

## DATA SET 301B-TYPE TRANSMITTER-RECEIVER TEST PROCEDURES

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Set 301B and 40.8 kilobit per second data systems.♦

**Note 2:** In installations provided with a DAS 806B5, Data Set (DS) 301B must be strapped for external transmitter timing (option Y). In these installations, strapping for external or internal transmitter timing, as specified in the test procedures, must be made in DAS 806B5. See Table C of Section 593-011-200 for proper connections.

### 1. GENERAL

**1.01** This practice contains two complete and separate tests. The first test procedure uses the 901B, 902B, and 903B Data Test Sets. The second test procedure uses the 912A Data Test Set (DTS). Both of the test procedures given are adequate tests of the data set which make it unnecessary to perform both procedures when checking the operation of the data set. The test equipment to be used is left to the discretion of the controlling office responsible for the service or is dependent on the availability of equipment. When the 912A DTS is available, it should be used in preference to the 901B, 902B, and 903B DTSs since the 912A duplicates operating conditions more accurately and is specifically designed for testing wideband stations. Each test also includes information on the use of Data Auxiliary Set (DAS) 806B5.

**Note 1:** ♦The 914 Data Test Set, which replaces the 901, 902, and 903 Data Test Sets, has a range to 20 kilobits per second and, therefore, cannot be used to test the Data

**1.02** This section is reissued to add a note specifying that the 914 DTS cannot be used to test DS 301B, change cable numbers on Fig. 3, add switch settings for the Q option, qualify reference to clear-to-send lamp, and rewrite Parts 5 and 6. Parts 5 and 6 have been rewritten to specify a different test sequence and for clarification.

**1.03** Change arrows are included where appropriate in Parts 1 through 4. Since Parts 5 and 6 have been rewritten, change arrows are shown at the beginning and end of each part.

**1.04** Before testing the data set, make sure that the set has been installed in accordance with the instructions contained in the section entitled Data Set 301B-Type, Transmitter-Receiver, Installation and Connections (593-011-200).

**1.05** Take the proper steps to ensure that the customer is not billed for any calls made in connection with testing the data set. Refer to the section entitled Crediting Charges on Test Calls (010-250-001).

**1.06** Three types of tests can be made using the 901B, 902B, and 903B DTSs. These tests are described as follows:

- (1) **Back-to-Back Test:** This is a local test of DS 301B in which the transmitter is driven by a 903B DTS. The transmitter output is fed

back through DAS 803A1, 803A2, or 806B5 into the receiver input. The received data is then fed to a 902B DTS which compares the signal from the data set with a signal from a second 903B. This test procedure is covered in 2.01 through 2.03.

(2) **End-to-End Test:** This is an overall test of the data system. The transmitter is driven by a 903B DTS at one station. The signal is transmitted over the wideband channel to the distant station. The received signal is fed to a 902B DTS where it is compared with a similar signal from another 903B DTS. After completing the test in one direction, the test setup is changed to reverse the direction of transmission. This test is covered in 3.01 through 3.03.

(3) **Static Test:** This test checks the customer interface circuits, power supply, and printed circuits. This test procedure is covered in 4.01 and 4.02.

**1.07** Two types of tests are made using the 912A DTS. These tests are described as follows:

(1) **Back-to-Back Test:** This is a local test of DS 301B where the transmitter is driven by a 912A DTS. In this test, the transmitter output is fed back through DAS 803A1, 803A2, or 806B5 into the receiver input. The received data is then fed back into the same 912A where it is compared with a similar signal. This test is covered in 5.01 through 5.03.

(2) **End-to-End Test:** This is an overall test of the data system. The transmitter is driven by a 912A DTS at one station. The signal is transmitted over the wideband channel to the distant station. The received signal is fed to a 912A DTS where it is compared with a similar signal. The 912A permits simultaneous testing of both directions of transmission (full-duplex operation). This test is covered in 6.01 through 6.03.

**Note 1:** The tests outlined in 1.06 (1) and (2) also check option Z (internal transmitter timing) and option Y (external transmitter timing).

**Note 2:** In installations provided with a DAS 806B5, DS 301B must be strapped for external transmitter timing (option Y). In

these installations, strapping for external or internal transmitter timing, as specified in the test procedures, must be made in DAS 806B5. See Table C of Section 593-011-200 for proper connections.

**1.08** The DAS 806B5 will be used in place of DAS 803A in some installations where a remote test capability is required. The 806B5 performs a function similar to the 803A in that it provides for test access to lines and means for looping the transmit and receive leads of DS 301B for back-to-back local testing. During the local test, the 806B5 also terminates the transmit and receive wideband transmission lines in 135 ohms rather than looping them back. A 2-way, plug-in, 135-ohm attenuator card is provided to furnish either 0- or 10-dB loss to the transmitter output for line signal power selection. A sealing current option as provided in the 803A is also furnished on a similar basis. In addition, DAS 806B5 provides a remote test feature which enables a test center to:

(1) Loop back the wideband facility at the data station line interface in order that transmission tests may be made from the test center.

**Note:** When remote or local tests are made, the serving test center (STC) should loop the transmitting and receiving channels at the wideband service bay towards the distant customer. This will loop back the idle code (10-00) signal from the distant DS 301B to maintain signal power for regulation of the receiving repeaters on the far-end loop.

(2) Effect a loop-back of the wideband data set at the customer interface so that overall data transmission tests may be made from the test center. Control of the two remote test modes is by means of a 10-second, 2800-Hz signal generated at the test center and transmitted over the voice coordination channel. The local test mode can be initiated in two ways:

(a) By operation of the LT key on the 10A2 Data Unit, a component part of the 806B5

(b) By customer control of the local test mode via the LT function provided in the customer interface. When the 806B5 is placed in the local test mode by either of these methods, the LT lamp on the 10A2 Data Unit and the

TEST lamp on an associated 804M will light and remain lighted for the duration of the test.

**1.09** In the remote test mode, a signal detector, bridged across either a 2-wire or the receive pair of a 4-wire private line voice circuit, detects the 10-second, 2800-Hz tone transmitted from the wideband data test bay. The first application and removal of the 2800-Hz control signal causes a loop-back of the wideband lines for transmission tests. This test mode is indicated by the RT1 lamp lighting on the 10A2 Data Unit. The auxiliary set remains in this test state until another 10-second, 2800-Hz tone is applied. The second application of the tone produces a station loop-back at the customer interface. Both the LT and RT1 lamps on the 10A2 Data Unit will light in this mode. The data auxiliary set remains locked in this mode until a third 10-second, 2800-Hz control signal is applied and released to extinguish the LT and RT1 lamps and to restore the data auxiliary set and associated data set to normal operation. All three steps must be performed in sequence.

**1.10** The test conditions, controlled through the use of the 2800-Hz signal, can be established under local control by depressing the LRT key located on the 10A2 Data Unit in the same sequence and duration as described for the remotely applied test signal.

**1.11** On some switched 40.8 kilobit per second data systems, the associated 4-wire voice coordinating channels are terminated at the customer's premises in DASs 804M2-type. Such systems will require an access line from the private line switch to the test center to permit remote tests. The following procedure is required to condition the customer's DAS 804M2 to connect the 4-wire voice coordination channel through to the 2800-Hz signal detector in DAS 806B5:

- (1) The test center initiates a call to the desired station through the wideband switch.
- (2) When answering the call, the customer is instructed to depress the TEST button on the 804M2 and hang up (telephone on-hook). The 804M2 is then conditioned to answer automatically and to provide the necessary data mode for remote tests.

- (3) The test center calls the desired station again. On receipt of the ringing signal, the 804M2 trips the ringing and extends the 4-wire voice facilities to the 806B5 where the 2800-Hz signal detector is bridged across the receiving pair.

- (4) The test center may now initiate the 2800-Hz control signal sequence to perform remote tests RT1 and RT2.

- (5) DASs 806B5 and 804M2 are automatically restored to normal operation by the application of an additional 10-second, 2800-Hz control signal.

**1.12** Test procedures as outlined in this section using the 901B, 902B, and 903B DTSs or the 912A DTS are valid for both DASs 803A and 806B5.

**1.13** The following paragraphs outline a procedure to follow to determine if trouble is in DS 301B or in DAS 806B5 when failure occurs with 806B5 in the LT mode.

**1.14** Verify that DS 301B and DAS 806B5 are strapped for proper options and all connections are made properly.

**1.15** *Equipment Required:*

1—KS-14510 multimeter or equivalent

1—P2B cord.

**1.16** When failure of system in the LT mode occurs:

- (1) Disconnect pendant cord from DAS 806B5 to DS 301B.
- (2) Disconnect cord from data test set to DAS 806B5 and check cords for continuity and shorts.
- (3) Connect cord from data test set to data set.
- (4) Set LT switch on 806B5 to ON. Observe that only the LT lamp is lighted.
- (5) Perform back-to-back test as outlined in this section. These tests are covered in Part 2 for 901B, 902B, and 903B DTSs and in Part 5 for the 912A DTS. Perform tests for both

internal transmitter timing (option Z) and external transmitter timing (option Y). If these tests are successful, replace the 14A2 Data Unit or DAS 806B5. Reconnect pendant cord from DAS 806B5 to DS 301B.

