

**DATA SET 201C-L1**  
**TRANSMITTER-RECEIVER**  
**TEST PROCEDURES USING 921A DATA TEST SET**

CONTENTS	PAGE	CONTENTS	PAGE
1. GENERAL . . . . .	1	I. Transmitter Output Test . . . . .	18
A. Test Capabilities . . . . .	2	2-Wire Switched Network . . . . .	18
B. Restrictions on Use of Self Tests . . . . .	2	2-Wire or 4-Wire Private Line . . . . .	20
2. INSTALLATION TESTS . . . . .	2	J. Digital Loopback Test (4-Wire Private Line) . . . . .	21
3. MAINTENANCE TESTS . . . . .	2	K. End-to-End Block Error Test . . . . .	22
4. TEST PROCEDURES . . . . .	9	2-Wire Switched Network or 2-Wire Private Line . . . . .	23
A. Analog Loopback Self Test . . . . .	10	4-Wire Private Line . . . . .	25
B. Digital Loopback Self Test (4-Wire Private Line) . . . . .	11	L. Automatic Answer Test (2-Wire Switched Network) . . . . .	26
C. End-to-End Self Test . . . . .	12	M. Start-Up Tests . . . . .	27
2-Wire Switched Network . . . . .	12	Analog Loopback Start-Up Test . . . . .	27
2-Wire Private Line . . . . .	13	Digital Loopback Start-Up Test (4-Wire Private Line) . . . . .	28
4-Wire Private Line . . . . .	13	End-to-End Start-Up Test . . . . .	30
D. Remote Test . . . . .	14	5. REFERENCES . . . . .	32
2-Wire Switched Network . . . . .	14		
2-Wire Private Line . . . . .	14	1. GENERAL	
4-Wire Private Line . . . . .	14	1.01 This section contains test procedures using the 921A data test set (DTS) and the self-test capabilities of data set (DS) 201C-L1. Test procedures using the 914-type DTS and the self-test capabilities of DS 201C-L1 are contained in Section 592-029-500. These procedures are to be used when testing DS	
E. Initial Test Setup for 921A DTS . . . . .	14		
F. Analog Loopback Test . . . . .	16		
G. CA-CB (RS-CS) Interval Test . . . . .	17		
H. Transmitter Clock Test . . . . .	17		

**NOTICE**

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## SECTION 592-029-501

201C-L1 on an initial installation or during a maintenance visit.

**1.02** This section is reissued to add coverage for Version 2 of the 921A DTS. Since this reissue is a general revision, arrows normally used to indicate changes have been omitted.

**1.03** When DS 201C-L1 is used as an extension of a DS 209A-L1 multiplex system, refer to Section 592-032-300 for maintenance information. Procedures used at the serving test center (STC) to maintain this system are contained in Section 666-511-504.

**1.04** When DS 201C-L1 is used as a subrate off-net extension of the Digital Data System (DDS), refer to Section 314-919-300 for maintenance information. Procedures used at the hub office STC to maintain the analog portion of this system are contained in Section 666-511-501.

### A. Test Capabilities

**1.05** Test circuitry built into DS 201C-L1 permits the following self tests to be performed: analog loopback, digital loopback, and end-to-end. The test circuitry also facilitates the remote test of the data set from a test center. The analog loopback, digital loopback, and end-to-end tests can also be performed by use of external test equipment such as the 921A DTS. The automatic answer and start-up tests require use of the 921A DTS.

**1.06** 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 the testing of serial data sets. The 921A DTS also provides additional testing capabilities that are described in Section 107-402-100. Input to the 921A DTS is made through a 20-button keyboard. A 32-character display provides operator prompting and test results.

### B. Restrictions on Use of Self Tests

**1.07** If DS 201C-L1 is used as a remote extension of a DS 209A-L1 multiplex system or as a subrate off-net extension of the digital data system

(DDS), the following restrictions apply to the use of the self tests:

(a) The analog loopback self test cannot be performed at a remote extension with options as installed. If the internal timing option is temporarily installed or the M23B cord is temporarily removed at the remote extension, this test can be performed.

(b) The digital loopback self test cannot be performed from a remote extension (with options as installed) in toward DS 201C-L1 collocated with DS 209A-L1. If the internal timing option is temporarily installed or the M23B cord is temporarily removed at the remote extension, this test can be performed.

(c) The digital loopback self test cannot be performed from a remote extension (with options as installed) in toward a hub office of the DDS. If the internal timing option is temporarily installed or the M23B cord is temporarily removed at the remote extension, this test can be performed.

## 2. INSTALLATION TESTS

**2.01** This part provides the sequence in which tests are to be performed following installation of the data set. This test sequence provides a method of verifying that the installation is satisfactory. The self-test features of the data set are used for all installation testing—external test equipment is not required.

**2.02** Before proceeding with the tests for a switched network installation, verify that the local loop meets the requirements specified in Section 314-205-501. For a 2-wire switched network, the installation test sequence is shown in Fig. 2.

**2.03** Before proceeding with the tests for a private line installation, verify that the private line meets the requirements specified in Section 314-410-500. For a 2-wire private line, the installation test sequence is shown in Fig. 3. For a 4-wire private line, the installation test sequence is shown in Fig. 4.

