DATA SETS 201A3, A4 AND 201B3, B4
TRANSMITTER-RECEIVER
TEST PROCEDURES

CONTENTS PAGE

1. GENERAL

1.01 This section contains information pertaining to the testing of data sets 201A3, A4 and 201B3, B4. This section is arranged so that tests may be performed individually if required.

Note: Test information for data set 201 list-type is contained in Section 592-011-502. Test information for data sets 201A1, A2 and 201B1, B2 is contained in Section 592-011-500.

1.02 This section is reissued to update the ground noise test, to include information for testing an arrangement using data auxiliary set (DAS) 804, and to add information about the use of the 914-type data test set (DTS).

1.03 ▶This section is arranged so that tests can be performed using either a 914-type DTS or 901-, 902-, and 903-type DTSs. However, if the 914 DTS is used, time intervals can be measured. This is not possible with the 901-, 902-, and 903-type DTSs. The 914B or 914C DTS can be used for the test procedures in this section. The 914C DTS contains additional features but performs all the functions of the 914B. For information on the differences, refer to the section entitled 914-Type Data Test Sets—Description and Operation (107-101-100).◀

1.04 Before proceeding with any tests of the data set, assure that:

(a) The installation meets standard dc signaling, supervision, and transmission requirements as specified in Section 314-205-501.

(b) For DATA-PHONE® service, the loop meets the requirements as specified in Section 314-205-501.

(c) For private line (PL) service, the facility meets the basic requirements specified in Section 314-410-500.

1.05 ▶If the data set and business machine are not connected to the same ground, errors may be caused by a potential difference between data set ground and business machine ground. To detect the presence of noise potentials, a test should be made using the 6-type impulse counter. The 6-type impulse counter is used to count the

number of impulse noise peaks during a measured time period. The counter will register only the peaks which exceed a preset amplitude and which are separated by approximately 150 milliseconds or more.

1.06 The end-to-end test should be performed at the time of installation and when investigating a trouble report.

- At time of installation, a short (3-minute) end-to-end test should be performed to verify that the overall system is functioning properly. If the customer equipment is installed at both locations, it may be possible to perform an end-to-end test using test messages between business machines.

- During investigation of a trouble report, the end-to-end test should be performed if trouble is suspected in the facilities, when there is no definite pattern to the trouble, or when it is suspected that trouble may be in the business machine. Complete end-to-end tests consist of two 15-minute calls and ten 1-minute calls. Tests should be performed during the same time of day as when the customer experiences trouble.

If it is not possible to obtain a craft employee to assist in testing at the far-end data station, the test may be performed from the local end to a data test center (DTC). It is recommended that the DTC nearest to the far-end data station be utilized.◀

2. TEST PROCEDURES USING 914-TYPE DATA TEST SET

2.01 This group of tests can be used for checking the data set transmitter, receiver, clock signals, and control signals. The tests are divided into four parts: ground noise test, installation tests, maintenance tests, and end-to-end test. For the procedures to be followed when investigating a trouble report, refer to the section entitled Data Sets 201A3, A4 and 201B3, B4 Transmitter-Receiver—Maintenance (592-011-301).

A. ▶Ground Noise Test◀

2.02 If the data set and business machine are not connected to the same ground, errors may be caused by a potential difference between data set ground and business machine ground. A test should be made using the 6H impulse counter to detect the presence of noise potentials. ▶Test equipment required for this test is as follows:

- One 6H impulse counter (or equivalent)

- One 914-type DTS

- One 2W6A test cord for 6H impulse counter (310 plug on one end; alligator clips connected to tip and ring on the other end).

Note: For information pertaining to the 6H impulse counter, refer to the section entitled 6H and 6HR Impulse Counters (J94006H and J94006HR)—Description and Operation (103-620-101). If the 6H impulse counter is not available, a 6A impulse counter may be used. For information pertaining to the 6A impulse counter, refer to the section entitled J94006A (6A) Impulse Counter—Description, Operation, and Maintenance (103-620-100).

2.03 In this test, the impulse counter is connected between the grounds of the data set and the customer equipment. The impulse counter will register when potential differences of sufficient amplitude have developed between the separated grounds. The 914 DTS is used to gain access to the ground interface leads. The test is performed as follows:

(1) Use a 2W6A test cord, or equivalent (310 plug on one end; alligator clips connected to tip and ring on the other end). Connect the 914-type DTS connector A to the customer connector on the data set. Connect the 914-type DTS connector B to the data set connector on the business machine. This test assumes that protective ground from the business machine appears at the customer interface.

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

(3) Connect one clip of the 2W6A cord to switch 1A and connect the other clip to switch 1B. Verify that power is applied to data set and business machine.

(4) Insert the 310 plug into the 310 MEAS jack on the 6H impulse counter. ◀

(5) On the 6H impulse counter, set the DIAL-MEAS switch to MEAS and set the DBRN dial to 90.

(6) Reset the counter on the 6H impulse counter to 0.

(7) Set the minutes control to 15. After the 15-minute test has elapsed, record the number of indications on the counter.

(8) Remove clips of 2W6A cord from 1A and 1B and connect to 7A and 7B.

(9) Reset the counter on the 6H impulse counter to 0.

(10) Set the minutes control to 15. After the 15-minute test has elapsed, record the number of indications on the counter.

2.04 At the end of both of the 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 grounds must be bonded together according to local instructions. At the end of the test, disconnect the test equipment and restore the data set to pretest condition.

B. Installation Tests

2.05 An installation test is to be performed after installing the data set or as a preliminary setup for the maintenance test (Part C of this section). This test can be used to check the data set transmitter, receiver, clock signals, control signals, and transmitter output level. If the data set fails this test, it must be replaced or repaired as outlined in the maintenance tests.

2.06 Equipment required for performing the test is as follows:

(a) For data sets equipped with internal timing:

- One 914 DTS.

(b) For data sets equipped for external timing:

- One 914 DTS ***and***

- One 32LBMP-2000 (for 201A) or −2400 (for 201B) frequency standard (available from Bulova Watch Company, American Time Products Division, 61-20 Woodside Avenue, Woodside, New York)

or

- One internally timed data set 201-type (in addition to the data set under test).

Note: The additional data set must be of the same operating speed as the data set under test.

(c) 66E3 connecting block (only for arrangement using DAS 804A).

2.07 All tests specified in this section are written for data sets equipped with internal timing. To test an externally timed data set, it will be necessary to provide a clock signal either from the frequency standard or the additional data set.

2.08 The procedure for testing an externally timed data set using the frequency standard is as follows:

(a) Run two leads from the frequency standard to the interface control switch panel on the 914 DTS (red to terminal 15, black to terminal 1).

(b) Connect the power cord of the frequency standard to a 117-volt ac outlet.

No further modifications are necessary. The data set, externally timed, can be tested as though it were internally timed.

2.09 The procedure for testing an externally timed data set by using an additional internally timed data set is as follows:

(1) Connect a cord from the B interface connector on the 914 DTS to the connector J2 (CUST EQPT) on the internally timed data set.

(2) Lift all B interface connector switches except 1 and 15.

(3) Connect the power cord of the internally timed data set to a 117-volt ac outlet.

No further operations are necessary. The externally timed data set can be tested as though it were internally timed.

Two-Wire Test

2.10 Set up the equipment as shown in Fig. 1. The test is performed as follows:

(1) ▶If a DAS 804 is ***not*** used in the connecting arrangement, disconnect the line wires (tip and ring) at the 66E3 connector block and◀ connect a 600- or 900-ohm resistor between terminals 14 and 16 on the 66E3 connector block. Connect the meter input leads across the resistor.