(6) If unable to carry out back-to-back tests due to an excessive error rate or loss of synchronization, proceed as follows:

(a) Plug P2B cord from transmitting monitor jack into receiving monitor jack on the 10A2 Data Unit. If this clears the trouble, replace 10A2 Data Unit or 806B5. If failure still occurs, remove 10A2 Data Unit, remove right-hand card (as seen from front of unit), and check that the pad is seated firmly in the connector. Reassemble data unit and plug it into the set.

(b) If trouble persists, recheck W9A cord (line cord) connections on TB1 of 806B5. If found correct, disconnect cord from terminal board and clip the transmit leads to the corresponding receive leads of the cord. If condition remains, check cord for continuity and shorts.

(c) If test conditions outlined in (a) and (b) fail to correct the trouble, replace the data set.

**1.17** The following paragraphs outline a procedure to follow to isolate trouble in the 806B5 in the RT1 mode. This mode of operation controlled either locally or from the test center results in a loop-back of the wideband transmission facilities through a relay located in the 10A2 Data Unit. This test is indicated by the RT1 lamp lighting on the 10A2 Data Unit. Only this lamp should be lighted at this time. This lamp indicates that the relay in the unit has operated. If lamp does not light, check that option Z has been installed and that the proper lamp is in the socket. If test is being performed from the test center, check that the voiceband line is connected to the data auxiliary set. If unable to initiate test from test center, a local-remote test should be performed by operating the LRT key for the proper interval. Failure in this mode would indicate trouble in the 10A2 Data Unit or CP AR122. (Note that RT1 lamp does not light until the 2800-Hz signal is removed or LRT key is released.) When the RT1 lamp is lighted and there is no indication to the test center that

lines have been looped, check all connections from transmission line to data auxiliary set. If trouble persists, with permission of the test center, disconnect wideband line from the 806B5 at terminal strip TB3. To avoid erroneous readings, disconnect W9A cord from DS 301B and unplug the 14A2 Data Unit. Test for continuity between terminals 1 and 3 and terminals 2 and 4 on TB3 of the 806B5. Check that approximately 40 ohms are between terminals 1 and 2 and terminals 3 and 4. If the data auxiliary set is wired with option K, there should be approximately 60 ohms between terminals 1 and 3 and terminals 2 and 4. Replace the 10A2 Data Unit if these tests fail. If the preceding tests pass indicating that there is a loop-back without shorts, the failure of the remote test may be due to the dc simplex sealing current circuit located on the 14A2 Data Unit. This should be replaced, all connections remade, and another remote test attempted. In the event of failure with an 806B5 which is known to be working, a check should be made to ensure that the transmission facilities meet specifications as outlined in Section 593-011-200.

**1.18** The following paragraphs outline a test procedure for the 806B5 in the RT2 mode. This mode of operation results in the looping of the 301B customer interface connections thus enabling the test center to test the overall performance of the data set and wideband facilities. An indication that the 806B5 is in the RT2 mode will be shown on the 10A2 Data Unit when both LT and RT1 lamps are lighted. It is assumed at the onset of the test that the 806B5 was not in the local test mode and that either two applications of 2800 Hz were sent from the test center or the LRT key was depressed twice for the specified period of time. The following paragraphs will help to isolate the trouble:

(1) Observe condition of LT lamp. When lamp is lighted, it indicates that the sequential relay circuit has cycled properly. If lamp is lighted, a check should be made to see if the RT2A relay located on the 14A2 Data Unit has operated. An initial check should be made to ensure that the 14A2 is plugged firmly into the set and that the pendant cord is plugged properly into the 301B.

(2) If all connections are made properly, the next step is a continuity check of the looping contacts of relay RT2A. Unplug the pendant cord and check for continuity between coaxial

contacts M and D, H and L, and E and K on the pendant cord.

(3) If continuity is not verified in (2), check voltage on pin 30 of connector J1. One of the following will be found:

- (a) A properly functioning unit will give a reading of approximately +16 volts.
- (b) A reading of -18 volts will indicate a failure in the 10A2 or a broken wire from the 10A2 to the 14A2.
- (c) An open RT2A relay on the 14A2 will be indicated by a +18 voltage.
- (d) If each of the preceding appears normal, check for shorts and grounds. If none are found, replace entire 806B5.

(4) A trouble in the timing circuit or sequential relay circuit results in the failure of the LT lamp to light. A reapplication of the test signal or operation of the LRT key for at least seven seconds should be made again in the event that the initial application was made incorrectly. The timing circuit CP AR122 can probably be eliminated as the source of trouble as it was previously capable of putting the unit into the RT1 mode. The 10A2 Data Unit should be replaced and another attempt made to put the set into the RT2 mode.

## 2. BACK-TO-BACK TEST USING THE 901B, 902B, AND 903B DATA TEST SETS

**2.01 Equipment Required:** The equipment required for making the following tests is listed as follows. Figures 1 and 2 show the connections required when making a back-to-back test.

1—901B DTS [901A DTS can be used on sets using internal transmitter timing (option Z). When necessary, sets equipped with option Y should be restrapped to provide option Z to facilitate testing.] Restrap data set at end of test.

**Note:** In installations provided with a DAS 806B5, DS 301B must be strapped for external transmitter timing (option Y). In these installations, strapping for external or internal

transmitter timing, as specified in the test procedures, must be made in DAS 806B5. See Table C of Section 593-011-200 for proper connections.

1—902B DTS

2—903B DTSs

3—200-ohm resistors.



**Before using the 902B and 903B DTSs, verify that they have been tested recently in accordance with the standard practices covering these sets.**

### 2.02 Test Preparation:



**Do not place both 803s in the test mode simultaneously. This action may cause the entire carrier to oscillate. It may disrupt service other than that being tested and cause damage to test equipment. This applies only when DAS 803A-type is used since this loops the line. If only one end operates the data auxiliary set, the idle code from the distant station will be looped back by the near-end DAS 803 and permit regulation of baseband repeaters. If both 803s are operated, loss of signal could cause oscillation. When the 806B5 type is used, the line is terminated and the signal is lost on the transmitting and far-end receiving lines. These tests should be checked with the serving central office.**

(1) Operate the key on DAS 803A to the TEST position or operate LT key on the 806B5 when used instead of the 803A. DAS 803A loops the lines towards the central office and connects the data transmit and receive leads together through a pad. In the case of the 806B5, operation of the LT key connects the data transmit and receive leads together through a 0- or 10-dB pad and terminates the lines in 135 ohms.

**Note:** DAS 803A2 normally provides a 10-dB pad (option Y) in the transmit path. Therefore, the data set must be strapped for option X to receive the 0-dBm level properly. DAS 803A1 provides a 30-dB pad in the looped

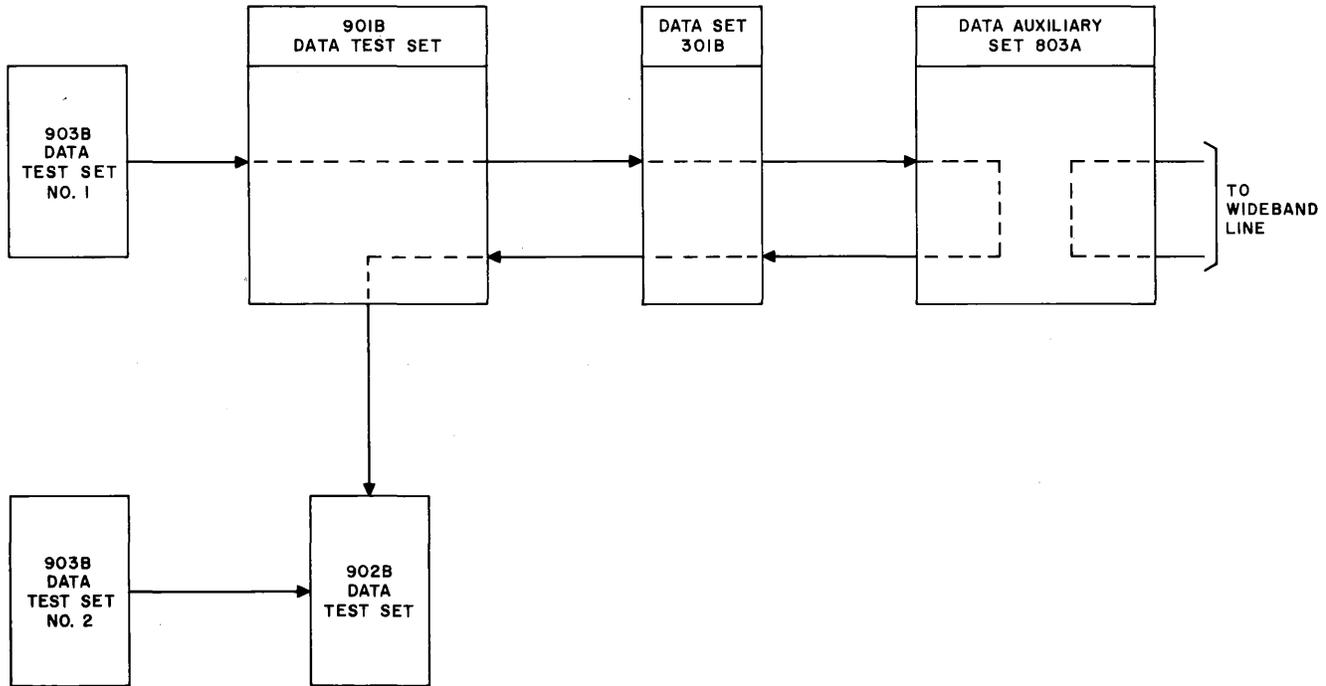


Fig. 1—Back-to-Back Test Using the 901B, 902B, and 903B Data Test Sets and Data Auxiliary Set 803A, Block Diagram