## 3. MAINTENANCE TESTS

**3.01** This part provides the sequence in which tests are to be performed when clearing a

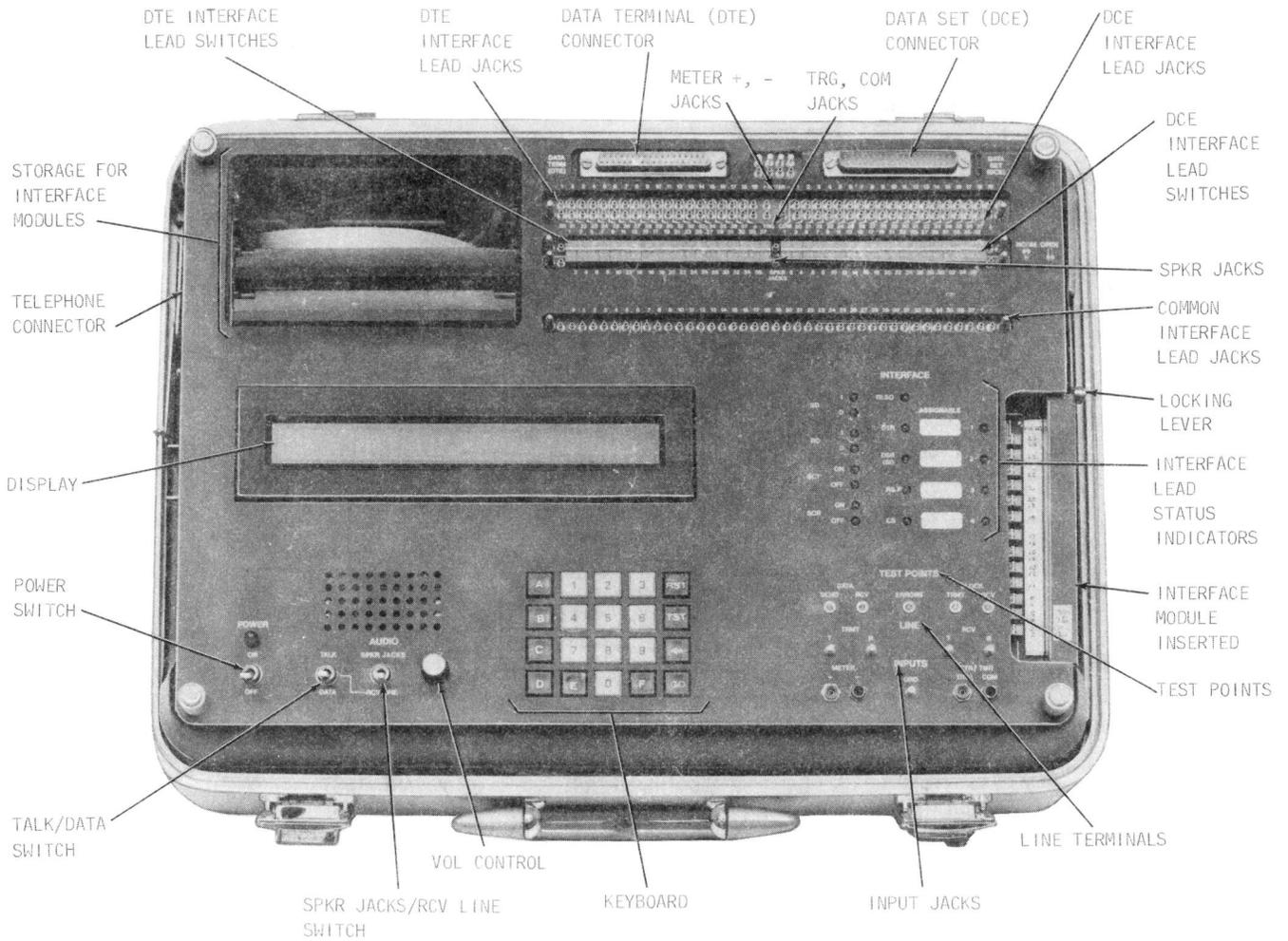


Fig. 1—921A Data Test Set—Front Panel

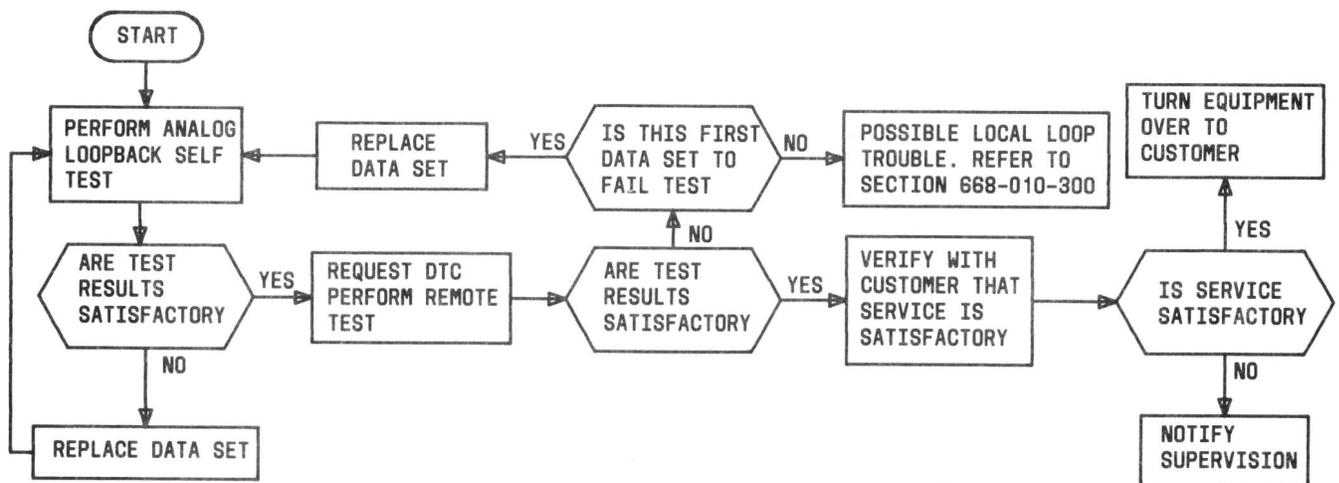


Fig. 2—Installation Test Sequence (2-Wire Switched Network)

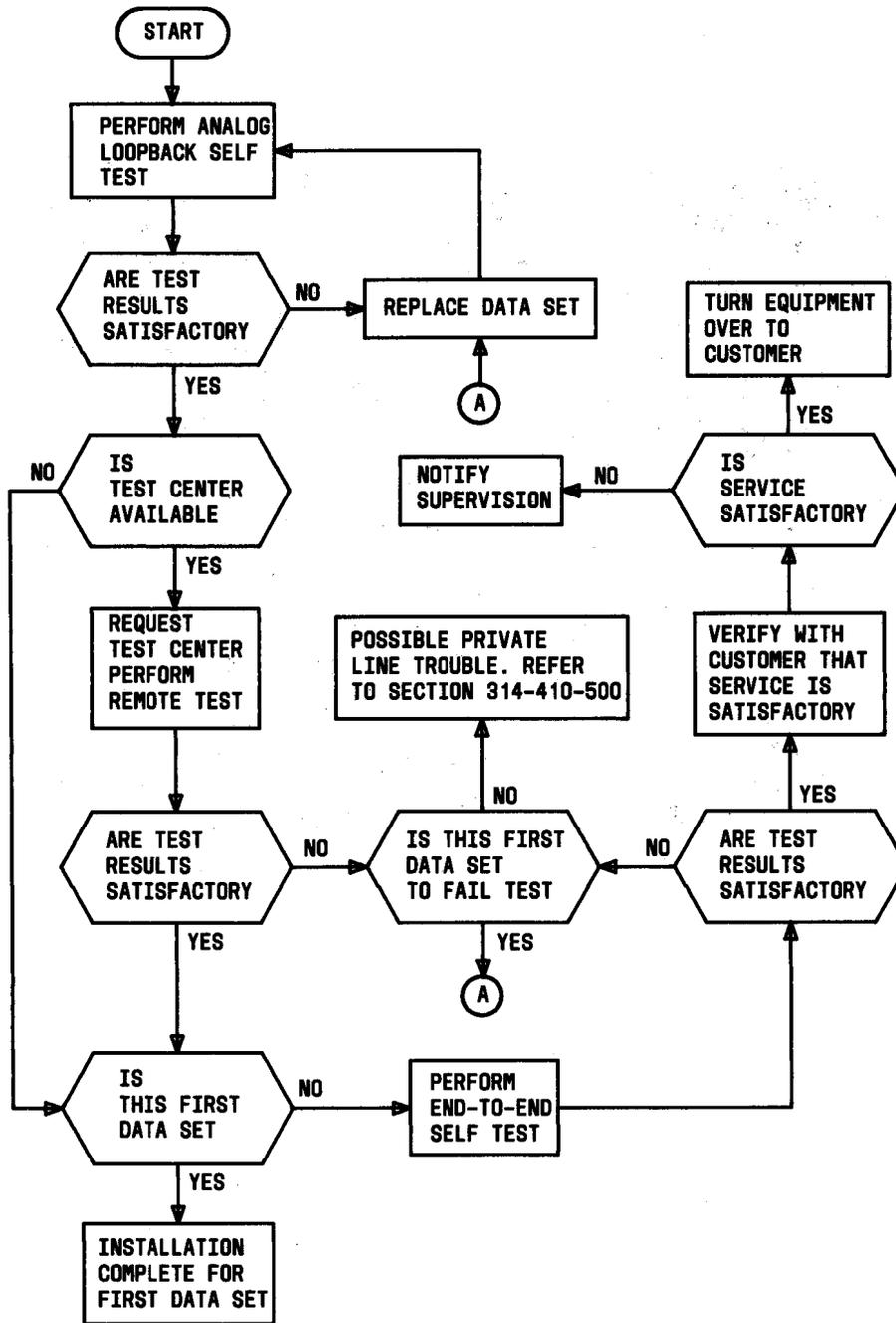


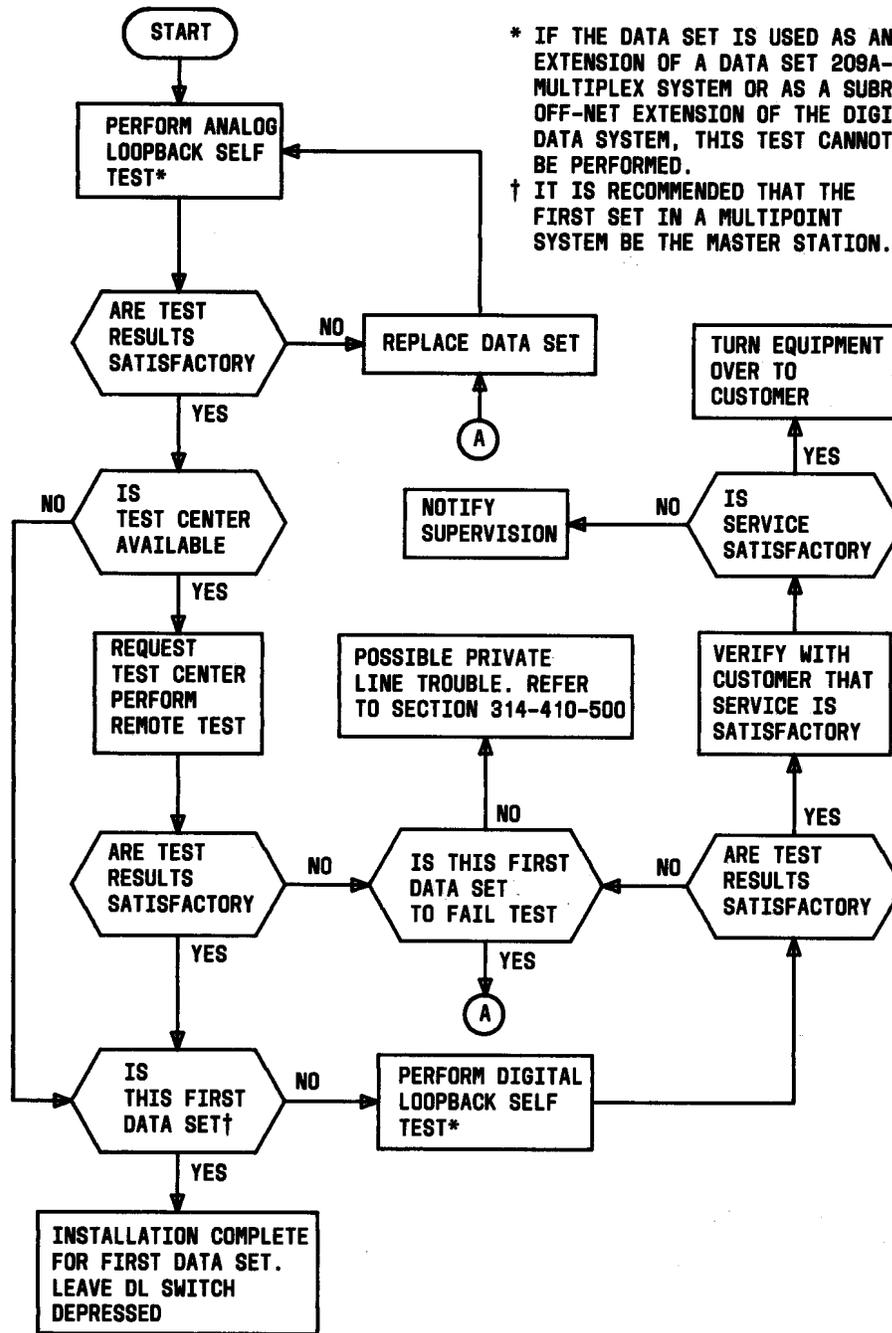
Fig. 3—Installation Test Sequence (2-Wire Private Line)

trouble report and during a maintenance visit to the data station.

