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SmartBits

Performance Analysis System

SmartApplications User Guide

Version 2.50

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SPIRENT Communications

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SPIRENT
Communications

About this Guide

In *About this Guide...*

This portion of the user guide contains the following sections:

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- *Audience.....2*
- *Manual Contents.....2*
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- *Related Manuals.....3*
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Purpose

This user guide provides information on all procedures required to perform tests using *SmartApplications* 2.50 application software. This includes details on software installation, test setup, and test result interpretation.

Audience

This user guide is for users of *SmartApplications* 2.50 software. It is assumed that users of this guide are familiar with Microsoft Windows and SmartBits equipment, and have an intermediate knowledge level of data communications theory.

Manual Contents

This guide contains the following chapters:

Chapter	Title	Description
1	*SmartApplications Overview*	Provides an overview of *SmartApplications*.
	Basic Test Theory	Explains general theory of operation and rules for testing.
3	*Install and Connect*	Lists system requirements and explains how to connect your PC to the SmartBits and DUT.
4	*Basic Navigation and Tools*	Describes the *SmartApplications* main window and results windows, including menus and task buttons.
5	*Set Up Tests*	Explains procedures required to set up *SmartApplications* tests.
6	*Run Tests*	Explains procedures to start, stop, and run tests, and view reports.
7	*Test Examples*	Provides sample test scenarios and explains test results.

Conventions Used in This Guide

This guide uses the following conventions:

- *Italics* are used for document names and special terms.
- Menu options, field names, and tab names are **bolded**.
- Paths are shown with "greater than" symbols: **Test > Setup Options > Throughput**. In this example, you would click on the **Test** menu option, then on the **Setup Options** selection, and then on the **Throughput** tab.
- Directory and file names are shown in Helvetica.
- The terms packet and frame are used interchangeably.
- The term *card* is used to refer generally to any SmartCard or module for SmartBits systems.

Notes, cautions, and other important user information are shown as follows:



Note: Includes related information and tips.



Caution: Includes related precautions.



Important: Includes related important.



Warning: Includes related warnings to prevent damage to equipment and or injury.

Related Manuals

Additional SmartBits documentation that is related to this User Guide include:

- *SmartBits Getting Started*
- *SmartBits System Overview and Reference*
- *Using GPS with SmartBits*

Online Help

SmartApplications provides online Help for all windows and tabs. You can access online Help in two ways:

- Press the **F1** key from the window about which you wish information.
- From the menu bar, select **Help > Contents** to view the entire contents of the Help file or **Help > Search** for Help On to search by a specific topic or word.

Chart Facility Help

SmartApplications includes a chart facility that can be used to represent test results graphically. The facility contains a separate Help file called *First Impression*. If you access Help from a chart-related window in either of the ways listed above, you will view chart-related Help only. Once you return to the Results window, you can view *SmartApplications* Help.

How to Contact Us

Technical support is available Monday through Friday between 07:00 and 18:00 Pacific Standard Time.

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1 SmartApplications Overview

In this Chapter

This chapter contains the following sections:

- *What is SmartApplications?.....6*
- *What are SmartCards and Modules?.....7*
- *Supported Cards and Modules.....7*

What is SmartApplications?

SmartApplications is an easy-to-use suite of tests for LAN switches and routers connecting to Ethernet, ATM, Wide Area Network (WAN), or Token Ring networks. It enables you to test how well a device performs with either packet-based or stream-based network traffic, as simulated by the SmartBits system. You can assess the performance of a device under test (DUT) with up to 768 ports.

SmartApplications tests are based on:

- RFC 1242, *Benchmarking Terminology for Network Interconnection Devices*, edited by Scott Bradner (sob@harvard.edu)
- An informational document, *Benchmarking Methodology for Network Interconnect Devices*, edited by Scott Bradner
- RFC 2544, *Benchmarking Methodology for Network Interconnect Devices*, edited by Scott Bradner and Jim McQuaid (mcquaidj@netscout.com)

RFC 1242 and RFC 2544 outline the following tests for network devices:

- Throughput
- Latency
- Frame Loss Rate
- Back-to-Back

These tests are implemented in SmartApplications.

RFC 1242 also contains a complete definition of the terms for which the tests are named. RFC 2544 describes how to measure and test performance, including specific formats in which to report test results and maximum frame rates to use with specific frame sizes.

RFC 1242 and RFC 2544 are available at www.ietf.org.

The informational document is available at the NDTL ftp site: ndtl.harvard.edu.

What are SmartCards and Modules?

SmartCards and modules are custom-designed printed circuit boards (PCBs) that fit within a SmartBits chassis to generate, capture, and analyze network packet data.

SmartBits systems use two types of cards and modules, depending on chassis type.

SmartCards are designed to fit into the SMB-2000 and SMB-200 chassis.

Modules are designed to fit into the SMB-6000B and SMB-600 chassis. They provide a higher port density than do SmartCards.

For simplicity, the term *card* is sometimes used to refer to any SmartCard or module in a SmartBits system.

Supported Cards and Modules

SmartApplications 2.50 may be used with the follow SmartCards and modules.

Table 1-1. Supported SmartCards and Modules

Chassis	Network Topology	SmartCard or Module
SMB-6000	10/100Mb Ethernet	LAN-6100A 100Mb Ethernet TP
		LAN-6101A 10/100Base-TX SmartMetrics
	Gigabit Ethernet	LAN-6200A(s) 1000Base-SX
		LAN-6201A(s) 1000Base-SX SmartMetrics
		LAN-6201B 1000Base-X GBIC SmartMetrics
SMB-600/6000B	10/100Mb Ethernet	LAN-3100A 10/100Base-TX SmartMetrics
		LAN-3101A 10/100Base-TX TeraMetrics
		LAN-3102A 10/100Base-TX SmartMetrics
		LAN-3111A 100Base-FX SmartMetrics
		LAN-3302A 10/100Base-T TeraMetrics
	10/100/1000Mb Ethernet *and* Gigabit Ethernet	LAN-3200A(s) 1000Base-SX
		LAN-3201As 1000Base-SX SmartMetrics
		LAN-3201B 1000Base-X GBIC SmartMetrics
		LAN-3300A 10/100/1000Base-T SmartMetrics

Table 1-1. Supported SmartCards and Modules (continued)

Chassis	Network Topology	SmartCard or Module
SMB-600/6000B (*continued*)	10/100/1000Mb Ethernet *and* Gigabit Ethernet (*continued*)	LAN-3301A 10/100/1000Base-T TeraMetrics
		LAN-3310A 1000Base-X GBIC SmartMetrics
		LAN-3311A 1000Base-X GBIC TeraMetrics
SMB-200/2000	ATM	AT-9015 1.544Mb T1
		AT-9020 2.048Mb E1
		AT-9025 25Mb
		AT-9034(B) 34Mb E3
		AT-9045B 45Mb DS3
		AT-9155(C)(Cs) 155Mb
		AT-9622(s) 622Mb
	Gigabit Ethernet	GX-1405B(s) 1Gb Ethernet Fiber
		GX-1420A 1Gb Copper Ethernet TP
		GX-1420B 100Mb/1Gb Copper Ethernet TP
	10Mb Ethernet	ML-5710 100Mb SmartMetrics Ethernet and USB (*only Ethernet mode is supported*)
		ST-6410 10Mb Full Duplex Ethernet TP
	100Mb Ethernet	ML-7710 100Mb SmartMetrics VLAN Ethernet TP
		ML-7711 100Mb SmartMetrics VLAN Ethernet Fiber
		SX-7210 100Mb Ethernet VLAN MII
		SX-7410B 100Mb Ethernet VLAN TP
		SX-7411 100Mb Ethernet VLAN Fiber
	Token Ring	TR-8405 4/16 Token Ring
	WAN	WN-3405 8Mb V.35 Frame Relay
		WN-3415 1.544Mb T1 Frame Relay
		WN-3420A 2.048Mb E1 Frame Relay

2 Basic Test Theory

In this Chapter...

This chapter contains the following sections:

- *General Testing Methodology.....10*
- *Throughput Test Methodology.....12*
- *Latency Test Methodology.....14*
- *Packet Loss Rate Test Methodology.....16*
- *Back-to-Back Test Methodology.....17*

General Testing Methodology

Each *SmartApplications* test has two features in common:

- Each test measures device forwarding capabilities, *and*
- Each requires a pair of SmartBits SmartCards to test frame forwarding: one card is the transmitter, the other is the receiver.

Before testing a device you must:

1. Identify the number of the ports you want to test.
2. Ensure that each port to be tested has a unique MAC address.

You can chose multiple packet sizes and test durations, as specified in the RFC.

SmartApplications logs test results into individual standard ASCII files that you can view or print with standard utilities.

Test Terminology

Test — The term *test* refers to the test type, such as Throughput or Latency, run for a specific frame size.

Iteration — An *iteration* occurs when *SmartApplications* varies the transmission rate, based on the last failed rate, while maintaining the frame size. The specified test resolution and number of repetitions determines the accuracy of results.

Trial — A *trial* is a set of *iterations* for a specific frame size, with varying transmission rates. Within a test, trials are used to determine the optimal rate of traffic for that frame size. It is possible to have multiple trials for one frame size. Detailed results display multiple trial results. You specify the number of trials in the *Setup Test Configuration* window.

Figure 2-1 illustrates these terms.

Sample Test Configuration

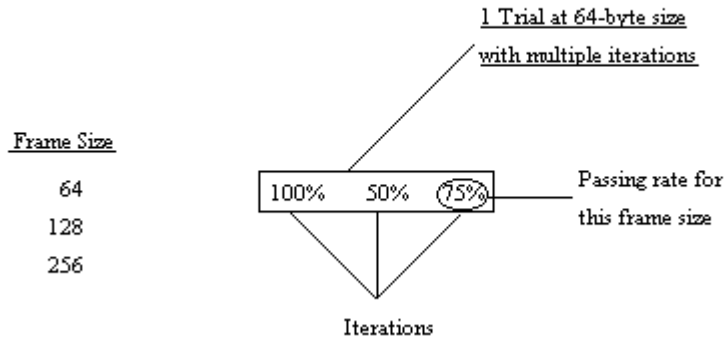


Figure 2-1. Trial and Iterations for a Sample Test Configuration

Address Learning for SmartCards

SmartApplications assumes that the device under test (DUT) has no knowledge of any forwarding or routing required. To initialize the DUT's forwarding tables, the SmartBits sends learning packets.

You can also instruct the SmartBits to send learning packets between every test trial, to refresh a device forwarding table before addresses are eliminated by aging.

Table 2-1 shows the makeup of the learning packets that are sent.

Table 2-1. Learning Packet Contents

Packet Area	Size (Bytes)	How Used
Destination	6	MAC address.
Source	6	MAC address.
Protocol	Variable	Matching user selection of IP, UDP, IPX, or 32 bytes of *All zeros* or *All 0xFF.*
Test Specific	12	**Packet Loss and Back-to-Back** Six bytes of the SmartBits stamp in an ASCII string (NETCOM), and six bytes of the destination address. **Throughput** A six-byte incrementing counter with six bytes of destination MAC address. **Latency** A six-byte decrementing counter with six bytes of destination MAC address.
Rest of Packet	*n*	Length varies, depending on the fill pattern for the selected protocol type.
CRC	4	Error detection.

Throughput Test Methodology

The Throughput test tests the fastest rate at which a device can forward frames without error. If a single frame is dropped, the test fails and is repeated at a lower throughput rate.

The throughput test satisfies the terminology criteria of RFC 1242 and the test methodology specified in RFC 2544. From RFC 1242, throughput is:

> *"the maximum rate at which none of the offered frames are dropped by the device."*

From RFC 2544, the methodology to measure throughput is to:

> *"send a specific number of frames at a specific rate through the DUT and then count the frames that are transmitted by the DUT."*

SmartApplications measures throughput by first sending a series of frames with a particular source and destination MAC address to the device under test. The frames are sent from one SmartBits port and are intended to be received by a second SmartBits port.

Interframe Gap

InterFrame Gap is determined by the initial rate in the test setup. If the initial rate is set to 100%, frames are sent initially with the gap set to the minimum legal size for the topology and speed of the transmitting SmartCard.

How frames are sent and counted

The number of frames sent is determined by the length of time the test is to run. Frames are validated by counting only frames generated by the sending port, not any packets sent by the switch. Keep-alive and routing update frames are not counted as received frames.

Initial frame rate

If the initial rate is 100%, the frame rate for the first trial, for a given frame length, is the maximum rate for the topology and speed of the transmitting SmartCard.

Test progress

1. If all frames from the transmitting SmartBits port are received by the receiving port, no further trials are attempted and the maximum frame rate is recorded as the throughput.
2. If the first trial fails (if even a single frame is lost), the second trial frame rate drops to 20% lower than the failed rate.
3. The third trial and each subsequent trial uses a binary search to determine a rate that is halfway between the last failed rate and the last successful rate.
4. The test finishes when the frame loss percent is less than or equal to the resolution value in the test setup (depending on the interframe gap resolution of the card[1]).

Test results

Test results are automatically logged to a file showing maximum data rate by port pair and aggregate frame data rate. Also logged is the percentage achieved of maximum theoretical frame data rate for each selected frame size.

This test is performed for a user-specified number of times and the results are averaged.

1. Refer to the *SmartBits System Reference* manual for information on the gap resolution of specific cards and modules.

Acceptable Loss Throughput

In some cases, differences in clock tolerances between the DUT port and the SmartBits port will cause Throughput test results to show frame loss. This frame loss does not reflect the capability of the switch or router, but rather is the result of these clocking variances.

To compensate for this, you can run a *SmartApplications* Throughput test in a mode termed *Acceptable Loss Throughput*. When this mode is selected, you specify what percentage of frame loss is to be discounted when evaluating the test's success or failure.

If you enable *Acceptable Loss Throughput* (by setting a loss value), the *SmartApplications* main window changes to show the alternate test mode (*Figure 2-2*). The Throughput Test Results window and Test Report also include information on the acceptable loss performance.

See *"Set Up Test Configurations" on page 48* for details on setting values.

Throughput with Acceptable Loss enabled

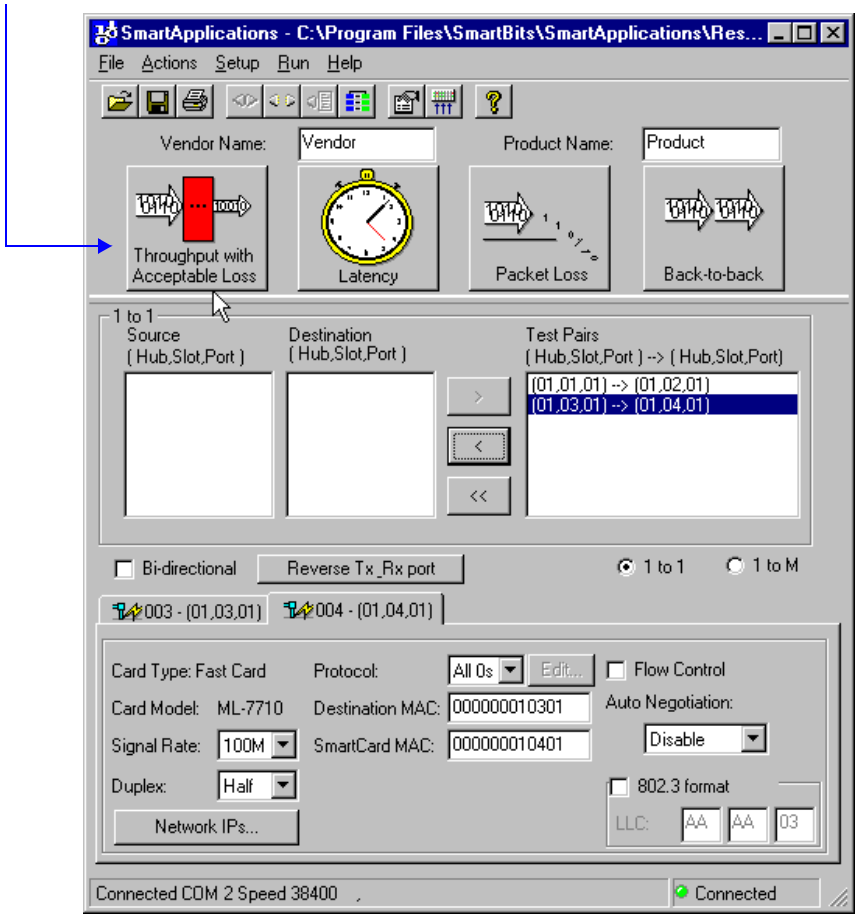


Figure 2-2. Throughput Test with Acceptable Loss

Latency Test Methodology

The Latency test measures latency as defined in RFC 1242, as described below for both store-and-forward devices and bit-forwarding devices.

How SmartApps calculates latency

The sending SmartCard sends a burst of frames at a user-specified frame size through the DUT at a user-specified throughput rate. In the middle of the burst stream, it inserts one frame with an identifying trigger (tag). The time when the trigger frame is fully transmitted is the Transmit Timestamp. The time the receiving SmartCard recognizes the trigger frame is the Receive Timestamp. *SmartApplications* calculates latency as:

```
(Receive Timestamp) minus (Transmit Timestamp) = Latency
```

Specifically, *SmartApplications* first measures the cut-through rate and then calculates the store and forward rate with this calculation:

```
(Cut-through Rate) minus (Frame Bit Time) = Store and Forward Rate
```

The Latency test is performed at a user-specified frame rate.

Cut-through (bit-forwarding) latency calculation

For cut-through device measurements, *SmartApplications* calculates latency as FIFO (first in-first out), meaning that it calculates the difference between the time that the end of the *first* bit of a transmitted frame reaches the DUT's input port (Transmit Timestamp) and the time the *first* bit of the same frame is seen on the DUT's output port (Receive Timestamp).

If **NA** ("Not Applicable") appears in either of the columns labeled *S&F* (*Store & Forward*) in the test *Results* window, this is because the S&F calculation is zero or less, indicating that the DUT is a cut-through device.

Store and forward latency calculation

For store and forward device measurements, *SmartApplications* calculates latency as LIFO (last in-first out), meaning it calculates the difference between the time that the end of the *last* bit of a transmitted frame reaches the DUT's input port (Transmit Timestamp) and the time that the end of the *first* bit of the same frame leaves the DUT's output port (Receive Timestamp).



Note:
1) It is recommended that you run the Throughput test before you run the Latency test in order to obtain the optimum throughput rate of the DUT. Then use the throughput rate obtained from the Throughput test for the Max Rate in the Latency test. Using a proven optimum rate prevents the tagged frame from being lost due to performance rate issues. If the tagged frame is not received, you may see a very large number for the *RcvByte* field of the Log file.

2) *SmartApplications* always measures latency and yields results for both store and forward devices and bit-forwarding (cut-through) devices regardless of the DUT. When viewing results, use the result that is appropriate for your type of device.

SmartMetrics Compensation Mode

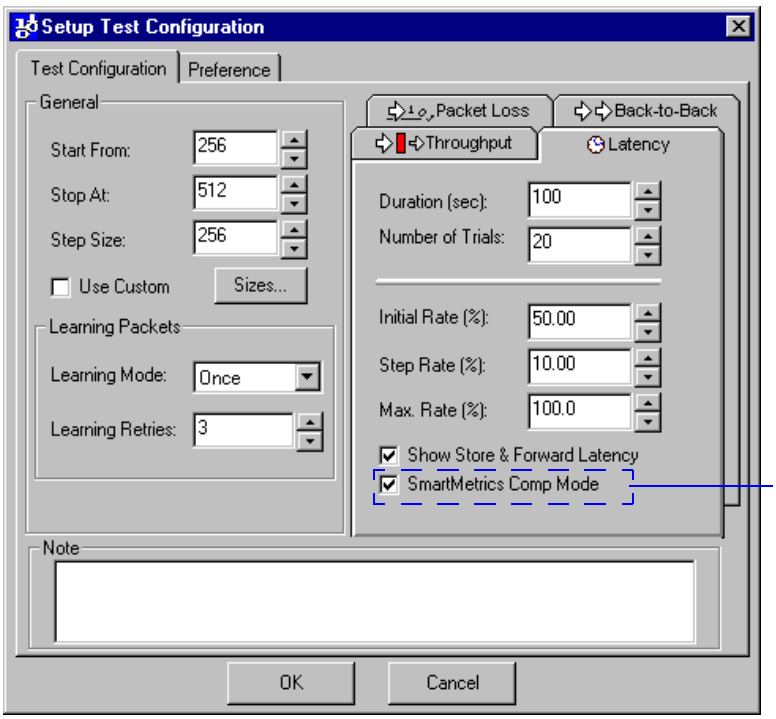
This mode enables *SmartApplications* to render the same latency results as would be produced by other SmartBits applications (such as *SmartWindow*) in SmartMetrics mode, when the transmitter and receiver are running at different speeds.

With the option is disabled, the Latency test runs as usual, with the trigger pattern at the usual offset in the frame. In this case, however, if the transmitter and receiver are running at different speeds, the latency result will be different from what it would be in a SmartMetrics test run through (for example) *SmartWindow*.

In contrast, when this option is enabled, the trigger pattern is offset to the same position in the frame where the Signature field would be placed in a SmartMetrics test. As a result, *SmartApplications* can produce the same latency result as a SmartMetrics application.

The SmartMetrics Compensation mode makes it possible to maintain continuity with past results, when this is desired.

You can enable *SmartMetrics Compensation Mode* by selecting **Setup > Test Configuration** from the main menu, the opening the *Latency* tab on the *Setup Test Configuration* window.



