DATA SET 208B-TYPE TRANSMITTER-RECEIVER TEST PROCEDURES USING THE 914-TYPE DATA TEST SET (DTS)

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1. GENERAL

1.01 This section contains procedures to be used when testing data set (DS) 208B-type on an initial installation or during a maintenance visit. Procedures required when investigating reported trouble are found in Section 592-030-300.

1.02 This section is reissued to include:

- Information pertaining to DS 208B-L1B, which replaces DS 208B-L1A. Concurrent with the introduction of DS 208B-L1B, DS 208B-L1A is rated Manufacture Discontinued/ Not Orderable (MD/NO).
- End-to-End Start-up Test.

1.03 This section is divided into six parts:

- General
- Test Facilities Available
- Installation Testing

- Maintenance Testing
- Test Procedures
- Ground Noise Test.

Part 2 describes the test capabilities of the data set. Part 3 specifies the tests to be made during installation. Part 4 specifies the tests to be made during a maintenance visit. Part 5 outlines the step-by-step procedures for performing the various tests. Part 6 provides a test of the grounding arrangement between data set and business machine.

1.04 In Part 5, the CA-CB interval test and CA-CF interval test require a yellow resistor pin for use with the 914-type data test set (DTS). The pin contains a 3300-ohm resistor, and is used to eliminate the effects of contact bounce produced by the S switches of the 914-type DTS, during timing interval tests.

1.05 If the resistor pin is not available, connect a 3300-ohm resistor between the center posts of terminals 9 and 4 of the interface selector switches on the 914-type DTS before performing tests.

2. TEST FACILITIES AVAILABLE

2.01 Test circuitry built into DS 208B-type permits testing of the data set in analog loop-back and end-to-end modes without the use of external test equipment. The same tests can also be made in greater depth using the 914-type DTS. Remote test circuitry enables the data set to be tested and evaluated by telephone company (telco) data test center (DTC) personnel.

A. Self-Test Features

2.02 The self-test features of the data set make use of pushbutton switches and lamps on the front of the data set. For a description of switches and lamps, refer to the section entitled Data Set 208B-Type Transmitter-Receiver— Description and Operation (592-030-100). Table A gives the test switch positions and lamp status during test and normal operation.

Lamp Test

2.03 The lamp test (LP) switch is a nonlocking button which when depressed lights the TR, MR, RS, CS, CO, and ER lamps to ensure proper operation of these lamps. The LP switch can be depressed at any time, as it does not affect normal data set operation. ▶On DS 208B-L1B, the LP switch is also used to inject errors (spaces) for test purposes. This feature is enabled only when the ST switch is depressed.◀

Analog Loop-Back Test

2.04 The analog loop-back test checks operation of the terminal equipment with the data set by allowing the terminal to loop back test signals through the data set. The terminal should be connected to the data set, the DSR-ON-in-AL-mode option should be installed in the data set, and the AL switch on the data set should be depressed to perform the test. The terminal should be able to operate full duplex and verify that the test signal is being sent through the local data set and back to the terminal without errors.

Analog Loop-Back Self Test

2.05 The analog loop-back self-test mode is entered by depressing the analog loop (AL) and self-test (ST) locking switches. Depressing the AL button connects the data set transmitter to its own receiver through an internal pad on the data set side. Depressing the ST button forces the internal request-to-send (CA) ON, transmits a steady mark on data set BA lead and enables the ER lamp to be used to indicate received errors (spaces). ▶On DS 208B-L1B, depressing the LP switch causes steady spaces to be sent.◀

End-to-End Self Test

2.06 The end-to-end self-test mode is entered, after a call connection has been established, by depressing the ST switch at the transmitting end and the ST and RO (receive only) switches at the receiving end and then transferring to data mode. This conditions the transmitting end to transmit steady marks. The ER lamp at the receiving end indicates any errors made in transmission. The direction of transmission can be reversed by releasing the RO switch at the receiving end (which now becomes the transmitting end) and depressing the RO switch at the transmitting end (which now becomes the receiving end). ▶On DS 208B-L1B, depressing the LP switch causes steady spaces to be sent which are detected as errors at the receiving end.◀

→TABLE A←

DATA SET 208B-TYPE SWITCH POSITIONS AND LAMP STATUS

SWITCH OR LAMP	NORMAL OPR	ANALOG LOOP-BACK SELF TEST	END-TO-END SELF TEST		REMOTE TEST	LAMP TEST	ANALOG LOOP-BACK TEST	END-TO-END START-UP TEST	
			XMT END	RCV END				RCV END	XMT END
LP Switch (Nonlock)*		Note 1	Note 1			X			
AL Switch*		X					X		
ST Switch*		X	X	X				X	X
RO Switch*				X				X	
RT Switch*					X				
ON Lamp	ON	ON	ON	ON	ON	ON	ON	ON	ON
TR Lamp	Note 2	Note 2	Note 3	Note 3	Note 3	ON	Note 2	Note 3	Note 3
MR Lamp	Note 4	OFF	Note 13	Note 13	Note 13	ON	Note 5	Note 13	Note 13
RS Lamp	Note 6	ON	ON	OFF	Note 7	ON	Note 6	OFF	ON
CS Lamp	Note 8	ON	ON	OFF	Note 8	ON	Note 8	OFF	ON
CO Lamp	Note 9	ON	OFF	ON	Note 9	ON	Note 9	ON	OFF
ER Lamp	Note 10	Note 11	ON	Note 11	Note 12	ON	Note 10	OFF	ON

* X = Switch Depressed; Blank = Switch Not Depressed.

Note 1: On DS 208B-L1B, LP switch is depressed to inject errors (steady space).

Note 2: Under control of customer interface (-L1 and -L1A only) -L1B — OFF.

Note 3: Under control of customer interface (-L1 and -L1A only) -L1B — ON.

Note 4: Monitors state of CC circuit. Lamp will be ON when CC-ON-in-AL-mode option is in set and the AL switch is depressed, or when set is in data mode.

Note 5: Monitors state of CC circuit. Lamp will be ON when CC-ON-in-AL-mode option is in set and the AL switch is depressed, or when set is in data mode (-L1 and -L1A only) -L1B — ON.

Note 6: ON when line signal is being transmitted.

Note 7: ON for approximately 2 seconds after CO lamp goes off.

Note 8: ON after completion of CA-CB interval (50 or 150 ms). Stays ON for completion of data transmission.

Note 9: ON when line signal is being received.

Note 10: ON when CO lamp is OFF. When CO lamp is ON, indicates state of adaptive equalizer. When both CO and ER lamps are ON, equalizer is retraining.

Note 11: OFF except when errors occur.

Note 12: ON when CO lamp is OFF. When CO lamp is ON, ER lamp is OFF except when errors occur.

Note 13: On DS 208B-L1 and -L1A — OFF; on -L1B — ON.

B. Tests Using 914-Type DTS

2.07 In this series of tests, the 914-type DTS is used to provide a more thorough test of the data set. By using the 914-type DTS, the customer interface is checked and facilities are available to perform an actual error count.

Caution: Certain 914B DTSs are susceptible to power line transients which may cause the fuse in the 5-volt power supply of the DTS to fail. To avoid this problem, do not unplug the data set while power is applied to the 914B. If the fuse in the 5-volt supply fails, the counter

will count continuously and will refuse to reset.

C. Remote Test From DTC

2.08 The RT switch is the only switch depressed. The remaining operations are performed by the DTC, which reports the results at the end of the test. ▶When testing of a DS 208B-L1B is completed, the DTC must send a minimum of 3 seconds of space signals for automatic disconnect, whereas earlier DS 208Bs typically required only 1.0 second of space signals.◀

3. INSTALLATION TESTING

3.01 Before proceeding with tests, verify that the channel is installed and meets requirements specified in the section entitled Data Systems—DATA-PHONE® Service and Data Access Arrangements on Direct Distance Dialing Network—Test Requirements for Subscriber, Foreign Exchange, and Remote Exchange Lines (314-205-501) (DATA-PHONE Type III).

3.02 Refer to Fig. 1 for the sequence of tests to be performed.

4. MAINTENANCE TESTING

4.01 Maintenance testing involves troubleshooting to isolate trouble to either the local loop, station wiring, or data set. The maintenance testing procedure is outlined in Fig. 2. Once the trouble has been isolated to the data set, the repair test procedures in Fig. 3 (DS 208B-L1 and -L1A) ▶or Fig. 4 (DS 208B-L1B)◀ should be used to isolate the trouble within the data set to a circuit pack (CP). It is assumed that the maintenance procedures outlined in Section 592-030-300 have been followed prior to dispatching the telco employee.

4.02 The overall repair test sequence is shown on the flowchart in Fig. 3 ▶and 4.◀ The test sequence is made up of six basic parts.

A. Power Supply Test

B. Automatic Answer Circuit Test

C. CA-CB Interval Test

D. Transmit Level Test

E. CA-CF Interval Test

F. Analog Loop-Back Test.

The End-to-End Test, Remote Start-up Test, Analog Loop Start-up Test, End-to-End Start-up Test, and Ground Noise Test are supplementary tests and are not specified in Fig. 3 ▶and 4.◀ These tests should be done as required.

4.03 When any test shown in Fig. 3 ▶or 4◀ (except the power supply) fails, a list of CPs associated with that particular test is given. The first CP in the list should be replaced with one that is known to be good, and the test repeated. If the data set still fails the test, the original card should be returned to the set and the next CP replaced. This procedure should be continued until a defective CP is located or the list of CPs is exhausted.

4.04 Following the repair procedure should quickly isolate the trouble to a CP or group of CPs. It is evident that in all the tests, one of the CP replacements recommended is HG19 (208B-L1), HG24 (208B-L1A) ▶or HG25 (208B-L1B).◀ This is the interface CP and the majority of data and control signals appear on this CP. If HG19, HG24, ▶or HG25◀ (or any other CP) has been replaced earlier in the test and further on it is a recommended replacement again, omit that replacement and proceed to the next CP in the CP replacement list in Fig. 3 or 4.

