DATA SET 201CR-L1C
TRANSMITTER-RECEIVER
SINGLE SET
TEST PROCEDURES USING 914-TYPE DATA TEST SET

CONTENTS PAGE

1. GENERAL

1.01 This section contains test procedures using the 914-type data test set (DTS) and the self test capabilities of data set (DS) 201CR-L1C. These procedures are to be used when testing DS 201CR-L1C on an initial installation or during a maintenance visit. Data set 201CR-L1C is the registered version of DS 201C-L1C and meets all requirements of the FCC Registration Program. The registration number for DS 201CR-L1C is AS593M-70105-DM-E.

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

Test Capabilities

1.03 Test circuitry built into DS 201CR-L1C permits the following tests to be performed:

- Analog Loopback Self Test
- End-to-End Self Test
- Receiver Margin Self Test
- Remote Test From Data Test Center (DTC).

1.04 If a 914-type DTS is used, the analog loopback and end-to-end tests can be performed with pseudorandom data. By using the 914-type DTS, the customer interface circuits are tested and more precise indications of bit and block errors are obtained. The 914-type DTS can also be used to perform a test of the data set automatic answer circuits. If a 53A1 data unit is used, an analog loopback start-up test can be performed.

2. INSTALLATION TESTS

2.01 This part provides the sequence in which tests are to be performed after the data set has been installed. 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 local loop meets the requirements specified in Section 314-205-501. Refer to Fig. 1 for the installation test sequence.

3. MAINTENANCE TESTS

3.01 This part provides the sequence in which tests are to be performed during a maintenance visit. This test sequence provides a method of isolating a trouble to the data set, the transmission facility, or the customer-provided equipment (CPE).

3.02 When a trouble report is received, the DTC is responsible for isolating the trouble to the data set or transmission facility. The procedure for doing this is shown in Fig. 2.

3.03 If it is suspected that the trouble is 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 DS 201CR-L1C
- 914C DTS ***or*** 914B DTS and 903-type DTS.

3.04 Refer to Fig. 3 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 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, proceed as follows.

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

(b) Verify that 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.