**3.02** When a trouble report is received, a test center is responsible for isolating the trouble to the data station or the transmission facility. The procedure for doing this is shown in Fig. 5

(2-wire switched network), Fig. 6 (2-wire private line), and Fig. 7 (4-wire private line).

**3.03** If the trouble seems to be in the data station equipment, a telephone company (telco) employee must be dispatched to conduct more



\* IF THE DATA SET IS USED AS AN EXTENSION OF A DATA SET 209A-L1 MULTIPLEX SYSTEM OR AS A SUBRATE OFF-NET EXTENSION OF THE DIGITAL DATA SYSTEM, THIS TEST CANNOT BE PERFORMED.  
 † IT IS RECOMMENDED THAT THE FIRST SET IN A MULTIPOINT SYSTEM BE THE MASTER STATION.

Fig. 4—Installation Test Sequence (4-Wire Private Line)

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. 8 (2-wire switched network), Fig. 9 (2-wire private line), and Fig. 10 (4-wire private line) 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, and returned to

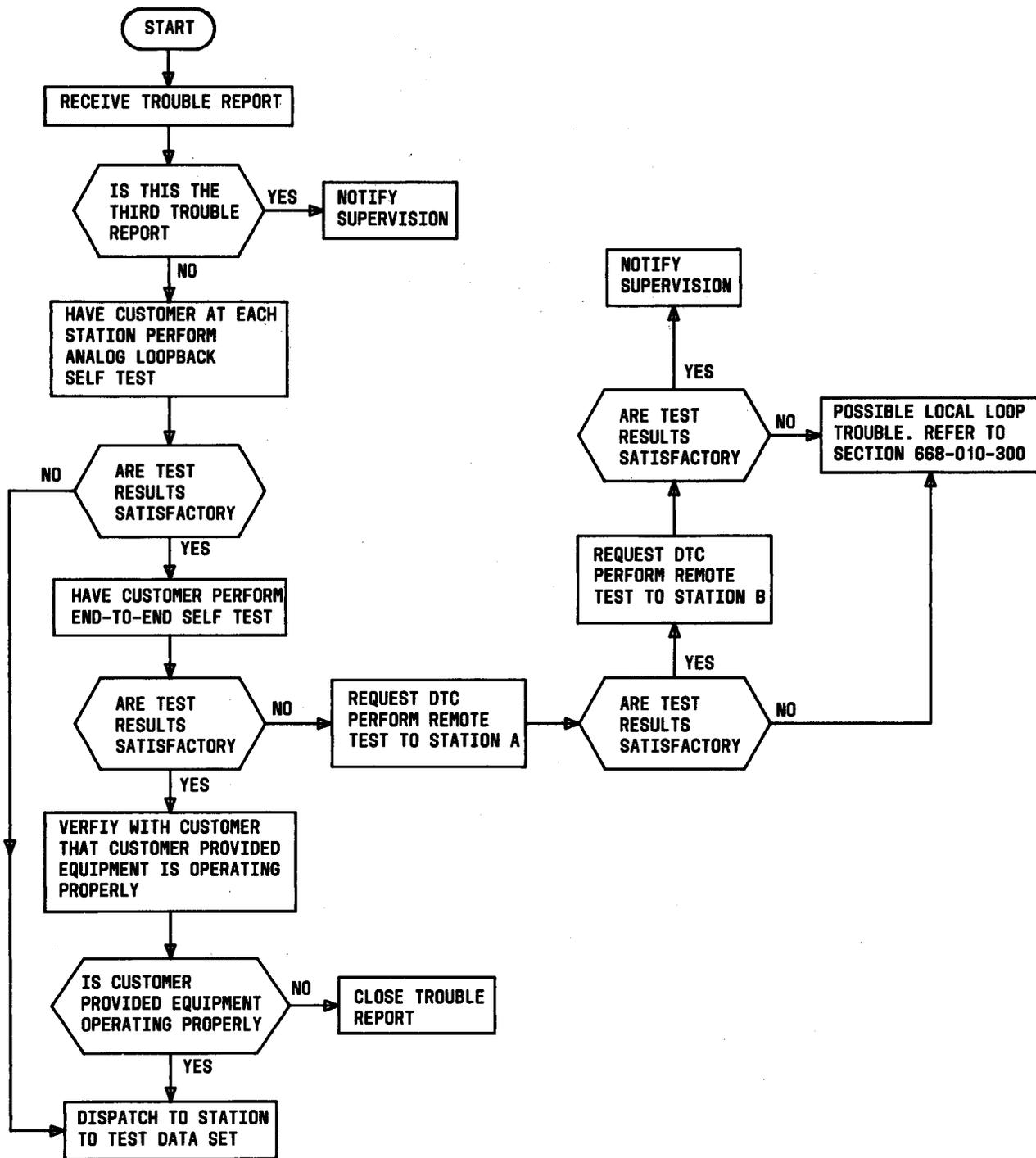


Fig. 5—Clearing Trouble Report (2-Wire Switched Network)

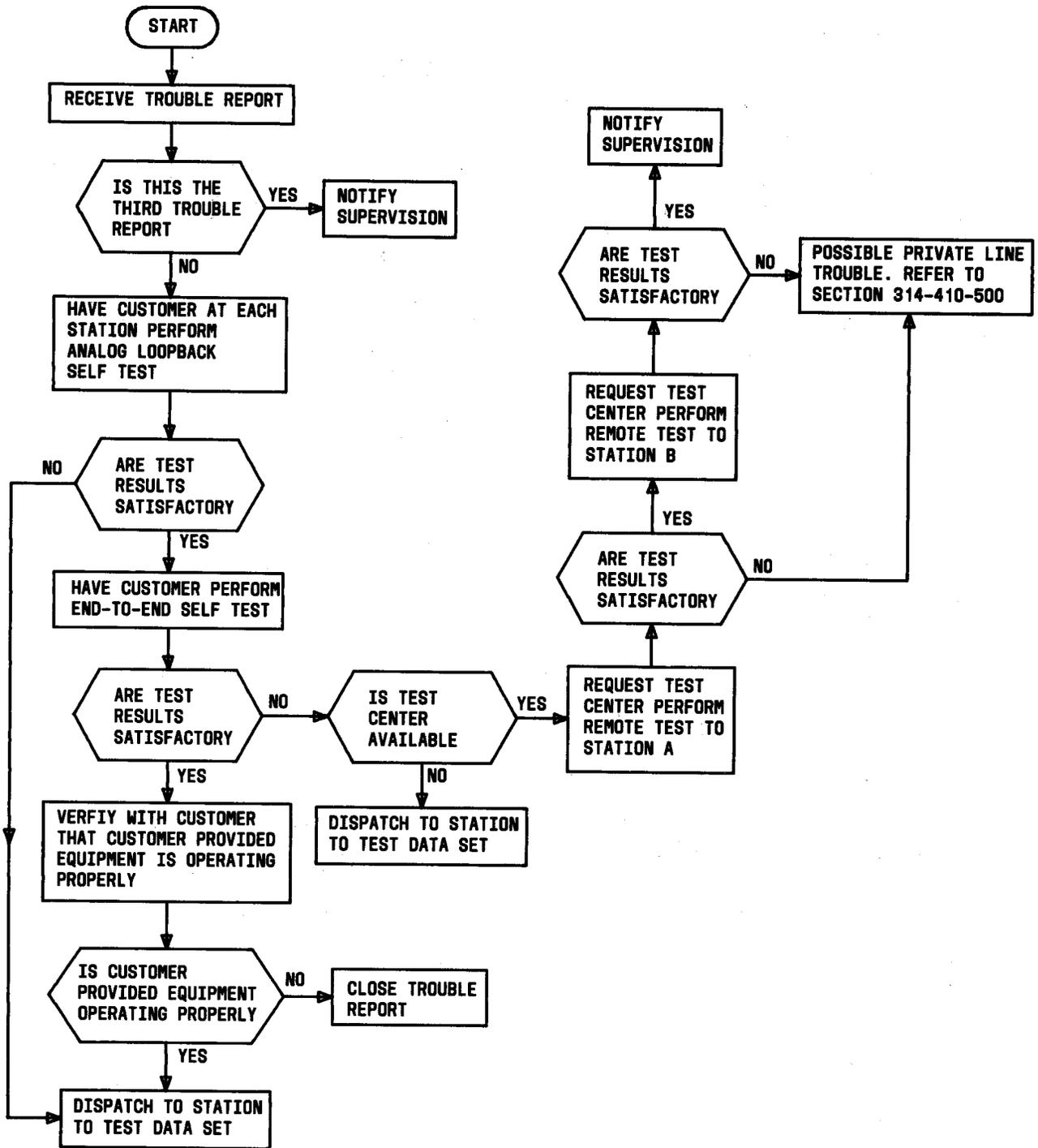


Fig. 6—Clearing Trouble Report (2-Wire Private Line)

