

DATA SET 203-TYPE TEST PROCEDURES

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1. GENERAL

1.01 This section contains test procedures for data set 203-type. The tests included in this section are as follows:

- 38A-Type Data Unit Tests
- Automatic Retraining Auxiliary Channel Tests
- Loop-Back Tests
- End-to-End Tests
- Remote Tests
- Power Test
- Ground Noise Test.

1.02 Retain Issue 2 of this section until the Organizational Maintenance group determines that Issue 2 is not required. Test procedures

requiring the use of 901-, 902-, and 903-type data test sets have been deleted from this issue. An exception is made in tests where a 914B data test set requires a second word generator for full-duplex operation. These tests will require the addition of a 903C data test set. The Organizational Maintenance group will know if these data test sets are presently being used and if the procedures in Issue 2 should be kept in file.

1.03 This section is being reissued to:

- Delete redundant test information
- Add corrections to the tests and update the requirements
- Provide test procedures for the automatic retraining auxiliary channel (ARAC), option list codes L11 and L12
- Provide test procedures for the 38A-type data unit, option list code L13
- Provide a rearrangement of text to separate installation and maintenance testing
- Provide test procedures for remote testing using a 914-type data test set (DTS)
- Delete the connector voltage tests.

Because of the rearrangement, additions, and deletions, change arrows normally used to indicate changes will not be used in this issue.

1.04 Installation testing will normally consist of the power test, ground noise test, and local loop-back tests. If these tests pass, no further tests need to be made. Maintenance tests may involve the use of all tests listed in 1.01, depending upon the type of trouble encountered. When a data test center (DTC) is not available, an end-to-end test should be made with a compatible data set.

1.05 A compatible data set is defined as a data set which consists of a transmitter and/or receiver bearing the same speed list coding as that of the data set to be tested and a low-speed (secondary) channel, if the data set to be tested is so equipped. For example, the testing of a data set 203A-L1C/2/7/8 requires the far-end station to be equipped with either a data set 203A-L1C/2/7/8 or a data set 203A-L1D/2/7/8, both sets to operate at the same bit rate.

1.06 If a compatible data set is not available for an end-to-end test, a loop-back test of the high-speed channel can be made for data set 203A-type. The loop-back test of the high-speed channel cannot be performed on data sets 203B or 203C since these are "transmitter-only" and "receiver-only" type data sets. The loop-back test of the low-speed secondary channel as described in this section can be performed on data sets 203A, 203B, or 203C.

1.07 Cautions: The following cautions must be observed when working with the data set:

(a) Check for strap or strapping link between frame ground (FG) and signal ground (SG)

on the terminal strip at the rear of the 41A-type power unit.

(b) Always disconnect the power cord before removing or installing circuit packs (CPs), networks, cords, or plugs. (Refer to Section 592-019-300 for replacement procedures.)

(c) Always measure the +4.5 Vdc supply voltage across the positive and signal ground connections shown in Fig. 1. Never measure this voltage by using the equipment frame ground for reference since erroneous readings may result.

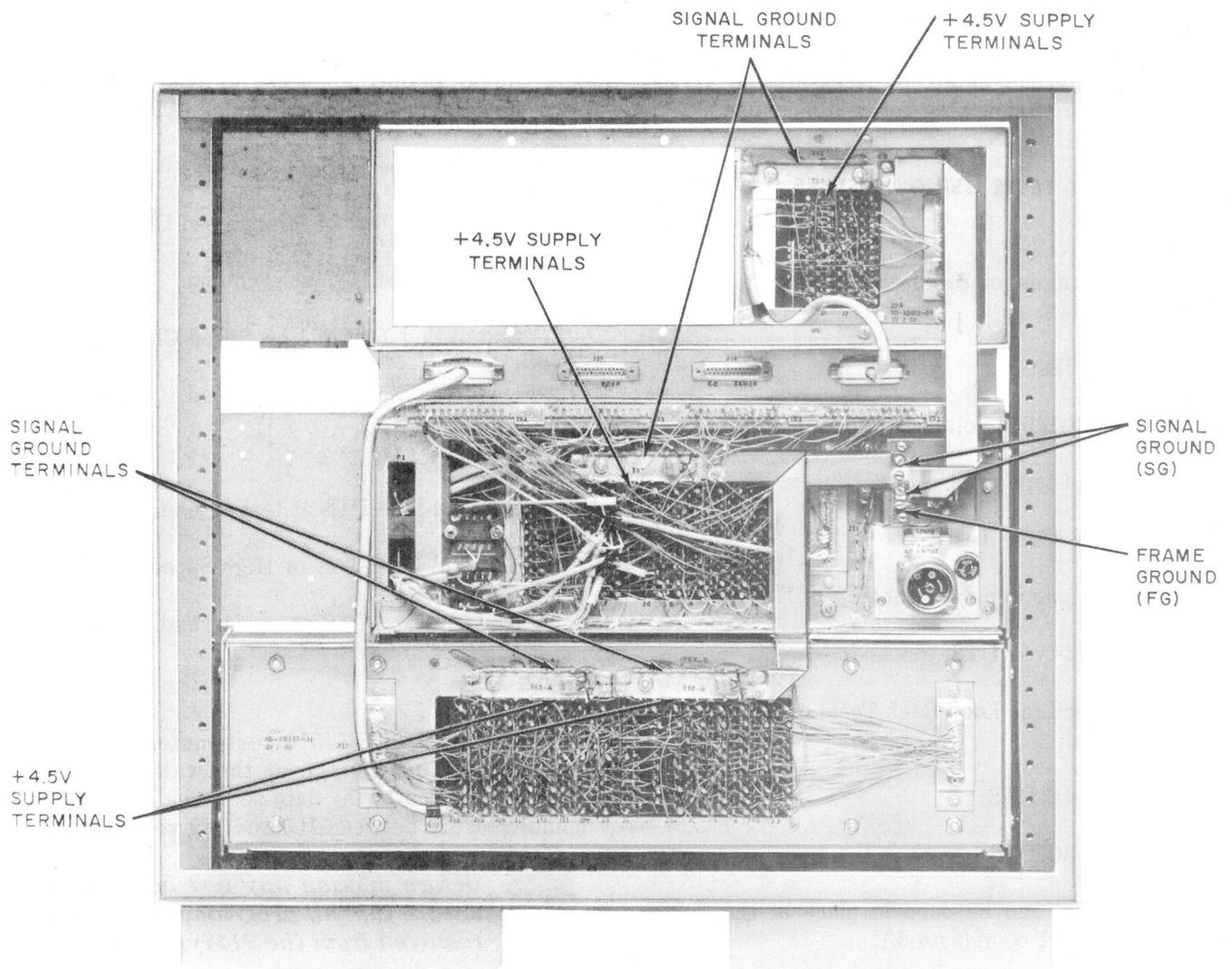


Fig. 1—Typical Data Set 203A-Type, Rear View

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(d) If it is necessary to repair or replace wires on the rear of the data set, remove power and use extreme care in order to avoid excessive bending or pulling on the terminal pins. Excessive pulling on the terminal pins will deform the contacts and destroy the terminal. Use wire wrapping and unwrapping tools only.

(e) Before attempting any test, be sure that all CPs are pushed all the way in and are securely seated in their respective connectors.

(f) Before applying power to the data set for the first time or after repair or replacement, visually check the alignment of every terminal on the wiring side and straighten, if necessary, to be sure that adjacent terminals are not touching.

1.08 After successful completion of the necessary tests, the data set option board AR335 should be checked and corrected, if necessary, to agree with the required strapping for customer use.

2. DATA SET TESTS USING 914-TYPE DATA TEST SET (DTS)

2.01 Test equipment required for these tests are as follows:

(1) Power Test

- One KS-14510 volt-ohm milliammeter
- One 914-type DTS.

(2) Ground Noise Test

- One 6-type impulse counter
- One 914-type DTS.

(3) Local or Line Loop-Back Tests of High-Speed Channel

- One 914B DTS
- One 903C DTS.

(One 914C DTS can be used in place of the 903C and 914B test set combination.)

(4) Local Loop-Back Test of Low-Speed (Secondary) Channel

- One 903C DTS
- One 914B DTS.

(One 914C DTS can be used in place of the 903C and 914B test set combination.)

(5) Local Loop-Back Test for the 38A-Type Data Unit

- One 914B DTS
- One 903C DTS.

(One 914C DTS can be used in place of the 903C and 914B test set combination.)

(6) Local Loop-Back Test of the Automatic Retraining Auxiliary Channel (ARAC)

- One 914-type DTS.

(7) End-to-End Test of High-Speed Channel

- One 914-type DTS at each end.

(8) End-to-End Test of Low-Speed Channel

- One 914-type DTS at each end.

(9) Remote Test

- One 914-type DTS at testing end.

(10) Digital Loop Test of High-Speed Channel

- One 914-type DTS at testing end.

POWER TEST

2.02 Using the KS-14510 test meter, measure the ac line voltage at the wall receptacle before connection to the data set. The line voltage should measure between 105 and 129 volts.



Before making any test connections, ensure that all programming pins are removed from the 914-type matrix.

2.03 Measure the +18.5 Vdc and -18.5 Vdc supply voltages as they appear on the interface connector. Use the following test procedure:

- (1) Using one of the supplied test set patch cords, patch from the A connector on the 914 to the CUSTOMER connector on the data set.
- (2) Operate (depress) all A and B selector switches on the 914 test set.
- (3) Position the 914 switches as follows:

METER—FUNCTION—OFF

METER—RANGE—30 DCV

METER—POLARITY—NOR

VERTICAL MONITOR—9.

- (4) Apply power to both the data set and the 914.
- (5) Position the 914 METER—FUNCTION switch to VOLT INT. The meter should indicate between 16.6 and 21.0 Vdc.
- (6) Position the 914 switches as follows:

METER—FUNCTION—OFF

METER—POLARITY—REV

VERTICAL MONITOR—10.

- (7) Position the 914 METER—FUNCTION switch to VOLT INT. The meter should indicate between 16.6 and 21.0 Vdc.

2.04 Measure the +4.5 Vdc supply voltage with the KS-14510 test meter at the rear of the 24A-type data unit using the following procedures:

Caution: *Accidental grounding of the +4.5 volt supply will destroy the power unit fuse. A spare fuse is stored at the rear of the power unit in an open, unwired fuse holder. The fuse is a medium delay, 1-1/2 amp or 2-1/2 amp type. It should be replaced only by a fuse having the following code: BUSSMAN MFG DIV-MDL,*

1-1/2 AMP for 41A power supply; or BUSSMAN AGS 2-1/2 AMP for 41A2 power supply.

- (1) Condition the test meter to measure 12 Vdc full scale.
- (2) Refer to Fig. 1 for location of the +4.5 volt supply and signal ground terminals.
- (3) Connect the positive test lead to the lower distribution bus bar and the negative test lead to the upper distribution bus bar.
- (4) The test meter should indicate 4.1 to 4.9 Vdc.
- (5) Make the above measurements on all of the distribution bus bars as shown in Fig. 1.

GROUND NOISE TEST

2.05 If the data set and business machines are not at the same ground potential, 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 6H impulse counter.

