

DATA SET 202R
TRANSMITTER-RECEIVER
TEST PROCEDURES

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2.04 The 6H impulse counter is connected and the test is performed as follows:

- (a) Use a 2W43A test cord or equivalent (310 plug on one end, alligator clips connected to tip and sleeve on the other end). Connect a 901 Data Test Set cover to the interface connector on Data Set 202R.
- (b) On the 901 DTS cover, open terminal 7 and connect one alligator clip to terminal 7 TST and the other to terminal 7 EQ.
- (c) Insert the 310 plug into the 310 MEAS jack on the 6H impulse counter.
- (d) Set the DIAL—MEAS switch to DIAL.
- (e) Set the DBRN dial to 90.
- (f) Reset the counter to zero.
- (g) Set the minutes control to 15.
- (h) At the end of the 15-minute period, there should be no reading on the counter. If there is a reading on the counter, the grounds must be bonded together according to local instructions.

Note: For information pertaining to the 6H impulse counter, refer to Section 103-620-101.

B. Loop-Back Test

2.05 Data Set 202R is equipped with a loop-back capability which allows it to be tested from a remote 904-type Data Test Center (DTC). Test equipment is not required at the data set in order to perform this test. The test procedure used by the DTC is contained in Section 668-102-517.

2.06 To enter the test mode, raise the metal flag labeled TST (at the rear of the data set). Move the toggle switch to the right. Upon completion of the remote test, move the toggle switch to the left and lower the flag.



The purpose of the metal flag is to prevent the toggle switch from accidentally being moved to the test position. When the data set is not being tested, the test switch must be at the left position (away from red

dot) or the data set will not go to the data mode.

2.07 In DATA-PHONE® service, after the call is received from the DTC and it has been agreed to enter the test mode, raise the exclusion key on the associated telephone set before performing the procedure explained in 2.06.

3. MAINTENANCE TESTS

3.01 Tests in this part are intended to be used as troubleshooting aids. The interface tests in combination with the loop-back test in Part 2 should enable the tester to isolate the trouble to either the data set or the business machine. In addition, the dynamic test permits end-to-end testing of the data system. The end-to-end test may be used to isolate a trouble to the data set or the transmission facilities.

INTERFACE TESTS (901 DATA TEST SET)

3.02 The purpose of this test is to verify that the transmitter and receiver are operating properly and that control leads are providing required voltages. If the data set is not operating correctly, card replacements are suggested. If the craft employee is equipped with a 914B DTS, omit this part and proceed to 3.09.

3.03 The following equipment is required at the data station:

- 1—901 Data Test Set (DTS)
- 1—KS-16979-L1 volt-ohm-milliammeter (VOM) or equivalent
- 1—1011-type handset.

A. Four-Wire (Carrier Controlled by Request to Send)

3.04 Connect the 901 DTS cover to the data set interface connector. The test is performed as follows:

- (a) If a LINE—TEST key (6017AP or 6017AR) is used, move the switch to the TEST position.
- (b) If a LINE—TEST key is not used, disconnect the line (T, R, T1, and R1) at the connecting block. Remove the data set cover and remove

the CP AR593 card. Move the 2-wire/4-wire switch to the 2W position and verify that screw switch S3B is closed and S3A is open (X option—data set carrier under control of customer's request-to-send lead). Insert the card back into the data set.

(c) Apply power to the data set. On the 901 DTS cover, strap terminal 9 (+P) to terminal 4 (RTS). This conditions the request-to-send lead **on**.

(d) Connect the 1011 handset across tip and ring (T and R) at the 44A connector block. A 1300-Hz tone will be heard (mark).

(e) Temporarily connect a strap from terminal 9 (+P) to terminal 2 (SD). The frequency of the tone will increase to 2100 Hz (space).

(f) Disconnect the 1011 handset from the terminal block. Connect the VOM to the 901 DTS cover with the positive probe to terminal 3 (RD) and the negative probe to terminal 7 (SG). The VOM should be set to measure dc voltage.

(g) Measure the voltage on the received data lead with the transmitter sending a "space."

Requirement: More positive than +5 volts

(h) Measure the voltage on the clear-to-send lead (terminal 5).

Requirement: More positive than +5 volts

(i) Measure the voltage on the data set ready lead (terminal 6).

Requirement: More positive than +5 volts

(j) Measure the voltage on the carrier detector lead (terminal 8).

Requirement: More positive than +5 volts

(k) On the 901 DTS cover, disconnect the lead between terminal 2 and terminal 9. The data set will now transmit a "mark" tone.

(l) Connect the positive probe of the VOM to ground (terminal 7) and connect the negative

probe to terminal 3. Measure the voltage on the received data lead.

Requirement: More negative than -5 volts

(m) Disconnect the lead between terminal 4 and terminal 9. This puts request to send **off**.