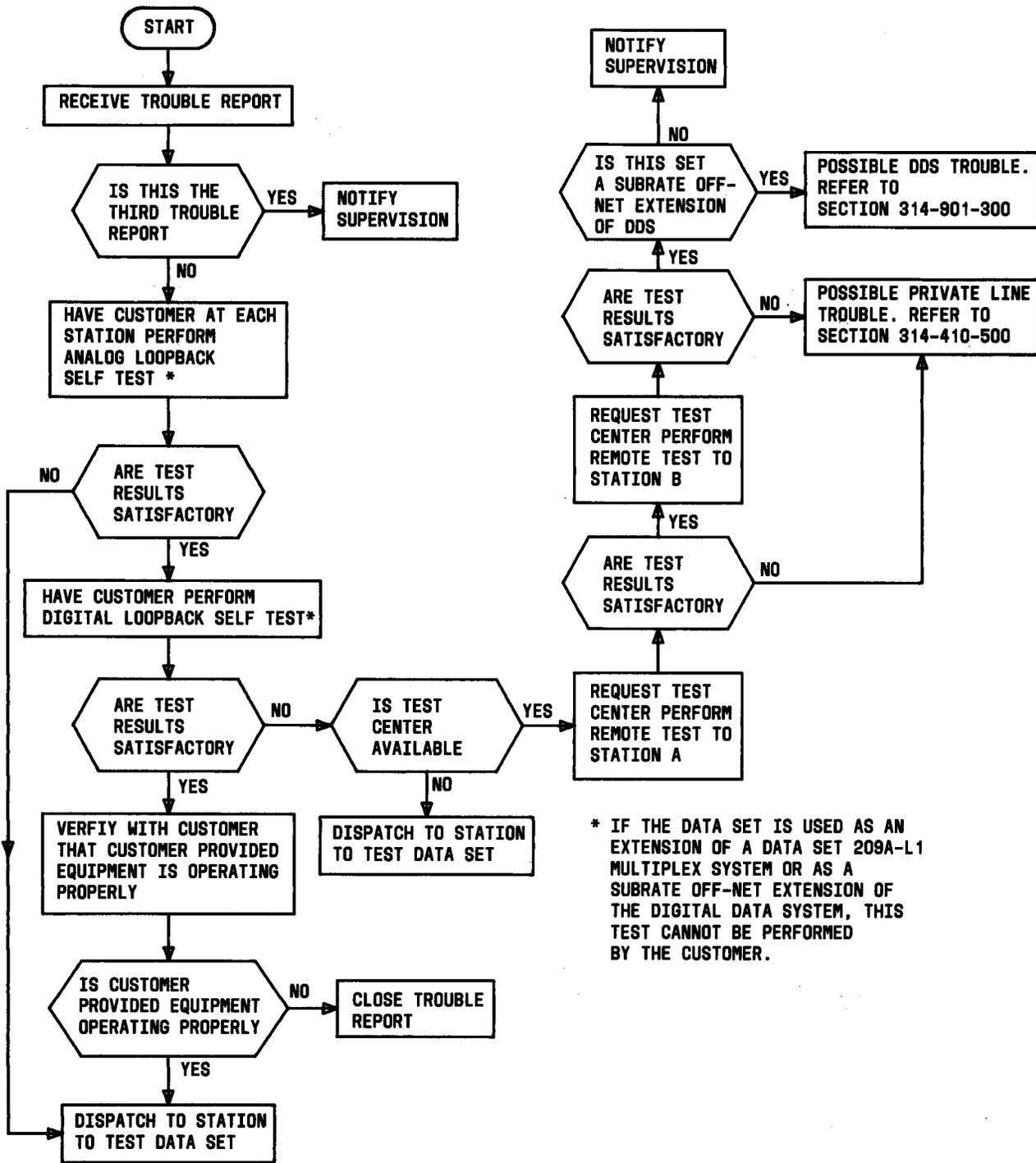


Fig. 7—Clearing Trouble Report (4-Wire Private Line)

the 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.

**4. TEST PROCEDURES**

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

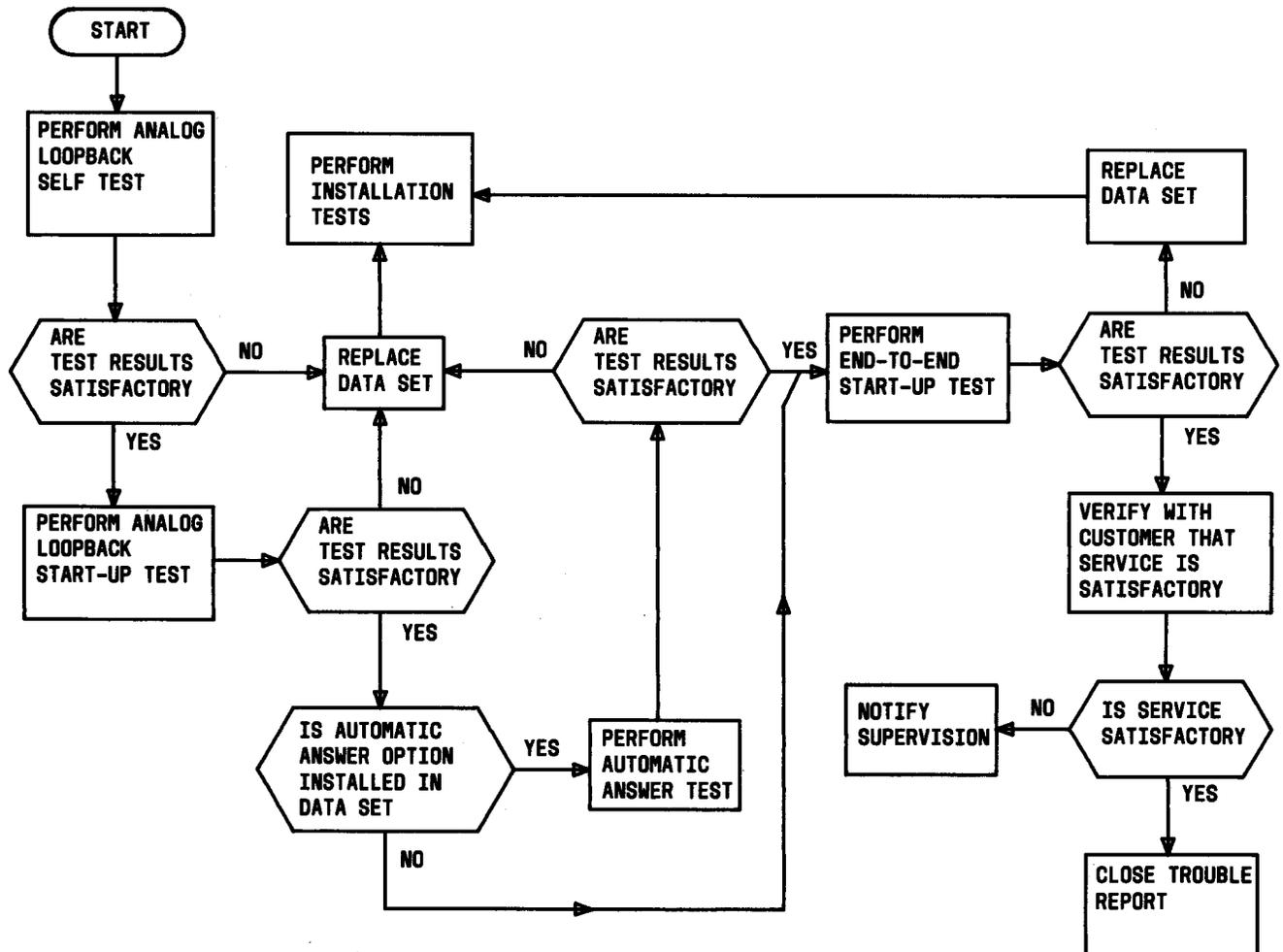


Fig. 8—Maintenance Test Sequence (2-Wire Switched Network)

