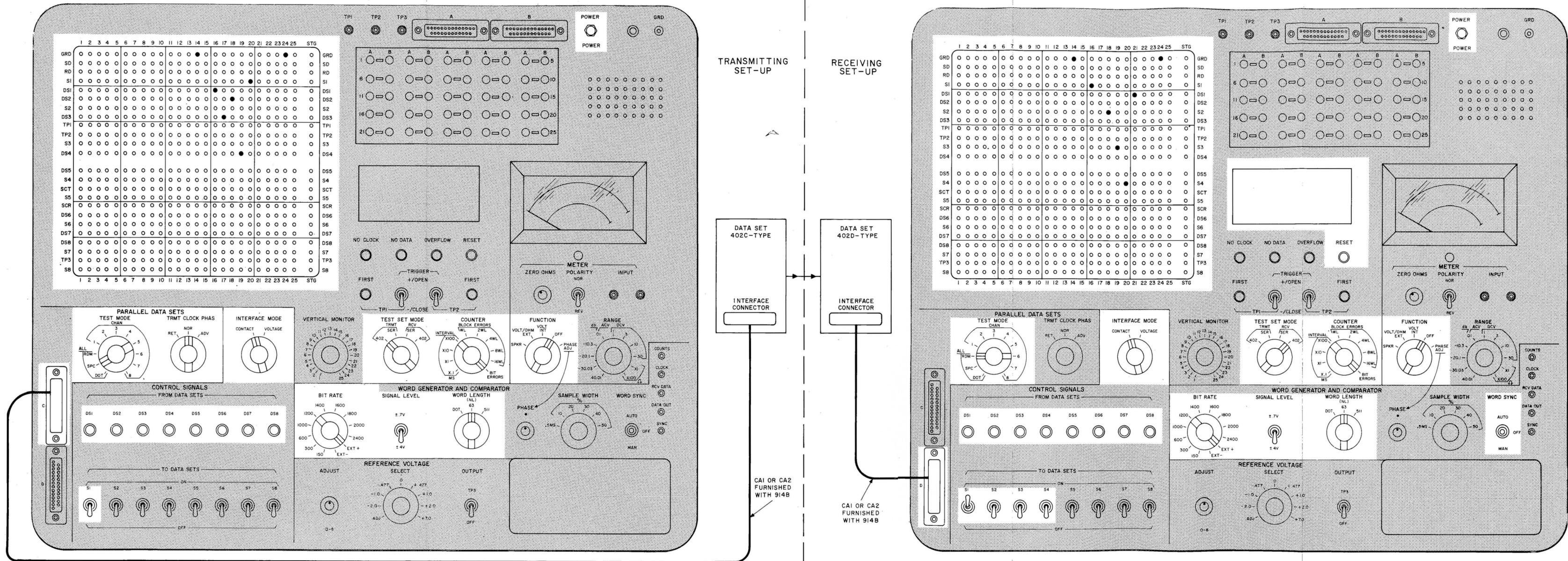


Fig. 4—Dynamic Test for End-to-DTC or End-to-End Test Using 914B Data Test Set—Test Connection Diagram

STEP	DATA STATION	DATA TEST CENTER
13	Transmit data for 6 minutes.	DTC totalizes errors for 5-minute error run.
14	After 6-minute transmission, set S1 switch to OFF.	DTC logs results of error run.
15	When DS3 lights, depress TALK key.	DTC sends answer-back AB to indicate third error run complete and returns to talk mode.
16	End of test. Restore equipment to normal operating conditions.	

E. End-to-DTC Dynamic Test (913A and 903 Data Test Sets)

3.11 This test should be made after the remote test when it is necessary to identify transmission facility troubles which the data set occasionally experiences. A DTC equipped for testing 402-type data sets is used as a substitute for the receiving station if it can be assured that the faulty facilities may be encountered. A number of calls may be required to obtain the connection involving the trouble.

3.12 Detailed test instructions are provided for the Telco employee in the left column. A summary of associated actions performed at the DTC is shown in the right column to provide coordination and to minimize testing time.

3.13 The following test equipment is required:

- 913A Data Test Set
- 903 Data Test Set.