(n) Measure the voltage on the clear-to-send lead (terminal 5).

Requirement: More negative than -5 volts

(o) Measure the voltage on the carrier detector lead (terminal 8).

Requirement: More negative than -5 volts

(p) Disconnect the meter from the 901 DTS cover. If the data set fails at (d) or (e), replace card AR593 and retest. If the data set still fails (d) or (e), replace card AR591. If the data set fails at (g) or (l), replace card AR592 and retest. If the data set still fails (g) or (l), replace card AR593. If the data set fails at (h), (i), (j), (n), or (o), replace card AR591.



Verify that the options are as specified on the service order before the new card is inserted in the data set. Refer to Section 592-025-200 for option information. Repeat the test starting at (b).

(q) Upon completion of the test, disconnect the test equipment and reconnect the line wires or move the LINE—TEST key to LINE.



If the LINE—TEST key was not used, remove card AR593 and reset the 2-wire/4-wire switch to the 4W position. Insert the card into the data set and replace the cover.

(r) Verify to the customer that service is satisfactory by placing a data call.

Note: Take proper steps to ensure that the customer is not billed for test calls. Refer to the section entitled Crediting Charges for Test Calls (010-250-001).

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B. Four-Wire Continuous Carrier

3.05 Connect the 901 DTS cover to the data set interface connector. The test is performed as follows:

- (a) If a LINE—TEST key (6017AP or 6017AR) is used, move the switch to the TEST position.
- (b) If a LINE—TEST key is not used, disconnect the line (T, R, T1, and R1) at the connecting block. Remove the data set cover and remove the AR593 card. Move the 2-wire/4-wire switch to the 2W position and verify that screw switch S3A is closed and S3B is open (W option—continuous carrier). Insert the card back into the data set.
- (c) Apply power to the data set.
- (d) Connect the 1011 handset across tip and ring (T and R) at the connector block. A 1300-Hz tone (mark) will be heard.
- (e) Temporarily connect a strap from terminal 9 (+P) to terminal 2 (SD). The frequency of the tone will increase to 2100 Hz (space).
- (f) Disconnect the 1011 handset from the terminal block. Connect the VOM to the 901 DTS cover with the positive probe to terminal 3 and the negative probe to terminal 7 (SG). The VOM should be set to measure dc voltage.
- (g) Measure the voltage on the received data lead with the transmitter sending a "space."

Requirement: More positive than +5 volts

- (h) Measure the voltage on the clear-to-send lead (terminal 5).

Requirement: More positive than +5 volts

- (i) Measure the voltage on the data set ready lead (terminal 6).

Requirement: More positive than +5 volts

- (j) Measure the voltage on the carrier detector lead (terminal 8).

Requirement: More positive than +5 volts

- (k) On the 901 DTS cover, remove the lead placed between terminal 9 and terminal 2. The data set will now transmit a mark signal.

- (l) Measure the voltage on the carrier detector lead and verify that it remains more positive than +5 volts.

- (m) Reverse the leads to the VOM and measure the voltage on the received data lead (terminal 3).

Requirement: More negative than -5 volts

- (n) Disconnect the meter from the 901 DTS cover. If the data set fails at (d) or (e), replace card AR593. If the data set fails at (g) or (m), replace card AR592. If the data set fails at (h), (i), (j), or (l), replace card AR591.



Verify that the options are as specified on the service order before the new card is inserted in the data set. Refer to Section 592-025-200 for option information. Repeat the test starting at (b).

- (o) Upon completion of the test, disconnect the test equipment and reconnect the line wires or move the LINE—TEST key to LINE.



If the LINE—TEST key was not used, remove card AR593 and reset the 2-wire/4-wire switch to the 4W position. Insert the card and replace the cover.

- (p) Verify to the customer that service is satisfactory by placing a data call.

Note: Take proper steps to ensure that the customer is not billed for test calls. Refer to the section entitled Crediting Charges for Test Calls (010-250-001).

C. Two-Wire (Carrier Controlled by Request to Send)

3.06 Connect the 901 DTS cover to the data set interface connector. The test is performed as follows:

- (a) Disconnect the line wires (T and R).
- (b) Perform the test as specified in 3.04 (c) through (p).
- (c) Upon completion of the test, disconnect the test equipment and reconnect the line wires.
- (d) Verify to the customer that service is satisfactory by placing a data call.

Note: Take proper steps to ensure that the customer is not billed for test calls. Refer to the section entitled Crediting Charges for Test Calls (010-250-001).

D. Two-Wire Continuous Carrier

3.07 Connect the 901 DTS cover to the data set interface connector.

- (a) Disconnect the line wires (T and R).
- (b) Perform the test as specified in 3.05 (b) through (n).
- (c) Upon completion of the test, disconnect the test equipment and reconnect the line wires.
- (d) Verify to the customer that service is satisfactory by placing a data call.