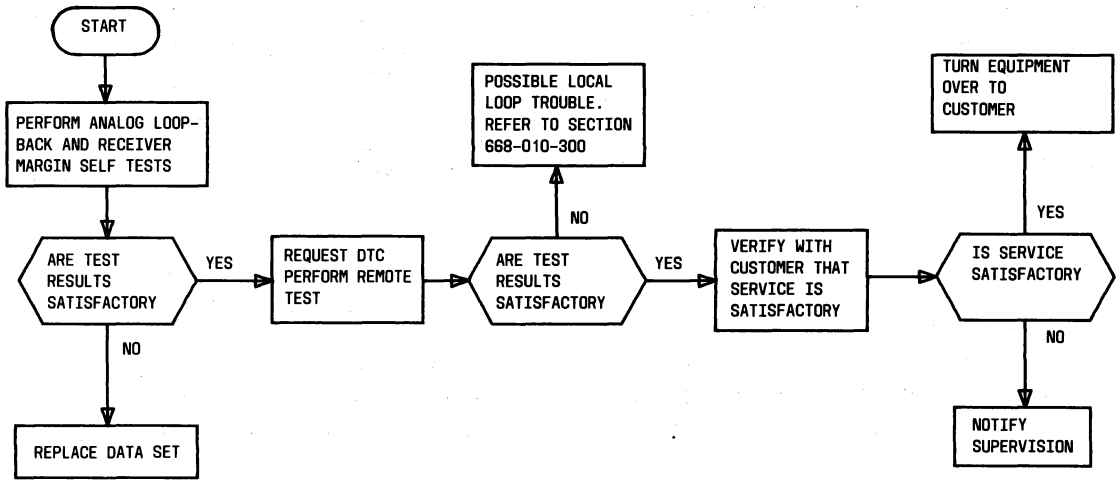


Fig. 1—Installation Test Sequence

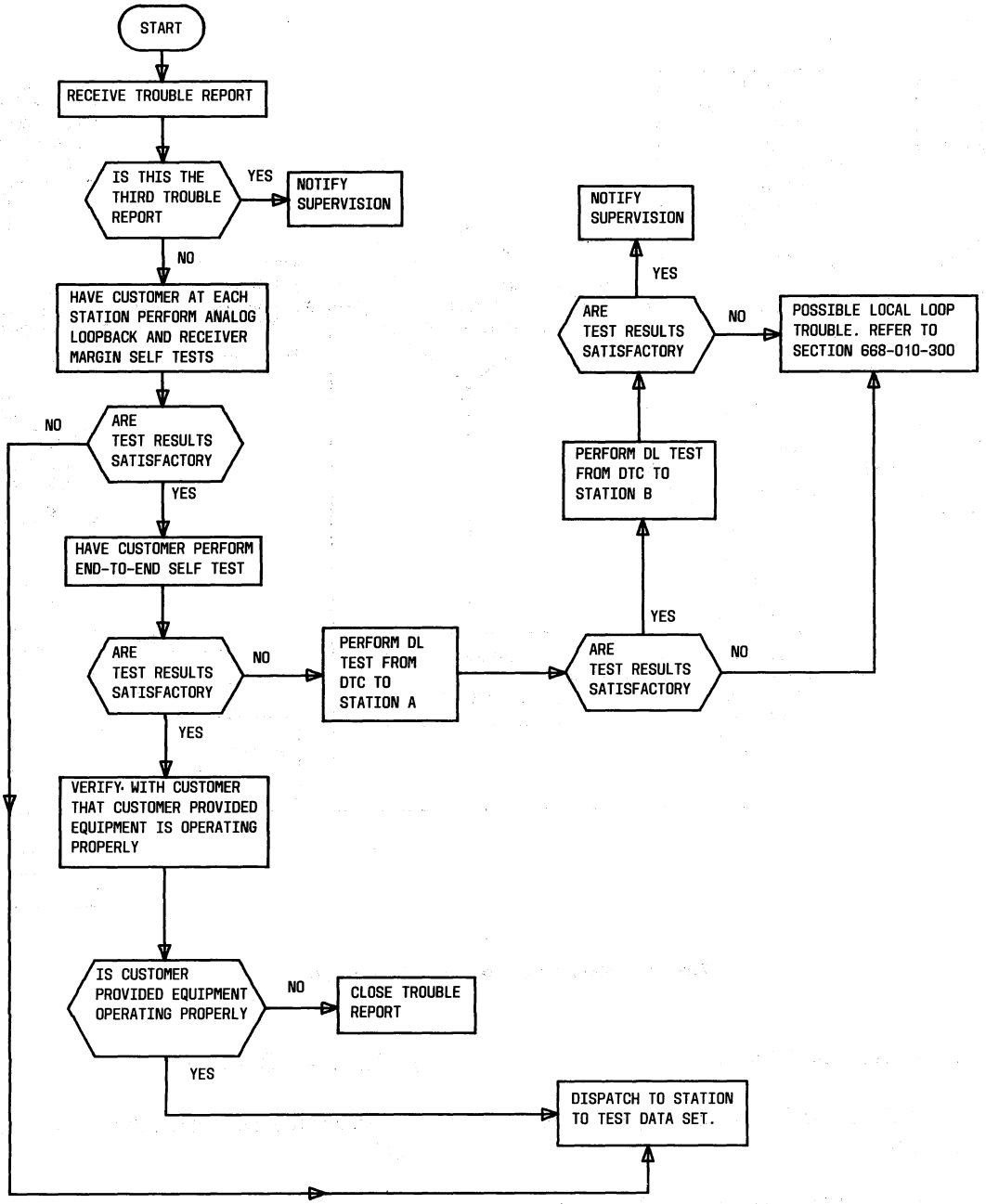


Fig. 2—Clearing Trouble Report

4. TEST PROCEDURES

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

A. Analog Loopback Self Test

4.02 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 data set status lamps. The DL switch can be used to force a loss of synchronization to verify that the data set will recognize a data set failure condition.