When CP HG19, HG24, ▶or HG25◀ is replaced, install correct options before proceeding with test. Refer to Sections 592-030-200 and 592-030-300 for option information and procedures for converting DS 208B-L1 to data set 208B-L1A. ▶DS 208B-L1A cannot be converted to a DS 208B-L1B because of backplane differences.◀

4.05 If a defective CP is located, it should be disposed of as outlined in Part 1 of Section 592-030-300. After the data set has been repaired and tested, verify to the customer that service is satisfactory by allowing the customer to make a data call.

4.06 In the unusual instance when the data set is obviously malfunctioning but CP replacements

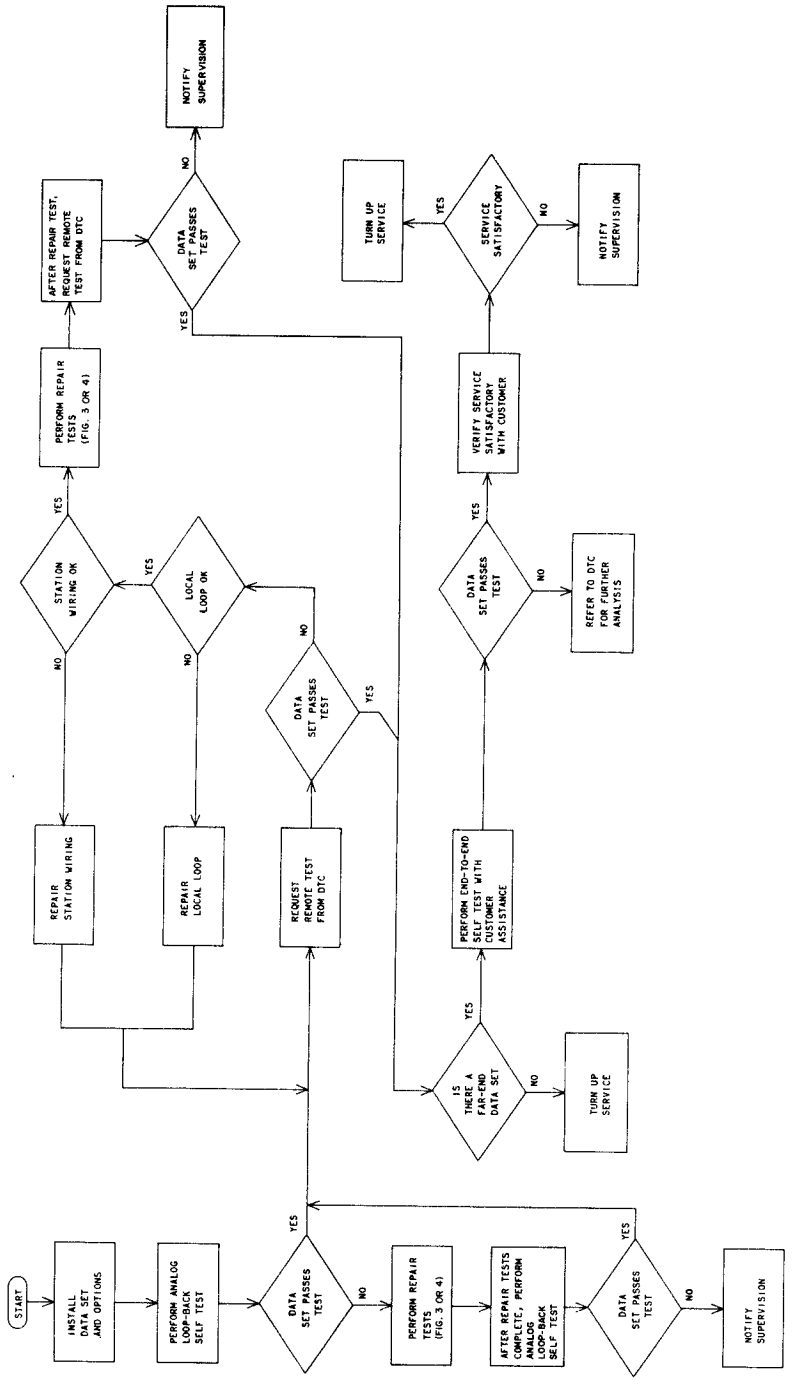


Fig. 1—Installation Test Procedures

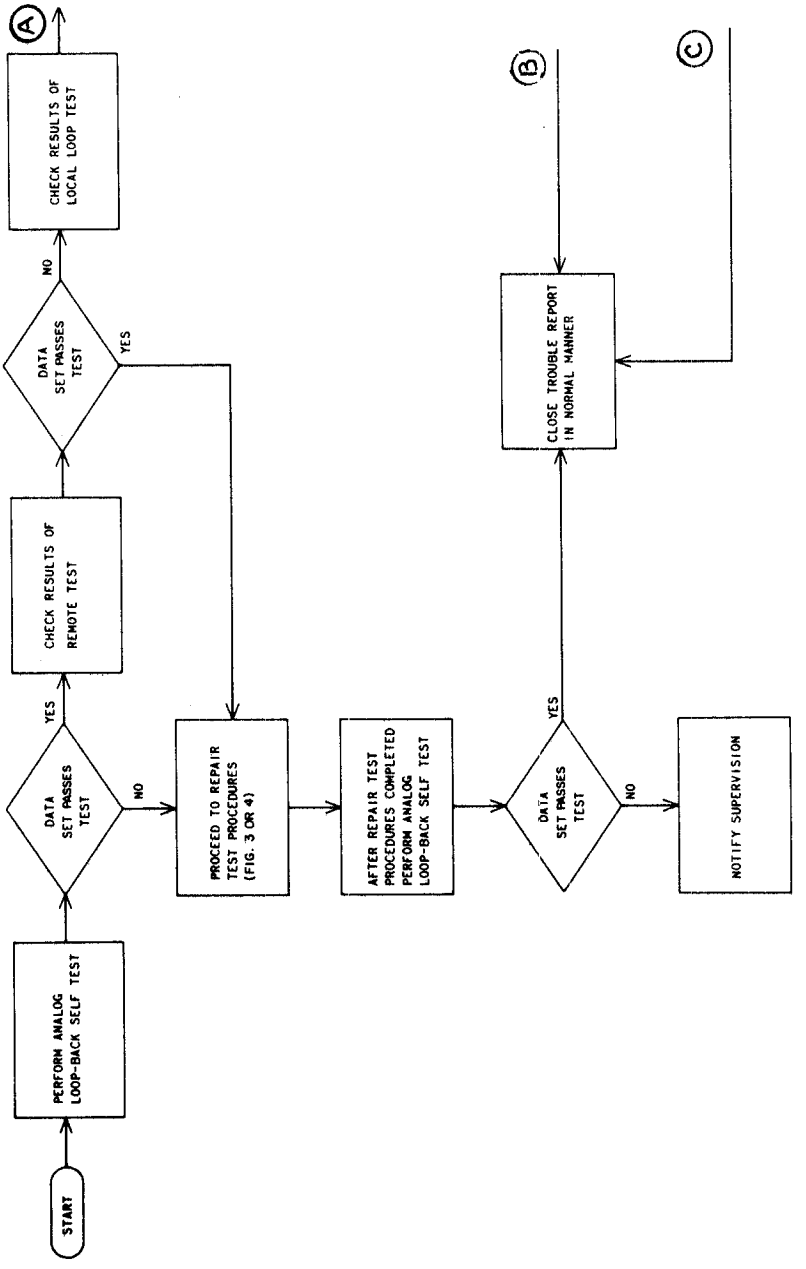


Fig. 2—Maintenance Test Procedures (Sheet 1 of 2)