Use the SmartMetrics Compensation Mode *when you wish to make test results from SmartApplications compatible with results from SmartMetrics tests run using other SmartBits applications, such as SmartWindow or SmartFlow, when the transmitter and receiver are running at different speeds.*

Limits on Latency Testing

The following limitation applies to latency tests using 10/100Mb cards in the SMB-200 or SMB-2000. With these cards and chassis, the latency test duration is limited to 112 seconds when the packet size is 64 bytes and you are testing at 100% rate in the 100Mb mode.

Packet Loss Rate Test Methodology

This test measures the percentage of frames lost by the DUT that should have been forwarded, based on the total number of packets sent.

The Frame Loss Rate test satisfies the terminology criteria of RFC 1242 and the test methodology specified in RFC 2544. From RFC 1242, Frame Loss Rate is:

> *"percentage of frames that should have been forwarded by a network device under steady state (constant) load that were not forwarded due to a lack of resources."*

The test allows for varying frame sizes from 64 bytes to 1518 bytes for Ethernet ports, and up to 8188 for Token Ring ports.

From RFC 2544, the methodology to measure frame loss is to:

> *"Send a specific number of frames at a specific rate through the DUT to be tested and count the frames that are transmitted by the DUT."*

How frames are counted

Frames are validated by counting only frames generated by the sending port, not any packets sent by the switch. Keep-alive and routing update frames are not counted as received frames.

How the test runs

The Frame Loss Rate test operates in essentially the same manner as the Throughput test.

1. First a packet burst is performed at the maximum possible rate for a user-specified period of time.
2. After all packets are sent, the receiving port is queried to determine how many packets were received.
3. The number of packets not received is determined and the percentage of loss is calculated, based on the total number of packets sent.



Note: For Many-to-1/1-to-Many test configurations between ATM and Ethernet or ATM and Frame Relay: If the DUT bundles multiple streams into one virtual circuit, *SmartApplications* counters reflect the number of packets received on a per virtual circuit basis (not per stream).

This test is performed a user-specified number of times and the results averaged.

Back-to-Back Test Methodology

Back-to-Back tests the buffering capability of the device under test.

The Back-to-Back test satisfies the terminology criteria of RFC 1242 and the test methodology specified in RFC 2544. From RFC 1242, the Back-to-Back test is performed by:

> *"fixed length frames presented at a rate such that there is the minimum legal separation (maximum rate) for a given medium between frames over a sort to medium period of time, starting from an idle state."*

The test allows for varying frame sizes from 64 bytes to 1518 bytes for Ethernet ports, and 8188 bytes for Token Ring ports.

From RFC 2544, the methodology to measure back-to-back frames is to:

> *"Send a burst of frames with minimum inter-frame gaps to the DUT and count the number of frames forwarded by the DUT."*

How frames are counted

Frames are validated by counting only frames generated by the sending port, not any packets sent by the switch. Keep-alive and routing update frames are not counted as received frames.

How the test runs

The Back-to-Back test operates in essentially the same manner as the Throughput test.

1. First a packet burst is performed for a user-specified period.
2. If all packets are received at the receiving port, the test is successful and testing is stopped.
3. If even one packet is lost, the number of packets sent in the burst is halved and retried.
4. If all packets are successfully received at this point, the packet burst is then chosen halfway between the successful and unsuccessful trials, and retried.
5. This pattern repeats until the actual number of packets that can be forwarded in a burst is determined.

This test is performed a user-specified number of times and the results are averaged.


SPIRENT
Communications

3 Install and Connect

In this Chapter...

This chapter contains the following sections:

- *Install SmartApplications.....20*
- *Launch SmartApplications.....21*

Install *SmartApplications*

It is assumed that you are familiar with Microsoft Windows and basic SmartBits operation.

System Requirements

To run *SmartApplications* 2.50, you must have the following:

Hardware

- SMB-200
  SMB-2000
  SMB-600
  SMB-6000B (formerly SMB-6000)
- At least two SmartCards or modules.
- IBM PC™ or 100% compatible.
- Pentium 200 or above.
- VGA video or better (recommended).
- 16 MB of RAM for Windows 95 / 98
  —*or*—
  32 MB of RAM for Windows NT.
- 10 MB free hard disk space.

Software

- Windows 95™, Windows 98™ or Windows NT™ 4.0 (see *"Operating System Requirements"* below for detailed requirements).
- SmartBits Firmware 10.10 or higher.
- *SmartApplications* software.

Operating System Requirements

Operating System	Version / Updates	Required RAM (Mbytes)
Windows 95	B and C with current Service Packs and library updates.	32
Windows 98	First and Second Edition.	32
Windows NT 4.0	Service Pack 6A.	64
Windows 2000	Professional Edition.	64

Installing from the CD

SmartApplications is provided on one CD-ROM disk. To install the program, refer to the instructions on the CD case.

Installation Using *AutoPlay*

AutoPlay (if enabled) will automatically begin the installation process.

1. Insert the *SmartApplications* installation CD in the CD-ROM drive. The *Install Shield* window is displayed.
2. Select *Install SmartApplications [Ver#]*.
3. Follow the instructions until all SmartBits software is installed.

If *AutoPlay* is Not Enabled

If AutoPlay is disabled or your PC does not support an automatic installation process, you can use the following alternative procedure.

1. From the Start Menu, select **Run**.
2. When the Run dialog box appears, type:

   `<cd-rom drive>:\SETUP`

   —in the Command Line, then click **OK**.
3. Follow the instructions displayed as the installation program installs the software.

Launch *SmartApplications*

From the **Start** menu, select **Programs > SmartBits Applications > SmartApplications**. The *SmartApplications* main window displays.

How to Close *SmartApplications*

To close *SmartApplications*, click the **Close** button at the top right corner of the screen.

or

Select **File > Exit** from the menu bar.


SPIRENT
Communications

4 Basic Navigation and Tools

In this Chapter

This chapter contains the following sections:

- *Features of the Main Window.....24*
- *Charting Test Results.....33*

Features of the Main Window

SmartApplications provides a dynamic main window that changes according to the selections you make—for example, selecting a 1-to-Many or 1-to-1 test type.

Figure 4-1 highlights the key elements.

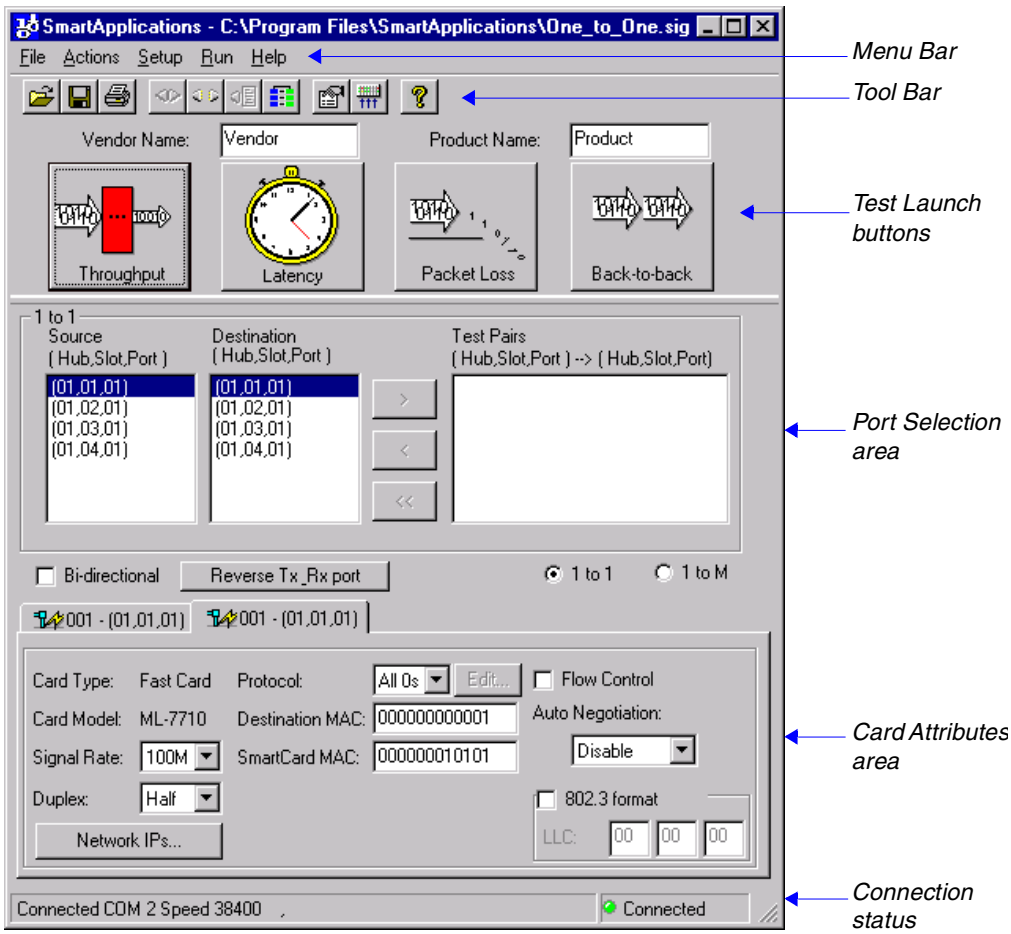


Figure 4-1. Main Window Elements

Connection Status

A connection status indicator (bottom right of main window) and the status message **Connected** shows when *SmartApplications* is connected to the SmartBits. When disconnected, the light is grey and the message **Disconnected** displays.

Menus

File Menu

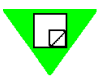
These menu options allow you to create and manage configuration files.

- **New**
  Opens the default *SmartApplications* test configuration (.sig) file. If you changed the default values, this option allows you to reset the values to the defaults.
- **Open**
  Opens a previously saved *SmartApplications* test configuration (.sig) file.
- **Save**
  Saves the current settings as a .sig file.
- **Save As**
  Saves the current test configuration under a new name.
- **View Results File**
  Opens the Results window. Once the Results window opens you can view results for the current configuration or for saved results for any previous configuration.
- **Print**
  Prints the current configuration file.
- **Print Setup**
  Allows the user to select the printer and setup printer options.
- **[path]**
  Use this option to load a .sig (configuration) file that you defined and save previously.
- **Exit**
  Closes *SmartApplications*.

Actions Menu

These menu options allow you to connect or disconnect to the SmartBits chassis.

- **Connect**
  Establishes the logical connection from your PC to the SmartBits chassis.
- **Disconnect**
  Breaks the logical connection from your PC to the SmartBits chassis.



Note: You define the connection type in the Setup SmartBits Connections dialog (select **Setup > SmartBits Connections** from the main menu). You must first disconnect *SmartApplications* from the SmartBits chassis to gain access this dialog.

Setup Menu

Some of these options are active only when *SmartApplications* is disconnected from the SmartBits chassis.

The Setup menu contains the following options:

- **Test Configuration**
  Opens the Setup Test Configuration window. Use this to specify test parameters such as test duration, learning packet information, and global test preferences.
- **All SmartCards**
  Opens the Setup All SmartCards window. Use this to specify setup information for all SmartCards from one window, instead of by individual card attribute tab, as well as to make test-by-test or global changes (such as the speed) to all cards. You can also access the Network IPs window and Token Ring Properties window from this window.
- **ATM Traffic Descriptor Type**
  Opens the Traffic Configuration window. Use this to specify call-setup broadband capabilities and forward and backward traffic descriptor specifications.
- **HTML Reports Setup**
  Opens the HTML Report Setup window. Use this when you wish to have test reports generated in HTML format and to specify the report output path, filename, and (optionally) comments.
- **SmartBits Connections**
  Opens the Setup SmartBits Connections window. Use this to define the IP address and TCP port number for IP network connections between *SmartApplications* and SmartBits chassis, as well as to select either Serial (COM) port or IP as the active connection type.
- **SmartCards Reservation**
  Enables you to change the Reserved or Available status of slots when multiple users are running tests on the same chassis.

Run Menu

The Run menu allows you to select one test to start running or to start all tests running in succession. (You can also use the test launch buttons on the main window to start a test.)

- **Throughput**
  Run the Throughput test (see *"Throughput Test Methodology" on page 12*).
- **Latency**
  Run the Latency test (see *"Latency Test Methodology" on page 14*).
- **Packet Loss**
  Run the Packet Loss test (see *"Packet Loss Rate Test Methodology" on page 16*).

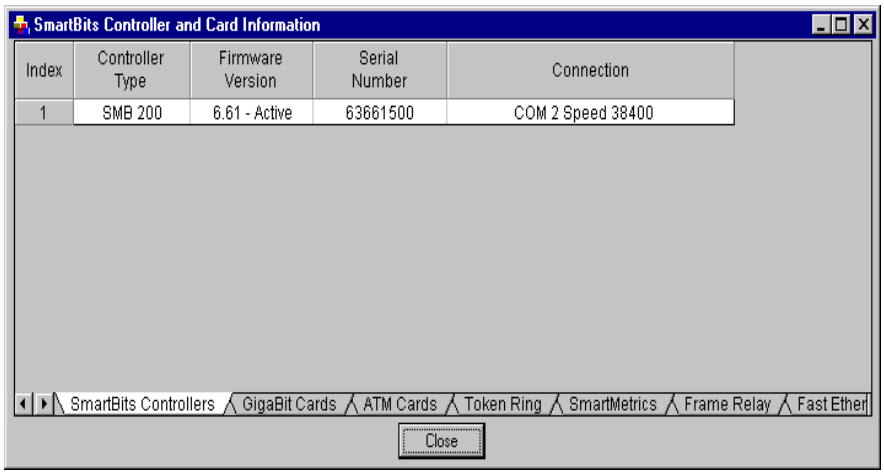
- **Back to Back**
  Run the Back-to-Back test (see *"Back-to-Back Test Methodology" on page 17*).
- **All**
  Run all four tests.

Help Menu

This menu contains two options:

- **Contents**
  Opens *SmartApplications* online Help.
- **About SmartApplications**
  Displays the current application version number, firmware number, SmartBits Programming Library version used, and the serial number of the SmartBits controller.

  From the About window, you can also access the SmartBits Controller and Card Information window (below), It displays firmware version and other information for the SmartBits chassis and installed cards. (You must have *SmartApplications* connected to the chassis to have access to this window.)



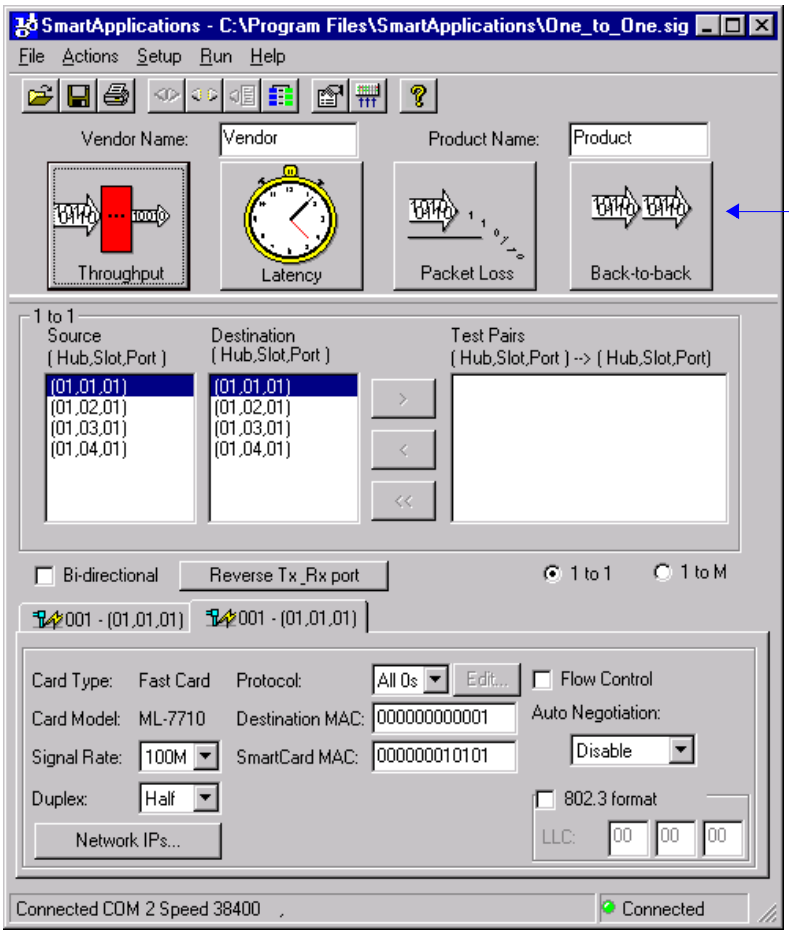
Launch Buttons

You can start any *SmartApplications* test by clicking on its launch button:

- **Throughput**
- **Latency**
- **Packet Loss**
- **Back-to-back**

You can also start individual tests by selecting **Run > <test name>** from the menu bar.

To run all tests in sequence, select **Run > All**.



Toolbar Buttons

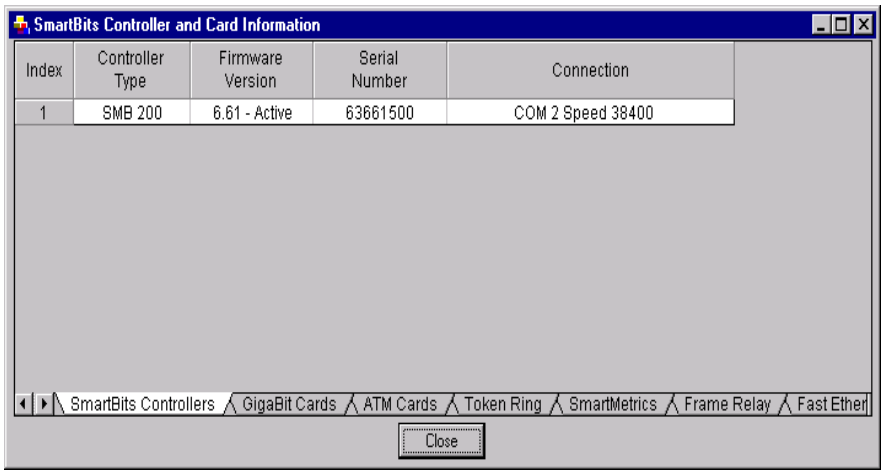
Table 4-1 Toolbar Buttons

Button	Description
	Opens an existing configuration file.
	Saves the current configuration to a file.
	Prints the current configuration file.
	Connects *SmartApplications* to the SmartBits chassis. This allows you to display the card attributes for the SmartCards in the chassis.
	Disconnects *SmartApplications* from the SmartBits chassis. **Note:** To set up IP or serial port connections, you must disconnect *SmartApplications* from the chassis.
	Displays the Setup SmartBits Connections window. Use this to set up IP and serial (COM) port connections and to select the active connection type.
	Displays the SmartCard Status window. Use this to check the status of cards and to reserve or release ports in multi-user configurations.
	Displays the Setup Test Configuration window. Use this to specify test configurations and preferences.
	Displays the Set Up All SmartCards window. Use this to configure the attributes for all ports or multiple ports in one window.

Continues

Table 4-1 Toolbar Buttons (continued)

Button	Description
	Accesses the About *SmartApplications* window, which displays the current application version number, firmware number, SmartBits Programming Library number used, and the serial number of the SmartBits controller.
	From the About window, click on **Card Versions** to obtain chassis and card information, such as firmware version.



Port Selection Area

Use the Port Selection pane to specify the ports to be included in a test and the test type.

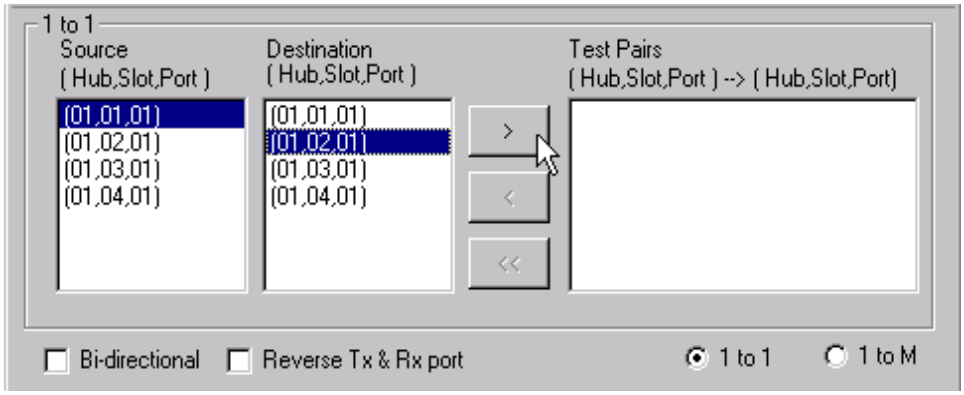
The test type may be **1 to 1** (one-to-one) or **1 to M** (one-to-many).

Checking **Bi-directional** causes the selected port pairs to transmit simultaneously in both directions, as in full-duplex operation.

Checking **Reverse Tx & Rx port** reverses the transmission direction, so that a Many-to-1 test can be run.