(2) ▶If a DAS 804 is used in the connecting arrangement, disconnect the data set at the bridging adapter and connect the data set to the 66E3 connector block provided by the installer. Connect a 600- or 900-ohm resistor across terminals 14 and 16 of the 66E3 connector block. Connect the meter input leads across the resistor.◀

(3) Apply power to the data set and to the 914 DTS.

(4) Turn S1 switch on. Verify that the NO CLOCK and NO DATA lamps are extinguished.

(5) Depress the RESET button. The counter should read zero errors.

(6) Set the WORD LENGTH switch to 63. The counter should count rapidly.

(7) Set the WORD LENGTH switch to DOT. The counter should stop. Lamps DS1, DS2, DS3, DS4, DS5, and DS6 should be lighted.

Note: Refer to Fig. 1 for a description of which interface lead is presented on which lamp.

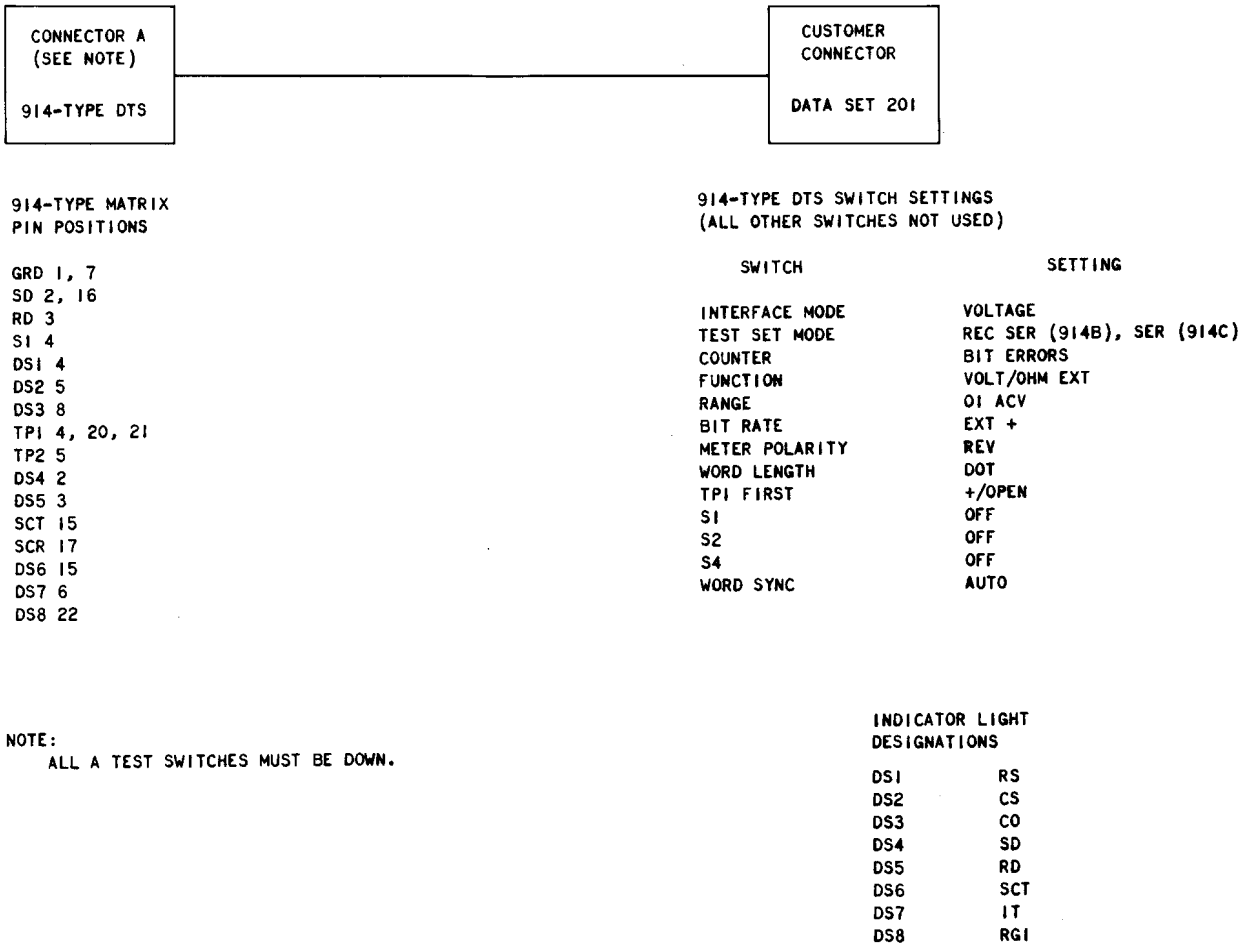

Fig. 1—Initial Test Setup

(8) Turn S1 switch off. Lamps DS1, DS2, DS3, and DS5 should be extinguished. The NO CLOCK and NO DATA lamps should light. (Disregard readings on the counter.)

(9) Turn S1 switch on. Remove the pin from SD-16 on the matrix and place it in S4-2. Only lamps DS1, DS2, DS3, and DS6 should be lighted.

(10) Turn S4 switch on. Lamps DS4 and DS5 should also light. The counter should count rapidly. Turn S1 switch off.

(11) Set the COUNTER switch to INTERVAL X.1 if the data set is equipped with option T. Set the COUNTER switch to INTERVAL X10 if the data set is equipped with option V or ZL.

(12) Move the BIT RATE switch to 2000 (for data set 201A) or 2400 (for data set 201B).

(13) Press the RESET button and move switch S1 to ON. The TP1 FIRST lamp should light. The counter will indicate the interval between request-to-send on and clear-to-send on.

Requirement:

Option T—6.5 to 9 on counter

Option V or ZL—15 to 25 on counter.

Note: Because of the setting of the INTERVAL switch, the 914 DTS is measuring an interval of 6.5 to 9.0 ms between RS and CS (with option T) or 150 to 250 ms (with option V or ZL).

(14) Read the transmitter output level from the meter on the 914 DTS. This reading should be ▶within ±0.5 dB of◀ the output level for which the data set is strapped.

(15) End of test. Proceed to the automatic answer test ▶if DAS 804 is used in the connecting arrangement. If DAS 804 is ***not*** used, disconnect the test equipment and restore the equipment to normal.◀

Four-Wire Switched Carrier Test

2.11 Set up the equipment as shown in Fig. 1. The test is performed as follows:

▶***Note:*** If a DAS 828A or other PL termination having loop-back capability and terminating the data set output is used, a test for carrier is made by operating the LOOP-BACK key.

(1) If a DAS 804 is ***not*** used in the connecting arrangement,◀ disconnect the line wires (tip and ring) at the 66E3 connector block and connect terminal 14 to terminal 18 and terminal 16 to terminal 20.

(2) ▶If a DAS 804 is used in the connecting arrangement, disconnect the data set at the bridging adapter and connect the data set to the 66E3 connector block provided by the installer. Connect terminal 14 to terminal 18 and terminal 16 to terminal 20.◀

(3) Connect the meter input leads across ▶terminals 14 and 16 of◀ the 66E3 connector block.

(4) Apply power to the data set and 914 DTS. Turn switch S1 on. Verify that the NO CLOCK and NO DATA lamps are extinguished.

(5) Depress the RESET button. The counter should read zero errors.

(6) Set the WORD LENGTH switch to 63. The counter should count rapidly.

(7) Set the WORD LENGTH switch to DOT. The counter should stop. Lamps DS1, DS2, DS3, DS4, DS5, and DS6 should be lighted.