Note: Take proper steps to ensure that the customer is not billed for test calls. Refer to the section entitled Crediting Charges for Test Calls (010-250-001).

E. Two-Wire Receive Only (Private Line and DDD)

3.08 Data sets used for receive only service will be tested with the assistance of the data test center. If the data set is being used on private lines, it will be necessary to patch the data test center to the private line at the central office. If the data set is operating on the switched message network (DDD) and it has been agreed to enter the test mode, raise the exclusion key on the associated telephone set before performing the test from the DTC.

- (a) Connect the 901 DTS cover to the data set interface connector.

- (b) Apply power to the data set. Using the VOM, measure the voltage on the clear-to-send lead (terminal 5). Use the 30-volt dc scale on the KS-16979 VOM.

Requirement: More negative than -5 volts

- (c) Measure the voltage on the carrier detector lead (terminal 8).

Requirement: More negative than -5 volts

- (d) Contact the data test center and request a 1300-Hz tone (mark). Measure the voltage on the received data lead (terminal 3).

Requirement: More negative than -5 volts

- (e) Reverse the leads to the VOM and measure the voltage on the carrier detector lead (terminal 8).

Requirement: More positive than +5 volts

- (f) Request that the data test center send a 2100-Hz tone (space).

- (g) Measure the voltage on the received data lead (terminal 3).

Requirement: More positive than +5 volts

- (h) Measure the voltage on the carrier detector lead and verify that it remains more positive than +5 volts.

INTERFACE TESTS (914B DATA TEST SET)

3.09 The purpose of this test is to verify that the transmitter and receiver are operating satisfactorily and that control leads are providing and responding to required voltages. In addition, the time intervals associated with the clear-to-send lead and carrier detector lead can be measured. If the data set is not operating correctly, card replacements are suggested.

A. Four-Wire (Carrier Controlled by Request-to-Send)

3.10 This test can be performed using only the 914B DTS. Proceed as follows:

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- (a) If a LINE—TEST key (6017AP or 6017AR) is used, move the switch to the TEST position.
- (b) If a LINE—TEST key is not used, disconnect the line leads (T, R, T1, and R1) at the connector block. Remove the data set cover and remove the CP AR593 card. Move the 2-wire/4-wire switch to the 2W position and verify that screw switch S3B is closed and S3A is open (X option—data set carrier under control of customer's request-to-send lead). Insert the card back into the data set.
- (c) Using the cable supplied with the 914B DTS, connect the data set interface connector to connector A on the 914B DTS. Make sure all A interface selector switches are pushed in.
- (d) Set the 914B DTS switches as follows:
FUNCTION switch to SPKR
INTERFACE MODE switch to VOLTAGE
RANGE switch to ACV-1
TRIGGER switches to +/OPEN
METER POLARITY switch to REV
S1-S8 switches to OFF.
- (e) Disregard the setting of the other switches.
- (f) Insert red pins into the matrix board on the 914B DTS in the following positions: 1-GRD, 7-GRD, 2-S1, 4-S2, 4-TP1, 3-DS1, 5-TP2, 5-DS2, 6-DS3, and 8-DS4. The test equipment will appear as in Fig. 1.
- (g) Apply power to the data set and to the 914B DTS.
- (h) Using the leads provided, connect the METER INPUT terminals to tip and ring (T and R) at the connector block.
- (i) Move switch S2 to ON. A 1300-Hz tone will be heard. Switch S2 controls the request-to-send lead.
- (j) Move switch S1 to ON. The frequency of the tone will increase to 2100 Hz (space). Switch S1 controls the send data lead.

(k) Verify that the DS1, DS2, DS3, and DS4 lamps are lighted. The DS1 lamp *on* indicates a positive voltage on the received data lead. The DS2 lamp *on* indicates a positive voltage on the clear-to-send lead. The DS3 lamp *on* indicates a positive voltage on the data set ready lead. The DS4 lamp *on* indicates a positive voltage on the carrier detector lead.

- (l) Move S1 to OFF. Disconnect the leads to the connector block.
- (m) Move the VERTICAL MONITOR switch to 3. Move the RANGE switch to DCV-10.
- (n) Move the FUNCTION switch to VOLTS INT and measure the voltage on the received data lead.

Requirement: More negative than -5 volts

- (o) Move switch S2 to OFF. Move the FUNCTION switch to OFF.
- (p) Move the VERTICAL MONITOR switch to 5 and move the FUNCTION switch to VOLTS INT. Measure the voltage on the clear-to-send lead.

Requirement: More negative than -5 volts

- (q) Move the VERTICAL MONITOR switch to 8. Measure the voltage on the carrier detector lead.