Note: For information pertaining to the 6H impulse counter, refer to the section entitled 6H and 6HR Impulse Counters (J94006H and J94006HR)—Description, Operation, and Maintenance (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).

2.06 The 6H impulse counter is connected and 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 sleeve 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.

2.07 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 local grounding conditions must be improved. At the end of the test, disconnect the test equipment and restore the data set to pretest condition.

LOCAL LOOP-BACK TEST OF HIGH-SPEED CHANNEL

2.08 The local loop-back test of the high-speed channel can be performed only on data set 203A-type (transmitter and receiver). The local loop-back test of the low-speed channel can be made on either data set 203A, 203B, or 203C. The local loop-back test should be performed to verify that the data set is operable.

2.09 Before testing, the following conditions must be met:

- (1) Record the option straps installed on option board AR335. Some of these straps may be removed for the loop-back test.

Note: After completing the test, restore the original option straps.

- (2) If the data set is not equipped with a list 7 low-speed secondary channel, install **only** the following straps on option board AR335: 1, 2, 3, 4, 5, 6, 7, 12, 15, 17, 20, 21, 24, 27, 28, 30, and 34. Remove all unlisted straps.
- (3) If the data set is equipped with a list 7 low-speed secondary channel, install **only** the following straps on option board AR335: 1, 2, 3, 4, 5, 6, 15, 17, 18, 20, 21, 24, 26, 27, and 28. Remove all unlisted straps.
- (4) Remove the cord connected to the TELEPHONE connector on the data set.
- (5) The BIT RATE KB/S switch should be in the position intended for customer use.
- (6) Place the REMOTE TEST—LINE—LOCAL TEST key in the LOCAL TEST position.
- (7) Position the ECU switch to OUT or DIGITAL LOOP-BACK switch to B, whichever is provided on the 24A-type data unit.

2.10 Connect and condition both the 903C test set and the 914B test set as required in Table A. A 914C test set can be used in place of the 903C and 914B test set combination.

2.11 Patch between the 914-type A connector and the CUSTOMER connector on data set 203. Plug in the ac power cords to the data set and both the 914-type and 903C test sets. On the 903C test set, position the POWER switch to ON and momentarily press the START button.

2.12 Momentarily press the RESET button on the 914-type DTS to zero the digital counter and then observe that both OVERFLOW and TP1 FIRST lamps are extinguished.

A. Start-Up Test—Local Test Mode

2.13 The following test will check the control functions of the data set. The test involves

TABLE A
INITIAL TEST SET CONDITIONING FOR LOCAL LOOP-BACK
AND LINE LOOP-BACK TESTS

914-TYPE MATRIX PINS REQUIRED	914-TYPE SWITCH POSITIONS
GRD - 1 and 7 SD - 2 (914C Only) RD - 3 SCT - 15 (914C Only) SCR - 17 S1 - 20 (controls DTR) S2 - 4 (controls RS) S3 - 19 (controls SRS) DS1 - 20 (shows DTR) DS2 - 6 (shows DSR) DS3 - 5 (shows CS) DS4 - 13 (shows SCS) DS5 - 18 (shows COD) DS6 - 21 (shows SQ) DS7 - 8 (shows CO) DS8 - 12 (shows SCO)	INTERFACE MODE to VOLTAGE CONTROL SIGNALS switches all OFF VERTICAL MONITOR to 9 TRIGGER TP1 to +/OPEN TRIGGER TP2 to +/OPEN METER FUNCTION to DCV-30 SIGNAL LEVEL to ± 4 WORD LENGTH to 63 SAMPLE WIDTH to $0.5\mu\text{s}$ REFERENCE VOLTAGE to 0
903C TEST SET CONNECTIONS*	903C SWITCH POSITIONS*
(1) Patch GRD terminal to 914B selector switch terminal 1A. (2) Patch SIG OUT terminal to 914B selector switch terminal 2A. (3) Patch EXT CLOCK terminal to 914B selector switch terminal 15A.	(1) Set BIT RATE switch to EXT CLOCK. (2) Set RANDOM-DOT switch to RANDOM. (3) Set TRIGGER switch to +(plus).

* The 903C DTS is used with the 914B DTS.

operating test set switch S2 and observing test set lamps. Switch S2 controls the request-to-send (RS) interface signal. Operation of this switch initiates the data set start-up sequence.

2.14 Observe that switch S2 is OFF and the DS2 lamp is extinguished. On the data set 203 control panel, operate the REMOTE TEST—LINE—LOCAL TEST key to the LINE position. Observe that the DS2 lamp is illuminated. Operate the key to LOCAL TEST position and observe that the DS2 lamp is extinguished.

2.15 Operate test set switch S2 to ON and observe that the DS5 lamp is illuminated within a few seconds. After several seconds, the DS6 lamp should illuminate. A few seconds after DS6

is illuminated, lamps DS3 and DS7 should illuminate almost simultaneously. All other lamps should remain extinguished with the following exception. For data set speed options L2, L5, and L6, the DS8 lamp should illuminate if the data set is equipped with a secondary channel (AR336 CP and network 4166A) in the 24A-type data unit. This start-up procedure may be repeated as often as necessary by an OFF to ON operation of switch S2.

2.16 If the above sequence does not occur, check that the 914 matrix is connected as shown in Table A and that *all* A and B selector switches have been operated (depressed). If the sequence still does not occur, the data set is not operating.

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2.17 Now test the data set start-up interval using the following steps:

- (1) On the 914-type matrix, insert a red shorting pin in row TP1, column 4, and row TP2, column 5.
- (2) Position the TEST SET MODE switch to TRMT-SER (914B) or INTERVAL (914C).
- (3) Operate BIT RATE switch to 150.
- (4) Position the COUNTER switch to INTERVAL—X100.
- (5) Operate switch S2 to OFF.
- (6) Momentarily press the RESET button to zero the digital counter display.
- (7) Operate switch S2 to ON.
- (8) Repeat (5) through (7) at least three times.

Requirement: The TP1 FIRST lamp should illuminate immediately and the digital counter should begin to count. When the DS3 lamp illuminates, the digital counter should stop counting. The expected count for different data sets is provided in Table B.

TABLE B
HIGH-SPEED CHANNEL TRANSMITTER
START-UP INTERVAL CHECK

DATA SET SPEED LIST NUMBER	APPROXIMATE COUNT	TIME BEING INDICATED
2	79	7.9 Sec
3	05	10.5 Sec*
4	79	7.9 Sec
5	60	6.0 Sec
6	53	5.3 Sec

*Since the digital display can only count to 10 seconds, the OVERFLOW lamp will illuminate and the display will indicate 05.

2.18 Measure the carrier-on (CO) to clear-to-send (CS) time interval by performing the following steps:

- (1) Move the shorting pin in the 914-type matrix from row TP1, column 4, to row TP1, column 8.
- (2) Position the COUNTER switch to INTERVAL—X10.
- (3) Operate test set switch S2 to OFF and reset the digital counter by pressing the RESET button.
- (4) Operate switch S2 to ON.
- (5) The DS3, DS5, DS6, and DS7 lamps will illuminate over a time interval and in the sequence observed in 2.15.
- (6) Repeat (3) through (5) at least three times.

Requirement: The TP1 lamp should be illuminated and the digital counter should indicate between 1 and 13 (10 to 130 milliseconds).

B. Data Transmission Test—Local Test Mode

2.19 Position the TEST SET MODE switch to RCV-SER (914B) or SER (914C). Position the BIT RATE switch(es) to EXT +. Position the COUNTER switch to BIT ERRORS.

2.20 Provided that the start-up test has passed, observe that the digital counter is counting very rapidly and that the OVERFLOW lamp is illuminated. The NO CLOCK and NO DATA lamps should be extinguished. If the NO DATA lamp is illuminated, momentarily press the START button on the 903C test set. The NO DATA lamp should now be extinguished. If the lamp does not extinguish, check that the 903C test set is generating an output signal.

2.21 Momentarily operate the 914 test set WORD SYNC switch to MAN. position and then press the RESET button. The digital counter should indicate zero and the OVERFLOW lamp should be extinguished.

2.22 Perform four 1-minute error runs. Between each error run, operate switch S2 to OFF, then to ON to restart the data set. After DS3 (CS) illuminates, repeat 2.21. The maximum number of allowable errors for the combined total of the four 1-minute runs is provided in Table C.

TABLE C
HIGH-SPEED CHANNEL LINE LOOP-BACK
OR END-TO-END TEST ERROR LIMITS

SPEED OPTION L-NUMBER	X	MAXIMUM ERRORS WHEN BIT RATE IS:		
		X KB/S	2X KB/S	3X KB/S
2	2.4	18	48	—
3	1.8	12	33	—
4	2.4	18	48	—
5	3.2	30	72	—
6	3.6	33	81	—

Note: X=Basic Baud Rate=Lowest Bit Rate

LINE LOOP-BACK TEST OF HIGH-SPEED CHANNEL

2.23 Line mode test can be performed only on data set 203A-type arranged for 4-wire full-duplex operation. Provided that the data transmission test—local test mode has passed, further loop-back tests may be made utilizing the regular line facilities with the AR335 option card strapped for customer options per service order. This test is similar to local test mode (2.20) except it permits overall data transmission testing from a customer location to any point where the line facilities can be looped back without the necessity for another 914 DTS at the far end. It offers positive assurance that the local data set, associated telephone connections, and the overall local and intercity facilities are successfully meeting data transmission requirements.

2.24 The data transmission test—line test mode should be performed if:

- The loop-back test—local test mode has successfully passed,
- The end-to-end maintenance test cannot be performed, or
- The end-to-end maintenance test is a failure.

2.25 Before testing, the following conditions must be met:

- The data set option board should be strapped according to the service order. However, if strap 35 (option Q) is installed, it must be

disconnected for duration of the test and reconnected when testing is complete.

- Connect any data auxiliary set (DAS), if used, as called for by the service order.
- The BIT RATE KB/S switch should be in the position intended for customer use.
- Place the REMOTE TEST—LINE—LOCAL TEST key in the LINE position.
- Position the ECU switch to OUT or DIGITAL LOOP-BACK switch to B, whichever is provided on the 24A-type data unit.
- Arrange to have the 4-wire facility looped back, ie, transmit pair looped to receive pair, *with transmit and receive levels properly set at the point of loop-back*. The loop-back point selected may be the local repeater, if any, at the data set location, the local serving toll test center, any intermediate toll offices where access to the toll facilities is available, or at the far-end serving toll test center. To expedite testing procedures, it is suggested that the first looparound be at the local toll serving office and, if successful, then at the far-end toll serving office. If the far-end test is not passed, remaining toll facility sections can be looped to determine the particular section where failure is occurring.

2.26 Condition the 914 and 903C test sets as required in Table A. Apply ac power to the data set and both the 914 and 903C test sets. On the 903C test set, position the POWER switch to ON and momentarily press the START button.

A. Start-Up Test—Line Test Mode

2.27 The following test will check the control functions of the data set. The test involves operating test set switches S1 and S2, conditioning the DAS (if used) for data mode, and observing the 914B test set lamps. Switch S1 controls the data-terminal-ready (DTR) interface signal and switch S2 controls the request-to-send (RS) interface signal. Operation of S2 initiates the data set start-up sequence.

