

DATA SET 201C-L1D
TRANSMITTER-RECEIVER
TEST PROCEDURES AND MAINTENANCE

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2-Wire Private Line	13	1.02 Whenever this section is reissued, the reason for reissue will be contained in this paragraph.	
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NOTICE

Not for use or disclosure outside the
Bell System except under written agreement

restrictions on their use. Part 2, Installation Tests, specifies the tests to be performed on an initial installation. Part 3, Maintenance Procedures and Tests, specifies the procedures to be used and the tests to be performed during a maintenance visit. Part 4, Supplementary Test, specifies a special purpose test that ordinarily is not required during installation and maintenance. Part 5, Test Procedures, provides the procedures for all installation, maintenance, and supplementary tests. Part 6, References, lists publications that provide additional information.

Test Capabilities

1.04 Test circuitry built into DS 201C permits the following self tests to be performed: analog loopback, digital loopback, and end-to-end. The analog loopback, digital loopback, and end-to-end tests can also be performed by use of external test equipment such as the 914C DTS. The ground noise test requires the use of a 6H impulse counter or equivalent.

Note: The TEST connector located behind the front cover of DS 201C-L1D is used for factory testing only.

Restrictions on Use of Self Tests

1.05 If DS 201C-L1D 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 digital loopback self test cannot be performed from a remote extension (with options as installed) in toward a DS 201C-L1D collocated with a DS 209A-L1 or a hub office of the DDS. If the internal timing option (option YC) is temporarily installed at the remote extension, this test can be performed.

Data Set Compatibility

1.06 Except where noted all tests contained in this section may be accomplished using either DS 201C-L1D or the older DS 201C-L1.

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, 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. 1. For a 4-wire private line, the installation test sequence is shown in Fig. 2.

3. MAINTENANCE PROCEDURES AND TESTS

Maintenance Procedures

3.01 When investigating a trouble report, proceed as directed in the following figures:

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

Fig. 4—Maintenance Sequence (4-Wire Private Line)

3.02 When DS 201C-L1D 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.

3.03 When DS 201C-L1D is used as a subrate off-net extension of the 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.

3.04 If DS 201C-L1D is used as a remote extension of a DS 209A-L1 multiplex system or as a subrate off-net extension of the DDS, refer to paragraph 1.05 for restrictions on the use of the self tests.

3.05 If it becomes necessary to dispatch a telephone company (telco) employee to the data set location, the following equipment should be taken along:

- 914C data test set (DTS)
- Spare DS 201C-L1D

3.06 If the data set is replaced, the defective data set should be tagged with a tag

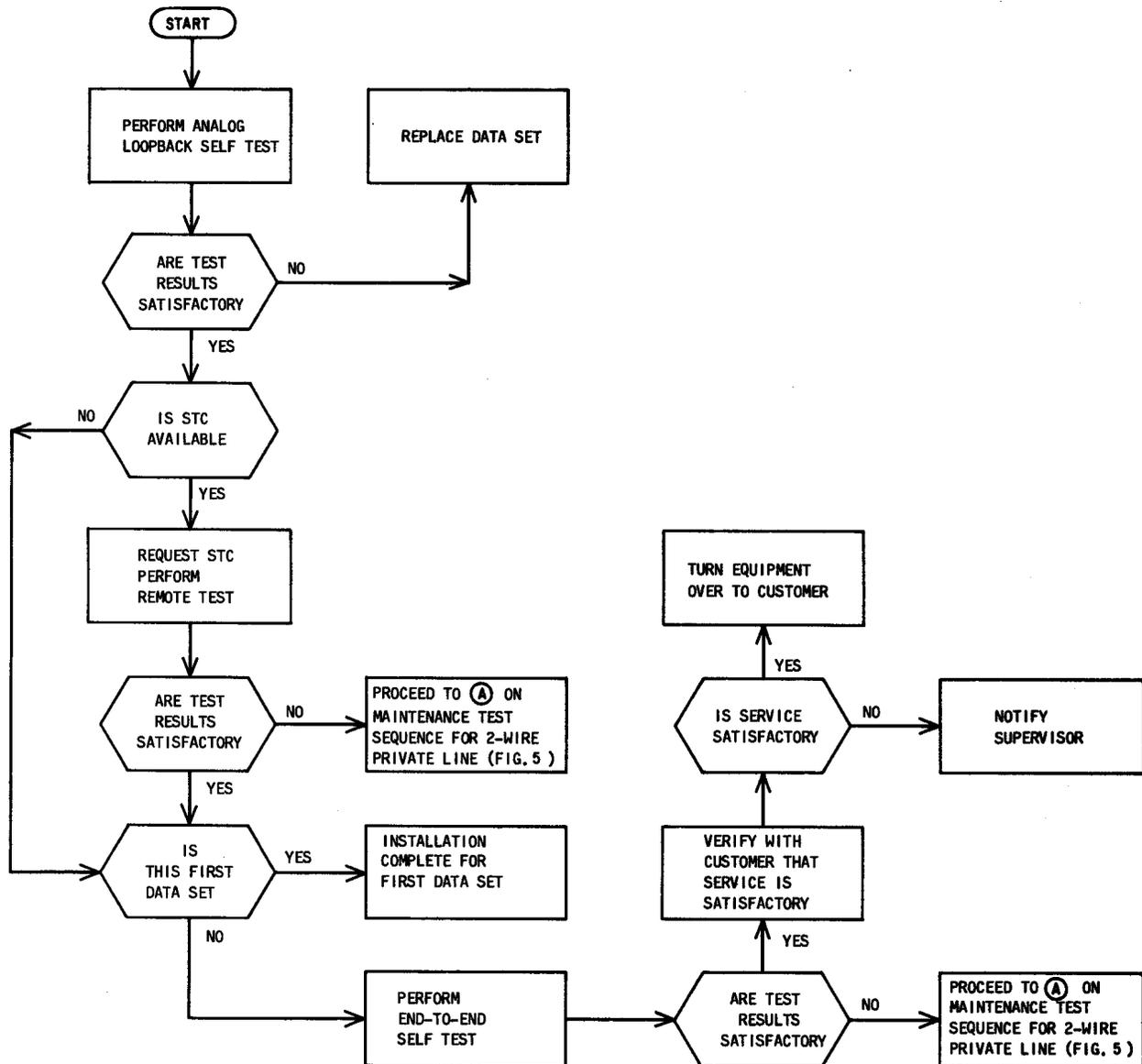


Fig. 1—Installation Test Sequence (2-Wire Private Line)

describing the nature of the trouble, carefully packed, and returned to a service center for repair. After the data set has been replaced, verify with the customer that service is satisfactory.