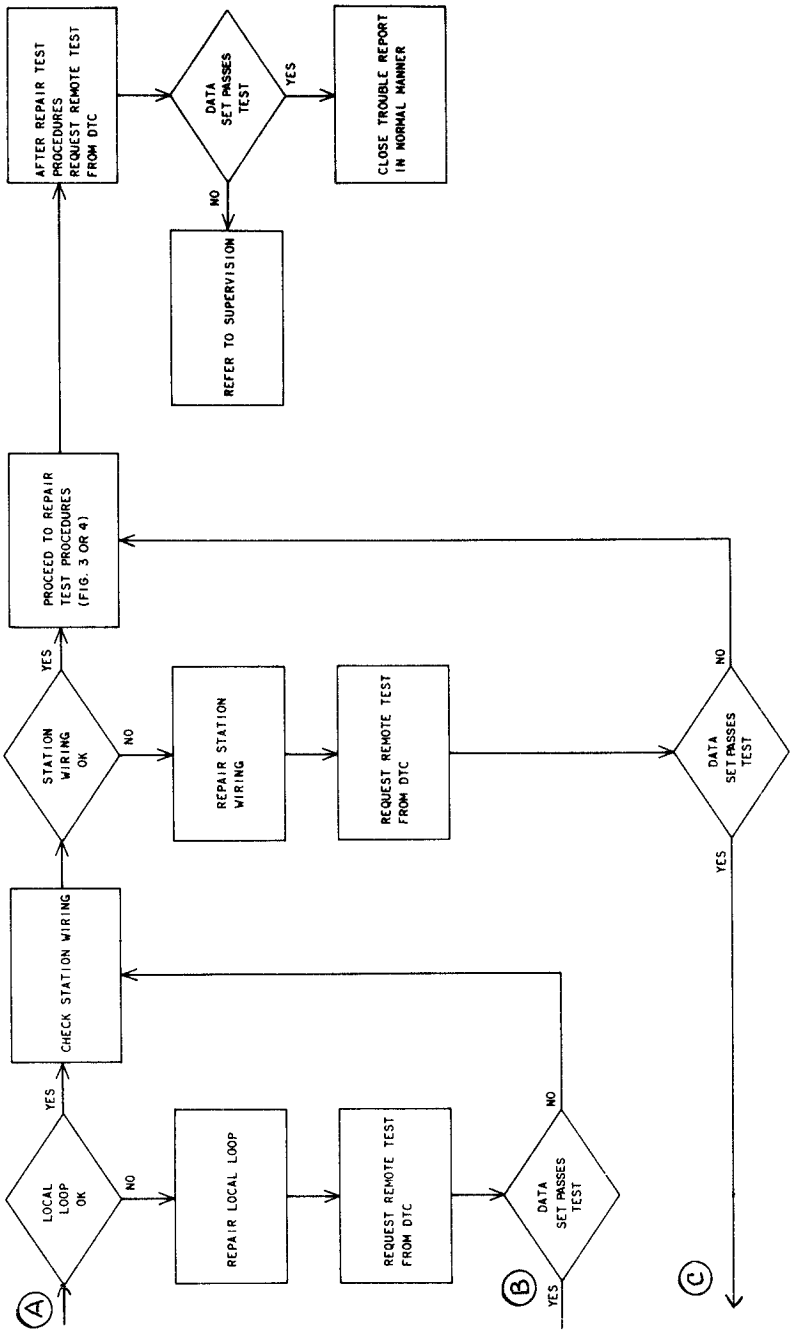


Fig. 2—Maintenance Test Procedures (Sheet 2 of 2)

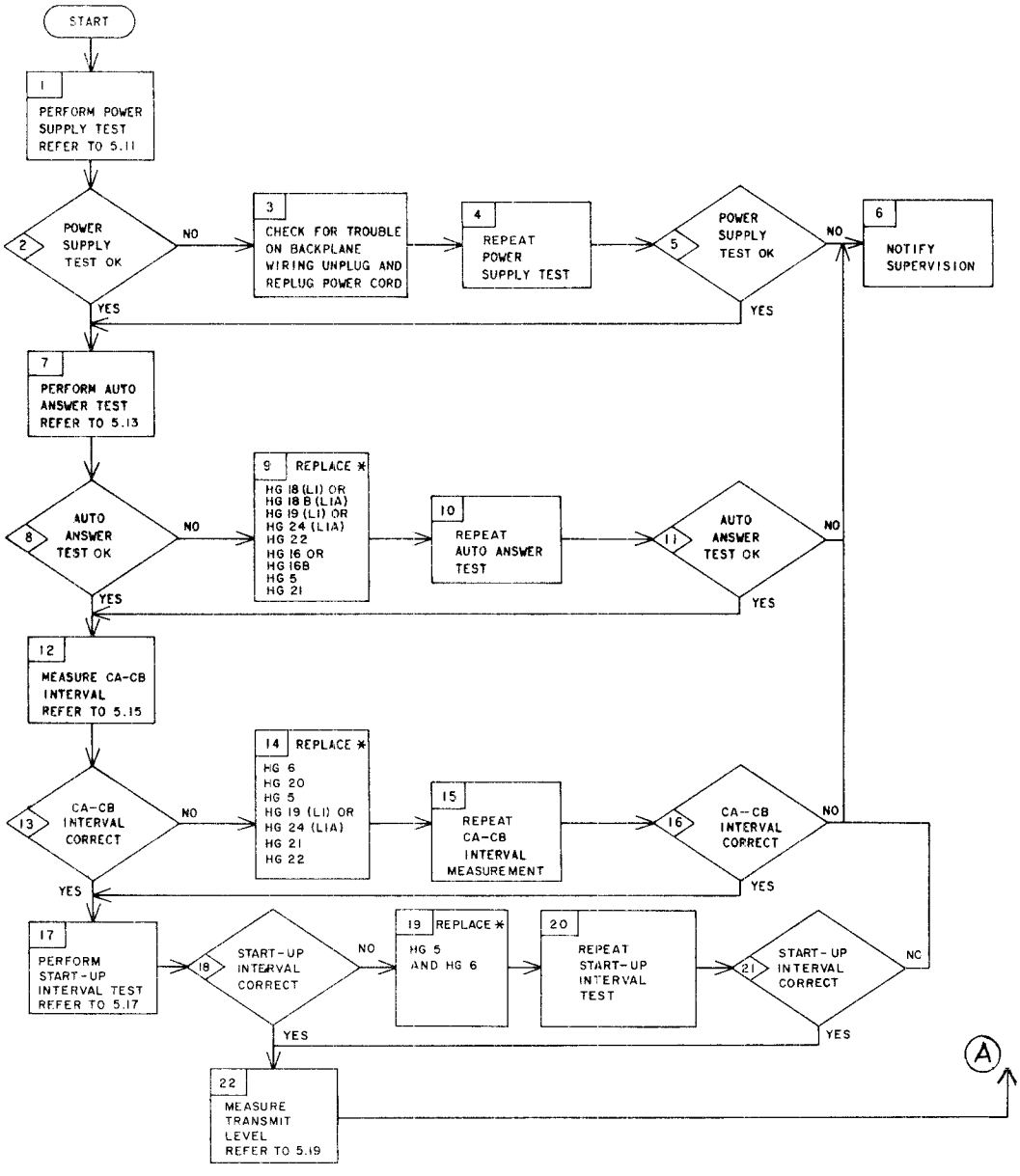


Fig. 3—Repair Procedures for DS 208B-L1 and DS 208B-L1A (Sheet 1 of 2)

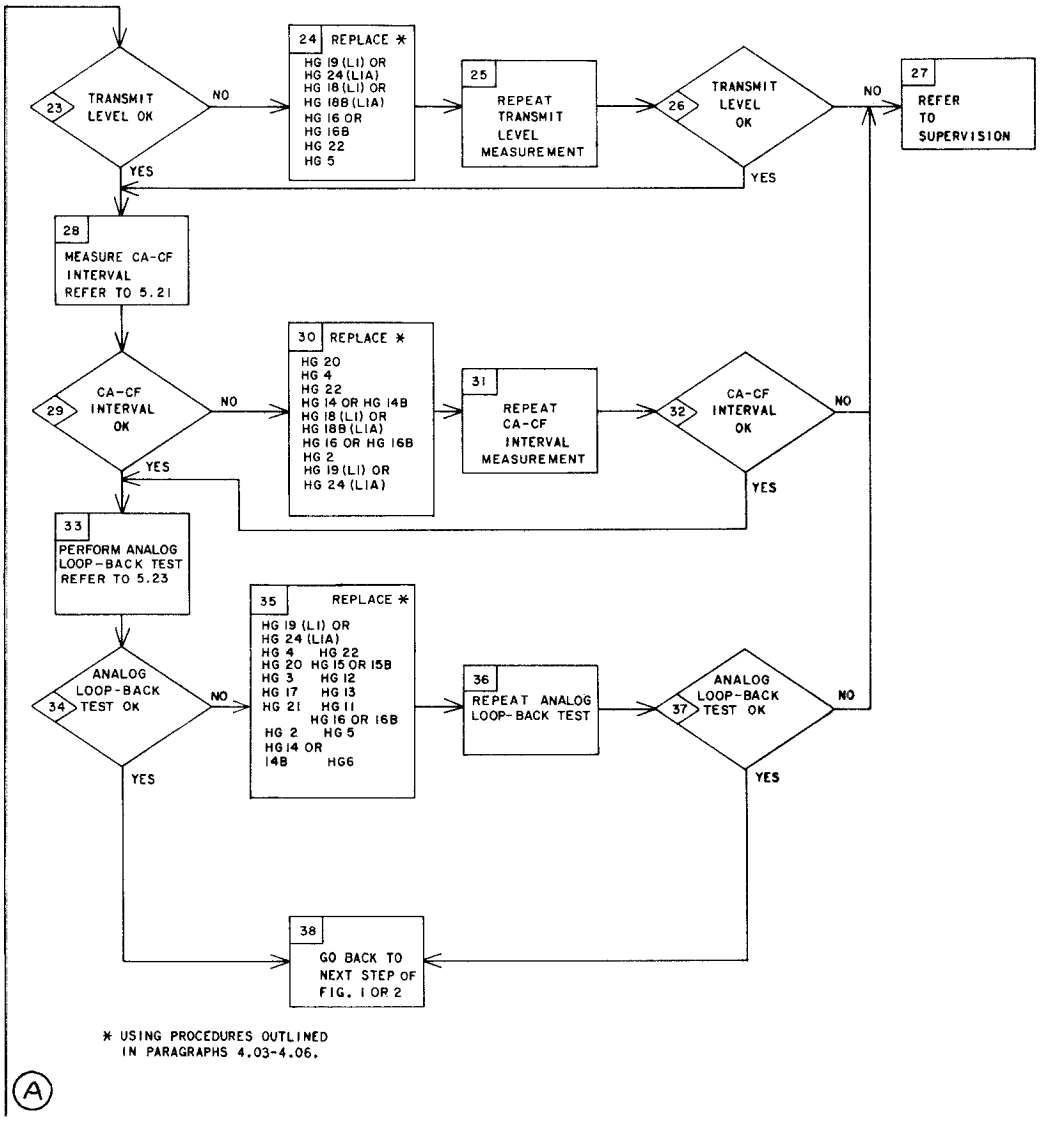


Fig. 3—Repair Procedures for DS 208B-L1 and DS 208B-L1A (Sheet 2 of 2)