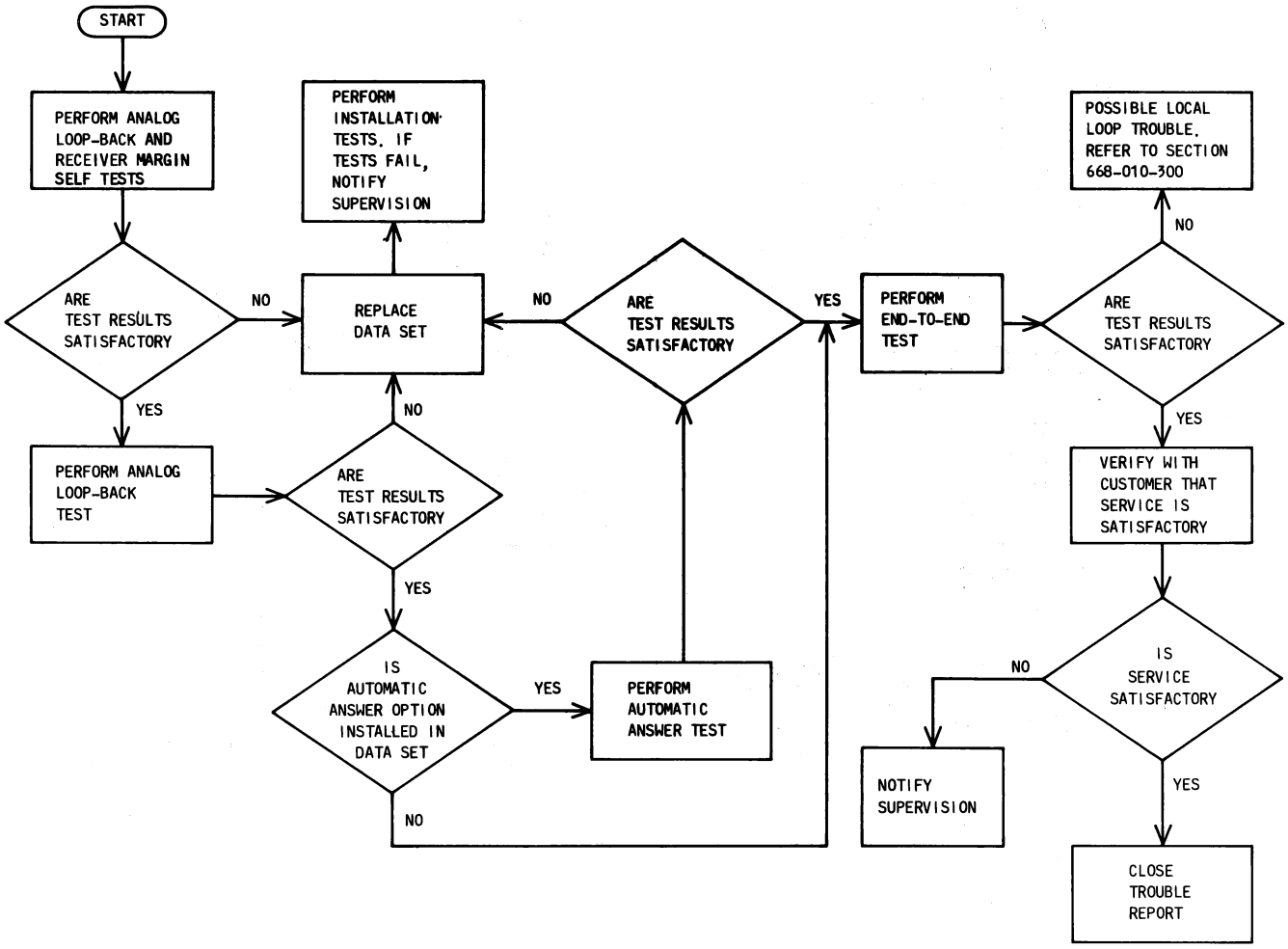


Fig. 3—Maintenance Test Sequence

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 data set status lamps for at least 30 seconds.