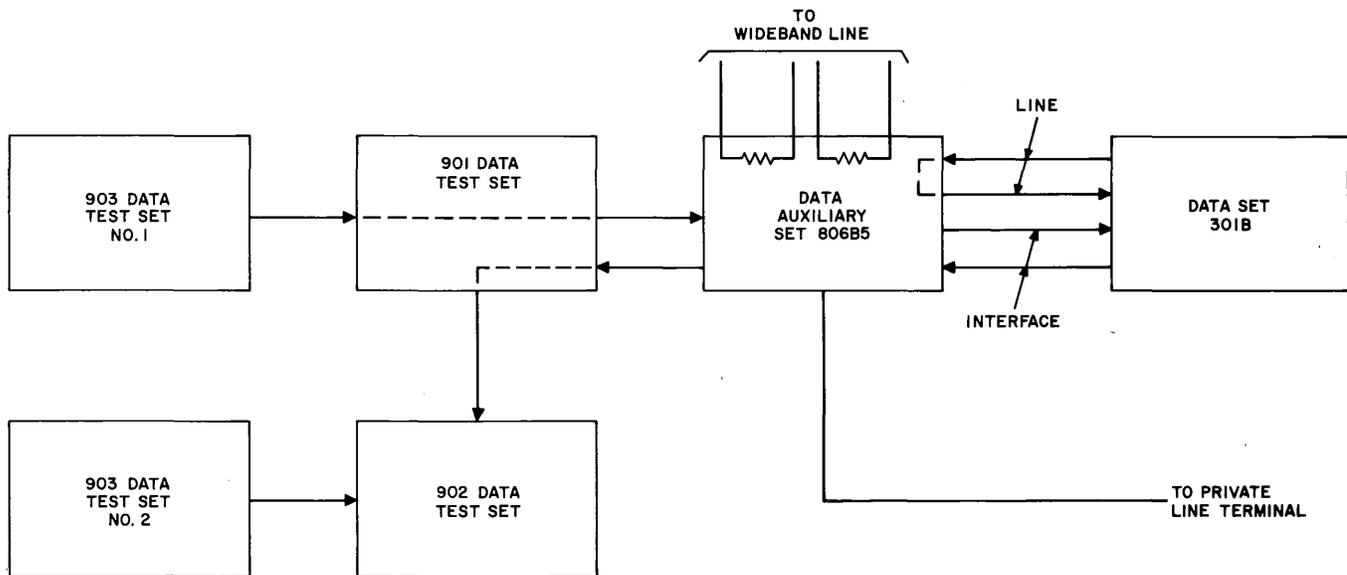


Fig. 2—Back-to-Back Test Using Data Auxiliary Set 806B5 in LT Mode With 901B, 902B, and 903B Data Test Sets, Block Diagram

path. Therefore, the data set must be strapped for option V or W for the data set to receive the -20 dBm input level properly.

(2) The test set controls are set as follows:

#### 901B DTS

- (a) Set the A TEST switch to position 9.
- (b) Set the B TEST switch to the OFF position.
- (c) Set the SELECTOR switch to position 3. (If the 901A set is used, set the switch to the 201A position.)
- (d) Set the toggle switch to the ATT position.

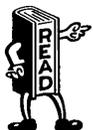
#### 902B DTS

- (a) Set the BIT RATE switch to EXT SYNC.
- (b) Set the TRIGGER switch to - (minus).
- (c) Set the meter selection switch to the DIST MEAS position.

#### 903B DTS (Both Sets)

- (a) Set the BIT RATE switch to EXT CLOCK.
- (b) Set the TRIGGER switch to the + (plus) position.
- (c) Set the RANDOM-DOT switch to RANDOM.

(3) Connect the data test sets together as follows:



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

(4) Run two leads from the SIGNAL OUT terminals of the No. 1 903B to the TRANSMIT DATA terminals of the 901B.

(5) Run two leads from the EXT CLOCK terminals of the No. 1 903B to the TRANSMIT CLOCK terminals of the 901B.

(6) Connect a 200-ohm resistor between the red and black TRANSMIT CLOCK terminals of the 901B.

(7) Run two leads from the DATA IN terminals of the 902B to the RECEIVE DATA terminals of the 901B.

(8) Connect a 200-ohm resistor between the red and black RECEIVE DATA terminals of the 901B.

(9) Run two leads from the EXT SYNC terminals of the 902B to the RECEIVE CLOCK terminals of the 901B.

(10) Connect a 200-ohm resistor between the red and black RECEIVE CLOCK terminals of the 901B.

(11) Connect the No. 2 903B to the 902B with the cord provided for this purpose.

(12) Disconnect the business machine cord from the connector designated CUST EQUIP. Connect the 901B to the data set interface connector designated TST. In installations with DAS 806B5, connect the 901B DTS to DAS 806B5 with the adapter cord (Fig. 3) and install option F (permanent send request) in the DAS.

(13) Strap data set for internal transmitter timing (option Z).

**Note:** In installations provided with a DAS 806B5, DS 301B must be strapped for external transmitter timing (option Y). In these installations, strapping for external or internal transmitter timing, as specified in the test procedures, must be made in DAS 806B5. See Table C in Section 593-011-200 for proper connections.

(14) Connect the power cords of both 903B DTSs to a 117-volt ac power receptacle. Turn the 903B power switches to ON.

#### 2.03 Test Procedure:

(1) Momentarily depress the START switch on both 903B sets.

(2) Momentarily depress the WORD SYNC & RESET switch on the 902B. The TOTAL

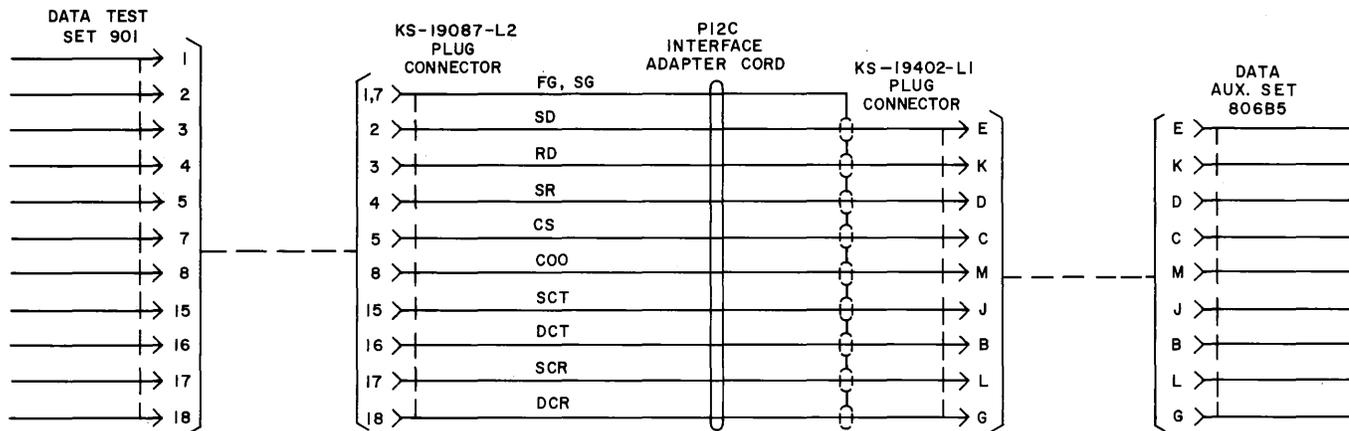


Fig. 3—The P12C Cord to Adapt 901B Data Test Set to Data Auxiliary Set 806B5

ERRORS lamps on the 902B will note any errors which occur.

- (3) To ensure that the 902B DTS is counting errors, depress the START switch on the No. 2 903B DTS. Errors should be indicated by the TOTAL ERRORS lamps after the START switch is depressed.
- (4) Depress the WORD SYNC & RESET switch and note the time when the test interval started.
- (5) Time a test interval of four minutes and five seconds. (This test interval provides a count of the number of errors occurring in 10 million bits.) The TOTAL ERRORS lamps will indicate the errors counted. To obtain the total errors, add the values indicated by all the lighted error lamps. When the bottom lamp is lighted, it indicates that the capacity of the counter (127 errors) has been exceeded.
- (6) No errors should be recorded. If any errors are recorded, repeat test by performing 2.03 (1) through (5). If no errors are recorded, the operation of the data set may be considered acceptable.
- (7) If option Y has been changed to option Z for test purposes, replace option Y if additional tests are not required.
- (8) At conclusion of tests, remove option F in DAS 806B5.