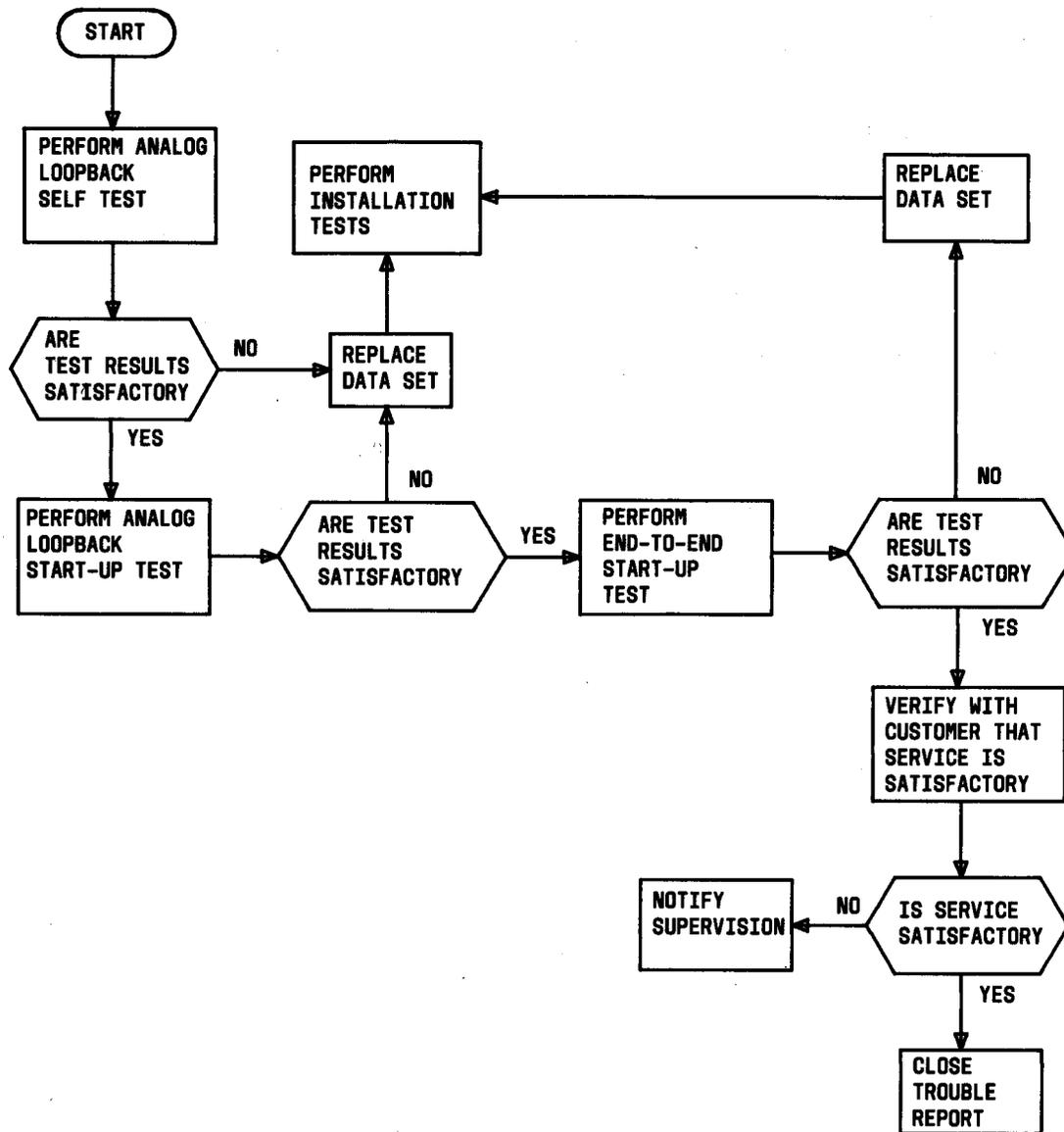


Fig. 9—Maintenance Test Sequence (2-Wire Private Line)

#### A. Analog Loopback Self Test

**4.02** This test checks the data set transmitter and receiver. The customer interface is not checked. Test data generated by the data set is looped back internally from the transmitter output to the receiver input. The received data is compared to the original data. Data errors and data set condition are indicated by the status of the data set indicator lamps.

**4.03** Perform the test as follows.

- (1) Ensure that data set is not transmitting or receiving data.
  - (2) Depress AL and ST switches on data set.
  - (3) Observe lamps on data set for at least 30 seconds.
- Requirements:** MC lamp is off continuously (does not blink). All other lamps are lighted.
- (4) Depress RO switch on data set.



(1) Ensure that data set is not transmitting or receiving data.

(2) Depress ST switch on data set.

**Requirement:** TM lamp lights.

(3) Contact distant data station and have DL switch on data set depressed. Verify that TM lamp is lighted.

**Requirements:** On local data set, all lamps are lighted except MC.

(4) Observe MC lamp for ten 1-minute periods.

**Requirement:** MC lamp does not blink more than an average of two blinks per 1-minute period.

(5) Contact distant data station and have DL switch on data set released. Verify that TM lamp is off.

(6) Release ST switch on local data set.

**Requirement:** TM lamp goes off.

**C. End-to-End Self Test**

**4.06** This test checks the transmitter and receiver of both data sets and the facilities connecting the data sets. The customer interfaces are not checked. Identical test data is generated by both data sets, transmitted by one of the data sets, and compared to the data generated by the receiving data set. Data errors and data set condition are indicated by the status of the indicator lamps on the data sets.

**2-Wire Switched Network**

**4.07** For the 2-wire switched network, a complete end-to-end self test involves making one 6-minute test run. Both data sets alternately transmit and receive blocks of data for about 2 seconds. Perform the test as follows.

(1) Establish voice communication between the data stations and arrange to conduct an end-to-end self test.

(2) Ensure that neither data set is transmitting or receiving data.

(3) On local data set, depress ST switch.

**Requirement:** TM lamp lights.

(4) On distant data set, depress RT switch.

**Requirement:** TM lamp lights.

(5) At both data stations, end voice communication.

(6) At local data station make a call to distant data station. If automatic answer is installed in distant data set, the distant data set automatically answers and transmits a 2025-Hz answer tone for about 2 seconds, immediately followed by a block of data for about 2 seconds (see note). After answer tone and the 2-second block of data (if present) are heard at local data set, depress DATA button on associated telephone set. If automatic answer is not installed in distant data set, distant end must depress DATA button on associated telephone set after answering call.

**Requirements:** On telephone set, DATA lamp is lighted. On data set, all lamps are lighted except CO.

**Note:** Data sets equipped with CP JB2 digital board, series 6 and higher, do not send the 2-second block of data.

(7) On local data set, depress RT switch.

**Requirements:** RS, CS, CO, and MC lamps change state about every 2 seconds and follow turnaround sequence indicated as follows. All other lamps remain lighted continuously.

LAMP INDICATION	DURATION	MEANING
RS, CS, MC — lighted CO — off	About 2 seconds	Block is being transmitted
RS, CS, MC — off CO — lighted	About 2 seconds	Block is being received

(8) If an error occurs in either direction, MC lamp remains lighted continuously or turnaround sequence stops.

(9) To clear error condition, release RT switch on local data set when CO lamp is lighted. Wait about 5 seconds and depress RT switch.

(10) On local data set, observe lamp pattern for four 1-1/2 minute periods.

**Requirement:** Error condition does not occur more than an average of once per 1-1/2 minute period.

**Note:** If an error condition occurs when RT switch is first depressed, clear error condition but do not count it.

(11) Establish voice communication between the data stations and discuss the test results.

(12) On distant data set, release RT switch.

**Requirement:** TM lamp goes off.

(13) On local data set, release RT and ST switches.

**Requirement:** TM lamp goes off.

#### 2-Wire Private Line

**4.08** For a 2-wire private line, a complete end-to-end self test involves making one 10-minute test run in each direction. Perform the test as follows.

(1) Establish voice communication between the data stations and arrange to conduct an end-to-end self test.

(2) Ensure that neither data set is transmitting or receiving data.

(3) On transmitting data set, depress ST switch.

**Requirement:** All lamps are lighted except CO.

(4) On receiving data set, depress ST and RO switches.

**Requirement:** All lamps are lighted except RS, CS, and MC.

(5) On receiving data set, observe MC lamp for ten 1-minute periods.

**Requirement:** MC lamp does not blink more than an average of two blinks per 1-minute period.

(6) Perform the end-to-end self test in the opposite direction. The receiving data set now becomes the transmitting data set.

(7) On original receiving data set, release RO switch.

**Requirement:** All lamps are lighted except CO.

(8) On original transmitting data set, depress RO switch.

**Requirement:** All lamps are lighted except RS, CS, and MC.

(9) On current receiving data set, observe MC lamp for ten 1-minute periods.

**Requirement:** MC lamp does not blink more than an average of two blinks per 1-minute period.

(10) On current receiving data set, release RO switch.

**Requirement:** All lamps are lighted except CO.

(11) On both data sets, release ST switch.

**Requirement:** On both data sets, TM lamp goes off.

#### 4-Wire Private Line

**4.09** For a 4-wire private line, a complete end-to-end self test involves making one 10-minute test run in each direction. The runs are made simultaneously (full duplex). Perform the test as follows.

(1) Establish voice communication between the data stations and arrange to conduct an end-to-end self test.

- (2) Ensure that neither data set is transmitting or receiving data.
- (3) On both data sets, depress ST switch.

**Requirement:** On both data sets, all lamps are lighted except MC.

- (4) On both data sets, observe MC lamp for ten 1-minute periods.