Requirement: MC lamp is off continuously. All other lamps are lighted.

(4) Depress RO switch on data set.

Requirement: RS, CS, and CO lamps go off and MC lamp lights.

(5) Release RO switch.

Requirement: All lamps are lighted except MC.

(6) Depress DL switch on data set.

Requirement: MC lamp blinks. All other lamps are lighted.

(7) Release DL, AL, and ST switches.

Requirement: ON and MC lamps are lighted. All other lamps are off.

B. End-To-End Self Test

4.04 The end-to-end self test checks the receiver and transmitter of a local and a distant data set and the facilities connecting the data sets. The customer interfaces are not checked. Since the data sets operate half-duplex, the transmitters and receivers are tested separately. This test requires that the local DS 201CR-L1C be connected to a distant DS 201C-type through a telephone channel and that both data sets be in the data mode. The distant data set may be a 201CR-L1C, 201C-L1C, or 201C-L1. If the distant data set is a 201CR-L1C or 201C-L1C, the DL switch on the distant data set can be used to inject errors into the data stream to verify proper operation of the test.

4.05 Perform the test as follows.

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

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

Requirement: All lamps are lighted except CO.

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

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

(4) Depress DL switch on transmitting data set while attendant at receiving data set observes MC lamp.

Requirement: MC lamp blinks.

(5) Release DL switch on transmitting data set.

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

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

(7) Perform end-to-end self test in opposite direction by releasing RO switch on original receiving data set and depressing RO switch on original transmitting data set.

(8) Repeat (4) through (6).

(9) Upon completing test, release test switches on both data sets and return to voice mode or terminate call.

C. Receiver Margin Self Test

4.06 In this test, the data set is in the analog loopback mode, but the receiver compromise equalizer is bypassed and the distortion threshold at which the MC indicator will light is reduced. The MC indicator acts not only as an indicator of errors in the locally looped data stream, but also blinks on for 50 ms whenever the peak signal distortion measured by the demodulator exceeds the "half-way" point to the receiver decision threshold. The DL switch can be used to force an out-of-sync condition and cause the MC indicator to blink.

4.07 Perform the test as follows:

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

(2) Depress AL and RT switches on data set.

(3) Observe data set status lamps for at least 30 seconds.

Requirement: MC and MR lamps are off. All other lamps are lighted.

(4) Depress DL switch on data set.

Requirement: MC lamp blinks.

(5) Release DL switch.

Requirement: MC lamp goes off.

(6) Release AL and RT switches.

Requirement: ON and MC lamps are lighted. All other lamps are off.

D. Remote Test From Data Test Center

4.08 The remote test enables a data test center to check the data set transmitter and receiver and the facilities connecting the data set and the data test center. The customer interface is not checked.

4.09 Perform the test as follows.

(1) Contact DTC and request a remote test.

(2) When directed by DTC, depress RT switch on data set.

(3) DTC performs remote test. If requested by DTC, depress DL switch on data set to inject errors into data stream.

(4) When directed by DTC, release test switches.

E. Analog Loopback Test

4.10 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 (DTS) 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) lead turns ***on.***

4.11 The following test equipment is required:

1—914C DTS ***or***

1—914B DTS ***and*** 1—903-type DTS.

4.12 Perform the test as follows.

(1) Connect and condition test equipment as shown in Fig. 4.

(2) Apply power to data set and then to test equipment.

(3) Depress AL switch on data set.

Requirement: TM lamp lights.

