# OFFICE CHANNEL UNIT AND AUXILIARY CIRCUITS

# TEST PROCEDURES

# DIGITAL DATA SYSTEM

## 1. GENERAL

**1.01** This practice describes the test procedures to be used when troubleshooting an OCU (office channel unit) or as installation tests of the OCU when a customer is added to the DDS (Digital Data System) at some time after the initial installation. The following text has been written with the assumption that the reader has a general knowledge of the operation, terminology, and physical appearance of the OCU assemblies. This information is provided in the practice entitled Digital Data System—Office Channel Unit and Auxiliary Circuits—Description (314-910-100).

**1.02** This practice is reissued to add the OCU latching loopback test. Revision arrows are used to emphasize the more significant changes.

**Installation Testing**

**1.03** If at some time after initial installation, a new customer is to be added to the DDS, perform the following tests in the sequence given:

- Chart 1 — on any added power units

- Chart 2 — on all added OCUs

- ▶Chart 3 — on all added OCU units with latching loopback.◀

**Maintenance Testing**

**1.04** Any or all of the tests provided herein may be used in troubleshooting an OCU.

*CAUTION: Performance of the OCU loopback test, chart 2, will interrupt customer service. Therefore, chart 2 must not be performed except after prior notice has been given to the customer or when the channel is known to be idle or out of service.*

**1.05** Chart 2 requires the use of the practices entitled Digital Data System—KS-20909 Data Test Set (Transmitter)—Description and Operation (107-600-100) and Digital Data System—KS-20908 Data Test Set (Receiver)—Description and Operation (107-601-100).

## 2. ▶LATCHING LOOPBACK CONTROL ON HL220 AND HL222

**2.01** To detect the presence of an OCU with latching loopback, a latching loopback must be executed. Some OCUs respond *only* to the non-latching loopback sequence used in the DDS network. The HL220 OCU will respond to both latching and non-latching loopback control sequences. Therefore, if the OCU fails to respond to a latching loopback control

sequence and successfully responds to the non-latching loopback, it is not an HL220 OCU.

**2.02** The latching loopback sequence uses three control codes and one equipment-specific data code. The control codes are:

• TIP (transition in progress)

• LBE (loopback enable)

• FEV (far-end voice).

The LBE code is mapped in the forward direction to allow the loopback of one of several identical plug-ins in tandem. MAP 0 or MAP 1 is also returned in the reverse direction in response to LBE codes sent during the looped state and may be used to differentiate between loopback locations.

**2.03** The latching loopback bit patterns are:

• TIP = $\emptyset$0111010

• LBE = $\emptyset$1010110

• FEV = $\emptyset$1011010

*Note:* $\emptyset$ = Don't care symbol.

**2.04** The latching loopback data codes are referred to as LSCs (loopback select codes). One of the following LSC bit patterns must be transmitted as part of the latching loopback sequence to select the loopback location:

| LSC BIT | MAP CODE |
|---|---|
| OCU | $\emptyset$1010101 MAP 1 |
| CSU (channel) | $\emptyset$0110001 MAP 0 |
| LSI HL222 | $\emptyset$1000111 MAP 1 |

*Note:* No LSC can equal 11111111.

MAP 0 = 10010011
MAP 1 = 01101101

MAP 0 or MAP 1 is also returned in the reverse direction in response to LBE codes sent during the looped state and may be used to differentiate between loopback locations.

**2.05** Loopback processors on each type of equipment are programmed (during manufacture) to respond to these unique data codes which must be received in the data stream before the loopback can be enabled.

**2.06** There are two latching loopback procedures that may be used to establish a loopback in the network. The two procedures are:

(a) Only one specific unit of equipment is on the circuit or the first of several identical units in tandem is to be looped back.

(b) The second of two identical units in tandem is to be looped back.

**2.07** To establish a loopback as described in paragraph 2.06 (a), the following procedure may be used.

(1) TIP - is sent to clear the channel.

(2) LSC - is sent to identify a particular unit of equipment, enables the equipment to recognize and respond to subsequent data bursts.