#### 2.04 Noise:

- (1) The 902B DTS may occasionally lose synchronization and record continuous errors due to the presence of impulse noise in the ac power line or due to impulses caused by operation of electric motors, fluorescent lights, switches, etc. See Section 593-011-200.
- (2) Random errors, occurring during a back-to-back test, are probably due to noise in the ac power supply. In this case, it is recommended that a 122A filter be used to minimize the effect of noise in the ac power source. Since this line noise may adversely affect any units to which it is connected, a 2-step test is required to distinguish whether the source of false indications comes from the test set or the data set.
- (3) For the initial back-to-back test, the 122A filter should be connected between the ac power source and the test set. If random errors are still detected, the back-to-back tests must be repeated with the 122A filter connected between the ac power source and both the test set and the data set. If the latter test is required to clear the occurrence of random errors, it will then be necessary to permanently include the 122A filter as a part of the station installation. It is assumed, however, that if standard precautions and procedures have been followed at the installation, such as a common ground between the data set and the business machine (refer to Section 593-011-200), the use of a 122A filter

should eliminate trouble or errors due to impulse noise in the ac power supply.

(4) The following procedure will require only one 122A filter to make the above tests. The 122A filter consists of a junction box containing a 145A filter and a terminal strip. A 3-wire plug (Hubbell No. 5264 or equivalent), 3-wire receptacle (Hubbell No. 5269 or equivalent), and two short ac line cords are required to connect the filter between the ac power outlet and the data set power cord.

(5) Since the 145A filter was designed to protect the ac power line from noise generated in a teletypewriter machine, the leads are labeled AC and TTY. To adapt this filter to protect the data set from impulse noise present in the ac line (refer to Fig. 4), connect the ac line cord to the filter leads marked TTY on terminal strip in the 122A as follows:

COLOR	TERMINAL
White	1
Black	2
Green	GRD

Connect the receptacle cord, which connects to the data set power cord, to the filter leads marked ac on the terminal strip as follows:

COLOR	TERMINAL
White	1
Black	2
Green	GRD

Connect a short wire from the GRD terminal on the terminal strip to the screw in the filter cover. The above connections will maintain the identity of the respective power leads through the 145A filter.

(6) In order to obtain the maximum noise rejection from the filter, keep all cords and leads as short as possible.

(7) When the data set and test set(s) are to be connected to the filtered ac power, use a

4-outlet junction box with a short power cord. Depending on the type of data test sets which are available, connect either one 912A or two 903B DTSs to the 4-outlet junction box and make the back-to-back test. If random errors are still encountered, connect the DS 301B power cord to the junction box and repeat the test. If the latter test results in a satisfactory error count, a 122A filter should be permanently installed between the ac power source and DS 301B.

(8) As the amount of noise on ac power lines varies considerably at different locations, the need for using this filter must be determined on a local basis for the particular conditions experienced at each installation area.

(9) In the event that this test fails to improve the error performance, DS 301B and the data auxiliary set together with the test sets should be relocated to a quiet location and retested. If this test fails, the data set is probably defective and should be replaced. If the test is satisfactory, it will be necessary to re-examine all grounding, locate sources of interference, and provide effective filtering to permit satisfactory data transmission.

### 3. END-TO-END TEST USING THE 901B, 902B, AND 903B DATA TEST SETS

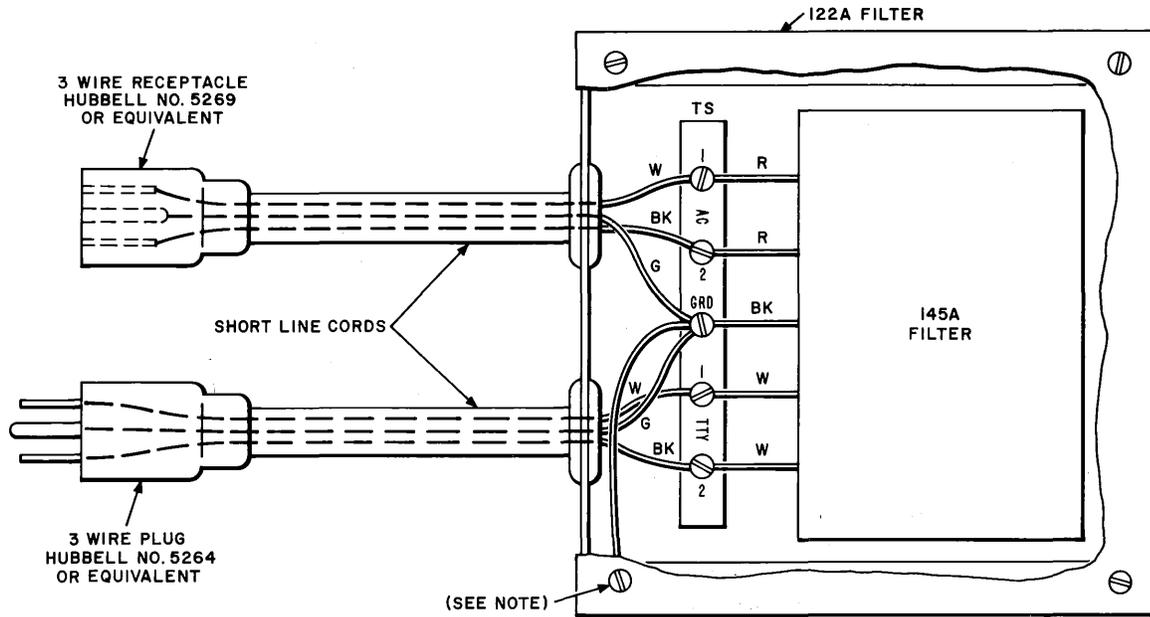
**3.01 Equipment Required:** The following equipment is required at each station. This test is to be made under the direction of the STC. Figures 5 and 6 show block diagrams of the units connected for this test.



*Before using the 902B and 903B DTSs, verify that they have been recently tested in accordance with the standard practices covering these sets.*

1—901B DTS [The 901A DTS can be used on sets using internal transmitter timing (option Z). When necessary, sets equipped with option Y should be restrapped to provide option Z to facilitate testing.]

**Note:** In installations provided with a DAS 806B5, DS 301B must be strapped for external transmitter timing (option Y). In these installations, strapping for external or internal transmitter timing, as specified in the test procedures, must be made in DAS 806B5. See



## NOTE:

RUN A WIRE FROM THE GROUND LUG ON THE TERMINAL STRIP TO A SCREW ON THE COVER OF THE 122A FILTER.

**Fig. 4—Noise Filter Connections**

Table C in Section 593-011-200 for proper connections.

1—902B DTS

1—903B DTS

3—200-ohm resistors.

### 3.02 Test Set Preparation:

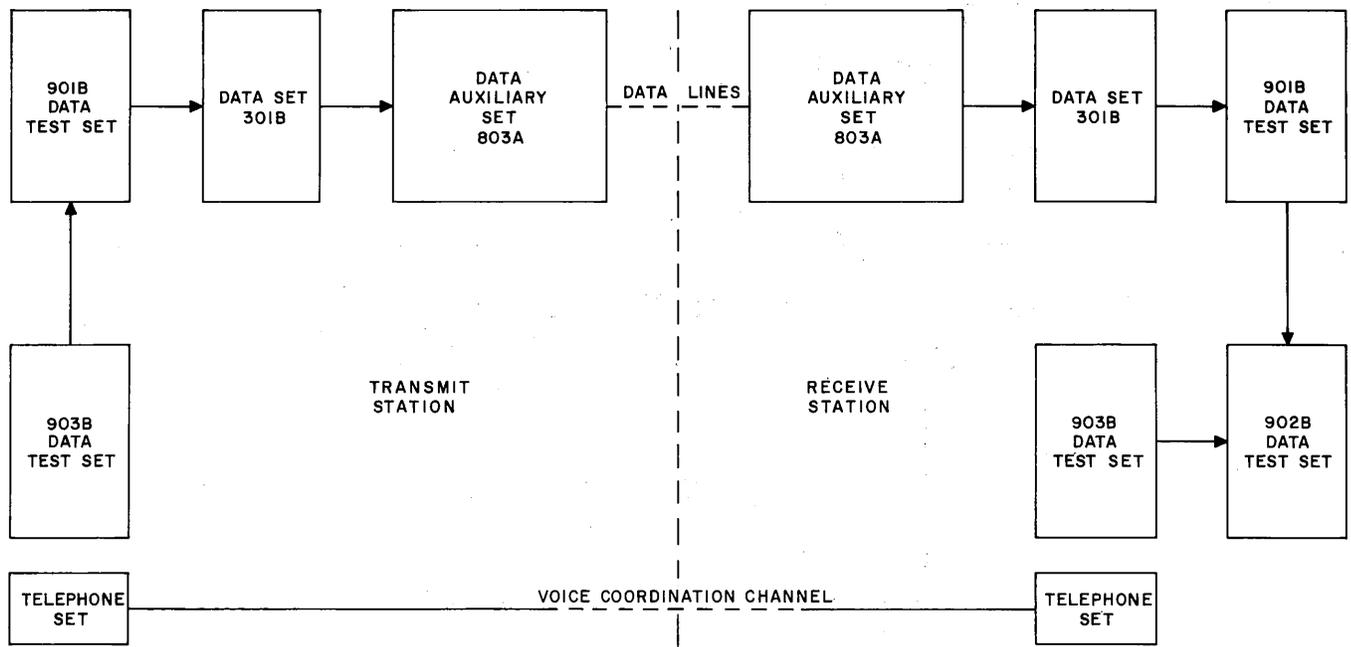
- (1) Set the controls at the transmitting station as follows:

#### 901B DTS

- (a) Set the A TEST switch to position 9.
- (b) Set the B TEST switch to the OFF position.
- (c) Set the SELECTOR switch to position 3. (If the 901A set is used, set the switch to the 201A position.)
- (d) Set the toggle switch to the ATT position.