(4) On 914-type DTS, set S1 to ON. (If 903-type DTS is used, momentarily depress START button.)

Requirement: DS1 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.

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

Requirement: No errors indicated.

(13) Set S1 to OFF.

(14) Condition test equipment as follows:

(a) On 914C DTS, set TEST SET MODE to INTERVAL, COUNTER to INTERVAL—X10, and RCV BIT RATE TO 1200.

(b) On 914B DTS, set TEST SET MODE to TRMT SER, COUNTER TO INTERVAL—X10, and BIT RATE to 1200.

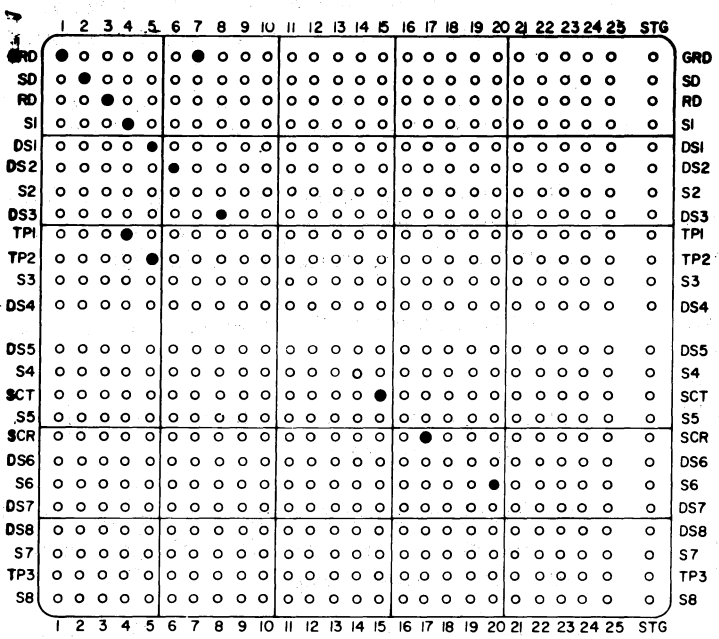
(15) On 914-type DTS, depress RESET and then set S1 to ON. CA-CB interval will appear on counter.

Requirement: 138 to 158 ms ***(14 to 16 on counter).***

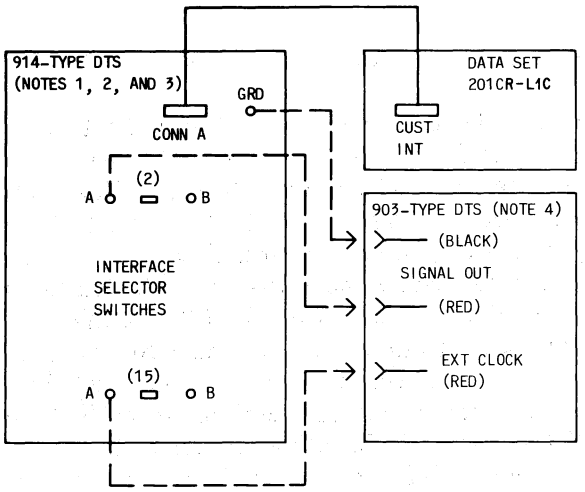
(16) To remeasure CA-CB interval, set S1 to OFF, depress RESET, and set S1 to ON.

(17) Release AL switch on data set.

Requirement: TM lamp goes off.