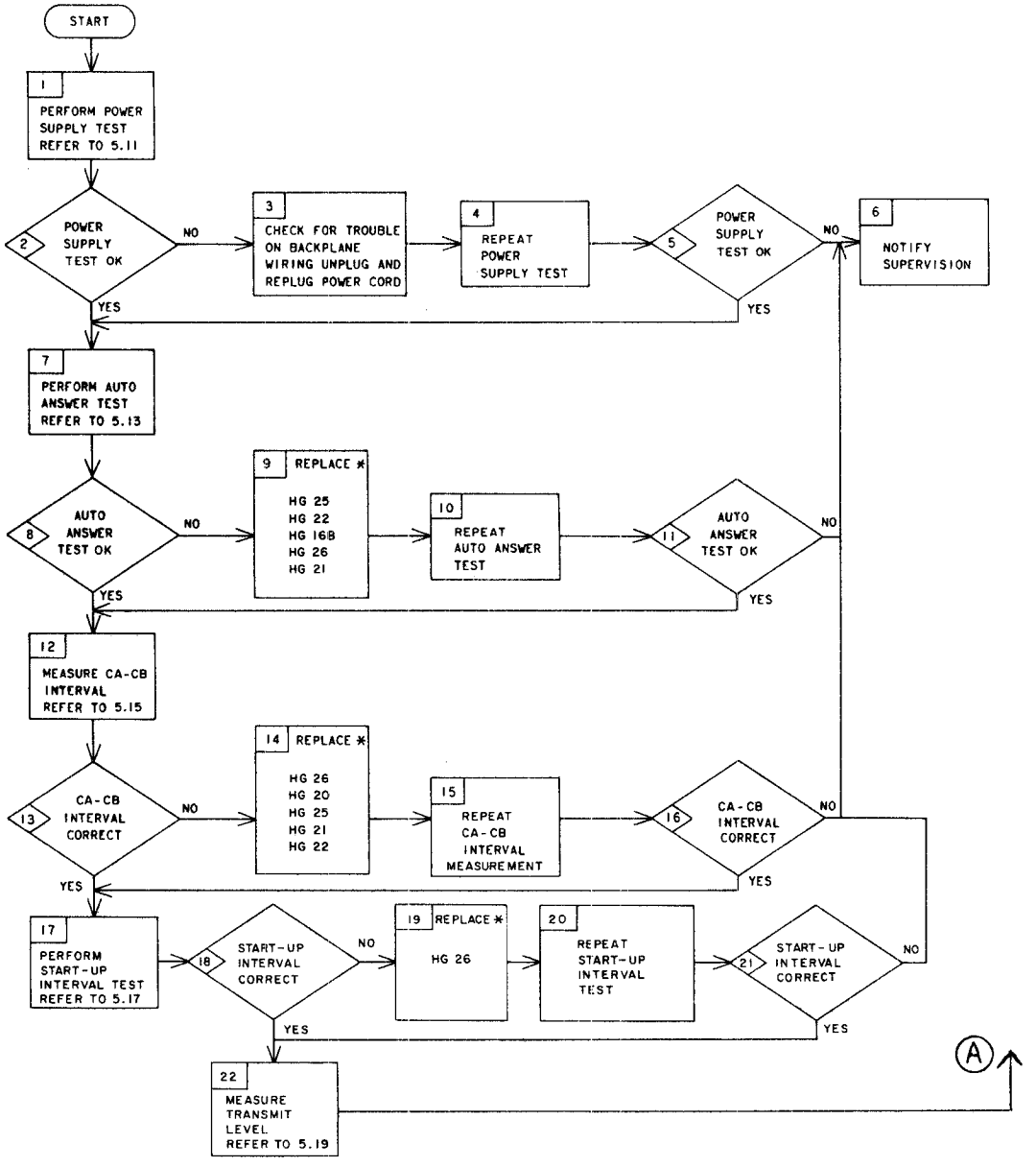


Fig. 4—Repair Procedures for DS 208B-1.1B (Sheet 1 of 2)

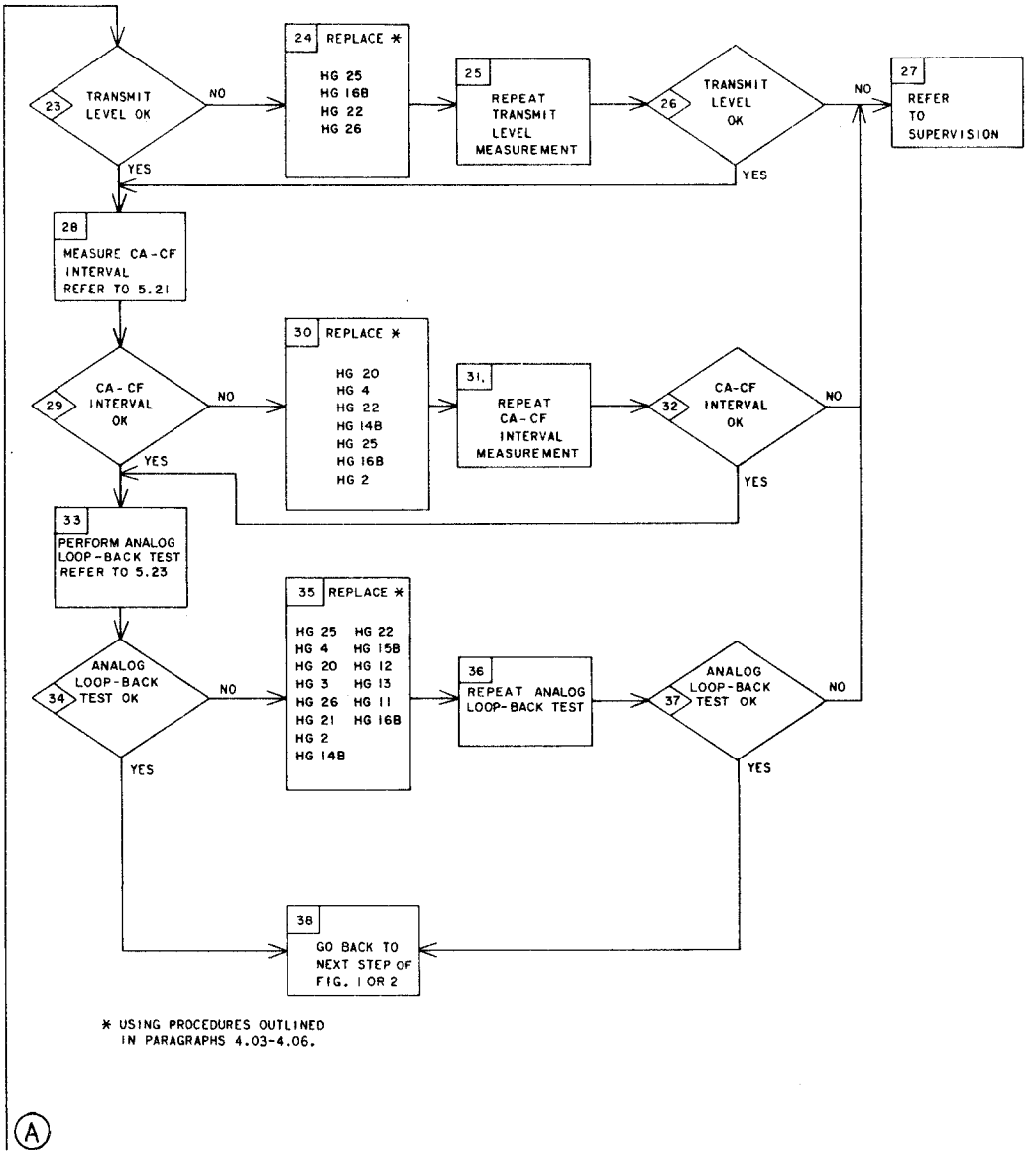


Fig. 4—Repair Procedures for DS 208B-L1B (Sheet 2 of 2)

do not clear the cause of trouble, it is recommended that the problem be referred to supervision, according to local instructions.

5. TEST PROCEDURES

5.01 This part provides a description of the various test procedures and a step-by-step procedure for performing the tests.

5.02 If a procedure requires that an option be installed in the set which is not specified on the service order or circuit layout card, remove the option at the end of the test, and verify that all specified options are installed in the set.

A. Analog Loop-Back Self Test

5.03 The analog loop-back self test provides a test of the data set without the use of external test equipment.

5.04 Perform the following procedure.

(1) Apply power to the data set.

(2) Depress LP switch.

Requirement: All lamps are lighted.

(3) Depress AL switch first, then depress ST switch.

Requirement: ON, RS, CS, and CO lamps are lighted. ER and MR lamps are extinguished. On DS 208B-L1 and -L1A, the TR lamp may be lighted or extinguished depending on the state of the CD lead from the customer. The TR lamp is extinguished on -L1B sets.

Note: ▶The ER lamp must extinguish immediately after the CO lamp lights. If there is a delay, the data set is defective.◀ If the ER lamp is lighted or blinks, the data set has failed the analog loop-back self test. ▶A blinking ER lamp which alternates with the CS lamp may indicate that CP HG19 is not the current series (series 8 or later).◀

(4) ▶**Depress LP switch (DS 208B-L1B only).**

Requirement: ER lamp lights. TR and MR lamps remain ***off*** when LP switch is depressed. The TR lamp depends on the state of the CD lead and may be ***on*** or ***off.***◀

(5) End of test. Depress to release AL and ST switches to restore set to its normal operating condition.

B. Remote Test From DTC

5.05 The remote test from the DTC checks data set performance, station wiring, and the local loop. No external test equipment is required for this test except a telco DTC.

5.06 Perform the following procedure.

(1) Call the nearest DTC and request that a remote test of the data set be conducted.

(2) After agreeing with the DTC to perform the test, depress RT switch, depress the "50" switch (if not already depressed), and hang up.