3.07 If the trouble persists, proceed as follows:

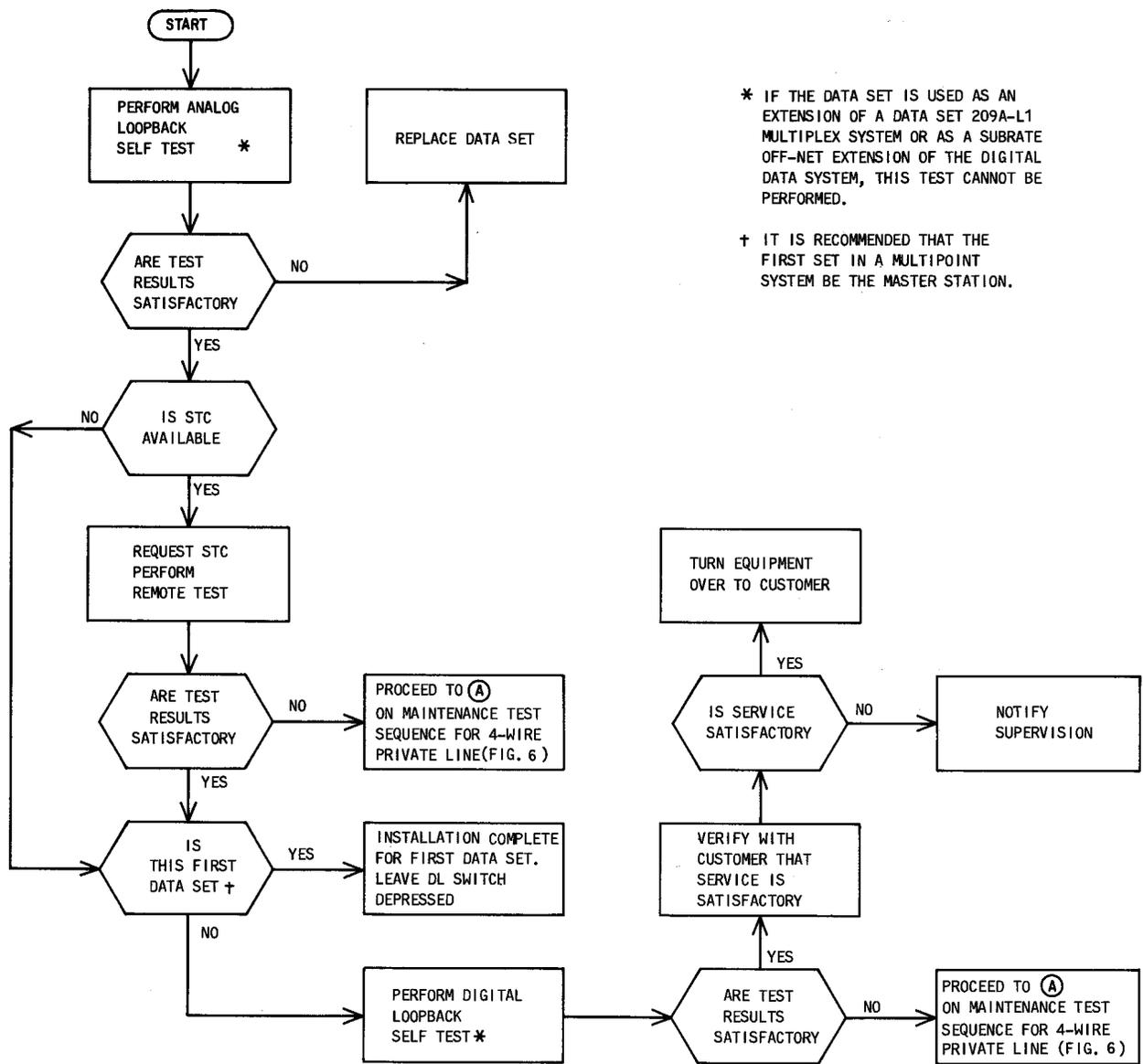
(a) Check that the options installed in the data set agree with those specified on the service order.

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

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

(d) Check for physical damage.

(e) Check for intermittent trouble in the station wiring.



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

- (f) Verify that the data set and the CPE are connected to a common ground.
- (g) If the trouble cannot be cleared, request help from immediate supervisor.

Maintenance Tests

3.08 For a 2-wire private line, the maintenance test sequence is shown in Fig. 5. For a

4-wire private line, the maintenance test sequence is shown in Fig. 6.

4. SUPPLEMENTARY TEST

4.01 The ground noise test ordinarily is not required during installation and maintenance visits but should be performed when needed. This test is performed to detect the presence of noise potentials caused by a potential difference between data set and CPE grounds.

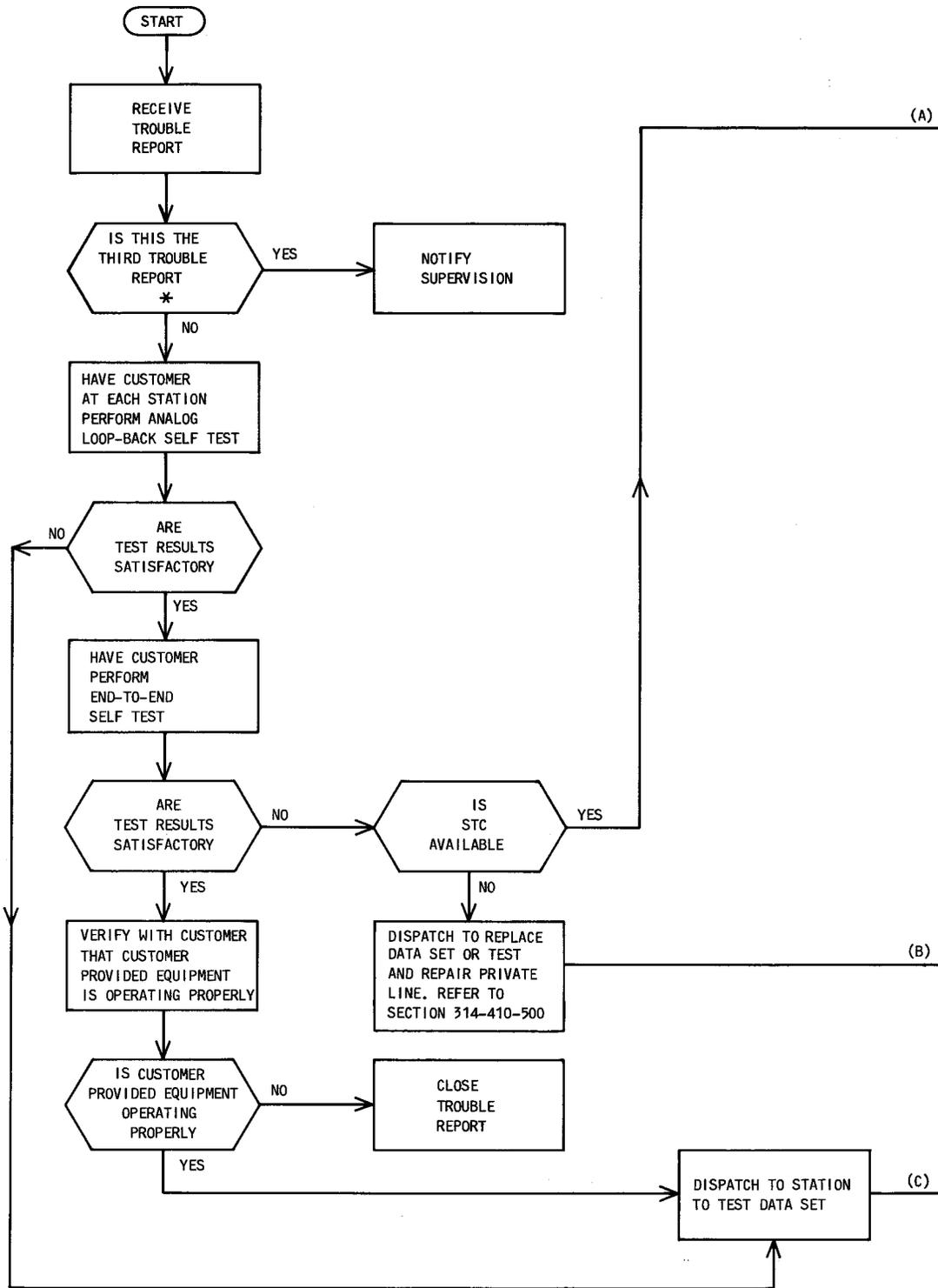


Fig. 3—Maintenance Sequence (2-Wire Private Line) (Sheet 1 of 2)

