

1. Purpose

This document provides information about the GoDigital XCel and GDSL POTS System STANDARD LOOP TEST and XCel POTS System MECHANIZED DROP TEST (MDT) capabilities, options, and their respective signatures. This document is available separately and is also included as an attachment to the *System Practice* with each XCel/GDSL/CarrierNode Shelf Shipped. One copy of the complete *System Practice* is recommended for each office. This is the fourth issue of this document and adds the CarrierNode capabilities.

1.1 Other References

1.1.1 MDT Standardization Evaluation Procedures

An additional reference document (*TECH NOTE 010190*) is available from GoDigital that details a standardization evaluation procedure for the XCel MDT capabilities in the XCel-8 and XCel-12 POTS Systems, that can assist in evaluation of MDT verification.

1.1.2 XCel Shelf Installation Procedures

INST NOTE 010108 describes the wiring for the XCel Shelf. This INST NOTE is included in the Appendix of the XCel System Practice.

1.1.3 CarrierNode Shelf Installation Procedures

INST NOTE 010212 describes the wiring for the CarrierNode Shelf, including by-pass pair daisy-chaining connections when multiple CarrierNode Shelves are placed at a single location. This INST NOTE is included in the Appendix of the XCel System Practice.

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1.3 Overview

1.3.1 XCel POTS Systems consist of a 19-inch or 23-inch XCel Multi-Service Shelf, an ACU Alarm Card, XCel-8 or XCel-12 Central Office Terminal Units (CTUs), and outside plant repeaters (STRs and ADRs) and Remote Terminal Units (RTUs and TADs). XCel-8 and XCel-12 Systems interface to the switch with individual analog (TR-057) lines, and transport these lines (either 8 or 12) over a single copper cable pair for distribution at the XCel RTU.

1.3.2 CarrierNode Systems consists of a small shelf and plug-in module and XCel-8 outside plant equipment including repeaters (STRs and ADRs) and Remote Terminal Units (RTUs and TADs). CarrierNode interfaces to the switch with an integrated (TR-008, D4, etc)) interface, and transports eight lines over three separate, single copper pair XCel loops, for distribution at the RTU. CarrierNode loop is identical to the XCel-8 loop, except for the integrated interface to the switch, and the resulting differences in the loop and drop testing.

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XCel™, GDSL® and CarrierNode™ Loop and Drop Testing



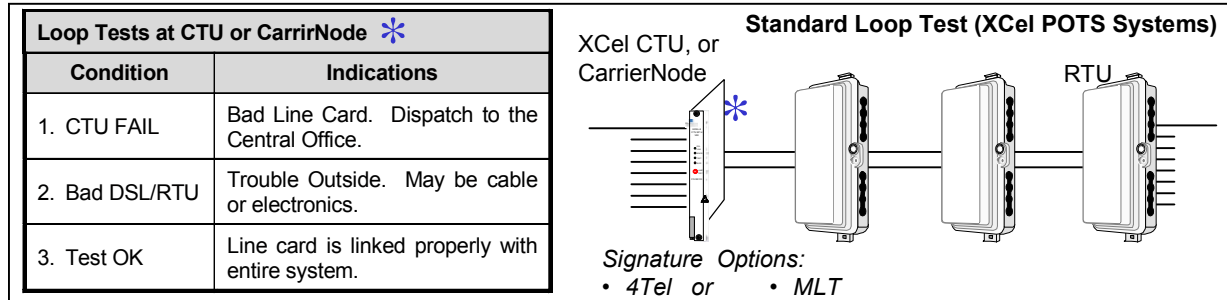
2. Loop and Drop Testing Options

The XCel/GDSL Systems support industry and customer specific standards for loop testing and for drop testing, and also for the various signature sets to respond with testing results upstream in response to the testing requests from the switch. This enables the System to be easily integrated into the current office and network environment of the various service providers. When selecting a XCel/GDSL POTS system the user must first decide whether they want to support GoDigital's Standard Loop Test, or Mechanized Drop Test (MDT).

2.1 Standard Loop Testing

Standard Loop Testing is an abbreviated testing that occurs in the XCel/GDSL CTU or CarrierNode.