Requirement: ▶The TR lamp is under control of the customer in -L1 and -L1A sets but is ***on*** in -L1B sets. MR lamp is extinguished in all sets.◀

(3) The DTC will place a call to the set. The set will answer automatically and enter data mode. The DTC will then perform the test and cause the set to terminate the call ▶by sending a 1-second space level (DS 208B-L1 or -L1A) or a 3-second space level (DS 208B-L1B).◀

(4) The DTC will place a second call to the data station to report results of the test. Answer the second call and receive the test results.

(5) After receiving test results from the DTC, release RT and "50" switches (if necessary) and hang up to return data set to its normal operating condition.

C. ▶End-to-End Start-up Self Test◀

5.07 ▶This test checks the start-up performance with the 4-dB and 8-dB slope compromise equalizers.

5.08 To perform the end-to-end start-up test perform the following procedure.

(1) Call a distant data set and arrange for the test. ▶(The distant data set should be one the customer will normally call or receive calls from.)◀

(2) Request that the ST switch be depressed on the distant end data set, and that the data set be transferred to data mode.

Requirement: The ON, RS, CS, and ER lamps on the distant data set are illuminated. ▶On DS 208B-L1 and -L1A,◀ the MR and CO lamps are extinguished. The TR lamp may be illuminated or extinguished (depending on state of CD lead). ▶On DS 208B-L1B, the TR and MR lamps are illuminated.◀

(3) Depress ST and RO switches on the local data set, then transfer to data mode by depressing the DATA button on the telephone set.

Requirement: The ON and CO lamps are illuminated. On DS 208B-L1 and -L1A, the RS, CS, MR, and ER lamps are extinguished. The TR lamp may be illuminated or extinguished (depending on state of CD lead). ▶On DS 208B-L1B, the TR and MR lamps are illuminated.◀ The ER lamp will flash each time an error is detected.

(4) Install the 4-dB slope compromise equalizer (option WU). Request the distant operator to depress and release RO at 5-second intervals for 1 minute.

Requirement: Observe that the local CO lamp illuminates at the same time the ER lamp is extinguished, without flickering.

(5) If the ER lamp flickers more than twice during the start-up interval [step (4)], install the 8-dB slope compromise equalizer (option ZS) and repeat step (4).

(6) If one slope produces substantially less flicker of the ER lamp than the other slope, use the slope compromise equalizer producing the least flicker. Unless the 8-dB slope compromise equalizer produces ***significantly*** less flicker of the ER lamp, use the 4-dB slope compromise equalizer (option WU).

(7) End of test. Return data sets to normal by having the distant end operator release the ST switch, and release the ST and RO switches on the local data set.◀

D. End-to-End Self Test

5.09 This test checks the operation of both far-end and a near-end data set and the telephone channel.

5.10 Perform the following procedure.

(1) Call the far-end data set and arrange to perform the end-to-end self test.

(2) Request that the ST switch be depressed on the far-end data set, and that the far-end data set be transferred to data mode by depressing the DATA button on the telephone set.

Requirement: The ON, RS, CS, and ER lamps on the far-end data set are illuminated. On DS 208B-L1 and -L1A, the MR and CO lamps are extinguished; the TR lamp may be illuminated or extinguished (depending on state of CD lead from customer). ▶On DS 208B-L1B, the TR and MR lamps are illuminated.◀

(3) Depress ST and RO switches on near-end data set, and then transfer to data mode by depressing the DATA button on the telephone set.

Requirement: The ON and CO lamps are illuminated. The RS, CS, MR, and ER lamps are extinguished. On DS 208B-L1 and -L1A, the TR lamp may be illuminated or extinguished (depending on the state of the CD lead from the customer). ▶On DS 208B-L1B, the TR and MR lamps are illuminated.◀

(4) Conduct at least a 5-minute error run.

Requirement: The ER lamp ▶on the near-end data set◀ remains extinguished and does not blink more than an average of three times in any 1-minute period.

(5) ▶At a prearranged time, the attendant at the ***far-end*** data set should depress the LP switch (DS 208B-L1B only) after the 5-minute error run.

Requirement: ER lamp lights on near-end data set. TR and MR lamps remain ***off*** at the far-end data set when LP switch is depressed.

(6) After a prearranged time, return to talk mode to discuss results of test. If the test failed for any reason, terminate the call, place a second call to involve a different connecting path, and repeat the test.

(7) To repeat the test in the opposite direction, have the RO button depressed on the far-end set, release the RO button on the near-end data set, and return both data sets to data mode.

Requirement: The near-end data set meets the requirements of step (2) and the far-end data set meets the requirements of steps (3), (4), and (5).

(8) End of test. Return data sets to their normal operating condition by releasing the ST buttons and the RO button at the end where it had been depressed.

E. Power Supply Test

5.11 The power supply test checks that ac voltage appears at the power supply input and then measures the +12, +5 and -12 volt supply voltages at the customer interface. The only test equipment required is a 914-type DTS and a volt-ohm-milliammeter (VOM).

5.12 Perform the following procedure.

(1) Connect the data set to the 914-type DTS as shown in Fig. 5. The only programming pins required in the matrix are at crosspoints GRD-1 and GRD-7.

(2) Apply power to the data set and then to 914-type DTS.

Requirement: The data set ON lamp lights.

(3) If the ON lamp fails to light or lights momentarily and goes out, check the ac source voltage with a VOM.

Requirement: 105 to 129 volts RMS

(4) Move the FUNCTION switch to VOLT INT and POLARITY to NORM. Measure the voltage on terminal 9 of customer interface.

Requirement: 11 to 13 volts

(5) Move the FUNCTION switch to OFF and move the VERTICAL MONITOR switch to 25.

(6) Move the FUNCTION switch to VOLT INT and measure the voltage on terminal 25 of customer interface.

Requirement: 4 to 6 volts

(7) Move the FUNCTION switch to OFF, move the VERTICAL MONITOR switch to 10, and move the POLARITY switch to REV.

(8) Move the FUNCTION switch to VOLT INT and measure the voltage on terminal 10 of customer interface.

Requirement: 11 to 13 volts

(9) Move the FUNCTION switch to OFF.

(10) End of test. Remove test equipment and return to pretest condition.

F. Automatic Answer Test

5.13 The automatic answer test checks the ability of the data set to answer and terminate calls properly. The CC, CD, and CE leads are checked along with an audio verification that the answer tone and 600-Hz tone are generated. The only test equipment required for this test is a 914-type DTS.

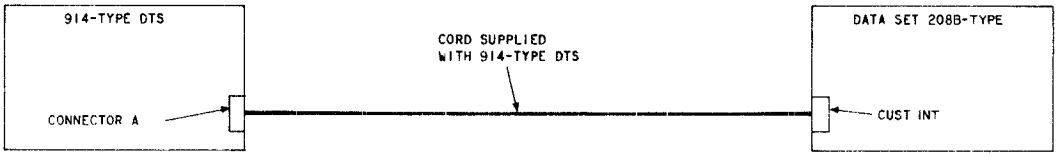
5.14 Perform the following procedure.

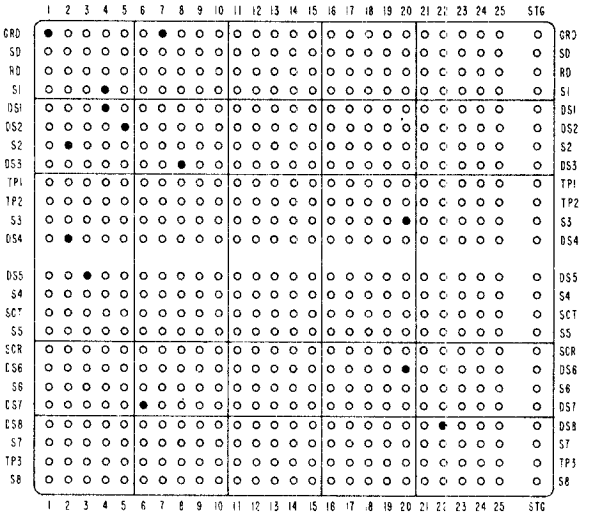
(1) Remove the front cover of the data set. Verify that the following options are installed:

- Compromise Equalizer IN:

  DS 208B-L1—(S2C UP)

  DS 208B-L1A and -L1B —(S2B UP and S2C UP)





SWITCH	SETTING
INTERFACE SELECTOR A SWITCHES	DEPRESSED
INTERFACE MODE	VOLTAGE
VERTICAL MONITOR	9
TEST SET MODE	SER(914C) RCV SER(914B)
COUNTER	INTERVAL XI
FUNCTION	OFF
RANGE	30 DCV
BIT RATE	EXT +
METER POLARITY	NOR
TPI TRIGGER	+/OPEN
TP2 TRIGGER	+/OPEN
SI (RS)	OFF
S2 (SD)	OFF
S3 (DTR)	OFF

INDICATOR LIGHTS	
DSI	RS
DS2	CS
DS3	COD
DS4	SD
DS5	RD
DS6	DTR
DS7	DSR
DS8	RI

Fig. 5—Repair Test Setup

- DSR OFF in Analog Loop-Back Mode (S3A DOWN)
- Manual Answer (S3B UP)
- Transmitter Internally Timed (S3C DOWN)
- -3 dBm Transmit Level (S1A DOWN; S1B UP; S1C UP; S2A DOWN)

(2) Verify that all pushbutton switches located on the front of the data set except the "50" switch are in the OUT (normal) position. The

"50" switch may be IN or OUT depending on the option installed.

(3) Verify that the data set is connected to the associated telephone set and the telephone set is connected to a working telephone line.

(4) Connect the data set to the 914-type DTS and set the controls per Fig. 5. Apply power first to the data set then to the DTS.

(5) Depress the nonlocking lamp test (LP) switch.

Requirement: On the data set, the TR, MR, RS, CS, CO, and ER lamps light.

(6) From a nearby telephone, dial a call to the data station.