914-TYPE DTS MATRIX



NOTES:

1. SET SWITCHES ON 914-TYPE DTS AS FOLLOWS:

SWITCH	SETTING
INTERFACE SELECTOR A	ALL DEPRESSED (NOTE 5)
INTERFACE MODE	VOLTAGE
VERTICAL MONITOR	9
TEST SET MODE	SER (914C) RCV SER (914B)
COUNTER	BIT ERRORS
FUNCTION	OFF
RANGE	DCV-30
POLARITY	NOR
SAMPLE WIDTH	.5μS
TRIGGER-TP1	+/OPEN
TRIGGER-TP2	+/OPEN
START (914C)	A OR B
RCV BIT RATE (914C)	EXT+
RCV WORD LENGTH (914C)	63
TRANSMIT BIT RATE (914C)	EXT+
TRANSMIT WORD LENGTH (914C)	63
SIG LEV (914C)	±4V
BIT RATE (914B)	EXT+
WORD LENGTH (914B)	63
SIGNAL LEVEL (914B)	±4V
S1	OFF
S6	ON

2. INSERT RED PROGRAMMING PINS IN 914-TYPE DTS MATRIX IN POSITIONS INDICATED.
3. 914-TYPE DTS SWITCHES AND INDICATOR LAMPS CORRESPOND TO THE FOLLOWING INTERFACE LEADS:

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

4. 903-TYPE DTS IS REQUIRED WITH 914B DTS. SET SWITCHES ON 903-TYPE DTS AS FOLLOWS:

SWITCH	SETTING
BIT RATE	EXT CLOCK
TRIGGER	+ (POSITIVE)
RANDOM-DOT	RANDOM

5. IF 914B DTS IS USED, PULL OUT INTERFACE SELECTOR SWITCHES A(2) AND A(15).

Fig. 4—Analog Loopback Test Setup

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

F. End-to-End Test

4.13 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. 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 assure that all calls do not use the same trunks and routes.

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

1—914-type DTS.

4.15 Perform the test as follows.

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

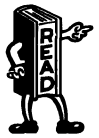
(2) At both stations, connect and condition test equipment as shown in Fig. 5 except as follows:

(a) At receiving station, on 914-type DTS set S1 to OFF.

(b) At transmitting station, if 914B DTS is used set TEST SET MODE to TRMT SER.

(3) At both stations, apply power to data set and then to test equipment.

(4) Establish a test call between stations.



The receiving station should verify that the 914-type 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.

(5) At receiving station, on 914-type DTS set WORD SYNC momentarily to MAN.

(6) At receiving station, on 914-type DTS depress RESET and allow counter to operate for 15 minutes. Record total errors indicated.

Requirement: Total errors are less than 23.

(7) If requirement in (6) is not met, repeat (4) through (6) one time.

(8) Perform the end-to-end test in the opposite direction. The receiving station now becomes the transmitting station.

(9) At original receiving station, on 914-type DTS set S1 to ON. (If 914B DTS is used, set TEST SET MODE to TRMT SER.)

(10) At original transmitting station, on 914-type DTS set S1 to OFF. (If 914B DTS is used, set TEST SET MODE to RCV SER.)

(11) Repeat (4) through (7).

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

G. Automatic Answer Test

4.16 The automatic answer test verifies that the data set will automatically answer and end a call.

4.17 The following test equipment is required:

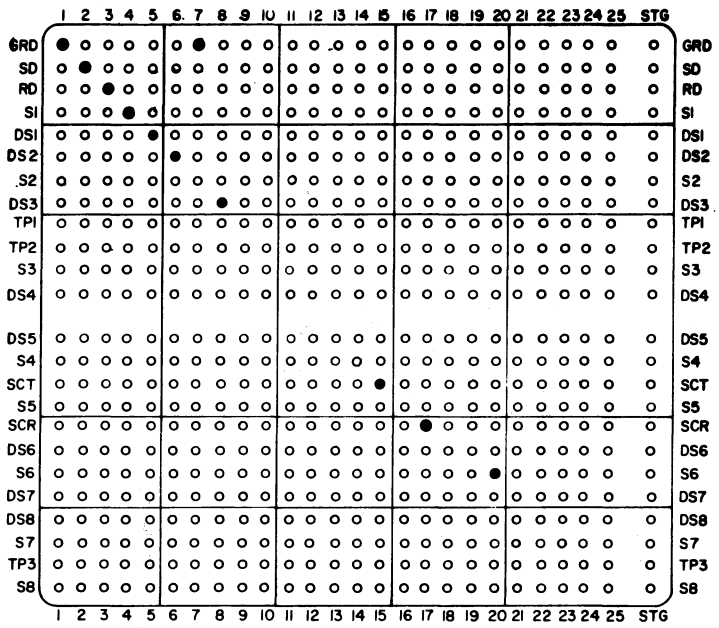
1—914-type DTS.