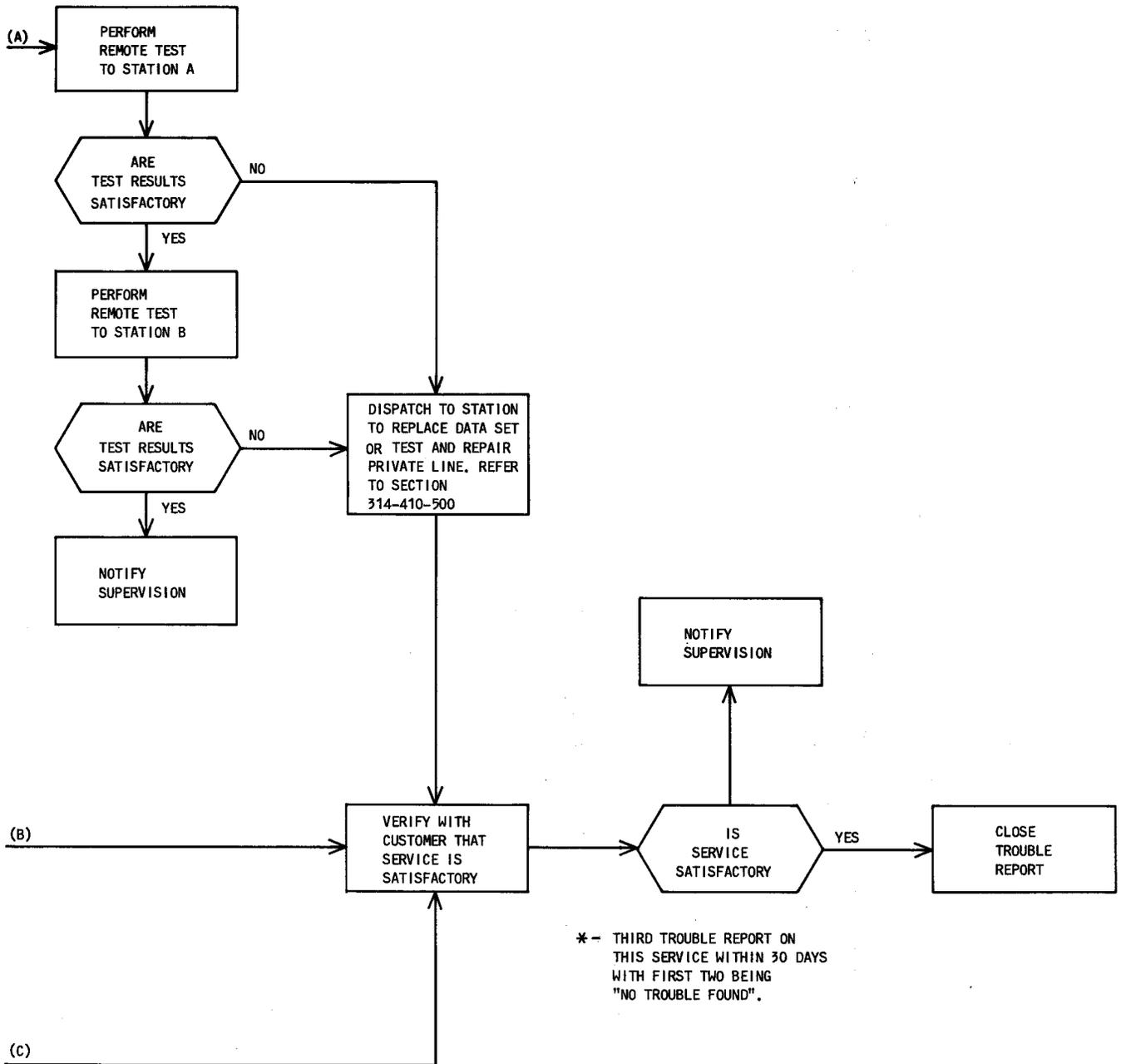


Fig. 3—Maintenance Sequence (2-Wire Private Line) (Sheet 2 of 2)

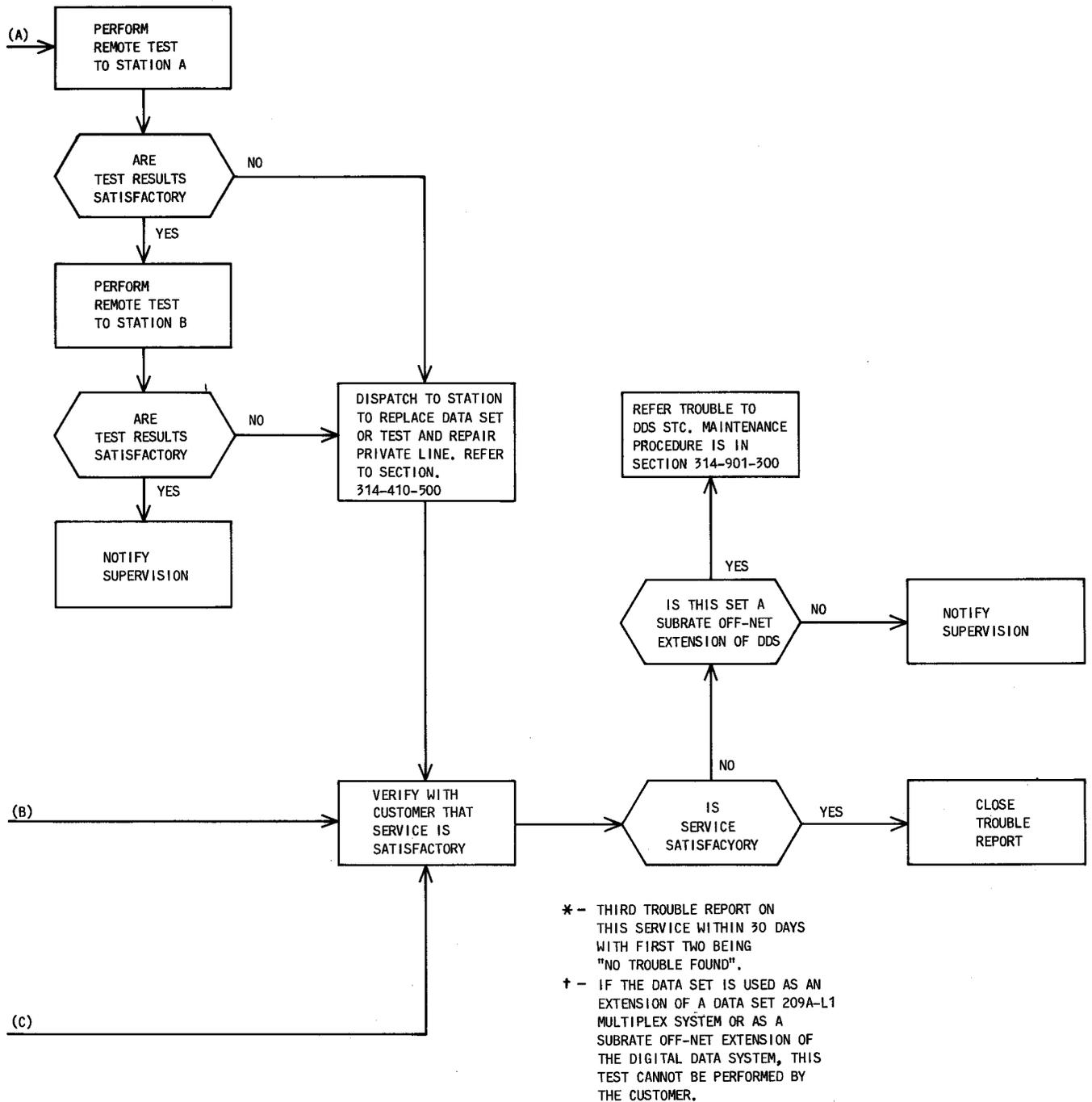


Fig. 4—Maintenance Sequence (4-Wire Private Line (Sheet 2 of 2))