Requirement: On the 914-type DTS, DS8 (RI) and on the telephone set, the lamp under the line key associated with the data set under test lights during the ringing cycle (approximately 2 seconds) and then go off during the quiet period (approximately 4 seconds).

(7) On the 914-type DTS, move switch S3 (DTR) to ON. The data station telephone set will continue to ring. After two or three ring cycles, move switch S3 to OFF.

(8) On the data set, install the automatic answer option (S3B DOWN). The data station telephone set will continue to ring. At the end of a ringing cycle, move switch S3 (DTR) on the DTS to ON.

Requirement: On the 914-type DTS, the DS6 (DTR) lamp lights; on the data set, the TR lamp lights. On the DTS, the DS8 (RI) lamp lights during the next ring cycle and at the end of ringing extinguishes. During ringing and at the end of this ring cycle, the lamp under the line key associated with the data set lights. Approximately 2 seconds after end of ringing, a high-pitched tone is heard for approximately 2 seconds (2021-Hz answer tone). At the end of this tone, the DS7 (DSR) lamp on the DTS and the MR lamp on the data set light. A lower pitched tone (600-Hz idle tone) should now be heard.

The data set has now automatically answered the call and switched to data mode.

(9) On the 914-type DTS, set switch S1 (RS) to ON.

Requirement: The 600-Hz idle tone ceases and a data signal is now heard.

(10) Set S1 OFF.

Requirement: The data signal ceases and the 600-Hz tone is heard.

(11) On the 914 DTS, set S3 to OFF.

Requirement: The MR and TR lamps on the data set, the DS6 (DTR) and DS7 (DSR) lamps on the 914-type DTS, and the lamp under the line key on the data station telephone set extinguish, indicating the data set has terminated the call.

(12) End of test. Remove test equipment and return to pretest condition.

G. CA-CB Interval Test

5.15 The CA-CB interval test checks both the 50-ms and 150-ms request-to-send/clear-to-send (CA-CB) intervals. As part of the test the transmitter clocks, as well as certain interface signals, are checked. The only test equipment required for this test is a 914-type DTS and the 3300-ohm (yellow) pin or equivalent circuit as described in 1.04 and 1.05.

5.16 Perform the following procedure.

(1) Connect the data set to the 914-type DTS and set the controls as shown in Fig. 5. Set BIT RATE switch to 2000.

(2) Place yellow pin in matrix position S1-9 or 3300-ohm resistor as described in 1.05 across 9 and 4 on the interface selector switches on the 914-type DTS.

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

(4) Depress AL button on data set.

(5) On the DTS, add red pins to the programmable matrix in the following positions: 4-TP1, 5-TP2.

(6) If a 914C DTS is used, place TEST SET MODE to INTERVAL and START A ONLY—A or B switch to START A ONLY. If a 914B DTS is used, set TEST SET MODE switch to TRMT SER position.

(7) Verify that the "50" switch on the data set is depressed and the transmitter internally timed option (S3C DOWN) is installed.

(8) Verify that switch S1 (RS) is OFF.

(9) On the DTS, zero the counter by pressing the RESET button.

(10) Move switch S1 to ON and record the CA-CB interval on the counter.

Requirement: 45 to 52 ms.

(11) To remeasure the CA-CB interval, move switch S1 to OFF and press the RESET button. When S1 is moved to ON, the CA-CB interval will appear on the counter.

(12) On the data set, release the "50" switch. On the DTS, move switch S1 to OFF, move the counter switch to INTERVAL X10, and reset the counter.

(13) Move switch S1 to ON, and record the CA-CB interval on the counter.

Requirement: 14 to 18 on counter (corresponds to 140 to 180 ms).

(14) To remeasure the CA-CB interval, move switch S1 to OFF and press the RESET button. When S1 is moved to ON, the CA-CB interval will appear on the counter.

(15) Move S1 to OFF.

(16) End of test. Remove test equipment and return to pretest condition.

H. ▶Remote Start-up Interval Self Test (DS 208B-L1B Only)◀

5.17 ▶This procedure tests a ***remote*** data set by making use of the ST and RO switches on a near-end data set to send blocks of data to a far-end data set, which is in remote test mode. Start-up errors made at the far-end data set will cause SPACE signals to be returned to the local data set. A MARK (no errors) will cause the near-end ER lamp to remain extinguished; a SPACE (one or more errors) will cause the near-end ER lamp to illuminate. If the ER lamp illuminates as a result of one operation of the RO switch, it is counted as one error.

5.18 Perform the following procedures:

(1) Have the far-end data set placed in RT mode.

(2) Depress ST and RO switches on local data set.

(3) Call the far end, check for auto answer, then go to DATA mode.

(4) Release RO (RS = ***on***) for at least 2 seconds to send blocks of data to the far end. The data set under test (far-end) samples RD for 1.25 seconds (6000 bits), beginning on a positive transition of COD.

(5) Depress RO (RS = ***off***) to receive 2-second MARK (no errors) or SPACE (one or more errors) from the far end. (MARK = ER lamp extinguished when CO lamp is lighted; SPACE = ER lamp lighted when CO lamp is lighted.)

(6) Repeat steps (4) and (5) a minimum of 19 times, (ie, 20 blocks of data).

Requirement: No more than 1 error in 20 blocks.

(7) If more than 1 block in 20 is reported in error at the far end, the test should be extended to 100 times, or a more specific test such as subpart M should be used.

Requirement: No more than 6 errors in 100 blocks.

(8) If testing from a DS 208B-L1B (near-end), quickly depress and release the LP switch within 1.25 seconds after RO is released. This should force an error and cause a SPACE to be returned. Since LP ***in*** and RO ***out*** cause a steady space to be transmitted, the LP switch should not be depressed for more than 2 seconds after RO is released, or the far end will go on-hook and auto answer will be inhibited.

Note: This step cannot be performed when the near-end data set is a DS 208B-L1 or -L1A.◀

I. Transmit Level Test

5.19 The transmit level test measures the 2021-Hz answer tone signal, the data transmit level, and the 600-Hz idle tone. These levels are measured at two different settings of the transmitter level adjust pad. The only test equipment required is a 914-type DTS.

5.20 Perform the following procedure.

(1) Remove the front cover of the data set and install the following options:

- Compromise Equalizer IN:

  DS 208B-L1—(S2C UP)

  DS 208B-L1A ▶and -L1B◀ —See Table B

- CC OFF in Analog Loop Mode (S3A DOWN)
- Manual Answer (S3B UP)
- Transmitter Internally Timed (S3C DOWN)
- -3 dBm Transmit Level (S1A DOWN; S1B UP; S1C UP; S2A DOWN).

(2) Verify that the data set is connected to the associated telephone set and the telephone set is connected to the telephone line.

(3) Verify that all switches on the data set except the "50" switch are in the OUT (normal) position. The "50" switch may be IN or OUT, depending on the option installed.

(4) Connect the data set to the 914-type DTS and set the controls as shown in Fig. 5.

(5) Apply power to the data set and then to the DTS.

(6) On the 914-type DTS, move switch S3 (DTR) to ON.

(7) From a nearby telephone, dial the data station. When the data station telephone set rings, answer it and go into data mode by depressing the nonlocking DATA button on the telephone set.

(8) On the DTS, set the RANGE switch to 0 DB, and set the FUNCTION switch to VOLT/OHM EXT.

→TABLE B←

DATA SET 208B-TYPE TRANSMIT LEVEL METER INDICATIONS
(ALL READINGS IN dBm WITH RESPECT TO 900 Ω)*

DATA SET	COMP EQUAL OPTION	ANSWER TONE 1	DATA 1	600 Hz 1†	ANSWER TONE 2	DATA 2	600 Hz 2†
208B-L1	IN (S2C-UP)	−1.2 (±2 dB)	−1.2 (±2 dB)	−8.2 (±2 dB)	−5.2 (±2 dB)	−5.2 (±2 dB)	−12.2 (±2 dB)
208B-L1A 208B-L1B	8-dB SLOPE (S2B-DOWN; S2C-UP)	−1.2 (±2 dB)	−1.2 (±2 dB)	−10.2 (±2 dB)	−5.2 (±2 dB)	−5.2 (±2 dB)	−14.2 (±2 dB)
208B-L1A 208B-L1B	4-dB SLOPE (S2B-UP; S2C-UP)	−1.2 (±2 dB)	−1.2 (±2 dB)	−8.2 (±2 dB)	−5.2 (±2 dB)	−5.2 (±2 dB)	−12.2 (±2 dB)

* Note that data levels and answer tone levels are independent of compromise equalizer options; whereas, 600-Hz levels are about 7 dB lower than data levels. Refer to Section 592-030-100 for information on compromise equalizer options.

† Meter RANGE switch may have to be changed to make these readings. In any case, these figures are relative to 0 dBm.

(9) Connect the meter INPUT terminals of the 914-type DTS across the telephone line tip and ring leads at the connecting block.

(10) If a 914C DTS is used, set TERM IN—OUT switch to OUT.

(11) At the data station telephone set, remove the handset from the cradle. Enter talk mode by depressing TALK button. Now depress DATA button.

Requirement: As the data set goes through the answer sequence, the answer tone (2021 Hz) is generated for approximately 2 seconds. During these 2 seconds, the meter on the 914-type DTS indicates the value given in ANSWER TONE 1 column of Table B for each of the compromise equalizer options.

The previous step should be repeated until an accurate reading can be recorded.

(12) On the 914-type DTS, move switch S1 (RS) to ON.

Requirement: The meter indicates the value given in DATA 1 column of Table B for each of the compromise equalizer options.

(13) Move switch S1 to OFF.

Requirement: The meter indicates the value given in the 600 Hz 1 column of Table B for each of the compromise equalizer options.

(14) On the data set, install the -7 dBm transmit level option (S1A DOWN; S1B DOWN; S1C UP; S2A DOWN).