2.28 Operate test set switch S1 to ON. Place the DAS in the data mode. The DS1 and DS2 lamps should be illuminated. Operate test set switch S2 to ON and observe that the DS5 lamp

is illuminated within a few seconds. After several seconds, the DS6 lamp should illuminate. A few seconds after DS6 is illuminated, lamps DS3 and DS7 should illuminate almost simultaneously. All other lamps should remain extinguished with the exception of the DS8 lamp if the data set is equipped with an auxiliary channel. This start-up procedure may be repeated as often as necessary.

2.29 If the above sequence does not occur, check that the 914 matrix is connected as listed in Table A with all A and B selector switches operated (depressed). Check that the 903C test set is connected as required by Table A and that the START button was operated momentarily. If after verifying connections and data mode position of the associated DAS, the start-up sequence still does not occur, the data set is not operating.

B. Data Transmission Test—Line Test Mode

2.30 Position the TEST SET MODE switch to RCV-SER (914B) or SER (914C). Position the BIT RATE switch(es) to EXT +. Position the COUNTER switch to BIT ERRORS.

2.31 Provided that the start-up test has passed, observe that the digital counter is counting very rapidly and that the OVERFLOW lamp is illuminated. The NO CLOCK and NO DATA lamps should be extinguished. If the NO DATA lamp is illuminated, momentarily press the START button on the 903C test set. The NO DATA lamp should now be extinguished. If the lamp does not extinguish, check that the 903C test set is generating an output signal.

2.32 Momentarily operate the 914 test set WORD SYNC switch to MAN. position and then press the RESET button. The digital counter should indicate zero and the OVERFLOW lamp should be extinguished.

2.33 Perform ten 1-minute error runs and record the total errors at the end of each minute. Between each error run, operate switch S2 to OFF, then to ON, to restart the data set. After DS3 (CS) illuminates, repeat 2.32. Eliminate the 1-minute error run with the largest number of errors. Add the errors for the remaining nine runs. The total errors should be less than or equal to the applicable number given in Table D.

TABLE D
HIGH-SPEED CHANNEL LOCAL LOOP-BACK TEST
ERROR LIMITS

SPEED OPTION L-NUMBER	X	MAXIMUM ERRORS WHEN BIT RATE IS:		
		X KB/S	2X KB/S	3X KB/S
2	2.4	0	0	0
3	1.8	0	0	0
4	2.4	0	0	6
5	3.2	0	0	6
6	3.6	0	0	9

Note: X=Basic Baud Rate=Lowest Bit Rate

2.34 If necessary, repeat all the loop-back tests for the remaining two-speed positions of the BIT RATE KB/S switch on the data set 203-type.

2.35 After performing the loop-back test of the high-speed channel, take appropriate action as follows:

- **TEST PASSED:** Has the end-to-end (maintenance) test been performed?

NO: Perform the local loop-back test of the low-speed (secondary) channel, the 38A-type data unit and/or automatic retraining auxiliary channel (ARAC) unit, if provided. If the data set is not equipped with a secondary channel, no further installation tests need to be made.

YES: If the high-speed transmitter and/or receiver failed the end-to-end test, the trouble is probably in the telephone facilities or in the far-end data set.

- **TEST FAILED:** Go to Loop-Back Failure Analysis (2.67).

LOCAL LOOP-BACK TEST OF LOW-SPEED (SECONDARY) CHANNEL (LIST 7)

2.36 The local loop-back test of the low-speed channel can be made on either data set 203A, 203B, or 203C. The local loop-back test should be performed to verify that the data set is operable.

2.37 Before testing, the following conditions must be met:

- (1) Record the option straps installed on option board AR335. Some of these straps may be removed for the loop-back test.

Note: After completing the test, restore the original option straps.

- (2) If the data set is equipped with a list 7 low-speed secondary channel, install *only* the following straps on option board AR335: 1, 2, 3, 4, 5, 6, 15, 17, 18, 20, 21, 24, 26, 27, and 28. Remove all unlisted straps.
- (3) Remove the cord connected to the TELEPHONE connector on the data set.
- (4) Place the REMOTE TEST—LINE—LOCAL TEST key in the LOCAL TEST position.
- (5) Position the ECU switch to OUT or DIGITAL LOOP-BACK switch to B, whichever is provided on the 24A-type data unit.

2.38 Connect and condition both the 903C test set and the 914B test set as required in Table A with the following exceptions. A 914C test set can be used in place of the 903C and 914B test set combination.

- Patch 903C SIG OUT terminal to 914B selector switch terminal 14A.
- The 903C EXT SIG patch is not used and must be removed from the 914B test set.
- Position the 903C BIT RATE switch to 150.
- Remove the red shorting pin from the 914 matrix row RD, column 3, and insert it in row RD, column 16. Remove the red shorting pin from the 914 matrix row SD, column 2, and insert it in row SD, column 14.
- Position the TEST SET MODE switch to RCV-SER (914B) or SER (914C).
- Position the BIT RATE switch(es) to 150.
- Position the COUNTER switch to BIT ERRORS.

2.39 Patch between the 914 A connector and the CUSTOMER connector on data set 203. Plug in the ac power cords to the data set and both the 914 and 903C test sets. On the 903C test set, position the POWER switch to ON and momentarily press the START button. Observe that the NO DATA, TP1 FIRST, and OVERFLOW on the 914 test set are illuminated.

A. Data Transmission Test—Local Test Mode

2.40 Operate switch S3 to ON. After a few seconds, lamps DS8 and DS4 will illuminate. All other DS lamps and the NO DATA lamp should be extinguished. The CONTROL SIGNAL lamps monitor the interface signals as follows:

- (a) DS4—Secondary Channel Clear to Send (SCS)
- (b) DS8—Secondary Channel Carrier ON (SCO).

2.41 Condition the 914 as follows:

- (1) Position the METER—FUNCTION switch to PHASE ADJ.
- (2) Turn the PHASE control until the meter indicates zero on the voltage scale (this usually occurs when the PHASE control is near midposition).
- (3) Position the METER—FUNCTION switch to OFF.
- (4) Momentarily press the WORD SYNC switch to MAN. position.
- (5) Press the RESET button.
- (6) Observe that the digital counter display indicates zero and that both TP1 FIRST and OVERFLOW lamps are extinguished.

2.42 Make a 5-minute error run.

Requirement: Zero errors for 5 minutes.

2.43 If the data set is equipped with a 24A1 data unit, go to 2.46. If the data set is equipped with a 24A2 data unit, proceed with 2.44 and 2.45.

B. Secondary Channel Clear-to-Send (SCS) to Secondary Channel Carrier-On (SCO) Interval Test—Local Test Mode

2.44 Condition the 914 as follows:

- (1) On the 914 test set matrix, insert red shorting pins in row TP1, column 12, and in row TP2, column 13.
- (2) Position the TEST SET MODE switch to TRMT—SER (914B) or INTERVAL (914C).
- (3) Position the COUNTER switch to INTERVAL—X100.
- (4) Operate switch S3 to OFF and press the counter RESET button.
- (5) Operate switch S3 to ON.

Requirement: After lamps DS4 and DS8 are illuminated, observe that the TP1 FIRST lamp is illuminated and the digital display indicates between 3 and 16 (0.3 to 1.6 seconds).

2.45 After this test is completed, remove the two red shorting pins inserted in 2.44. Position the 914B TEST SET MODE switch to RCV—SER (914B) or SER (914C). Operate switch S3 to OFF. Position the COUNTER switch to BIT ERRORS.

2.46 After performing the local loop-back test of the low-speed (secondary) channel, take appropriate action as follows:

- **TEST PASSED:** Has the end-to-end (maintenance) test of the low-speed channel been performed?

NO: No further installation tests need to be made.

YES: If the low-speed channel failed the end-to-end test, the trouble is most probably in the telephone facilities or the far-end data set.

- **TEST FAILED:** Go to the Loop-Back Failure Analysis (2.67).

LOCAL LOOP-BACK TEST OF 38A-TYPE DATA UNIT

2.47 The local loop-back test of the 38A-type data unit can be performed only on a data set 203A-type (transmitter and receiver). Tests of the 38A-type data unit mounted in either a data set 203B-type or 203C-type can only be performed on an end-to-end arrangement. Perform a complete end-to-end test of the high-speed channel (see 3.01 through 3.19) using connector J1 on the 38-type data unit. For the 38A-type data unit connectors J2 through J6, perform the tests specified in 3.10 through 3.17.

Note: Lamps DS5 (COD), DS6 (SQ), and DS8 (SCO) will *not* illuminate when using connectors J2 through J6.

2.48 Condition the data set as described in 2.09.

2.49 Condition the test equipment as directed in Table A. A 914C test set can be used.

- Position the TEST SET MODE switch to RCV-SER (914B) or SER (914C).
- Position the BIT RATE switch(es) to EXT +.
- Position the COUNTER switch to BIT ERRORS.

2.50 Patch between connector A on the 914 test set and connector J1 on the 38A-type data unit. Plug in the ac power cords to the data set and both the 914 and 903C test sets. Apply power to the 914 test set. On the 903C, position the POWER switch to ON and momentarily press the START button.

A. Start-Up Test—Local Test Mode

2.51 The following test will check the control functions of the data set. The test involves operating test set switch S2 and observing test set lamps. Switch S2 controls the request-to-send (RS) interface signal. Operation of this switch initiates the data set start-up sequence.

2.52 Observe that the DS2 lamp is extinguished. On the data set 203 control panel, operate the REMOTE TEST—LINE—LOCAL TEST key to the LINE position. Observe that the DS2 lamp is illuminated. Operate the key to LOCAL TEST position and observe that the DS2 lamp is extinguished.

2.53 Operate test set switch S2 to ON and observe that the DS5 lamp is illuminated within a few seconds. After several seconds, the DS6 lamp should illuminate. A few seconds after DS6 is illuminated, lamps DS3 and DS7 should illuminate almost simultaneously. All other lamps should remain extinguished with the following exception. For data set speed options L2, L5, and L6, the DS8 lamp should illuminate if the data set is equipped with a secondary channel (AR336 CP and network 4166A) in the 24A-type data unit. This start-up procedure may be repeated as often as necessary by an OFF to ON operation of switch S2.

2.54 If the above sequence does not occur, check that the 914 matrix is connected as shown in Table A and that *all* A and B selector switches have been operated (depressed). If the sequence still does not occur, the data set is not operating.

B. Data Transmission Test—Local Test Mode

2.55 Provided that the start-up test has passed, observe that the digital counter is counting very rapidly and that the OVERFLOW lamp is illuminated. The NO CLOCK and NO DATA lamps should be extinguished. If the NO DATA lamp is illuminated, momentarily press the START button on the 903C test set. The NO DATA lamp should now be extinguished. If the lamp does not extinguish, check that the 903C test set is generating an output signal.

2.56 Momentarily operate the 914 test set WORD SYNC switch to MAN. position and then press the RESET button. The digital counter should indicate zero and the OVERFLOW lamp should be extinguished.

Requirement: The 914 test set can synchronize. An error run is not required.