Selecting Ports for 1-to-1 Tests

1 Select the **1 to 1** radio button. The main window displays the 1-to-1 port selection pane.



2 Select at least one pair of **Source** and **Destination** ports.

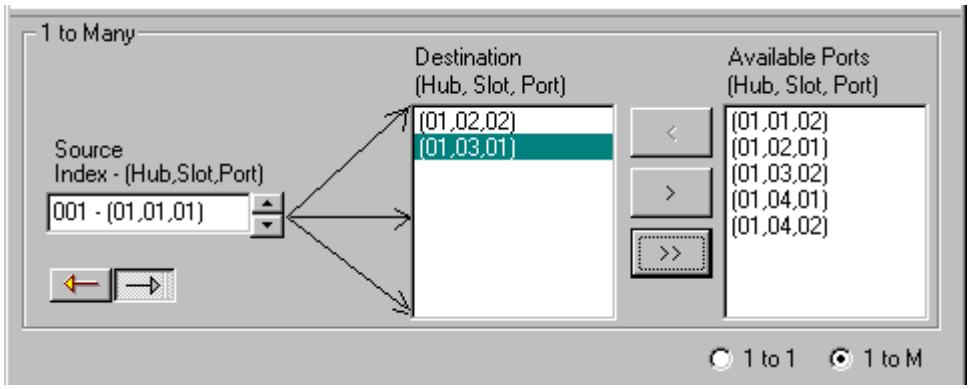
3 Check **Bi-directional** if you want the selected port pair(s) to transmit and receive simultaneously.

—or—

Check **Reverse Tx & Rx port** to reverse the transmission direction.

Selecting Ports for 1 to Many Tests

1 Select the **1 to M** radio button. The main window displays the 1 to M port selection pane.

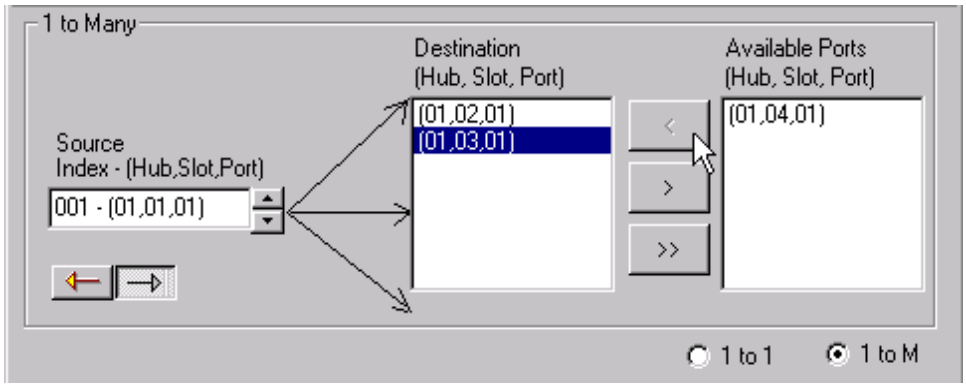


Note: 1 to Many and Many to 1 tests are not compliant with RFC 2544.

2 Select the direction for the test using one of the direction buttons. The Source and Destination fields will change locations depending on the direction you select.
Note: If you change the direction, the Destination MAC and SmartCard MAC addresses on the card attributes tab remain unchanged. Ensure that you enter the correct destination MAC address for the DUT.

3 Select Source card(s) and Destination card(s).

The last card that you select in the **Source** (Many to 1), or **Destination** (1 to Many) or **Available Ports** field will be the card whose attributes appear as the second tab, as illustrated in this Destination Index example:



Charting Test Results

Once a test has finished running, you can present the results of the test in graph form. You can create a wide variety of charts to graphically represent test results by using the Chart Wizard. Charts range from 2D or 3D pie and bar charts to Gantt charts. You can also customize titles, layouts, legends, and axes. The Chart Wizard is a separate charting facility provided with *SmartApplications*.



Note: To understand *how* a test derives the results that are shown, refer to the appropriate description of test methodology in this manual. See *Chapter 2, "Basic Test Theory"* and the section for the test you are running.

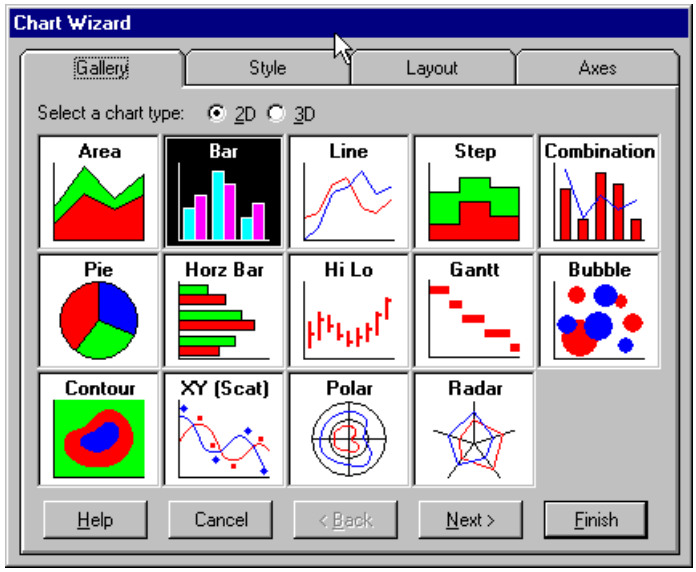
To create a chart from the appropriate Results window tab do these steps:

1 Select the rows and columns you want to appear on the chart. To do this, click on the first cell and then hold down the **Shift** key and click on the last cell to include. The block of cells will be highlighted.

Frame Size	Rate Tested(%)	(01,02,01) to (01,01,01) (%)	(01,03,01) to (01,01,01) (%)	Average
		100M-100M	100M-100M	
64	100.00	50.000	50.000	50.000
128	100.00	50.000	50.000	50.000
256	100.00	50.000	50.000	50.000
512	100.00	50.000	50.000	50.000
1024	100.00	50.000	50.000	50.000
1280	100.00	50.000	50.000	50.000
1518	100.00	50.000	50.000	50.000

2 Click the **Create Chart** button to display the Chart Wizard.

3 Select the type of chart you want to create from the Chart Wizard. The chart will be attached to the spreadsheet.



4 Double click on the outside of the chart to access the Format Chart window and customize the format.

For more information about how to use the Chart Wizard, refer to the Chart Wizard's online help user guide. To access the online Help click the **Help** button from the Chart Wizard window. The online Help system is called First Impression.

5 Set Up Tests

In this chapter...

This chapter contains the following sections:

- *Summary of Steps to Set up a Test.....36*
- *Connect the Device Under Test.....36*
- *SmartBits Connection Setup.....37*
- *Set Up Test Configurations.....48*
- *Select Test Ports.....60*
- *Configure Test Ports.....67*
- *Router Testing.....115*
- *Set up Next Hop Tests.....117*
- *Set Up IP/UDP/IPX Protocols.....119*
- *Set up ATM 1-to-Many/Many-to-1 Tests with PVC CLIP.....123*

Summary of Steps to Set up a Test

Here is a brief overview of the steps to set up *SmartApplications* tests. See the following sections for detailed procedures.

Step	Task	Refer to:	Page
1	If running *SmartApplications* for the first time, set up the communications port between the PC and the SmartBits chassis.	*"SmartBits Connection Setup"*	37
2	Set up the test configuration and preferences.	*"Set Up Test Configurations"*	48
3	Select the ports for the test(s) and the traffic direction.	*"Select Test Ports"*	60
4	Configure the ports.	*"Configure Test Ports"*	67
5	Run the test.	*Chapter 6, "Run Tests"*	125
6	Review test results.	*Chapter 7, "Test Examples"*	151



Note: If you are testing a router, you must check the Router Test box at the Test Setup window **Preference** tab.

Connect the Device Under Test

If possible, connect the same-numbered ports on the SmartBits and the device under tests (DUT). That is, connect SmartBits port 1 to DUT port 1, port 2 to port 2, and so on.

To verify that the cable is connected correctly, check that the device link light is on.

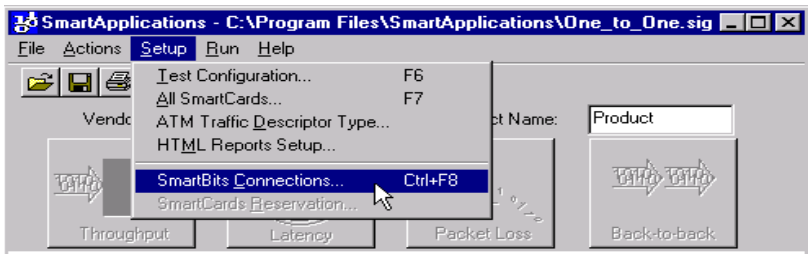


Note: For complete information about setting up the hardware and your SmartBits chassis, refer to the related *Installation* manual and to the *SmartBits System Reference* manual.

SmartBits Connection Setup

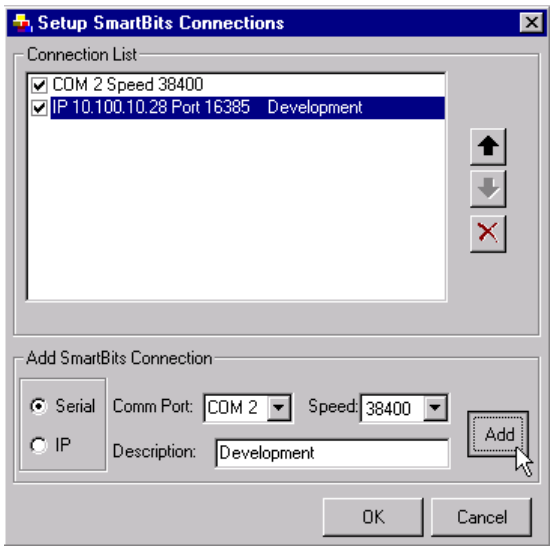
SmartApplications needs to know the communications port your PC is using to connect to the SmartBits chassis. To define this, select **Setup > SmartBits Connections...** from the main menu.

Note: The SmartBits Connections option is active only when *SmartApplications* is disconnected from a SmartBits chassis. Connection status is shown on the status bar.



The SmartBits Connections dialog enables you to manage both serial and IP connections.

- **Serial**
  (Default) For point-to-point connections. See *"Connect Using a Serial Port" on page 38* for more information.
- **Ethernet**
  Requires a network card in your PC, and a SmartBits chassis with Ethernet capabilities (SMB 200/2000 or SMB-600/6000B. Allows you to run *SmartApplications* over an Ethernet connection (including the Internet) from your PC. See *"Connect Using an Ethernet Port" on page 40* for more information.



The Connection List displays all connections that are already defined.

Click to move up or down in the list or to delete an entry.

Use this pane to define new connections.

Connect Using a Serial Port

Use the following steps to set up a serial (COM) port connection between the PC and the SmartBits chassis.

1 Choose **Setup > SmartBits Connections...**

2 In the *Add SmartBits Connections* pane, click the **Serial** radio button.

3 In the *Comm Port* list, select the COM port you have used to connect the PC to the SmartBits.

By default, the selected port is COM2 at 38400 bps. The list shows only available COM ports. If the list does not include an installed COM port (for example, COM1), this may be caused by the following:

- You have a serial mouse connected to that port.
- The port is opened by another currently running program.

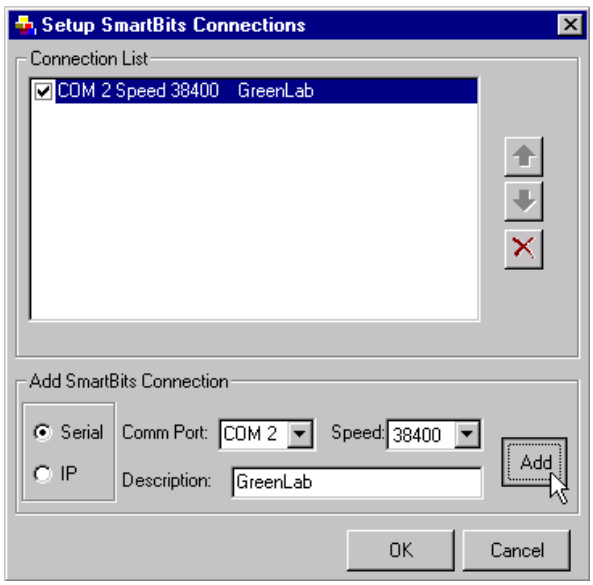
4 Use the *Speed* list to select the baud rate for the port.

SmartBits supports connections up to 38400 bps (the default). Some PCs may have trouble keeping up with baud rates above 9600 bps. *SmartApplications* attempts to connect to SmartBits at all possible baud rates, then sets the final baud rate to the rate selected.

5 Optionally, use the *Description* field to define a name for the connection.

6 Click **Add**.

The new entry appears in the *Connection List.*



Serial Connection Problems

If *SmartApplications* cannot establish the serial-port communication link, some troubleshooting may be required. Refer to your *SmartBits 200/2000 Installation Manual* or *SmartBits 600/6000B Installation Manual* for detailed information on the possibilities listed below.

- An invalid COM port was selected from the drop-down *Comm Port* list in the Setup SmartBits Connections dialog. The COM port may already be in use by another Windows application, or there may not be hardware available to support it. In this case, try another COM Port.
- The wrong type of cable was used to interconnect the PC and the SmartBits chassis.

  Ensure that the RS-232 cables connecting the PC serial port to the SmartBits chassis (as well as any succeeding SmartBits chassis) are properly chosen, connected, and terminated. Ensure that cable is *not* a *null modem* cable.
- The port is configured incorrectly. Ensure that the Speed setting in the Setup SmartBits Connections dialog is consistent with the baud rate on the SmartBits chassis.

Connect Using an Ethernet Port

A configured SmartBits chassis has an IP address that was set either through:

- *SmartWindow* or HyperTerminal for the SMB 200/2000
- HyperTerminal for the SMB 600/6000B.

This enables you to connect to the SmartBits by using an Ethernet network connection.

Note: Refer to your *SmartBits 200/2000 Installation Manual* or *SmartBits 600/6000B Installation Manual* for the steps to assign the IP address.

Use the following steps to define the IP address in *SmartApplications*. You can control up to 16 different chassis from one *SmartApplications* instance (and can define many more IP addresses, if necessary).

1 Choose **Setup > SmartBits Connections...**

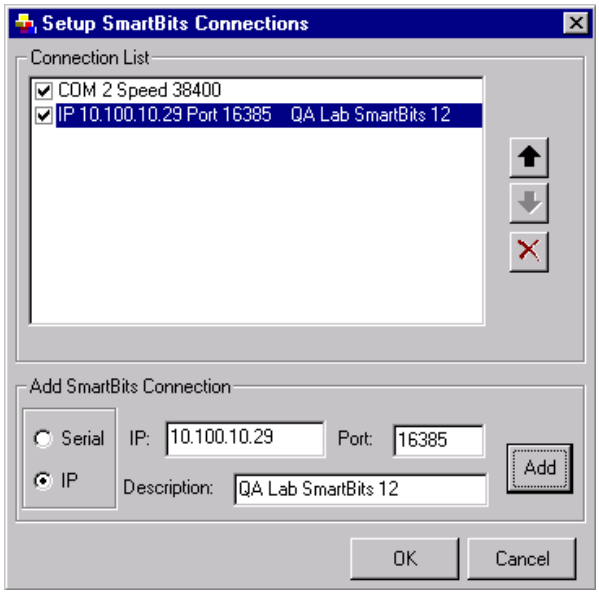
2 In the *Add SmartBits Connections* pane, click the **IP** radio button.

3 Set the IP address of the SmartBits chassis. The factory assigns the TCP port number 16385 to the chassis.

4 Optionally, use the *Description* field to define a name for the connection.

5 Click **Add**.

The new entry appears in the *Connection List.*



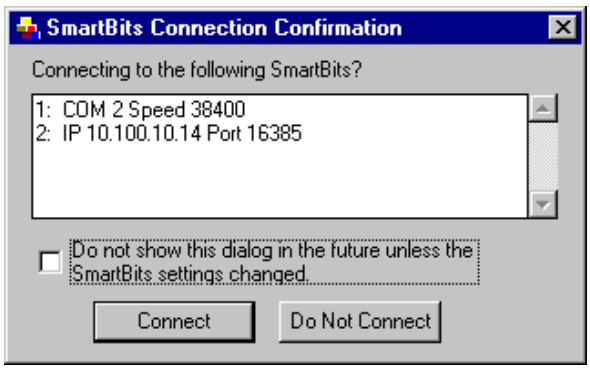
Making the Connection

Once you have set up the connection type, you are ready to connect *SmartApplications* to the SmartBits chassis.

1 Choose **Actions > Connect**, or click on the **Connect SmartBits** button on the toolbar.

The *SmartBits Connection Confirmation* dialog lists all the connections that are currently selected (checked in the *Setup SmartBits Connections* dialog).

SmartApplications will try to connect first using the **1:** link or address in the list. If it cannot establish that connection, it tries the **2:** entry, then following entries (if necessary).



2 If connection is successful, the *Connected* indicator appears in the lower right corner of the main window. If *Disconnected* is shown, *SmartApplications* is not connected. In this case, review all connections for conformance with instructions in your SmartBits *Installation* manual.

Linking Multiple SmartBits Chassis

You can connect multiple controlling SmartBits chassis by assigning each controlling chassis an IP address, as shown in *Figure 5-1*.

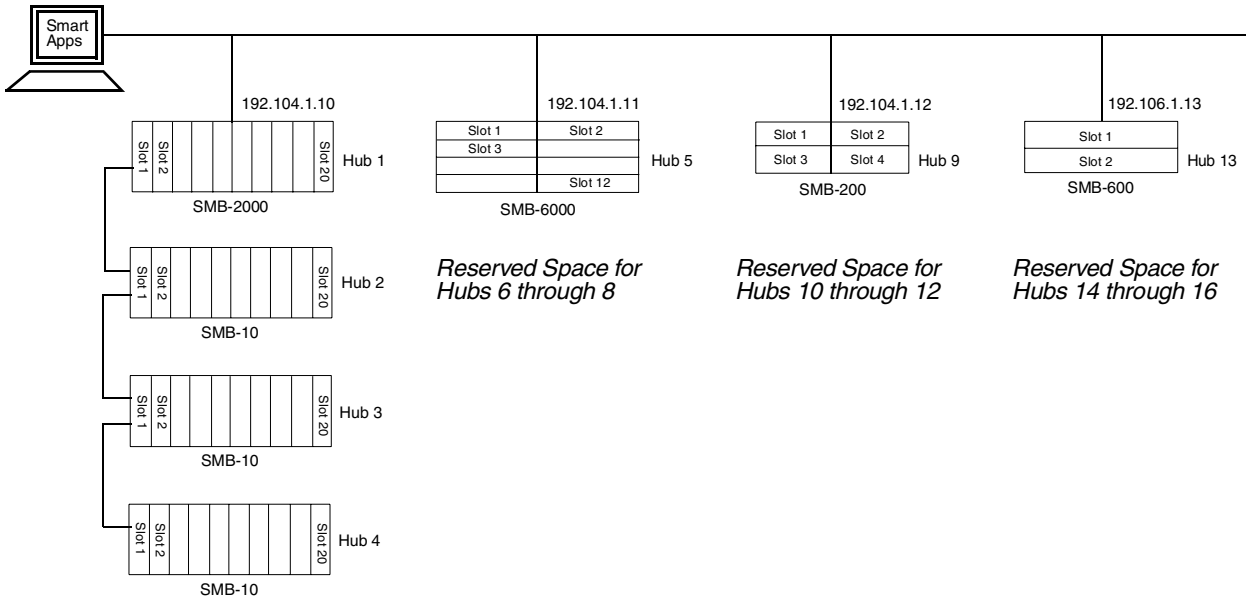


Figure 5-1. Numbering Stacked and Daisy-chained Chassis

Rules for Selecting Hub/Slot/Port Configurations

To understand hub/slot/port designations in *SmartApplications*, keep these rules in mind:

- You can link a maximum of 16 chassis across, each with a unique IP address or COM port.
- You can stack SMB-2000 chassis in arrangements of up to four individual chassis. The top hub in the stack must be an SMB-2000. The bottom three chassis may be SMB-2000s or SMB-10s.



Note: You cannot stack SMB-6000B, SMB-600, or SMB-200 chassis.

- When you link SmartBits chassis, four real or virtual hubs are allocated to each IP address (for each chassis linked across; see *Figure 5-1*). Space is reserved for these hubs whether or not physical chassis are actually installed with the first (*master*) hub.
- The number of ports per slot depends on the type of card installed in the slot. The maximum configuration for a SmartBits chassis stack is 96 ports. This results in a theoretical maximum port capacity of 1536 ports per SmartBits chain (16 SMB-6000B chassis each populated with 96 ports).

- Hub/slot/port information appears in port selection dialogs and window, and in test reports. Information displays in the format [xx,xx,xx]. For example, [05,04,03] represents hub 5, slot 4, port 3.
- The arrangement of hub/slot/port information in the connection list is based on the order in which IP addresses are arranged on the list. For example, with the chassis illustrated above, the IP address for Hub 13 (192.106.1.13) is listed fourth in the connection list. If this IP address had been listed first, Hub 13 would be Hub 1. The IP address listed next would then become Hub 5, and so on.

Synchronizing Clocks in Local or Remote Chassis

You can synchronize the clocks in multiple SmartBits that are local to one another or remote from each other. Doing this enables you to start and stop tests simultaneously at the SmartBits chassis. Local synchronization is done through cable interconnections. Remote synchronization makes use of a GPS (Global Positioning System), which becomes the clock source for each chassis, providing each SmartBits with an atomic clock.

Local synchronization

For the steps to synchronize local chassis, refer to your *SmartBits Installation Manual*.

Remote synchronization

For information on how to set up the GPS receiver, including cabling information, refer to the *Application Note #15 — Using GPS with SmartBits*. It accompanies the GPS unit.



Note: Before running a latency test between two remote SmartBits chassis in GPS mode, endure that the GPS receiver has been on for several hours. This is necessary for the GPS receiver components to be locked on. If you fail to do this, *SmartApplications* may send error messages.