**Requirement:** On both data sets, MC lamp does not blink more than an average of two blinks per 1-minute period.

- (5) On both data sets, release ST switch.

**Requirement:** On both data sets, TM lamp goes off.

**D. Remote Test**

**4.10** This test allows a test center to check the data set transmitter and receiver and the facilities connecting the data set and the test center. The customer interface is not checked.

**2-Wire Switched Network**

**4.11** For the 2-wire switched network, a data test center (DTC) and the data set generate test data. The DTC and the data set alternately transmit and receive blocks of this data for about 2 seconds. The received data is compared to the original data. Perform the test as follows.

- (1) Contact DTC and request a remote test.
- (2) When directed by DTC, depress RT switch on data set.

**Requirement:** TM lamp lights.

- (3) DTC performs remote test.

- (4) When directed by DTC, release RT switch on data set.

**Requirement:** TM lamp goes off.

**2-Wire Private Line**

**4.12** For a 2-wire private line, an end-to-end self test is performed with a test center replacing one of the data sets. Refer to paragraph 4.08 for the required test procedures.

**4-Wire Private Line**

**4.13** For a 4-wire private line, test data is generated and transmitted by a test center. This data is looped back internally from the receiver output to the transmitter input of the data set and retransmitted. The data is received by the test center and compared to the original data. Perform the test as follows.

- (1) Contact test center and request a remote test.
- (2) When directed by test center, depress DL switch on data set.

**Requirement:** TM lamp lights.

- (3) Test center performs remote test.
- (4) When directed by test center, release DL switch on data set.

**Requirement:** TM lamp goes off.

**E. Initial Test Setup for 921A DTS**

**4.14** Perform the initial test setup for the 921A DTS when used to test DS 201C-L1 as follows.

**STEP**

**ACTION**

**VERIFICATION**

1 Connect data set to DTS using interface cable and Electronic Industries Association (EIA) adapter cord provided with DTS.

**Note:** 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.	ON lamp lights.
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 RS-232-C 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 62 on keyboard.  <i>Note:</i> To delete a wrong entry on keyboard during any test, press back arrow (←).	Display reads— DATA SET: 62
12	Press GO.	Display reads— BIT RATE:
13	Enter 24.	Display reads— BIT RATE: 24
14	Press GO.  <i>Note:</i> If GO or TST is pressed at an unauthorized point in a test, the test is ended and the DTS recycles to this step.	Display reads— TEST SEQ:

**F. Analog Loopback Test**

**4.15** In this test, an analog loopback block error run is performed. The block error run checks the data set transmitter and receiver and the customer interface. Test data is generated by the 921A DTS and looped back internally from the

data set transmitter output to the receiver input. The received data is compared to the original data by the DTS. Data errors are indicated by the DTS display.

**4.16** Perform the test as follows.

STEP	ACTION	VERIFICATION
1	Ensure that initial test setup described in paragraph 4.14 has been performed.	Display reads— TEST SEQ:
2	On data set, depress AL switch.	TM lamp lights.
3	On DTS, enter 55.	Display reads— TEST SEQ: 55
4	Press GO.	Display reads (briefly)— SELECT ERROR TEST Display then reads— D=DT 0=SP 1=MK 2=2047 5=511 6=63
5	Enter 5.	Display reads (briefly)— 511 BIT ERROR TEST Display then reads— 1=BIT ERRORS 2=BLOCK ERRORS
6	Enter 2.	Display reads— ???? BITS IN A BLOCK
7	Enter 01024.	Display reads (briefly)— 01024 BITS IN A BLOCK Display then reads— ??? SECONDS
8	Enter 0300.	Display reads (briefly)— 0300 SECONDS Display then reads— BLK RCVD=0000 ERR=0000 From this point, display counts number of blocks received and number of blocks 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, total blocks received, and total blocks in error.

**Requirement:** No blocks in error.

**Note:** To perform functions listed below, press associated key.

STEP	ACTION	VERIFICATION
KEY	FUNCTION	
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.	
9	On data set, release AL switch.	TM lamp goes off.

**G. CA-CB (RS-CS) Interval Test**

turned *on* and the clear-to-send (CB) lead turns *on*.

**4.17** This test measures the interval between the time the request-to-send (CA) lead is

**4.18** Perform the test as follows.

STEP	ACTION	VERIFICATION
1	Ensure that initial test setup described in paragraph 4.14 has been performed.	Display reads— TEST SEQ:
2	On data set, depress AL switch.	TM lamp lights.
3	On DTS, enter 30.	Display reads— TEST SEQ: 30
4	Press GO.	Display reads RS-CS (CA-CB) interval in milliseconds.
	<i>Note 1:</i> Only the option actually installed in the data set need be tested.	<b>Requirement:</b>
	<i>Note 2:</i> To repeat test, press A.	Option XA—7 to 11 ms
		Option XB—7 to 11 ms
		Option XC—0 to 2 ms
		Option XD—138 to 158 ms
		Option XE—138 to 158 ms
5	On data set, release AL switch.	TM lamp goes off.

**H. Transmitter Clock Test**

**4.20** Perform the test as follows.

**4.19** This test measures the frequency of the transmitter clock signal, DB (SCT), on the transmitter signal element timing lead.

STEP	ACTION	VERIFICATION
1	Ensure that initial test setup described in paragraph 4.14 has been performed.	Display reads— TEST SEQ:
2	Enter 47 48 17 47.	Display reads— TEST SEQ: 47 48 17 47
3	Press GO.	Display reads (briefly)— TEST COMPLETE Display then reads— SW CONN: X=?? Y=??
4	Enter 04 03.	Display reads (briefly)— SW CONN: X=04 Y=03 Display then reads— SW CONN: X=?? Y=??
5	Press GO.	Display reads (briefly)— TEST INTERRUPTED  For Version 2 and higher DTS: Display then reads (briefly)— CROSS CONNECTIONS MANUALLY SET  Display then reads transmitter clock frequency in hertz.  <b>Requirement:</b> 2399 to 2401 Hz.
6	Press GO.	Display reads (briefly)— TEST INTERRUPTED  For Version 2 and higher DTS: Display then reads (briefly)— CROSS CONNECTIONS MANUALLY SET  Display then reads (briefly)— TEST COMPLETE Display then reads— TEST SEQ:

### I. Transmitter Output Test

**4.21** This test uses the 921A DTS to check the transmitter output. For private line service, the output level of the transmitted signal is measured with the DTS providing the proper output termination. For switched network service, an audio check of the transmitted signal is made.

Since the output termination is the actual telephone line impedance, an accurate measurement of the output level is difficult to obtain.

#### 2-Wire Switched Network

**4.22** Perform the test as follows.

STEP	ACTION	VERIFICATION
1	If option YH is installed in data set, temporarily install option YG.	
2	Ensure that initial test setup described in paragraph 4.14 has been performed.	Display reads— TEST SEQ:
3	If option YE is installed in data set, set DCE interface lead switch 21 to OPEN and connect a jumper wire between DCE interface lead jacks 9 and 21.	
4	Connect data set to DTS using telephone interface cable and adapter cord provided with DTS.  <i>Note:</i> The telephone interface cable is equipped with two 9-pin connectors. The 6-inch adapter cord is equipped with a 9-pin connector and a double-faced, 25-pin connector. Connect interface cable from 9-pin telephone connector on left side of DTS to 9-pin connector on adapter cord. Insert double-faced, 25-pin connector on adapter cord between telephone line connector on data set and telephone line cord.	
5	On front of DTS:  (a) Connect meter leads from LINE—TRMT terminals T and R to INPUTS—METER jacks + and -.  (b) Connect jumper wires from SPKR JACKS to METER jacks + and - located above SPKR JACKS.  (c) Set TALK/DATA switch to DATA.  (d) Set SPKR JACKS/RCV LINE switch to SPKR JACKS.	
6	Enter 53.	Display reads— TEST SET: 53
7	Press GO.	Display reads (briefly)— SELECT ERROR TEST Display then reads— D=DT 0=SP 1=MK 2=2047 5=511 6=63
8	Enter 1.	Display reads— MARKING BIT ERROR TEST

STEP	ACTION	VERIFICATION
9	Place a call to data set from any convenient telephone set.  <i>Note:</i> VOL control adjusts speaker volume.	<b>Requirement:</b> Ringing is heard on DTS speaker followed by answer tone sequence (1 second of silence, 2 seconds of 2021-Hz answer tone, and then continuous line signal from data set).
10	If option YG was temporarily installed in data set in Step 1, remove option YG and install option YH.	
11	Disconnect meter leads, jumper wires, telephone interface cable, and adapter cord.	