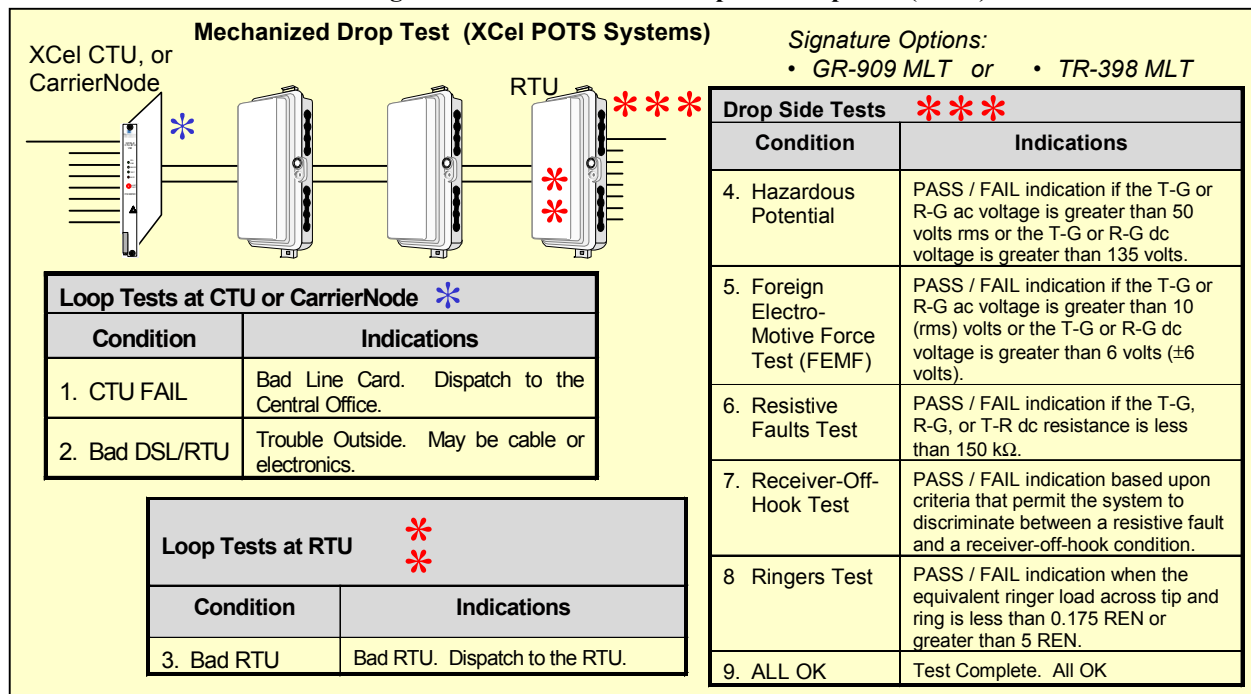
Figure 2.1-1: Standard Loop Test



2.2 Mechanized Drop Testing (MDT)

Mechanized Drop Testing supports additional pass/fail tests at the RT including drop testing based on industry standard (GR-909) criteria. MDT functionality is available as an option when ordering MDT capable XCel CTUs, CarreirNode Modules and outside plant elements

Figure 2.2-1: Mechanized Loop and Drop Test (MDT)



2.2.1 All XCel Outside Plant Elements that are designated with an "M9" designation are capable of supporting Drop testing. When drop testing is desired, the MDT options must be used with different (optional MDT capable) OSP equipment with drops. XCel-8 and XCel-12 CTUs must also be ordered with the designation "M9" or "M3" in the product description.

2.2.2 CarrierNode does not come in various options. The type of testing (Standard Loop Test or MDT) is established with provisioning switch settings. CarrierNode does require that the “M9” OSP units be used when supporting MDT drop testing capability.