Multi-User Access

If a SmartBits chassis is multi-user-capable, it allows up to ten users to connect simultaneously. When *SmartApplications* is connected to a multi-user chassis, it lists the installed cards and shows their current status as either *Reserved* or *Available*. You must reserve a card to be able to use it in your test.

An SMB-6000B chassis is always capable of multi-user connections. An SMB-2000 chassis must display a *Multi-user Ready* identifying sticker to be multi-user capable. The SMB-200 is a single-user-only chassis.

On an SMB-2000, the multi-user sticker indicates that:

- An SMB-2000 multi-user-compliant backplane is installed.
- Chassis firmware 6.50 or later is installed.



Note: Any SMB-2000 chassis can be factory-refitted to become multi-user compliant.

Reserving Cards

In a multi-user test environment, you must reserve cards or modules before you can use them in tests. To do this:

- Check card status.
- Reserve available cards for your use.
- When done, release the cards.

To check card status:

To check the card availability:

- Click the **Reserve/Release SmartCards** toolbar button on the *SmartApplications* main window.

  —or—

- Select **Setup > SmartCard Reservation**.

The SmartCard Status window displays information like that shown in *Figure 5-2 on page 44*.

3 Click the tab for the controller (chassis) you wish to view.

Each controller tab shows the hub, slot, and number of each port, the card model number, and the status of the port: Reserved or Available. In the Hub column, a blue light indicates *Reserved*, and a green light indicates *Available*.

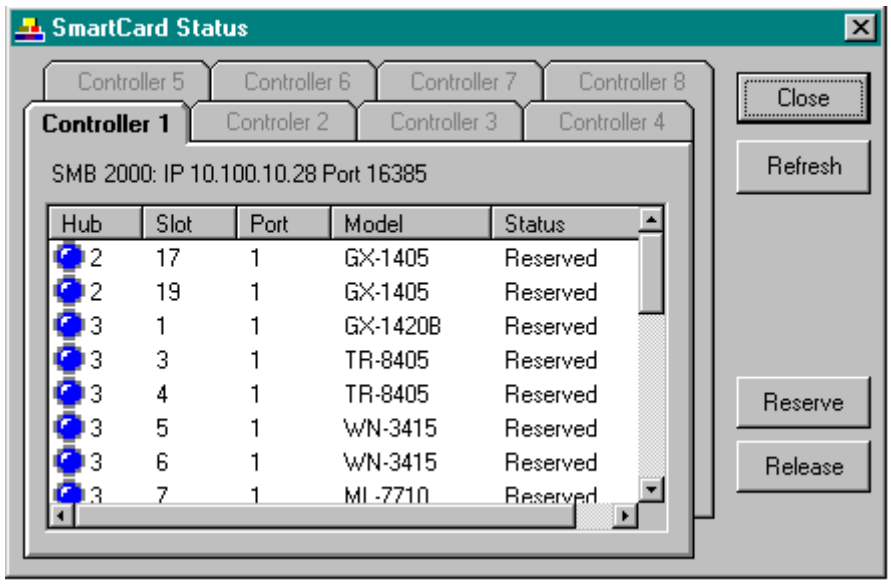


Figure 5-2. SmartCard Status Window

To reserve cards:

To reserve an available card from a controller tab in the SmartCard Status window:

1. Click on the port you wish to reserve to highlight it.
2. Click **Reserve**.

   SmartApplications automatically updates the controller field to show your selection. You can also click **Refresh** to update the field.
3. When you are finished reserving cards, click **Close**.

To release cards:

To release a card you have reserved:

1. Open the appropriate controller tab in the SmartCard Status window.
2. Click on the port you wish to release to highlight it.
3. Click **Release**.

   SmartApplications automatically updates the controller field to show your selection. You can also click **Refresh** to update the field.
4. Click **Close** when finished.

Starting and Stopping a Test

The remainder of this chapter describes how to set up test configurations to use in testing (see *"Set Up Test Configurations" on page 48* and following).

To start a test:

Once you have set up test parameters and selected the ports to test, you can start the test in several ways:

- Click the appropriate launch button on the main *SmartApplications* window
- Select **Run** from the menu bar.

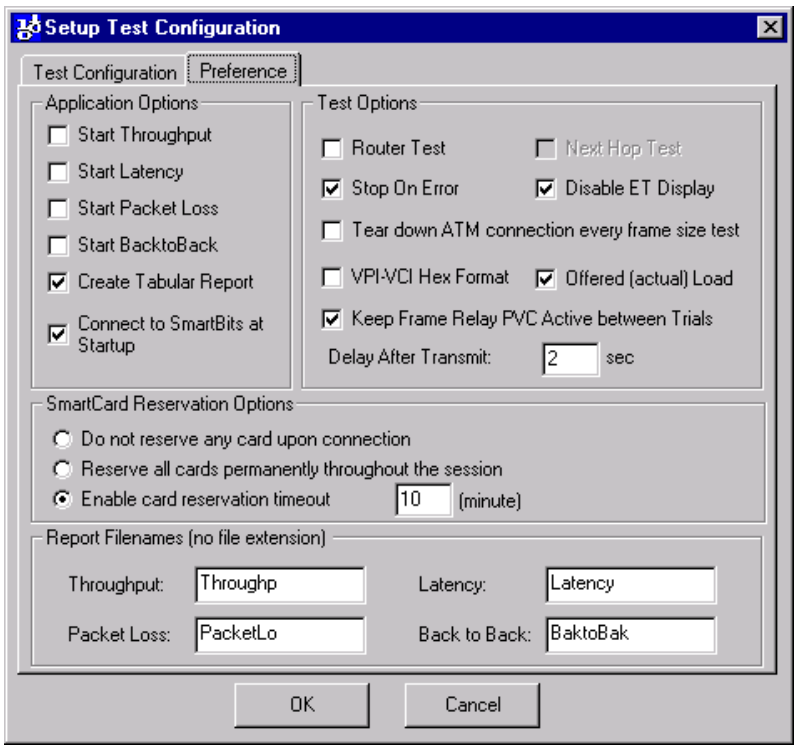
To start one or more tests automatically:

You can set one or more tests to run automatically each time you launch *SmartApplications*.

1 Select **Setup > Test Configuration**.

2 Open the **Preference** tab, the use the *Application Options* pane to select the tests you wish to run.

The next time you open *SmartApplications*, the selected tests will begin running automatically.



Note: If you check **Stop on Error** in the *Test Options* pane of the **Preference** tab, the test will stop running when it encounters an error conditions (for example, *Latency packet not received*).

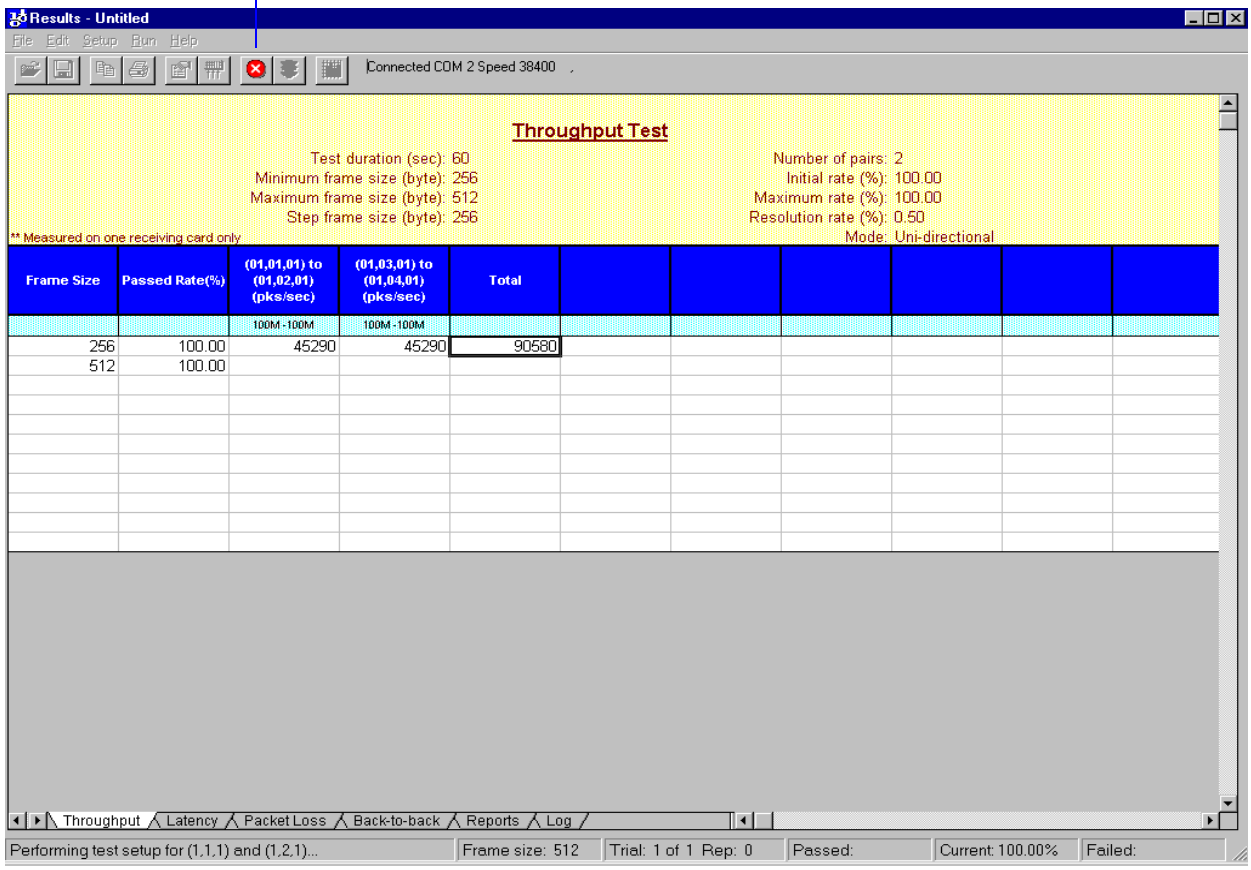
If you want the test to continue to run regardless of errors, leave this option unchecked.

If you plan to run a long test, we recommend that you do *not* check this option.

To stop a test:

To stop a test that is running, click the **Stop** button in the *Results* window.

Click the **Stop** button in the *Results* window to halt a test.



Set Up Test Configurations

To set up test configurations:

1 Select **Setup > Test Configurations** from the main menu.

2 Use the **Test Configuration** tab *Figure 5-3*) to set options for tests.

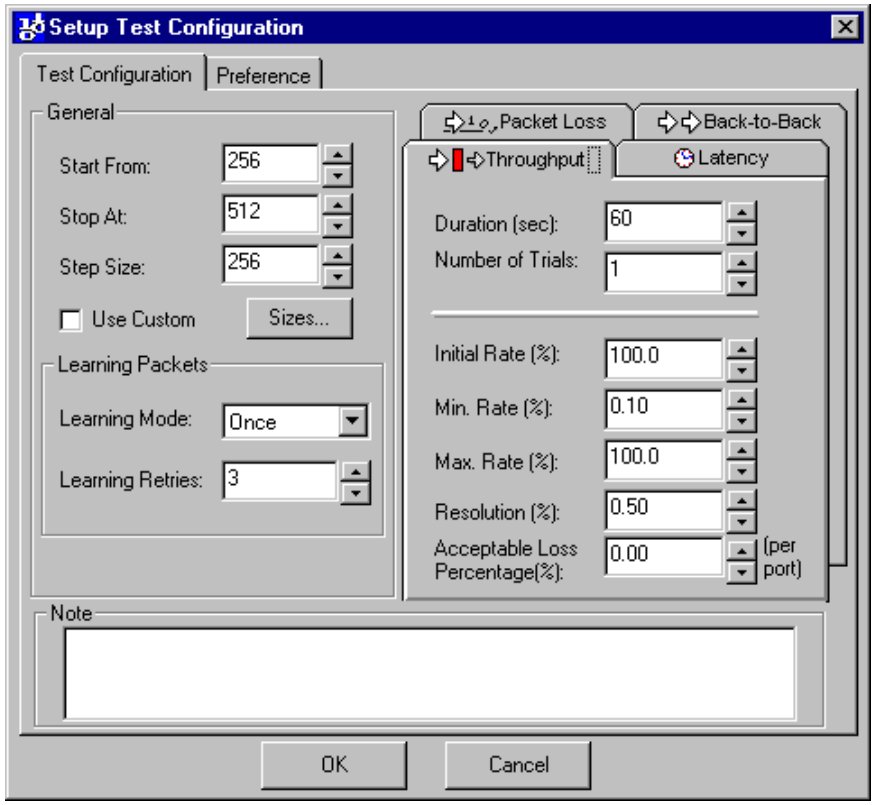


Figure 5-3. Test Configuration Tab with Test Options

Note: Remember that *SmartApplications* enables you to save test configurations to a file for future use. See *"File Menu" on page 25* for options.

The Setup Test Configuration dialog includes two tabs:

- **Test Configuration** See *"Test Configuration Options" on page 49*
- **Preference** See *"Preference Tab" on page 55*

Test Configuration Options

The Test Configuration tab (*Figure 5-4*) includes panes to define General test parameters; the handling of Learning Packets; and individual test parameters.

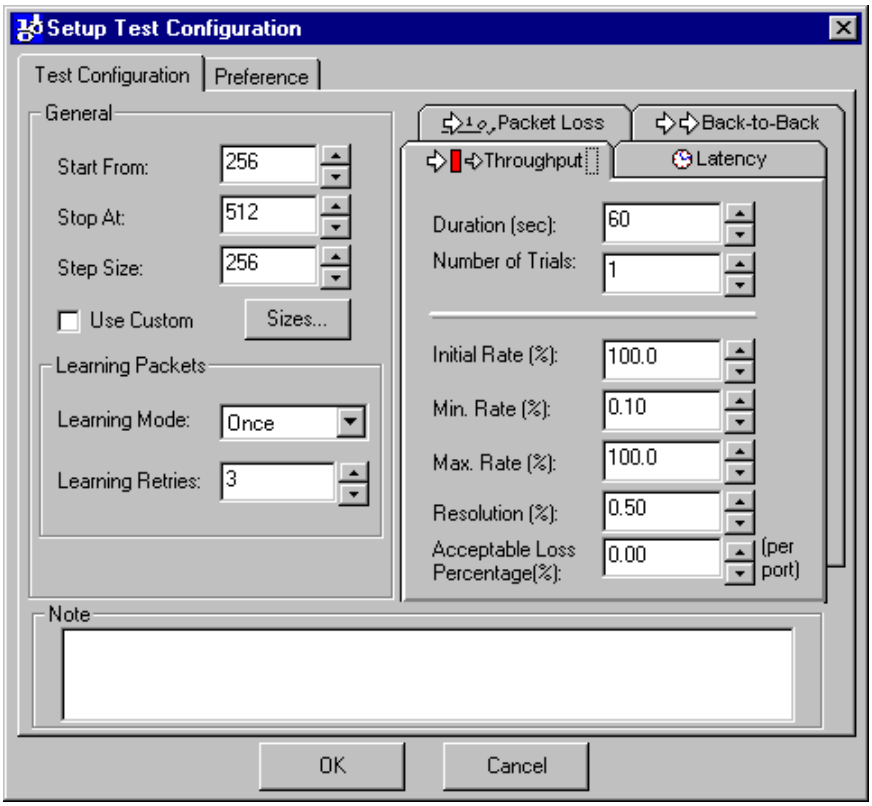


Figure 5-4. Setup Areas on the Test Configuration Tab

General Options

Use the fields in the *General* pane to specify the range of packet sizes to be transmitted during the test. Standard packet sizes are in multiples of 64 bytes. (Click on **Sizes** to view the list of standard sizes.)

Tests do not necessarily run until the maximum (*Stop At*) packet size is sent. If the *Step Size* value increments the packet size to a value larger than the *Stop At* value, the test stops at the *Stop At* value. For example, if you set the fields as follows:

Start From	64
Stop At	200
Step Size	64

—the test will send packets of 64, 128, and 192 bytes, then stop. It will not send 256-byte packets (larger than *Stop At*), and will it not send 200-byte packets (not in the *Step Size* increment sequence).

Start From

Enter or select the size of the smallest packet to send. The default size is 64 bytes.

Stop At

Enter or select the size of the largest packet to send. The default size is 1518 bytes.

Step Size

Enter or select the number of bytes that the current packet size will be incremented with each test. For example if the step size is 10 bytes, the first test transmits packets that are 64 bytes, and the next test transmits packets that are 74 bytes.

Use Custom

Unchecked
Runs tests according to settings in the *Test Configuration* tab.
Default custom sizes are: 64, 128, 256, 512, 1024, 1280 and 1518.

Checked
Runs tests according to the packet sizes specified at the *Custom Packet Sizes* window.
Enables the **Sizes** button.

Setting an Acceptable Loss Percentage

If you select *Use Custom*, you can set a level of acceptable frame loss for each frame size sent during the test. (See *"Acceptable Loss Percentage (%) (per port)" on page 53* for an explanation of this option. Also see *"Acceptable Loss Throughput" on page 13* for a general description of this option for Throughput tests.)

Click on **Sizes**. In the *Custom Packet Sizes* window, use the *Acceptable Loss (%)* column to set an acceptable level of frame loss for each frame size, as needed for your test.

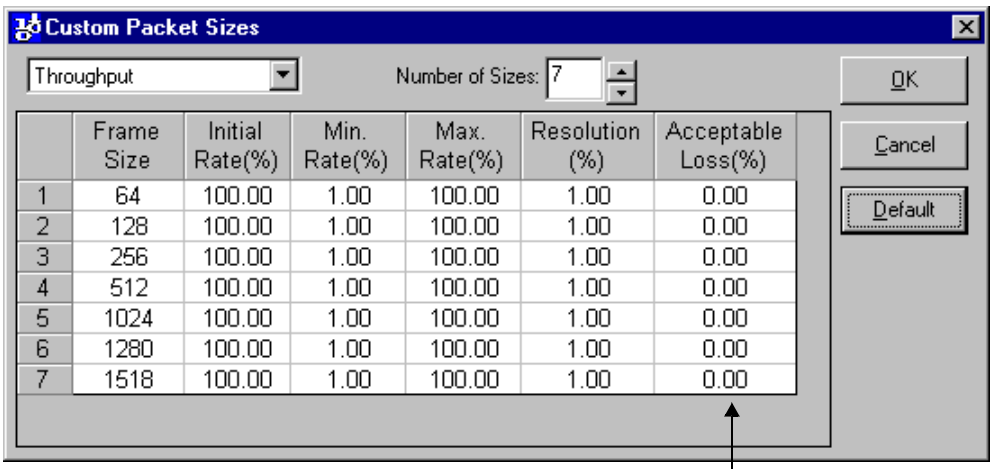


Figure 5-5. Setting Acceptable Loss for Custom Packet Sizes

Learning Packets Options

Learning packets are used by the DUT to build its forwarding tables of MAC addresses for the sending and receiving SmartBits ports. You can send cause learning packets to be sent once for the test or between every test trial, to refresh the DUT's forwarding tables before addresses are eliminated by aging.

Learning Mode

Select the mode by which *SmartApplications* sends out learning packets to update the device's forwarding tables. Possible modes:

Never
Never send learning packets to the device under test.

Once
Send learning packets once at the beginning of each test. For example, if you select packet sizes of 64 and 128 bytes, *SmartApplications* sends learning packets before the 64-byte test and again before the 128-byte packet test.

Every Trial
Send learning packets before each trial. For example: You wish to test at a packet size of 64 bytes, starting at 50% and incrementing 10% each trial. Learning packets will be sent before the 50% trial, before the 60% trial, and so on.

Learning Retries

Enter or select the number of times *SmartApplications* should retry sending learning packets before it starts the actual test. Some devices require more packets to learn an address. This value is used to loop on the transmission of the learning packets. There is a one-second delay between retries.



Note: If the DUT shows signs of flooding during testing, consider increasing the default values in the *Learning Packets* pane or increasing the aging timer in the DUT.

Individual Test Options

Open the tab for each test that you want to run and set test parameters.

Duration (sec)

Enter or select the length in seconds for which you want to run each trial of the test. It is the amount of time that SmartBits will send data for each packet for the selected test. Possible values range from 1 to 999 seconds.



Note: For 100Mb cards, do not use a value greater than 110 seconds, or *SmartApplications* will send the error message "Parameter out of range." when you run the test.

Number of Trials

Enter or select the number of times that you want *SmartApplications* to repeat the selected test(s). Values range from 1 to 25 for each packet length. After all tests, *SmartApplications* averages the results before reporting a summary of all trials for each test.

Initial Rate (%)

The rate at which packets will be transmitted at the start of a trial.

Step Rate (%)

Does not apply to the Throughput test.

The percentage that the test increments with each trial. Step rate specifies how quickly the test rate will increase after a trial finishes. Select or enter an integer or decimal value. The minimum decimal value you can enter is .1.

Min. Rate (%)

Does not apply to Latency tests.

The rate at which transmission trials will stop. Select or enter an integer or decimal value. The minimum decimal value you can enter is .1.

Max. Rate (%)

The maximum rate at which each packet size should be transmitted. Select or enter an integer or decimal value. The minimum decimal value you can enter is .1.

When selecting this rate for the Latency test, the Latency measurement should be at the rate where the Throughput test passed. Setting a value of 100% may not be measuring the true latency of your device under test. Set this value accordingly. For example, if you know a particular device cannot exceed 90% of wire speed, set the maximum to 90% to save time.