**2-Wire or 4-Wire Private Line**

4.23 Perform the test as follows.

STEP	ACTION	VERIFICATION
1	Ensure that initial test setup described in paragraph 4.14 has been performed.	Display reads— TEST SEQ:
2	Connect data set to DTS using telephone interface cable and adapter cord provided with DTS.  <i>Note:</i> The telephone interface cable is equipped with two 9-pin connectors. The 6-inch adapter cord is equipped with a 9-pin connector and a double-faced, 25-pin connector. Connect interface cable from 9-pin telephone connector on left side of DTS to 9-pin connector on adapter cord. Insert double-faced, 25-pin connector on adapter cord between telephone line connector on data set and telephone line cord.	
3	On front of DTS:  (a) Connect meter leads from LINE—TRMT terminals T and R to INPUTS—METER jacks + and -.  (b) Set TALK/DATA switch to DATA.  (c) Set SPKR JACKS/RCV LINE switch to RCV LINE.	
4	Enter 36.	Display reads— TEST SET: 36 RS=? (0 OR 1)

STEP	ACTION	VERIFICATION
5	Enter 1.	Display reads— TEST SET: 36 RS=1 (0 OR 1)
6	Enter 11.	Display reads— :11 R=? 1=135 6=600 9=900 0=N
7	Enter 6.	Display reads (briefly)— :11 R=6 1=135 6=600 9=900 0=N Display then reads— :
8	Press GO.	Display reads (briefly)— TEST COMPLETE Display then reads transmitter output level in mV ac and dBm.  <b>Requirement:</b> -2.0 to +2.0 dBm
9	Disconnect meter leads, telephone interface cable, and adapter cord.	

**J. Digital Loopback Test (4-Wire Private Line)**

**4.24** This test checks the transmitter and receiver of both data sets and the facilities connecting the data sets. The customer interface at the distant data set is not checked. Test data is generated by the 921A DTS and transmitted by the local data set. This data is looped back

internally from the receiver output to the transmitter input of the distant data set and retransmitted. The data is received by the local data set and compared to the original data by the DTS. Data errors are indicated by the DTS display.

**4.25** Perform the test as follows.

STEP	ACTION	VERIFICATION
1	Ensure that initial test setup described in paragraph 4.14 has been performed.	Display reads— TEST SEQ:
2	Contact distant data station and have DL switch on data set depressed.	TM lamp lights on distant data set.
3	On DTS, enter 55.	Display reads— TEST SEQ: 55
4	Press GO.	Display reads (briefly)— SELECT ERROR TEST Display then reads— D=DT 0=SP 1=MK 2=2047 5=511 6=63
5	Enter 5.	Display reads (briefly)— 511 BIT ERROR TEST Display then reads— 1=BIT ERRORS 2=BLOCK ERRORS

STEP	ACTION	VERIFICATION
6	Enter 2.	Display reads— ????? BITS IN A BLOCK
7	Enter 01024.	Display reads (briefly)— 01024 BITS IN A BLOCK Display then reads— ???? SECONDS
8	Enter 0900.	Display reads (briefly)— 0900 SECONDS Display then reads— BLK RCVD=0000 ERR=0000 From this point, display counts number of blocks received and number of blocks 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, total blocks received, and total blocks in error.  <b>Requirement:</b> Total blocks in error are less than 23.

**Note:** To perform functions listed below, press associated key.

KEY	FUNCTION
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.

9	Contact distant data station and have DL switch on data set released.	TM lamp goes off on distant data set.
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**K. End-to-End Block Error Test**

**4.26** This test checks the transmitter and receiver of both data sets and the facilities connecting the data sets. The customer interfaces are also

checked. Identical test data is generated by 921A 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.

**2-Wire Switched Network or 2-Wire Private Line**

assure that all calls do not use the same trunks and routes. For a 2-wire private line, a complete end-to-end test involves making one 15-minute test run in each direction.

**4.27** For the 2-wire switched network, a complete end-to-end test involves making one 15-minute test run in each direction. If the test fails in either direction, it is repeated one time. These test calls should be made during busy hours to

**4.28** 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 block error test.	
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**Note 1:** If distant station is not equipped with a 921A DTS, use a test set that provides at least one of the test patterns provided by the 921A DTS and use the same word length at both stations.

**Note 2:** Procedure at transmitting station must be performed first.

**At transmitting station, perform Steps 2 through 6.**

2	Ensure that initial test setup described in paragraph 4.14 has been performed.	Display reads— TEST SEQ:
3	Enter 53.	Display reads— TEST SET: 53
4	Press GO.	Display reads (briefly)— SELECT ERROR TEST Display then reads— D=DT 0=SP 1=MK 2=2047 5=511 6=63
5	Enter 5.	Display reads— 511 BIT ERROR TEST
6	Place data set in data mode.	On DTS, DSR indicator lights (data set ready lead <i>on</i> ) Display continues to read— 511 BIT ERROR TEST

**At receiving station, perform Steps 7 through 15.**

7	Ensure that initial test setup described in paragraph 4.14 has been performed.	Display reads— TEST SEQ:
8	Enter 54.	Display reads— TEST SEQ: 54

STEP	ACTION	VERIFICATION
9	Press GO.	Display reads (briefly)— SELECT ERROR TEST Display then reads— D=DT 0=SP 1=MK 2=2047 5=511 6=63
10	Enter 5.	Display reads (briefly)— 511 BIT ERROR TEST Display then reads— 1=BIT ERRORS 2=BLOCK ERRORS
11	Enter 2.	Display reads— ????? BITS IN A BLOCK
12	Enter 01024.	Display reads (briefly)— 01024 BITS IN A BLOCK Display then reads— ???? SECONDS
13	Place data set in data mode.	On DTS, DSR indicator lights (data set ready lead <i>on</i> ) Display continues to read— ???? SECONDS
14	Enter 0900.	Display reads (briefly)— 0900 SECONDS Display then reads— BLK RCVD=0000 ERR=0000 From this point, display counts number of blocks received and number of blocks 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, total blocks received, and total blocks in error.

**Requirement:** Total blocks in error are less than 23.

**Note:** To perform functions listed below, press associated key. Keys A through D function at receiving station only. Keys E and F function at transmitting station only.

KEY	FUNCTION
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.

STEP	ACTION	VERIFICATION
15	For 2-wire switched network, if requirement in Step 14 is not met—press A to repeat test one time.	
16	Perform the end-to-end block error test in the opposite direction. The receiving station now becomes the transmitting station.	

**4-Wire Private Line**

test run in each direction. The runs are made simultaneously (full duplex).

**4.29** For a 4-wire private line, a complete end-to-end block error test involves making one 15-minute

**4.30** Perform the test as follows.

STEP	ACTION	VERIFICATION
1	Establish voice communication between the data stations and arrange to conduct an end-to-end block error test.  <i>Note:</i> If distant station is not equipped with a 921A DTS, use a test set that provides at least one of the test patterns provided by the 921A DTS and use the same word length at both stations.	

**At both stations, perform Steps 2 through 8.**

2	Ensure that initial test setup described in paragraph 4.14 has been performed.	Display reads— TEST SEQ:
3	Enter 55.	Display reads— TEST SEQ: 55
4	Press GO.	Display reads (briefly)— SELECT ERROR TEST Display then reads— D=DT 0=SP 1=MK 2=2047 5=511 6=63
5	Enter 5.	Display reads (briefly)— 511 BIT ERROR TEST Display then reads— 1=BIT ERRORS 2=BLOCK ERRORS
6	Enter 2.	Display reads— ????? BITS IN A BLOCK
7	Enter 01024.	Display reads (briefly)— 01024 BITS IN A BLOCK Display then reads— ???? SECONDS

STEP	ACTION	VERIFICATION
8	Enter 0900.	<p>Display reads (briefly)— 0900 SECONDS Display then reads— BLK RCVD=0000 ERR=0000 From this point, display counts number of blocks received and number of blocks 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, total blocks received, and total blocks in error.</p> <p><b>Requirement:</b> Total blocks in error are less than 23.</p>

**Note:** To perform functions listed below, press associated key.

KEY	FUNCTION
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.

**L. Automatic Answer Test (2-Wire Switched Network) 4.32 Perform the test as follows.**

**4.31** This test verifies that the data set will automatically answer a call, go to the data mode, and end the call.

STEP	ACTION	VERIFICATION
1	If option YH is installed in data set, temporarily install option YG.	
2	Ensure that initial test setup described in paragraph 4.14 has been performed.	Display reads— TEST SEQ:
3	If option YE is installed in data set, set DTS DCE interface lead switch 21 to OPEN and connect a jumper wire between DCE interface lead jacks 9 and 21.	
4	On DTS, enter 40.	Display reads— TEST SEQ: 40

STEP	ACTION	VERIFICATION
5	Press GO.	Display reads— WAITING FOR RI
6	Place a call to data set from any convenient telephone set.	Display reads— RINGING (during ringing period—ring indicator lead <i>on</i> ). ASSIGNABLE 1 indicator follows ring indicator lead. After 3 complete ringing cycles, DTR indicator lights (data terminal ready lead <i>on</i> ). After several seconds, DSR indicator lights (data set ready lead <i>on</i> ). Display then reads— ANSWERED After several more seconds, DTR indicator goes off (data terminal ready lead <i>off</i> ). Then DSR indicator immediately goes off (data set ready lead <i>off</i> ).  <b>Requirement:</b> Display reads (briefly)— TEST PASSED
7	If option YG was temporarily installed in data set in Step 1, remove option YG and install option YH.	

