



**Bell
Communications
Research**

**Bellcore Practice
BR 314-410-312
Issue 2, August 1987**

**LOCAL AREA DATA CHANNELS
TESTS AND REQUIREMENTS**

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BR-314-410-312
Issue 2, August 1987

**Prepared by the Information Management Services Division,
Bell Communications Research, Inc., August 1987.**

Produced under Project Number 422241

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LOCAL AREA DATA CHANNELS

TESTS AND REQUIREMENTS

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1. GENERAL

A. Purpose

1.01 This practice describes the test procedures to be performed on a Local Area Data Channel (LADC) during installation and maintenance periods. These channels provide for baseband transmission of data signals between two customer terminal locations within a serving wire center area.

1.02 This practice is reissued to conform to the changes in Part 68 of the Code of Federal Regulations that governs the terms and conditions for connecting customer premise equipment to the telephone network. This reissue also reflects a change in language that was generated by divestiture of the Bell Operating Companies.

1.03 The LADCs use nonloaded metallic facilities exclusively, with limited amounts of bridged tap. The facilities may reside entirely within the customer premises or may be routed through the Serving Central Office (SCO). When the facilities are routed through the SCO, some testing may be accomplished by Mechanized Loop Testing (MLT) at a Maintenance Center (MC).

1.04 The MLT (One Employee) tests covered in this practice are:

Test A - Foreign Voltage:

This procedure checks for foreign voltage on the cable pairs. The test may be made at an end-user interface, SCO, or another convenient test access midpoint.

Test B - Insulation Resistance:

This test checks the resistance between the cable pairs, and between the cable pairs and ground. The test may be made at an end-user interface, the SCO, or another convenient test access midpoint.

Test C - Loop Resistance:

The loop resistance procedure verifies that the loop resistance for each pair meets the maximum DC resistance requirement for insulation. For subsequent tests, this resistance value should meet the benchmark resistance value recorded on the Work Order Record and Details (WORD) document or equivalent.

Test D - Insertion Loss:

This measurement is made to verify that the channel meets the maximum insertion loss requirements for installation. This test also checks for the presence of load coils on the cable pairs and associated bridged taps.

Test E - Noise:

This test is made using a Noise Measuring Set (NMS) equipped with a C-message weighting network. The NMS may be used to measure both noise and impulse noise counts. The measurements should be made during a busy-hour period in the central office to ensure best results.

Test F - Impulse Noise:

The impulse noise test follows in sequence with the noise test. The same apparatus and equipment may be used for making both tests.

1.05 Tests A, B, and C are DC measurements that should be performed during installation periods. These tests may be made from one of the end-user interfaces or from a convenient test access midpoint, such as the SCO. During maintenance periods, the tests are performed as required.

1.06 Tests D, E, and F are AC measurements that should be performed during installation periods. These tests are made at the end-user network interfaces on an end-to-end basis. During maintenance periods, the tests are performed as required.

B. Testing Responsibility

1.07 Initial trouble sectionalization to the telephone company provided service should be performed by the customer. Use of any and all modem testing features by the customer should be encouraged.

C. Test Access

1.08 When a LADC is routed through the SCO, DC tests A, B and C may be made at the MLT. Access is obtained at the Main Distributing Frame (MDF) using MDF test cords that connect to MLT test trunks. When long test trunks are used, the resistance of the test trunk must be measured and the measured resistance subtracted from the overall loop resistance.

1.09 A typical arrangement showing test access to a LADC routed through a SCO is shown in Figure 1. The pair identification T, R, and T1, R1 is for four wire channels. However, channels are also offered on a 2-wire basis and when provided, only have T and R leads for testing.

1.10 For end-to-end tests, test access is obtained at the end user interface.

2. TEST EQUIPMENT

2.01 This part of the practice provides a listing of the test equipment required for testing LADCs. The applicable test equipment is listed in paragraph 2.03. All such test equipment must also meet IEEE Standard 743-1984.

A. Apparatus Required For CO Testing

2.02 Testing arrangements vary between and within the telephone companies.

B. Apparatus Required For End-to-End Testing

2.03 The following apparatus is required when testing end-to-end between the two end-user interfaces:

- One multimeter, or equivalent
- Two Transmission Measuring Sets (TMS)
- Two Noise Measuring Sets (NMS) with C-message and flat weighting networks
- Two 135-ohm resistors, per wire pair.