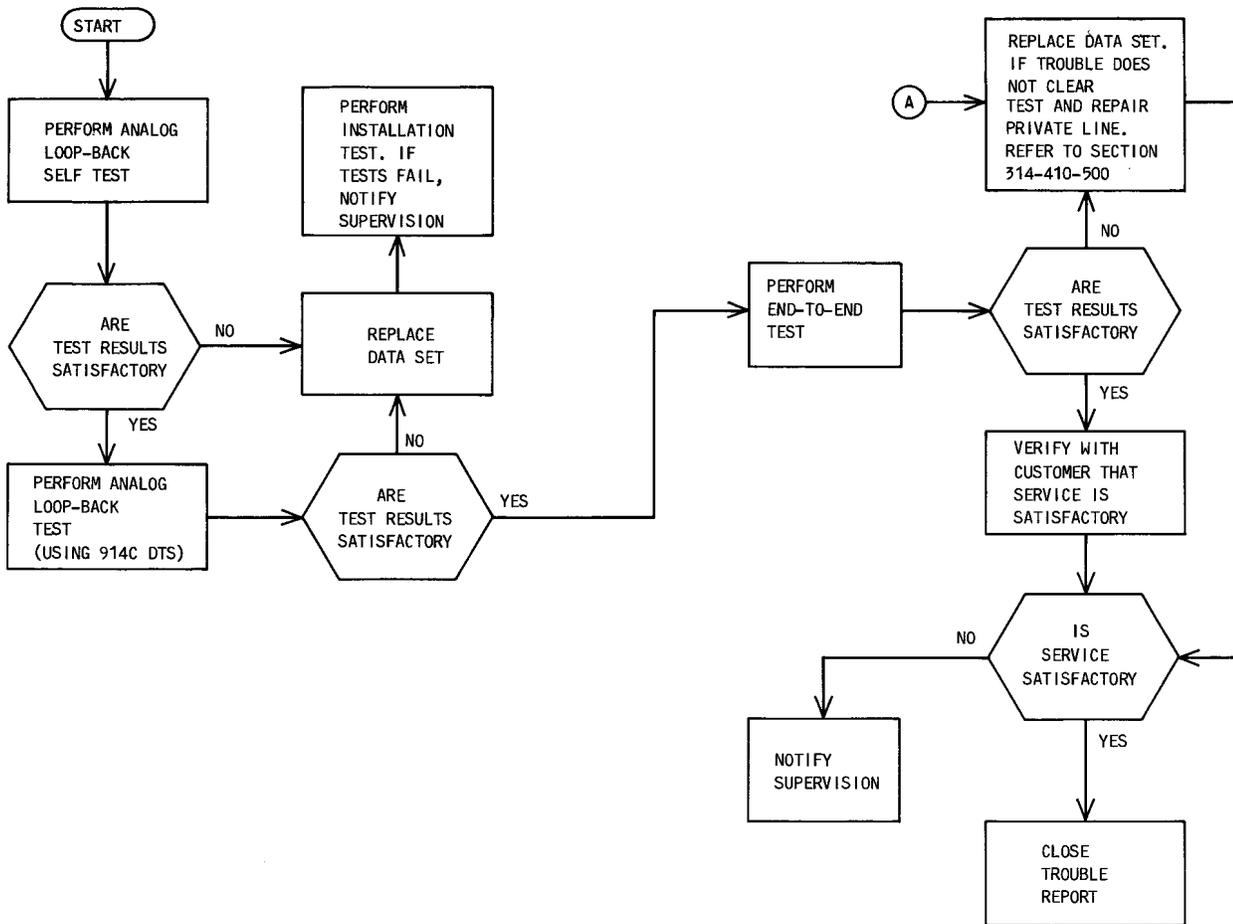


Fig. 5—Maintenance Test Sequence (2-Wire Private Line)

5. TEST PROCEDURES

5.01 This part provides the procedures for the installation, maintenance, and supplementary tests.

A. Analog Loopback Test (Using CPE)

5.02 The analog loopback test checks the data set transmitter and receiver and the customer interface. The data set is internally disconnected from the line interface and the transmitter output is looped back to the receiver input. The CPE transmits data and tests the customer interface by examining transmitter and receiver output signals at the CPE. Data set ready indication can be optioned on or off at the CPE (options YM and YN).

5.03 The analog loopback test can be entered either by depressing the data set AL switch or remotely via customer interface pin 18 (option YS).

5.04 Perform the test as follows (refer to Fig. 7 for data set switch positions and lamp status):

- (1) Ensure that data set is not transmitting or receiving data.
- (2) Depress AL switch or condition CPE to turn on customer interface pin 18.

Requirement: ON and TM lamps are lighted.

- (3) Release AL switch on data set (if depressed).

Requirement: TM lamp goes off.

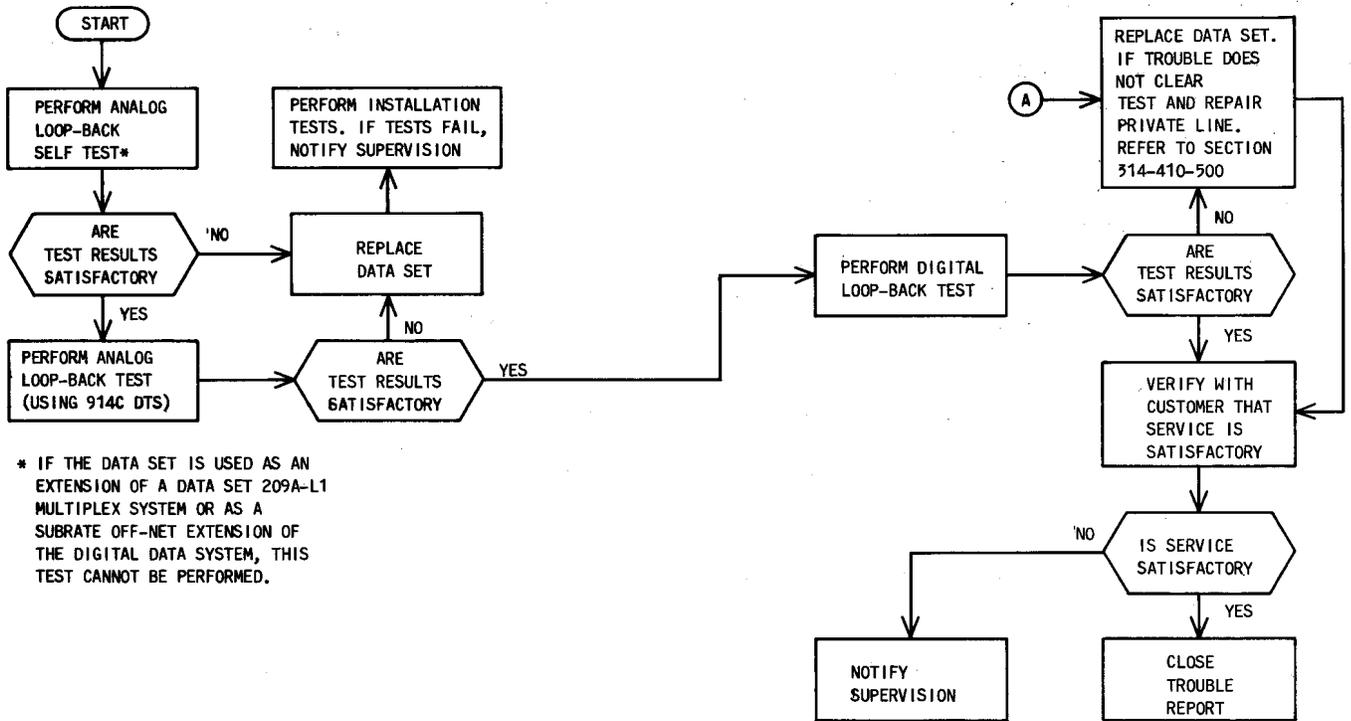
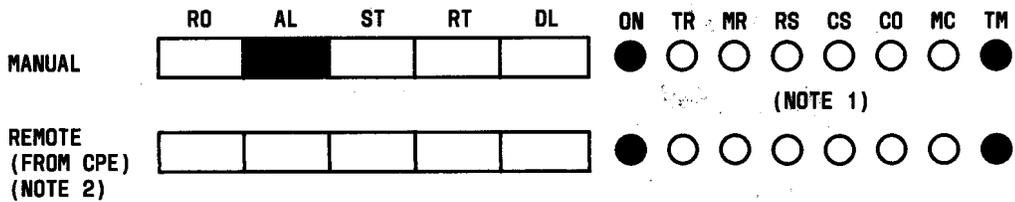


Fig. 6—Maintenance Test Sequence (4-Wire Private Line)



- NOTES:
1. ALL LAMPS OTHER THAN ON AND TM ARE UNDER CPE CONTROL.
 2. CPE CONTROLS AL VIA PIN 18.

LEGEND:



Fig. 7—Analog Loopback Test, Data Set Switch Positions, and Lamp Status

B. Analog Loopback Self Test

5.05 The analog loopback self test checks the data set transmitter and receiver. The customer interface is not checked. Test data generated by the data set is looped back from the transmitter output to the receiver input through an internal attenuator. 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.

5.06 Perform the test as follows (refer to Fig. 8 for data set switch positions and lamp status):

- (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: (Normal test mode) MC lamp is off continuously (does not blink). All other lamps are lighted.

- (4) Depress RO switch on data set.