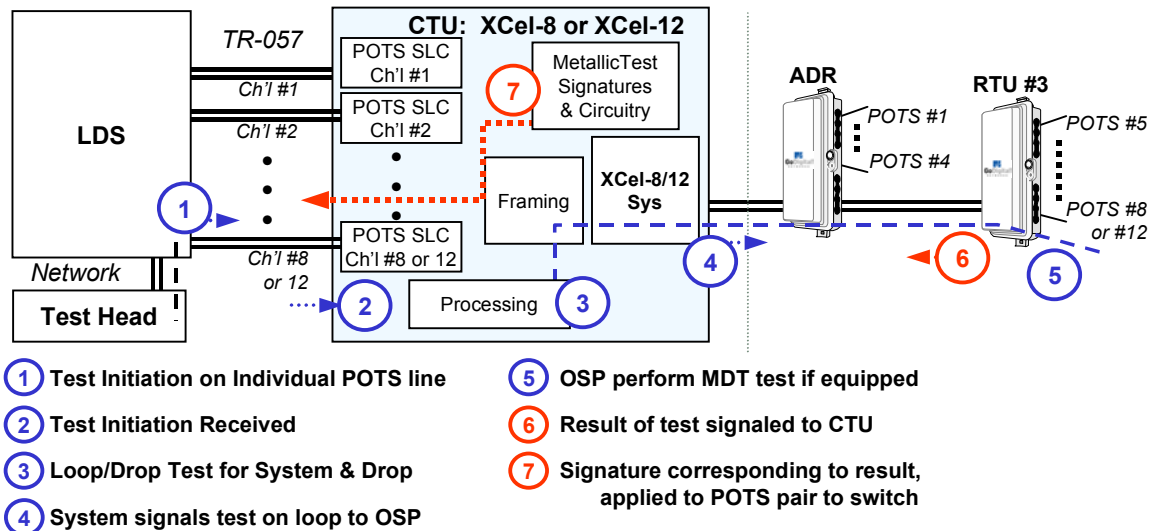
2.2.3 The MDT option is not available with GDSL-8 System in the older GDSL Shelf.

3. XCel-8, GDSL-8 and XCel-12 POTS Systems Loop and Drop Testing

3.1 XCel-8, GDSL-8 and XCel-12 POTS Systems interface to the switch with TR-057 analog POTS interfaces. Testing is initiated from the switch and testing system on each line individually, and the XCel-8, GDSL-8 or XCel-12 CTU runs the appropriate tests (Standard Loop, or MDT). A CTU automatically responds by presenting an appropriate “signature” on the line same to the switch, based on the results of the testing.

3.2 Signatures are resistance values across tip-to-ground, ring-to-ground, and tip-to-ring, which match a published template and are quickly interpreted by the test system. The Teradyne and MLT test systems, in coordination with the switch, read and interpret the signatures provided by the XCel CTU. 4Tel reports test results using the UDC system format. XCel-8, GDSL-8 and XCel-12 CTUs are customized for particular signature templates for reporting results. For detail on the signatures, see [Section 5](#) of this INST NOTE.

Figure 3.1-1: XCel-8 and XCel-12 Loop and Drop Testing



4. CarrierNode POTS Loop and Drop Testing

4.1 General CarrierNode Loop and Drop Testing

4.1.1 The CarrierNode System interfaces via an integrated DS1 line (TR-008, D4 etc) to the switch.

4.1.2 Testing is initiated by the switch and test system using signaling within the DS1. The CarrierNode detects the test request for a line and runs the appropriate tests. These tests will include drop testing if the MDT settings have been provisioned on the CarrierNode Module, and if the OSP units are MDT capable.

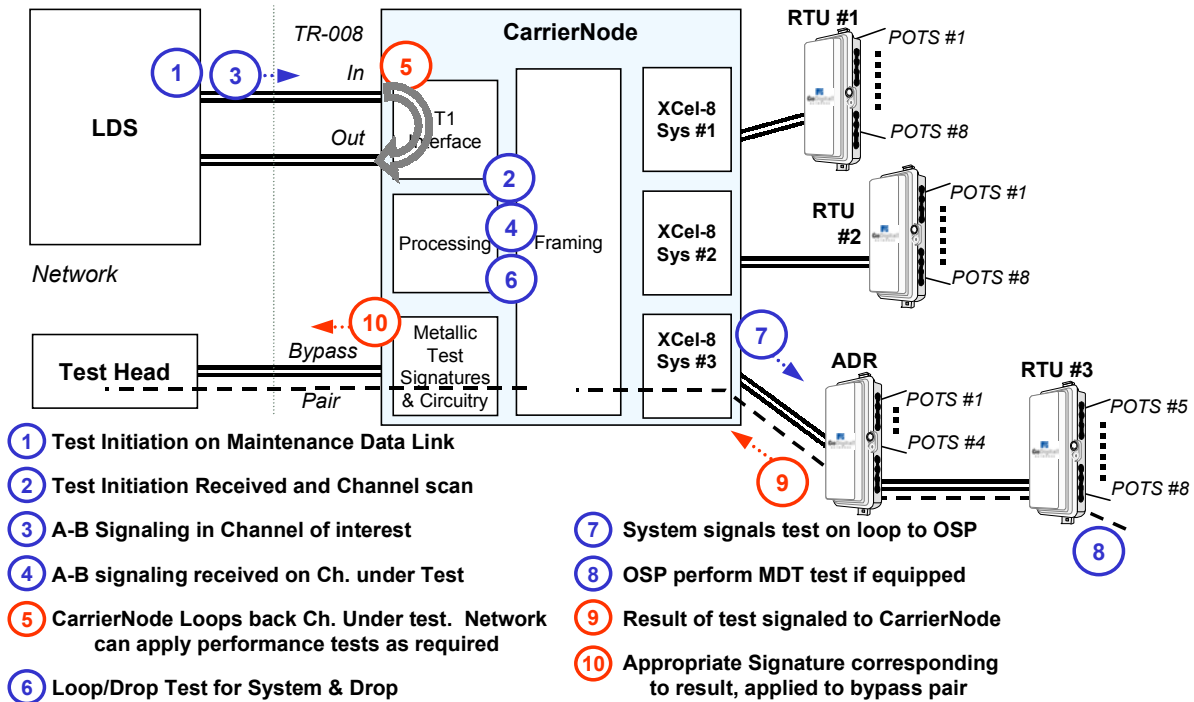
4.1.3 CarrierNode then automatically responds, based on the results of the testing, by presenting the appropriate “signature” on the CarrierNode BYPASS pair to the testing system.