2.57 Move the 914 patch cord from connector J1 to connector J2 on the 38A-type data unit. Position switch S2 to OFF and repeat the tests of 2.49 through 2.53 for the same requirements but with the following exception: lamps DS5 (COD), DS6 (SQ), and DS8 (SCO) will not illuminate in this part of the test.

2.58 Repeat 2.57 with the 914 patch cord moved sequentially to connectors J3, J4, J5, and J6 on the 38A-type data unit for the same requirements.

LOCAL LOOP-BACK TEST OF THE AUTOMATIC RETRAINING AUXILIARY CHANNEL (ARAC) (LIST 11, LIST 12)

2.59 The following procedures provide a limited conditional (loop-back) test of the ARAC operation using a 914-type DTS. The following equipment is required to perform the tests:

- One 914-type DTS
- One stopwatch, graduated in seconds
- Two 8-inch insulated wire leads with an alligator clip on each end.

2.60 Prepare the data set and the 914-type test set as follows:

- (1) Remove ac power from the data set and establish the conditions required in 2.09.
- (2) Remove AR582 CP (option L11) or AR583 (option L12) from the 24A-type data unit. Note and record the original screw switch settings. Then condition the screw switches on the ARAC CP to provide the fast-start sequence delay timing (see Table E). Return the ARAC CP to the original location.

TABLE E

ARAC OPERATIONAL DIFFERENCES

Option	L11	L12
Circuit Pack	AR582	AR583
Slot Location	11	11
Fast Turnaround	3.08 Sec	2.37 Sec
Screw Switch Settings*	Open S1B and S2C; Close S1A and S2D	
Slow Turnaround	10.92 Sec	8.4 Sec
Screw Switch Settings*	Open S1A and S2D; Close S1B and S2C	
Total Time Sequence	17.9 Sec	13.78 Sec

*Install both OPEN and CLOSE screw switch conditions on either option L11 or L12.

- (3) Condition the 914-type test set as follows:

INTERFACE MODE switch—VOLTAGE
VERTICAL MONITOR switch—8

TEST SET MODE switch—RCV-SER (or SER on 914C)
 COUNTER switch—BIT ERRORS
 METER FUNCTION switch—OFF
 METER RANGE switch—DCV-10
 METER POLARITY switch—NOR
 BIT RATE switch—EXT +
 SIGNAL LEVEL switch— $\pm 4V$
 WORD LENGTH switch—63
 SAMPLE WIDTH switch— $0.5\mu s$
 REFERENCE VOLTAGE SELECT switch—0

Red matrix shorting pins inserted into:
 GRD—1 and 7
 DS7—8.

Connect clip leads between the following terminals on the interface selector switches:
 Between 4A and 16A (RS/CA to SRD/SBB)
 Between 14B and 21A (SSD/SBA to SQ/CG).

Patch from connector A on the 914-type test set to the CUSTOMER connector on data set 203A-type.

- (4) Apply ac power to both data set and 914-type test set. Operate the POWER switch on the 914-type test set and allow approximately 20 seconds for the data set circuitry to synchronize. Set the stopwatch to 0 seconds.
- (5) Observe that the DS7 lamp on the 914-type test set is illuminated. Hold the stopwatch in one hand. Simultaneously start the watch and pull up on terminal 14A. This interrupts the SQ/CG interface lead and simulates a poor line signal quality condition.

Note: After the test, push down on terminal 14A. The terminal should be in the down position for at least 18 seconds to be sure the ARAC is reset. This is necessary if the test procedures are to be repeated.

A. Automatic Retraining Option L11 With Fast-Start Sequence Delay

2.61 Perform the test as follows:

- (1) Observe that the DS7 lamp indications occur within ± 1.0 second of the following intervals:

TIME (CONTINUOUS SECONDS)	LAMP INDICATION
0	ON
3	OFF
11	ON
21	OFF
29	ON
39	OFF
47	ON
57	OFF
65	ON

- (2) Observe that the lamp indication occurs in sequence for at least three 21-second intervals.
- (3) If the test is satisfactory, proceed to 2.63.

B. Automatic Retraining Option L12 With Fast-Start Sequence Delay

2.62 Perform the test as follows:

- (1) Observe that the DS7 lamp indication occurs within ± 1.0 second of the following intervals:

TIME (CONTINUOUS SECONDS)	LAMP INDICATION
0	ON
3	OFF
7.5	ON
16.5	OFF
22	ON
30.5	OFF
35	ON
44	OFF
49.5	ON

(2) Observe that the lamp indication occurs in sequence for at least three 16.5-second intervals.

(3) The sequence listed in 2.61 or 2.62 provides an indication of the ARAC control function on initial loss of signal quality and that the ARAC circuitry will recycle a request for retraining until line signal quality returns to normal. Return the SQ/CG interface lead to normal by pressing down on terminal 14A on the 914-type test set. Observe that the DS7 lamp is illuminated.

(4) Remove the ac power from the data set. Remove the ARAC CP from the data set and condition the screw switches to provide the slow-start sequence delay timing (see Table G). Replace the ARAC CP to the original location. Repeat the test procedures from (1) through (5), noting the following time variation in the sequence for the applicable slow-start sequence.

C. Automatic Retraining Option L11 With Slow-Start Sequence Delay

2.63 Perform the test as follows:

(1) Observe that the DS7 lamp indication occurs within ± 1.0 second of the following intervals:

TIME (CONTINUOUS SECONDS)	LAMP INDICATION
0	ON
11	OFF
19	ON
29	OFF
37	ON
47	OFF
54	ON

(2) Observe that the lamp indication occurs in sequence for at least three 18-second intervals.

(3) If the test is satisfactory, proceed to 2.65.

D. Automatic Retraining Option L12 With Slow-Start Sequence Delay

2.64 Perform the test as follows:

(1) Observe that the DS7 lamp indication occurs within ± 1.0 second of the following intervals:

TIME (CONTINUOUS SECONDS)	LAMP INDICATION
0	ON
8.5	OFF
14	ON
22.5	OFF
27.5	ON
36	OFF
41.5	ON

(2) Observe that the lamp indication occurs in sequence for at least three 14-second intervals.

(3) Return the SQ/CG interface lead to normal by pressing in terminal 14A on the 914-type selector switch terminal block.

2.65 Position the METER RANGE switch on the 914-type test set to 10 and the VERTICAL MONITOR switch to 8. Observe that the METER POLARITY switch is in NOR position and turn METER FUNCTION switch to VOLT IN position. The meter indication should be 6 (± 2.0) volts indicating normal operation.

2.66 Remove ac power from the data set and the 914-type test set. Disconnect the 914-type test set from the data set CUSTOMER interface connector. Remove the ARAC CP and ensure that the original screw switch settings [recorded in 2.60(2)] are properly installed. Return the ARAC CP to the original location and restore the data set to service.

LOOP-BACK FAILURE ANALYSIS

2.67 If a loop-back test fails, inspect and/or test as follows:

- (a) Are the data set and test equipment power cords plugged into a powered outlet?
- (b) Is the test equipment working properly?
- (c) Is the data set option board AR335 strapped correctly?
- (d) Are you correctly performing the test procedures?
- (e) If the answer to all of the above is yes and the high-speed channel failed, replace the data unit CPs with known good CPs and retest. If the test still fails, replace the networks with known good networks and retest. If the test fails again, return the CPs and networks to their original location and replace the data set. If retesting indicates the trouble is cleared, replace the new CPs and/or networks with original apparatus one at a time until the trouble recurs. This procedure will isolate the defective CP and/or network with a minimum of down time. If the low-speed channel (list 7) failed, replace the AR336 CP and the 4166A network. If the 38A-type data unit failed, replace its CPs. If the ARAC (list 11 or list 12) failed, replace the AR582 CP and the 4166B network (list 11) or the AR583 CP and the 4166C network (list 12).

3. MAINTENANCE TESTS

END-TO-END TEST OF HIGH-SPEED CHANNEL

3.01 The end-to-end test can be performed during a maintenance visit when a DTC is not available or when suggested by responsible authority. The type of line facilities and station equipment used in the end-to-end test should be compatible (if not identical) to that intended to be used by the customer. It is recommended that a separate telephone line be used to provide voice communication during testing of the data sets and telephone facility.

3.02 Before testing end-to-end, the following conditions must be met:

- (a) The data set option board AR335 should be strapped according to the service order. However, if strap 35 (option Q) and/or strap 25 (part of option J) is installed, they must be disconnected for the duration of the test and reconnected when testing is complete.

(b) The following options must be the same at both locations:

- Mode of Operation (Options X, or Y, or Z)
- Control of Secondary Channel (Options T, or V, or W, or YD)
- Initiate Start-Up of High-Speed Channel (Options K, or ZR, or YB).

(c) Both data sets must have identical speed option lists and secondary channel, if required.

(d) The BIT RATE KB/S switch should be in the position intended for customer use and must be in the same position at both stations.

(e) The REMOTE TEST—LINE—LOCAL TEST key should be in the LINE position at both stations.

(f) At both stations, position the ECU switch to OUT or DIGITAL LOOP-BACK switch to B, whichever is provided on the 24A-type data unit.

3.03 Condition the 914-type test set at both stations as required in Table F.



Test set switches not mentioned in text are not required for the test. Lamp indications not called are not pertinent and may be disregarded. Before making any test connections, ensure that all programming pins are removed from the 914 matrix. Insert only those pins as called for in Table F.

3.04 At both transmit and receive stations, apply ac power to both data set and DTS.

3.05 Establish voice communication with the distant station and ascertain which will be the transmit station and the receive station. Ensure that the BIT RATE KB/S switch on both data sets is in the same position.

3.06 At the receive end, switch S2 should be OFF. At the transmit end, position switch S2 to ON. This switch controls the request-to-send (RS) signal. If no DAS 804A-type is being used, switch S2 at the transmit end must be positioned to ON *after* a line connection is made.

TABLE F
914-TYPE DATA TEST SET CONDITIONING
FOR END-TO-END TESTS

914 MATRIX PINS REQUIRED	914 SWITCH POSITIONS
GRD - 1 and 7 SD - 2	INTERFACE MODE — VOLTAGE VERTICAL MONITOR — 9 TRIGGER TP1 — +/OPEN TRIGGER TP2 — +/OPEN
RD - 3	TEST SET MODE — SER *
S1 - 20 (DTR)	COUNTER — BIT ERRORS
DS1 - 20 (DTR)	METER POLARITY — NOR
DS2 - 6 (DSR)	METER FUNCTION — OFF
S2 - 4 (RS)	METER RANGE — DCV-30
DS3 - 5 (CS)	BIT RATE — EXT +
S3 - 19 (SRS)	SIGNAL LEVEL — $\pm 4V$
DS4 - 13 (SCS)	WORD LENGTH — 63
DS5 - 18 (COD)	SAMPLE WIDTH — $0.5\mu s$
SCT - 15	REFERENCE VOLTAGE — 0
SCR - 17	CONTROL SIGNALS switches —
DS6 - 21 (SQ)	S1 to ON, all others to OFF
DS7 - 8 (CO)	Interface Selector Switches —
DS8 - 12 (SCO)	All pushed down

*At the receiving station, this switch should be set to RCV-SER position or, at the transmitting station, set the switch to TRMT-SER when using 914B DTS.