(3) LBE - is sent to enable the equipment to be looped back. The first unit to receive this code maps it into MAP 0 or MAP 1 and sends these MAP data codes downstream.

(4) FEV - is then sent to actually cause the loopback. The equipment returns FEV in the SC mode or $\emptyset$1111010 in the nonsecondary channel mode to the tester when the loopback is successfully latched.

**2.08** If the loopback is as described in paragraph 2.06 (b), the following procedure applies.

(1) TIP - is sent to clear the channel

(2) LSC - is sent to identify a particular unit of equipment, enables the equipment to recognize and respond to subsequent data bursts.

(3) LBE - is sent to enable the equipment to be looped back. The first unit to receive this code maps it into MAP 0 or MAP 1 and sends these MAP data codes downstream.

(4) ALL ONES - burst is sent and the equipment will cease to send mapped code downstream. Instead, it will send through whatever is received. Thus, the sequence shown addresses the second of two identical units in tandem.

(5) LBE - is sent to enable the equipment to be looped back.

(6) FEV - is sent for the second unit to loop back and return FEV in the SC mode or Ø1111010 in the non-SC mode to the tester. This procedure (i.e., repetitions of LBE and ALL ONES) can be repeated as often as necessary to loop back any one of an unlimited number of identical tandem units.

**2.09** Termination of the loopback is accomplished by sending a TIP code.

**2.10** The OCU latching loopback tests are covered in Chart 3.◀

## 3. CHARTS

**3.01** The tests covered are as follows:

Chart 1. ***Power Unit Test:*** This test checks the +12, −12, and +15 volt outputs of the 71C (or 76C) and 71C1 (or 76C1) power units and the central office battery supply (−24 V or −48 V) to the power units.

Chart 2. ***OCU Loopback Test:*** This test checks the loopback feature of the OCU from the following:

DDS Hub Office

● Test points on the faceplate of the D-T (digital-terminal) CP (HL7)

DDS Local Office

● OCU used with D-T CP HL7—M-JCP (multiplexer jack and connector panel) or SM-JCP (submultiplexer jack and connector panel)

● OCU used with D-T CP HL89—test jacks on the faceplate of the D-T CP

● OCU used with ISMX (integral subrate multiplexer) CP HL8/HL8B or HL88/HL88B—test points on the faceplate of the ISMX CP.

In addition, an error run is made on the data being looped back by the OCU.

▶Chart 3. ***Latching Loopback Test:*** This test checks the latching loopback feature of the HL220 OCU and the HL222 LSI (loop side interface). Also, this test detects the presence of an OCU or LSI without latching loopback.◀

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**CHART 1**

**POWER UNIT TEST**

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**APPARATUS:**

1 —KS-16979-L1 VOM (volt-ohm-milliammeter) or equivalent

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| STEP | PROCEDURE |
|------|-----------|
| 1 | Condition the VOM to measure −48 V dc (71C or 71C1 power unit) or −24 V dc (76C or 76C1 power unit). |
| 2 | Connect the positive (+) meter lead to the BAT RTN test point of the power unit. |
| 3 | Connect the negative (−) meter lead to the −48 V (or −24 V) test point of the power unit. |
| | ***Requirement:*** Meter indicates between 42 and 52 volts (71C or 71C1) or between 20 and 27 volts (76C or 76C1). |
| 4 | Disconnect both meter leads. |
| 5 | Connect the negative (−) meter lead to the SG test point of the power unit. |
| 6 | Connect the positive (+) meter lead to the +12 V test point of the power unit. |
| | ***Requirement:*** Meter indicates between 11 and 13 volts. |
| 7 | Disconnect the positive (+) meter lead and connect it to the +5 V test point of the power unit. |
| | ***Requirement:*** Meter indicates between 4.5 and 5.5 volts. |
| 8 | Disconnect both meter leads. |
| 9 | Connect the positive (+) meter lead to the SG test point of the power unit. |
| 10 | Connect the negative (−) meter lead to the −12 V test point of the power unit. |
| | ***Requirement:*** Meter indicates between 11 and 13 volts. |
| 11 | Disconnect both meter leads. |