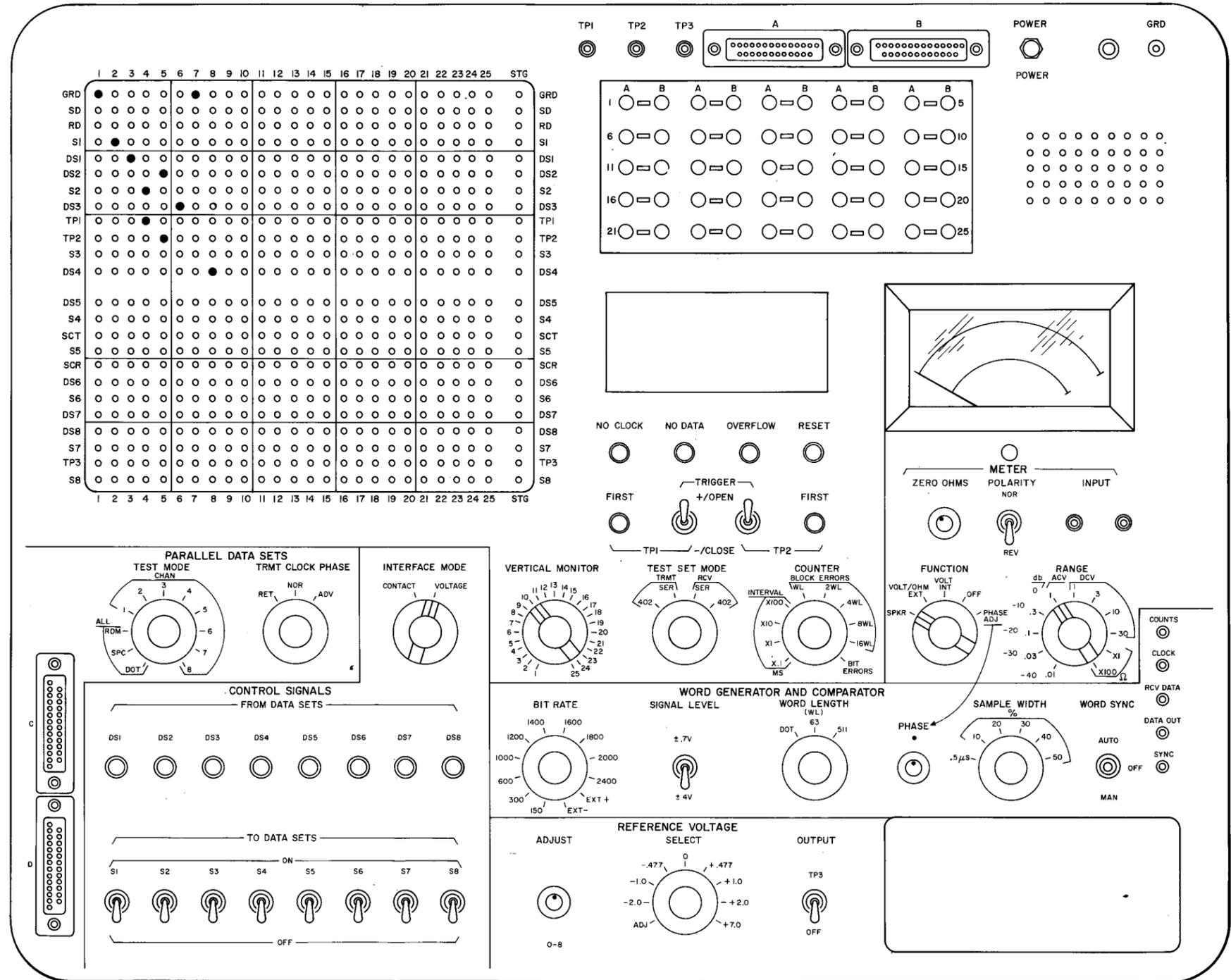
Requirement: More negative than -5 volts

- (r) Move the FUNCTION switch to OFF. Press the RESET button to zero the counter. Move the COUNTER switch to INTERVAL X1 MS (milliseconds) if the data set is strapped for the 30- or 60-millisecond time interval (E or F option). If the data set is strapped for the 200 msec clear to send (G option), set the COUNTER switch to INTERVAL X10.

- (s) Move switch S2 to ON. The counter will indicate the interval between request to send *on* and clear to send *on*.

Requirement:

- 25 to 35 msec for E option
- 50 to 70 msec for F option
- 175 to 225 msec for G option



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Fig. 1—Equipment Setup

(t) After the clear-to-send interval has been measured, verify with the service order that the data set is equipped with the correct interval. If it is not, refer to Section 592-025-200 for installing and removing options.

(u) Move switch S2 to OFF. Move matrix pin from TP2-5 to TP2-8. Press the RESET button to zero the counter. Move the COUNTER switch to INTERVAL X1.

(v) Move switch S2 to ON. The counter will indicate the interval required to turn the carrier detector *on*.