(15) At the data station telephone set, remove handset from cradle and enter talk mode by depressing TALK button. Now depress DATA button.

Requirement: As the data set goes through the answer sequence, the answer tone (2021 Hz) is generated for approximately 2 seconds. During these 2 seconds, the meter on the DTS indicates the value given in ANSWER TONE 2 column of Table B for each compromise equalizer option.

(16) The previous step should be repeated until an accurate reading can be recorded.

(17) Move switch S1 to ON.

Requirement: The meter indicates the value given in DATA 2 column of Table B for each compromise equalizer option.

(18) Move switch S1 to OFF. Move RANGE SWITCH to -10 dB if necessary (see Table B).

Requirement: The meter indicates the value given in the 600 Hz 2 column of Table B for each compromise equalizer option.

(19) Terminate the call by moving switch S3 (DTR) on DTS to OFF. Move FUNCTION switch to OFF. Disconnect meter INPUT terminals from the telephone line.

(20) End of test. Return all equipment to pretest condition.

J. CA-CF Interval Test

5.21 The CA-CF interval test measures the length of time it takes for CF to turn on after a request-to-send signal is given. The test also checks that the received line signal propagates through the receiver analog circuitry and checks receiver clocks and certain interface signals. The only test equipment required is a 914-type DTS and the 3300-ohm (yellow) pin or equivalent circuit as described in 1.04 and 1.05.

5.22 Perform the following procedure.

(1) Connect data set to 914-type DTS as shown in Fig. 5. Set BIT RATE switch to 2000.

(2) Depress AL button on data set.

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

(4) Insert red programming pins into matrix at TP1-4 and TP2-8.

(5) Insert yellow resistor pin into matrix at S1-9 or 3300-ohm resistor as described in 1.05 across 9 and 4 of the interface selector switches.

(6) If 914C DTS is used, set TEST SET MODE to INTERVAL, and START A ONLY—A or B switch to START A ONLY. If 914B is used, set TEST SET MODE switch to TRMT SER.

(7) Move switch S1 (RS) to OFF and reset the counter to 0.

(8) Move switch S1 to ON and read the CA-CF interval on the counter.

Requirement: 46.0 to 56.0 ms

(9) To remeasure CA-CF interval, move S1 to OFF and reset counter. When S1 is set to ON, the CA-CF interval will appear on the counter.

(10) End of test. Return all equipment to pretest condition.

K. Analog Loop-Back Test Using a Pseudo-Random Word

5.23 The analog loop-back test checks that random data can be transmitted through the data set without errors. The received signal is compared with the transmitted signal and any errors are recorded by the 914-type DTS. The test equipment required for this test is a 914C DTS or a 903-type DTS and a 914B DTS. When using the 903-914B DTS combination, a 63-bit word is used. When using a 914C DTS, a 511-bit word is used.

5.24 Perform the following procedure.

(1) Connect equipment as shown in Fig. 6.

(2) Depress AL button on data set.

(3) Apply power to data set and then to the DTSs.

(4) On 914-type DTS, move S1 (RS) to ON and reset counter by depressing RESET button. If a 903-type DTS is used, momentarily depress START button.

Requirement: On the 914-type DTS, the DS1 (RS), DS2 (CS), and DS3 (COD) lamps are lighted. Lamps DS4 (SD) and DS5 (RD) are dimly lighted. The counter is not counting.

(5) To verify that the equipment is connected properly and that the counter is functioning, remove programming pin from crosspoint RD-3.

Requirement: On the 914-type DTS, the error counter counts rapidly and shortly afterward the NO DATA and OVERFLOW lamps light.

(6) Reinsert programming pin into crosspoint RD-3 and reset counter.

Requirement: On the 914-type DTS, the error counter stops counting and the NO DATA and OVERFLOW lamps extinguish.

(7) Conduct a 10-minute error run and record number of errors.

Requirement: No errors recorded.

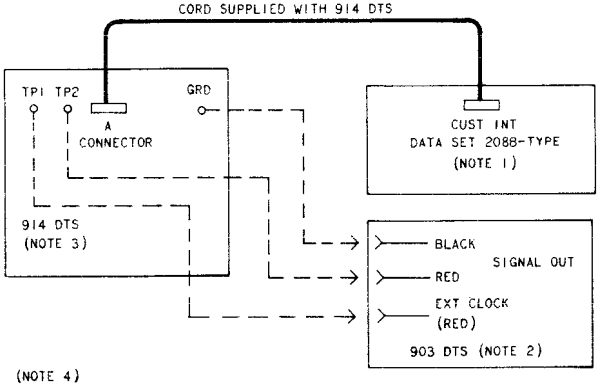
(8) End of test. Return all equipment to normal operating condition.

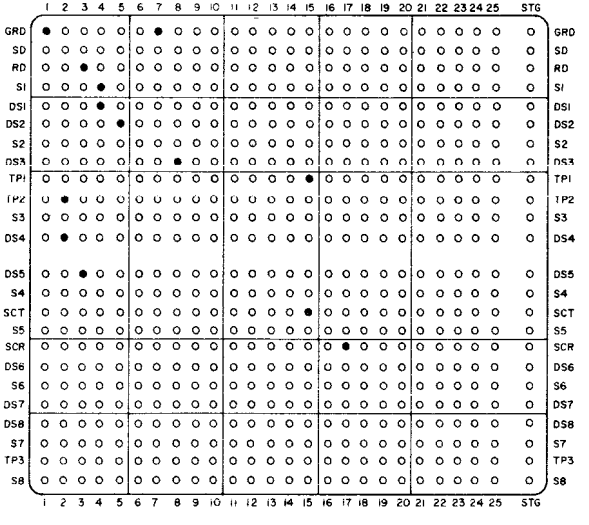
L. End-to-End Test Using a Pseudo-Random Word

5.25 The end-to-end test should be made only when it is necessary to identify facility troubles which the data set has been occasionally experiencing over a period of time. The test is made using two data stations remote from each other or a DTC and a station. The test consists of transmitting random data (63-bit or 511-bit words formed into 1000-bit blocks) and establishing a block error rate. If the 511-bit word is available, it should be used, as it provides a more critical test. Two 914-type DTSs, one at the transmitting end and one at the receiving end, are required.

5.26 Perform the following procedure.

STEP	TRANSMIT	RECEIVE
1	Establish test connections and set switches as shown in Fig. 6. ***Note:*** Information regarding the setup for the 903-type DTS may be disregarded.	Establish test connections and set switches as shown in Fig. 6.





NOTES:

1. VERIFY THE FOLLOWING OPTIONS ARE INSTALLED:

OPTION	SETTING
TRANSMITTER INTERNALLY TIMED	S3C DOWN
CC OFF IN AL MODE	S3A DOWN
COMPROMISE EQUALIZER IN	S2C UP (208B-L1) S2B UP (208B-L1A OR -L1B) S2C UP

2. IF 903 AND 914B DTS ARE USED, CONNECT 903 AS SHOWN AND SET THE FOLLOWING 903 CONTROLS.

CONTROL	SETTING
BIT RATE	EXT CLOCK
TRIGGER	(-) NEGATIVE
RANDOM-DOT	RANDOM

3. SET SWITCHES ON 914 DTS AS FOLLOWS:

SWITCH	SETTING
INTERFACE SELECTOR	ALL DEPRESSED
INTERFACE MODE	VOLTAGE
TEST SET MODE	SER (914C) RCV SER (914B)
BIT RATE(S)	EXT +
COUNTER	16WL (63 BIT WORD) 2WL (511 BIT WORD)
FUNCTION	OFF
SIGNAL LEVEL	±4V
SAMPLE WIDTH	0.5μF
WORD SYNC	AUTO
S1-S8	OFF
WORD LENGTH(S)	63 OR 511

4. IF 914C IS USED REMOVE PINS FROM TP1-15 AND TP2-2. INSERT PIN IN SD-2.

Fig. 6—Analog Loop-Back and End-to-End Test Setup

STEP	TRANSMIT	RECEIVE
	Note: Information regarding the setup for the 903-type DTS may be disregarded.	
2	Remove programming pins from TP1-15, TP2-2, and RD-3.	Remove programming pins from TP1-15 and TP2-2.
3	Insert programming pin at SD-2, S3-20, and DS6-20.	Insert programming pin at S3-20 and DS6-20.
4	Set TEST SET MODE to SER (914C) or TRMT SER (914B).	Set COUNTER switch to BLOCK ERRORS 16 WL, (63-bit word) or 2 WL (511-bit word).
5	Apply power to the data set and then to the 914-type DTS.	Apply power to the data set and then to the 914-type DTS.
6	Call the receiving end to coordinate test procedure.	Coordinate test procedure with transmitting end.
7	On the 914 DTS, move switch S3 (DTR) to ON.	On the 914 DTS, move switch S3 (DTR) to ON.
8	Go to data mode.	Go to data mode.
9	Set S1 (RS) to ON.	Reset counter.
10	To verify equipment is operating properly, set switch S1 (RS) to OFF.	Counter should count at least once and shortly thereafter the NO DATA lamp should illuminate.
11	Set switch S1 (RS) to ON.	Reset counter. The NO DATA lamp should extinguish.
12	Conduct 10-minute error run.	Counter should record less than 30 counts (less than 30 block errors).
13	At end of 10-minute interval, go to talk mode. If test is required in other direction, set up as receiving station.	At end of 10-minute interval, go to talk mode and give results. If test is required in other direction, set up as transmitting station.
14	End of test. Return equipment to normal operating condition.	End of test. Return equipment to normal operating condition.