STEP	DATA STATION	DATA TEST CENTER
1	Set 913A DTS controls as follows: Power switch—ON DATA SET switch—402 TRMTR CLOCK switch—75 NOR MODE switch—DATA TEST MODE switch—ALL SPC MODEL switch—402C/D REMOTE switch—OPR.	
2	Set 903 DTS controls as follows: BIT RATE switch—EXT CLOCK TRIGGER switch—+ RANDOM—DOT switch—RANDOM.	
3	Establish connections as shown in Fig. 5.	
4	Using the telephone portion of the data set, call the <i>servicing</i> DTC and request a dynamic test using Section 668-104-522. Inform DTC whether 402C under test is equipped with reverse channel (402C2, 402C4, 402C6, 402C8).	DTC operator conditions test equipment to perform test and informs station when ready to perform first error run test.
5	Depress data set DATA key.	

TRANSMIT STATION

RECEIVE STATION

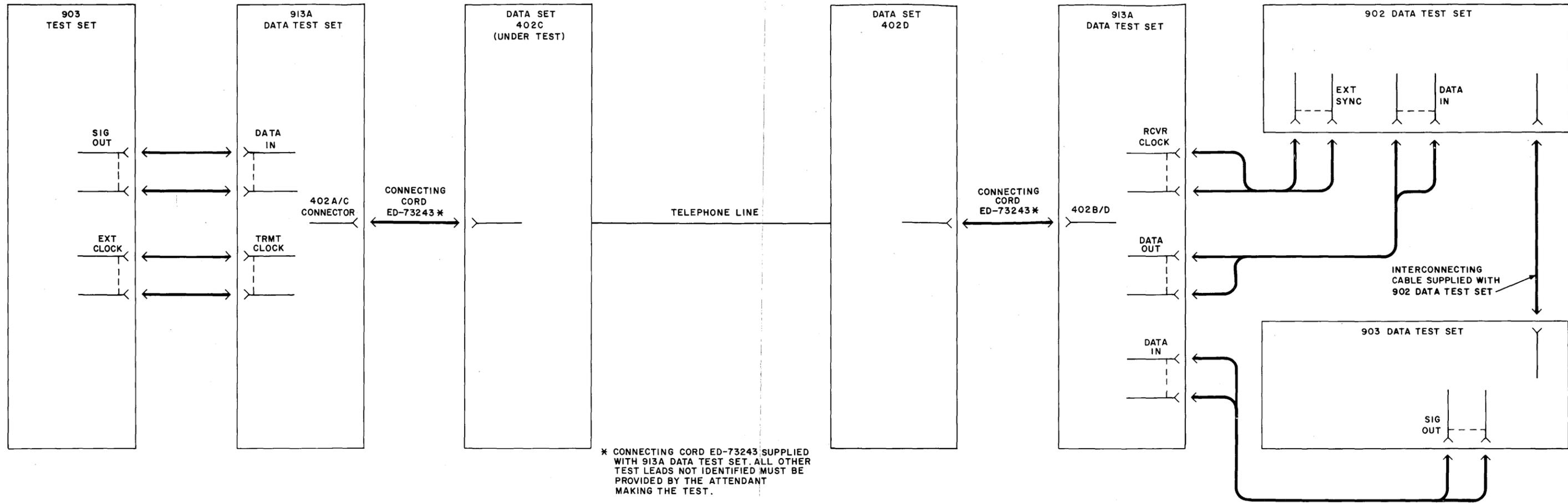


Fig. 5—Dynamic Test for End-to-DTC or End-to-End Test Using 913A and 903 Data Test Set—Test Connection Diagram