3.07 If both stations are equipped with DAS 804A-type, the following procedure should be used. If no DAS 804A-type is being used, go to 3.08.

- (1) After establishing voice contact, the *called* station should enter the data mode first by momentarily pressing the DATA button. The *called* station is identified by an illuminated TALK button.
- (2) A 2025-Hz answer-back tone should be heard at the *calling* station. After this tone, either a lower pitched tone (or no tone at all) should be noted. When hearing the lower pitched tone or noting the loss of the 2025-Hz tone, momentarily press the DATA button.
- (3) After each station has entered the data mode, the handset may be replaced on its cradle. To re-enter the talk mode, lift the handset and press the TALK button.

- (4) At the *calling* end, observe that the test set DS2 lamp becomes illuminated immediately after the DATA button is pressed. At the *called* end, the test set DS2 lamp should become illuminated approximately 3 to 5 seconds after the DATA button is pressed. The DS2 lamp monitors the data-set-ready (DSR) interface signal.

A. Start-Up Test—End-to-End Test Mode

3.08 This test checks the start-up sequence of the high-speed channel. At the transmit end, request-to-send (switch S2 on the 914-type test set) is switched OFF and then ON to restart the data set transmitter. A restart at the transmitter causes the receiver to restart. At the transmit end, the time between request-to-send—ON and clear-to-send —ON is checked. At the receive end, the time between carrier-on-delayed—ON and carrier-on—ON is checked.

3.09 At the *transmit* end, insert red shorting pins in row TP1, column 4, and in row

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TP2, column 5. There should be no other pins inserted in row TP1 or TP2.

3.10 At the *receive* end, insert red shorting pins in row TP1, column 18, and in row TP2, column 8. There should be no other pins inserted in row TP1 or TP2.

3.11 At *both* ends, position the COUNTER switch to INTERVAL—X100, the TEST SET MODE switch to TRMT-SER (914B) or INTERVAL (914C), the BIT RATE switch to 2400, and momentarily press the RESET button.

3.12 At the *transmit* end, operate switch S2 to OFF and then back to ON. The following observations should be made at each end:

Transmit End

(1) Lamp TP1 FIRST should illuminate and the counter should start counting immediately after switch S2 is positioned to ON.

(2) When lamp DS3 illuminates, the counter should stop counting. The expected count is provided in Table B.

Receive End

(1) Lamp TP1 FIRST should illuminate and the counter should start counting immediately after lamp DS5 illuminates.

(2) Lamp DS6 should illuminate a few seconds after lamp DS5 illuminates.

(3) Lamp DS7 should illuminate a few seconds after lamp DS6 illuminates. The counter should stop counting immediately after lamp DS7 illuminates. The expected count is provided in Table G.

TABLE G

HIGH-SPEED CHANNEL RECEIVER START-UP INTERVAL CHECK

DATA SET SPEED LIST NUMBER	APPROXIMATE COUNT	TIME BEING INDICATED
2	6.1	6.1 Sec
3	8.1	8.1 Sec
4	6.1	6.1 Sec
5	4.6	4.6 Sec
6	4.1	4.1 Sec

3.13 At the completion of the above test, position the 914-type test set switches as follows:

Transmit End

COUNTER to BIT ERRORS

BIT RATE to EXT +

TEST SET MODE to XMT-SER (914B) or SER (914C).

Receive End

COUNTER to BIT ERRORS

BIT RATE to EXT +

TEST SET MODE to RCV-SER.

B. Data Transmission Test—End-to-End Test Mode

3.14 After entering the data mode and observing a successful completion of the data set start-up, the following data transmission test should be performed. After a successful data set start-up, the CONTROL SIGNAL lamps should be checked as follows:

Transmit End

DS1, DS2, DS3—Illuminated

DS4, DS5, DS6, DS7—Extinguished

DS8—Illuminated only if data set option W (straps 29 and 30) is installed.

Receive End

DS1, DS2, DS5, DS6, DS7—Illuminated

DS3, DS8—Extinguished (see note)

DS4—Illuminated only if data set option W (straps 29 and 30) is installed.

Note: For data set speed options L2, L5, and L6, the DS8 lamp will illuminate if the data set is equipped with a secondary channel (AR336 CP and 4166A network) in the 24A-type data unit.

The lamps should remain illuminated or extinguished, as required above, until the TALK button is pressed

or switch S2 on the 914-type test set at the transmit end is positioned to OFF.

3.15 At the receive end, momentarily press the WORD SYNC to the MAN. position. The counter should not be counting or should be counting at a slow rate. Momentarily press the RESET button. The counter will now register any errors that occur.

3.16 If both stations are equipped with DAS 804A-type, the following procedure should be used. If no DAS 804A-type is being used, go to 3.17.

- (1) Perform a 1-minute error run. Record the total errors at the end of one minute.

Requirement: No more than nine errors.

- (2) Disconnect the call by lifting the handset, pressing the TALK button, and replacing the handset. Repeat the call and enter the data mode as outlined in 3.09. After allowing time for data set start-up, perform a 1-minute error run. Do this for a total of ten calls.

Requirement: Eight of the ten error runs must meet the requirement of (1).

- (3) Repeat the call to obtain a connection that meets the requirements of (1). On this connection, perform ten 1-minute error runs and record the total errors at the end of each minute. Eliminate the 1-minute error run with the largest number of errors. Add the errors for the remaining nine runs. The total errors should be less than or equal to the applicable number given in Table C.

3.17 If no DAS 804A-type is being used, the following procedure should be followed:

- (1) Perform a 1-minute error run and record the total errors.
- (2) At the transmit end, operate switch S2 on the 914-type test set to OFF and then to ON to restart the data set. After allowing time for data set start-up, perform another 1-minute error run and record the total errors.
- (3) Perform Step (2) for a total of ten restarts. Record the total errors after each 1-minute

run. To reset the error counter after each run, press the WORD SYNC switch on the 914-type test set to the MAN. position and momentarily press the RESET button. Eliminate the 1-minute run with the largest number of errors. Add up the errors for the remaining nine runs. The total errors should be less than or equal to the applicable number given in Table C.

3.18 If both stations are equipped with data set 203A-type, repeat the end-to-end test of the high-speed channel in the opposite direction of transmission.

3.19 After performing the end-to-end test of the high-speed channel, take the appropriate action as follows:

- **TEST PASSED:** Perform the end-to-end test of the low-speed (secondary) channel. If the data set is not equipped with a secondary channel, no further tests need to be made.
- **TEST FAILED:** Go to End-to-End Test Failure Analysis (3.33).

END-TO-END TEST OF LOW-SPEED (SECONDARY) CHANNEL (LIST 7)

3.20 The required test equipment is the same as for testing the high-speed channel. The 914 test set remains conditioned as required in Table F with the following exceptions:

- (1) Remove the red shorting pin from row SD, column 2, and place in row SD, column 14.
- (2) Remove the red shorting pin from row RD, column 3, and place in row RD, column 16.
- (3) Position the BIT RATE switch to 150.

3.21 If option W (straps 29 and 30) is installed on option board AR335, position switch S3 on the 914-type test set to OFF at both stations and position switch S2 as follows:

- (a) Transmit end—OFF
- (b) Receive end—ON.

Switch S2 controls the data set interface signal request to send (RS).

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3.22 If either option V (strap 28) or option T (strap 29) is installed on option board AR335, position switch S2 on the 914-type test set to OFF at both stations and position switch S3 as follows:

- (a) Transmit end—ON
- (b) Receive end—OFF.

Switch S3 controls the data set interface signal secondary request to send (SRS).

3.23 Establish voice communications with the distant station and ascertain which will be the transmit station and the receive station.

3.24 If there is no DAS 804A-type used with the data set, the data mode will start immediately after a line connection is made.

3.25 If both stations are equipped with DAS 804A-type, the following procedure should be used for entering the data mode. If no DAS 804A-type is being used, go to 3.27.

- (1) After establishing voice contact, the *called* station should enter the data mode first by momentarily pressing the DATA button.
- (2) A 2025-Hz answer-back tone should be heard at the *calling* station. At the end of this tone, a lower pitched tone will be heard. Upon hearing the lower pitched tone, momentarily press the DATA button.
- (3) After each station has entered the data mode, the handset may be replaced on its cradle. To re-enter the talk mode, lift the handset and press the TALK button.

3.26 At the *calling* station, the DS2 lamp on the 914-type test set should illuminate as the DATA button is pressed. At the *called* end, the DS2 lamp will illuminate approximately 3 to 5 seconds after the DATA button is pressed. The DS2 lamp monitors the data-set-ready (DSR) interface signal.

3.27 At the *transmit* end, observe that the test set DS4 lamp is illuminated within a few seconds after entering the data mode. This lamp monitors the secondary clear-to-send (SCS) signal.

3.28 At the *receive* end, observe that the test set DS8 lamp is illuminated within a few

seconds after entering the data mode. This lamp monitors the secondary carrier-on (SCO) interface signal.

3.29 At the *receive* end, position the METER—FUNCTION switch on the 914-type test set to PHASE ADJ. Adjust the PHASE control on the test set until the meter indicates zero on the voltage scale. This normally occurs when the control is near its midposition. Position the METER—FUNCTION switch to OFF. Momentarily press the WORD SYNC switch to MAN. position. Press the RESET button and observe that the counter indicates zero.

3.30 Perform a 5-minute error run.

Requirement: No more than two errors.

3.31 Repeat the end-to-end test of the low-speed (secondary) channel in the opposite direction of transmission. This may easily be done by the two stations changing the TEST SET MODE switch to TRMT-SER or RCV-SER as required if a 914B is used, or SER if a 914C is used, and repeating 3.21 through 3.30.

3.32 After performing the end-to-end test of the low-speed (secondary) channel, take appropriate action as follows:

- TEST PASSED: No further tests need to be made
- TEST FAILED: Go to the End-to-End Test Failure Analysis (3.33).

END-TO-END TEST FAILURE ANALYSIS

3.33 If the end-to-end test is a complete failure in that the test set cannot be synchronized to allow counting of transmission errors, inspect and/or test as follows:

- (a) Are the data set and test equipment power cords plugged into a powered outlet?
- (b) Is the data set option board AR335 strapped correctly?
- (c) Are the test sets supplying output signals?
- (d) Is the DAS 804A- or 804M-type (if used) correctly strapped for operation with a data set 203-type?

(e) Are you correctly performing the end-to-end test procedures?

(f) If the answer to all of the above is yes:

(1) If the high-speed channel failed, either perform the local loop-back test if this is a data set 203A, or replace the CPs and/or networks on data units if this is a data set 203B or 203C.

(2) If the low-speed channel failed, perform the local loop-back test of the low-speed channel.

3.34 If the end-to-end test fails because of excessive errors or distortion or loss of sync occurs after initially being able to sync-in, inspect and/or test as follows:

(a) Is the data set option board AR335 strapped correctly?

(b) Have you been assured that the far-end equipment is working properly?

(c) If the test is made over PL facilities, do these facilities meet the conditioning requirements?