#### M. Start-Up Tests

**4.33** The start-up tests check the ability of the data set to begin error-free transmission. In these tests, the 921A DTS (1) starts transmitting a 128-bit word, (2) stops transmitting the word, and (3) checks the word for errors. This sequence of operations is automatically repeated for the duration of the tests.

**4.34** Three types of start-up tests can be performed.

- **Analog Loopback:** The local data set is placed in the analog loopback mode. The local data set must be equipped with switched carrier.

- **Digital Loopback:** The local data set is placed in the data mode and the distant data set is placed in the digital loopback mode. Both local and distant data sets must be equipped with switched carrier.

- **End-to-End:** Both local and distant data sets are placed in the data mode. Either the local or distant data set must be equipped with switched carrier.

#### Analog Loopback Start-Up Test

**4.35** Perform the test as follows.

STEP	ACTION	VERIFICATION
1	If continuous carrier (option XB or XC) is installed in data set, temporarily install switched carrier (option XA).	
2	Ensure that initial test setup described in paragraph 4.14 has been performed.	Display reads— TEST SEQ:

SECTION 592-029-501

STEP	ACTION	VERIFICATION
3	On data set, depress AL switch.	TM lamp lights.
4	On DTS, enter 67.	Display reads— TEST SET: 67
5	Press GO.	Display reads— 1=ONE WAY 2=IR SW 3=IR CONT
6	Enter 2.	Display reads— TRMT: 1=MAN 2=TIMED 3=SW CARR
7	Enter 2.	Display reads— PRESS A TO START
8	Press A.	Display reads— BLK RCVD=0000 ERR=0000 *=0000 From this point, BLK RCVD display counts number of blocks received, ERR display counts number of received blocks in error, and * display counts number of times DTS transmitted a block but did not receive a block.

**Note 1:** When A is pressed, a count may appear on BLK RCVD, ERR, and/or \* display. If this occurs, press C to clear displays.

**Note 2:** To perform functions listed below, press associated key.

**KEY      FUNCTION**

- A    Restart test.
- C    Clear display.
- D    Stop test.

9	At end of about 1 minute, press D.	<b>Requirement:</b> Zero count on ERR and * displays.
10	On data set, release AL switch.	TM lamp goes off.

**Note:** If switched carrier (option XA) was temporarily installed in data set in Step 1, leave this option installed until all remaining tests are completed.

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**Digital Loopback Start-Up Test (4-Wire Private Line)**

4.36 Perform the test as follows.

STEP	ACTION	VERIFICATION
1	If continuous carrier (option XB or XC) is installed in local or distant data set, temporarily install switched carrier (option XA).	
2	Ensure that initial test setup described in paragraph 4.14 has been performed.	Display reads— TEST SEQ:
3	Contact distant data station and have DL switch on data set depressed.	TM lamp lights on distant data set.
4	On DTS, enter 70.	Display reads— TEST SEQ: 70
5	Press GO.	Display reads— 1=ONE WAY 2=IR SW 3=IR CONT
6	Enter 2.	Display reads (briefly)— ENTER HEX CHARS Display then fills with 32 "?"s.
7	Enter FF FF FF 16 16 01 31 32 33 02 53 54 41 52 54 03.  <i>Note:</i> To delete last character entered, press back arrow (←).	Display reads (briefly)— FFFFFFF16160131323302535441525403 Display then reads— TRMT: 1=MAN 2=TIMED 3=SW CARR
8	Enter 2.	Display reads— PRESS A TO START
9	Press A.	Display reads— BLK RCVD=0000 ERR=0000 *=0000 From this point, BLK RCVD display counts number of blocks received, ERR display counts number of received blocks in error, and * display counts number of times DTS transmitted a block but did not receive a block.

*Note 1:* When A is pressed, a count may appear on BLK RCVD, ERR, and/or \* display. If this occurs, press C to clear displays.

*Note 2:* To perform functions listed below, press associated key.

**KEY      FUNCTION**

A    Restart test.  
C    Clear display.  
D    Stop test.

10    At end of about 1 minute, press D.

**Requirements:** Count of less than 2 on ERR display and zero count on \* display.

SECTION 592-029-501

STEP	ACTION	VERIFICATION
11	Contact distant data station and have DL switch on data set released.	TM lamp goes off on distant data set.

**Note:** If switched carrier (option XA) was temporarily installed in local or distant data set in Step 1, leave this option installed until all remaining tests are completed.

**End-to-End Start-Up Test**

operating control of the test. Perform the test as follows.

4.37 In this test, one end is arbitrarily selected as the controlling station. This station has

STEP	ACTION	VERIFICATION
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1 Establish voice communication between the data stations and arrange to conduct an end-to-end start-up test.

**Note 1:** For 4-wire service, if continuous carrier (option XB or XC) is installed in data set at controlled station, temporarily install switched carrier (option XA).

**Note 2:** Procedure at controlled station must be performed first.

**At controlled station, perform Steps 2 through 7.**

2	Ensure that initial test setup described in paragraph 4.14 has been performed.	Display reads— TEST SEQ:
3	Enter 68.	Display reads— TEST SEQ: 68
4	Press GO.	Display reads— 1=ONE WAY 2=IR SW 3=IR CONT
5	For 2-wire service, enter 2. For 4-wire service with switched carrier (option XA) at controlling station, enter 2. For 4-wire service with continuous carrier (option XB or XC) at controlling station, enter 3.	Display reads— PRESS A TO START
6	Place data set in data mode.	On DTS, DSR indicator lights (data set ready lead <b>on</b> ) Display continues to read— PRESS A TO START

STEP	ACTION	VERIFICATION
7	Press A.  <b>Note:</b> When A is pressed in Step 14, a count may appear on BLK RCVD, ERR, and/or * displays. If this occurs, press C to clear displays.	Display reads— BLK RCVD=0000 ERR=0000 * =0000 After A is pressed at controlling station, BLK RCVD display counts number of blocks received, ERR display counts number of received blocks in error, and * display counts number of times DTS transmitted a block but did not receive a block. All displays stop counting when D is pressed at controlling station.  <b>Requirements:</b> Count of less than 2 on ERR display and zero count on * display.
<b>At controlling station, perform Steps 8 through 15.</b>		
8	Ensure that initial test setup described in paragraph 4.14 has been performed.	Display reads— TEST SEQ:
9	Enter 67.	Display reads— TEST SEQ: 67
10	Press GO.	Display reads— 1=ONE WAY 2=IR SW 3=IR CONT
11	For 2-wire service, enter 2. For 4-wire service with switched carrier (option XA) at controlling station, enter 2. For 4-wire service with continuous carrier (option XB or XC) at controlling station, enter 3.	Display reads— TMRT: 1=MAN 2=TIMED 3=SW CARR
12	Enter 2.	Display reads— PRESS A TO START
13	Place data set in data mode.	On DTS, DSR indicator lights (data set ready lead <i>on</i> ) Display continues to read— PRESS A TO START
14	Press A.	Display reads— BLK RCVD=0000 ERR=0000 * =0000 From this point, BLK RCVD display counts number of blocks received, ERR display counts number of received blocks in error, and * display counts number of times DTS transmitted a block but did not receive a block.

**Note 1:** When A is pressed, a count may appear on BLK RCVD, ERR, and/or \* displays. If this occurs, press C to clear displays.

STEP	ACTION	VERIFICATION
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**Note 2:** To perform functions listed below, press associated key.

KEY	FUNCTION
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A	Restart test.
C	Clear display.
D	Stop test.

15	At end of about 1 minute, press D.	
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**Requirements:** Count of less than 2 on ERR display and zero count on \* display.

**Note:** If switched carrier (option XA) was temporarily installed in data set at controlled station, leave this option installed until all remaining tests are completed.

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## 5. REFERENCES

SECTION	TITLE	SECTION	TITLE
5.01	Additional information concerning the testing of DS 201C-L1 is contained in the following publications:	592-029-100	Data Set 201C—Transmitter-Receiver— Description and Operation
		592-029-200	Data Set 201C—Transmitter-Receiver— Installation and Connections
107-402-100	921A Data Test Set—Description and Operation	592-029-500	Data Set 201C—Transmitter-Receiver—Test Procedures Using 914-Type Data Test Set
314-205-501	Data Systems—DATAPHONE® Service and Data Access Arrangements on Direct Distance Dialing Network—Test Requirements for Subscriber, Foreign Exchange, and Remote Exchange Lines	592-032-300	Data Set 209A-L1—Transmitter-Receiver—Maintenance
		666-511-501	Test of Data Services Provided by Data Set 201C From a Private Line Testroom
314-410-500	Voice Bandwidth Private Line Data Circuits—Tests and Requirements	666-511-504	Test of Data Services Provided by Data Set 209A-L1 From a Private Line Testroom
314-901-300	Digital Data System—Serving Test Center—Two-Point Private Line Circuit—Maintenance Procedures	668-010-300	Data Systems—DATAPHONE® Service on Direct Distance Dialing Network—Data Test Center— Trouble Analysis Procedures
314-919-300	Digital Data System— Subrate Off-Net Extension Arrangements—Maintenance	5.02	Detailed information concerning DS 201C-L1 is contained in CD- and SD-1D239-01.