(8) Turn switch S1 off. Lamps DS1, DS2, DS3, and DS5 should extinguish. The NO CLOCK and NO DATA lamps should light. (Disregard readings on the counter.)

Note: Refer to Fig. 1 for a description of which interface lead is presented on which lamp.

(9) Turn switch S1 on. Remove the pin from SD-16 on the matrix and place it in S4-2. Only lamps DS1, DS2, DS3, and DS6 should be lighted.

(10) Turn switch S4 on. Lamps DS4 and DS5 should also light. The counter should count rapidly. Move switch S1 to OFF.

(11) Set the COUNTER switch to INTERVAL X.1 if the data set is equipped with option T. Set the COUNTER switch to INTERVAL X10 if the data set is equipped with option V or ZL.

(12) Move the BIT RATE switch to 2000 (for data set 201A) or 2400 (for data set 201B).

(13) Press the RESET button and switch S1 to ON. The TP1 FIRST lamp should light. The counter will indicate the interval between request-to-send on and clear-to-send on.

Requirement:

Option T—6.5 to 9 on counter

Option V or ZL—15 to 25 on counter.

Note: Because of the setting of the INTERVAL switch, the 914 DTS is measuring an interval of 6.5 to 9.0 ms between RS and CS (with option T) or 150 to 250 ms (with option V or ZL).

(14) Read the transmitter output level from the meter on the 914 DTS. This reading should be approximately equal to the output level for which the data set is strapped.

(15) End of test. Proceed to the test of the automatic answer ▸if DAS 804 is used in the connecting arrangement. If DAS 804 is ***not*** used, disconnect the test equipment and restore the equipment to normal.◂

Four-Wire Continuous Carrier Test

2.12 Set up the equipment as shown in Fig. 1. The test is performed as follows:

▸***Note:*** If a DAS 828A or other PL termination having loop-back capability and terminating the data set output is used, a test for carrier is made by operating the LOOP-BACK key.

(1) If DAS 804 is ***not*** used in the connecting arrangement,◂ disconnect the line wires (tip and ring) at the 66E3 connector block, and connect terminal 14 to terminal 18 and terminal 16 to terminal 20.

(2) ▸If a DAS 804 is used in the connecting arrangement, disconnect the data set at the bridging adapter and connect the data set to the 66E3 connector block provided by the installer. Connect terminal 14 to terminal 18 and terminal 16 to terminal 20.◂

(3) Connect the meter input leads across ▸terminals 14 and 16 of◂ the 66E3 connector block.

(4) Apply power to the data set and to the 914 DTS. Verify that the ▸DS3,◂ DS4, DS6, and NO DATA lamps are lighted and that the counter counts rapidly.

Note: Refer to Fig. 1 for a description of which interface lead is presented on which lamp.

(5) Turn switch S1 on. Lamps DS1, DS2, DS3, DS4, DS5, and DS6 should be lighted. The NO DATA lamp should extinguish and the counter should stop.

(6) ▸Switch WORD LENGTH switch to 63 to check that counter counts; switch back to DOT and check that counter stops.◂

(7) Remove the pin from SD-16 on the matrix and place it in S4-2. Lamps DS1, DS2, DS3, DS6, and the NO DATA lamp should be lighted.

(8) Turn switch S4 on. Lamps DS4 and DS5 should light. Move switch S1 to OFF.

(9) Set the COUNTER switch to INTERVAL X.1 if the data set is equipped with option T. Set the COUNTER switch to INTERVAL X10 if the data set is equipped with option V or ZL.

(10) Move the BIT RATE switch to 2000 (for data set 201A) or 2400 (for data set 201B).

(11) Press the RESET button and switch S1 to ON. The TP1 FIRST lamp should light. The counter will indicate the interval between request-to-send and clear-to-send on.

Requirement:

Option T—6.5 to 9 on counter

Option V or ZL—15 to 25 on counter.

Note: Because of the setting of the INTERVAL switch, the 914 DTS is measuring an interval of 6.5 to 9.0 ms between RS and CS (with option T) or 150 to 250 ms (with option V or ZL).

(12) Read the transmitter output level indicated on the meter of the 914 DTS. This reading should be approximately equal to the output level for which the data set is strapped.

(13) End of test. Proceed to the automatic answer test ▶if DAS 804 is used in the connecting arrangement. If DAS 804 is ***not*** used, disconnect the test equipment and restore the equipment to normal.◀

Automatic Answer Test

2.13 This is a test of the remote control (RC) lead, the ready (RDY) lead, and the ring indicator (RG1 and RG2) leads. If the data set fails this test, verify that the strapping on the L4 circuit board is correct. If the test fails again, replace circuit board L4 and check wiring between the data set and the DAS 804.

(1) Set up the equipment as shown in Fig. 1. Remove the matrix pin from TP1-4 and move the FUNCTION switch to SPKR.

(2) If the data set is strapped for contact closure (option ZG), insert a matrix pin in TP1-20, TP1-21, TP2-9, TP2-22, DS8-23, and TP3-19. If the data set is strapped for EIA interface (option ZF), insert a matrix pin in DS7-6, DS8-22, and S2-20.

(3) The DAS 804A should be connected to the data set. If the DAS 804A is ***not*** strapped for permanent automatic answer, press the AUTO ANS button.

(4) Connect the 914 INPUT terminals across the transmitting tip and ring pair.

(5) Call the number associated with the DAS 804A from a different phone.

(6) If the data set is equipped for contact closure interface, proceed to (7). If the data set is equipped for Electronic Industries Association (EIA) voltage interface, verify that DS8 lights every time the ringing current is heard. Move switch S2 to ON. This applies a positive voltage to RC. The ringing should stop, indicating that the DAS 804A has answered the call. Approximately 1.5 seconds after the end of ringing, a 2025-Hz tone will be heard coming from the speaker. At the time the tone changes (approximately 2 to 5 seconds), lamp DS7 will light, indicating that the interlock (IT) lead has gone positive. If all indications are as specified, the automatic answer feature is functioning correctly. Proceed to (8).

(7) Verify that lamp DS8 lights every time ringing is heard. This indicates that a contact closure is occurring between RG1 and RG2 every time ringing is heard. Place a pin in matrix position TP3-20. The ringing should stop, indicating that the DAS 804A has answered the call. Approximately 1.5 seconds after ringing ceases, a 2025-Hz tone will be heard coming from the speaker. This tone will remain for approximately 2 to 5 seconds. After the answer-back tone ceases, lamp DS7 will light, indicating that the IT lead has gone positive. If all indications are as specified, the automatic answer feature is functioning correctly.

(8) End of test. Disconnect the test equipment and restore the equipment to normal unless the end-to-end test is to be performed.

C. Maintenance Tests

2.14 This test procedure provides a method of isolating a data set trouble to a board or group of boards in the data set. This is done by analyzing the pattern of lighted and unlighted lamps which appear on the 914 DTS. Refer to Fig. 2 for the flowchart which indicates the order in which the lamps are to be analyzed.

2.15 Before attempting to use the flowchart (Fig. 2), the installation test must be set up. Refer to Part 2B (Installation Tests) and set up the equipment as instructed for the data set under test. Each test set lamp is connected to a different interface lead. The lamp will light when a positive voltage appears on that lead. The NO CLOCK lamp will light when the 914 DTS is ***not***

DS LAMPS ON 914B DTS ARE ASSIGNED AS FOLLOWS:

DS1	DS2	DS3	DS4	DS5	DS6
RS	CS	CO	SD	RD	SCT

* IF R1,R2,R3 ARE NOT AVAILABLE AS A MATCHED GROUP, REPLACE THE DATA SET.