Requirement:

15 to 25 msec with N option
30 to 50 msec with M option

(w) After the carrier detector acquisition time has been measured, verify with the service order that the data set is equipped with the correct option.

(x) If the data set fails at (i) or (j), replace card AR593 and retest. If the data set still fails (i) or (j), replace card AR591. If the data set fails at (k) or (n), replace card AR592 and retest. If the data set still fails (k) or (n), replace card AR593, and retest. If the data set still fails (k), replace card AR591. If the data set fails at (p), (q), (s), or (v), replace card AR591.



Verify that the options are as specified on the service order before the new card is inserted in the data set. Refer to Section 592-025-200 for option information. Repeat the test with the new card in place.

(y) Upon completion of the test, disconnect the test equipment and reconnect the line wires or move the LINE—TEST key to LINE.



If the LINE—TEST key was not used, remove card AR593 and reset the 2-wire/4-wire switch to the 4W position. Insert the card into the data set and replace the cover.

(z) Verify to the customer that service is satisfactory by placing a data call.

Note: Take proper steps to ensure that the customer is not billed for test calls. Refer to the section entitled Crediting Charges for Test Calls (010-250-001).

B. Four-Wire Continuous Carrier

3.11 This test can be performed using only the 914B DTS. Proceed as follows:

(a) If a LINE—TEST key (6017AP or 6017AR) is used, move the switch to the TEST position.

(b) If a LINE—TEST key is not used, disconnect the line leads (T, R, T1, and R1) at the connector block. Remove the data set cover and remove the AR593 card. Move the 2-wire/4-wire switch to the 2W position and verify that screw switch S3A is closed and S3B is open (W option—continuous carrier). Insert the card back into the data set.

(c) Using the cable supplied with the 914B DTS, connect the data set interface connector to connector A on the 914B DTS. Make sure all A interface selector switches are pushed in.

(d) Set the 914B DTS switches as follows:

FUNCTION switch to SPKR

INTERFACE MODE switch to VOLTAGE

RANGE switch to ACV-1

TRIGGER switches to +/OPEN

METER POLARITY switch to REV

S1—S8 switches to OFF.

(e) Disregard the setting of the other switches.

(f) Insert red pins into the matrix board on the 914B DTS in the following positions: 1-GRD, 7-GRD, 2-S1, 3-DS1, 5-DS2, 6-DS3, and 8-DS4.

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

(h) Using the leads provided with the 914B DTS, connect the METER INPUT terminals to tip and ring (T and R) at the connector block. A 1300-Hz tone will be heard.

(i) Move switch S1 to ON. The frequency of the tone will increase to 2100 Hz (space). Switch S1 controls the send data lead.

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- (j) Verify that the DS1 lamp is lighted. The DS1 lamp **on** indicates a positive voltage on the received data lead.
- (k) Verify that the DS2, DS3, and DS4 lamps are lighted. The DS2 lamp **on** indicates a positive voltage on the clear-to-send lead. The DS3 lamp **on** indicates a positive voltage on the data set ready lead. The DS4 lamp **on** indicates a positive voltage on the carrier detector lead.
- (l) Move S1 to OFF. Disconnect the leads to the connector block.
- (m) Move the VERTICAL MONITOR switch to 3. Move the RANGE switch to DCV-10.
- (n) Move the FUNCTION switch to VOLTS INT and measure the voltage on the received data lead.

Requirement: More negative than -5 volts

- (o) Verify that the DS2, DS3, and DS4 lamps remain lighted.
- (p) If the data set fails at (h) or (i), replace card AR593 and retest. If the data set still fails (h) or (i), replace card AR591. If the data set fails at (j) or (n), replace card AR592 and retest. If the data set still fails (j) or (n), replace card AR593. If the data set fails at (k) or (o), replace card AR591.



Verify that the options are as specified on the service order before the new card is inserted in the data set. Refer to Section 592-025-200 for option information. Repeat the test with the new card in place.

- (q) Upon completion of the test, disconnect the test equipment and reconnect the line wires or move the LINE—TEST key to LINE.



If the LINE—TEST key was not used, remove card AR593 and reset the 2-wire/4-wire switch to the 4W position. Insert the card into the data set and replace the cover.

- (r) Verify to the customer that service is satisfactory by placing a data call.

Note: Take proper steps to ensure that the customer is not billed for test calls. Refer to the section entitled Crediting Charges for Test Calls (010-250-001).

C. Two-Wire (Carrier Controlled by Request to Send)

3.12 This test can be performed using only the 914B DTS. Proceed as follows:

- (a) Disconnect the line wires (T and R).
- (b) Perform the test as specified in 3.10 (c) through (x).
- (c) Upon completion of the test, disconnect the test equipment and reconnect the line wires.
- (d) Verify to the customer that service is satisfactory by placing a data call.

Note: Take proper steps to ensure that the customer is not billed for test calls. Refer to the section entitled Crediting Charges for Test Calls (010-250-001).