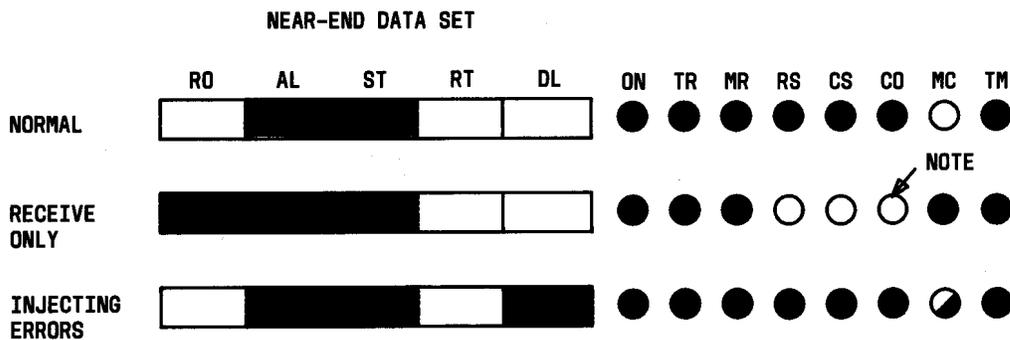
Requirements: (Idle test mode) RS and CS lamps go off. MC lamp lights. If data set is optioned for switched carrier (option XA or XE), CO lamp goes off. If data set is optioned for continuous carrier (option XB or XC), CO lamp remains lighted.

- (5) Release RO switch on data set.

Requirement: All lamps are lighted except MC.

- (6) Depress DL switch on data set (DS 201C-L1D only).

Requirements: All lamps are lighted except MC. MC lamp is flashing.



NOTE:
 IF DATA SET IS OPTIONED SWITCHED CARRIER (XA OR XE), CO LAMP IS OFF. IF DATA SET IS OPTIONED FOR CONTINUOUS CARRIER (XB OR XC), CO LAMP IS LIGHTED.

LEGEND:

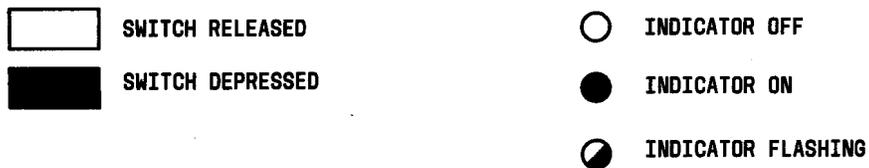


Fig. 8—Analog Loopback Self Test, Data Set Switch Positions, and Lamp Status

- (7) Release AL, ST, and DL switches on data set.

Requirement: TM lamp goes off.

C. Digital Loopback Self Test (4-Wire Private Line)

5.07 The digital loopback self test checks the transmitter and receiver of both data sets and the facilities connecting the data sets. The customer interfaces are not checked. Test data generated and transmitted by the near-end data set is looped back from the receiver output to the transmitter input of the far-end data set and retransmitted. This data is received by the near-end data set and compared to the original data. Data errors and data set condition are indicated by the status of the indicator lamps on the near-end data sets.

5.08 Perform the test as follows (refer to Fig. 9 for data set switch positions and lamp status):

- (1) Ensure that data set is not transmitting or receiving data.
- (2) Depress ST switch on the near-end data set.

Requirement: TM lamp lights.

- (3) Contact far-end data station and have DL switch on data set depressed. (For this portion of the digital loopback self test the far-end data set may be either a DS 201C-L1D or 201C-L1.) Verify that TM lamp is lighted.

Requirements: On near-end 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) On near-end data set depress DL switch.

Requirement: On near-end data set, all lamps are lighted except MC, which is flashing. (For this requirement to be met the near-end data set must be a DS 201C-L1D.)

- (6) Contact far-end data station and have DL switch on data set released. Verify that TM lamp is off.

- (7) Release ST and DL switch on near-end data set.

Requirement: TM lamp goes off.

D. End-to-End Self Test

5.09 The end-to-end self 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. This test is performed with either 2- or 4-wire facilities. In the 2-wire test the transmitter and receiver sections are tested separately. In the 4-wire test both sections are tested simultaneously.

2-Wire Private Line

5.10 Perform the test as follows (refer to Fig. 10 for data set switch positions and lamp status):

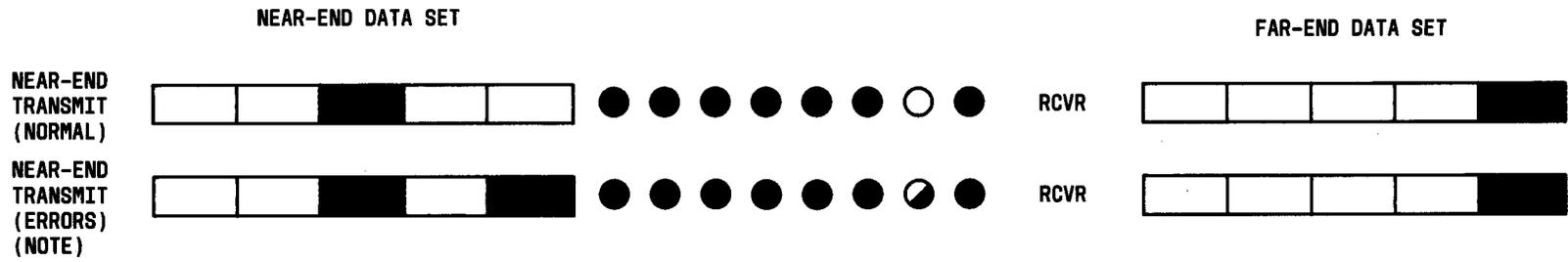
- (1) Establish voice communication between the data stations and arrange to conduct an end-to-end self test.
- (2) Ensure that both data sets are not transmitting or receiving data.
- (3) Contact far-end data station and have RO and ST switches depressed on the data set.
- (4) On near-end data set depress ST switch.

Requirements: On far-end data set all lamps are lighted except RS, CS, and MC.

- (5) Make a 10-minute error run.

Requirement: At the far-end data set the MC lamp is off and does not blink for more than an average of three times in any 2-minute period.

- (6) If the near-end data set is not a 201C-L1D, go to (7), otherwise depress DL switch.

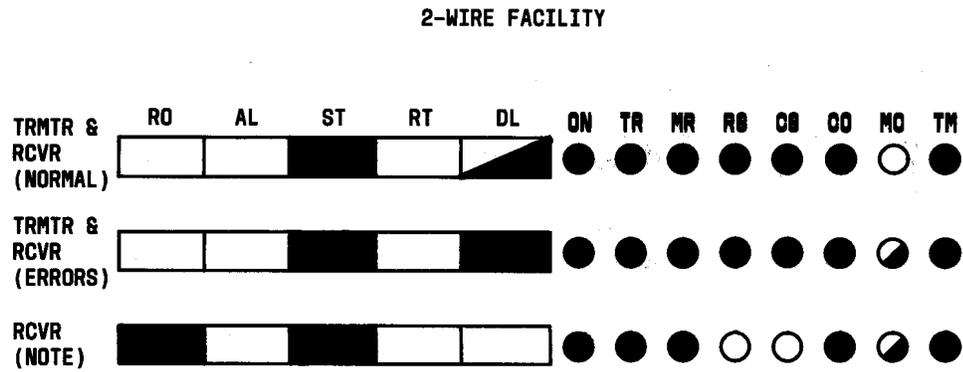
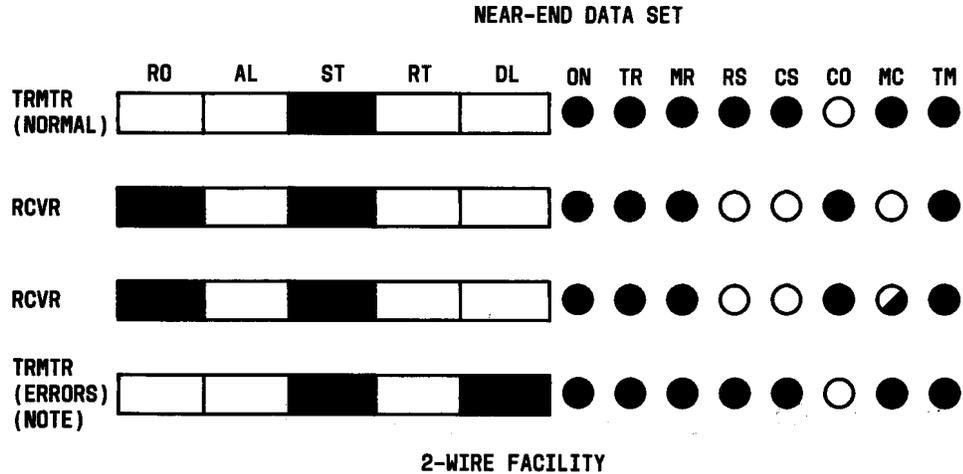


NOTE:
 TO OBTAIN PROPER LAMPS STATUS INDICATIONS FOR THIS TEST, THIS DATA SET MUST BE A 201C-LID.