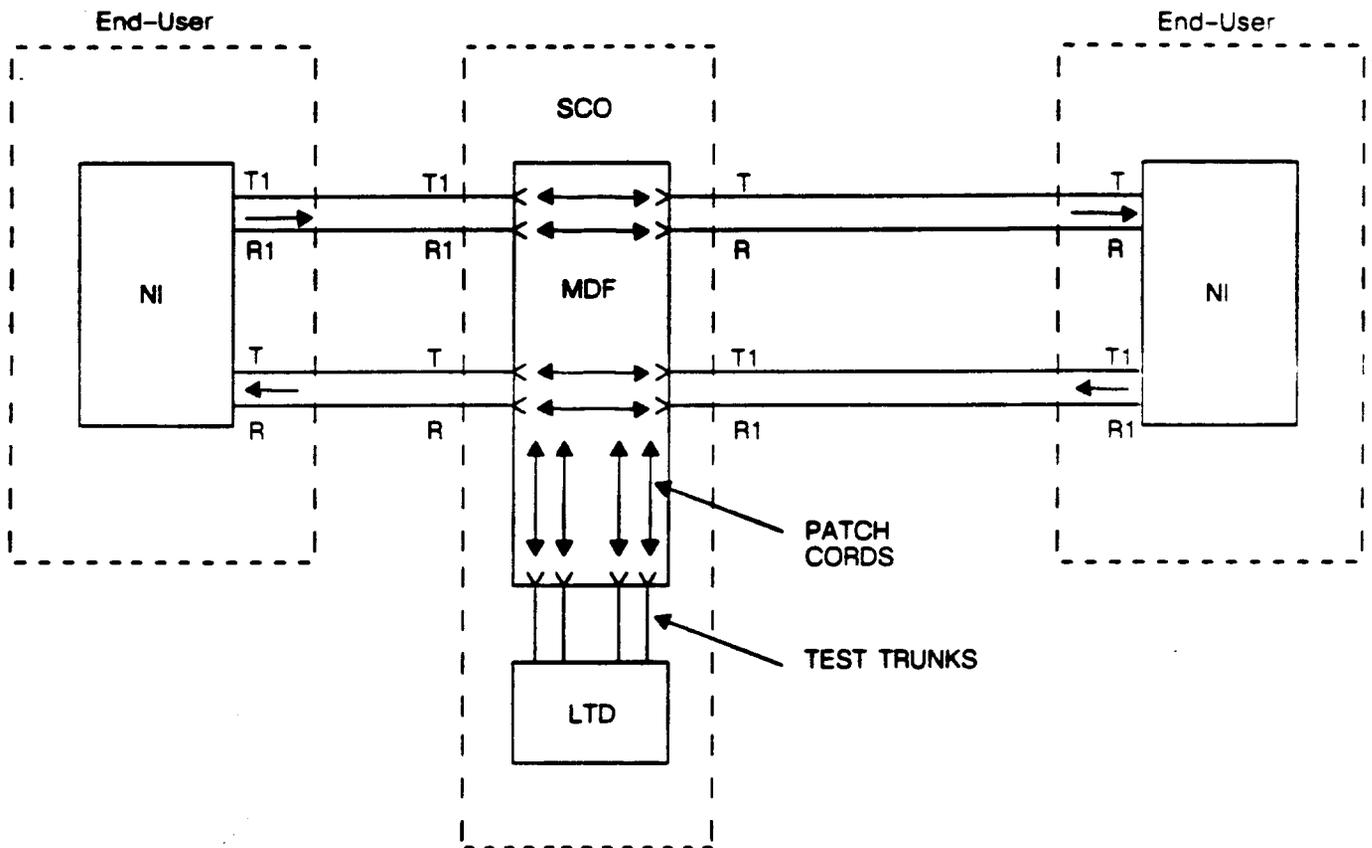


Figure 1. Test Access to a Local Area Data Channel Routed Through the SCO

3. OVERALL CHANNEL TESTS

3.01 This part of the practice provides the suggested test procedures to be followed during installation and maintenance of LADCs. The procedures consist of DC and AC measurements performed between the two end-user interfaces, with the terminal equipment (modems) disconnected. If any of the test requirements are *not* met, proceed according to instructions in the Trouble Clearing Procedures of BR 314-410-311.