#### 903B DTS

- (a) Set the BIT RATE switch to EXT CLOCK.
  - (b) Set the TRIGGER switch to the + (plus) position.
  - (c) Set the RANDOM-DOT switch to RANDOM.
- (2) Run two leads from the SIGNAL OUT terminals of the 903B to the TRANSMIT DATA terminals of the 901B.
  - (3) Run two leads from the EXT CLOCK terminals of the 903B to the TRANSMIT CLOCK terminals of the 901B.
  - (4) Connect a 200-ohm resistor between the red and black TRANSMIT CLOCK terminals of the 901B.
  - (5) Disconnect the business machine cord from the CUST EQUIP connector. Connect the 901B to the data set interface connector designated TST. In installations with DAS 806B5, connect the 901B DTS to DAS 806B5 with the adapter cord (Fig. 3) and install option F (permanent send request) in the DAS.



**Fig. 5—End-to-End Test Using the 901B, 902B, and 903B Data Test Sets and Data Auxiliary Set 803A, Block Diagram**

(6) Connect the power cord of the 903B to a 117-volt ac receptacle. Turn the 903B power switch to ON.

(7) Set the controls at the receiving station as follows:

#### **901B DTS**

- (a) Set the A TEST switch to the OFF position.
- (b) Set the B TEST switch to position 8.
- (c) Set the SELECTOR switch to position 3. (If the 901A set is used, set the switch to the 201A position.)
- (d) Set the toggle switch to the UNATT position.

#### **902B DTS**

- (a) Set the BIT RATE switch to EXT SYNC.
- (b) Set the TRIGGER switch to - (minus).
- (c) Set the meter selection switch to the DIST MEAS position.

#### **903B DTS**

- (a) Set the BIT RATE switch to EXT SYNC.
  - (b) Set the TRIGGER switch to the + (plus) position.
  - (c) Set the RANDOM-DOT switch to RANDOM.
- (8) Run two leads from the DATA IN terminals of the 902B to the RECEIVE DATA terminals of the 901B.
  - (9) Connect a 200-ohm resistor between the red and black RECEIVE DATA terminals of the 901B.
  - (10) Run two leads from the EXT SYNC terminals of the 902B to the RECEIVE CLOCK terminals of the 901B.
  - (11) Connect a 200-ohm resistor between the red and black RECEIVE CLOCK terminals of the 901B.
  - (12) Connect the 903B DTS to the 902B DTS by using the cord provided for this connection.

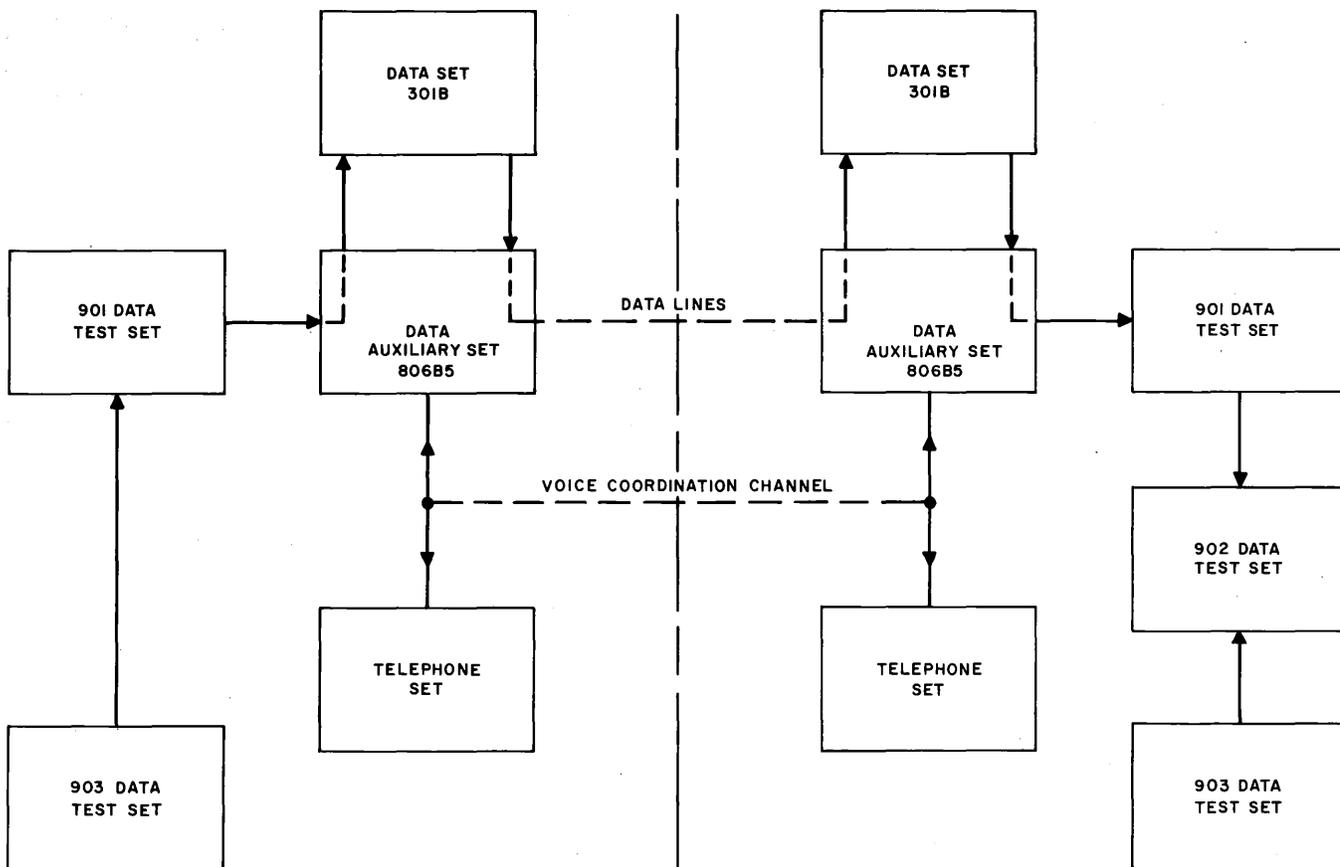


Fig. 6—End-to-End Test Using the 901B, 902B, and 903B Data Test Sets and Data Auxiliary Set 806B5, Block Diagram

- (13) Strap data set for internal transmitter timing (option Z).

**Note:** In installations provided with a DAS 806B5, DS 301B must be strapped for external transmitter timing (option Y). In these installations, strapping for external or internal transmitter timing, as specified in the test procedures, must be made in DAS 806B5. See Table C of Section 593-011-200 for proper connections.

- (14) Disconnect the business machine cord from the CUST EQUIP connector. Connect the 901B DTS to the data set interface connector designated TST. In installations with DAS 806B5, connect the 901B DTS with the adapter cord (Fig. 3).
- (15) Connect the power cord from the 903B to a 117-volt ac receptacle. Turn the power switch to the ON position.

### 3.03 Test Procedure:

- (1) Voice communication between the two stations should now be established over the voice coordination channel.
- (2) At the transmitting station, momentarily depress the START switch on the 903B. The transmitting station has no further duties until the end of the test period.
- (3) At the receiving station, momentarily depress the START switch on the 903B, then depress the WORD SYNC & RESET switch on the 902B.
- (4) To determine that the test data is being received, depress the START switch. One or more of the TOTAL ERRORS lamps should light. Depress the WORD SYNC & RESET switch and note the time when the test interval started.

**Note:** Disregard any meter reading.

(5) Time a test interval of four minutes and five seconds. (This test interval provides a count of the number of errors occurring in 10 million bits.) The TOTAL ERRORS lamps will indicate the errors counted. To obtain the total errors, add the values indicated by all the lighted error lamps. When the bottom lamp is lighted, it indicates that the capacity of the counter (127 errors) has been exceeded.

(6) The total of the errors counted during the timed interval must not exceed 10 for operation of the data set to be considered acceptable.

(7) If synchronization is lost during the timed interval, a second test should be performed by repeating 3.03 (4) through 3.03 (6).