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## CHART 2

## OCU LOOPBACK TEST

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**APPARATUS:**

1 —KS-20909 DTS (data test set) transmitter

1 —KS-20908 DTS receiver

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| STEP | PROCEDURE |
|------|-----------|
| 1 | Plug the clock input cords of both DTSs into TST1 and TST2 of the BCPA (bay clock, power, and alarms) or LTS (local timing supply) assembly. |
| 2 | Plug the power cords of both DTSs into 117-volt, 60-Hz outlets and operate both POWER ON switches.<br><br>***Requirement:*** POWER ON switches and CLOCK LED (light-emitting diode) indicators on both DTSs lighted. |
| 3 | Set switches on KS-20908 DTS receiver as follows:<br><br>• INPUT to BIPOLAR for OCU or LSI (loop side interface [HL222]) with HL7 D-T CP *or* NEAR LOGIC for OCU or LSI HL222 with ISMX or HL89 D-T CP<br><br>• DATA RATE to speed of OCU or LSI (HL222) under test<br><br>• COUNTER to BLOCK ERRORS<br><br>• TESTWORD to LOOPED<br><br>• SUBRATE CHANNEL to SINGLE<br><br>• COUNTER MODE to HOLD. |
| 4 | Set switches on KS-20909 DTS transmitter as follows:<br><br>• OUTPUT to BIPOLAR for use with HL7 D-T CP *or* NEAR LOGIC for use with ISMX or HL89 D-T CP<br><br>• DATA RATE to speed of OCU or LSI (HL222) under test<br><br>• FUNCTION to LOOPBACK TEST. |
| 5 | Connect the data input cord of the KS-20908 DTS receiver as follows:<br><br>• DDS hub offices—Connect to appropriate transmit (OUT) test points on HL7 D-T CP in accordance with Table A. |

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**CHART 2 (Contd)**

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| STEP | PROCEDURE |
|------|-----------|

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- DDS local office OCU or LSI (HL222) with HL7 D-T CP—Connect to appropriate FROM (NEAR) jack on SM-JCP or M-JCP. If the KS-20908 DTS is equipped with a TERMINATE key, depress the key and/or observe that the TERMINATE LED is lighted.

- DDS local office OCU or LSI (HL222) with ISMX (HL8/HL8B or HL88/HL88B) CP—Connect to appropriate test points (test points 7 through 20 only) on ISMX (HL8/HL8B) CP in accordance with Table B, or appropriate test points (test points 3 through 12 and 17 through 26) on ISMX (HL88/HL88B) CP in accordance with Table C.

- DDS local office OCU or LSI (HL222) with HL89 D-T CP—Connect to TEST jack on HL89 D-T CP.

6    Connect data output cord of KS-20909 DTS as follows:

- DDS hub office—Connect to appropriate receive (IN) test points on HL7 D-T CP in accordance with Table A.

- DDS local office OCU or LSI (HL222) with HL7 D-T CP—Connect to appropriate TO (NEAR) jack on SM-JCP or M-JCP.

- DDS local office OCU or LSI (HL222) with ISMX (HL8/HL8B or HL88/HL88B) CP—Connect to appropriate test jack on ISMX CP in accordance with Table B or C.

- DDS local office OCU or LSI (HL222) with HL89 D-T CP—Connect to appropriate jack (J1-J5) on HL89 D-T CP in accordance with Table A.

7    If testing an OCU in a DDS hub office—Request the testing technician to insert a dummy plug into the TO (NEAR) jack of the ♦associated JCP♦ under test.

8    Momentarily operate the KS-20909 DTS RESET key.

*Requirement:* All CONTROL CODES and LOOPBACK TEST indicators extinguished.

9    Depress and hold the KS-20909 DTS OCU LOOPBACK TEST key.

*Requirement:* On KS-20908 DTS, BYTE PATTERN LED 8 and one other lighted. All others extinguished.

*Note:* If the requirement for Step 9 is not met, troubleshoot the OCU as directed in Practice 314-910-300.