Required Tests

3.02 Tests (A through F) covered in this part *should* be performed in the order given. Testing should be completed far enough in advance of the terminal equipment installation to allow time to locate and correct channel problems that may appear. (For maintenance, perform the tests as required.)

DC Tests

3.03 The following tests are performed on the LADC cable pairs to locate foreign voltage, opens, shorts, crosses, or grounds.

- Test A - Foreign Voltage
- Test B - Insulation Resistance
- Test C - Loop Resistance

Test A – Foreign Voltage

3.04 FOREIGN VOLTAGE Test Procedure:

STEP	PROCEDURE
<ol style="list-style-type: none">1. At each end-user interface, disconnect the modem from the channel and leave the cable pairs open-circuited.2. At one end-user interface, set the voltmeter range switch to the appropriate scale.3. Connect the meter to each LADC cable pair as follows and check for a voltage reading:<ul style="list-style-type: none">T and RT1 and R1 *T and GNDR and GNDT1 and GND *R1 and GND *	
	* 4-wire channels
	REQUIREMENT: Voltage reading 60 Vdc \pm 1 Vdc
<ol style="list-style-type: none">4. If voltage readings meet the above requirements, proceed to the insulation test procedure.5. If a voltage reading exceeded the requirement on any wire or pair, the faulty pair must be repaired or replaced.	

Test B – Insulation Resistance

3.05 INSULATION RESISTANCE Test Procedure:

STEP	PROCEDURE
<ol style="list-style-type: none">1. At each end-user interface, verify that the cable pairs are open-circuited and not shorted to each other or to ground.2. At one end-user interface, set the ohmmeter range switch to the OHMS x 10,000 or appropriate scale and zero adjust the meter.3. Measure insulation resistance between:	

T and R, R and R1*
T and R1*, R and T1*
T and T1*, T1 and R1*
T and GND
R and GND
T1 and GND*
R1 and GND*

* 4-wire channels

REQUIREMENT: Each insulation resistance reading must be greater than 300 kOhms

4. If the requirement of Steps 3 and 4 are met, proceed to the loop resistance test procedures.
5. If the requirement of Steps 3 and 4 are *not* met, the faulty cable pair must be repaired or replaced.

Test C – Loop Resistance

3.06 LOOP RESISTANCE Test Procedure:

STEP	PROCEDURE
1.	At one of the end-user interfaces, short the T, R pair.
2.	At the other end-user interface, set the ohmmeter range switch to the appropriate scale and zero adjust the meter.
3.	Measure the resistance of the T, R loop.
	REQUIREMENT: The resistance reading must be less than or equal to the limit specified for the channel length provided; the value is recorded on the appropriate document. If the test is not an installation test, then the loop resistance must equal $RL1 \pm 20$ percent.
* 4.	Remove the short from the T, R pair and place the short across the T1, R1 pair.
* 5.	Measure the resistance of the T1, R1 loop.
	REQUIREMENT: The resistance reading must be less than or equal to the limit specified for the channel length provided; the value is recorded on the appropriate document. If the test is not an installation test, then the loop resistance must equal $RL2 \pm 20$ percent.
6.	If the requirement of Steps 3 and 5 are met, remove the short on the cable pair and proceed to AC tests.
7.	If the requirement of Steps 3 and 5 are <i>not</i> met, there may be a faulty cable pair. If faulty, the cable pair must be repaired or replaced.

Note: When the channel is routed through the SCO, the loop resistance of each cable pair *must* be measured at the MLT and recorded on the appropriate document for future reference. The end-to-end total DC resistance should be less than or equal to 3040-ohms. channel length provided.

♦ 4-wire channels

AC Tests

3.07 The following tests are performed on the channel to ensure that the insertion loss and noise requirements are met:

- Test D - Insertion Loss
- Test E - Noise
- Test F - Impulse Noise

If the noise requirements cannot be met, the problem may be caused by pair imbalance. If faulty, the cable pair must be repaired or replaced.