† IF R13,R14,R15, AND R16 ARE NOT AVAILABLE AS A MATCHED GROUP, REPLACE THE DATA SET.

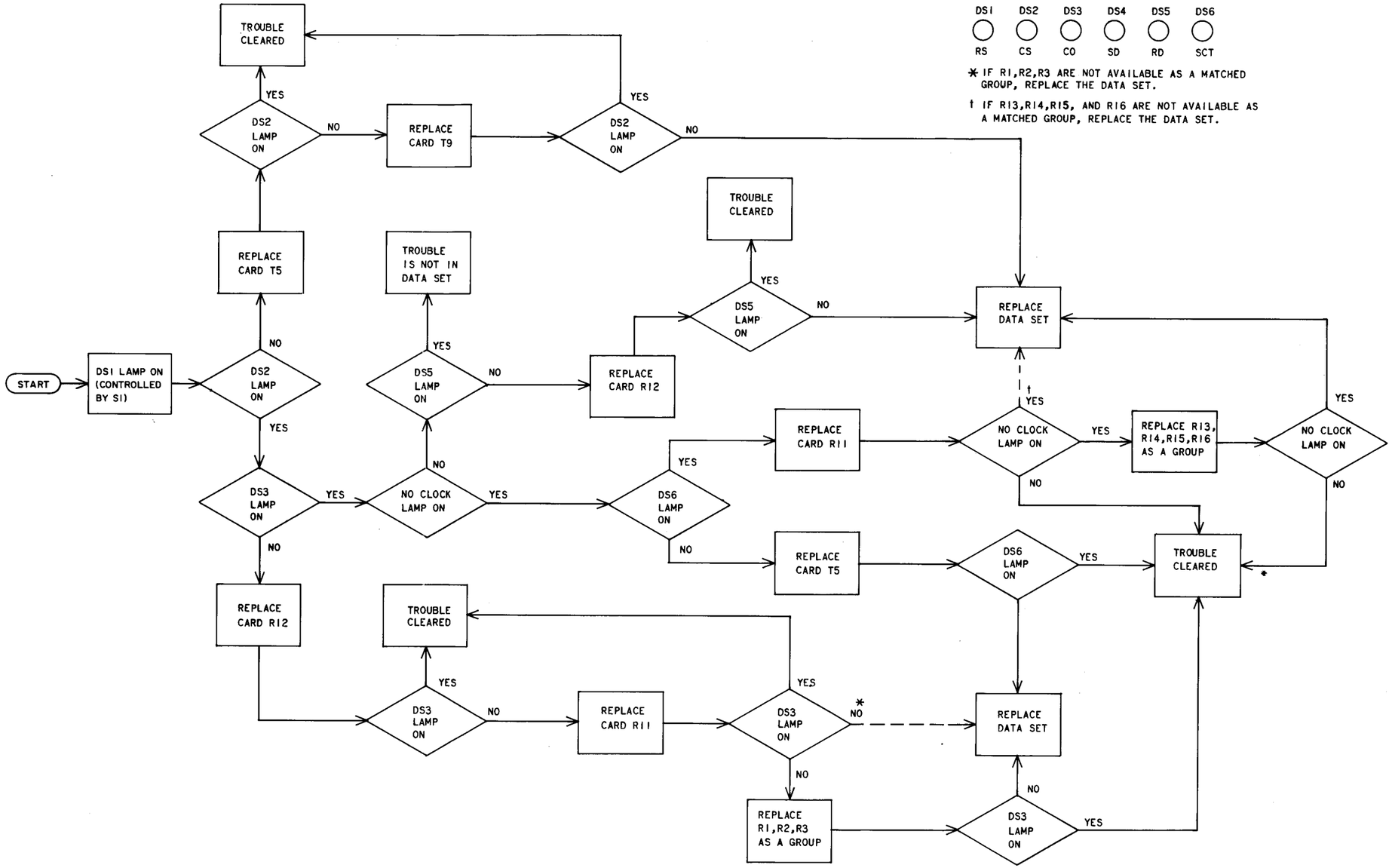

Fig. 2—Maintenance Flowchart

receiving a clock signal from the data set. The NO DATA lamp will light when data is not being received from the data set. Refer to Fig. 2 for a comparison of which data set lamp is connected to which interface lead.

2.16 The DS1 lamp is connected to the request-to-send lead and will light when switch S1 is turned on. When performing the installation test and a test set lamp fails to light or, if the NO CLOCK or NO DATA lamps light when they should not, refer to Fig. 2 and replace cards as recommended. If the lamps then light in the proper sequence, proceed with the installation test. Refer to Section 592-011-301 for other procedures to be followed when investigating a trouble report.

D. End-to-End Test

2.17 This is a test of the data set transmitter and receiver and of the connecting facilities. In this test, data set 201-type is driven by a word generator in the 914 DTS. At the distant end, the data signals are fed either to a 904B or 904D DTC or to a remote data set 201-type. Figure 3 shows the equipment setup at both the transmitting and receiving ends.

2.18 If the test is conducted using a DTC, the test will be coordinated under the direction of the DTC. In either case, the transmitting and receiving equipment setup is as shown in Fig. 3.

Note: The procedure for testing from a 904 DTC is included in Section 668-102-500.

Switched Network Testing

2.19 Apply power to the 914 DTS. On the switched telephone network, complete end-to-end tests consist of making two 15-minute calls and ten 1-minute calls. Establish voice communication in the manner normally used by the customer when placing data calls.

914-TYPE MATRIX
PIN POSITIONS

GRD	1, 7, 14
SD	2
RD	3
SI	4
DSI	4
DS2	5
DS3	8
TPI	19, 20, 21
DS4	6
SCT	15
SCR	17

914-TYPE DTS SWITCH SETTINGS
(ALL OTHER SWITCHES NOT USED)

SWITCH	SETTING
INTERFACE MODE	VOLTAGE
TEST SET MODE	(NOTE 2)
COUNTER	BIT ERRORS
BIT RATE	EXT +
METER POLARITY	REV
SI	(NOTE 3)
WORD SYNC	OFF

NOTES:
1. ALL A TEST SWITCHES MUST BE DOWN.
2. ON THE 914B, THE TEST SET MODE SWITCH IS SET TO TRMT SER AT THE TRANSMITTING END OR TO REC SER AT THE RECEIVING END. ON THE 914C, THE TEST SET MODE SWITCH IS SET TO SER AT EITHER END.
3. SWITCH SI IS INITIALLY SET TO ON AT THE TRANSMITTING END AND MUST BE SET TO OFF AT THE RECEIVING END.

INDICATOR LIGHT DESIGNATIONS

DSI	RS
DS2	CS
DS3	CO
DS4	IT

Fig. 3—End-to-End Test

Take proper steps to ensure that the customer is not billed for toll calls on test. Refer to Section 010-250-001.

2.20 Place calls alternately from each end except where one customer location will always be originating the call. Test calls should be placed during busy hours. This will increase the probability that all test calls do not use the same trunks and routes.

2.21 During the 15-minute calls, the receiving station should make a minute-by-minute count of errors as indicated by the counter on the 914 DTS. To prevent exceeding the counter capacity, the RESET button should be depressed at the end of each minute after the error count has been noted. Figure 4 illustrates a format which can be used for recording test data. The PEAK DISTORTION columns of Fig. 4 should be ignored for these tests. Occasionally, a noise burst or "hit" may cause the error counter to lose synchronization and indicate continuous errors. The interval up to and including the burst should be tabulated as "over 100 bit errors." The RESET button on the 914 DTS should be depressed ▸and the WORD SYNC switch momentarily switched to MAN◂ to continue tests.