4.1.4 Signatures are resistance values across tip-to-ground, ring-to-ground, and tip-to-ring, which match a published template and are quickly interpreted by the test system.

4.1.5 The Teradyne and MLT test systems, in coordination with the switch, read and interpret the signatures provided by the CarrierNode.

4.1.6 For detail on the signatures options, see [Section 5](#) of this INST NOTE.

Figure 4.1-1: CarrierNode Loop and Drop Testing



4.2 CarrierNode Bypass Pair

CarrierNode uses a bypass pair connection on the backplane to present test result signatures because CarrierNode does not use individual analog lines to the switch. The bypass pair can be a physical pair and run directly to the test system in the office, or the CarrierNode bypass pair can use the “electronic bypass” capability of a digital loop carrier system such as an MCU. Alternatively the CarrierNode bypass pair signatures can be relayed through a DLC or a fiber mux, in conjunction with a stand alone electronic bypass pair system such as the Tollgrade Micro-Bank.

4.2.1 Daisy-Chaining Multiple CarrierNode Shelves

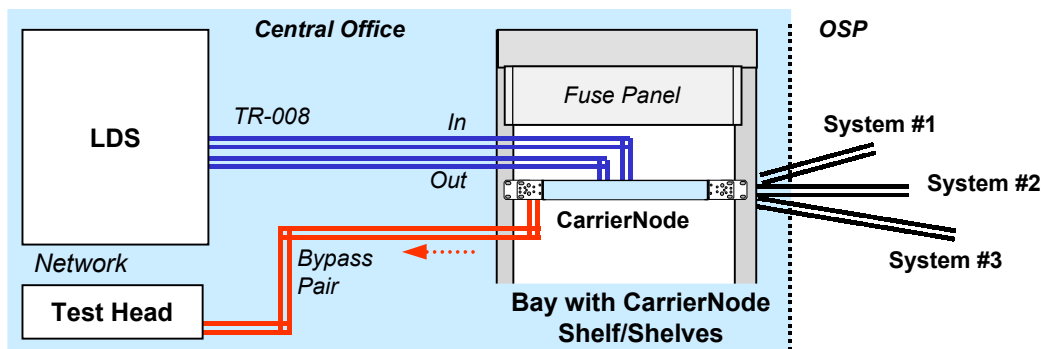
Multiple CarrierNode Shelves can have their by-pass pairs daisy chained onto the same bypass pair interface to the test system. For detail on daisy-chain wiring of more than one CarrierNode Shelf, see *INST NOTE 020212* shipped with each CarrierNode Shelf.

4.2.2 By-pass Pair Configurations

4.2.2.1 CarrierNode Placed in the Central Office

If CarrierNode is placed in the C.O., the bypass pair can run directly to the test system.

Figure 4.2.2-1: CarrierNode in Central Office with By-pass Pair



4.2.2.2 CarrierNode placed in a DLC RT

If CarrierNode is placed in a DLC RT (remote terminal) cabinet or site, there are three basic options for transporting the CarrierNode by-pass pair signatures to the office.