Note: Run the Throughput test before the Latency test to obtain the DUT's maximum throughput rate. Then use that throughput rate for the Max Rate in the Latency test. Using a proven rate prevents the tagged frame from being lost due to rate (gap size) issues.

Resolution (%)

Applies only to the Throughput test.

Resolution determines the exactness of the test result. Lower settings yield a more precise result but usually results in longer test times.

How Resolution Affects Test Progress

If you set the resolution to 2%, testing will stop when the difference between the last successful test and the last unsuccessful test is less than 2%. If the initial trial failed at 100%, the second trial might run at 50%. Assuming no packets were dropped at 50%, the next trial would increase to 75%. Again assuming no lost packets, the rate of the next trial might increase to 87.5%, and so on. Eventually, you might run a trial at 98.2%. Since the resolution was set to 2%, testing would stop here, because 100 – 98.2 is 1.8%, which is less than 2%. If the resolution had been set to 1% another trial would be run, since 1.8% is greater than 1%.

Acceptable Loss Percentage (%) (per port)

Applies only to the Throughput test.

This option provides a way to compensate for frame loss caused by differences in clock tolerances at the DUT port and the SmartBits port. Such variances in clocking can cause a Throughput test to show frame loss that is caused not by the operation of the switch or router, but rather by these discrepancies in clock timing.

When you select *Acceptable Loss Percentage (per port)*, the Throughput Test launch button on the *SmartApplications* main window changes to show the selected mode (*Figure 5-6*). The test result reports also show how the specified acceptable loss has figured into the test (see *"Sample Reports – Throughput Test" on page 137*).

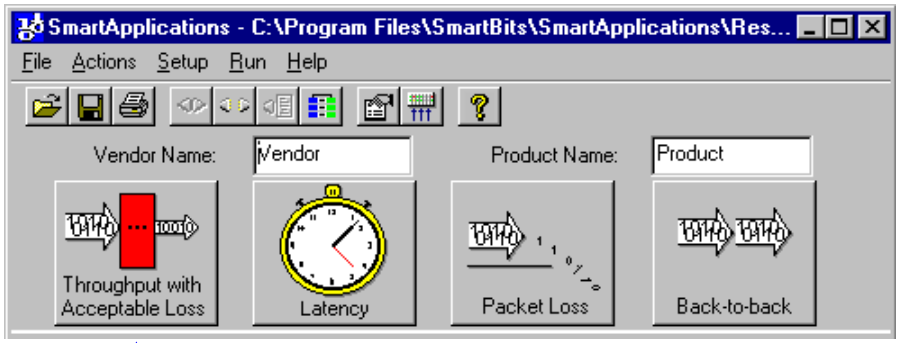


Figure 5-6. Throughput Test Launch Button with Acceptable Loss Enabled

SmartApplications considers the last trial a success if frame loss did not exceed the specified percentage. The test then continues according to the settings of other test options, such as *Number of Trials* and *Resolution (%)*.

Setting Acceptable Loss for each frame size

When you set a value to this option, the percentage applies to *all* frame sizes generated through the port for the test. You can also specify an acceptable loss percentage for each frame size sent during the test. To do this, select *Use Custom* in the *Test Configuration* window, then click on **Sizes** to open the *Custom Packet Sizes* dialog. Use that dialog to set a percentage value for each frame size, as desired (see *"Use Custom" on page 50*).

Customizing Test Packets

You can select packet sizes other than the standard by selecting **Use Custom** on the *Test Configuration* tab. Click **Sizes** to open the *Custom Packet Sizes* dialog (*Figure 5-7*).

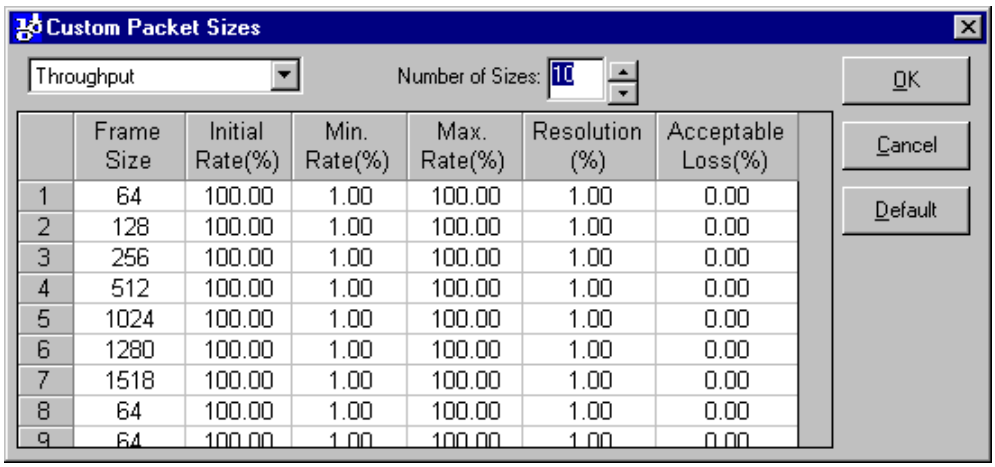


Figure 5-7. Custom Packet Sizes Dialog

The default values are the seven packet sizes specified for Ethernet testing in Section 9.1 of RFC 1242.

To change the number packet sizes:

Enter or select a new value in the *Number of Sizes* field. The maximum number of packet sizes is 25. To enter a custom value for a packet size, click on a *Packet Size* field and type in a value.

Click **OK** to close the window and make your selected sizes the current settings.

Click **Cancel** to close the window without making changes.

Click **Default** to revert to the seven default packet sizes.

Setting Acceptable Loss (%) per frame size

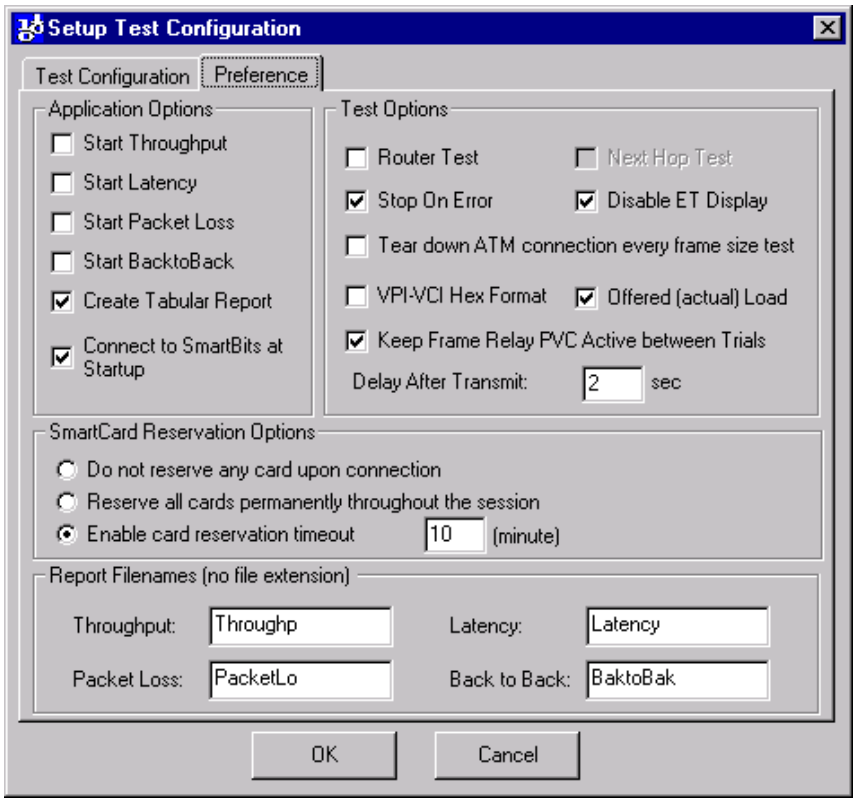
Use the *Acceptable Loss (%)* column to specify what degree of frame loss should be discounted, for each frame size, when running the test.

See *"Acceptable Loss Percentage (%) (per port)" on page 53* for an explanation of this option, as it applies to *all* frame sizes generated during the test.

Preference Tab

Use the *Preference* tab of the *Setup Test Configuration* window to report filenames and other application or test options.

Select **Setup > Test Configuration** from the menu bar and click the *Preference* tab.



Preference Tab Fields

Table 5-1 describes the fields on the *Preference* tab.

Table 5-1. Preference Tab Fields.

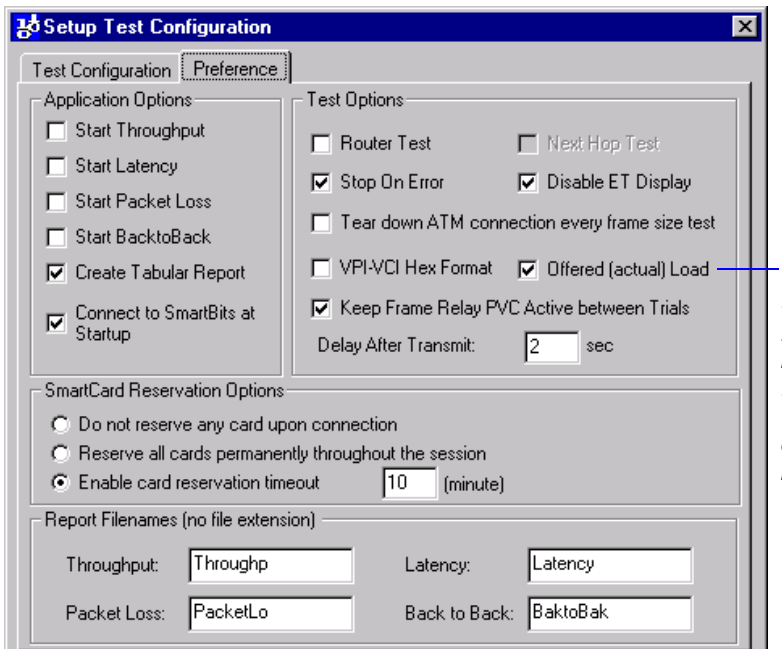
Pane	Field	Description
Application Options	**Start Throughput**	Check to start this test automatically when you start *SmartApplications*.
	Start Latency	Check to start this test automatically when you start *SmartApplications*.
	Start Packet Loss	Check to start this test automatically when you start *SmartApplications*.
	Start Back to Back	Check to start this test automatically when you start *SmartApplications*.
	Create Tabular Report	Check to generate reports in tabular format with results by packet size running horizontally across the page. Uncheck if you want to use the non-tabular format.
	Connect to SmartBits at Startup	Check to automatically connect to the SmartBits chassis when *SmartApplications* starts. This speeds up application startup time.
Test Options	**Router Test**	Check if you are testing a router. This enables the *Next Hop Test* checkbox.
	Stop On Error	**Checked:** When errors are encountered, the test stops and error messages display, to enable you to correct the condition. **Unchecked:** Errors are ignored and the test continues. Error messages are logged to the results file. Leave this box unchecked if you want the test to run regardless of error conditions.
	Next Hop Test	Enables you to test the Next Hop gateway address.
	Disable ET Display	**Checked:** The SmartBits does not try to track updates for the front panel of an attached ET-1000. **Unchecked:** Uncheck only if your test bay includes an ET-1000 controller and you want to track ET-1000 counters through the front panel display.

Table 5-1. Preference Tab Fields.

Pane	Field	Description
Test Options (continued)	**Tear down ATM connection every frame size test**	When testing ATM cards, disconnect the stream and connection for each trial.
	VPI-VCI Hex Format	When testing ATM cards, check to view VPI and VCI values in hex format.
	Offered (actual) Load	You can run each test using either an "Intended" method of loading the device under test (DUT) or an "Offered Load" method of loading the DUT. **Checked:** "Offered Load" method is enabled. **Unchecked:** "Intended" method is enabled. See *"Offered vs. Intended Load" on page 58* for further information on this option. **Note:** On LAN-3300A/3301A modules, the Latency test is not supported when *Offered Load* is enabled (checked). To run the Latency test with these modules, disable this option.
	Keep Frame Relay PVC Active between Trials	When testing ATM cards, check to prevent the teardown of the PVC between tests (when changing from one packet size to the next) or between trials (changing from one frame rate to the next).
	Delay After Transmit	Select the number of seconds to wait after all Tx cards have finished transmitting.
SmartCard Reservation Options	**—**	Select the option for reserving or releasing cards in multi-user environments. You can elect to reserve one to all cards throughout the session, or no cards, when you connect to a multi-user chassis. Optionally, specify a reservation timeout by using the *Minutes* field. If you do this, the timer starts each time you connect. If the timeout occurs, all reserved cards are released.
Report Filenames (no file extension)	**—**	You can accept the default filenames for test results (as shown in the field for each test) or specify a different filename.

Offered vs. Intended Load

You can run any test using either an *Intended* method of loading the device under test (DUT) or an *Offered Load* method of loading the DUT. The *Offered (actual) Load* checkbox on the *Preference* tab selects the method. When checked, the "Offered Load" method is enabled (default). When unchecked, the "Intended" method is enabled.



Use this checkbox to select how the DUT should be loaded during the test: by either the "Intended" method or "Offered Load" method.

The Intended transmit rate is derived by calculating the number of frames per second, based on configured load, for the duration of the test.

Offered Load is supported in *SmartApplications* 2.50 and later. It takes into account the possibility that flow control from the DUT may cause the transmitting SmartBits port to send fewer frames than attempted—for example, because the port is held off by Pause commands from the DUT. When Offered Load is selected, performance measurements are based on this actual transmit rate ("Offered Load"). In previous versions, measurements were based on the derived ("Intended") rate. Here, "derived" and "intended" refer to the rate attempted based on the configured frame size and rate, with respect to the line rate. Because Offered Load reflects the actual transmit rate, the resulting performance measurements may be considered "more accurate" than those obtained by using the "Intended" method.

Note: Latency tests are not supported on the LAN-3300A/3301A modules when *Offered (actual) Load* is enabled. To run Latency tests with these modules, disable *Offered (actual) Load*.

Saving a Test Configuration

You can save your test configurations in a `.sig` file. Doing this can save considerable time—for example, in editing protocol header fields—and it is highly recommended.

To save your test setup to a file

Select **File > Save As** and enter the file name.

The last saved configuration becomes the default configuration for any future tests.

To load the file later

Select **File > Open** and select the file.

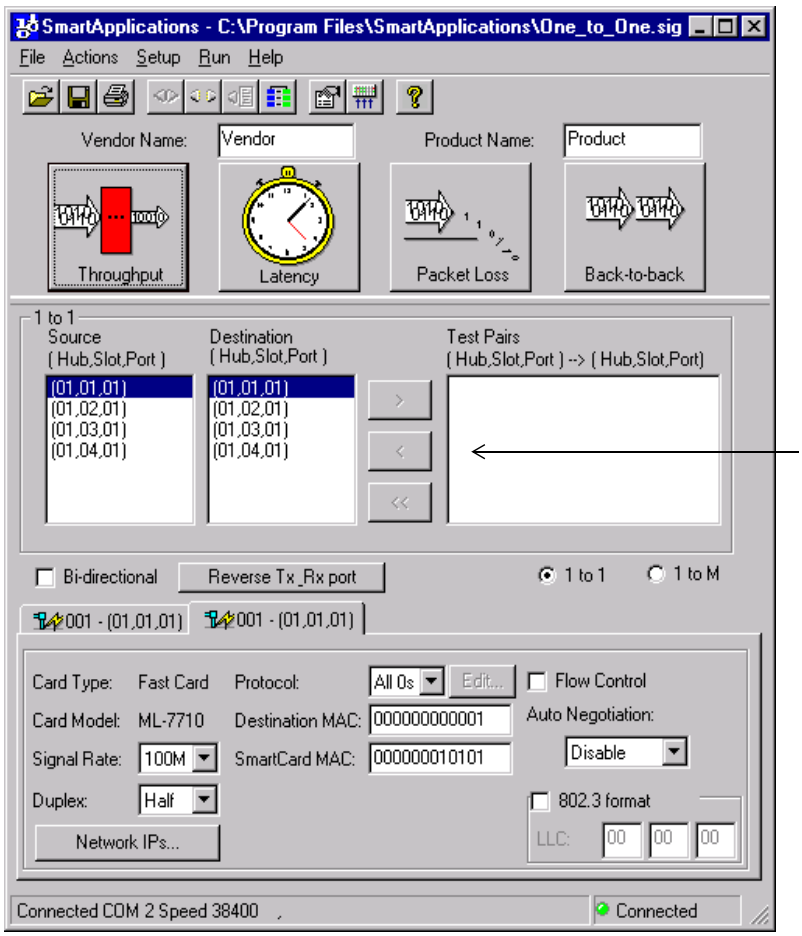
Select Test Ports

In any test, one or more *source* ports generate traffic to the device under test (DUT), and one or more *destination* ports receive and check the frames received from the DUT. You must select at least two ports for any test: one source port and one destination port.

The port configuration needed for a test depends on its type:

- **1 to 1** tests use only port *pairs*.
- **1 to Many** tests use a single source port and multiple destination ports.
- **Many to 1** tests use a multiple source ports and one destination port.

For any test type, you use the arrow buttons to add and remove ports from the port lists. At startup, *SmartApplications* queries the SmartBits to determine what cards are installed, and it lists them in the *Available Ports* list box.



Use the arrow buttons to add and remove ports from the port list for a test.

Hub, Slot, and Port Numbering

When you connect *SmartApplications* to a chassis, the *Source* and *Destination* port lists identify the installed ports in the "hub/slot/port" format. These three values are:

Hub# The SmartBits chassis number (in multi-chassis setups).

Slot# The slot where the card or module is inserted.

Port# The port on the card or module.

For all three values in the hub/slot/port triplet, numbering starts at **01**.



Note: Slot numbers increment sequentially whether or not ports are physically installed.

SMB-200/2000 Port Numbering

The SMB-200 and SMB-2000 chassis accept single-width cards with one port, as well as double-width cards with one to four ports. Each slot is numbered on the chassis, and on multi-port cards each port is numbered on the card face.

Refer to "Linking Multiple SmartBits Chassis" on page 42 for additional information.

SMB-600/6000B Port Numbering

The SMB-600 and SMB-6000B chassis accept modules with one to eight ports. Each module slot is numbered on the chassis. The two modules that occupy each slot are designated **A** and **B**, with the A module on the left and the B module on the right.

Ports are numbered from left to right on the module face.

Refer to "Linking Multiple SmartBits Chassis" on page 42 for additional information.

Allowed Port Pair Combinations

You can use *SmartApplications* to test mixed topologies or matched topologies.

Table 5-2 and *Table 5-3* list the possible combinations of card types for the 1 to 1 test and the 1 to Many/Many to 1 test.

1 to 1 Test: Allowed Card Combinations

The 1 to 1 test topology provides results for all four tests, using all currently available cards and modules, with exceptions listed below.

Table 5-2. 1 to 1 Tests: Allowed Card (Port-pair) Combinations

	TO			
FROM	**Ethernet**	**Token Ring**	**ATM**	**WAN**
Ethernet	Y	Y[1]	Y[2]	Y[3]
Token Ring	Y[1]	Y	N	Y
ATM	Y[4]	N	Y[5]	Y[1,6]
WAN	Y[3]	Y	Y[1,3,7]	Y[3]

1 Router testing only.
2 Ethernet to ATM supports all four tests using LANE 1.0 SVCs or Classical IP PVCs.
3 Frame Relay cards support only one DLCI.
4 ATM to Ethernet does not support Latency or Back-to-Back tests. Throughput and Packet Loss tests are supported, but only using LANE SVCs or Classical IP PVCs.
5 ATM to ATM supports Throughput, Packet Loss, and Latency tests, for router or ATM switch testing. The Back-to-Back test is not supported. Latency measurements are based on the first frame in the burst, not the frame in the midst of the burst.
6 ATM to Frame Relay supports only the Throughput and Packet Loss tests, and you must use Classical IP PVCs.
7 Frame Relay to ATM supports all tests, and you must use Classical IP PVCs.

1 to Many/Many to 1 Test: Allowable Card Combinations

The 1 to Many/Many to 1 test topology provides results only for the Packet Loss and Back-to-Back tests, using all currently available cards and modules, with the exceptions listed below.



Notes:

ATM to Ethernet or ATM to WAN:
If the DUT bundles multiple streams into one virtual circuit, *SmartApplications* counters reflect the number of packets received for each virtual circuit (not per stream).

WAN Cards:
WAN ports may be used only on the "many" side of a 1 to Many/Many to 1 test topology. They may not be used on the "one" side.

Table 5-3. 1 to Many/Many to 1 Tests: Allowed Card Combinations

	TO			
FROM	**Ethernet**	**Token Ring**	**ATM**	**WAN**
Ethernet	Y	Y[1]	Y[2]	Y[3]
Token Ring	Y[1]	Y	N	Y
ATM	Y[4]	N	Y[5]	Y[6]
WAN	N/A	N/A	N/A	N/A

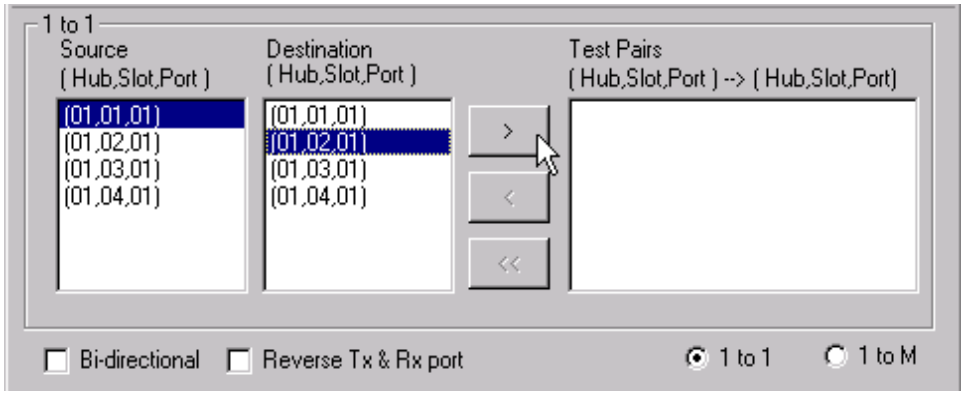
1 Router testing only.
2 Ethernet to ATM supports all four tests using LANE 1.0 SVCs or Classical IP PVCs.
3 Frame Relay cards support only one DLCI.
4 ATM to Ethernet does not support Latency or Back-to-Back tests. Throughput and Packet Loss tests are supported, but only using LANE SVCs or Classical IP PVCs.
5 ATM to ATM supports the Packet Loss test for PVC CLIP only.
6 Router testing only, with ATM to Frame Relay using PVC CLIP only.