10    Release the OCU LOOPBACK TEST key.

11    Momentarily operate the COUNTER MODE switch on the KS-20908 DTS to RESET and start timing a 15-second interval.

*Requirement:* OVERFLOW indicator extinguished and COUNTER resets to all zeros.

CHART 2 (Contd)

| STEP | PROCEDURE |
|---|---|
| 12 | At the end of the 15-second interval—Operate COUNTER MODE switch to HOLD. |
| | *Requirement:* KS-20908 DTS counter indicates zero errors. |
| | *Note:* If errors are recorded, troubleshoot the OCU as directed in Practice 314-910-300. |
| 13 | Disconnect both DTSs. |
| 14 | If testing an OCU in a DDS hub office—Request the testing technician to remove the dummy plug inserted in Step 7. |

## ♦CHART 3

### HL220 or HL222 LATCHING LOOPBACK TEST

The DDS network latching loopback sequence can be generated with the existing DDS KS-20909 DTS transmitter or the BATS (Bit Access Test System) panel through the use of the byte encoder and all ones in the switches. The procedure requires the circuit to be accessed at DS-0A level. This test can be used to indicate compatibility of the OCU. The DDS network loopback application is shown in Fig. 1.

**APPARATUS:**

1 —KS-20909 DTS transmitter

1 —KS-20908 DTS receiver

| STEP | PROCEDURE |
|---|---|
| 1 | Plug the clock input cords of both DTSs into TST1 and TST2 of the BCPA (bay clock, power, and alarms) or LTS (local timing supply) assembly. |
| 2 | Plug the power cords of both DTSs into 117-volt, 60-Hz outlets and operate both POWER ON switches. |
| | *Requirement:* POWER ON switches and CLOCK LED (light-emitting diode) indicators on both DTSs lighted. |
| 3 | Set switches on KS-20908 DTS receiver as follows: |
| | • INPUT to BIPOLAR for use with HL7 D-T *or* NEAR LOGIC for use with ISMX or HL89 D-T CP |
| | • DATA RATE to speed of OCU or LSI under test |

| ♦CHART 3 (Contd) | |
| --- | --- |
| STEP | PROCEDURE |

- COUNTER to BLOCK ERRORS

- TESTWORD to LOOPED

- SUBRATE CHANNEL to SINGLE

- COUNTER MODE to HOLD.

4    Set switches on KS-20909 DTS transmitter as follows:

- OUTPUT to BIPOLAR for use with HL7 D-T CP *or* NEAR LOGIC for use with ISMX or HL89 D-T CP

- DATA RATE to speed of OCU or LSI under test

- FUNCTION to BYTE ENCODER

5    Connect the data input cord of the KS-20908 DTS receiver as follows:

- DDS hub offices—Connect to appropriate transmit (OUT) test points on HL7 D-T CP in accordance with Table A.

- DDS local office OCU or LSI with HL7 D-T CP—Connect to appropriate FROM (NEAR) jack on SM-JCP or M-JCP. If the KS-20908 DTS is equipped with a TERMINATE key, depress the key and/or observe that the TERMINATE LED is lighted.

- DDS local office OCU or LSI with ISMX (HL8/HL8B or HL88/HL88B) CP—Connect to appropriate test points (test points 7 through 20 only) on ISMX (HL8/HL8B) CP in accordance with Table B, or appropriate test points (test points 3 through 12 and 17 through 26) on ISMX (HL88/HL88B) CP in accordance with Table C.

- DDS local office OCU or LSI with HL89 D-T CP—Connect to TEST jack on HL89 D-T CP.

*Caution:* *If receiver BYTE PATTERN indicator lamp number 8 is lighted, and indicators 2 through 7 are dimly lighted, customer data is being sent over that channel. Obtain customer permission to test before disturbing the circuit.*

6    Connect data output cord of KS-20909 DTS as follows:

- DDS hub office—Connect to appropriate receive (IN) test points on HL7 D-T CP in accordance with Table A.

- DDS local office OCU or LSI with HL7 D-T CP—Connect to appropriate TO (NEAR) jack on SM-JCP or M-JCP.