LEGEND:

-  SWITCH RELEASED
-  SWITCH DEPRESSED
-  INDICATOR OFF
-  INDICATOR ON
-  INDICATOR FLASHING

Fig. 9—Digital Loopback Self Test, Data Set Switch Positions, and Lamp Status



4-WIRE FACILITY

NOTE:
 TO OBTAIN PROPER LAMP STATUS INDICATIONS FOR THIS TEST, THIS DATA SET MUST BE A 201C-L1D. IF EITHER TRANSMITTER IS NOT A 201C-L1D, THE CORRESPONDING RECEIVER MC LAMP WILL FLASH WHEN TRANSMITTER DL SWITCH IS DEPRESSED.

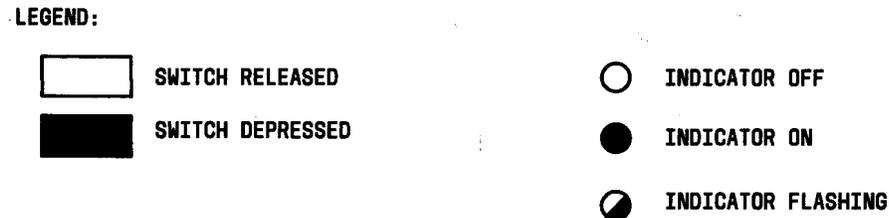


Fig. 10—End-To-End Self Test, Data Set Switch Positions, and Lamp Status (Sheet 1 of 2)

Requirements: At the far-end (receiving) data set all lamps are lighted except RS and CS and MC is flashing.

Requirements: The lamps at the near-end (receiving) data set are all lighted except RS, CS, and MC.

- (7) Contact far-end data station and have RO switch released.
- (8) On near-end data set depress RO switch. Release DL switch if depressed.

- (9) Make a 10-minute error run.

Requirement: At the near-end data set the MC lamp is off and does not blink for

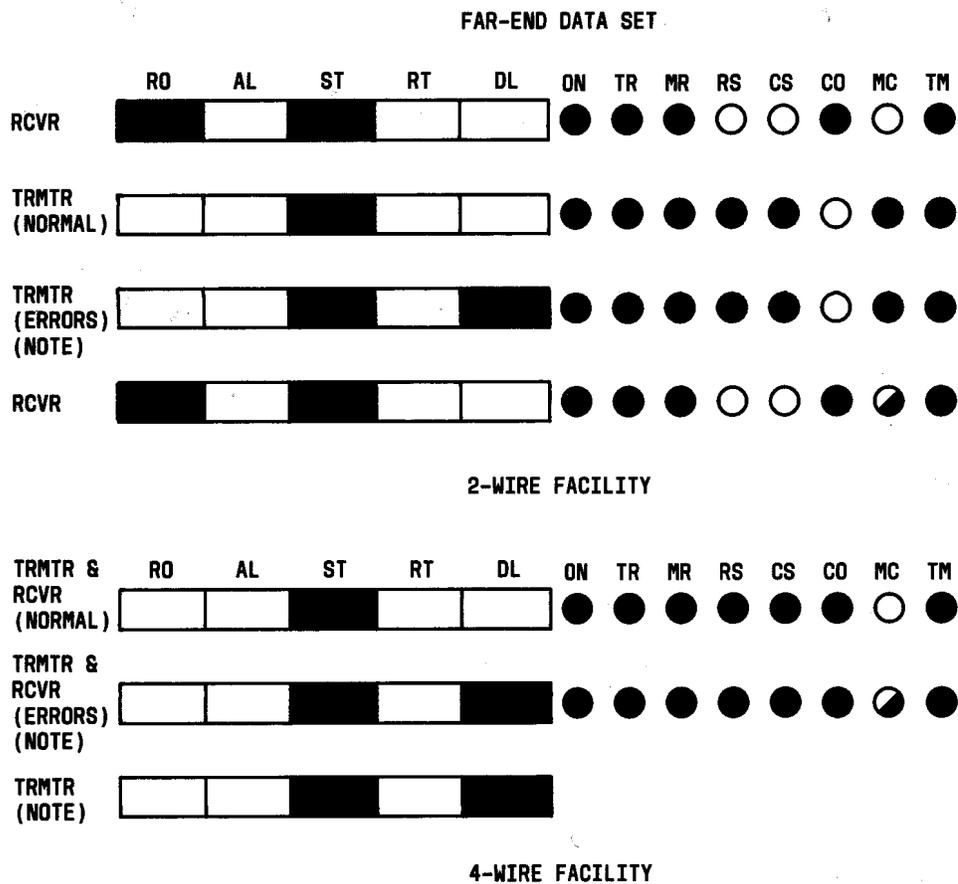


Fig. 10—End-To-End Self Test, Data Set Switch Positions, and Lamp Status (Sheet 2 of 2)

more than an average of three times in any 2-minute period.

Requirements: At the near-end (receiving) data set all lamps are lighted except RS and CS and MC is flashing.

(10) If the far-end data station is not a 201C-L1D, go to (11), otherwise contact far-end data station and have DL switch depressed.

(11) Contact the far-end data station and have any depressed switches released.

Requirement: TM lamp goes out.

- (12) At near-end data set release RO switch.

Requirement: TM lamp goes out.

4-Wire Private Line

5.11 Ensure that both data sets are not transmitting or receiving data. Perform the test as follows (refer to Fig. 10 for data set switch positions and lamp status):

- (1) Contact far-end data station and have ST switch depressed on the data set.
- (2) On near-end data set depress ST switch.

Requirement: All lamps are lighted except MC on both near- and far-end data sets.

- (3) Contact far-end data station and have DL switch depressed.
- (4) On near-end data set depress DL switch.

Requirements: On both near-end and far-end data sets, all lamps are lighted except MC, which is flashing.



If either near- or far-end transmitter is not a DS 201C-LID, the corresponding receiver MC lamp will not flash.

- (5) Contact far-end data station and have ST and DL switches released.
- (6) On near-end data set release DL and ST switches.

Requirement: On both near- and far-end sets, TM lamp goes out.

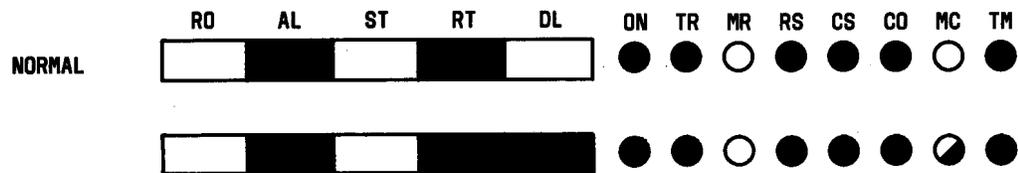
E. Local Loopback Receiver Margin Test

5.12 The local loopback receiver margin test is essentially the same as the analog loopback self test. This test differs in that the receiver compromise equalizer is bypassed and the distortion threshold at which the MC lamp will light is greatly reduced.

5.13 Ensure that both data sets are not transmitting or receiving data. Perform the test as follows (refer to Fig. 11 for data set switch positions and lamp status):

- (1) Depress AL and RT switches on data set.

Requirement: All lamps are lighted except MR and MC.



LEGEND:

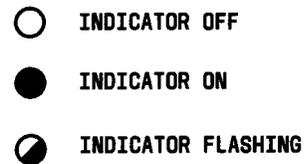
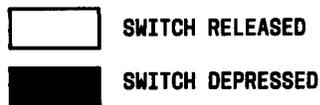


Fig. 11—Local Loopback Receiver Margin Test, Data Set Switch Positions, and Lamp Status

- (2) Depress DL switch on data set.

Requirements: ON, TR, RS, CS, CO, and TM lamps are lighted. MR lamp is off. MC lamp is flashing.

- (3) Release AL, RT and DL switches on data set.

Requirement: TM lamp goes off.