4.2.2.2.1 DLC RT Option 1: Daisy-chain Existing DLC MCU to By-pass Pair Interface on Carrier Node

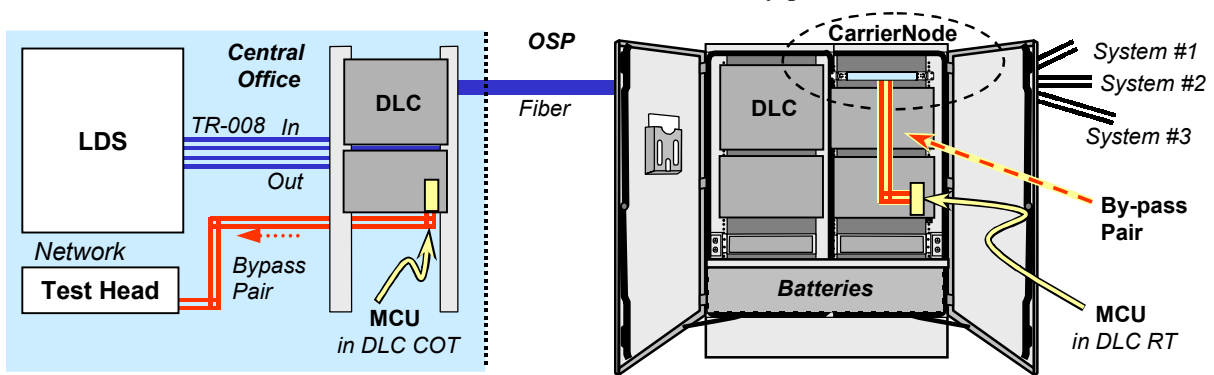
- This can be used with non Alcatel DLC systems, and with

4.2.2.2.2 Alcatel Litespan in “Non-LiteSpan Mode” DLC RT Option 2: Additional DLC MCU to By-pass Pair Interface on Carrier Node.

- This can be used with Alcatel Litespan when it is operating in “Litespan mode”.

Figure 4.2.2-2

CarrierNode in DLC RT Location with By-pass Pair via MCU in DLC

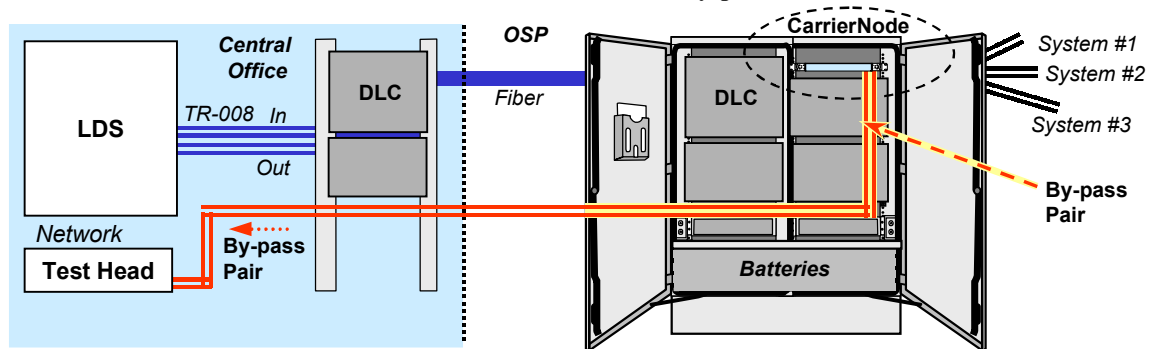


4.2.2.2.3 DLC RT Option 3: Dedicated By-pass Pair to the Central Office

If a dedicated pair is available from the C.O. to the RT location, the CarrierNode bypass pair can be run directly to C.O. and the test system.

Figure 4.2.2-3

CarrierNode in DLC RT Location with By-pass Pair RT Direct to CO



4.2.2.3 CarrierNode placed in remote Fiber Mux site (no DLC).

If CarrierNode is placed at a remote site that does not have a DLC, but which does have a fiber mux, then separate remotely based electronic by-pass equipment can be used. Example: Tollgrade Micro-Bank to by-pass pair interface on Carrier Node

4.2.2.3.1 The Micro-Bank interfaces to the Fiber Mux (or to a DLC) with a DS1, and the DS1 is transported through the fiber to a Micro-Bank in the CO, where the CarrierNode signatures are recreated and delivered to the Test System.