2.22 After a voice connection has been established, the attendant at the receiving end should verify that the CLOCK and DATA lamps on the 914 DTS are extinguished. This will indicate that a valid connection has been established. If either of the lamps light during the test, the receiving station attendant must contact the transmitting station attendant and agree to retest.

2.23 At the end of the prearranged time interval, voice communication is established again and an agreement is made to repeat the test in the opposite direction. The test is then repeated with the first transmitting station becoming the receiver and the first receiving station becoming the transmitter.

2.24 The test call requirements for the switched telephone network are as follows:

(a) For 15-minute calls:

- During ten of the fifteen 1-minute calls, no more than two bit errors per interval
- During three of the remaining five 1-minute intervals, no more than ten bit errors per interval
- During the remaining two 1-minute intervals, no error requirements.

(b) For 1-minute calls:

- During eight out of ten calls, no more than ten bit errors in any one minute.

▸Private Line Testing◂

2.25 ▸On PL systems, voice communication between terminals can be established over a separate facility if a DAS 804A or telephone set is not associated with the data set. Proceed as follows:

(1) Connect the 914 DTS to the near-end data set and verify that the 914 DTS has been connected at the far-end data set.

(2) Insert red pins into the matrix and set switches on the near-end data as shown in Fig. 3.

Note: This will be the transmitting station for the first part of the test.

(3) Conduct an error run for 1 minute. Record errors and reset the counter.

(4) At the receiving end, momentarily operate the WORD SYNC switch on the 914 DTS to MAN after the DS3 (carrier on) lamp lights. The counter should stop counting except when errors occur. Reset counter.

(5) Repeat (3) for a total of ten 1-minute error runs. Eliminate the one error run with the most errors.

Requirement: Total errors of the other nine error runs must be less than ten.

(6) Perform the test in the opposite direction, ie, the transmitting station becomes the receiver and the receiving station becomes the transmitter.◂

2.26 Restore the equipment to operating condition. Refer to Section 592-011-201 for option strapping.

Date: _____

Data Test Calls Placed Between:

	LOCATION	TEL. # OF TEST LINE OR STATION
(A)	_____	_____
(B)	_____	_____

Contemplated Customer
S.O. Number's_____

Under Control of Data
Test Center at_____

LONG DURATION TEST CALLS					BIT ERROR COUNT — MINUTE NUMBER														
ORIGINATED #	AT	TIME	PEAK DISTORTION AT	%	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

SHORT DURATION TEST CALLS			SHORT CALL — NUMBER (READINGS AT _____)						(READINGS AT _____)					
ORIGINATED AT	TIME		1	2	3	4	5		1	2	3	4	5	
		Peak Dist. Reading (%)												
		One Minute Error Count (Bits in Error)												
		Peak Dist. Reading (%)												
		One Minute Error Count (Bits in Error)												

Billing Adjustment (if required) referred to:_____

Parties involved in Tests:_____

Coordinated with tests to other locations at:_____

Comments and Notes:

Fig. 4—Data Set Pre-Service Performance Test Record

3. TEST PROCEDURES USING 901-, 902-, AND 903-TYPE DATA TEST SETS

3.01 This group of tests is divided into three parts: ground noise test, installation and maintenance tests, and end-to-end test. For the procedure to be used when investigating a trouble report, refer to the section entitled Data Sets 201A3, A4 and 201B3, B4—Transmitter-Receiver—Maintenance (592-011-301).

A. ▶Ground Noise Test◀

3.02 ▶Test equipment required for this test is as follows:

- One 6H impulse counter (or equivalent)
- One 901 DTS cover
- One 2W6A test cord for 6H impulse counter (310 plug on one end, alligator clips connected to tip and ring on the other end).

Note: For information pertaining to the 6H impulse counter, refer to the section entitled 6H and 6HR Impulse Counters (J94006H and J94006HR)—Description and Operation (103-620-101). If the 6H impulse counter is ***not*** available, a 6A impulse counter may be used. For information pertaining to the 6A impulse counter, refer to the section entitled J94006A (6A) Impulse Counter—Description, Operation, and Maintenance (103-620-100).

3.03 In this test, the impulse counter is connected between the grounds of the data set and the customer equipment. The impulse counter will register when potential differences of sufficient amplitude have developed between the separated grounds. The 901 DTS cover is used to gain access to the ground interface leads.

3.04 The test is performed as follows:

(1) Break the connection between TST and EQ on terminals 1 and 7 on the 901 DTS cover.

(2) Using the 2W6A test cord, connect between TST and EQ at terminal 7 on the 901 DTS cover. Insert the plug in the 310 MEAS jack on the 6H impulse counter.

(3) On the 6H impulse counter, set the DIAL—MEAS switch to MEAS; set the DBRN dial to 90, and zero the counter.

(4) Set the minutes control to 15.

(5) At the end of the 15-minute test period, there should be no reading on the counter. If there is a reading on the counter, grounds must be connected together according to local instructions.

(6) Upon completion of the test, disconnect the test equipment and restore the data station to pretest condition.◀

B. Installation and Maintenance Tests

3.05 These tests are to be performed after installing the data set or when investigating a trouble report. This procedure provides a method of verifying proper data set operation. If the data set is ***not*** operating properly, this procedure also provides a method of isolating a data set trouble to a board or group of boards in the data set.

3.06 The back-to-back test must be performed first. If no errors are detected, this verifies that the data set is operating correctly. If excessive errors are detected during the back-to-back test, proceed as outlined in 3.14. For further information covering data set maintenance, refer to Section 592-011-301.

3.07 These tests check the operation of the transmitter, receiver, clock signals, control signals, and transmitter output level. Equipment required for performing this test is listed as follows:

(a) For data sets equipped with internal timing:

- One 901-type DTS
- One 902-type DTS
- Two 903-type DTSs
- One KS-20538 volt-ohm-milliammeter (VOM)
- One 600- or 900-ohm resistor ▶(for 2-wire systems).◀

(b) For data sets equipped for external timing:

All of the equipment listed in (a) ***and***

- One 32LBMP-2000 (for data set 201A) or −2400 (for data set 201B) frequency standard. This is available from Bulova Watch Company, American Time Products Division, 61-20 Woodside Avenue, Woodside, New York

or

One 901-type DTS and an internally timed data set 201-type (in addition to the data set under test).

Note: The additional data set must be of the same speed as the data set under test.

3.08 All tests specified throughout this section are written for data sets equipped with internal timing. To test an externally timed data set, it will be necessary to provide a clock signal from either the frequency standard or the additional data set.

3.09 The procedure for testing an externally timed data set by using the frequency standard is as follows:

(1) Run two leads from the TRANSMIT CLOCK terminals of the 901-type DTS to the OUTPUT terminals of the frequency standard (red to red, black to black). These leads must remain connected for the duration of the test.

(2) Connect the power cord of the frequency standard to a 117-volt ac outlet.

No further modifications are necessary. The data set, externally timed, can be tested as though it were internally timed.

3.10 The procedure for testing an externally timed data set by using an internally timed data set and an additional 901-type DTS is as follows:

(1) Set the controls on the additional 901-type DTS as follows:

SELECTOR switch to 201A or 901A DTS (position 3 for 901B DTS)

A TEST switch to OFF

B TEST switch to OFF

ATT-UNATT switch to ATT.

(2) Run two leads between the 901-type DTSs to connect the TRANSMIT CLOCK terminals together (red to red, black to black).

(3) Plug the additional 901-type DTS into the internally timed data set 201A or 201B (in place of the business machine cord).

(4) Connect the data set power cord to a 117-volt ac outlet.