Running 1 to 1 Tests

The 1 to 1 test sends test traffic between port pairs: from source port to destination port.

To run a 1 to 1 test:

1. Click the **1 to 1** radio button.
2. Select a port number from the *Source* list box, and another port number from the *Destination* list box.
3. With both ports highlighted, click the **>** button to add the port pair to the *Test Pairs* list box.
4. Select *Bi-directional* to cause the selected port pairs to transmit simultaneously in both directions, as in full-duplex operation.



Note: When you run bi-directional Latency tests, *SmartApplications* determines results for only one direction. For example, if you select source Port 1 and destination Port 3, the results would reflect the Port 1 to Port 3 direction only.

Bi-directional Traffic

Checking *Bi-directional* causes the selected port pairs to transmit simultaneously in both directions, for full duplex implementations. This option (available only for 1 to 1 tests) is not recommended when the transmitting and receiving cards have different link speeds and/or network topology.

As an example, if you test a router using a port pair made up of one Ethernet port and one ATM port, bi-directional results would not be meaningful, because the percentage of traffic offered on each side would not be equal.

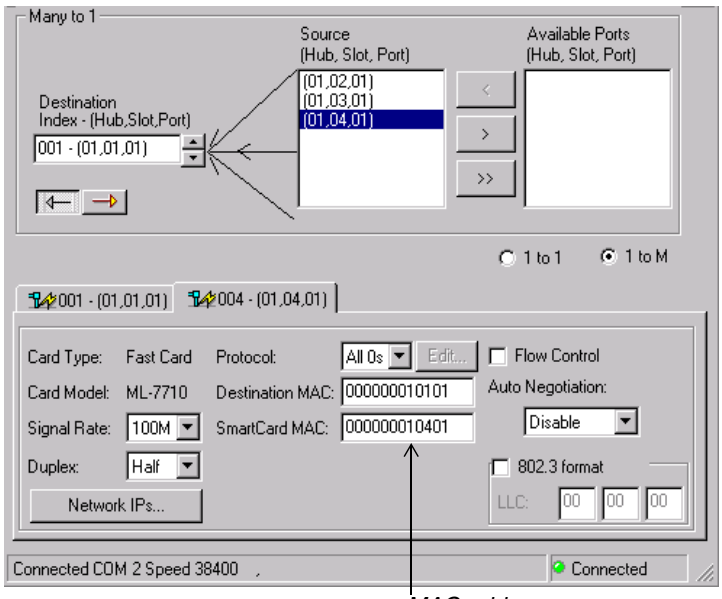
Bi-directional tests in half-duplex mode: Performing bi-directional throughput tests in half-duplex mode at high rates will result in line collisions. Excessive collisions will effectively increase the total transmission time which may render the test results invalid. When this occurs, throughput is calculated based on the intended load as opposed to the actual offered load.

Bi-directional Latency tests: When you run bi-directional Latency tests, *SmartApplications* determines results for only one direction. For example, if you select source port 1 and destination port 3, the test results will reflect only the port 1-to-port 3 direction.

Running 1 to Many/Many to 1 Tests

The 1 to Many test sends test traffic from one port to many ports. The r Many-to-1 test sends test traffic from many ports to one port. With a 1 to Many configuration, only Packet Loss and Back-to-back test results are available.

Direction buttons



MAC addresses on card attributes tab

To run a 1 to Many or Many to 1 test

1. Click the **1 to M** radio button.
2. Click a direction button to select one port to many, or many ports to one.
3. Select one or more ports from the *Available Ports* list box. and click the **<** button. The ports appear in the *Source* or *Destination* list box, depending on the direction you select. (The figure above shows the *Destination* box.)

If you change the test direction, the Destination MAC and Source MAC addresses shown in the card attributes tab remain unchanged. Ensure that you enter the correct destination MAC address for the DUT (see figure).

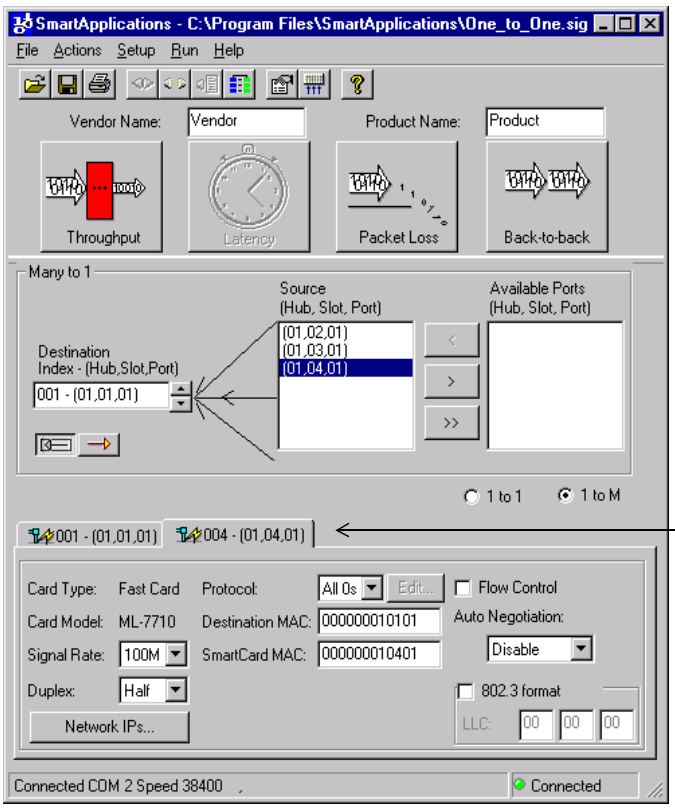
For configurations between ATM and Ethernet or ATM and Frame Relay: If the DUT bundles multiple streams into one virtual circuit, *SmartApplications* counters reflect the number of packets received on a per virtual circuit basis (not per stream).

Configure Test Ports

You can configure the SmartBits test ports in two ways:

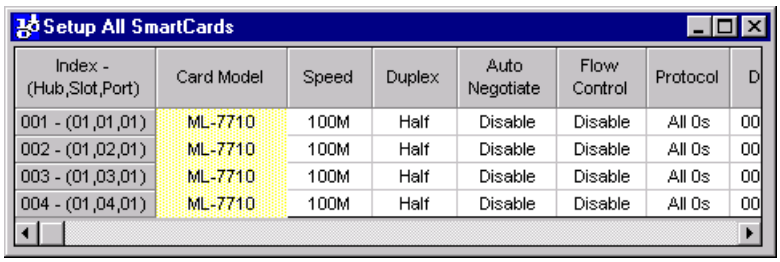
1. Configure ports individually by using the port attribute tabs in the main window.
2. Configure multiple ports by selecting **Setup > All SmartCards** and using the *Setup All SmartCards* window. This is a faster and more convenient method if your test will include many ports, because it allows global changes.

SmartApplications stores the last four setup configuration (`.sig`) files that were used in a `SMARTAPP.INI` file in your Windows directory. Each time you open *SmartApplications*, the last configuration file is recalled automatically.



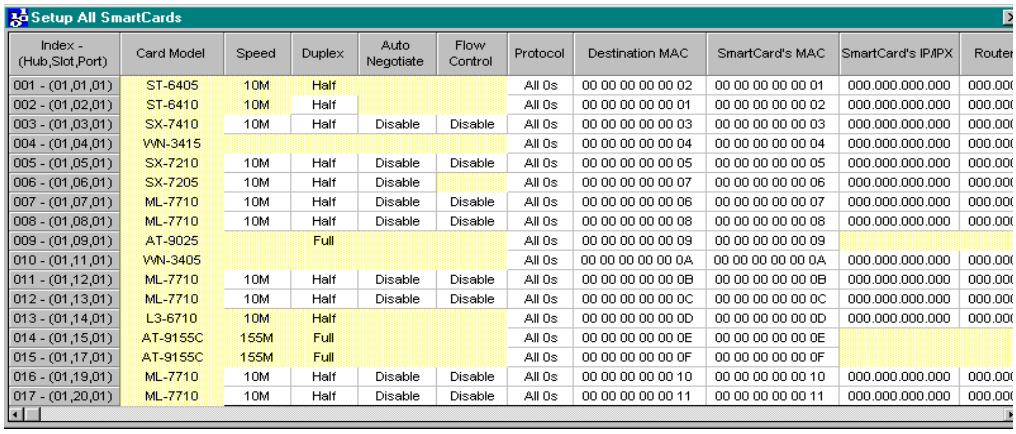
You can configure test ports individually, by using the port attributes tabs in the main window.

*Or, select **Setup > All SmartCards** to configure all ports (or multiple ports) at one time.*



Configuring Multiple Ports at Once

You can use the *Setup All SmartCards* window to configure the attributes for multiple ports. Select **Setup > All SmartCards** from the *SmartApplications* main window:



Index - (Hub,Slot,Port)	Card Model	Speed	Duplex	Auto Negotiate	Flow Control	Protocol	Destination MAC	SmartCard's MAC	SmartCard's IPXPX	Router
001 - (01,01,01)	ST-6405	10M	Half			All 0s	00 00 00 00 00 02	00 00 00 00 00 01	000.000.000.000	000.00
002 - (01,02,01)	ST-6410	10M	Half			All 0s	00 00 00 00 00 01	00 00 00 00 00 02	000.000.000.000	000.00
003 - (01,03,01)	SX-7410	10M	Half	Disable	Disable	All 0s	00 00 00 00 00 03	00 00 00 00 00 03	000.000.000.000	000.00
004 - (01,04,01)	WN-3415					All 0s	00 00 00 00 00 04	00 00 00 00 00 04	000.000.000.000	000.00
005 - (01,05,01)	SX-7210	10M	Half	Disable	Disable	All 0s	00 00 00 00 00 05	00 00 00 00 00 05	000.000.000.000	000.00
006 - (01,06,01)	SX-7205	10M	Half	Disable		All 0s	00 00 00 00 00 07	00 00 00 00 00 06	000.000.000.000	000.00
007 - (01,07,01)	ML-7710	10M	Half	Disable	Disable	All 0s	00 00 00 00 00 06	00 00 00 00 00 07	000.000.000.000	000.00
008 - (01,08,01)	ML-7710	10M	Half	Disable	Disable	All 0s	00 00 00 00 00 08	00 00 00 00 00 08	000.000.000.000	000.00
009 - (01,09,01)	AT-9025		Full			All 0s	00 00 00 00 00 09	00 00 00 00 00 09		
010 - (01,11,01)	WN-3405					All 0s	00 00 00 00 00 0A	00 00 00 00 00 0A	000.000.000.000	000.00
011 - (01,12,01)	ML-7710	10M	Half	Disable	Disable	All 0s	00 00 00 00 00 0B	00 00 00 00 00 0B	000.000.000.000	000.00
012 - (01,13,01)	ML-7710	10M	Half	Disable	Disable	All 0s	00 00 00 00 00 0C	00 00 00 00 00 0C	000.000.000.000	000.00
013 - (01,14,01)	L3-6710	10M	Half			All 0s	00 00 00 00 00 0D	00 00 00 00 00 0D	000.000.000.000	000.00
014 - (01,15,01)	AT-9155C	155M	Full			All 0s	00 00 00 00 00 0E	00 00 00 00 00 0E		
015 - (01,17,01)	AT-9155C	155M	Full			All 0s	00 00 00 00 00 0F	00 00 00 00 00 0F		
016 - (01,19,01)	ML-7710	10M	Half	Disable	Disable	All 0s	00 00 00 00 00 10	00 00 00 00 00 10	000.000.000.000	000.00
017 - (01,20,01)	ML-7710	10M	Half	Disable	Disable	All 0s	00 00 00 00 00 11	00 00 00 00 00 11	000.000.000.000	000.00

Changing Cell Values

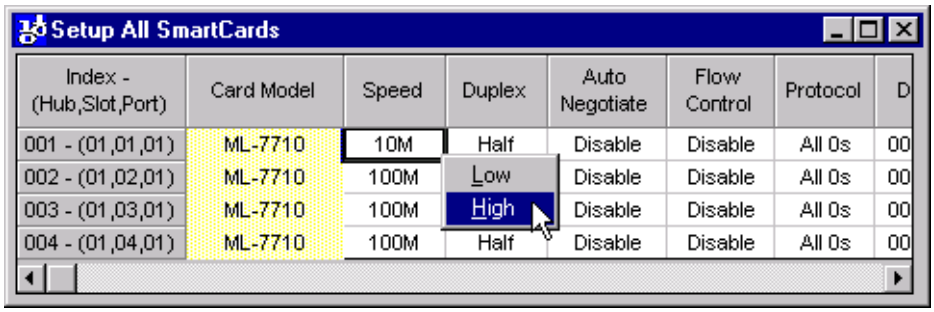
Certain cells are locked and their field values cannot be modified. These fields are highlighted in yellow in the *Setup All SmartCards* window.

To modify unlocked cells, use the following steps, depending on field type.

To modify Speed, Duplex, and Protocol fields:

1 Click on a cell to outline it.

2 Right click on the cell to display the popup menu and select a value.



Note: On LAN-3300A/3301A modules:

- Half-duplex currently is not supported.
- When selecting speed values, **High** specifies Gigabit (1000Mbps), **Low** specifies 100Mbps. To set 10Mbps, use the *card attributes* tab.

To modify Destination MAC and IP/IPX fields:

To modify these fields:

- Destination MAC
- SmartCard's MAC
- SmartCard's IP/IPX
- Router's IP/IPX

1 Click on the cell.

2 Enter the new value.

To modify the *Net IPs/+Ring field:

1 Click on the cell to highlight it.

2 Right click on the cell to display the popup menu.

3 Select * Network IPs to open a popup menu and modify the Network IPs for Next Hop tests.

4 Select + Ring Properties to open a popup menu and modify values for Token Ring networks.

If either Network IPs or Token Ring does not apply to the port, the option is greyed out on the popup menu.

To change all the field values in a column

You can change a field value globally for all ports.



Note: You must specify MAC and IP fields individually by port.

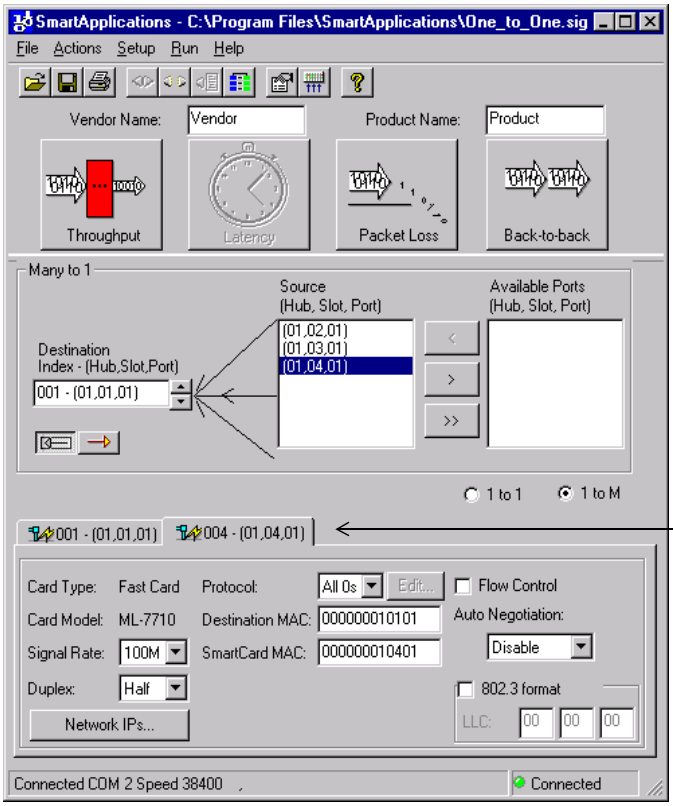
1 Click the column header to highlight the entire column.

2 Right-click on the header. A popup show available options.

3 Select an option. All cells in the column change to the selected value.

Configuring a Ports Individually

You can configure ports individually by using the port attributes tabs in the main window. Each tab displays options appropriate to the network topology of the selected port (see the following sections for descriptions of options).



Use the port attributes tabs to configure test ports one by one.

1 Select the ports for the test from the main window (if not yet done). The tabs display the two ports (source and destination) you selected last.

Note: Ensure that these are the ports you wish to use in your test.

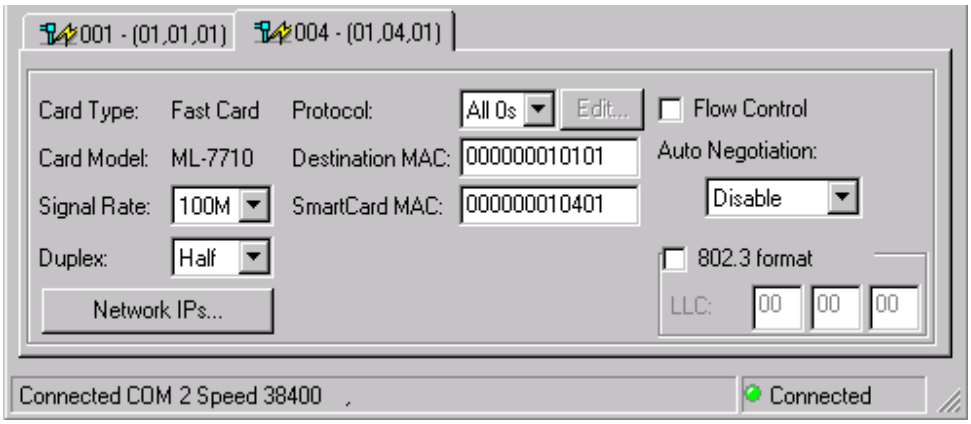
2 Select each tab in turn, and define the following:

- MAC addresses. For routers, this is the MAC address of the local router port. If you are doing 1 to Many/Many to 1 tests, you must define addresses for each card in the test.
- All other information relevant to the selected port type, such as:
  - Next hop network IPs for Next Hop tests.
  - Token Ring properties for Token Ring cards.
  - Line and ELAN parameters for ATM cards.
  - Line or LMP or Address information for WAN cards.

Configuring Ethernet Ports

When you select an Ethernet port, the port attribute tab displays Ethernet setup options.

Note: For Ethernet cards, *SmartApplications* sends out Ethernet 802.3 test frames.



Ethernet Options (Port Attributes Tab)

Table 5-4 lists the options on the port attribute tab for an Ethernet port.

Table 5-4. Ethernet Options (Port Attributes Tab)

Field	Description
Card Type	The card type, such as **Fast Card** for 100Mb.
Card Model	The card model number, such as ML-7710.
Signal Rate	The port's transmission rate in megabits per second. You set the rate for each port in a pair separately. For Ethernet cards, possible values are: **10**, **100**, and **1000**.
Duplex	The port's duplex mode. Possible values for Ethernet are **Full** and **Half**. **Note:** Half-duplex currently is not supported on the LAN-3300A/3301A modules.
Protocol	Select the protocol for the port. The protocol you select shows or hides other fields on the tab. If you select **IP** or **UDP**, the *SmartCard's IP* and *Router's IP* fields appear. If you select **IPX**, the *Source Net* and *Destination Net* fields appear. When testing a router, you must select either **IP**, **UDP**, or **IPX**. Options such as the **All 0s** option refer to the packet contents (excluding MAC addresses). **Note:** You must set the same protocol within a port pair. For example, you cannot configure the transmitting port for IP and the receiving port for UDP.