F. Remote Test

5.14 The remote 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 Private Line

5.15 For a 2-wire private line, an end-to-end self test is performed with a serving test center (STC) replacing one of the data sets. Refer to paragraph 5.10 for the required test procedures.

4-Wire Private Line

5.16 For a 4-wire private line, test data is generated and transmitted by the STC. This data is looped back from the receiver output to the transmitter input of the data set and retransmitted. The data is received by the STC and compared to the original data. Perform the test as follows (Refer to Fig. 12 for data set switch positions and lamps status):

- (1) Contact STC and request a remote test.
- (2) When directed by STC, depress DL switch.

Requirement: TM lamp lights.

- (3) STC performs remote test.
- (4) When directed by STC, release DL switch.

Requirement: TM lamp goes off.

G. Analog Loopback Test (Using 914C DTS)

5.17 In this test, the power supply voltages are measured, an analog loopback error run is performed, and the CA-CB (RS-CS) interval is checked. The error run checks the data set

transmitter and receiver and the customer interface. Test data is generated by a data test set and looped back from the data set transmitter output to the receiver input through an internal attenuator. The received data is compared to the original data by the DTS. Data errors are indicated by the DTS counter. The CA-CB interval check measures the interval between the time the request-to-send (CA) lead is turned **on** and the clear-to-send (CB) leads turns **on**.

5.18 The following test equipment is required:

1—914C DTS

5.19 Perform the test as follows:

- (1) Connect and condition test equipment as shown in Fig. 13.
- (2) Apply power to data set and then to test equipment.
- (3) Depress AL switch on data set.

Requirement: TM lamp lights.

- (4) On 914C DTS, set S1 to ON.

Requirement: DS1, DS2, and DS3 are lighted.

- (5) Set FUNCTION to VOLT INT.

Requirement: +11.0 to +14.5 volts.

- (6) Set FUNCTION to OFF, POLARITY to REV, and VERTICAL MONITOR to 10.

- (7) Set FUNCTION to VOLT INT.

Requirement: -12.2 to -15.0 volts.

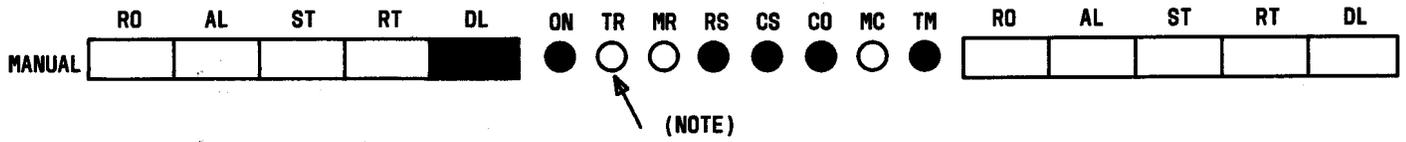
- (8) Set FUNCTION to OFF, POLARITY to NOR, RANGE to DCV-10, and VERTICAL MONITOR to 19.

- (9) Set FUNCTION to VOLT INT.

Requirement: +4.75 to +5.25 volts.

- (10) Set FUNCTION to OFF.

- (11) Set WORD SYNC momentarily to MAN.



NOTE:
TR LAMP UNDER CPE CONTROL.

LEGEND:

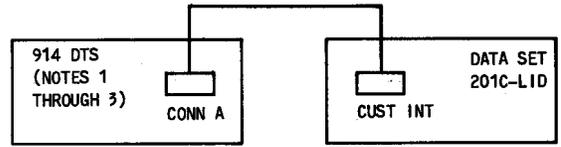
SWITCH RELEASED
 SWITCH DEPRESSED

INDICATOR OFF
 INDICATOR ON

Fig. 12—Remote Test Data Set Switch Positions and Lamp Status (4-Wire Private Line)

SECTION 592-029-520

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	STG	
GRD	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	GRD
SD	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	SD
RD	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	RD
SI	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	SI
DS1	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	DS1
DS2	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	DS2
S2	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	S2
DS3	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	DS3
TP1	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	TP1
TP2	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	TP2
S3	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	S3
DS4	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	DS4
DS5	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	DS5
S4	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	S4
SCT	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	SCT
S5	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	S5
SCR	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	SCR
DS6	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	DS6
S6	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	S6
DS7	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	DS7
DS8	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	DS8
S7	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	S7
TP3	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	TP3
S8	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	S8



NOTES:

1. SET SWITCHES ON 914 DTS AS FOLLOWS:

SWITCH	SETTING
INTERFACE SELECTOR	ALL DEPRESSED
INTERFACE MODE	VOLTAGE
VERTICAL MONITOR	9
TEST SET MODE	SER
COUNTER	BIT ERRORS
FUNCTION	OFF
RANGE	DCV-30
POLARITY	NOR
SAMPLE WIDTH	.5US
TRIGGER-TP1	+ / OPEN
TRIGGER-TP2	+ / OPEN
START	A OR B
RCV BIT RATE	EXT +
TRANSMIT BIT RATE	EXT +
RCV WORD LENGTH	511
TRANSMIT WORD LENGTH	511
SIG LEV	+4V
S1	OFF
S4	OFF
S6	ON

2. INSERT RED PROGRAMMING PINS IN 914 DTS MATRIX IN POSITIONS INDICATED ABOVE

3. 914 DTS SWITCHES AND INDICATORS CORRESPOND TO THE FOLLOWING INTERFACE LEADS:

SWITCH	LAMP	LEAD	EIA
S1	DS1	REQUEST TO SEND (RS)	CA
	DS2	CLEAR TO SEND (CS)	CB
	DS3	DATA SET READY (DSR)	CC
		RECEIVED LINE SIGNAL DETECTOR (CO)	CF
S4		NEW SYNC (NS)	
S6		DATA TERMINAL READY (DTR)	CD

Fig. 13—Analog and Digital Loopback Test Setup

- (12) Depress RESET and allow counter to operate for 5 minutes.

Requirement: No errors indicated.

- (13) Set S1 to OFF.
- (14) On 914C DTS, set TEST SET MODE to INTERVAL, COUNTER to INTERVAL—X1, and RCV BIT RATE to 1200.
- (15) On 914C DTS, depress RESET and then set S1 to ON. CA-CB interval will appear on counter.

Requirements:

- Option XA—7 to 16 ms
 - Option XB—7 to 16 ms
 - Option XC—0 to 7 ms
 - Option XE (On 914C DTS set COUNTER to INTERVAL—X10. Counter indicates 14 to 16)—138 to 158 ms.
- (16) To remeasure CA-CB interval, set S1 to OFF, depress RESET, and set S1 to ON.
- (17) Release AL switch on data set.
- Requirement:** TM lamp goes off.
- (18) Remove all test equipment and restore data set to pretest condition.

H. Digital Loopback Test (4-Wire Private Line)

5.20 The digital loopback test checks the transmitter and receiver of both data sets and the facilities connecting the data sets. The customer interface at the far-end data set is not checked. Test data is generated by a DTS and transmitted by the near-end data set. This data is looped back from the receiver output to the transmitter input of the far-end data set and retransmitted. The data is received by the near-end data set and compared to the original data by the DTS. Data errors are indicated by the DTS counter.

5.21 The following test equipment is required:

1—914C DTS.

5.22 Perform the test as follows:

- (1) Connect and condition test equipment as shown in Fig. 13, except on 914C DTS set COUNTER to BLOCK ERRORS—2WL.
- (2) Contact far-end data station and have DL switch on data set depressed.

Requirement: TM lamp lights.

- (3) Apply power to data set and then to test equipment.
- (4) On 914C DTS, set S1 to On.

Requirement: DS1, DS2, and DS3 are lighted.

- (5) Set WORD SYNC momentarily to MAN.
- (6) Depress RESET and allow counter to operate for 15 minutes. Record total errors indicated.

Requirement: Total errors are less than 23.

- (7) Set S1 to OFF.
- (8) Contact far-end data station and have DL switch on data set released.

Requirement: TM lamp goes off.

- (9) Remove all test equipment and restore data set to pretest condition.

I. End-to-End Test

5.23 The end-to-end 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 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 counter.

5.24 The following test equipment is required at both transmitting and receiving data stations.

- (a) For half-duplex tests (2-wire service):

1—914C DTS.

(b) For duplex tests (4-wire service):

1—914C DTS.