No further modifications are necessary. The externally timed data set can be tested as though it were internally timed.

Back-to-Back Test

3.11 In this test, the transmitter is driven by a 903-type DTS (63-bit generator). The receiver output is fed to a 902-type DTS (distortion- and error-checking test set). A second 903-type DTS feeds a signal to the 902-type DTS. The 902-type DTS compares the two signals and counts the errors in the receiver output. The 901-type DTS is used to gain access to the necessary interface leads and to provide the voltage which holds the data set 201-type in the transmit mode. Figure 5 shows the connection diagram for the back-to-back test.

3.12 The controls on the data test sets should be as follows:

- 901-type DTS

SELECTOR switch to 201A for 901A DTS (position 3 for 901B DTS)

A TEST switch to position 9

B TEST switch to OFF

ATT-UNATT switch to UNATT.

- 902-type DTS

BIT RATE switch to EXT SYNC

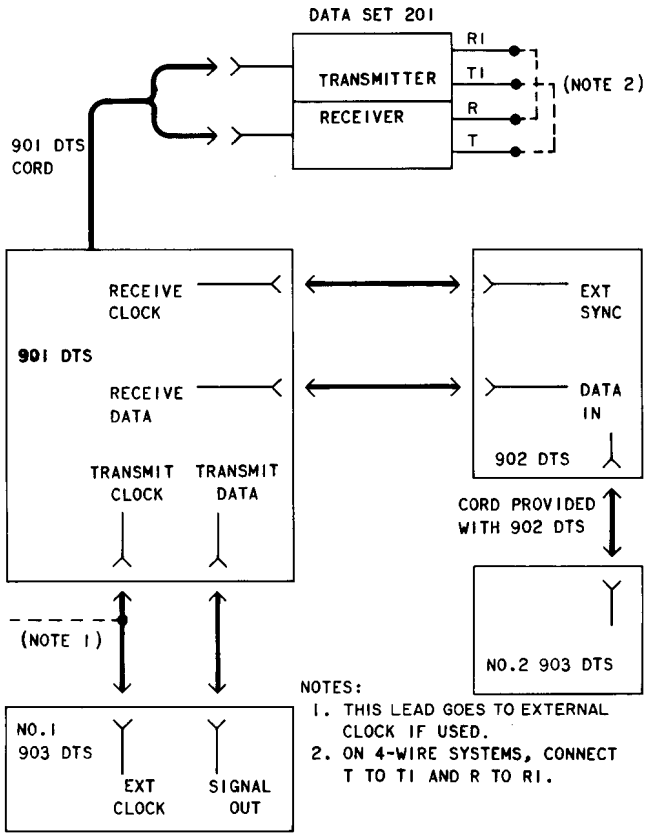

Fig. 5—Back-to-Back Test, Block Diagram

Meter selection switch to DIST MEAS

TRIGGER switch to minus (−).

- No. 1 (transmitting) and No. 2 (receiving) 903-type DTSs

BIT RATE switch to EXT CLOCK

RANDOM-DOT switch to RANDOM

TRIGGER switch to plus (+).

Each pair of terminals on all DTSs has one red and one black terminal. Connections between test sets must be made red to red and black to black.

(1) Run two leads from the SIGNAL OUT terminals of the No. 1 903-type DTS to the TRANSMIT DATA terminals of the 901-type DTS.

(2) Run two leads from the EXT CLOCK terminals of the No. 1 903-type DTS to the TRANSMIT CLOCK terminals of the 901-type DTS.

Note: For externally timed data sets, there are two pairs of leads on the TRANSMIT CLOCK terminals of the 901-type DTS.

(3) Run two leads from the RECEIVE DATA terminals of the 901-type DTS to the DATA IN terminals of the 902-type DTS.

(4) Run two leads from the EXT SYNC terminals of the 902-type DTS to the RECEIVE CLOCK terminals of the 901-type DTS.

(5) Connect the No. 2 903-type DTS to the 902-type DTS with the cord provided.

(6) Connect the power cords of both 903-type DTSs to a 117-volt ac outlet.

(7) Connect the 901-type DTS to the connector of data set ▶201A or◀ 201B (in place of the business machine cord).

(8) ***Two-Wire Systems:*** Disconnect line wires (tip and ring) ▶and connect a 600- or 900-ohm resistor between terminals 14 and 16 on the 66E3 connector block.◀ Temporarily strap terminal 5 to terminal 7 on circuit board L2 and leave strapping as called for on the service order.

(9) ***Four-Wire Systems:*** Disconnect line wires. If the installation includes a LINE—TEST key circuit, place the key in the TEST position. If installation does ***not*** include a LINE—TEST key circuit, ▶temporarily connect a strap from terminal 16 to terminal 20 on the 66E3 connector block.◀

(10) Connect data set 201-type power cords to a 117-volt ac outlet.

(11) Apply power to both 903-type DTSs by setting both power switches to ON.

(12) Momentarily depress the START switch on both 903-type DTSs.

(13) Momentarily depress the WORD SYNC & RESET switch on the 902-type DTS. The purpose of the 902-type DTS in this test is to count errors; therefore, any meter reading or any adjustment of controls DISTORTION, VOLTS, or PHASE should be disregarded.

(14) The TOTAL ERRORS lamps on the 902-type DTS note any errors which occur. To obtain the total errors, add the values indicated by all lighted lamps. When the bottom lamp is lighted, the capacity of the counter is exceeded and the amount indicated is erroneous.

(15) To insure that the 902-type DTS is counting errors, depress the START switch on the No. 2 903-type DTS. The 902-type DTS should indicate maximum errors by the bottom lamp lighting.

(16) Momentarily depress the WORD SYNC & RESET switch on the 902-type DTS and allow the test to continue for at least 5 minutes. No errors should be recorded. If an error is recorded, perform (12) through (15) again. If errors are recorded during the second test, the set is faulty and should be replaced or repaired as specified in 3.14.

(17) Reterminate line wiring. Remove the temporary straps from the connector block. If a LINE—TEST key was used, place it in the LINE position.

3.13 If no errors are detected during the back-to-back test, the data set is operating correctly. If the data station trouble persists, proceed as follows:

(a) Confirm that the business machine and associated cords test satisfactorily.

(b) Check for cord and connector defects.

(c) Check for intermittent trouble in the drop, inside wire, protector, etc.

Interface Test

3.14 If excessive errors are detected during the back-to-back test, the control signals should be tested. To test the control signals, proceed as follows:

(1) Disconnect the 901-type DTS from the data set 201-type and connect it to the interface test adapter (cover of 901-type DTS). Connect the interface test adapter to connector J2 (CUST EQPT) on the data set 201-type.

(2) Connect the VOM to the interface test adapter with the negative probe to terminal 1 and the positive probe to terminal 4. Verify that request-to-send (RS) is high.

Requirement: Approximately +12 volts.

(3) Move the positive probe of the meter to terminal 5. Measure the voltage on the clear-to-send (CS) lead when RS is high.

Requirement: +5 volts or greater.

(4) Move the positive probe of the meter to terminal 8. Measure the voltage on the carrier-on (CO) lead when RS is high.

Requirement: +5 volts or greater.

Note: If the data set does not meet the requirements specified in (3), replace cards T5 and T9. If the data set does ***not*** meet the requirements specified in (4), replace cards R11 and R12.

(5) Remeasure CS and CO as specified in (3) and (4). If CS and CO do ***not*** meet requirements, the data set must be replaced.

Note: Verify that the replacing data set is equipped with the same options as the data set being replaced.

(6) If CS and CO meet the specified requirements, perform the back-to-back test again.

