

**DATA SET 103A-TYPE**  
**TEST PROCEDURES USING 921A DATA TEST SET**

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**1. GENERAL**

**1.01** This section contains test procedures to be followed when using a 921A (version 2 or higher) data test set (DTS) to test a data set (DS) 103A-type. These procedures are to be followed when needed on an initial installation or during a maintenance visit.

**1.02** When this section is reissued, the reason for reissue will be contained in this paragraph.

**1.03** The DS 103A-type provides asynchronous, full-duplex transmission and reception of serial binary data over the switched network at bit rates up to 300 bits per second (bps). The DS

103A-type also provides two modes of operation, originate and answer.

*Note:* The DS 102A2A and 102A3 can be used at speeds up to 300 bps. The DS 102A2 and 102A2B should not be used at speeds greater than 200 bps.

**1.04** The 921A DTS (Fig. 1) is a portable, general purpose, data test set that provides the serial testing capabilities of the 914C DTS and is compatible with the 914C DTS for end-to-end testing. In addition, the 921A DTS is compatible with the 911A and 911NA DTSs for end-to-end start-stop distortion measurements. Additional information concerning the 921A DTS is contained in Section 107-402-100.

**1.05** Input to the 921A DTS is made through a 20-button keyboard. A 32-character alphanumeric display provides operator prompting and test results.

**Test Capabilities**

**1.06** Test circuitry built into DS 103A-type permits the remote test of the data set from a data test center (DTC).

**1.07** If a 921A DTS is used, an end-to-end test can be performed using pseudorandom data. By use of the 921A DTS, the customer interface circuits are tested and a more precise indication of bit and block errors can be obtained. Start-stop distortion tests can be performed for asynchronous operation. The 921A DTS can also be used to test the data set automatic answer circuits.

**2. INSTALLATION TESTS**

**2.01** This part provides the sequence in which tests are to be performed following installation of the data set. Before proceeding with the tests,

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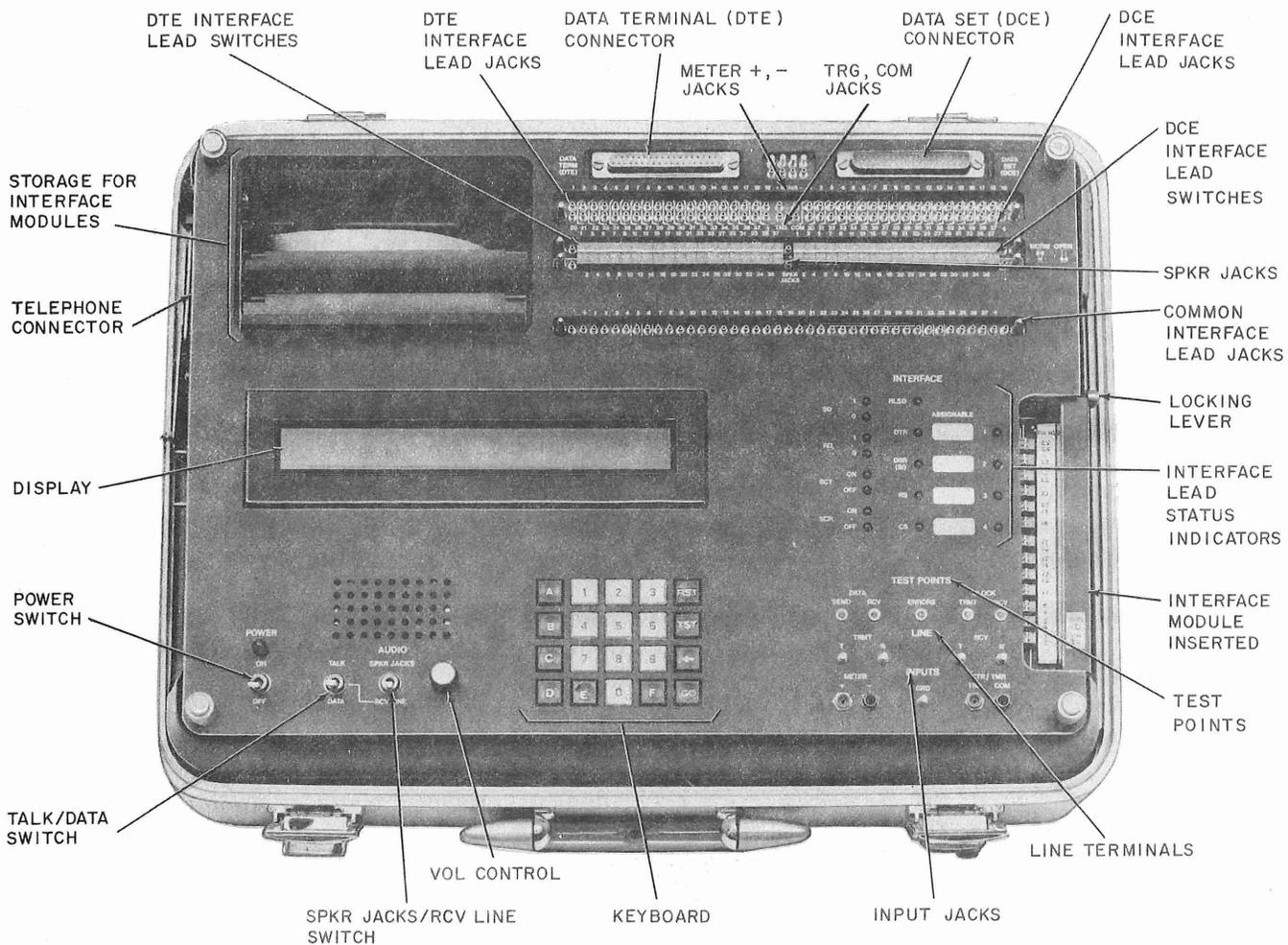