STEP	DATA STATION	DATA TEST CENTER
6	Five seconds after DATA key is depressed (or RC lamp lights if reverse channel is used), operate TEST MODE switch on 913A DTS to ALL RDM.	
7	Transmit data for 6 minutes.	DTC totalizes errors for 5-minute error run.
8	After 6-minute transmission, position 913A MODE switch to ANS BACK.	DTC logs results of error run.
9	When ANS BACK A lamp lights on the 913A DTS (which indicates completion of first error run), position the TRANS CLOCK switch to 75 ADV and the TEST MODE switch to ALL SPC.	DTC sends answer-back A to indicate first error run complete and ready to start second test.
10	Operate MODE switch to DATA. After 5 seconds (or when REV CHAN lamp lights), operate TEST MODE switch to ALL RDM.	
11	Transmit data for 6 minutes.	DTC totalizes errors for 5-minute error run.
12	After 6-minute transmission, position the 913A MODE switch to ANS BACK.	DTC logs results of error run.
13	When ANS BACK B lamp lights, operate TRANS CLOCK switch to 75 RET and TEST MODE switch to ALL SPC. Set the MODE switch to DATA. After about 5 seconds (or when RC lamp lights), operate TEST MODE switch to ALL RDM.	DTC sends answer-back B to indicate second error run complete and ready to start third test.
14	Transmit data for 6 minutes.	DTC totalizes errors for 5-minute error run.
15	After 6-minute transmission, position the 913A MODE switch to ANS BACK.	
16	When ANS BACK AB lamp lights, position 913A DTS MODE switch to DATA and depress TALK key.	DTC sends answer-back AB to indicate third error run complete and returns to talk mode.
17	End of test. Restore equipment to normal operating conditions.	

F. End-to-End Dynamic Test (914B Data Test Set)

3.14 The dynamic test should be made after the loop-back test but only when it is necessary to identify facility troubles which the data system has been occasionally experiencing over a period of time. This test is made using two data stations remote from each other (end-to-end). A number

of calls may be required to obtain a connection involving the suspected faulty facility.

3.15 Figure 4 shows the type of overall arrangement to be made when performing an end-to-end test. The attendant at the transmit station establishes communications between the two stations by using the telephone portion of the data set,

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then both stations agree to go into the data mode of operation. If the receive station should desire to go into the talk mode before the test is completed, arrangements should be made between the two stations for the attendant at the receive station to signal the transmit station of such a request by

TRANSMIT (Data Set 402C)

- (1) Establish test connections and set switches as shown in Fig. 4.
- (2) Program the 914B matrix as shown in Fig. 4.
- (3) Operate POWER switch on 914B DTS.
- (4) Establish communications as explained in 3.15.
- (5) Depress DATA key on Data Set 402C. Set S1 switch on 914B to ON.
- (6) Five seconds after DATA key is depressed (or DS1 on 914B lights, if reverse channel is used), set TEST MODE switch to ALL RDM.
- (7) Transmit data for 6 minutes.
- (8) After 6-minute transmission, set S1 switch to OFF. Set TEST MODE switch to ALL SPC and TRMT CLOCK PHASE switch to ADV.
- (9) When DS2 lights (indicates completion of first error test), set S1 switch to ON. After 5 seconds, set TEST MODE switch to ALL RDM.
- (10) Transmit data for 6 minutes (second error test).
- (11) After 6-minute transmission, set S1 switch to OFF. Set TEST MODE switch to ALL SPC and TRMT CLOCK PHASE switch to RET.
- (12) When DS4 lights, set S1 switch to ON. After 5 seconds, set TEST MODE switch to ALL RDM.

use of the reverse-channel switch (S1 to OFF on the 914B DTS).

3.16 The test equipment required for this test is as follows:

- 914B Data Test Set (2 required).

RECEIVE (Data Set 402D)

- (1) Establish test connections and set switches as shown in Fig. 4.
- (2) Program the 914B matrix as shown in Fig. 4.
- (3) Operate POWER switch on 914B DTS.
- (4) Establish communications as explained in 3.15.
- (5) Depress data set DATA key (goes into the data mode). Set S4 switch on 914B to ON.
- (6) Note when DS1 on 914B DTS lights, momentarily operate WORD SYNC switch to MAN, and momentarily operate display counter RESET switch.
- (7) Time data reception 5 minutes and observe and record any errors displayed on 914B counter.
- (8) When DS1 extinguishes, set S2 switch to ON and S4 switch to OFF. (This sends answer-back A to the transmitting station.)
- (9) Set S4 switch to ON and S2 switch to OFF. Note when DS1 lights, momentarily operate WORD SYNC switch to MAN, and momentarily operate counter display RESET switch.
- (10) Time data reception 5 minutes. Observe and record any errors displayed on 914B counter.
- (11) When DS1 extinguishes, set S3 switch to ON and S4 switch to OFF. (This sends answer-back B to the transmitting station.)
- (12) Set S4 switch to ON and S3 switch to OFF. When DS1 lights, momentarily operate WORD SYNC switch to MAN, and momentarily operate counter display RESET switch.