(7) If excessive errors are detected, move the A TEST switch to position 7. This applies +12 volts to the send data (SD) lead. Turn both 903-type DTSs off.

(8) Move the positive probe of the meter to terminal 3. Measure received data (RD) when +12 volts is applied to the SD lead.

Requirement: +5 volts or greater.

(9) Disconnect the meter. Move the A TEST switch to position 6. This applies −12 volts to the SD lead. Connect the VOM to the interface test adapter with the positive probe to terminal 1 and the negative probe to terminal 3.

(10) Measure RD when −12 volts is applied to the SD lead.

Requirement: More negative than −4 volts.

Note: If RD does ***not*** meet the requirements specified in (8) or (10), replace card R12.

(11) Remeasure the RD voltage as specified in (7) through (10). If the RD voltage does ***not*** meet requirements, the data set must be replaced.

(12) If RD meets the specified requirements, disconnect the VOM and move the A TEST switch to position 9.

(13) Perform the back-to-back test again as specified in 3.11.

(14) If excessive errors are detected, replace cards R13, R14, R15, and R16 as a group.

Note: Cards R13 through R16 are a matched group. If any card in the group is defective, the entire group must be replaced. If it is necessary to replace only one card in the group, the entire group must be tested and matches as specified in Section 592-011-151.

(15) If cards R13 through R16 are ***not*** available, replace the data set.

(16) If the data set is operating correctly, disconnect the DTSs, replace the cord to customer equipment, and restore the data station to normal. If the data set has a problem with the automatic answer, proceed to 3.15.

Automatic Answer Test

3.15 This is a test of the remote control (RC) lead, the ready (RDY) lead, and the ring indicator (RG1 and RG2) leads. If the data set fails this test, verify that the strapping on circuit board L4 is correct. If the test fails again, replace circuit board L4.

Note: Verify that the new L4 card is strapped for the same options as the card being replaced.

(1) Plug the interface adapter (cover of 901-type DTS) into connector J2 (CUST EQPT) on the data set. Plug the 901-type DTS into the interface test adapter. The DAS 804A must be connected to the data set. Press the AUTO ANS button.

(2) Set the controls on the 901-type DTS as follows:

A TEST switch to OFF

B TEST switch to 5

ATT-UNATT switch to UNATT

SELECTOR switch to OFF.

(3) If the data set is strapped for contact closure, proceed to (7). If the data set is strapped for EIA voltage interface, connect terminal 9 to terminal 20 on the interface test adapter. This applies a positive voltage to the RC lead and the incoming call will be answered after the first full ring cycle.

(4) Connect the VOM to the interface test adapter with the positive probe to terminal 22 (RG1) and the negative probe to terminal 1 (ground). The meter should be set to measure +12 volts.

(5) Call the number associated with the DAS 804A. The meter should indicate greater than +5 volts every time ringing is heard.

(6) Move the probe from terminal 22 (RG1) and place it on terminal 6 (IT). The meter should indicate greater than +5 volts. This indicates that the IT lead has gone positive. If all indications are as specified, the automatic answer feature is functioning correctly. Proceed to (12).

(7) For data set strapped for contact closure interface, connect terminal 9 to terminal 22 on the interface test adapter. Connect the VOM to the test adapter with the positive probe on terminal 23 and the negative probe on terminal 1 (ground). Set the meter to measure up to +12 volts.

(8) Call the number associated with the DAS 804A. The meter should indicate greater than +5 volts every time ringing is heard.

(9) On the interface test adapter, connect terminals 19, 20, and 21 together. This connects RC, RDY, and RR. The ringing should stop, thus indicating that the DAS 804A has answered the call.

(10) Move the positive probe of the VOM to terminal 6 of the interface test adapter. A reading of +5 volts or greater indicates that the IT lead has gone positive.

(11) If all indications are as specified, the automatic answer feature is functioning correctly. Proceed to (12).

(12) End of automatic answer test. Disconnect the test equipment and restore the station to normal unless the end-to-end test is to be performed.

C. End-to-End Test

3.16 This test checks the transmitter and receiver of the data set and the connecting facilities. Refer to Fig. 6. In this test, data set 201-type is driven by a 903-type DTS. The 901-type DTS is used to provide access to the interface of data set 201-type. At the distant end, the data signals are fed either to a 904B or 904D DTC or to a remote data set 201-type. The block diagram shows equipment set up for testing either end with a DTC or a remote data set 201-type.

Note: The procedure for testing with a 904 DTC is included in Section 668-102-500.

3.17 If the test is conducted using a DTC, the test will be coordinated and made under the direction of DTC. The transmitting and receiving setup is the same for testing with a DTC or a remote data set 201-type. The block diagram shows the equipment setup at two terminals for testing one direction of transmission. The test equipment is set up as shown in each location for one-half of the test, then reversed for the second half.

3.18 The transmitting-end controls on the DTSs should be as follows:

- 901-type DTS

  SELECTOR switch to 201A for 901A DTS (position 3 for 901B DTS)

  A TEST switch to position 9

  B TEST switch to OFF

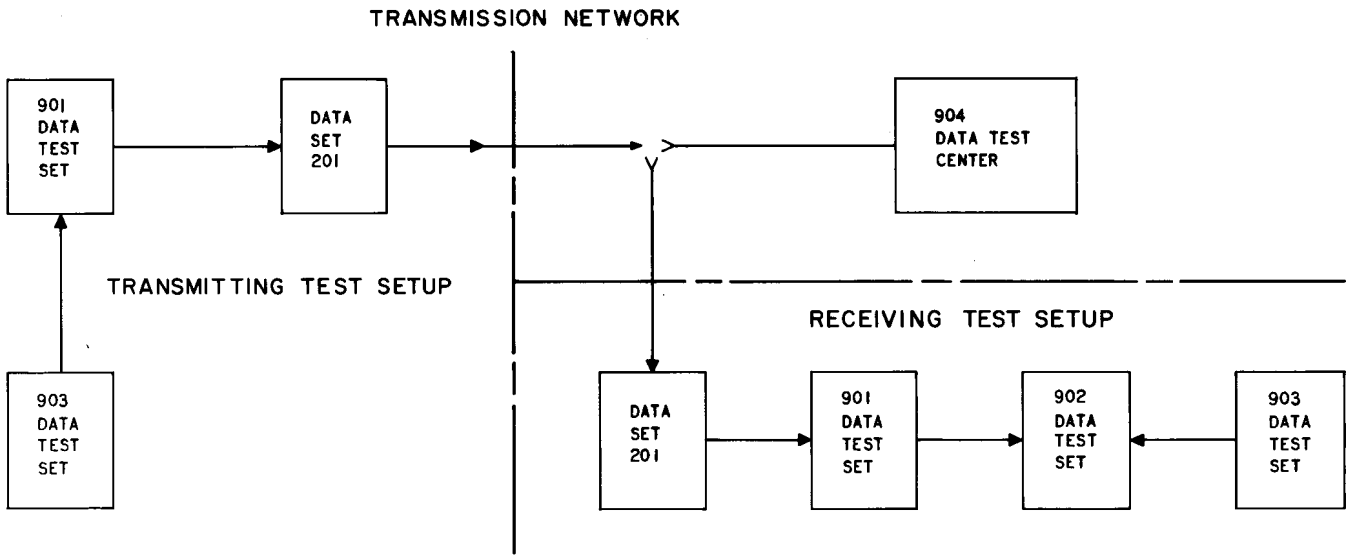

Fig. 6—End-to-End Test, Block Diagram

ATT-UNATT switch to UNATT.

- 903-type DTS

- TRIGGER switch to plus (+)

RANDOM-DOT switch to RANDOM

BIT RATE switch to EXT CLOCK.