- DDS local office OCU or LSI with ISMX (HL8/HL8B or HL88/HL88B) CP—Connect to appropriate test jack on ISMX CP in accordance with Table B or C.

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### ♦CHART 3 (Contd)

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| STEP | PROCEDURE |
|------|-----------|

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• DDS local office OCU or LSI with HL89 D-T CP—Connect to appropriate jack (J1-J5) on HL89 D-T CP in accordance with Table A.

7    If testing an OCU in a DDS hub office—Request the testing technician to insert a dummy plug into the TO (NEAR) jack of the associated JCP under test.

8    Momentarily operate the KS-20909 DTS RESET key.

*Requirement:*   All CONTROL CODES and LOOPBACK TEST indicators extinguished.

**Setting of Switches on KS-20909 DTS**

9    Set BYTE ENCODER to TIP (00111010) code.

10    Depress and hold ALL-ONES button. This transmits an all 1s data pattern while the BYTE ENCODER switches are changed.

11    Set BYTE ENCODER switch to 01010101 (OCU LSC) or 01000111 (LSI LSC).

12    Release ALL-ONES button to transmit LSC. Transmit the LSC for at least one second.

13    Depress ALL-ONES button and set BYTE ENCODER to LBE (01010110) code.

14    Release ALL-ONES button to transmit LBE code.

15    Depress ALL-ONES button.

16    Set BYTE ENCODER to FEV (01011010) code.

17    Release ALL-ONES button and observe code display on receiver to confirm a successful loopback.

| HL222 | | Ø1011010 |
|-------|------|----------|
| HL220 | SC | |
| | *NSC | Ø1111010 |

\* NSC = non-secondary channel

18    Perform error rate tests using any pattern of data except TIP (00111010) or LBE (01010110) codes using applicable AT&T practices.

| | |
|---|---|
| **▶CHART 3 (Contd)** | |

| STEP | PROCEDURE |
|---|---|
| 19 | When testing is completed, ensure that the KS-20909 DTS FUNCTION switch is set to BYTE ENCODER. Set BYTE ENCODER to TIP (00111010) code and transmit to release loopback. |
| 20 | Disconnect both DTSs. |
| 21 | If testing an OCU in a DDS hub office—Request the testing technician to remove the dummy plug inserted in Step 7.◀ |

## 4. ISSUING ORGANIZATION

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| TABLE A | | | | |
| --- | --- | --- | --- | --- |
| KS-20909/20908 DTS CONNECTIONS ON D-T HL7 AND HL89 | | | | |
| CHANNEL OF OCU SHELF UNDER TEST | D-T POSITION | D-T CP RECEIVE TEST POINTS* | D-T CP TRANSMIT TEST POINTS* | HL89 D-T CP JACKS† |
| 1 | 33 | IN 1 | OUT 1 | J1 |
| 2 | 33 | IN 2 | OUT 2 | J2 |
| 3 | 33 | IN 3 | OUT 3 | J3 |
| 4 | 33 | IN 4 | OUT 4 | J4 |
| 5 | 33 | IN 5 | OUT 5 | J5 |
| 6 | 35 | IN 1 | OUT 1 | J1 |
| 7 | 35 | IN 2 | OUT 2 | J2 |
| 8 | 35 | IN 3 | OUT 3 | J3 |
| 9 | 35 | IN 4 | OUT 4 | J4 |
| 10 | 35 | IN 5 | OUT 5 | J5 |

\* The signal at these test points is at the bipolar level.