(d) If the answer to all of the above is yes, replace the CPs and/or networks in the unit being tested, ie:

(1) 22A-type data unit (high-speed transmitter)

(2) 23A-type data unit (high-speed receiver)

(3) AR336 CP and 4166A network (low-speed channel).

Note: It is recommended to replace the data unit CPs with known good CPs and retest. If the test still fails, replace the networks with known good networks and retest. If the test fails again, return the CPs and networks to their original location and replace the data set. If retesting indicates the trouble is cleared, replace the new CPs and/or networks with the original apparatus one at a time

until the trouble recurs. This procedure will isolate the defective CP and/or network with a minimum of down time.

REMOTE TEST USING A 914-TYPE DATA TEST SET

3.35 The following procedures describe remote testing of a data set 203A-type with or without an L7 secondary channel over 2- or 4-wire facilities. There is no attempt made in providing individual testing of all possible data set 203-type arrangements, however these procedures may be used as a general guide to test other arrangements.

3.36 The procedures should narrow troubles to a major functional part of the far-end data set (ie, the high-speed transmitter, the high-speed receiver, and/or the low-speed secondary channel, if provided). A successful test should provide assurance that the remote data set is functioning properly.

3.37 No attempt is made to isolate a trouble condition to an individual CP and some faults may exist that will not be detected by a remote test. One example is the options for INITIATE START-UP OF HIGH-SPEED CHANNEL (options K, J, and ZR) which are automatically removed when the data set is put in the remote test mode and these options are not tested. Similarly, understand that not all signals to and from the customer are tested at the customer side of the data set interface connector (ie, SCT, RS, CS, CO, COD, SQ, DTR, and DSR).

3.38 The remote test circuitry provided in a data set 203A-type will produce four separate test states although not all are presently required. A functional block diagram illustrating the test state response for a data set 203A with the secondary channel is shown in Fig. 2. When the secondary channel is provided, Test State I is used to test the high-speed transmitter circuits, Test IIa is used to test the low-speed transmitter circuits, and Test State IIb is used to test the high-speed receiver circuits while using the low-speed transmitter circuits to send error information back to the local data set. Test State III is used to test the low-speed receiver circuits while using the high-speed transmitter circuits to send error information back to the local data set. Test State IV is the same as Test State II.

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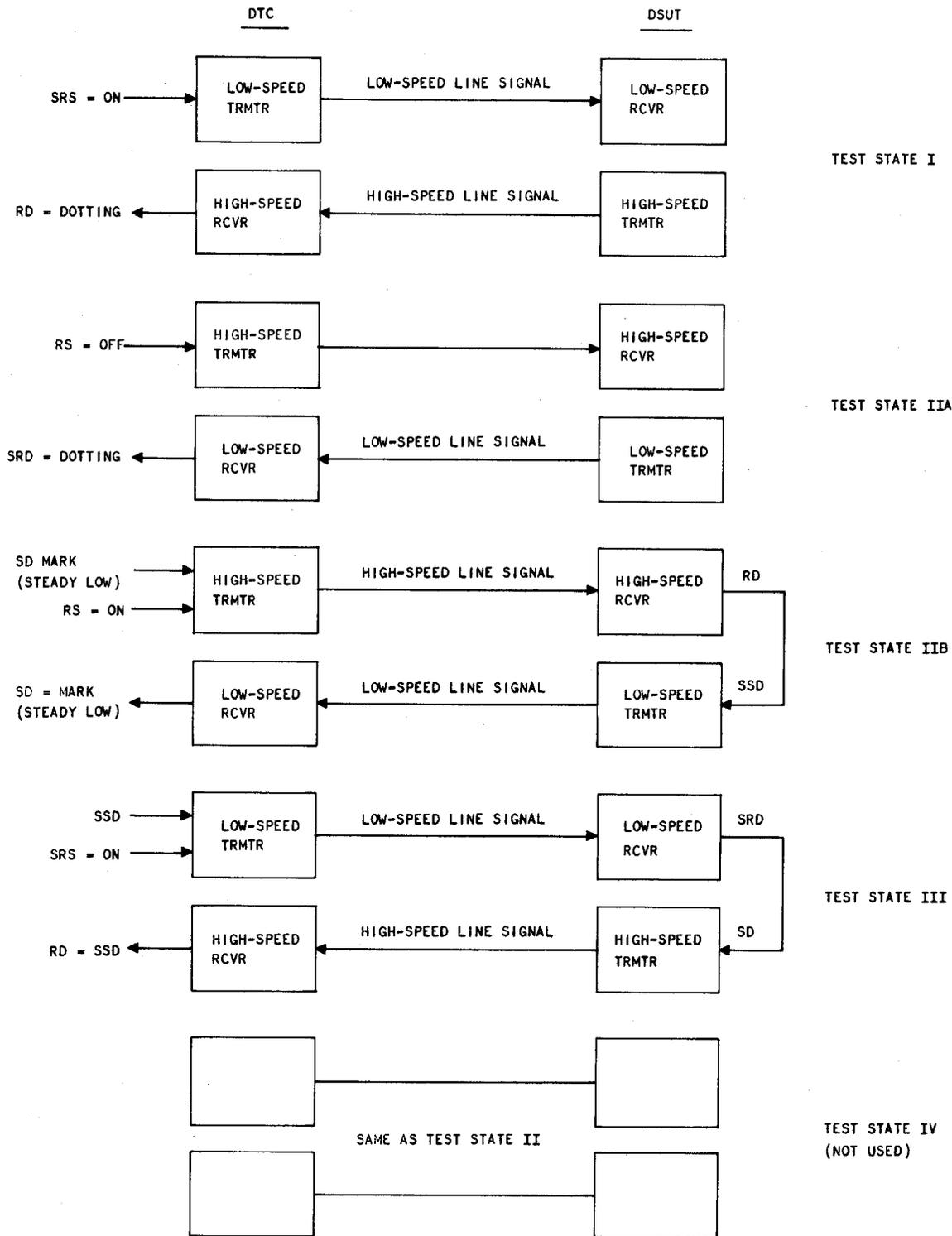


Fig. 2—Remote Test of Data Set 203A With Secondary Channel, Block Diagram

3.39 A functional block diagram illustrating the test state response for a data set 203A without the secondary channel is shown in Fig. 3. Test State I is used to test the high-speed transmitter circuits and Test State II is used to test the high-speed receiver circuits. Test State III and Test State IV are *not* used for this data set arrangement.

3.40 The local data set will step the far-end data set through the test states. This is accomplished

by using the RS (request-to-send) switch on the interface access (or S1 on the 914-type test set). The SRS (secondary request-to-send) switch (or S2 on the 914) is used when the far-end data set is provided with a low-speed secondary channel. The test states can be repeated (ie, I, II, III, IV, I, II, etc) as necessary. To terminate the remote test at the far-end data set, the local data set must transmit a steady SPACE signal (a positive voltage) over the high-speed channel (or over the low-speed channel, if used) while in Test States II, III, or IV.

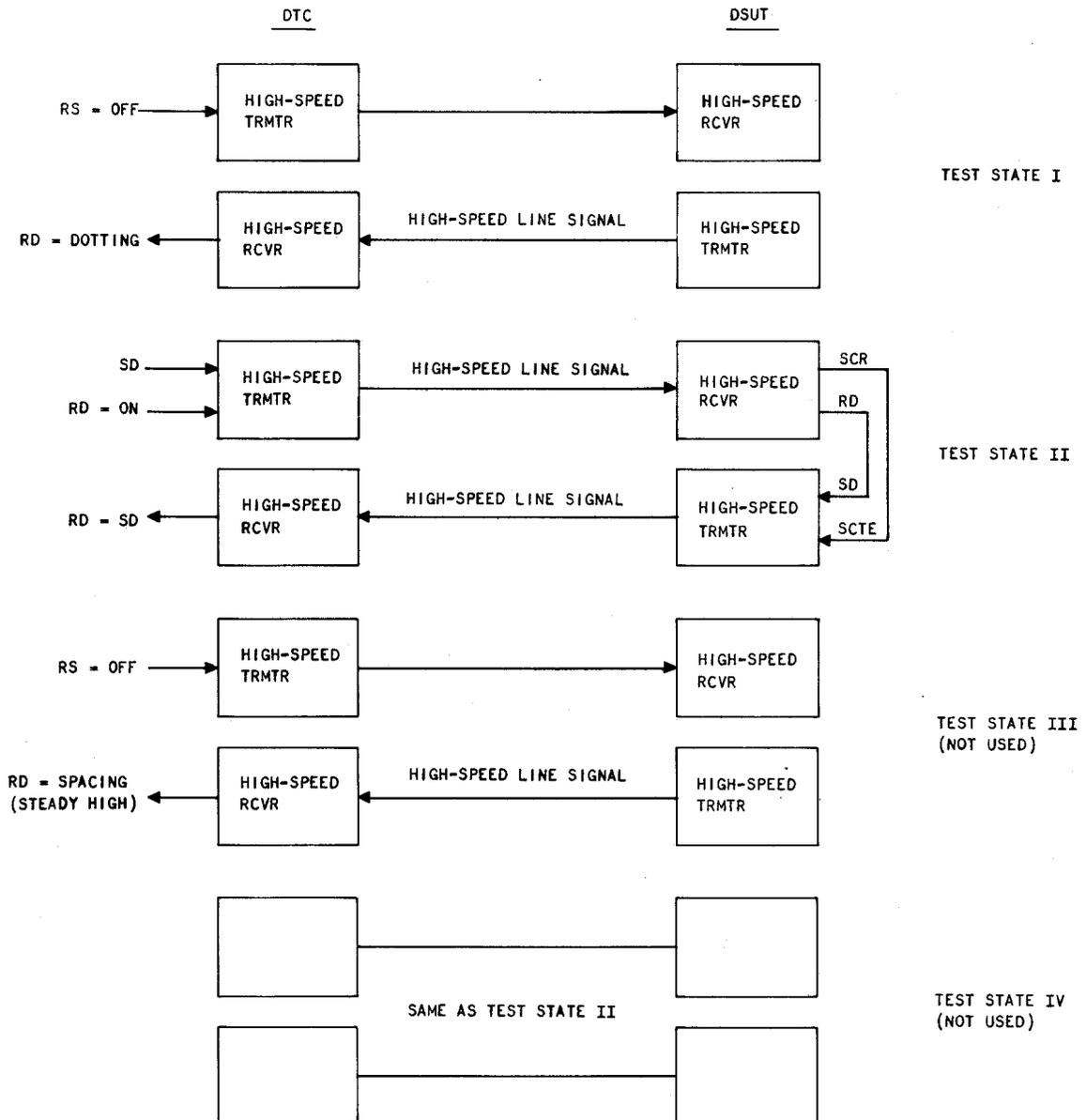


Fig. 3—Remote Test of Data Set 203A Without Auxiliary Channel, Block Diagram

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3.41 Only the far-end data set is placed in the remote test mode. The local data set remains in the normal line mode.