(1) Run two leads from the SIGNAL OUT terminals of the 903-type DTS to the TRANSMIT DATA terminals of the 901-type DTS.

Each pair of terminals on the DTS has one red and one black terminal. Connections between test sets must be made red to red and black to black.

(2) Run two leads from the EXT CLOCK terminals of the 903-type DTS to the TRANSMIT CLOCK terminals of the 901-type DTS.

(3) Connect the 901-type DTS to connector J2 (CUST EQPT) on data set 201A or 201B.

(4) Connect the power cord of the 903-type DTS to a 117-volt ac outlet. Turn the power switch ON.

3.19 The receiving-end controls on the DTSs should be as follows:

- 901-type DTS

SELECTOR switch to 201A for 901A DTS (position 3 for 901B DTS)

A TEST switch to OFF

B TEST switch to position 8

ATT-UNATT switch to UNATT.

- 902-type DTS

BIT RATE switch to EXT SYNC

TRIGGER switch to minus (−)

Meter selection switch to DIST MEAS.

- 903-type DTS

RANDOM-DOT switch to RANDOM

BIT RATE switch to EXT CLOCK

TRIGGER switch to plus (+).

(1) Connect the 903-type DTS to the 902-type DTS with the cord provided.

(2) Connect the 901-type DTS to connector J2 (CUST EQPT) on data set 201A or 201B.

(3) Run two leads from the RECEIVE DATA terminals of the 901-type DTS to the DATA IN terminals of the 902-type DTS.

(4) Run two leads from the EXT SYNC terminals of the 902-type DTS to the RECEIVE CLOCK terminals of the 901-type DTS.

(5) Connect the power cord of the 903-type DTS to a 117-volt ac outlet. Turn the power switch to ON.

Switched Network Testing

3.20 On the switched telephone network, complete end-to-end tests consist of making two 15-minute and ten 1-minute test calls. Establish voice communication in the manner normally used by the customer when placing data calls.

Take proper steps to ensure that the customer is not billed for toll calls on test. See Section 010-250-001.

3.21 Place calls alternately from each end except where one customer location will always be originating the call. Test calls should be placed during busy hours. This will make certain that all test calls do not use the same trunks and routes.

3.22 During the 15-minute calls, the receiving station should make a minute-by-minute count of errors as indicated by lighted lamps on the 902-type DTS. To prevent exceeding counter capacity, the RESET button should be depressed at the end of each minute after error count has been noted. Figure 4 illustrates format which can be used for recording test data. The PEAK

DISTORTION columns of Fig. 4 should be ignored for these tests. Occasionally, a noise burst or "hit" may cause the error counter to lose synchronization and indicate continuous errors. The interval up to and including the burst should be tabulated as "over 100 bit errors." The RESET button on the 902-type DTS should be momentarily depressed to continue tests.

3.23 After a voice connection has been established, a brief continuity check must be made. This continuity check is conducted in the following manner:

(a) ***DAS 804A Associated With the Data Set:*** The transmitting station can be shifted from the talk mode to the data mode by depressing the DATA button. The START switch of the 903-type DTS should be depressed for approximately 15 seconds. The receiving station attendant should hear a high-pitched tone which indicates that data is being received.

(b) ***No Telephone Set Associated With the Data Set:*** The transmitting station attendant must depress the START switch on the 903-type DTS for approximately 15 seconds. By connecting a 1011-type handset across tip and ring (2-wire systems) or the receive pair (4-wire systems), the receiving station attendant should hear a high-pitched tone which indicates that data is being received.

3.24 After a prearranged time interval (approximately 15 seconds), the transmitting station attendant must shift the data set back to the talk mode, and if the receiving station reports that data is being received, the attendant must shift the data set to the data mode and depress the START switch on the 903-type DTS for 15 seconds. The transmitting station attendant has no further duties until the end of the test.

3.25 The receiving station attendant must listen to verify that data is being received and must shift the data set to the data mode (if necessary). The WORD SYNC & RESET switch must then be depressed on the 902-type DTS.

3.26 The TOTAL ERRORS lamps on the 902-type DTS register any errors which occur in transmission. To obtain the total errors, add the values indicated by all lighted lamps. When the bottom lamp is lighted, it indicates that the capacity of the counter is exceeded and the amount indicated is erroneous.

3.27 To ensure that the 902-type DTS is counting errors, depress the START switch on the receiving 903-type DTS. The 902-type DTS should indicate maximum errors by the bottom lamp lighting.

3.28 Momentarily depress the WORD SYNC & RESET switch on the 902-type DTS and note the time.

3.29 At the end of each minute, the WORD SYNC & RESET switch should be depressed after the total errors have been noted. This prevents exceeding the counter capacity.

3.30 At the end of the prearranged time interval, voice communication is established again and an agreement is made to repeat the test in the opposite direction. The test is then repeated with the first transmitting station becoming the receiver and the first receiving station becoming the transmitter.

3.31 The test call requirements for the switched telephone network are as follows:

(a) For 15-minute calls:

- During ten of the fifteen 1-minute intervals, no more than two bit errors per interval
- During three of the remaining five 1-minute intervals, no more than ten bit errors per interval
- During the remaining two 1-minute intervals, no error requirement.

(b) For 1-minute calls:

- During eight out of ten calls, no more than ten bit errors in any one minute.

Private Line Testing

3.32 On PL systems, voice communication between terminals can be established over a separate facility if a DAS 804A or telephone set is not associated with the data set. Proceed as follows:

(1) Connect the transmitting test setup in Fig. 6 and verify that the receiving test setup has been connected at the far-end data set.

(2) At the transmitting end, depress and release the START button.

(3) Conduct an error run for one minute. Record errors. At the end of each minute, the WORD SYNC and RESET switch should be depressed.

(4) Repeat (3) for a total of ten 1-minute error runs. Eliminate the one error run with the most errors.

Requirement: Total errors of the other nine error runs must be less than ten.

(5) Perform the test in the opposite direction.

4. REFERENCES

4.01 The following Bell System Practices are listed for reference:

010-250-001	Crediting Charges on Test Calls
103-620-100	J94006A (6A) Impulse Counter—Description, Operation, and Maintenance
103-620-101	6H and 6HR Impulse Counters (J94006H and J94006HR)—Description, Operation, and Maintenance
314-205-500	Data Systems—"DATA-PHONE"® Service and Data Access Arrangements on Direct Distance Dialing Network—Overall Data Transmission Test Requirements
314-205-501	Data Systems—"DATA-PHONE"® Service and Data Access Arrangements on Direct Distance Dialing Network—Test Requirements for Subscribers, Foreign Exchange, and Remote Exchange Lines
314-410-500	Private Line Data Circuits—Voice Bandwidth Circuits for Miscellaneous Overall Tests and Requirements
592-011-101	Data Sets 201A3, A4 and 201B3, B4 Transmitter-Receiver—Description and Operation
592-011-151	Data Sets 201A3, A4 and 201B3, B4 Transmitter-Receiver—Supplementary Information
592-011-201	Data Sets 201A3, A4 and 201B3, B4 Transmitter-Receiver—Installation and Connections
592-011-301	Data Sets 201A3, A4 and 201B3, B4 Transmitter-Receiver—Maintenance
592-011-500	Data Sets 201A1, A2 and 201B1, B2 Transmitter-Receiver—Test Procedures
592-011-502	Data Sets 201A and 201B List-Type Transmitter-Receiver—Test Procedures
668-102-500	Data Test Center—904B- and 904D-Types—Test Procedure—Data Set 201-Type—Dynamic Test