D. Two-Wire Continuous Carrier

3.13 This test can be performed using only the 914B DTS. Proceed as follows:

- (a) Disconnect the line wires (T and R).
- (b) Perform the test as specified in 3.11 (c) through (p).
- (c) Upon completion of the test, disconnect the test equipment and reconnect the line wires.
- (d) Verify to the customer that service is satisfactory by placing a data call.

Note: Take proper steps to ensure that the customer is not billed for test calls. Refer to the section entitled Crediting Charges for Test Calls (010-250-001).

E. Two-Wire Receive Only (Private Line and DDD)

3.14 Data sets used for receive only service will be tested with the assistance of the data test center. If the data set is being used on

private lines, it will be necessary to patch the data test center to the private lines at the central office. If the data set is operating on the switched message network (DDD), and it has been agreed to begin the test, raise the exclusion key on the associated telephone before performing the test from the DTC.

(a) Connect the 914B DTS to the data set interface connector.

(b) Set the controls on the 914B DTS as follows:

INTERFACE MODE switch to VOLTAGE
S1—S8 switches to OFF

VERTICAL MONITOR switch to 5

FUNCTION switch to OFF

RANGE switch to DCV-10

METER POLARITY switch to REV.

(c) Disregard the settings of the other switches.

(d) Insert red pins into the matrix board in the following locations: 1-GRD, 7-GRD, 3-DS1, 5-DS2, 6-DS3, and 8-DS4.

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

(f) Move the FUNCTION switch to VOLTS INT and measure the voltage on the clear-to-send lead.

Requirement: More negative than -5 volts

(g) Move the FUNCTION switch to OFF and move the VERTICAL MONITOR switch to 8. Move the FUNCTION switch to VOLTS INT and measure the voltage on the carrier detector lead.

Requirement: More negative than -5 volts

(h) Move the FUNCTION switch to OFF. Contact the data test center and request a 1300-Hz tone (mark).

(i) Move the VERTICAL MONITOR switch to 3. Move the FUNCTION switch to VOLTS INT and measure the voltage on the received data lead.

Requirement: More negative than -5 volts

(j) Verify that the DS4 lamp is lighted. The DS4 lamp *on* indicates a positive voltage on the carrier detector lead.

(k) Request a 2100-Hz tone from the data test center.

(l) Verify that the DS1 lamp lights. This indicates a positive voltage on the received data lead.

(m) Verify that the DS3 lamp remains lighted.

(n) If the data set fails any of the requirements, replace the circuit boards and retest.

Note: Verify that the correct options are strapped into the new cards before they are inserted in the data set. Refer to 592-025-200 for option information.

(o) Upon completion of the test, verify to the customer that service is satisfactory by placing a data call.

Note: Take proper steps to ensure that the customer is not billed for test calls. Refer to the section entitled Crediting Charges for Test Calls (010-250-001).

DYNAMIC TEST (901, 902, AND 903 DATA TEST SETS)

3.15 The purpose of this test is to check the transmitter and receiver of both data sets and the two directions of transmission of the connecting facility. One terminal can be a data test center.

3.16 These tests measure the distortion and error rate of the data system. The transmitting data set is driven by a 903 DTS (63-bit word generator). At the receiving end, the data set feeds the data signals to a 902 DTS (distortion-measuring and error-checking set). Also at the receiving end, a 903 DTS is used to deliver to the 902 DTS a signal which is identical to the signal sent from the transmitting end. The 902 test set synchronizes these two signals, measures the peak distortion, and counts the number of errors in the received data.

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3.17 The following test equipment is required at *each* station:

- 1—901-type Data Test Set
- 1—902-type Data Test Set
- 1—903-type Data Test Set
- 1—1011 handset.

3.18 The following switch settings and connections are to be made at the transmitting end for switched network and private line testing.

- 901 DTS

SELECTOR to position 4

A TEST to position 8

B TEST to OFF

ATT-UNATT to UNATT.

- 903 DTS

TRIGGER to + (plus)

RANDOM-DOT to RANDOM

BIT RATE as close as possible to the business machine bit rate, but *not* lower.

- (a) Run two leads from the SIGNAL OUT terminals of the 903 DTS to the TRANSMIT DATA terminals of the 901 DTS. (Terminals are connected red to red and black to black.)
- (b) Connect the 901 DTS to the data set interface connector.
- (c) Connect the power cord of the 903 set to the ac power. Turn the power switch *on*.

3.19 The following switch settings and connections are to be made at the receiving end for switched network and private line testing.

- 901 DTS

SELECTOR to position 4

A TEST switch to OFF

B TEST switch to OFF

ATT-UNATT to UNATT.

- 902 DTS

BIT RATE to transmitted bit speed

Meter selection switch to DIST ADJ

TRIGGER—Not required.