4.2.2.3.2 This option can also be used in a DLC that does not support an additional by-pass pair into an MCU in its RT. When using a DLC to transport the

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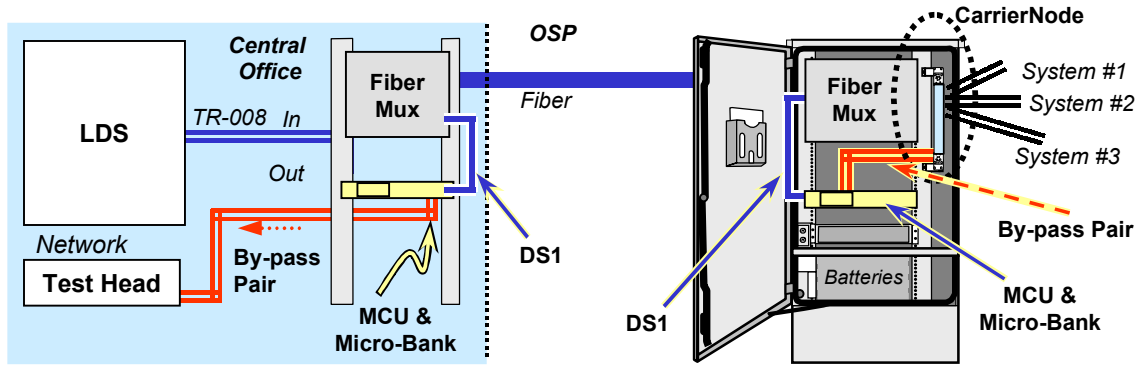


remote location's Micro-Bank signaling, only 4 DS0s are required, and they are provisioned directly to the CO Micro-Bank.

4.2.2.3.3 TollGrade's Micro-Bank can also regenerate DC alarms from CarrierNode.

Figure 4.2.2-4

CarrierNode at Fiber Mux Site with By-pass Pair via MCU & Micro-Bank



5. Signature Options for GoDigital POTS Loop and Drop Testing

5.1 XCel/GDSL Test Signatures with Loop Testing ONLY (No Drop Testing)

5.1.1 XCel/GDSL Standard Loop Testing 4Tel Signatures (No Drop Testing Option)

CTU Description	CTU Part Number	Platform
• CTU 8P 190V 544 UNI 4T V90	990160-A	GDSL Shelf Only
• CTU H 8P 190V 544 UNI 4T V90	990120-A	XCel Multi-Svc Shelf Only
• CTU H 12P 190V 784 UNI 4T V90	990153	XCel Multi-Svc Shelf Only
• CN MOD 3X8P SELV 544 INT	990295	CarrierNode Shelf Only

Table 5.1-1 : XCel/GDSL Standard Loop Testing 4Tel Signatures

4TEL Test Signatures*					
Loop Tests Only					
	CODE	T/R	T/G	R/G	Indications
1	CTU	OPEN	185.25K – 204.75K 195K	185.25K – 204.75K 195K	Bad Line Card. Dispatch to the Central Office.
2	RTU / DSL	OPEN	185.25K – 204.75K 195K	451.25K – 498.75K 475K	Trouble Outside. May be cable or electronics.
3	OK	OPEN	185.25K – 204.75K 195K	315K – 348.6K 331.8K	Line card is linked properly with entire system.

*Signatures –3%, +5%

5.1.2 XCel/GDSL Standard Loop Testing MLT Signatures (No Drop Testing Option)

CTU Description	CTU Part Number	Platform
• CTU 8P 130V 544 UNI M V90	990165	GDSL Shelf Only
• CN MOD 3X8P SELV 544 INT	990295	CarrierNode Shelf Only

Table 5.1-2 : GDSL Standard Loop Testing MLT Signatures

MLT Test Signatures*					
Loop Tests Only					
	Condition	T/R	T/G	R/G	Indications
1	CTU FAIL	3500K/OPEN	160K	160K	Bad Line Card. Dispatch to the Central Office.
2	Bad DSL/RT	160K	80K	80K	Trouble Outside. May be cable or electronics.
3	Test OK	3500K/OPEN	80K	80K	Line card is linked properly with entire system.