(8) The 902B DTS may occasionally lose synchronization and record continuous errors due to the following abnormal conditions:

- (a) Unusual disturbances on the wideband channel
- (b) Impulses caused by operation of electric motors, fluorescent lights, switches, etc, at the receiving station.

**Note:** Test equipment should be operated in an area free of noise influences. When loss of synchronization occurs, immediately depress the WORD SYNC & RESET switch to regain synchronization. The timing interval should be restarted at this time. See Section 593-011-200.

(9) When synchronization is lost repeatedly, it should be determined whether the trouble is caused by hits or opens on the line or by local power line impulses.

- (a) If synchronization is lost when making the back-to-back test described in 2.01 through 2.03, it may be due to the presence of impulse noise in the ac power supplied to the 900 series test sets. This type of interference is sometimes caused by the customer's data processing equipment. The DS 301B and DAS 803A should be retested in a quiet location.

If synchronization is lost again, the data set is probably defective.

- (b) If synchronization is not lost when making the back-to-back test described in 2.01 through 2.03, call the nearest toll test center and arrange to make a back-to-back test on the local loop facilities at a loop-around connection in the toll central office. (The key on the data auxiliary set must be in the normal position for this test.) Further tests to sectionalize trouble should be under the control of the toll test center.

(10) After testing has been completed in one direction, change the test setup so that the former transmit station becomes the receive station and the former receive station becomes the transmit station.

(11) Repeat the tests outlined in 3.03 (1) through 3.03 (7). Upon completion of 3.03 (7), the transmission will have been checked in both directions. The results of these tests should be given to the STC for analysis and instruction.

(12) If option Y has been changed to option Z for test purposes, replace option Y if additional tests are not required.

(13) ♦At conclusion of tests, remove option F in DAS 806B5.♦

#### 4. STATIC TEST

##### 4.01 *Equipment Required:*

1—901B DTS [The 901A DTS can be used on sets using internal transmitter timing (option Z). When necessary, sets equipped with option Y should be restrapped to provide option Z to facilitate testing.] Restrap data set at end of test.

**Note:** In installations provided with a DAS 806B5, DS 301B must be strapped for external transmitter timing (option Y). In these installations, strapping for external or internal transmitter timing, as specified in the test procedures, must be made in DAS 806B5. See Table C of Section 593-011-200 for proper connections.

1—KS-14510 List 1 volt-ohmmeter or equivalent, eg, 50-kHz frequency response and 20,000 ohms per volt, such as Simpson Model 260 Series 4.

1—Hewlett-Packard 400E, 403B, 427A, or equivalent meter with frequency range of 10-50 kHz, minimum accuracy  $\pm 2$  percent full scale. This instrument is to be used in Steps 15 through 18 of Table A.

**4.02** Table A shows procedure for performing this test.

**Note:** The 901B DTS (or 901A), used in the previous test procedures, performs the following functions:

- (1) **SELECTOR Switch in Position 3 (or 201A):**  
Prepares the A and B TEST switches to control the data set in a manner similar to the customer business machine.
- (2) **A TEST Switch:** Connects various interface leads to test terminals on the set and is also used to simulate business machine operation (Table B).
- (3) **B TEST Switch:** Used in conjunction with A TEST switch in a similar manner (Table B).
- (4) The following fixed codes are generated in Steps 15 through 18 of the static test in Table A.

Step 15	10-00 Code
Step 16	11-11 Code
Step 17	00-00 Code
Step 18	01-01 Code

- (5) If option Y has been changed to option Z for test purposes, replace option Y if additional tests are not required.

**5. BACK-TO-BACK TEST USING THE 912A DATA TEST SET**

**5.01** One 912A DTS is required to perform this test.

**5.02** This test must be run twice to test the data set for both internal and external transmitter timing. In installations provided with a DAS 803, the strapping for internal or external timing is made in the data set (option Z for internal timing and option Y for external timing). Refer to Table A of Section 593-011-200 for proper connections. In installations provided with a DAS 806B5, the data set must be strapped for external timing (option Y) and the strapping for either internal or external timing is made in DAS 806B5 (option Q for internal timing and option N for external timing). Refer to Tables A and C of Section 593-011-200 for proper connections.

**5.03 Test Preparation:**



*Do not place both 803s in the test mode simultaneously. This action may cause the entire carrier to oscillate. It may disrupt service other than that being tested and cause damage to test equipment. This applies only when DAS 803A-type is used since this loops the line. If only one end operates the data auxiliary set, the idle code from the distant station will be looped back by the near-end DAS 803 and permit regulation. If both 803s are operated, loss of signal could cause oscillation. When DAS 806B5 is used, the line is terminated and the signal is lost on the transmission line. These tests should be checked with the serving central office.*

- (1) In installations using a DAS 803A, operate the key on the DAS to the TEST position. In installations with a DAS 806B5, operate the LT switch on the 912A DTS to put the DAS in the local test mode. This connects DS 301B transmit and receive lines together and disconnects DS 301B from the transmission lines. Figures 7 and 8 show a back-to-back test using the 912A DTS.
- (2) In installations using DAS 806B5, strap DAS 806B5 for internal transmitter timing. In installations using DAS 803A, strap DS 301B for internal timing.
- (3) The test set controls are set as follows:

OUTPUT—NORMAL

TABLE A — STATIC TEST

STEP	PREPARATION	901 DATA TEST SET			VOLT-OHM-MILLIAMMETER				LEAD TESTED
		A TEST	B TEST	TOGGLE SWITCH	SCALE	CONNECT PROBE		REQUIREMENTS	
						+	-		
1	(a) Remove business machine cord from CUST EQUIP connector. (b) Plug 901 set into TST connector of Data Set 301B. (c) Set 901 SELECTOR switch to 3 (901A* set to 201A position). (d) Operate key on data auxiliary set to TEST position.	OFF	1	ATT	60 Vdc	C	A	12 ±1.0 Volts	Power Supply
2		OFF	2	ATT	60 Vdc	A	C	12 ±1.0 Volts	
3		OFF	OFF	ATT	3 Vdc	Transmit Data Black Red		1 ±0.2 Volts	SD
4A	301B L1, 301B L2 (only)	18	OFF	ATT	3 Vdc	A	C	2.5 ±0.5 Volts	DCR
4B	301B2 (only)	18	OFF	ATT	120 mA	A	C	14 ±2.0 mA	DCR
5	Disconnect test probes before moving test switch A.	10	OFF	ATT	120 mA	A	C	28 ±4.0 mA	CS
6	Disconnect test probes before moving test switch A.	17	OFF	ATT	120 mA	A	C	28 ±4.0 mA	COO
7	Disconnect test probes before moving test switch A.	19	OFF	ATT	120 mA	A	C	14 ±2.0 mA	SCR
8		20	OFF	ATT	120 mA	A	C	21 ±3.0 mA	RD
9		21	OFF	ATT	12 mA	A	C	0 ±0.5 mA	CS
10		22	OFF	ATT	120 mA	A	C	14 ±2.0 mA	DCT
11		23	OFF	ATT	120 mA	A	C	14 ±2.0 mA†	SCT
12		20	3	ATT	12 mA	A	C	0 ±0.5 mA	RD
13	Disconnect test probes before moving test switch B.	20	4	ATT	120 mA	A	C	28 ±4.0 mA	
14		20	5	ATT	120 mA	A	C	14 ±2.0 mA	DR1 DT1
15‡§	Connect meter probes to data auxiliary set terminal strip with Data Auxiliary Set 803-type equipped with a 10-dB pad and set to the TEST position.	OFF	OFF	ATT	3 Vac‡	Data Auxiliary Set Terminal 5 6		1.15 ±0.25‡ Volts	
16‡		OFF	3	ATT	3 Vac‡	Data Auxiliary Set Terminal 5 6		1.05 ±0.25‡ Volts	
17‡		OFF	4	ATT	3 Vac‡	Data Auxiliary Set Terminal 5 6		1.15 ±0.25‡ Volts	
18‡		OFF	5	ATT	3 Vac‡	Data Auxiliary Set Terminal 5 6		1.00 ±0.25‡ Volts	
19	Remove test equipment.								

\* The 901A Data Test Set can be used on sets using internal transmitter timing (option Z) only. If necessary, restrap option Y sets to option Z for testing.

‡ On sets equipped with option Y (external transmitter timing), the reading should be 9 ±1.5 mA on the 12 mA scale.

‡ Measurements listed in Steps 15 through 18 must be made with an extended frequency response voltmeter, such as the Hewlett-Packard 400D, 403B, 427A, or the Simpson Model 260 Series 4 or later KS-14510-L5 volt-ohmmeter.

§ Attenuator pad must be in 10-dB position.