Test D - Insertion Loss

3.08 When performed during initial installation, this test will verify that the channel meets the insertion loss requirements, and that load coils are not present on the cable pairs and associated bridged taps. The Actual Measured Loss (AML) should be less than or equal to the insertion loss requirements given in Table A for the particular channel length being provided. The AML should be marked on the appropriate document as a benchmark value. Insertion loss measured during maintenance tests must be within 3 dB of the value measured at installation; however, insertion loss must always be less than or equal to the limits specified in Table A.

3.09 This test requires two Transmission Measuring Sets (TMS); one at each end-user interface.

3.10 INSERTION LOSS MEASUREMENT Test Procedure:

STEP

PROCEDURE

1. Follow the manufacturers instructions and prepare the TMS for loss measurement.
2. Test must be performed at 135-ohm impedance.
3. Read the received level and record the insertion loss value on the appropriate document.

REQUIREMENT: Refer to Table A.

Note: The insertion loss (dB) = Transmit Level (dBm) - Received level (dBm). For example, if Transmit Level = -10 dBm and the Received Level = -25 dBm, then the insertion loss = -10 - (-25) = 15 dB.

4. Repeat step 3 at each test frequency indicated in Table A for the particular channel length provided.
 5. If the test results meet requirements, disconnect test equipment from both ends and proceed to the noise measurement test procedures.
 6. If test results do *not* meet the requirements, repair or replace the cable.
-

Table A. INSERTION LOSS REQUIREMENTS FOR INITIAL INSTALLATION TESTS

MAXIMUM END TO END CHANNEL LENGTH (MILES)	TEST FREQUENCY (KHz)	MAXIMUM MEASURED LOSS W/500Z (dB)
1	1.0	10.5
	2.4	12.0
	4.8	15.0
	9.6	19.0
	19.2	22.5
	38.4	26.5
2	1.0	14.5
	2.4	16.5
	4.8	20.5
	9.6	27.5
	19.2	35.5
	38.4	46.0
3	1.0	18.0
	2.4	21.0
	4.8	27.0
	9.6	36.5
	19.2	50.0
	38.4	67.0
4	1.0	21.0
	2.4	26.0
	4.8	34.0
	9.6	46.0
	19.2	62.5
5	1.0	23.5
	2.4	30.5
	4.8	39.5
	9.6	53.5
6	1.0	26.5
	2.4	33.0
	4.8	43.5
	9.6	58.5

Note: The 500Z channel protection unit is no longer required on LADCs. The above figures include the maximum loss that is still applicable for those LADCs installed with or without CPUs.

Test E - Noise

3.11 The noise test will require two measurements: one using C-message weighting and the other using flat weighting. At each end-user interface, the following equipment or apparatus will be required.

- One (1) Noise Measuring Set (NMS) with C-message and Flat weighting network settings.
- Two (2) 135-ohm resistors

3.12 **NOISE MEASUREMENT Test Procedures:**

STEP	PROCEDURE
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Note: PERFORM THE FOLLOWING STEPS AT BOTH ENDS

1. Connect the NMS and a 135-ohm resistor between the T, R pair as shown in Figure 2.
- * 2. Connect the other 135-ohm resistor between the T1, R1 pair.
3. Follow the manufacturers instructions and adjust for the C-message weighting network in the NMS.
4. Set the FUNCTION switch to 600 ohm/BRIDGE or equivalent setting.
5. Record the result.

REQUIREMENT: Less than or equal to 11 dBmC

6. Adjust the NMS for the use of the flat weighted measurements.
7. Set FUNCTION switch to the 600 ohm/BRIDGE or equivalent setting.
8. Record the result.

REQUIREMENT: Less than or equal to 28 dBm

9. If both noise requirements are met, proceed to the impulse noise test procedures.
10. If any noise requirement is *not* met, repair or replace the cable pair.