*Signatures –3%, +5%

5.2 Test Signatures with Loop and Mechanized Drop Testing (MDT)

5.2.1 MDT Testing with GR-909 MLT Signatures and XCel BIAS Voltage (-14V).

<u>CTU Description</u>	<u>CTU Part Number</u>	<u>Platform</u>
• CTU H 8P 190V 544 UNI M9 V90.....	990106.....	XCel Multi-Svc Only
• CTU H 8P 130V 544 UNI M9 V90.....	990124-A.....	XCel Multi-Svc Only
• CTU H 12P 190V 784 UNI M9 V90.....	990144.....	XCel Multi-Svc Only
• CTU H 12P 130V 784 UNI M9 V90.....	990127.....	XCel Multi-Svc Only
• CN MOD 3X8P SELV 544 INT.....	990295.....	CarrierNode Shelf Only

Table 5.2-1: XCel Standard Loop AND Mechanized Drop Testing with GR-909 MLT Signatures (M9)

		MLT Test Signatures**			Indications
CODE	T/R	T/Bias*	R/Bias*		
Loop Tests					
1	CTU FAIL	17.8K	110K	110K	Bad Line Card. Dispatch to the Central Office.
2	Bad DSL/RT	OPEN	90.9K	90.9K	Trouble Outside. May be cable or electronics.
3	RTU FAIL	17.8K	90.9K	90.9K	Bad RTU. Dispatch to the RTU.
Drop Tests					
4	HP	78.5K	90.9K	90.9K	PASS / FAIL indication if the T-G or R-G ac voltage is greater than 50 volts rms or the T-G or R-G dc voltage is greater than 135 volts
5	FEMF	27.8K	90.9K	90.9K	PASS / FAIL indication if the T-G or R-G ac voltage is greater than 10 volts or the T-G or R-G dc voltage is greater than 6 volts.
6	RES FAULT	58K	90.9K	90.9K	PASS / FAIL indication if the T-G, R-G, or T-R dc resistance is less than 150 kΩ.
7	ROH	68K	90.9K	90.9K	PASS / FAIL indication based upon criteria that permit the system to discriminate between a resistive fault and a receiver-off-hook condition.
8	RINGERS	48.3K	90.9K	90.9K	PASS / FAIL indication when the equivalent ringer count across tip and ring is less than 0.175 REN or greater than 5 REN.
9	OK	38.3K	90.9K	90.9K	Test Complete. All OK

**Signatures -3%, +5%, *BIAS = -14 Volts

5.2.2 MDT Testing with TR-398 MLT Signatures and XCel BIAS Voltage (-14V).

<u>CTU Description</u>	<u>CTU Part Number</u>	<u>Platform</u>
• CTU H 12P 130V 784 UNI M3 V90.....	990235.....	XCel Multi-Svc Only
• CTU H 12P 190V 784 UNI M3 V90.....	990237.....	XCel Multi-Svc Only
• CN MOD 3X8P SELV 544 INT.....	990295.....	CarrierNode Shelf Only

Table 5.2-2: XCel Standard Loop and MDT Drop Testing with Standard TR-398 MLT Signatures (M3)

		MLT Test Signatures**			Indications
CODE	T/R	T/Bias*	R/Bias*		
Loop Tests					
1	CTU FAIL	OPEN (>1000)	75.9K	75.9K	Bad Line Card. Dispatch to the Central Office.
2	Bad DSL/RT	28.0K	75.9K	75.9K	Trouble Outside. May be cable or electronics.
3	RTU FAIL	17.8K	75.9K	75.9K	Bad RTU. Dispatch to the RTU.
Drop Tests					
4	HP	63.4K	75.9K	75.9K	PASS / FAIL indication if the T-G or R-G ac voltage is greater than 50 volts rms or the T-G or R-G dc voltage is greater than 135 volts
5	FEMF	63.4K	75.9K	75.9K	PASS / FAIL indication if the T-G or R-G ac voltage is greater than 10 volts or the T-G or R-G dc voltage is greater than 6 volts.
6	RES FAULT	63.4K	75.9K	75.9K	PASS / FAIL indication if the T-G, R-G, or T-R dc resist. is less than 150 kΩ.
7	ROH	102.0K	75.9K	75.9K	PASS / FAIL indication based upon criteria that permit the system to discriminate between a resistive fault and a receiver-off-hook condition.
8	RINGERS	80.6K	75.9K	75.9K	PASS / FAIL indication when the equivalent ringer count across tip and ring is less than 0.175 REN or greater than 5 REN.
9	OK	130.0K	75.9K	75.9K	Test Complete. All OK

**Signatures -3%, +5%, *BIAS = -14 Volts

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XCel™, GDSL® and CarrierNode™ Loop and Drop Testing



6. CarrierNode Local Test Initiation and Local Display of Results

CarrierNode is locally able to select any of the twenty-four POTS lines (eight lines for each of the three XCel-8 loops) and check status (off-hook, ringing, or on-hook) and locally run a loop and drop test.