3.42 The local data set must be compatible with the far-end data set. The speed option and the position of the BIT RATE KB/S switch must be identical at both ends. The local data set may be equipped with a low-speed secondary channel even if the far-end data set is not. The local data set options should be those which would be provided for customer operation, except for the following:

- Initiate start-up of high-speed channel must be YB (terminals 25, 33, and 38 strapped)
- Control of secondary channel must be V when the low-speed channel is provided (terminals 28 strapped)

3.43 Conditioning of the far-end data set is as follows:

- The customer interface cord should be removed from the far-end data set. If this is not convenient, there should be assurance that *all* signals from the connected business machine are OFF (negative voltage potential).
- In particular, the request-to-send interface lead should be OFF when the far-end data set is placed in the remote test mode.
- If a special cord (ie, the M23A-51) is used to provide permanent request-to-send—ON, it *must* be disconnected from the far-end data set CUSTOMER connector.
- If the far-end data set option board AR335 has a strap at terminal 31, it should be disconnected for the duration of the remote test and reconnected after testing is complete.

3.44 The far-end data set may be placed in the remote test mode by momentarily operating the REMOTE TEST—LINE—LOCAL TEST key to the REMOTE TEST position and then back to the LINE position.

3.45 The remote test is usually terminated by the local testing data set. However, the far-end data set attendant should be made aware that remote testing can be terminated at the far end, if necessary, by one of the following actions:

- (a) Reoperating the TEST button on DAS 804A-type while on-hook (if provided)
- (b) Going off-hook and reoperating the TALK button on DAS 804M-type (if provided)
- (c) Operating the REMOTE TEST—LINE—LOCAL TEST key on the far-end data set to LOCAL TEST position and then back to LINE.

A. Remote Test of Data Set 203A With Secondary Channel (List 7)

3.46 Connect and condition both the 903C test set and the 914B test set as required in Table H. Patch from connector A on the 914B test set to the CUSTOMER connector on the data set 203A-type. Connect the red METER INPUT terminal through a 10-megohm resistor to selector switch terminal 3A on the 914B test set. Connect the black METER INPUT terminal to selector switch terminal 1B.

3.47 Apply ac power to both test sets. Momentarily press the START button on the 903C test set. Temporarily move the lead from selector switch terminal 3A and connect to terminal 14B. This enables the operator to use the 914 test set speaker for verification that a random word signal tone is present on the SIG OUT lead from the 903C test set. Return the temporary connection from selector switch terminal 14B to terminal 3A.

3.48 After the far-end data set is placed in the remote test mode, the amber light on the far-end data set should be illuminated. If a DAS 804A- or 804M-type is being used, the TEST lamp on the DAS should also be illuminated. These lamps should remain illuminated for the duration of the test. Confirm this at the end of the test.

Note: If a DAS is not being used, the far-end data set must be placed in the remote test mode *after* the data sets at both ends are connected to the telephone line.

Test State I

3.49 Upon entry into the remote test mode, the far-end data set should be in Test State I and should transmit a high-speed dotting signal after completion of start-up.

TABLE H
CONDITIONING TEST EQUIPMENT FOR REMOTE TEST
OF DATA SET 203A WITH SECONDARY CHANNEL

914-TYPE TEST SET CONDITIONING	
MATRIX PINS REQUIRED	SWITCH POSITIONS
GRD - 1 and 7	INTERFACE MODE to VOLTAGE CONTROL SIGNAL switches S1 through S7: OFF, S8: ON BIT RATE to EXT + SIGNAL LEVEL to $\pm 4V$ WORD LENGTH to DOT SAMPLE WIDTH to $0.5\mu s$ TEST SET MODE to RCV SER COUNTER to BIT ERRORS METER FUNCTION to SPKR METER RANGE to 0.3 ACV
RD - 3	
S1 - 4 (controls RS)	
DS1 - 4 (shows RS)	
DS2 - 5 (shows CS)	
S2 - 19 (controls SRS)	
DS3 - 18 (shows COD)	
DS4 - 21 (shows SQ)	
DS5 - 8 (shows CO)	
SCR - 17	
DS6 - 13 (shows SCS)	
DS7 - 12 (shows SCO)	
S8 - 20 (controls DTR)	
903C TEST SET CONDITIONING*	
(1) Patch GRD terminal to 914B selector switch terminal 1A. (2) Patch SIG OUT terminal to 914B selector switch terminal 14B. (3) Set controls as follows: BIT RATE switch to 150 RANDOW-DOT switch to RANDOM TRIGGER switch to + (plus).	

*The 903C DTS is used with the 914B DTS.

3.50 To check for proper start-up, observe that lamp DS3 (COD), DS4 (SQ), and DS5 (CO) illuminate, in that order. These lamps should remain illuminated during Test State I.

3.51 After lamp DS5 (CO) illuminates, a steady tone (high-speed dotting) should be heard on the 914B test set speaker. After hearing the tone, operate the WORD SYNC switch to the MAN. position and reset the counter. Do not place the WORD SYNC switch to the AUTO position. When errors occur, they will in most cases occur in groups of three. If the WORD SYNC switch is in the AUTO position, the errors will in most cases occur in groups of seven. Record the number of errors in 1-minute intervals for 5 minutes. Eliminate the 1-minute interval with the highest number of errors. The total errors for the remaining four intervals should not exceed the applicable number given in Table I.

TABLE I
ERROR RATES FOR
TEST STATE 1

SPEED OPTION	BIT RATE (KB/S)	MAXIMUM TOTAL ERRORS
L2	2.4	9
	4.8	24
L3	1.8	6
	3.6	16
L4	2.4	9
	4.8	24
L5	3.2	15
	6.4	36
L6	3.6	16
	7.2	40

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3.52 If the dotting signal is not heard on the speaker, the far-end data set may be in the wrong test state. In this case, step the far-end data set through the test states until dotting is heard.

3.53 To do this, operate request-to-send (RS) switch S1 to ON for approximately 5 seconds and then OFF. Observe lamps DS3 (COD), DS4 (SQ), and DS5 (CO) for start-up and listen for the dotting signal.

3.54 If no dotting signal is heard within 15 seconds, operate secondary request-to-send (SRS) switch S2 to ON for approximately 5 seconds and then OFF. Wait approximately 5 seconds and then operate switch S1 (RS) to ON for approximately 5 seconds and then OFF. Observe lamps DS3 (COD), DS4 (SQ), and DS5 (CO) for start-up and listen for the dotting signal. If the dotting signal is not received, go to Failure Analysis (3.65).

Test State II

3.55 Remove the meter input of the 914 test set from pin 3 and connect the meter input to pin 16 (SRD). No signal should be heard. Step the far-end data set into Test State II by operating SRS switch S2 to ON for approximately 5 seconds and then OFF. Observe that lamps DS3 (COD), DS4 (SQ), and DS5 (CO) extinguish and lamp DS7 (SCO) illuminates within 2 seconds after SRS is switched OFF. Immediately after lamp DS7 (SCO) illuminates, a steady low-frequency tone should be heard.

3.56 Operate switch S1 (RS) to ON. After approximately 8 seconds, the low-frequency tone should stop. The signal on SRD, pin 16, should be clamped to MARK (negative voltage) except when errors occur on high-speed receive data at the far-end data set. When an error occurs, a SPACE (positive voltage) pulse will be transmitted to the testing data set through the low-speed secondary channel.

3.57 Use the following procedure to count the number of SPACING pulses on SRD:

- Remove the red matrix pin from SCR-17.
- Connect the red matrix pin to SCR-16.
- Remove the red matrix pin from RD-3.

- Ensure that the following switch settings are made:

BIT RATE to EXT +

TEST SET MODE to RCV-SER

BLOCK ERRORS to BIT ERRORS

WORD SYNC to AUTO.

3.58 Record the number of pulses in 1-minute intervals for ten consecutive minutes. Eliminate the interval with the highest number of counts. Add the counts for the remaining nine intervals. The total shall not exceed the applicable number given in Table J.

3.59 At the end of the above check, remove the red matrix pin from SCR-16 and insert into SCR-17. Insert a red matrix pin in RD-3.

Test State III

3.60 Remove the meter input of the 914 test set from pin 16 (SRD) and connect it to pin 3 (RD). No signal should be heard. On the 914 test set, operate the BIT RATE switch to 150.

3.61 Step the far-end data set into Test State III by operating switch S1 (RS) to OFF. Observe that lamp DS7 (SCO) extinguishes within one second and that lamps DS3 (COD), DS4 (SQ), and DS5 (CO) illuminate, in that order. After lamp DS5 (CO) illuminates, operate switch S2 (SRS) to ON. Within a few seconds, lamp DS6 (SCS) should illuminate and a low-frequency random word should be heard on the speaker. Momentarily operate the WORD SYNC switch on the 914 test set to the MAN. position and reset the counter. Do not place the WORD SYNC switch to the AUTO position. The counter should now count errors as they occur. Observe the counter for 5 minutes. During the 5-minute interval, no more than two errors shall occur.

3.62 The test can be ended at this point or the far-end data set can be stepped through Test State IV to Test State I and the test repeated. To step the far-end data set into Test State IV, operate switch S2 (SRS) to OFF. Test State IV is the same as Test State II. To step the far-end data set into Test State I, operate switch S1 (RS) to ON for approximately 5 seconds and then to OFF.

TABLE J

MAXIMUM NUMBER OF SPACING PULSES FOR TEST STATE II

SPEED OPTION	BIT RATE (KB/S)	MAXIMUM COUNT
L2	2.4	7
	4.8	16
L3	1.8	5
	3.6	11
L4	2.4	7
	4.8	16
L5	3.2	11
	6.4	25
L6	3.6	12
	7.2	28

Note: Record counts in 1-minute intervals for 10 minutes. Eliminate the 1-minute interval with the highest number of counts. The total counts for the remaining 9 intervals shall not exceed the maximum count given in the table.

End of Test

3.63 This end-of-test procedure assumes that the far-end data set is in Test State III and the procedures outlined in 3.59 have been completed. The test is ended by transmitting a steady SPACE (positive voltage on SSD, pin 14). To do this, press the START button on the 903C test set for at least 5 seconds. Confirm that the far-end data set is out of the remote test mode (the amber light on the data set and the TEST lamp on the DAS, if provided, should be extinguished).

3.64 The test may also be terminated while in Test States II or IV by transmitting a steady SPACE for at least 5 seconds on SD (pin 2).

Failure Analysis

3.65 If the far-end data set fails to go into or out of the remote test mode, the trouble is probably in the 24A-type data unit and, in particular, AR337, AR340/AR503 CPs, or the 19A data unit.

3.66 If the far-end data set cannot be stepped from Test State I to Test State II and/or from Test State III to Test State IV, the problem

is that the secondary channel carrier detector signal is not toggling the counter on the remote test CP. The trouble may be:

- (a) The far-end data set is receiving a weak line signal or no signal at all.
- (b) The secondary channel receiver is defective (AR336 CP or 4166A network).
- (c) The remote test logic CP is defective (AR337).

3.67 If the far-end data set cannot be stepped from Test State II to Test State III and/or from Test State IV to Test State I, the problem is that the high-speed channel carrier detector signal is not toggling the counter on the remote test CP. The trouble may be:

- (a) The far-end data set is receiving a weak line signal or no signal at all.
- (b) The 23A-type data unit is not receiving a line signal from the 24A-type data unit. This could be caused by wiring failure of just about any CP in the 24A-type data unit.