Table 5-4. Ethernet Options (Port Attributes Tab) (continued)

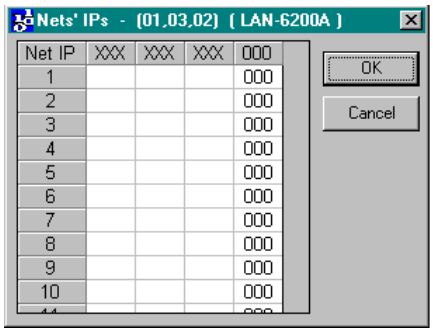
Field	Description
Destination MAC	Specify the MAC addresses used. Default addresses correspond to the port numbers. For example, for Ports 1 and 2 the Destination MAC are 000000000001 and 000000000002 respectively. To specify a different MAC address, enter a different value in the field. Repeat this process until all the addresses are specified correctly for your test pairs. **Special conditions** • When testing a router, this value is the MAC address of the local router port. • When testing a switch, this value is the MAC address of the destination SmartCard.
SmartCard MAC	The MAC address of the sending port.
SmartCard's IP	Enter the IP address of the port displayed on the tab. The *SmartCard IP* address should have the same network address as the router port to which the port is connected, but with a different host address.
Router's IP	Enter the IP address of the router port to which the port is connected. If you are testing a switch, you can use the default value. **Note:** If you change direction in the port selection area of the main window, the *Destination MAC* and *SmartCard MAC* and *SmartCard's IP* addresses remain unchanged in the port attributes tab for each port. Be sure to verify that these fields reflect the correct addresses.
Source Net	The 4-byte network address of the transmitting port.
Destination Net	The 4-byte network address of the router port (for router testing) or receiving port (for switch testing).
Flow Control	Enables traffic flow control. **Note:** This field appears only for SX-7x10 and GX-1405 SmartCards. When this box is checked and the SmartCard receives a pause frame, the card will stop transmitting for the number of slot times specified in the pause frame. Default is Off (unchecked).
Auto Negotiation	Auto-negotiation (AN) provides a means for the communicating interfaces at each end of a link (the *link partners*) to exchange information about their speed and duplex capabilities, and so to achieve the best possible mode of operation. The information exchanged in the AN protocol is kept in memory registers termed *MII registers*. Values for this option are: *Continues –>*

Table 5-4. Ethernet Options (Port Attributes Tab) (continued)

Field	Description
Auto Negotiation *(Continued)*	**Disable** Sets register 0 and register 4 to the user-selected flow control, speed, and duplex (if applicable) settings. Sets register 0 to Disable AN on this port. With this option, the port *does not* participate in the AN protocol. **Force** Sets register 0 and register 4 to the user-selected flow control, speed, and duplex (if applicable) settings. Sets register 0 to Enable AN on this port and sets the appropriate bit to signal a restart of the AN process.
802.3 Format	For Ethernet cards, *SmartApplications* sends out Ethernet 802.3 test frames. You can edit the LLC (IEEE 802.2) header by selecting this option, then entering the desired values in the three entry fields. Field / Offset / Description First / 15 / Destination Service Access Point (SSAP) Second / 16 / Source Service Access Point (SSAP) Third / 17 / Control Byte (LLC frame type)

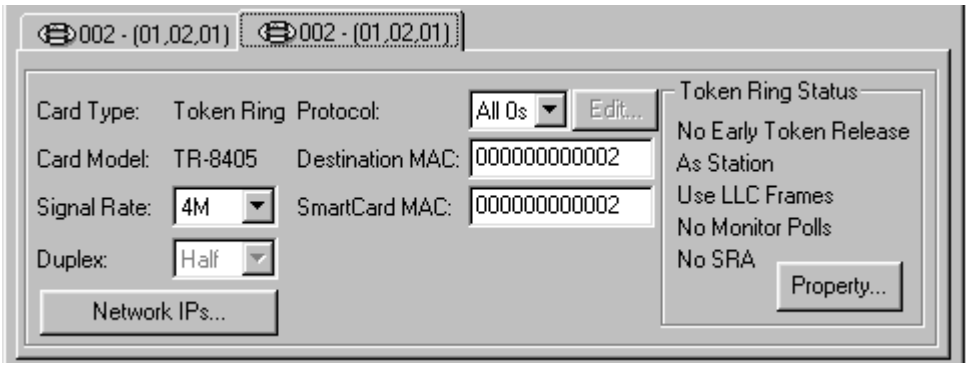
Network IPs...

Click to open the *Network IPs* dialog. This allows you to define the contents of RIP (Routing Information Protocol) packets. RIP packets are used to update routing tables and are sent when testing over multiple hops.



Configuring Token Ring Ports

When you select a Token Ring port and the *Show Card Attribute* box is checked, the port attribute tab displays Token Ring setup options.



Token Ring Options (Port Attribute Tab)

Table 5-5 lists the options on the port attribute tab for a Token Ring port.

Table 5-5. Token Ring Options (Port Attributes Tab)

Field	Description
Card Type	Displays the card type, in this case *Token Ring*.
Card Model	Displays the card model number (TR-8405).
Signal Rate	Select the transmission rate in megabits per second. For Token Ring cards, possible values are **4** and **16**.
Duplex	Select the duplex mode. For Token Ring both TXI or TKP are allowed.
Protocol	Select the protocol for the port. The protocol you select shows or hides other fields on the tab. For example, if you select **IP** or **UDP**, the *SmartCard's IP* and *Router's IP* fields are displayed. If you select **IPX**, the *Source Net* and *Destination Net* fields are displayed. When testing a router, you must select either **IP**, **UDP**, or **IPX**. Options such as the **All 0s** option refer to the packet contents (excluding MAC addresses). **Note:** You must set the same protocol within a port pair. For example, you cannot configure the transmitting card with IP and the receiving card with UDP.

Table 5-5. Token Ring Options (Port Attributes Tab) (continued)

Field	Description
Destination MAC	For router testing, this is the MAC address of the local router port. The *SmartCard's MAC* destination address must be set to be the MAC address of the router port to which the card is connected. For switch testing using 1 to Many or Many to 1 tests, this is the MAC address of the destination port.
SmartCard MAC	The port's MAC address. MAC addresses are 48 bits long, usually written as 6 bytes in hexadecimal. For simplicity, set this to match the port number in the SmartBits system. For example, port 1 would be 00 00 00 00 00 01 for the transmitter and port 2 would be 00 00 00 00 00 02 for the receiver.
SmartCard's IP	(This field and the *Router's IP* field appear when you select **IP** or **UDP** in the *Protocol* field.) Enter the port's IP address. The *SmartCard's IP* address should have the same network address as the router port to which the port is connected, but with a different host address.
Router's IP	Enter the IP address of the router's port to which the port is connected. If testing a switch, this field can be the packet contents.
Source Net	The 4-byte network address of the transmitting port.
Destination Net	The 4-byte network address of the router port (for router testing) or receiving port (for switch testing).

Buttons – Status Pane

This pane on the tab for a Token Ring port shows the port's current status (for example, whether Early Token Release is enabled). It reflects the settings from the *Token Ring Properties* window.

Network IPs
Click to open the *Network IPs* dialog. This allows you to define the contents of RIP (Routing Information Protocol) packets. RIP packets are used to update routing tables and are sent when testing over multiple hops.

Property
Click to open the *Token Ring Properties* dialog, which allows you to define the properties of the Token Ring port (see *"Defining Token Ring Properties" on page 76*).

Defining Token Ring Properties

To specify properties for the Token Ring port, click the **Property** button on the port attributes tab for a Token Ring port. This opens the *Token Ring Properties* window.

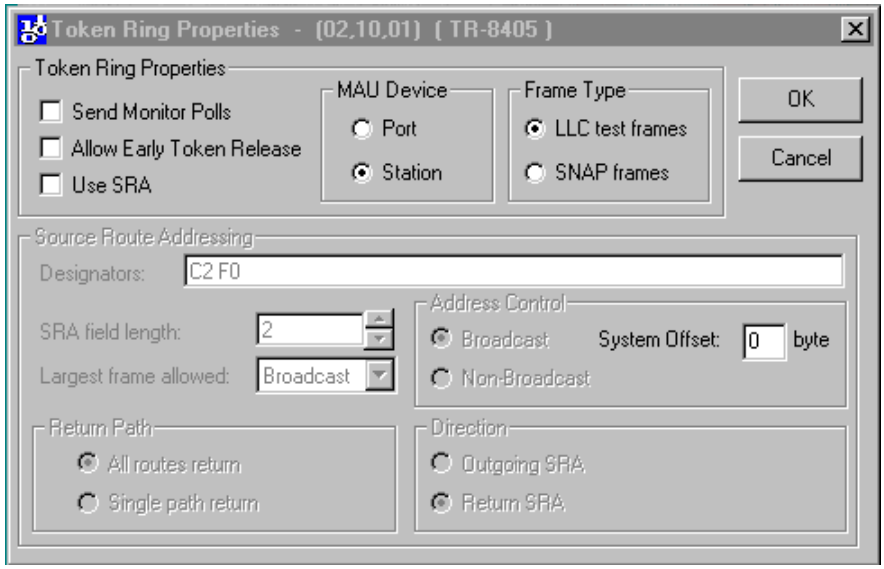


Table 5-6 lists the options in this dialog.

Table 5-6. Token Ring Properties Dialog

Field	Description
Send Monitor Polls	Enables the card to send out standby monitor polls in response to active monitor polls.
Allow Early Token Release	For 16MHz operation only, allows the SmartCard to release a token prior to receiving its own transmitted frame back. This can improve throughput, especially for small frames.
Use SRA	Select to create the source routing field for Token Ring frames. The fields used to enter source routing information become active. When SRA is enabled, the source address for the frame is automatically modified (before transmission) so that its uppermost bit indicates to the network that the frame contains source routing information. You must ensure that the field contents are correct—for example, the length specification must be valid for it to be interpreted correctly by the network devices.
Port	When selected, configures the SmartCard port as a Media Adapter Unit (MAU) port.

Table 5-6. Token Ring Properties Dialog (continued)

Field	Description
Station	When selected, configures the SmartCard port as a station.
LLC test frames	Select this radio button to use LLC test frames in the test.
SNAP frames	Select this radio button to use SNAP frames in the test.

Source Route Addressing Area

The control bytes (first two bytes) in the *Designators* field are automatically updated when you select any combination of options in this area of the window.

Table 5-7 lists the Source Route Addressing fields.

Table 5-7. Source Route Addressing Fields

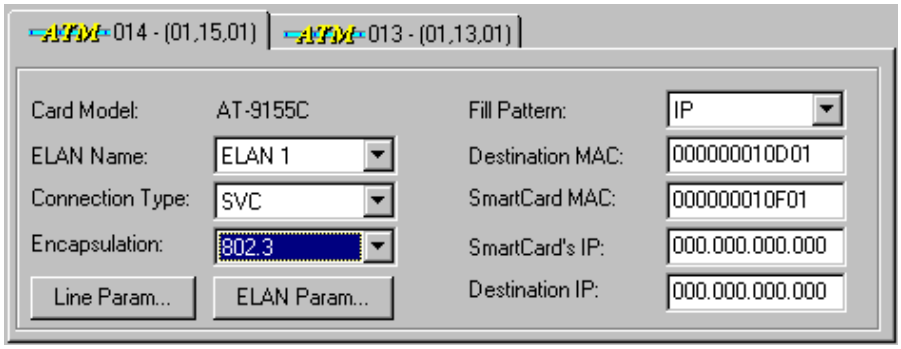
Field	Description
Designators	Defines how you want to route source packets. Enter hexadecimal values directly into this field or make selections from the other fields in the Source Route Addressing area. As you select other fields the Designators field reflects the changes in hexadecimal code for: SRA Length Largest frame allowed Address Control Return Path Direction => 2-byte control field
SRA field length	Enter or select the length of the routing information field in bytes, including the control field. Range: 2 to 30 bytes.
Largest frame allowed	Enter or select the largest frame size that can be transmitted between two communicating stations on a specific route. Available values are: 516, 1470, 2052, 4472, 8144, 11407, 17800, and Broadcast. The Broadcast setting is normally used in explorer frames.

Table 5-7. Source Route Addressing Fields (continued)

Field	Description
Access Control	This bit specifies the route through the network that the frame should travel. Options are: **Broadcast** Select this radio button if you want the frame transmitted along every route in the network to the destination station (often resulting in many copies of the frame). When you select **Broadcast**, the *Number of Hops* field displays. Select this option to test the Token Ring source routing number of bytes that will be in the system offset. **Non-Broadcast** Select this radio button if you want the segment number fields to contain the specified route through the network that the frame is to travel. **System Offset** Enter the number of bytes offset by the source routing information inserted by the DUT into each frame.
Return Path	This bit defines a single path return or return through all available paths. Options are: **All routes return** Select this radio button for a single path return. **Single path return** Select this radio button for return through all available paths.
Direction	This bit determines whether the of ring numbers and bridge numbers in the routing information field are read from left to right or right to left by the network devices. **Outgoing SRA** Select this radio button for the bridge to interpret the routing information field from left to right **Return SRA** Select this radio button for the bridge to interpret the routing information field from right to left.

Configuring ATM Ports

When you select an ATM port, the port attribute tab display ATM options.



Summary of Steps to Configure an ATM Port

Use the following steps to configure an ATM port using the port attributes tab:

1. Set up the line parameters. Click **Line Param** to open the *Port Configuration* window.
2. Set up the protocol. Click **ELAN Param** to open the *ELAN Registration* window.
3. Add and configure at least one ELAN from the *ELAN Registration* window.
4. Specify the MAC addresses for the local router port and the SmartCard, and other options, by using the port attributes tab.

Note: See *"Set up ATM 1-to-Many/Many-to-1 Tests with PVC CLIP" on page 123* for additional information on setting up ATM tests.

ATM Options (Port Attributes Tab)

Table 5-8 lists the options on the port attributes tab for an ATM port.

Table 5-8. ATM Options (Port Attributes Tab)

Field	Description
Card Model	Displays the model number of the card, such as AT-9025.
ELAN Name	This field is displayed if you select **SVC** for the *Connection Type* field and **802.3** for the *Encapsulation* type. Select the name of the ELAN you want to use for the test. This field is blank if you have not yet set up any ELANs. Click the **ELAN Param** button to access the *ELAN Registration* window to set up ELANs.

Table 5-8. ATM Options (Port Attributes Tab) (continued)

Field	Description
VPI-VCI	This field is displayed if you select **PVC** for the *Connection Type* field. Enter the contents in decimal or hexadecimal of the header portion of the cell.
Connection Type	The type of virtual circuit for the connection between the SmartBits chassis and the device under test. This field controls the options available in the *Encapsulation* field. The possible values for *Connection Type* are: **SVC** Switched Virtual Circuit. The connection is established only when needed. **PVC** Permanent Virtual Circuit. The connection is permanently established.
SmartCard's IP	(This option is active when you select **PVC** for the *Connection Type* field.) Enter the port's IP address. The *SmartCard's IP* address must have the same network number and subnet address as the router port to which the port is connected. Use the IP address of the outer port with its last digit modified as the IP source address of the port.
Destination IP	(This option is active when you select **PVC** for the *Connection Type* field.) Enter the IP address of the receiving SmartCards.
Encapsulation	The possible values for this field depend upon the value set for *Connection Type*, as follows: If *Connection Type* is **PVC**, the possible values for *Encapsulation* are: • **SNAP** • **Classic IP** • **VC Mux Routed** If *Connection Type* is **SVC**, the possible values for *Encapsulation* are: • **SNAP** • **802.3** (Ethernet) • **Classic IP** • **VC Mux Routed** For **Bridged RFC 1483**: Select **SNAP**.

Continues –>

Table 5-8. ATM Options (Port Attributes Tab) (continued)

Field	Description
Encapsulation *(continued)*	For **RFC 1577** or **Routed RFC 1483** (using Routed SNAP, IP, or UDP protocols): Select **Classic IP**. **VC Mux Routed**: VC Multiplexing creates a binding between an ATM VC and the type of the network protocol carried on that VC. Thus, there is no need for protocol identification information to be carried in the payload of each AAL5 CPCS-PDU. This reduces payload overhead and can reduce per-packet processing. VC multiplexing can improve efficiency by reducing the number of cells needed to carry PDUs of certain lengths. (RFC2684). **SNAP** (Subnetwork Access Protocol) uses the subnetwork and performs data transfer, connection management, and QoS selection.
Fill Pattern	The protocol to use for the payload. If you selected PVC for the *Connection Type*, the fill pattern is **IP** or **UDP**.
Destination MAC	For switch testing in 1 to Many / Many to 1 tests, this is the MAC address of the destination port. For router testing, this is the MAC address of the local router port. If you do not specify an address, you will get zero throughput. The SmartCard's MAC destination address must be the MAC address of the router port to which the port is connected—for example, a MAC destination of 08 00 02 06 89 22 for the transmitter and 08 00 02 12 27 22 for the receiver.
SmartCard MAC	The MAC address of the SmartCard. MAC addresses are 48 bits long, usually written as 6 bytes in hexadecimal. For simplicity, set this to match the port number in the SmartBits system. For example, port 1 would be 00 00 00 00 00 01 for the transmitter and port 2 would be 00 00 00 00 00 02 for the receiver.

Buttons

Line Param
Click this button to access the *Port Configuration* window, to specify physical interface parameters such as framing and loopback, as well as other ATM protocol information.

ELAN Param
Click this button to access the *ELAN Registration* window, to specify LAN Emulation client information and to register ELANs.

Defining ATM Line Parameters

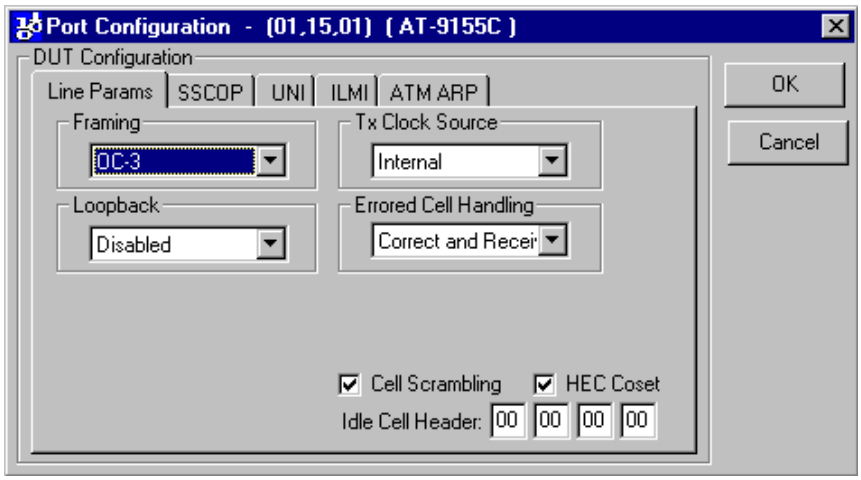
Use the Port Configuration dialog to define the physical interface for the ATM card. It contains the following tabs:

Line Params
Use this tab to specify physical interface parameters, such as framing and loopback. See *"Line Params Tab" on page 83*.

SSCOP
Use this tab to specify the UNI version and timer values for SSCOP. See *"SSCOP Tab" on page 87*.

UNI
Use this tab to specify the UNI version and various timer values for UNI. Currently used for point-to-point only, the UNI configuration offers the standard user-side timers and a special testing teardown timer. See *"UNI Tab" on page 89*.

ILMI
Use this tab to define the method used by an ATM card to acquire its 20-byte ATM address from the network device to which it is connected. See *"ILMI Tab" on page 91*.



Line Params Tab

Table 5-9 lists the options on the *Line Params* tab of the ATM Port Configuration dialog.

Table 5-9. Line Params Tab — ATM Port Configuration Dialog

Field	Description
Framing Mode	Select to define the physical layer of the frame. Possible values are: • **AT-9025 25 Mbps SmartCard** ATM 25 Indicates direct cell mapping at 25.6 Mbps. • **AT-9015 DS1 SmartCard** • DS1 Cell - Maps the ATM cells directly into the DS1 frame with no intermediate mapping. • DS1 PLCP - Maps the ATM cells into PLCP frames and maps the PLCP frames into the DS1 frame. • **AT-9020 E1 SmartCard** • E1 Cell - Maps the ATM cells directly into the E1 frame with no intermediate mapping. • E1 PLCP - Maps the ATM cells into PLCP frames and maps the PLCP frames into the E1 frame. • **AT-9034B E3 SmartCard** • E3 Cell - Maps the ATM cells directly into an E3 G.832 frame with no intermediate mapping. • E3 PLCP - Maps the ATM cells into the PLCP frames and maps the PLCP frames into an E3 G.751 frame. • **AT-9045 DS3 SmartCard** • DS3 Cell - Maps the ATM cells directly into the DS3 frame with no intermediate mapping. • DS3 PLCP - Maps the ATM cells into PLCP frames and maps the PLCP frames into the DS3 frame. • **AT-9155C ATM OC-3c 155 Mbps** • OC3 - For SONET, OC-3c type of optical carrier line. • STM1 - Enables the European STM 1 framing method (equivalent to OC-3c) • **AT-9622 ATM OC-12c 622 Mbps SmartCard** • OC12 - For SONET, OC-12c type of optical carrier line. The SmartCard maps the ATM cells directly into a SONET OC-12c frame. • STM4 - Enables the European STM-4 framing method (equivalent to OC-12c). The SmartCard maps the ATM cells directly into an STM-4 frames.

Table 5-9. Line Params Tab — ATM Port Configuration Dialog (continued)

Field	Description
Tx Clock Source	This field does not apply to the AT-9025 SmartCard, which uses only an internal clock. Specifies the clock against which you want to run the tests. Possible values are: **Internal** Uses an internally generated clock as the transmit clock. **Loopback** Uses the recovered (received) clock as the transmit clock.
Loopback	Specifies the type of loopback to be used. Possible values are: **Disabled** No loopback is used. This is the normal operating mode of the device. **Local** Loops card output back to the card's input. **Remote** Traffic returns to the remote machine.
Errored Cells Handling	Specifies the action to take for cells with errors. Possible values are: **Drop Errored Cells** Drops all cells that have a header error as determined by the HEC byte. **Receive Errored Cells** Receives all cells even if they have errors. **Receive and Correct Errored Cells** Receives and corrects all cells with single-bit header errors.