Fig. 1—921A Data Test Set—Front Panel

verify that the local loop meets the requirements specified in Section 314-205-501.

**2.02** Refer to Fig. 2 for the sequence of tests to be performed to verify proper installation. The 921A DTS is not required for installation testing, but may be used if desired.

**3. MAINTENANCE TESTS**

**3.01** This part provides the sequence in which tests are to be performed when clearing a trouble report and during a maintenance visit to the data station.

**3.02** When a trouble report is received, a DTC is responsible for isolating the trouble to

the data station or the transmission facility. The procedure for doing this is shown in Fig. 3.

**3.03** If the trouble seems to be in the data station equipment, a telephone company (telco) employee must be dispatched to conduct more extensive tests at the data station. The following equipment should be taken on a trouble visit:

- Spare data set
- 921A DTS.

**3.04** Refer to Fig. 4 for the sequence in which tests are to be performed by the telco employee at the data station. If the data set is replaced, the defective data set should be tagged with a description of the trouble, carefully packed,

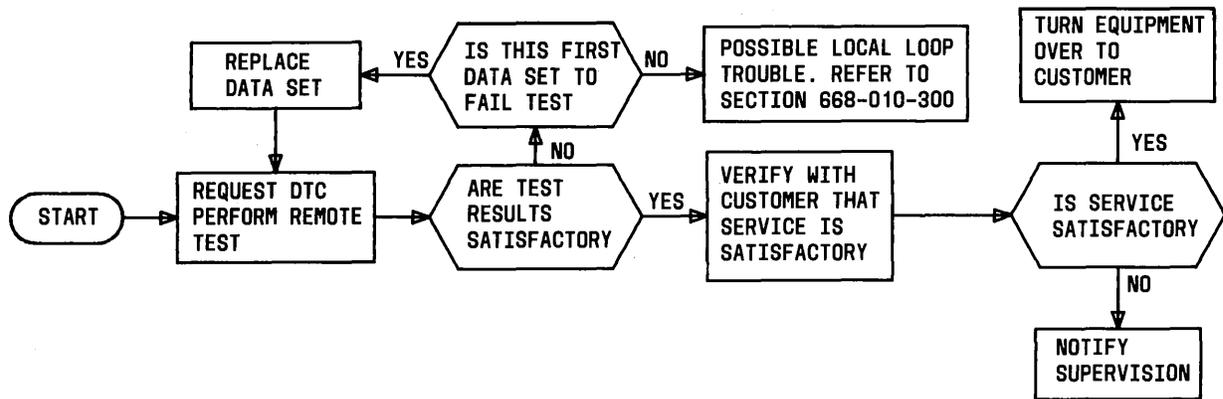


Fig. 2—Installation Test Sequence

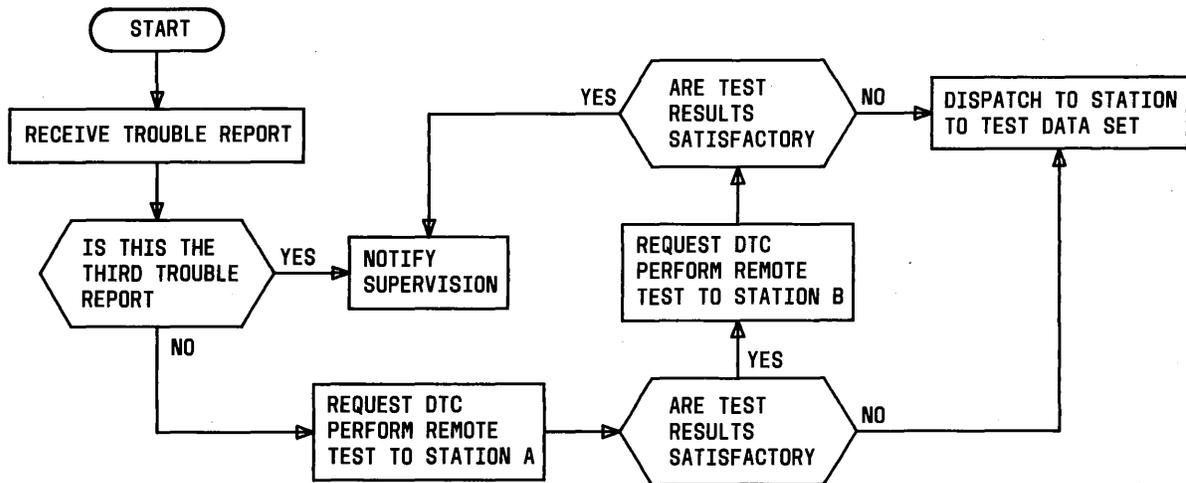


Fig. 3—Clearing Trouble Report

and returned to a service center for repair. Verify that the replacement data set is equipped with the proper options before placing the data set in service.

**3.05** If the trouble persists after the tests have been completed, proceed as follows:

(a) Check that options installed in data set agree with those specified on service order.

(b) Verify that customer-provided equipment (CPE) has been tested and is operating properly.

(c) Check for physical damage to data station equipment.

(d) Verify that all cords and connectors are properly connected.

(e) Check for intermittent trouble in station wiring.

(f) Verify that data set and CPE are connected to a common ground.

(g) If trouble persists, request help from immediate supervisor.