† The signal present at these jacks is at the logic level, and can be checked by inserting the KS-20909 DTS plug into the appropriate jack (J1-J5) and inserting the KS-20908 DTS plug into the TEST jack.

| TABLE B |
|---|
| **ISMX (HL8/8B) TEST POINT AND JACK USE** |

| TEST POINT(S)* OR TEST JACK† | OCU OR LSI CHANNEL(S) ACCESSED | TYPE SIGNAL | FROM | TO | USE |
|---|---|---|---|---|---|
| TP1 and TP2 | 1 through 5 | 64-kb/s composite 5-channel bipolar | M-JCP | HL8/8B | Monitor composite 5-channel data signal. |
| TP3 and TP4 | | | HL8/8B | M-JCP | |
| TP7 | 1 | 64-kb/s single channel logic level | OCU | HL8/8B | Monitor individual channel data. |
| TP8 | | | HL8/8B | OCU | |
| TP9 | 2 | | OCU | HL8/8B | |
| TP10 | | | HL8/8B | OCU | |
| TP13 | 3 | | OCU | HL8/8B | |
| TP14 | | | HL8/8B | OCU | |
| TP17 | 4 | | OCU | HL8/8B | |
| TP18 | | | HL8/8B | OCU | |
| TP19 | 5 | | OCU | HL8/8B | |
| TP20 | | | HL8/8B | OCU | |
| J1 | 1 | | Signal flow direction depends on portable DTS OUTPUT LOGIC NEAR/FAR switch setting. | | Transmit individual channel data with portable DTS. |
| J2 | 2 | | | | |
| J3 | 3 | | | | |
| J4 | 4 | | | | |
| J5 | 5 | | | | |
| TP12 | Signal ground point | | | | |
| * The use of the test points alone does not interrupt the OCU or LSI channel. | | | | | |
| † The use of test jack interrupts the OCU or LSI channel. | | | | | |

| TABLE C | | | | | |
|---|---|---|---|---|---|
| ISMX (HL88/88B) TEST POINT AND JACK USE | | | | | |
| TEST POINT(S)* OR TEST JACK† | OCU OR LSI CHANNEL(S) ACCESSED | TYPE SIGNAL | FROM | TO | USE |
| TP1 and TP2 | | | | | Initialize CP during Installation. |
| TP3 | 6 | 64-kb/s single channel logic level | OCU | HL88/88B | Monitor individual channel data |
| TP4 | | | HL88/88B | OCU | |
| TP5 | 7 | | OCU | HL88/88B | |
| TP6 | | | HL88/88B | OCU | |
| TP7 | 8 | | OCU | HL88/88B | |
| TP8 | | | HL88/88B | OCU | |
| TP9 | 9 | | OCU | HL88/88B | |
| TP10 | | | HL88/88B | OCU | |
| TP11 | 10 | | OCU | HL88/88B | |
| TP12 | | | HL88/88B | OCU | |
| TP13 and TP14 | 1 thru 10 | 64-kb/s composite 10-channel bipolar | M-JCP | HL88/88B | Monitor composite 10-channel data signal |
| TP15 and TP16 | | | HL88/88B | M-JCP | |
| TP17 | 1 | 64-kb/s single channel logic level | OCU | HL88/88B | Monitor individual channel data |
| TP18 | | | HL88/88B | OCU | |
| TP19 | 2 | | OCU | HL88/88B | |
| TP20 | | | HL88/88B | OCU | |
| TP21 | 3 | | OCU | HL88/88B | |
| TP22 | | | HL88/88B | OCU | |
| TP23 | 4 | | OCU | HL88/88B | |
| TP24 | | | HL88/88B | OCU | |
| TP25 | 5 | | OCU | HL88/88B | |
| TP26 | | | HL88/88B | OCU | |