2-Wire Private Line

5.25 For a 2-wire private line, a complete end-to-end test involves making one 15-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 test.
- (2) At both stations, connect and condition test equipment as shown in Fig. 14 except at receiving station, on 914C DTS set S1 to OFF.
- (3) At both stations, apply power to data set and then to test equipment.



The receiving station should verify that the 914C DTS NO DATA and NO CLOCK lamps are off. This indicates that a valid connection has been established between the stations. If either lamp lights during the test, the receiving station must contact the transmitting station and arrange to retest.

- (4) At receiving station, 914C DTS set WORD SYNC momentarily to MAN.
- (5) At receiving station, on 914C DTS depress RESET and allow counter to operate for 15 minutes. Record total errors indicated.

Requirement: Total errors are less than 23.

- (6) Perform the end-to-end test in the opposite direction. The receiving station now becomes the transmitting station.
- (7) At original receiving station, on 914 DTS set S1 to ON.
- (8) At original transmitting station, on 914C DTS set S1 to OFF.
- (9) Repeat (4) and (5).

(10) At both stations, remove all test equipment and restore data sets to pretest condition.

4-Wire Private Line

5.26 For a 4-wire private line, a complete end-to-end test involves making one 15-minute test run in each direction. The runs are made simultaneously (duplex). At both data stations, perform the test as follows:

- (1) Establish voice communication between the data stations and arrange to conduct an end-to-end test.
- (2) Connect and condition test equipment as shown in Fig. 14.
- (3) Apply power to data set and then to test equipment.



Both stations should verify that the 914C DTS NO DATA and NO CLOCK lamps are off. This indicates that a valid connection has been established between the stations. If either lamp lights during the test, the stations must arrange to retest.

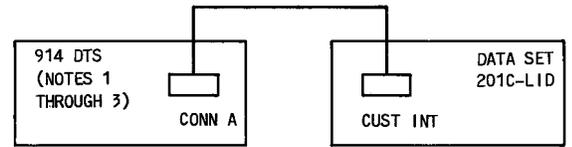
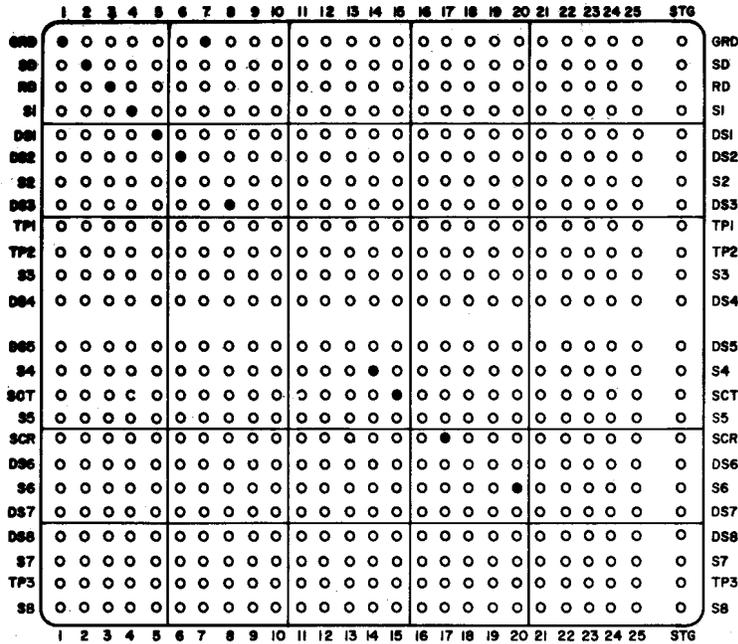
- (5) On 914C DTS, set WORD SYNC momentarily to MAN.
- (6) On 914C DTS, depress RESET and allow counter to operate for 15 minutes. Record total errors indicated.

Requirement: Total errors are less than 23.

(7) Remove all test equipment and restore data sets to pretest condition.

J. Ground Noise Test

5.27 If the data set and the CPE are not connected to the same ground, errors may be caused by a potential difference between data set ground and CPE ground. To detect the presence of noise potentials, a test should be made using the 6-type impulse counter. This counter is used to count the number of impulse noise peaks during a measured time period. The counter registers only the peaks that exceed a preset amplitude and that are separated by about 150 ms or more.



NOTES:

1. SET SWITCHES ON 914 DTS AS FOLLOWS:

SWITCH	SETTING
INTERFACE SELECTOR	ALL DEPRESSED
INTERFACE MODE	VOLTAGE
TEST SET MODE	SER
COUNTER	BLOCK ERRORS-2WL
FUNCTION	OFF
SAMPLE WIDTH	.5US
RCV BIT RATE	EXT +
TRANSMIT BIT RATE	EXT +
RCV WORD LENGTH	511
TRANSMIT WORD LENGTH	511
SIG LEV	+4V
S1	ON
S4	OFF
S6	ON

2. INSERT RED PROGRAMMING PINS IN 914 DTS MATRIX IN POSITIONS INDICATED ABOVE
 3. 914 DTS SWITCHES AND INDICATORS CORRESPOND TO THE FOLLOWING INTERFACE LEADS:

SWITCH	LEAD	EIA
S1	REQUEST TO SEND (RS)	CA
S4	NEW SYNC (NS)	
S6	DATA TERMINAL READY (DTR)	CD

Fig. 14—End-To-End Test Setup

5.28 The following test equipment is required:

- 1—6H impulse counter *or* equivalent
- 1—914C DTS *or* interface test adapter (cover of 901B DTS)

1—2W6A test cord (310 plug on one end, alligator clips connected to tip and ring on other end).

Note: Refer to Section 103-620-101 for information on the 6H impulse counter. If the 6H impulse counter is not available, a 6A

impulse counter may be used. Refer to Section 103-620-100 for information on the 6A impulse counter.

5.29 In this test, the impulse counter is connected between the grounds of the data set and the CPE. The impulse counter registers when potential differences of sufficient amplitude have developed between the separated grounds. The 914C DTS is used to gain access to the ground interface leads. It is assumed that protective ground from the CPE appears on pin 1 of the customer interface connector.

5.30 Perform the test as follows:

- (1) Using the interface cables provided with the 914C DTS, connect the 914C DTS connector A to the customer connector on the data set, and connect the 914C DTS connector B to the data set connector on the CPE.
- (2) On the 914C DTS, remove all programming pins from the matrix. Pull up all A and B interface selector switches.
- (3) Connect one clip of 2W6A cord to interface selector switch 1B and connect other clip to any unpainted metal on the data set.
- (4) Verify that power is applied to data set and CPE.
- (5) Insert 310 plug of 2W6A cord into 310 MEAS jack on 6H impulse counter.
- (6) Set 6H impulse counter DIAL-MEAS switch to MEAS.
- (7) Set 6H impulse counter DBRN dial to 90.
- (8) Reset counter on 6H impulse counter to 0.
- (9) Set 6H impulse counter MINUTES control to 15. At the end of the 15-minute period, record number of counter indications.
- (10) Remove clips of 2W6A cord from 1B and the data set and connect to 7A and 7B.
- (11) Repeat (8) and (9).

5.31 At the end of both 15-minute periods, there should be no indications on the counter of the 6H impulse counter. If there is an indication on the counter, the data set and CPE grounds must be bonded together according to local instructions. At the end of the test, remove all test equipment and restore the data station to pretest condition.

6. REFERENCES

6.01 Additional information concerning DS 201C-L1D is contained in the following publications:

SECTION	TITLE
103-620-100	J94006A(6A) Impulse Counter — Description, Operation, and Maintenance
103-620-101	6H and 6HR Impulse Counters (J9006H and J9006HR) — Description, Operation, and Maintenance
107-101-100	914-Type Data Test Sets — Description and Operation
314-410-500	Voice Bandwidth Private Line Data Circuits — Tests and Requirements
592-029-120	Data Set 201C-L1D — Transmitter-Receiver — Description and Operation
592-029-220	Data Set 201C-L1D — Transmitter-Receiver — Installation and Connections
666-511-501	Test of Data Services Provided by Data Set 201C From a Private Line Testroom
999-100-138	Data Set 201C — How to Operate Manual

6.02 Detailed information concerning DS 201C-L1D is contained in Circuit Description (CD) and Schematic Drawing (SD) 1D-290-01 entitled Data Systems Station — Data Set 201C-L1D.