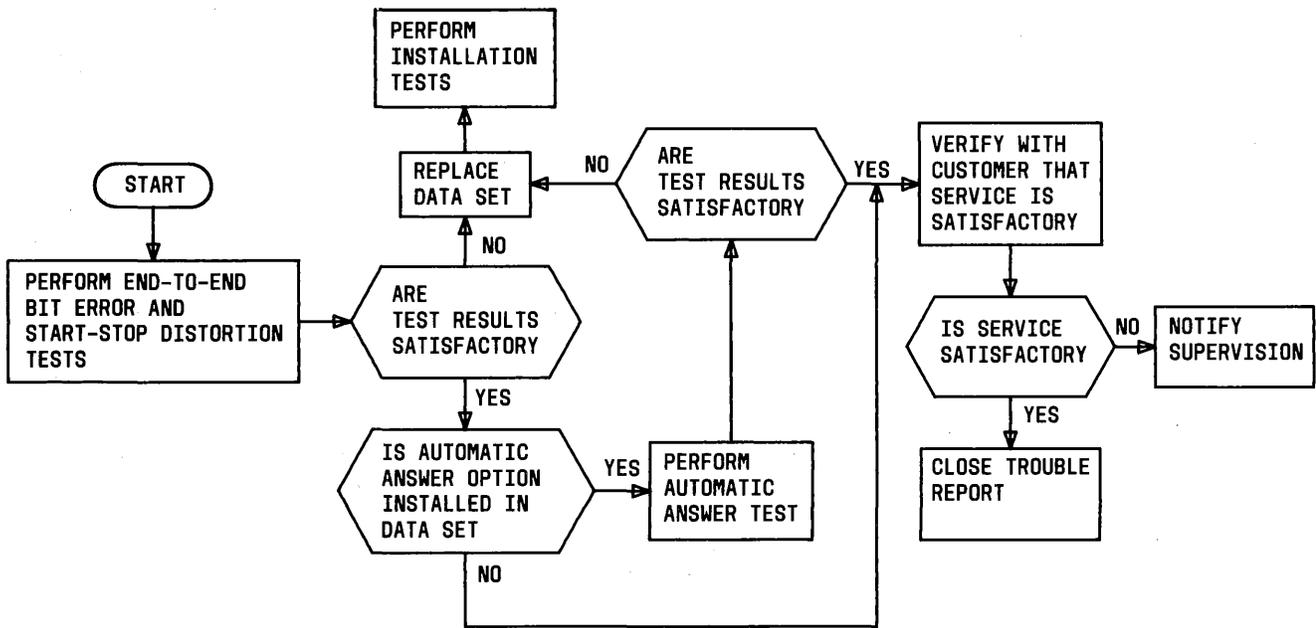


Fig. 4—Maintenance Test Sequence

4. TEST PROCEDURES

4.01 This part provides the procedures for the installation and maintenance tests.

A. Remote Test

4.02 This test allows a data test center (DTC) to check the data set transmitter and receiver and the facilities connecting the data set and the DTC. The customer interface is not checked.

4.03 Perform the test as follows:

- (1) For DS 103A2-type, call DTC and request a remote test.
- (2) For DS 103A3, if AUTO ANS lamp on telephone set is lighted, depress MANUAL

ANS button on telephone set. When AUTO ANS lamp goes off, call DTC and request a remote test.

**Note:** If DS 103A3 has been modified (DS 103E5 or 103E6 replaced with DS 103E2 or 103E4 optioned to operate in the inverted frequency mode), notify DTC of change.

- (3) DTC provides instructions for remainder of test and restores data set to normal operation at end of test.

B. Initial Test Setup for 921A DTS

4.04 Perform the initial test setup for the 921A DTS when used to test DS 103A-type as follows:

STEP	ACTION	VERIFICATION
1	Connect data set to DTS using interface cable and Electronic Industries Association (EIA) adapter cord provided with DTS.  <b>Note:</b> The interface cable is equipped with two 37-pin connectors. The 6-inch adapter cord is equipped with a 37-pin female connector	

STEP	ACTION	VERIFICATION
	and a 25-pin male connector. Connect interface cable from DATA SET (DCE) connector on DTS to 37-pin connector on adapter cord. Insert 25-pin connector on adapter cord into customer interface connector on data set.	
2	Connect DTS to a 105- to 129-Vac 60-Hz power source.	
3	Apply power to data set.	
4	On front of DTS, set POWER switch to ON.	POWER lamp lights.
5	Press RST on keyboard.  <i>Note:</i> If RST is pressed during a test, the test is ended and the DTS recycles to this step.	Display reads (briefly) version number of DTS. DTS then performs self tests. If DTS is defective, display reads— TEST FAILED. If DTS is satisfactory, display reads— DATA SET:
6	Remove EIA interface module from storage and ensure that all 25 interface module switches are in TERM position.	
7	On right side of DTS, ensure that locking lever is in OPEN position.	
8	Insert interface module into slot.	
9	Move locking lever to CLOSE position.	
10	On front of DTS, ensure that all 37 DCE interface lead switches are in NORM position.	
11	Enter 20 on keyboard.  <i>Note:</i> To delete a wrong entry on keyboard during any test, press back arrow (←).	Display reads— DATA SET: 20
12	Press GO.	Display reads— BIT RATE:
13	Enter 03.  <i>Note:</i> If data set is a 103A2 or 103A2B, enter 01 instead of 03. Display reads—BIT RATE: 01.	Display reads— BIT RATE: 03

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STEP	ACTION	VERIFICATION
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14	Press GO.	Display reads— TEST SEQ:
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**Note:** If GO or TST is pressed at an unauthorized point in a test, the test is ended and the DTS recycles to this step.