**TABLE B**  
**901 DATA TEST SET FUNCTIONS**

A TEST POSITION	CONNECTS			A TEST POSITION	CONNECTS		
	INTERFACE LEAD		A TERMINAL OF 901 SET		INTERFACE LEAD		A TERMINAL OF 901 SET
	RS TO	SD TO			RS TO	SD TO	
1				13	+12		
2				14	+12		
3			SCT	15	+12		
4			CS	16	+12		
5			CO	17			CO
6	+12	-12	RD	18			DCR
7	+12	+12	RD	19			SCR
8	+12	DCT	RD	20			RD
9	+12		SCR	21			CS
10	+12		CS	22			DCT
11	+12		CO	23			SCT
12	+12			OFF			

B TEST POSITION	CONNECTS			B TEST POSITION	CONNECTS		
	INTERFACE LEAD		A TERMINAL OF 901 SET		INTERFACE LEAD		A TERMINAL OF 901 SET
	RS TO	SD TO			RS TO	SD TO	
1			-12	7	GRD	DCT	
2			+12	8	GRD	DCT	
3	+12	-12		9	GRD	DCT	
4	+12	+12		10	+12	+12	
5	+12	DCT		11	GRD	+12	
6	GRD	DCT		OFF			

**Note 1:** Blank spaces indicate no connection.

**Note 2:** Both the A and B TEST switches have access to the same interface leads. Care should be taken to prevent connecting battery and ground to the same lead simultaneously. For example, A TEST in position 9 puts +12 volts on the RS lead. B TEST in position 6 puts ground on the same lead.

RECEIVE TEST SIGNAL—131111

TRANSMIT TEST SIGNAL—131111

RECEIVE BIT RATE—EXT

TRANSMIT BIT RATE—(See note)

**Note:** The TRANSMIT BIT RATE—EXT position is used when testing DS 301B for internal transmitter timing (option Z in DS 301B). When testing DS 301B for external transmitter timing, the TRANSMIT BIT RATE—40.8 position is used (option Y in DS 301B).

INPUT—NORMAL

TIMING—0

COUNTER—OFF

RECEIVE TRIGGER—+ (plus)

RECEIVE WORD SYNC—NEUT

TRANSMIT TRIGGER—+ (plus)

TEST MODE—UNBAL

MODE—SYNC

DATA TERM READY—OFF

LOCAL TEST—ON (See note)

**Note:** The use of the LT switch on the 912A DTS is preferred over the LT key on DAS 806B5. Using the LT key on 912A DTS provides the additional testing of the local test cable terminators and logic circuits in DAS 806B5 and also lights the clear-to-send (CS) lamp on the 912A DTS. The LT switch on the 912A DTS should be set to the OFF position when using DAS 803A.

SEND REQ—ON

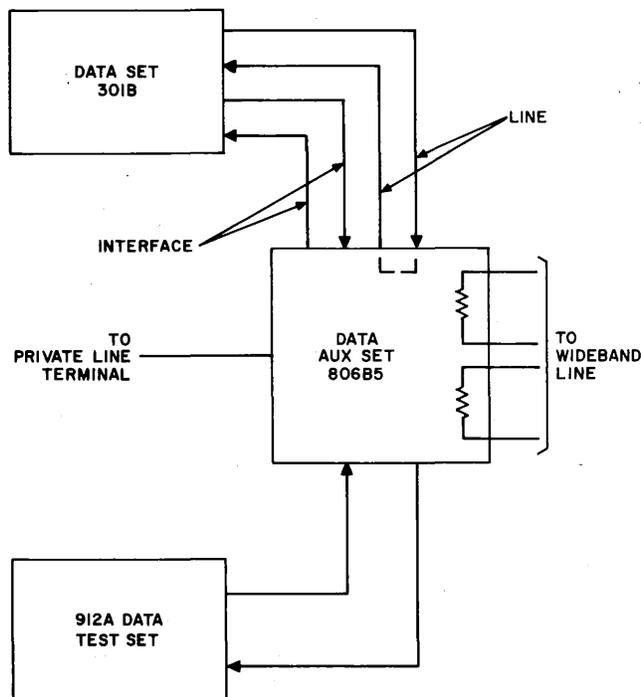
A Channel—See note

B Channel—See note

**Note:** These switches may be left in any position because they do not function when testing the 301B.

(4) In installations provided with a DAS 803, disconnect the business machine cord from the CUST EQUIP connector. Connect the 912A DTS to DS 301B using the BURNDY connector cable provided. In installations provided with DAS 806B5, disconnect the business machine cord from the customer interface connector on DAS 806B5. Connect the 912A DTS to the DAS 806B5 by using the BURNDY connector cable provided.

(5) Connect the power cord of the 912A DTS to the 117-volt ac receptacle. Turn the POWER switch to ON.



**Fig. 7—Back-to-Back Test Using Data Auxiliary Set 806B5 in LT Mode With 912A Data Test Set, Block Diagram**

#### 5.04 Test Procedure:

- (1) A signal from the data set will cause the AGC lamp on the test set to light which indicates that the data set is receiving carrier.
- (2) The clear-to-send (CS) lamp on the 912A DTS will light. (This lamp will not light if the LT switch on the 912A DTS is off.)
- (3) The NO DATA lamp should not be lighted. This indicates that data is being received.
- (4) Momentarily operate the RECEIVE WORD SYNC switch to MAN. This will synchronize the receive word and local word signals and will extinguish the NO SYNC lamp.

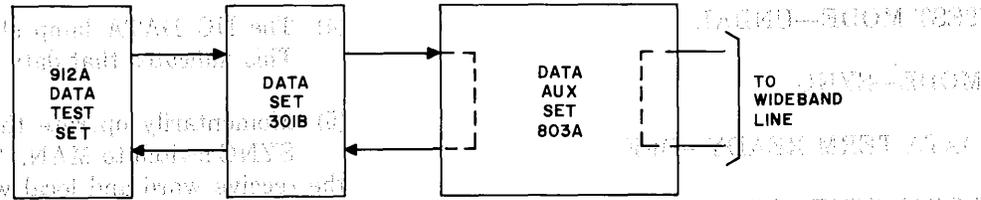


Fig 8—Back-to-Back Test Using the 912A Data Test Set and Data Auxiliary Set 803A2, Block Diagram

(5) Set the COUNTER switch to the ON position and reset the COUNTER to zero. The error lamps on the 912A will note any errors which occur in transmission. When the OVERFLOW lamp is lighted, it indicates that the rate at which the errors are occurring exceeds the capabilities of the mechanical counter.

(6) Continue the test for a time interval of four minutes and five seconds. No errors should be recorded. If any errors are recorded, time a second 4-minute and 5-second period. If any errors are recorded again and the data test set is known to be operating properly, the data set may be considered defective.

(7) The 912A DTS may occasionally lose synchronization and record continuous errors due to the presence of impulse noise in the ac power line or due to impulses caused by operation of electric motors, fluorescent lights, switches, etc.

(8) At the end of the first test, strap DS 301B or DAS 806B5 for external transmitter timing. Reset the TRANSMIT BIT RATE switch to TRANSMIT BIT RATE—40.8 and repeat the test procedure outlined in 5.04 (1) through (7).

**6. END-TO-END TEST USING THE 912A DATA TEST SET**

**6.01** One 912A DTS is required at each station.

**6.02** This test must be run twice to test the data set for both internal and external transmitter timing. In installations provided with a DAS 803, the strapping for internal or external timing is made in the data set (option Z for internal timing and option Y for external timing). Refer to Table A of Section 593-011-200 for proper connections. In installations provided with a DAS 806B5, the data set must be strapped for external timing

(option Y) and the strapping for either internal or external timing is made in DAS 806B5 (option Q for internal timing and option N for external timing). Refer to Tables A and C of Section 593-011-200 for proper connections.

**6.03 Test Preparation:**

(1) Make the proper connections in DS 301B or DAS 806B5 for internal transmitter timing.

(2) The test set controls are set as follows:

- OUTPUT—NORMAL
- RECEIVE TEST SIGNAL—131111
- TRANSMIT TEST SIGNAL—131111
- RECEIVE BIT RATE—EXT
- TRANSMIT BIT RATE—(See note)

**Note:** The TRANSMIT BIT RATE—EXT position is used when testing DS 301B for internal transmitter timing (option Z in DS 301B). When testing DS 301B for external transmitter timing, the TRANSMIT BIT RATE—40.8 position is used (option Y in DS 301B).

- INPUT—NORMAL
- TIMING—0
- COUNTER—OFF
- RECEIVE TRIGGER—+ (plus)
- RECEIVE WORD SYNC—NEUT
- TRANSMIT TRIGGER—+ (plus)

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TEST MODE—UNBAL

MODE—SYNC

DATA TERM READY—OFF

LOCAL TEST—OFF

SEND REQ—ON

A Channel—See note

B Channel—See note

**Note:** These switches may be left in any position because they do not function when testing the 301B.

- (3) In installations provided with a DAS 803A, disconnect the business machine cord from the CUST EQUIP connector. Connect the 912A DTS to DS 301B by using the BURNDY connector cable provided. In installations provided with DAS 806B5, disconnect the business machine cord from the customer interface connector on DAS 806B5. Connect the 912A DTS to the DAS 806B5 by using the BURNDY connector cable provided. Refer to Fig. 9 and 10 for block diagrams of the end-to-end test setup.
- (4) Connect the power cord on the 912A DTS to the 117-volt ac receptacle. Turn the POWER switch to ON.