TRANSMIT (Data Set 402C)

- (13) Transmit data for 6 minutes (third error test).
- (14) After 6-minute transmission, set SI switch to OFF.
- (15) When DS3 lights, depress TALK key on data set.

Note: If the data set is operated within the margin of error rate (less than 3 errors in the three 5-minute runs), the test may be considered complete. If this margin is exceeded, the data set should be tested in each of the following modes to determine which channels are defective and should be replaced:

- Testing individual channels
- Dotting on all channels
- Dotting on all channels except channel being tested.

3.17 If the data set performance indicates that further testing is required, proceed as follows:

- (a) **Testing Individual Channels:** Perform the test exactly as it is written with the following exception:
 - At the receive station, set the TEST MODE switch to the CHAN number of the channel to be tested. Each of the eight channels should be tested for the three error tests.

Note: When searching for the channel or channels causing the errors, the receiving station will step through each CHAN 1 through 8 position allowing only enough time to determine that the channel is not causing errors. This test may also be performed when the transmitted signal is a dotting signal. In this case in (6), (9), and (12), the TEST MODE switch should be set to DOT, and the WORD LENGTH switch at the receive station should be set to DOT.

RECEIVE (Data Set 402D)

- (13) Time data reception 5 minutes. Observe and record any errors displayed on 914B DTS counter.
- (14) When DS1 extinguishes, set S2 and S3 switches to ON (sends answer-back AB) and S4 switch to OFF.
- (15) Establish voice communication between stations using the telephone portion of the data set. Inform the transmitting station of any errors recorded in the three tests.

(b) **Dotting on All Channels:** Perform the test exactly as it is written with the following exception:

- In (6), (9), and (12), set the TEST MODE switch at the transmitting station to ALL DOT. The WORD LENGTH switch at the receiving station should be set to DOT during the three error tests. Individual channels may be tested using the dotting signal on all channels as previously explained.

(c) **Dotting on All Channels Except Channel Being Tested (Used to Detect Code Sensitivity):** Perform the test exactly as it is written with the following exception:

- In (6), (9), and (12), set the TEST MODE switch at the transmitting station to the channel number to be tested. The receiving station should set the TEST MODE switch to the same channel number as the transmitting station.

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G. End-to-End Dynamic Test (913A, 903, 902 Data Test Sets)

3.18 The following test (dynamic) should be made after the remote test but only when it is necessary to identify facility troubles which the data system has been occasionally experiencing over a period of time. This test is made using two data stations remote from each other (end-to-end). A number of calls may be required to obtain a connection involving the suspected faulty facility.

3.19 Connections and test set control settings are given for the transmit station only. A summary of what is taking place at the receive station is also given to promote better communications between the two stations while the test is in progress.

3.20 Connect the test equipment for the transmit station in accordance with Fig. 5. Connections for the receive station are illustrated for general information only.

3.21 The test equipment required for this test is as follows:

- 913A Data Test Set (2 required)
- 903 Data Test Set (2 required).

3.22 Apply power to and set the 913A DTS controls as follows:

TRANSMIT (Data Set 402C)	RECEIVE (Data Set 402D)
---------------------------------	--------------------------------

- | | |
|---|---|
| <ul style="list-style-type: none"> ● Power switch — ON ● DATA SET switch — 402 ● TRMTR CLOCK switch — 75 NOR ● MODE switch — DATA | <ul style="list-style-type: none"> ● Power switch — ON
(REV CHAN on, if applicable) ● DATA SET switch — 402 ● MODE switch — DATA |
|---|---|

TRANSMIT (Data Set 402C)

- (1) Depress DATA key on Data Set 402C.
- (2) Five seconds after DATA key is depressed (or RC lamp lights), operate TEST MODE switch on 913A DTS to ALL RDM.