4.18 Perform the test as follows.

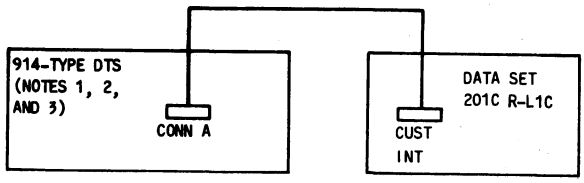
(1) Connect and condition test equipment as shown in Fig. 6.

(2) Apply power to data set and then to test equipment.

(3) Have a call made to data set.



914-TYPE DTS MATRIX



NOTES:

1. SET SWITCHES ON 914-TYPE DTS AS FOLLOWS:

SWITCH	SETTING
INTERFACE	
SELECTOR A	ALL DEPRESSED
INTERFACE MODE	VOLTAGE
TEST SET MODE	SER (914C) RCV SER (914B)
COUNTER	BLOCK ERRORS-16WL
FUNCTION	OFF
SAMPLE WIDTH	.5μS
RCV BIT RATE (914C)	EXT+
RCV WORD LENGTH (914C)	63
TRANSMIT BIT RATE (914C)	EXT+
TRANSMIT WORD LENGTH (914C)	63
SIG LEV (914C)	±4V
BIT RATE (914B)	EXT+
WORD LENGTH (914B)	63
SIGNAL LEVEL (914B)	±4V
S1	ON
S6	ON

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

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

Fig. 5—End-to-End Test Setup

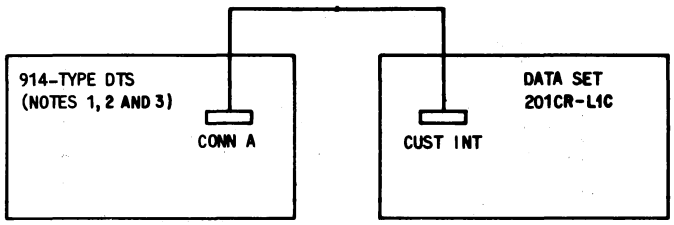
Requirement: DS8 lights (ring indicator ***on***) during ringing period. DS8 goes off (ring indicator ***off***) during silent period. Data set does ***not*** answer call.

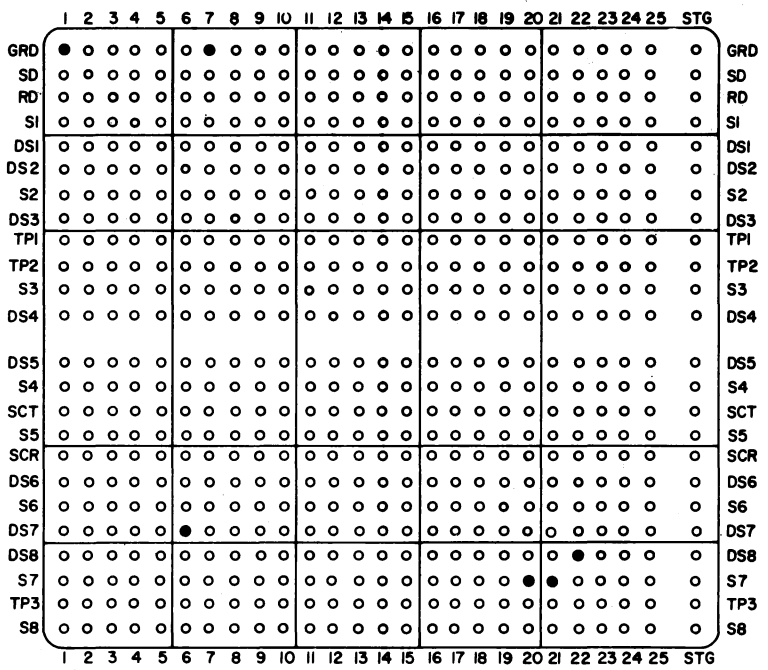
(4) During silent period of ringing cycle, set S7 to ON (data terminal ready and ready ***on***).