### 6.04 Test Procedure:

- (1) Voice communication between the two stations should now be established over the voice coordination channel.
  - (2) At the transmitting station, a signal from the data set will cause the clear-to-send (CS) lamp on the test set to light. The transmitting test generator will start automatically. The DSR lamp on the 912A should light to indicate the data set ready condition. No further action is required.
  - (3) At the receiving station, a signal from the data set will cause the AGC lamp on the test set to light which indicates that the data set is receiving carrier.
- (4) The NO DATA lamp should not be lighted. This indicates that data is being received.
  - (5) Momentarily operate the RECEIVE WORD SYNC switch to MAN. This will synchronize the receive word and local word signals and will extinguish the NO SYNC lamp.
  - (6) Set the COUNTER switch to the ON position and reset the COUNTER to zero. The error lamps on the 912A will note any errors that occur in transmission. When the OVERFLOW lamp is lighted, it indicates that the rate at which the errors are occurring exceeds the capabilities of the mechanical counter.
  - (7) Continue the test for a time interval of four minutes and five seconds. No more than ten errors should be recorded. If more than ten errors are recorded, time a second 4-minute and 5-second period and record the number of errors.
    - (a) The data test set may occasionally lose synchronization due to disturbances on the wideband channel or impulses caused by electric motors, fluorescent lights, light switches, etc.
- Note:** The test equipment should be operated in an area free of noise influences. When loss of synchronization occurs, immediately try to regain synchronization and start a new timing interval. See Section 593-011-200.
- (8) When synchronization is lost repeatedly, it should be determined whether the trouble is caused by hits or opens on the line, or by local power line impulses.
    - (a) If synchronization is lost when making the back-to-back test described in 5.01 through 5.03, it may be due to the presence of impulse noise in the ac power supplied to the 912A DTS. This type of interference is sometimes caused by the customer's data processing equipment. The DS 301B and DAS 803A should be retested in a quiet location. If synchronization is lost again, the data set is probably defective.
    - (b) If synchronization is not lost when making the back-to-back test described in 5.01 through 5.03, call the nearest toll test center

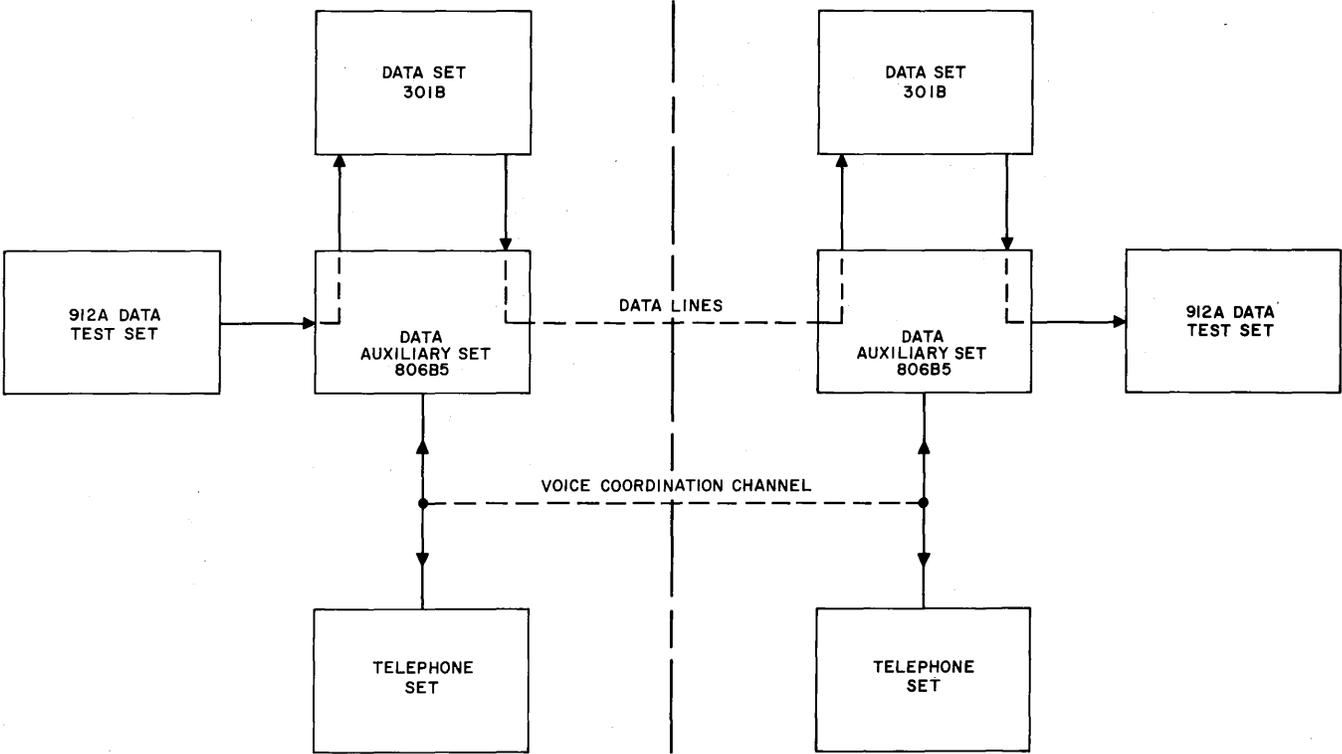


Fig. 9—End-to-End Test Using the 912A Data Test Set and Data Auxiliary Set 806B5, Block Diagram

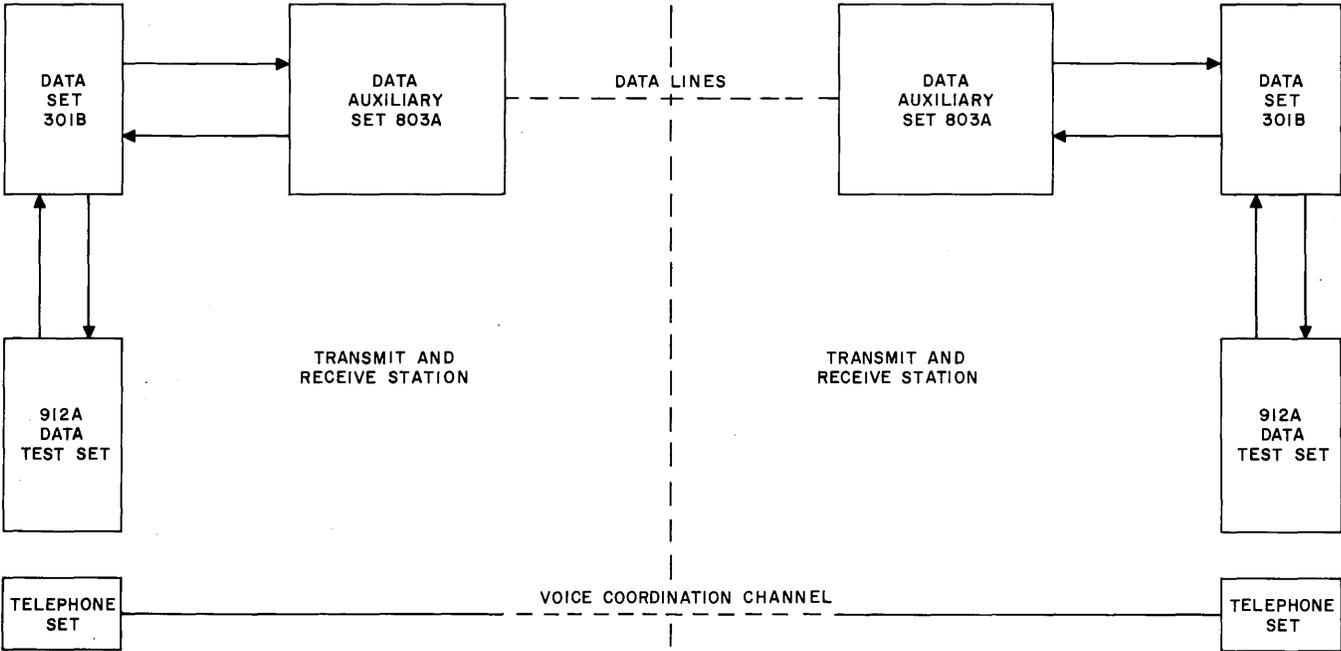


Fig. 10—End-to-End Test Using the 912A Data Test Set and Data Auxiliary Set 803A, Block Diagram

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and arrange to make a back-to-back test on the local loop facilities at a loop-around connection in the toll central office. (The data auxiliary set must not be in the test condition for this test.) Further tests to sectionalize trouble should be under the control of the toll test center.

- (9) The results of these tests should be given to the STC for analysis and instruction.
- (10) At the end of a prearranged test period, strap the data set for option Y if option Z was strapped in to make the previous test.

**Note:** In installations provided with a DAS 806B5, DS 301B must be strapped for external transmitting timing (option Y). In these installations, strapping for external or internal transmitter timing, as specified in the test procedures, must be made in DAS 806B5. See Table C of Section 593-011-200 for proper connections.

- (11) Reset the TRANSMIT BIT RATE switch to 40.8 and repeat the test procedure outlined in steps 6.03 (1) through 6.03 (9).
- 6.05** If the data set successfully passes the applicable test sections of this practice, it may be considered to be operating properly.♦