**C. End-to-End Bit Error Test**

**4.05** This test checks the transmitter and receiver of a local and a distant data set and the facilities connecting the data sets. The customer interface at both data sets is also checked. Identical test data is generated by DTSs at both data sets.

This data is transmitted by one of the data sets and compared to the data generated by the DTS at the receiving data set. Data errors are indicated by the DTS display.

**4.06** Perform the test as follows:

STEP	ACTION	VERIFICATION
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1	Establish voice communication between the data stations and arrange to conduct an end-to-end bit error test.	
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**At both stations, perform Steps 2 through 10.**

2	For DS 103A3, if AUTO ANS lamp on telephone set is lighted, depress MANUAL ANS button on telephone set.	AUTO ANS lamp on telephone set goes off.
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3	Ensure that initial test setup described in paragraph 4.04 has been performed.	Display reads— TEST SEQ:
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4	On DTS, enter 55.	Display reads— TEST SEQ: 55
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5	Press GO.	Display reads— TRANSMITTER=? 1=921 2=914 3=903
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6	Enter 1, 2, or 3 to correspond to the type of DTS being used at distant end.	Typical display reads (briefly)— TRANSMITTER=1 1=921 2=914 3=903 Display then reads— D=DT 0=SP 1=MK 2=2047 5=511 6=63
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7	Enter 5.  <b>Note:</b> If distant end DTS is a 903, enter 6 instead of 5. Display reads (briefly)—63 BIT ERROR TEST.	Display reads (briefly)— 511 BIT ERROR TEST Display then reads— 1=BIT ERRORS 2=BLOCK ERRORS
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8	Enter 1.	Display reads— ???? SECONDS
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STEP	ACTION	VERIFICATION
9	Place data set in data mode.	On DTS, DSR indicator lights.
10	Enter 0900.  <i>Note:</i> To perform functions listed below, press associated key.	Display reads (briefly)— 0900 SECONDS Display then reads— 0000 BITS IN ERROR From this point, display counts number of bits in error. If sync is lost during test, display flashes OSYN. If this occurs, test must be repeated by pressing A. At end of test, display reads TEST COMPLETE, total sync losses, and total bits in error.
	<b>KEY            FUNCTION</b>	
	A Repeat test.	
	B Display time remaining in test.	
	C Clear display.	
	D End test.	
	E Inject 8 errors into data stream.	
	F Force out-of-sync condition.	<b>Requirement:</b> Total bits in error are less than 6.

**D. End-to-End Start-Stop Distortion Test**

**4.07** This test uses the 921A DTS to measure three types of start-stop distortion, as follows:

- Peak distortion

- Number of "hits" above a specified threshold
- Average bias distortion.

**4.08** Perform the test as follows:

*Note:* A 911-type DTS can be used at the distant data station.

STEP	ACTION	VERIFICATION
1	Establish voice communication between the data stations and arrange to conduct an end-to-end start-stop distortion test.	
<b>At both stations, perform Steps 2 through 12.</b>		
2	For DS 103A3, if AUTO ANS lamp on telephone set is lighted, depress MANUAL ANS button on telephone set.	AUTO ANS lamp on telephone set goes off.
3	Ensure that initial test setup described in paragraph 4.04 has been performed.	Display reads— TEST SEQ:
4	Enter 52 79.	Display reads— TEST SEQ: 52 79

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STEP	ACTION	VERIFICATION
5	Press GO.	Display reads— PARITY=? (0=EVEN, 1=ODD)
6	Enter 0.	Display reads (briefly)— PARITY=0 (0=EVEN, 1=ODD) Display then reads— TRMT=? (1=MAN 2=CONT)
7	Enter 2.  <i>Note:</i> Ignore display, PRESS A TO START.	Display reads (briefly)— TRMT=2 (1=MAN 2=CONT) Display then reads— PRESS A TO START
8	Press GO.	Display reads (briefly)— TEST INTERRUPTED Display then reads— MODE=? (1=RCV 2=RCV & TRMT)
9	Enter 2.	Display reads (briefly)— MODE=2 (1=RCV 2=RCV & TRMT) Display then reads— HITS OVER ??% (MAX=49%)
10	Enter 08.	Display reads (briefly)— HITS OVER 08% (MAX=49%) Display then reads— ???? SECONDS
11	Place data set in data mode.	On DTS, DSR indicator lights.
12	Enter 0060 and after about 2 seconds, press C.  <i>Note:</i> To perform functions listed below, press associated key.	Display reads (briefly)— 0060 SECONDS Display then reads— PEAK=00% HITS=00/08 AVG BIAS=00% At end of test, display reads TEST COMPLETE and test results.