TRANSMIT (Data Set 402C)

- TEST MODE switch — ALL SPC
- MODEL — 402C/D
- REMOTE switch — OPR

RECEIVE (Data Set 402D)

- TEST MODE switch — ALL RDM
- MODEL — 402C/D
- REMOTE switch — OPR

3.23 Set the 903 DTS controls as follows:

TRANSMIT (Data Set 402C)

- BIT RATE selector switch — EXT CLOCK
- TRIGGER — +
- RANDOM-DOT switch — RANDOM

RECEIVE (Data Set 402D)

- BIT RATE selector switch — EXT CLOCK
- TRIGGER — —
- RANDOM-DOT switch — RANDOM

3.24 Set the 902 DTS controls as follows:

TRANSMIT (Data Set 402C)

- Not applicable

RECEIVE (Data Set 402D)

- BIT RATE switch — EXT SYNC
- TRIGGER — +

3.25 The attendant at the transmit station establishes communications between the two stations by using the telephone portion of the data set. Then both stations agree to go into the data mode of operation. If the receive station should desire to go into the talk mode before the test is completed, arrangements should be made between the two stations for the attendant at the receive station to signal the transmit station of such a request by use of the reverse-channel switch (if available). Complete the test as follows.

RECEIVE (Data Set 402D)

- (1) Goes into the data mode.
- (2) Notes when CO (carrier on) lamp on 913A DTS lights and resets the counter on the 902 DTS.

TRANSMIT (Data Set 402C)

- (3) Transmit data for 6 minutes.
- (4) After 6-minute transmission, position MODE switch on 913A DTS to ANS BACK.
- (5) When ANS BACK A lamp lights on the 913A DTS (which indicates completion of first error run), position the TRANS CLOCK switch to 75 ADV and the TEST MODE switch to ALL SPC.
- (6) Operate MODE switch to DATA. After 5 seconds (or when REV CHAN lamp lights), operate TEST MODE switch to ALL RDM.
- (7) Transmit data for a 6-minute period.
- (8) Position the 913A DTS MODE switch to ANS BACK.
- (9) When ANS BACK B lamp lights, operate TRANS CLOCK switch to 75 RET and TEST MODE switch to ALL SPC. Position the 913A DTS MODE switch to DATA. After about 5 seconds (or when RC lamp lights), operate TEST MODE switch to ALL RDM.
- (10) Transmit for a 6-minute period.
- (11) Position the 913A DTS MODE switch to ANS BACK.
- (12) When the ANS BACK AB lamp lights, position the 913A DTS MODE switch to DATA.
- (13) Depress TALK key.

Note: If the data set is operating within the margin of error rate (less than three errors in the three 5-minute runs), the test may be considered complete. If this margin is exceeded, the data set should be tested in each of the following modes to determine which channels are defective and should be replaced.

RECEIVE (Data Set 402D)

- (3) Times data reception 5 minutes and observes and records errors displayed by 902 DTS.
- (4) Observes when CO lamp extinguishes and transmits the answer-back A signal to the transmit station.
- (5) Stops sending the answer-back A signal and resets the 902 DTS counter.
- (6) No action required.
- (7) Times data reception 5 minutes and observes and records errors displayed by 902 DTS.
- (8) Observes when CO (carrier on) lamp extinguishes and transmits the answer-back B signal to the transmit station.
- (9) Stops sending the answer-back B signal, resets the 902 DTS counter, and goes into the data receive mode.
- (10) Times data reception 5 minutes and observes and records errors displayed by the 902 DTS.
- (11) When 913A DTS CO lamp extinguishes, transmits answer-back AB frequency.
- (12) Stops sending the answer-back AB signal, resets the 902 DTS counter, and goes into the data receive mode.
- (13) Establishes communications between the two stations using the telephone portion of the data set. Informs the transmit station of number of errors recorded in the three 5-minute error runs.

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- Testing individual channels
- Dotting on all channels
- Dotting on all channels except channel being tested.

3.26 If data set performance indicates that further tests are required, proceed as follows:

(a) **Testing Individual Channels:** Perform the test exactly as it is written with the following exception:

- In (2), set the TEST MODE switch on the 913A DTS at the 402D to the CHAN number of the channel to be tested.

Note: When searching for the channel causing the errors, the receiving station will step

through the channels, allowing only enough time to determine that the channel is not causing errors.

(b) **Dotting on All Channels:** Perform the test exactly as it is written with the following exception:

- In (2), set the TEST MODE switch on the 913A DTS to ALL DOT.

(c) **Testing With Dotting on All Channels Except Channel Being Tested:** Perform the test exactly as it is written with the following exception:

- In (2), set the TEST MODE switch on the 913A DTS to the CHAN number of the channel to be tested.