Requirement: At end of next ringing cycle, data set answers call. After about 4 seconds, DS7 lights (data set ready ***on***). This indicates that data set is in data mode.

(5) Set S7 to OFF (data terminal ready and ready ***off***) to end call.

Requirement: DS7 goes off (data set ready ***off***).





914-TYPE DTS MATRIX

NOTES:

1. SET SWITCHES ON 914-TYPE DTS AS FOLLOWS:

SWITCH	SETTING
INTERFACE SELECTOR A	ALL DEPRESSED
INTERFACE MODE	VOLTAGE
FUNCTION	OFF
S7	OFF

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

3. 914-TYPE DTS SWITCHES AND INDICATOR LAMPS CORRESPOND TO THE FOLLOWING INTERFACE LEADS:

SWITCH	LAMP	LEAD	EIA
S7	DS7	DATA SET READY (DSR)	CC
	DS8	RING INDICATOR (RI)	CE
		DATA TERMINAL READY (DTR) AND READY (RDY)	CD

Fig. 6—Automatic Answer Test Setup

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

H. Analog Loopback Start-Up Test Using 53A1 Data Unit

4.19 Using a 53A1 data unit in place of the customer terminal at the local end, perform the analog loopback start-up test in accordance with Section 590-100-138.

I. Ground Noise Test

4.20 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 level and that are separated by about 150 ms or more.

4.21 The following test equipment is required:

1—6H impulse counter (or equivalent)

1—914-type 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.

4.22 In this test, the impulse counter is connected between the grounds of the data set and the CPE. The counter registers when potential differences of sufficient amplitude have developed between the separated grounds. The 914-type DTS is used to gain access to the ground interface leads. If a 914-type DTS is not available, any suitable method of access may be used.

4.23 Perform the test as follows.

(1) Using the interface cables provided with the 914-type DTS, connect the 914-type DTS connector A to the customer connector on the data set, and connect the 914-type DTS connector B to the data set connector on the CPE. These connections assume that protective ground from the CPE appears at the customer interface.

(2) On 914-type DTS, remove all programming pins from matrix. Pull up all A and B interface selector switches.

(3) Connect one clip of 2W6A cord to interface selector switch 1B on 914-type DTS and connect other clip to any clear, bare metal on data set housing.

(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) Connect clips of 2W6A cord to interface selector switches 7A and 7B on 914-type DTS.

(11) Repeat (8) and (9).

4.24 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 in accordance with local instructions. At the end of the test, disconnect the test equipment and restore the data set to pretest condition.

5. REFERENCES

5.01 Additional information concerning the testing of DS 201CR-L1C 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
107-200-100	903-Type Data Test Sets—Description and Operation
314-205-501	Data Systems—DATAPHONE® Service and Data Access Arrangements on Direct Distance

SECTION	TITLE
	Dialing Network—Test Requirements for Subscriber, Foreign Exchange, and Remote Exchange Lines
592-036-100	Data Set 201CR-L1—Transmitter-Receiver—Single Set—Description and Operation
592-036-200	Data Set 201CR-L1C—Transmitter-Receiver—Single Set—Installation and Connections
668-010-300	Data Systems—DATAPHONE® Service on Direct Distance Dialing Network—Data Test Center—Trouble Analysis Procedures

5.02 Detailed information concerning DS 201CR-L1C is contained in CD- and SD-1D288-02.