**KEY            FUNCTION**

- A Repeat test.
- B Display time remaining in test.
- C Clear display.
- D End test.

**Requirements:**

1. Less than 09% peak distortion.
2. Less than 01/08 hits.
3. Less than 03% average bias distortion.

**E. Automatic Answer Test**

**4.09** This test uses the DTS to verify that the data set will automatically answer a call, go to the data mode, and end the call.

**4.10** Perform the test as follows:

STEP	ACTION	VERIFICATION
1	Ensure that initial test setup described in paragraph 4.04 has been performed.	Display reads— TEST SEQ:
2	Enter 40.	Display reads— TEST SEQ: 40
3	Press GO.	Display reads— WAITING FOR RI
4	For DS 103A2-type with wiring option W (alternate automatic or manual answering) installed in telephone set, if AUTO lamp on telephone set is off, depress AUTO button on telephone set.	AUTO lamp on telephone set lights.
5	For DS 103A3, if AUTO ANS lamp on telephone set is off, depress AUTO ANS button on telephone set.	AUTO ANS lamp on telephone set lights.
6	Place a call to data set from any convenient telephone set.	Display reads— RINGING (during ringing period—ring indicator lead <b>on</b> ). ASSIGNABLE 1 indicator follows ring indicator lead. After 3 complete ringing cycles, DTR indicator lights (data terminal ready lead <b>on</b> ). After several seconds, DSR indicator lights (data set ready lead <b>on</b> ). Display then reads— ANSWERED After several more seconds, DTR indicator goes off (data terminal ready lead <b>off</b> ). Then DSR indicator immediately goes off (data set ready lead <b>off</b> ).  <b>Requirement:</b> Display reads (briefly)— TEST PASSED

**F. Interface Test**

**4.11** This test checks the ability of the data set to respond to interface control and to provide

indications through the interface. The signals that the data set will respond to and the indications given depend on the options installed. In this test, the DS 103A-type interface is checked using a 921A

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DTS. This test requires assistance from a data test center (DTC).

ability of the data set to disconnect (go on-hook) upon receiving a spacing signal from a distant data set.

**4.12 Test of Receive Space Disconnect—LONG Option:** This test checks the

**4.13** Perform the test as follows:

STEP	ACTION	VERIFICATION
1	For DS 103A2-type, verify that responds to disconnect option is installed in data set.	
2	For DS 103A3, verify that option V (receive space disconnect—LONG) is installed in data set.	
3	Ensure that initial test setup described in paragraph 4.04 has been performed.	Display reads— TEST SEQ:
4	Enter 37.	Display reads— TEST SEQ: 37 DTR=? (0 OR 1)
5	Enter 1.	Display reads— TEST SEQ: 37 DTR=1 (0 OR 1)
6	Press GO.	Display reads (briefly)— TEST COMPLETE Display then reads— TEST SEQ:
7	For DS 103A3, if AUTO ANS lamp on telephone set is lighted, depress MANUAL ANS button on telephone set.	AUTO ANS lamp on telephone set goes off.
8	Place a call to DTC and request DTC to place a call to data set and then send about 10 seconds of marking followed by at least 4 seconds of spacing.	
9	Answer call, go to data mode, and place handset on-hook.	<b>Requirements:</b> On DTS, DSR indicator lights and shortly thereafter RLSD and CS indicators light.
10	When DTC sends spacing.	<b>Requirements:</b> On DTS, RD-0 indicator lights and about 1-1/2 seconds later RLSD, DSR, and CS indicators go off (data set drops call).