- 903 DTS

BIT RATE to EXT CLOCK

RANDOM-DOT to RANDOM

TRIGGER to + (plus).

- (a) Run two leads from the RECEIVE DATA terminals of the 901 DTS to the DATA IN terminals of the 902 DTS.
- (b) Connect the 903 DTS to the 902 DTS with the cord provided.
- (c) Connect the 901 DTS to the data set interface connector.
- (d) Connect the power cord of the 903 DTS to the ac power. Turn the power switch *on*.

Private Line

3.20 The private line dynamic test will require a 5-minute test run if the customer's complaint indicates excessive errors (more than three errors in 10^5 bits) or a 15-minute test if the complaint indicates random errors. Perform the following procedure to determine the error rate of the data set.

- (a) Establish voice communications between stations.
- (b) The transmitting station attendant must momentarily depress the START switch on the 903 DTS. The transmitting station attendant has no further duties until the end of the test period.
- (c) The receiving station attendant must perform the following steps:
 - (1) Allow the 902 meter selection switch to remain in the DIST ADJ position for

several seconds before making distortion calibration adjustment. Zero the meter by means of the DISTORTION adjustment knob.

- (2) Move the meter selection switch to the VOLT ADJ position and again zero the meter by means of the VOLTS adjustment control.
- (3) Move the meter selection switch to PHASE ADJ and again zero the meter by means of the PHASE adjustment control.
- (4) Move the meter selection switch to DIST MEAS. Momentarily depress the WORD SYNC & RESET switch.
- (5) The microammeter should settle down to some relatively stable value that indicates peak distortion. One microamp is equal to 1 percent distortion. For example, a meter indication of 8 microamps would be 8 percent peak distortion.

Requirement: The average distortion should not exceed 20 percent. Occasional peaks over 20 percent are permissible.

- (6) The TOTAL ERRORS lamps lighted on the 902 DTS indicate the number of errors in received data from the time the WORD SYNC & RESET switch was released. For example, if the 8, 4, and 1 lamps are lighted, this would indicate a total of 13 errors.

Requirement: The maximum allowable number of errors as a function of bit rate is shown in Table A.

TABLE A

MAXIMUM ERRORS ALLOWED
(PRIVATE LINE USING 902 DTS)

BPS	MAXIMUM NUMBER
1000	3
1200	5
1400	6
1600	7
1800	8

Switched Network

3.21 Complete end-to-end tests will involve making two 15-minute and ten 1-minute test runs. Establish voice communications using the associated telephone set. Alternately place calls from each end except where one customer location will only be a data transmitter. These test calls should be made during busy hours. This will give reasonable assurance that all test calls do not use the same trunks and routes.

3.22 Perform the following procedure for each test call:

- (a) Establish voice communication between stations.
- (b) Both stations must go to the data mode by lifting the exclusion key on the telephone set.
- (c) The transmitting station attendant must momentarily depress the START switch of the 903 DTS. The transmitting station attendant has no further duties until the end of the test.
- (d) The receiving station attendant performs the following steps:
 - (1) Allow the 902 meter selection switch to remain in the DIST ADJ position for several seconds before making distortion calibration adjustments. Zero the meter by means of the DISTORTION adjustment knob.
 - (2) Move the meter selection switch to the VOLT ADJ position and again zero the meter by means of the VOLTS adjustment control.
 - (3) Move the meter selection switch to PHASE ADJ and again zero the meter by means of the PHASE adjustment control.
 - (4) Move the meter selection switch to DIST MEAS. Depress the WORD SYNC & RESET switch momentarily and record the time.
 - (5) The microammeter should settle down to some relatively stable value that indicates peak distortion. One microamp is equal to 1 percent distortion. The maximum allowable

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peak distortion is 20 percent. Occasional peaks over 20 percent are permissible.

(6) The TOTAL ERRORS lamps lighted on the 902 DTS indicate the number of errors in received data from the time the WORD SYNC & RESET switch was released. For example, if the 4, 8, and 1 lamps are lighted, this would indicate a total of 13 errors.

Test Call Requirements

3.23 Refer to Fig. 2 for an example of a form for recording test results. During the 15-minute calls, count errors at the end of 1-minute test periods. This test is used to determine the acceptability of the long-term error rate.

- Disregard the two test periods with the highest number of errors.
- Total errors in the remaining 13 test periods should be no more than five.

3.24 The 1-minute calls are used to determine acceptability of randomly selected facilities available for routing data calls. The requirements for 1-minute calls are as follows:

- Eight of the ten calls should have no more than three errors each.
- The average distortion of 20 percent should not be exceeded in nine out of ten calls.

DYNAMIC TEST (914B DATA TEST SET)

3.25 The purpose of this test is to check the transmitter and receiver of both data sets and the two directions of transmission of the connecting facility. One terminal can be a data test center.