6.1.1 A loop/drop test is initiated at the CarrierNode by:

- First, selecting a System (#1, #2 or #3) and
- Then by selecting and viewing the status of a particular line (#1 - #8).
- Once the line status is being viewed, pressing the “MDT” button on the front of the CarrierNode Module will trigger a loop/drop test.
- The test is run automatically when the button is pressed.
- The results are displayed locally on the CarrierNode’s Alpha-Numeric Display.

6.1.2 For detailed procedures, including menu and displays, for initiating a loop/drop test at the CarrierNode, see *Item 9* in *INST NOTE 010213*, in the Appendix of the System Practice.

Figure 6.1-1: CarrierNode Alpha-Numeric Local Display of Locally Initiated Loop/Drop Test Results

<p>SY1_LN_x_MDT_TST</p> <p>After testing is completed</p> <p>↓</p> <p>Results are Automatically reported →</p> <p>·</p> <p>·</p> <p>·</p> <p>·</p> <p>·</p> <p>·</p> <p>·</p> <p>·</p> <p>After 2-5 seconds the display returns to the line display SY1_LN_x_--</p>	<p>The MDT test on System #1 Line #x is being run and the results will automatically be reported. The test will take 1 – 2 seconds to complete. After the test is complete, the test results will be displayed for approximately two to five (2 – 5) seconds. After 2-5 seconds, the Diagnostic Display will clear the MDT results and will return to show the System # and Line # status.</p>
<p>MDT 1.1 SY1_LN_x_M_CTUF</p>	<p>XCel System: “CTU FAIL” “CTU” circuit in the CarrierNode Is testing bad. Dispatch to the CarrierNode site for maintenance.</p>
<p>MDT 1.2 SY1_LN_x_M_DSLF</p>	<p>XCel System: “Bad DSL or RTU” “DSL” or RTU has failed. Trouble may be cable or electronics.</p>
<p>MDT 1.3 SY1_LN_x_M_RTUF</p>	<p>XCel System (*M9 ONLY): “Bad RTU” The “RTU” functioning but is indicating a problem. Dispatch to the outside plant remote unit (RTU, ADR etc).</p>
<p>MDT 1.4 SY1_LN_x_M_HAZP</p>	<p>XCel System (*M9 ONLY): HAZARDOUS POTENTIAL Problem on Drop: T-G or R-G, AC voltage is greater than 50 volts rmsm or the T-G or R-G dc voltage is greater than 135 V. Dispatch to the drop site for maintenance.</p>
<p>MDT 1.5 SY1_LN_x_M_FEMF</p>	<p>XCel System (*M9 ONLY): “Foreign Electro-Motive Force” Problem on Drop: T-G or R-G, voltage is greater than 10 (rms) volts or the T-G or R-G dc voltage is greater than 6 volts (±6 V.) Dispatch to the drop site for maintenance.</p>
<p>MDT 1.6 SY1_LN_x_M_RESF</p>	<p>XCel System (*M9 ONLY): “Resistive Fault” Problem on Drop: T-G, R-G or T-R dc res. is less than 150 kΩ. Dispatch to the drop site for maintenance.</p>
<p>MDT 1.7 SY1_LN_x_M_ROH_</p>	<p>XCel System (*M9 ONLY): “Receiver-Off-Hook Test” Indication based on criteria that discriminate between a resistive fault and a receiver-off-hook condition.</p>
<p>MDT 1.8 SY1_LN_x_M_RNGR</p>	<p>XCel System (*M9 ONLY): “Ringers Test” Indication when the equivalent ringer load on the drop across tip and ring is less than 0.175 REN or greater than 5 REN.</p>
<p>MDT 1.9 SY1_LN_x_ _M_OK</p>	<p>XCel System: “ALL OK”</p>

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