| TABLE C (Contd) | | | | |
|---|---|---|---|---|
| ISMX (HL88/88B) TEST POINT AND JACK USE | | | | |
| TEST POINT(S)* OR TEST JACK† | OCU OR LSI CHANNEL(S) ACCESSED | TYPE SIGNAL | FROM          TO | USE |
| J1 | 1 | 64-kb/s single channel logic level | Signal flow direction depends on portable DTS OUTPUT LOGIC NEAR/FAR switch setting. | Transmit individual channel data with portable DTS. |
| J2 | 2 | | | |
| J3 | 3 | | | |
| J4 | 4 | | | |
| J5 | 5 | | | |
| J6 | 6 | | | |
| J7 | 7 | | | |
| J8 | 8 | | | |
| J9 | 9 | | | |
| J10 | 10 | | | |
| TP27 | Signal ground point | | | |
| * The use of the test points alone does not interrupt the OCU or LSI channel. | | | | |
| † The use of a test jack interrupts the OCU or LSI channel. | | | | |
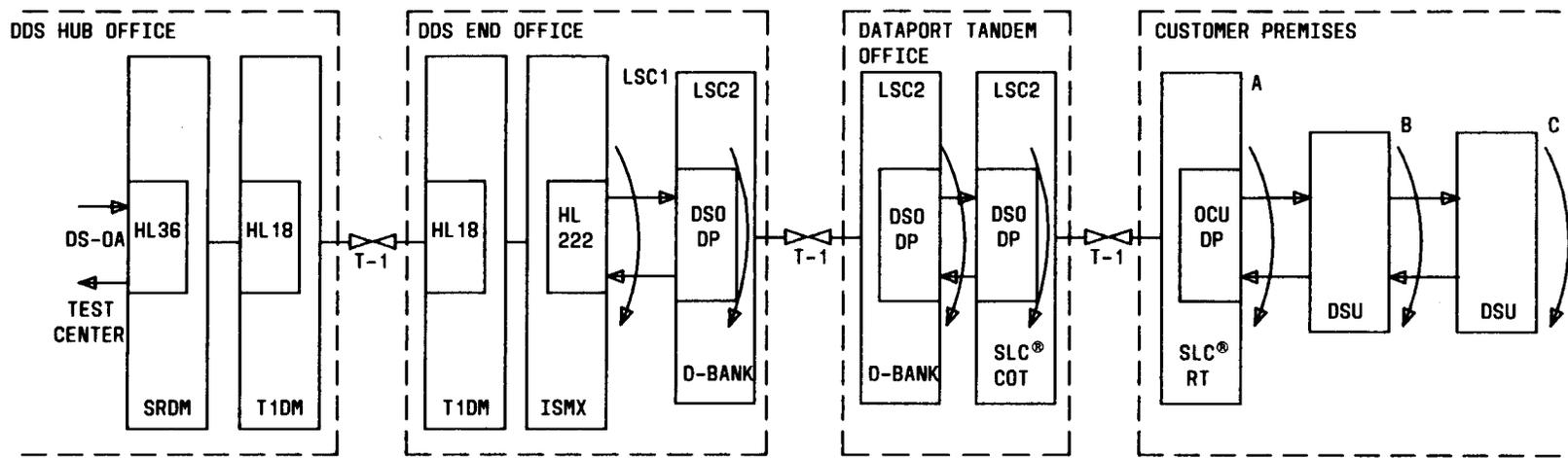
LEGEND:

CSU = CHANNEL SERVICE UNIT    SLC® COT = CENTRAL OFFICE TERMINAL
DSU = DATA SERVICE UNIT        SLC®RT   = REMOTE TERMINAL
 DP = DATAPORT                SRDM = SUB-RATE DATA MULTIPLEXER
ISMX = INTEGRATED SUB-RATE     T1DM = T1 DATA MULTIPLEXER
      DATA MULTIPLEXER
OCU = OFFICE CHANNEL UNIT

NOTE:
  1. SEQUENCES SENT FROM HUB TO LOOPBACK CONTROL OF INDICATED PLUG-INS

| HL222 | DSO-DP | DSO-DP | DSO-DP | |
|-------|--------|--------|--------|---|
| TIP | TIP | TIP | TIP | TIP = TRANSITION IN PROGRESS----(00111010) |
| LSC1 | LSC2 | LSC2 | LSC2 | LSC = LOOPBACK SELECT CODE -----(SEE PAR. 2.04) |
| LBE | LBE | LBE | LBE | LBE = LOOPBACK ENABLE ----------(01010110) |
| FEV | FEV | ALL-ONES | ALL-ONES | FEV = FAR-END VOICE-------------(01011010) |
| | | LBE | LBE | |
| | | FEV | ALL-ONES | |
| | | | LBE | |
| | | | FEV | |

Fig. 1—DDS Network Loopback Applications (Note 1)