- * 4 wire channels
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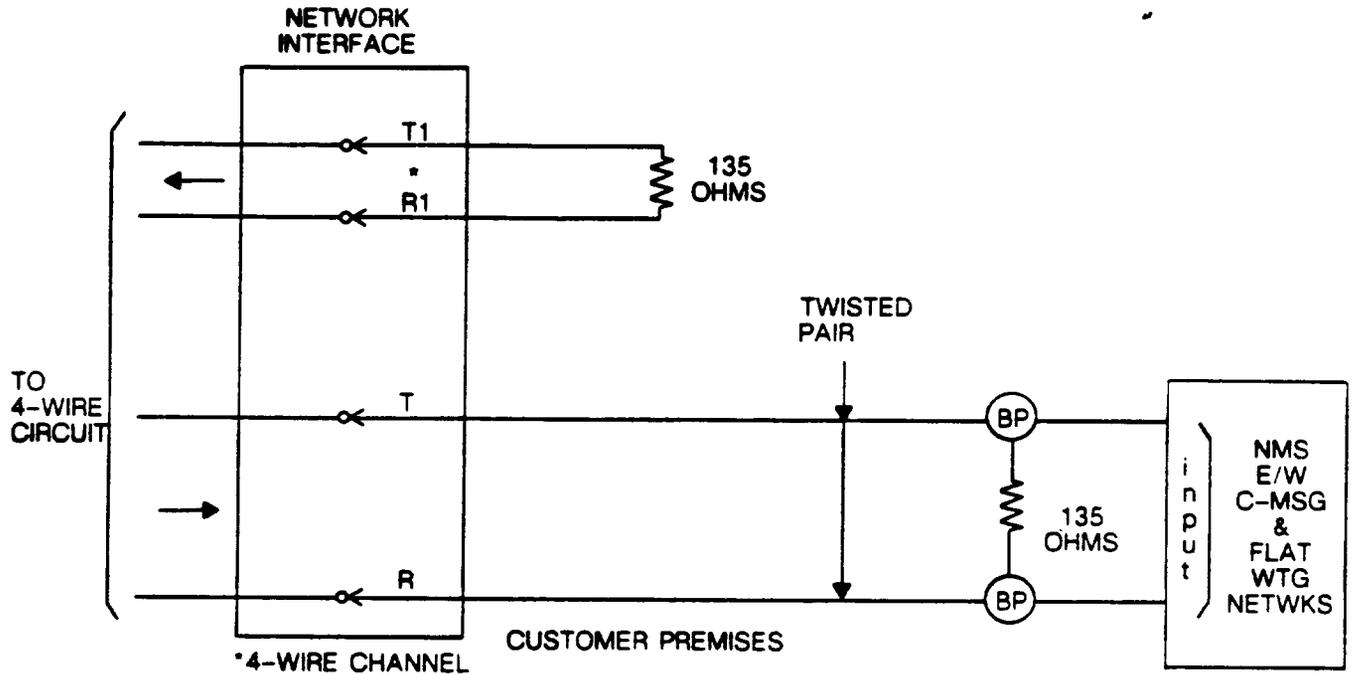


Figure 2. Test Connection For Noise Measurements

Test F - Impulse Noise

3.13 IMPULSE NOISE Test Procedure:

STEP	PROCEDURE
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1. Verify that the equipment is connected for FLAT WEIGHTED measurements.

At Both Locations

2. Adjust the NMS for an impulse noise threshold of 44 dBm.
3. Reset the counter to zero and make a 15 minute test. At the end of this time, read the total number of counts recorded on the counter.
4. Record the result.

REQUIREMENT: Less than or equal to 15 counts/15 minutes.

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5. If the impulse noise requirement is met, disconnect all test equipment and the test leads from the circuit.
 6. Remove the 135-ohm resistors from the end-user terminal.
 7. If the impulse noise requirement is *not* met, repair or replace the cable pair.
-

3.14 If all the test requirements in part 3 are met, the channel should be suitable for service.

4. REFERENCES

4.01 The following practices can be referenced for additional information:

PRACTICE	TITLE
AT&T Practice 314-410-311	Local Area Data Channels - Maintenance Procedures
AT&T Practice 460-100-400	Station Protection and Grounds
BR 880-102-100	Local Area Data Channels - Engineering Guidelines
TR Pub 41028 (6-1979)	Data Communications using Local Area Data Channels