**4.14 Test of CB and CE Indications—COMMON Option (DS 103A3 Only):**

detector (CF) interface circuit goes **off**. This test checks proper operation of this option.

When option A (CB and CF indications—COMMON) is installed, the clear-to-send (CB) interface circuit is forced **off** whenever the received line signal

**4.15** Perform the test as follows:

STEP	ACTION	VERIFICATION
1	Verify that option A (CB and CF indications—COMMON) and option W/O S (loss of carrier disconnect—NO) are installed in data set.	
2	Ensure that initial test setup described in paragraph 4.04 has been performed.	Display reads— TEST SEQ:
3	Enter 37.	Display reads— TEST SEQ: 37 DTR=? (0 OR 1)
4	Enter 1.	Display reads— TEST SEQ: 37 DTR=1 (0 OR 1)
5	Press GO.	Display reads (briefly)— TEST COMPLETE Display then reads— TEST SEQ:
6	If AUTO ANS lamp on telephone set is lighted, depress MANUAL ANS button on telephone set.	AUTO ANS lamp on telephone set goes off.
7	Place a call to DTC and request DTC to place a call to data set.	
8	Answer call, go to data mode, and place handset on-hook.  <i>Note:</i> DTC should go to data mode after receiving answer tone.	<b>Requirements:</b> On DTS, DSR indicator lights and shortly thereafter RLSD and CS indicators light.
9	Have DTC go from data mode to talk mode without dropping call (or go from TEST to TALK of 904 DTC).	<b>Requirements:</b> On DTS, RLSD and CS indicators go off and DSR indicator remains lighted.

**4.16 Test of Loss of Carrier Disconnect—YES Option (DS 103A3 Only):** When option S (loss of carrier disconnect—YES) is installed, the data set terminates the call if carrier disappears

from the line for approximately 200 ms. This test checks proper operation of this option.

**4.17** Perform the test as follows:

STEP	ACTION	VERIFICATION
1	Verify that option S (loss of carrier disconnect—YES) is installed in data set.	
2	Ensure that initial test setup described in paragraph 4.04 has been performed.	Display reads— TEST SEQ:
3	Enter 37.	Display reads— TEST SEQ: 37 DTR=? (0 OR 1)

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<b>STEP</b>	<b>ACTION</b>	<b>VERIFICATION</b>
4	Enter 1.	Display reads— TEST SEQ: 37 DTR=1 (0 OR 1)
5	Press GO.	Display reads (briefly)— TEST COMPLETE Display then reads— TEST SEQ:
6	If AUTO ANS lamp on telephone set is lighted, depress MANUAL ANS button on telephone set.	AUTO ANS lamp on telephone set goes off.
7	Place a call to DTC and request DTC to place a call to data set.	
8	Answer call, go to data mode, and place handset on-hook.  <i>Note:</i> DTC should go to data mode after receiving answer tone.	<b>Requirements:</b> On DTS, DSR indicator lights and shortly thereafter RLSD and CS indicators light.
9	Have DTC go from data mode to talk mode without dropping call (or go from TEST to TALK at 904 DTC).	<b>Requirements:</b> On DTS, RLSD and CS indicators go off immediately. DSR indicator goes off in about 200 ms or after about 3 seconds if option T is installed in data set.

**5. REFERENCES**

<b>SECTION</b>	<b>TITLE</b>	<b>SECTION</b>	<b>TITLE</b>
5.01	Additional information concerning the testing of DS 103A-type is contained in the following publications:	591-014-101	Data Set 103A3—Description and Operation
		591-014-200	Data Set 103A-Type—Installation and Connections
107-402-100	921A Data Test Set—Description and Operation	591-014-201	Data Set 103A3—Installation and Connections
314-205-501	Data Systems—DATAPHONE® Service and Data Access Arrangements Direct Distance Dialing Network—Test Requirements for Subscriber, Foreign Exchange, and Remote Exchange Lines	591-014-500	Data Sets 103A2, 103A2A, and 103A2B—Test Procedures
		591-014-501	Data Set 103A3—Test Procedures
591-014-100	Data Set 103A-Type—Description	668-010-300	Data Systems—DATAPHONE® Service on Direct Distance Dialing Network—Data Test Center—Trouble Analysis Procedures