M. ▶Remote Start-up Test (Remote DS 208B-L1B Only)◀

5.27 ▶This test uses a 914-type DTS to check start-up of both far-end and near-end data sets. The far-end set must be a DS 208B-L1B; the near-end set may be any DS 208B-type. The RS switch on the near-end 914-type DTS is used to initiate transmission of blocks of data to the far-end set, which is in RT mode. Start-up errors made at the far end will cause SPACE signals to be returned to the near-end data set. A lamp at the RD input to the 914-type DTS will indicate the error status of the far-end data set. MARK signals (no errors) will cause the RD lamp on the near-end data set to remain extinguished. SPACE signals (one or more errors) will cause the RD lamp on the near-end data set to illuminate. If the RD lamp illuminates as a result of one operation of the RS switch, it is counted as one error. Errors

made in the start-up of the near-end receiver are displayed as actual error counts on the 914-type DTS.

Note: This test requires a 914-type DTS and a test person knowledgeable in using the DTS at the near end only.

5.28 Perform the test as follows:

(1) Connect equipment as shown in Fig. 7.

(2) Condition the 914-type DTS as shown in Fig. 8.

(3) Have attendant at far end place data set in RT mode.

(4) Call the far end, check for auto answer, and go to data mode at the near end (switch S8 must be ***on***).

(5) Operate switch S1 (RS) to ***on*** for at least 2 seconds to send blocks of steady MARK to far end (switch S2 ***off***). Data set under test samples RD lead for 1.25 seconds (6000 bits), beginning on a positive transition of COD.

(6) Operate switch RS to ***off*** to receive 2-second MARK (no errors) or SPACE (one or more errors) from far end. [MARK = RD (DS3) lamp extinguished; SPACE = RD (DS3) lamp lighted for 2 seconds].

(7) There are three possible conditions to monitor at the 914-type DTS during the test interval (ie, the 2 seconds after RS is turned ***off***).

(a) A steady SPACE sent back from the far-end data set (RD lamp illuminated on 914-type DTS and CO lamp illuminated on near-end data set) means that the far-end data set has made one block error.

(b) A steady MARK sent back from the far-end data set (RD lamp on data set extinguished and counter on 914-type DTS not counting) means that both data sets are performing satisfactorily.

(c) A steady MARK returned from the far-end data set (RD lamp extinguished on near-end data set), and counter on 914-type DTS not counting means that the near-end set is making start-up errors.

(8) The counter on the 914-type DTS may register a few counts (hits) on the RD lead upon turning ***off*** the RS switch. These counts are not start-up errors and should be ignored. Allow sufficient time between repetitions of the test to permit clearing the counter on the 914-type DTS.

(9) Repeat steps (5) and (6) 19 times, producing a total of 20 blocks.

Requirement: No more than 1 error in 20 blocks of data.

(10) If more than 1 block in 20 is reported in error from the far-end data set, repeat steps (5) and (6) 100 times to send 100 blocks of data.

Requirement: No more than 6 errors in 100 blocks of data.

(11) Errors may be forced by quickly operating and releasing the SD switch within 1.25 seconds after the RS switch is turned ***on***. The far-end receiver should detect the error and return a 2-second block of steady SPACE. If the SD switch remains ***on*** for more than 2 seconds after RS is turned ***on***, the far-end data set will go on-hook and auto answer will be inhibited. This procedure may be used to end the test.◀

N. ▶Analog Loop Start-up Test (DS 208B-L1B Only)◀

5.29 ▶This test uses a 914-type DTS to check start-up of a DS 208B-L1B. The RS switch on the 914-type DTS is used to initiate the transmission of blocks of data through the data set, which is placed in AL mode. Start-up errors will cause the counter on the 914-type DTS to register one count for each block of data in which one or more errors is made.

5.30 Perform the test as follows:

(1) Connect equipment and condition the 914-type DTS as shown in Fig. 8.

(2) Place the data set in analog loop made by pressing the AL switch.

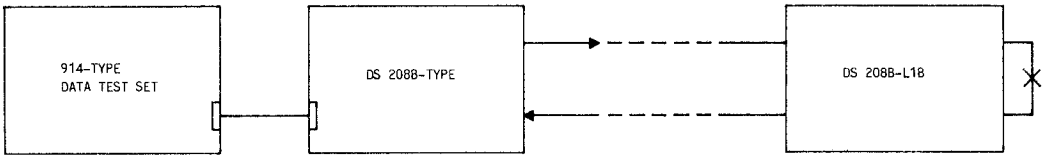
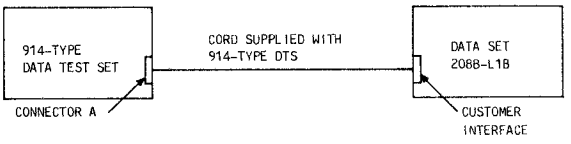


Fig. 7—Remote Start-up Test Setup



914 DTS MATRIX

COLOR OF PIN	VERTICAL	HORIZONTAL	OBSERVE OR CONTROL
RED	2	S2	SD
RED	4	S1	RS
YELLOW (3KΩ)	9	S1	CONTACT BOUNCE
RED	8	DS6	OBSERVE CO
WHITE (DIODE)	3	TP1	CHECK ERRORS
YELLOW (3KΩ)	17	TP1	
RED	19	TP1	
RED	19	SCR	
RED	3	DC3	OBSERVE RD
RED	20	S8	OTR
RED	7	GRD	

914 DTS CONTROLS

TEST SET MODE - SER OR RCV SER
BIT RATE - EXT +
COUNTER - INTERNAL X 1

Fig. 8—Test Setup Using 914-Type DTS

(3) Zero the counter on the 914-type DTS by depressing the RESET switch.

(4) Operate S1 (RS) switch on 914-type DTS to ***on*** for at least 2 seconds to send blocks of steady MARK (S2 ***off***).

Requirement: NO CLOCK and NO DATA lamps on the 914-type DTS are illuminated. Counter does not indicate any counts.

(5) Operate switch S1 (RS) to ***off*** to terminate start-up interval test. The counter on the 914-type DTS may register a few counts (hits on the RD lead at turnoff) which should be ignored.

(6) Zero the counter on the 914-type DTS and repeat steps (4) and (5) 19 times, to send a total of 20 blocks of data.

Requirement: Zero errors on the counter during the start-up interval.

If 1 error is made in 20 blocks, repeat steps (4) and (5) 100 times.

Requirement: No more than 6 errors on the counter in 100 blocks of data (6000 bit blocks).◀

O. ▶End-to-End Start-up Test◀

5.31 ▶This test checks the start-up interval of any DS 208B-type at either end. A 914-type DTS and test personnel knowledgeable in using the DTS are required at both ends.

5.32 Perform the test as follows:

(1) Connect test equipment as shown in Fig. 9.

(2) Condition the 914-type DTS at each end according to the direction of test as shown in Fig. 9. (The basic condition of the 914-type DTS is the same as shown in Fig. 8.)

(3) By prearrangement with the far-end test person, establish a procedure whereby the near-end test person will initiate a data start periodically. The far-end test person should observe the 914-type DTS at each start interval and reset the counter between intervals.

(4) Place data set at each end in DATA mode.

(5) ***Near-End Test Person:*** Operate S1 (RS) to ***on*** for an estimated 1 second to send one block of steady MARK to far end (S2 is ***off***). (One second is equivalent to one 4800-bit block.)

Far-End Test Person: Observe counter on 914-type DTS when CO lamp illuminates (indicating carrier is present). Errors during start-up will cause the counter on the 914-type DTS to register.

Requirement: Zero errors on the counter during start-up interval.

(6) ***Near-End Test Person:*** Operate S1 (RS) to ***off***.

Far-End Test Person: Observe that CO lamp extinguishes. Reset counter on 914-type DTS if necessary. Hits on the counter that occur when RS is turned ***off*** are not counted as errors.

(7) ***Far-End Test Person:*** After 5 seconds (to permit counter reset at far end), repeat steps (5) and (6) until 20 one-second blocks of data have been sent (ie, 20 ***on*** and ***off*** operations of the RS switch). After a prearranged number of tests (or time interval), return to talk mode to discuss test results.

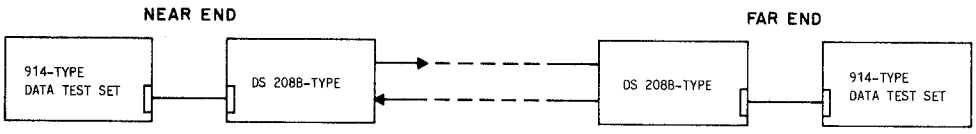
Far-End Test Person: After a prearranged number of tests (or time interval) return to talk mode and discuss test results.

(8) If more than one error is observed in 20 blocks, repeat steps (5) and (6) 100 times. There shall be no more than 5 errors in 100 blocks of data (approximately 4800 bits per block).

(9) If desired, the test can be reversed (Fig. 9). Perform steps (4) through (7) with the far-end sending data and the near-end receiving data and observing the counter on the 914-type DTS.◀

6. GROUND NOISE TEST

6.01 If the data set and business machine are not at the same ground potential, errors may be caused by a potential difference between



TO TEST FAR-END START-UP:
(NO SWITCHES DEPRESSED ON
EITHER DATA SET EXCEPT
"50" SWITCH)

NEAR - END DTS

S1 - ON FOR 2 SECONDS
- OFF FOR 2 SECONDS
S2 - OFF (SEND MARKS)
S8 - ON

FAR - END DTS

S1 - OFF
S2 - EITHER
S8 - ON
MODE - SER OR RCV SER
BIT RATE - EXT +
COUNTER - INTERVAL X 1
MATRIX - PER FIG 8

TO TEST NEAR - END START - UP:
REVERSE ABOVE CONDITIONS

Fig. 9—End-to-End Start-up Test Setup

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).

6.02 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 ring on the other end). Connect the 914-type DTS connector A to the customer connector on the data set. Connect the 914-type DTS connector B to the data set connector on the business machine. This test assumes that protective ground from the business machine appears at the customer interface.

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

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

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

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

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

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

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

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

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

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