3.26 These tests measure the distortion and error rate of the data system. The transmitting data set is driven by a word generator in the 914B DTS. At the receiving end, the data signals are received by the data set and compared to a locally generated signal in the 914B DTS. The 914B DTS synchronizes the two signals and counts the number of errors in the received data.

3.27 The test equipment is set up as follows:

Transmitting End

- TEST SET MODE to TRMT SER
- BIT RATE as close as possible to the business machine bit rate, but *not* lower
- SIGNAL LEVEL to $\pm 4V$
- WORD LENGTH to 63
- Switch S1 to ON
- INTERFACE MODE to VOLTAGE
- FUNCTION switch to OFF.

Receiving End

- TEST SET MODE to REC SER
- BIT RATE to transmitted bit speed
- SIGNAL LEVEL to $\pm 4V$
- WORD LENGTH to 63
- COUNTER to bit errors
- PHASE to midposition
- FUNCTION to PHASE ADJ
- SAMPLE WIDTH to 30.

3.28 Plug the 914B DTS power cord into the 117-vac outlet. Turn the 914B DTS on by pressing the POWER button. Connect the 914B DTS (A connector) to the data set interface connector. Insert red pins into matrix positions 1-GRD, 7-GRD, 2-SD, 3-RD, and 4-S1.

Private Line

3.29 A 5-minute run of the private line dynamic test will be required if the customer's complaint indicates excessive errors (more than three errors in 10^5 bits) or a 15-minute test if the complaint indicates random errors. Perform the following procedure for the test call:

- (a) Establish voice communication between stations using an adjacent telephone.

Date: _____

Data Test Calls Placed Between:

<u>LOCATION</u>	<u>TEL. # OF TEST LINE OR STATION</u>
(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		PEAK DISTORTION		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
	AT	TIME	AT	%																

SHORT DURATION TEST CALLS			SHORT CALL — NUMBER									
ORIGINATED AT	TIME		(READINGS AT _____)					(READINGS AT _____)				
			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. 2—Data Set Pre-Service Performance Test Record

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(b) When the transmitting data set begins sending data, the attendant at the receiving data station must do the following:

- (1) On the 914B DTS, set the FUNCTION switch to PHASE ADJ.
- (2) Adjust the PHASE control for a null on the meter.
- (3) Move the FUNCTION switch to OFF.
- (4) Operate the WORD SYNC switch momentarily to MAN.
- (5) Momentarily press the RESET button to clear the counter.

Requirement: The maximum allowable number of errors as a function of bit rate is shown in Table B.

TABLE B

**MAXIMUM ERRORS ALLOWED
(PRIVATE LINE USING 914B DTS)**

BPS	MAXIMUM NUMBER
1000	4
1200	6
1400	8
1600	9
1800	10

Switched Network

3.30 Complete end-to-end tests will involve making two 15-minute and ten 1-minute test runs. Establish voice communications using the associated telephone set. Alternately place calls from each end except where one customer location will always be originating the call. These test calls should be made during busy hours. This will give reasonable assurance that all test calls do not use the same trunks and routes.

3.31 Perform the following procedure for each test call:

- (a) Establish voice communications between stations.

(b) Both stations must go to the data mode by lifting the exclusion key on the telephone set.

(c) When the transmitting data set begins sending data, the attendant at the receiving data station must do the following:

- (1) On the 914B DTS, set the FUNCTION switch to PHASE ADJ.
- (2) Adjust the PHASE control for a null on the meter.
- (3) Move the FUNCTION switch to OFF.
- (4) Momentarily operate the WORD SYNC switch to MAN.
- (5) Momentarily press the RESET button to clear the counter.

Test Call Requirements

3.32 Refer to Fig. 2 for an example of a form which can be used to record test results. During the 15-minute test calls, count errors at the end of 1-minute intervals. Disregard the two test periods with the highest number of errors. Total errors in the remaining 13 test periods should be no more than six.

3.33 The 1-minute calls are used to determine the acceptability of randomly selected facilities available for routing data calls. Eight of the ten calls should have no more than four errors each.

4. REFERENCES

4.01 The following documents contain information pertaining to Data Set 202R:

SECTION	TITLE
502-501-102	502-, 510-, 511-, 515-, 555-, and 558-Type Telephone Sets
502-503-102	2502-, 2510-, 2511-, 2515-, 2555-, and 2558-Type Telephone Sets
592-025-100	Data Set 202R, Transmitter-Receiver, Description and Operation

592-025-180 Data Set 202R, Transmitter-Receiver, Summarizing Specification, Data Systems Station

592-025-300 Data Set 202R, Transmitter-Receiver, Maintenance

592-025-200 Data Set 202R, Transmitter-Receiver, Installation and Connections

668-102-517 Data Test Center 904A- and 904C-Types, Test Procedures—Data Set 202R, Loop-Back Test.