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(c) The 23A-type data unit is defective. Trouble is most likely caused by AR343, AR353, AR349, AR354, AR342, or the CP in slot 13.

(d) The remote test logic CP is defective (AR337).

3.68 If Test State I fails, the following symptoms and causes may help in locating the trouble:

<i>Symptom</i>	<i>Probable Defect</i>
(a) High-speed channel line signal from far-end data set being received or it does not sound normal.	Could be any circuit pack in 22A or 24A data unit
(b) High-speed channel signal being received but no dotting signal on RD.	AR337 or AR473 circuit pack
(c) Dotting signal being received but error rate is excessive.	Could be any circuit pack in the 22A data unit or the telephone line

3.69 If Test State II fails, the following symptoms and causes may help in locating the trouble:

<i>Symptom</i>	<i>Probable Defect</i>
(a) No low-speed auxiliary channel line signal from far-end data set.	AR336 or 4166A network
(b) Low-speed auxiliary channel signal being received but no tone on SRD.	AR336, AR337, or AR342 circuit pack
(c) Tone on SRD is not steady (indication of excessive errors).	Telephone line
(d) Tone on SRD does not stop after RS is switched ON.	Could be any circuit pack in 23A data unit or AR337, AR341/AR501 circuit pack in the 24A data unit
(e) Counts exceed requirement in Table C.	Could be any circuit pack in 23A data unit or the telephone line

3.70 If Test State III fails and Test State I passes, the trouble is most likely caused by AR336 CP or 4166A network.

B. Remote Test of Data Set 203A Without Secondary Channel (List 7)

3.71 For this arrangement, connect and condition both the 903C test set and the 914B test set as required in Table K. Patch from connector A on the 914B test set to the CUSTOMER connector on the data set 203A-type. Connect the red METER INPUT terminal through a 10-megohm resistor to selector switch terminal 3A on the 914B test set. Connect the black METER INPUT terminal to selector switch terminal 1B.

3.72 Apply ac power to both test sets. Momentarily press the START button on the 903C test

set. Temporarily move the lead from selector switch terminal 3A and connect to terminal 2B. This enables the operator to use the 914 test set speaker for verification that a random word signal tone is present on the SIG OUT lead from the 903C test set. Return the temporary connection from selector switch terminal 2B to terminal 3A.

3.73 After the far-end data set is placed in the remote test mode, the amber light on the far-end data set should be illuminated. If a DAS 804A- or 804M-type is being used, the TEST lamp on the DAS should also be illuminated. These lamps should remain illuminated for the duration of the test. Confirm this at the end of the test.

Note: If a DAS is not being used, the far-end data set must be placed in the remote test mode *after* the data sets at both ends are connected to the telephone line.

TABLE K

CONDITIONING TEST EQUIPMENT FOR REMOTE TEST OF DATA SET 203A WITHOUT SECONDARY CHANNEL

914-TYPE TEST SET CONDITIONING	
MATRIX PINS REQUIRED	SWITCH POSITIONS
GRD - 1 and 7	INTERFACE MODE to VOLTAGE
RD - 3	CONTROL SIGNAL switches
S1 - 4 (controls RS)	S1 through S7: OFF, S8: ON
DS1 - 4 (shows RS)	BIT RATE to EXT +
DS2 - 5 (shows CS)	SIGNAL LEVEL to $\pm 4V$
	WORD LENGTH to DOT
DS3 - 18 (shows COD)	SAMPLE WIDTH to $0.5\mu s$
DS4 - 21 (shows SQ)	TEST SET MODE to RCV SER
DS5 - 8 (shows CO)	COUNTER to BIT ERRORS
SCR - 17	METER FUNCTION to SPKR
S8 - 20 (controls DTR)	METER RANGE to 0.3 ACV
903C TEST SET CONDITIONING*	
(1) Patch GRD terminal to 914B selector switch terminal 1A.	
(2) Patch SIG OUT terminal to 914B selector switch terminal 2A.	
(3) Patch EXT CLOCK terminal to 914B selector switch terminal 15A.	
(4) Set controls as follows:	
BIT RATE switch to EXT CLOCK	
RANDOM-DOT switch to RANDOM	
TRIGGER switch to + (plus).	

*The 903C DTS is used with the 914B DTS.

Test State I

3.74 Upon entry into the remote test mode, the far-end data set should be in Test State I and should transmit a high-speed dotting signal after completion of start-up.

3.75 To check for proper start-up, observe that lamp DS3 (COD), DS4 (SQ), and DS5 (CO) illuminate, in that order. These lamps should remain illuminated during Test State I.

3.76 After lamp DS5 (CO) illuminates, a steady tone (high-speed dotting) should be heard on the 914B test set speaker. After hearing the tone, operate the WORD SYNC switch to the MAN. position and reset the counter. Do not place the WORD SYNC switch to the AUTO position. When errors occur, they will in most cases occur in groups of three. If the WORD SYNC switch is in the AUTO position, the errors will in most cases occur in groups of seven. Record the number of errors in 1-minute intervals for 5 minutes. Eliminate the 1-minute interval with the highest number of errors. The total errors for the remaining four intervals should not exceed the applicable number given in Table L.

3.77 If the dotting signal is not heard on the speaker, the far-end data set may be in the wrong test state. In this case, step the far-end data set through the test states until dotting is heard.

3.78 To do this, operate request-to-send (RS) switch S1 to ON for approximately 5 seconds and then OFF. Observe lamps DS3 (COD), DS4 (SQ), and DS5 (CO) for start-up and listen for the dotting signal.

3.79 If no dotting signal is heard within 15 seconds, repeat 3.75 a maximum of two more times. If the dotting signal is not received, go to Failure Analysis (3.86).

Test State II

3.80 Step the far-end data set into Test State II by operating RS switch S1 to ON for approximately 5 seconds and then OFF. Observe that lamps DS3 (COD), DS4 (SQ), and DS5 (CO) extinguish within 2 seconds.

3.81 Position the WORD LENGTH switch to 63. Operate RS switch S1 to ON. Observe that lamps DS2 (CS), DS3 (COD), DS4 (SQ), and DS5 (CO) illuminate in that order.

3.82 After lamp DS5 (CO) illuminates, random data should be heard from the speaker. (Make sure the 903C or 914B test set is transmitting a 63-bit word on SD.) After hearing random data, operate the WORD SYNC switch to the MAN. position and reset the counter. Do not place the WORD SYNC switch to the AUTO position. When errors occur, they will in most cases occur in groups of three.

TABLE L

SPEED OPTION	BIT RATE (KB/S)	MAXIMUM TOTAL ERRORS
L2	2.4	9
	4.8	24
L3	1.8	6
	3.6	16
L4	2.4	9
	4.8	24
L5	3.2	15
	6.4	36
L6	3.6	16
	7.2	40

3.83 Record the number of pulses in 1-minute intervals for ten consecutive minutes. Eliminate the interval with the highest number of counts. Add the counts for the remaining nine intervals. The total shall not exceed the applicable number given in Table M.

3.84 If desired, the far-end data set can be stepped through Test States III or IV to return to Test State I. The far-end data set is stepped into the next test state by operating RS switch S1 to ON for approximately 5 seconds and then OFF for at least 5 seconds.

End of Test

3.85 The far-end data set is switched out of the remote test mode by transmitting a steady SPACE signal while the far-end data set is in Test State II, III, or IV. To do this, operate the RS switch S1 to ON and press the START button on the 903C test set for at least 5 seconds. Confirm that the far-end data set is out of the remote test mode (the amber light on the data set and the TEST lamp on the DAS, if provided, should be extinguished).

Failure Analysis

3.86 If the far-end data set fails to go into or out of the remote test mode, the trouble is probably in the 24A-type data unit and, in particular, AR337, AR340/AR503 CPs, or the 19A data unit.

3.87 If the far-end data set cannot be stepped from Test State I to Test State II, the problem is that the carrier detector signal is not toggling the test state counter on the remote test CP. The trouble may be:

- (a) The far-end data set is receiving a weak line signal or no signal at all.
- (b) The 23A-type data unit is not receiving a line signal from the 24A-type data unit. This could be caused by wiring failure of just about any CP in the 24A-type data unit.
- (c) The 23A-type data unit is defective. Trouble is most likely caused by AR343, AR353, AR349, AR354, AR342, or the CP in slot 13.
- (d) The remote test logic CP is defective (AR337).

TABLE M

SPEED OPTION	BIT RATE (KB/S)	MAXIMUM TOTAL ERRORS
L2	2.4	36
	4.8	96
L3	1.8	24
	3.6	66
L4	2.4	36
	4.8	96
L5	3.2	60
	6.4	144
L6	3.6	66
	7.2	162

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3.88 If it is known that the far-end data set is being stepped through the test states, but both Test States I and II fail, the following

symptoms and causes may help in locating the trouble:

<i>Symptom</i>	<i>Probable Defect</i>
(a) No line signal from the far-end data set	Could be any circuit pack in the 22A or 24A data unit
(b) Line signal being received from far-end data set but unable to synchronize 914B test set with RD	Could be any circuit pack in the 22A data unit
(c) Can synchronize 914B test set with RD but errors are excessive	Could be any circuit pack in the 23A data unit or the telephone line.

3.89 If Test State I fails but Test State II passes, the probable symptom could be that the dotting signal is not present or is incorrect. The probable cause is a defective far-end remote test CP (AR337).

3.90 If Test State I passes but Test State II fails, the following symptoms and causes may help in locating the trouble:

<i>Symptom</i>	<i>Probable Defect</i>
(a) Line signal being received from far-end data set but unable to synchronize 914B test set with RD	Could be any circuit pack in the 23A or 24A data unit.
(b) Can synchronize 914B test set with RD but errors are excessive	Could be any circuit pack in the 23A data unit or the telephone line.

DIGITAL LOOP-BACK TEST OF DATA SET 203A

3.91 When a data set 203A-type at the far end of a 4-wire facility is provided with a DIGITAL LOOP-BACK switch, a digital loop-back test can be performed. During the test, data is transmitted to the far-end receiver. The data output at the far-end receiver is looped back to the far-end transmitter and sent to the near-end receiver. As a result, the far-end data set and connecting facilities are tested from the near-end data set.

3.92 The far-end station must go into the loop-back mode first by operating the REMOTE TEST—LINE—LOCAL TEST key first to REMOTE TEST position and then to LINE position, and set the DIGITAL LOOP-BACK switch to position A.

The near-end data set remains in the normal line mode. This procedure establishes a loop-back condition at the far end up to the CUSTOMER interface connector and returned through the far-end transmitter.

3.93 The digital loop-back test can be performed as described in LINE LOOP-BACK TEST OF HIGH-SPEED CHANNEL using procedures given in 2.26 through 2.33.

3.94 When the test has been completed, the far-end station returns to normal operation by first setting the DIGITAL LOOP-BACK switch to position B and then operating the REMOTE TEST—LINE—LOCAL TEST key first to LOCAL TEST position and then to LINE position. This procedure will reestablish the normal line mode of operation.