Table 5-9. Line Params Tab — ATM Port Configuration Dialog (continued)

Field	Description
Buildout	This field applies only to the AT-9015 DS1 and AT-9045 DS3 SmartCards. Select to change possible values for the electrical output of the SmartCard to either: **1** Accommodate the length of the cable with which you are testing or, **2** Specify the amount of attenuation to apply to the signal. **AT-9015 DS1** • **Cable Lengths** • <=133 Feet Pulse shaping for cable lengths up to 133 feet. • >133, <=266 Feet Pulse shaping for cable lengths more than 133 feet and up to 266 feet. • >266, <=399 Feet Pulse shaping for cable lengths more than 266 feet and up to 399 feet. • >399, <=533 Feet Pulse shaping for cable lengths more than 399 feet and up to 533 feet. • >533, <=655 Feet Pulse shaping for cable lengths more than 533 feet and up to 655 feet. • **Buildout Attenuation Values** • -7.5 dB Pulse shaping to generate -7.5 dB of attenuation. • -15.0 dB Pulse shaping to generate -15.0 dB of attenuation. • -22.5 dB Pulse shaping to generate -22.5 dB of attenuation. **AT-9045 DS3** • **Cable Length** • <= 225 Feet Pulse shaping for cable lengths up to 225 feet. • >225 Feet Pulse shaping for cable lengths more than 225 feet.

Table 5-9. Line Params Tab — ATM Port Configuration Dialog (continued)

Field	Description
Line Coding	This field applies only to AT-9015 DS1 and AT-9020 E1 SmartCards. Select the type of encoding to be used for the line. The possible values are: **AMI** Uses AMI line encoding. **B8ZS** DS1 mode using B8ZS line encoding. (AT-9015 only). **HDB3** E1 mode using HDB3 line encoding (AT-9020) only.
Line Framing	This field applies only to the AT-9015 SmartCard. Select the framing mode for the physical layer. The possible values are: **D4** Uses D4 line framing. **ESF** Uses Extended Super Frame line framing.
Cell Scrambling	When checked, the payload of the cells is scrambled to facilitate cell delineation. Most ATM devices require this feature to be on.
HEC Coset	When checked, exclusive ORs the HEC with the bit pattern 0x55. Most ATM devices require this feature to be on.
Idle Cell Header	Specifies the header contents (4-bytes in hexadecimal) of the ATM idle cell payload that is transmitted when no data cells are being transmitted.

SSCOP Tab

Table 5-10 lists the options on the *SSCOP* tab of the ATM Port Configuration dialog.

Click the **Default** button to reset all timers to the *SmartApplications* default values.

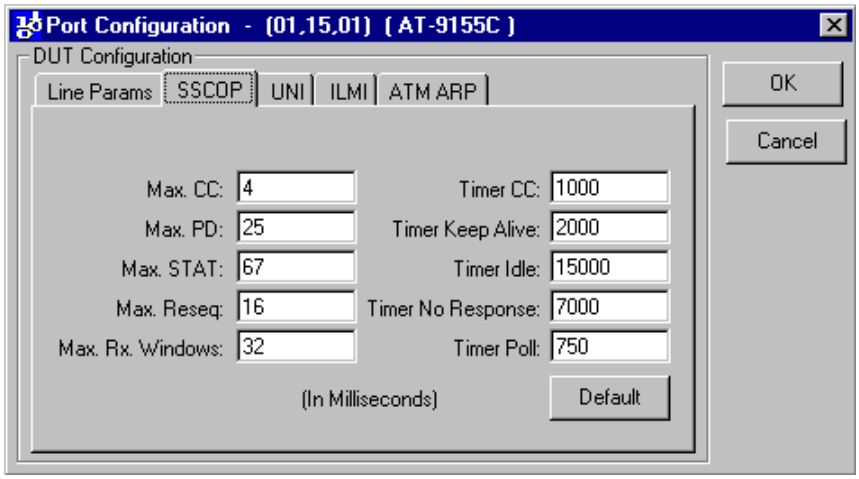


Table 5-10. SSCOP Tab — ATM Port Configuration Dialog

Field	Description
Max. CC	Enter the maximum number of transmissions of a BGN, END, ER, to RS PDU. Valid maximum value is 2^{32} -1 (over 4 billion).
Max PD	Enter the maximum number of SD PDUs that may be sent before sending a POLL PDU. Value must be in the following range: 1 ≤ Max PD ≤ 25.
Max. STAT	Enter the maximum number of list elements placed in a STAT PDU. Value must be an odd number in the following range: 3 ≤ Max STAT ≤ 67.
Max. Reseq	Enter the maximum receive resequencing queue depth in the following range: 1 ≤ Max Reseq ≤ 16.
Max. Rx. Windows	Enter the maximum number of unacknowledged SD PDUs that may be received. Value must be in the following range: 1 ≤ Max Rx Windows ≤ 32.
Timer CC	Enter the interval between transmission of BGN, END, RS, and ER PDUs as long as acknowledgment to these PDUs has not been received.
Timer Keep Alive	Enter the maximum time spent in the transient phase where POLL or STAT PDUs may be lost.

Table 5-10. SSCOP Tab — ATM Port Configuration Dialog (continued)

Field	Description
Timer Idle	Enter the maximum time spent in IDLE phase before reverting to transient phase.
Timer No Response	Enter the maximum time interval during which at least one STAT PDU must be received. Default is 10,000 ms for UNI 3.0; 7,000 ms for UNI 3.1.
Timer Poll	Enter the interval between transmission of POLL PDUs. Default is 100 ms for UNI 3.0; 750 ms for UNI 3.1. **Note:** Timer values must not be zero.

UNI Tab

Table 5-11 lists the options on the *UNI* tab of the ATM Port Configuration dialog. *Table 5-12 on page 90* lists the UNI timers.

Click the **Default** button to reset all timers to the *SmartApplications* default values.

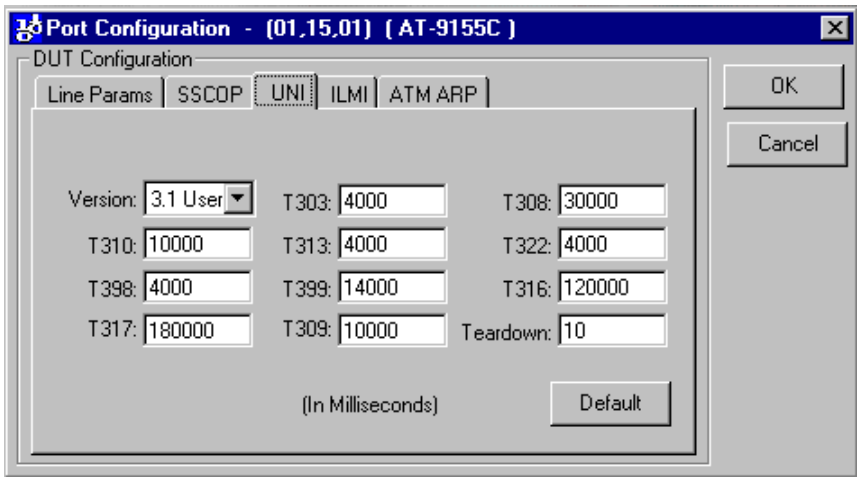


Table 5-11. UNI Tab — ATM Port Configuration Dialog

Field	Description
Version	Possible values are **3.0 User** or **3.1 User** (for SmartBits ATM cards).
Txx	UNI timers. See *Table 5-12* for descriptions. **Note:** *T398* and *T399* will be implemented in a future release.
Teardown	Enter the timer value (mandatory). This value is the time between teardowns (call release requests) when resetting tests. A minimum of 10 milliseconds is recommended to avoid test failure. **Note:** Timer values must not be zero.

Table 5-12. UNI Timers

Timer	Default Timeout	State of Call	Cause for Start and Stop
T303	4s	Call initiated	Start: SETUP sent. Stop: CONNECT, CALL PROCEEDING, or RELEASE COMPLETE received.
T308	30s	Release Request	Start: RELEASE sent. Stop: RELEASE COMPLETE or RELEASE received.
T309	10s	Any stable state	Start: SAAL disconnection. Calls in the active state are not lost. Stop: SAAL reconnected.
T310	10s	Outgoing Call Proceeding	Start: CALL PROCEEDING started. Stop: CONNECT or RELEASE received.
T313	4s	Connect Request	Start: CONNECT sent. Stop: CONNECT ACKNOWLEDGE received.
T316	2 min.	Restart Request	Start: RESTART sent. Stop: RESTART ACKNOWLEDGE received.
T317	< T316	Restart	Start: RESTART received. Stop: Internal clearing of call references.
T322	4s	Any call state	Start: STATUS ENQUIRY sent. Stop: STATUS, RELEASE, or RELEASE COMPLETE received.

ILMI Tab

Table 5-13 lists the options on the *ILMI* tab of the ATM Port Configuration dialog.

Click the **Default** button to reset all values to the *SmartApplications* defaults.

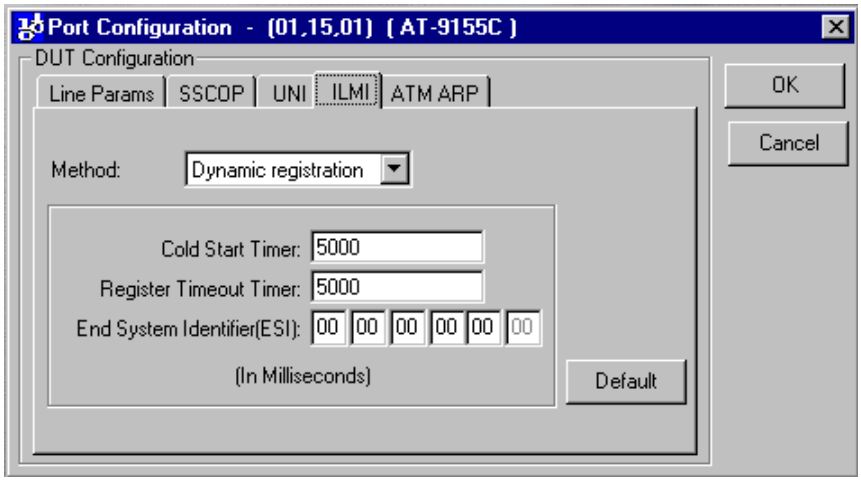


Table 5-13. ILMI Options — ATM Port Configuration Dialog

Field	Description
Method	Select the method by which you want to register ILMI information. **Dynamic registration** Assigns the SmartCard address using information from the switch and from the SmartCard. **Static registration** You define the 20-byte ATM address of the SmartCard. You must also manually define the ATM address to the switch. If you select **Dynamic registration**, the following fields appear: • Cold Start Timer • Register Timeout Timer • End System Identifier (ESI) If you select **Static registration**, the following fields appear: • Prefix • ESI • Sel

Table 5-13. ILMI Options — ATM Port Configuration Dialog (continued)

Field	Description
Cold Start Timer	Defines the interval between ILMI Cold Start TRAP requests sent to the switch when no network prefix has been registered. Default is 5000 ms.
Register Timeout Timer	Defines retransmission interval of address registration SET requests when no acknowledgement is received from the switch.
End System Identifier (ESI)	Six bytes in the 20-byte ATM address for identifying the end station (SmartCard in this case) on a particular user-to-network interface. The first five bytes are user-definable. *SmartApplications* automatically sets the sixth byte to a value that represents a specific SmartCard. **Note:** Timer values must not be zero.
Prefix	The first 13-bytes of the ATM address.
Sel	This field is disabled.

ATM ARP Tab

Table 5-13 lists the options on the *ILMI* tab of the ATM Port Configuration dialog.

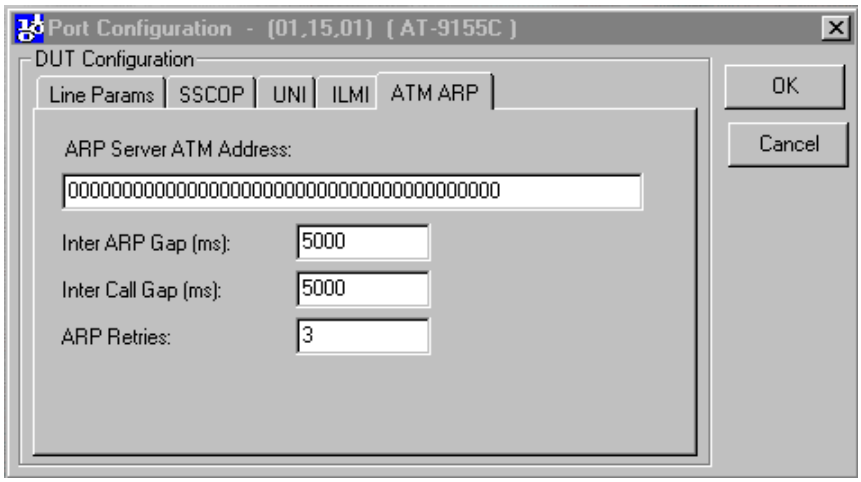


Table 5-14. ATM ARP Options — ATM Port Configuration Dialog

Field	Definition
ARP Server ATM Address	The ATM address of the ATM ARP Server that must be running in the system under test. This address must be a valid address of the ATM ARP Server for Classical IP services to work properly. Right-click on the field to copy/paste contents.
Inter ARP Gap	The time in seconds between successive ARP request transmissions. It is recommended that you keep this value larger than 0 to avoid flooding the ATM ARP server with excessive ARP requests.
Inter Call Gap	The time in seconds between successive call setup for calls trying to resolve the same destination IP address. It is recommended that you keep this value larger than 0 to avoid overloading the switching device under test.
ARP Retries	Number of ARP retries to attempt before giving up.

Defining ATM ELAN Parameters

To configure the ATM port, you must add and register an ELAN, if none exists. Before you register an ELAN, ensure that:

1 ILMI is up or has already obtained the ATM address of the SmartCard.

2 SSCOP/UNI is up (that is, SSCOP in Data Transfer Ready State, and SAAL in Connected state). The LEC has to set up SVCs to communicate with the LECS and LES.

You define and register ELANs by using the ELAN Registration window. *Table 5-15* lists the fields in the window.

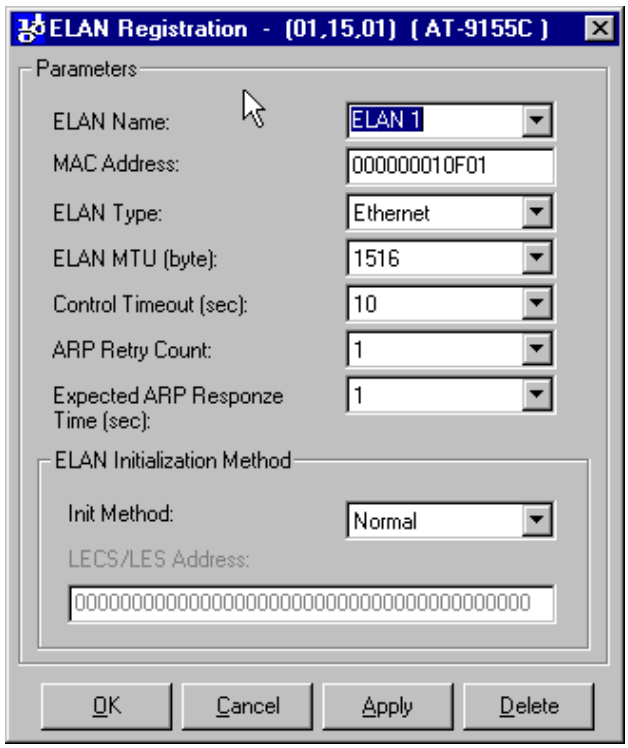


Table 5-15. Options in the ELAN Registration Window

Field	Description
ELAN Name	Select the name of an ELAN that you want to join. The name must exactly match (case-sensitive) one of the ELAN names specified on the device under test.
MAC Address	The 6-byte MAC address of the LAN Emulation Client on the ATM SmartCard.
ELAN Type	LANE 802.3 is the only type currently supported.
ELANMTU	Specify the maximum transmission unit of this ELAN.
ARP Retry Count	Number of ARP retries to attempt before giving up.
Expected ARP Resp. Time	Time to wait before retrying to send another LE_ARP or expiring (time out).
Init Method	Select the ELAN initialization method to match the setting of the device under test. The possible methods are: **Normal** Default method. The LEC (LAN emulation client) on the ATM SmartCard attempts to contact the LECS (LAN emulation client server) at the default address specified by the ATM Forum to obtain addressing information of the LES and BUS. **LECS Direct** Allows you to directly input the ATM address of the LECS. Use this field if LECS does not reside at the default address specified by the ATM Forum. **LES Direct** Allows you to input the ATM address of the LES. This method can be used when no LECS service is available and the ATM address of the LES is known.
LEC/LES Address	This field is greyed out if you select **Normal** for the **Init Method** field. Enter the ATM address of the LEC or LES.

Configuring WAN Ports

When you select an WAN port, the port attribute tab display WAN options.

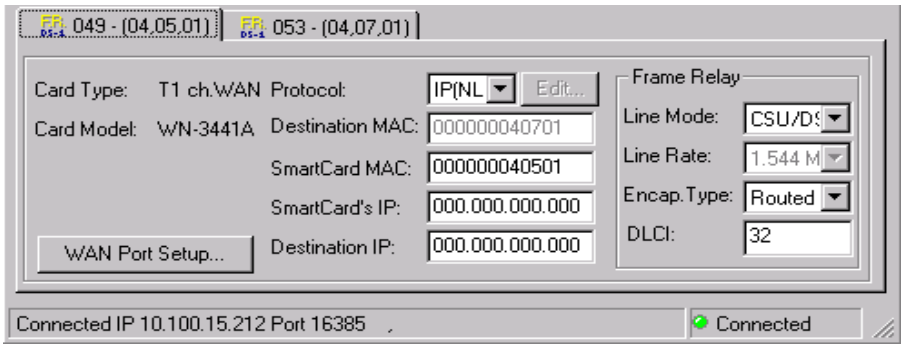


Table 5-16 lists the options on the port attribute tab for a WAN port.

Table 5-16. WAN Options (Port Attributes Tab)

Field	Description
Card Type	Displays the type of SmartCard for that port, in this case Frame Relay.
Card Model	Displays the model number of the card, such as WN-3405.
Protocol	Select the protocol for the port. Values such as **All 0s** refer to the packet contents. If you select **IP** or **UDP** for this field, the *Smart Card's IP* and *Destination IP* fields appear. If you select **IPX**, the *Source Net* and *Destination Net* fields appear. You must assign the same protocol within a port pair. For example, you may not configure the transmitting port for IP and the receiving port for UDP.
SmartCard's IP	Enter the IP address of the SmartCard port. The SmartCard's IP address must have the same network number and subnet address as the router port to which the port is connected. Use the IP address of the router port with its last digit modified as the IP source address of the port.
Destination IP	Enter the IP address of the receiving SmartCard.
Source Net	The 4-byte network address of the transmitting card.
Destination Net	The 4-byte network address of the router port (for router testing) or receiving port (for switch testing).

Table 5-16. WAN Options (Port Attributes Tab) (continued)

Field	Description
Destination MAC	For switch testing using 1 to Many or Many to 1 tests, this is the MAC address of the destination port. For router testing, this is the MAC address of the local router port. If you do not specify an address, you will get zero throughput. The SmartCard's MAC destination address must be set to the MAC address of the router port to which the card is connected—for example, the destination MAC address is 08 00 02 06 89 22 for the transmitter and 08 00 02 12 27 22 for the receiver.
SmartCard MAC	The MAC address of the SmartCard. MAC addresses are 48 bits long, usually written as 6 bytes in hexadecimal. For simplicity, set this to match the port number in the SmartBits system. For example, transmitting port 1 would be 00 00 00 00 00 01 and receiving port 2 would be 00 00 00 00 00 02.

Table 5-16. WAN Options (Port Attributes Tab) (continued)

Field	Description
Line Mode	This field is the same as the **Line Physical Mode** field on the *Line* tab of WAN Port Setup window. If you change the value at the WAN Port Setup window, the new value will be displayed here. **WN-3405 SmartCard** Select how you want to define the equipment mode (according to the V.35 specification) within the Frame Relay User/Network interface. Normally, the SmartCard is configured as DTE. **DTE** User side (also referred to as CPE or Customer Premises Equipment). **DCE** Network side **WN-3415 SmartCard** Select how you want to define the equipment mode within the Frame Relay User/Network interface. Normally, the SmartCard is configured as CSU/DSU. **CSU/DSU** Channel Service Unit/Data Service Unit (also known as Customer Premises Equipment). Defines the SmartCard port as residing on the customer (subscriber) side of the T1/E1 connection. **NET** Network side. Defines the SmartCard port as residing on the network side of the T1/E1 connection. **WN-3420 SmartCard** Select how you want to define the electrical characteristics of the T1 interface. Normally, the SmartCard is configured as CSU/DSU. **CPE** Channel Service Unit/Data Service Unit (also known as Customer Premises Equipment). Defines the SmartCard port to emulate the customer (subscriber) side of the T1/E1 connection. **NET** Network side. Defines the SmartCard port to emulate the network side of the T1/E1 connection.

Table 5-16. WAN Options (Port Attributes Tab) (continued)

Field	Description
Line Rate	*Applies only to the V.35 interface of the WN-3405 SmartCard.* This field is the same as the *Line Rate (kbps)* field on *Line* tab of the WAN Port Setup window. If you change the value at the WAN Port Setup window, the new value will be displayed here. Select a line rate from 19.2 to 8192 Kbps. This value sets the internal clock rate.
Encapsulation Type	Select an encapsulation type to be used for the Frame Relay payload. This field is the same as the *Encapsulation Type* field on *Address* tab of the WAN Port Setup window. If you change the value at the WAN Port Setup window, the new value will be displayed here **None** No encapsulation is used to send traffic. Select when source and destination ports both use Frame Relay. **Bridged** Select if the device you are testing is a bridge. **Routed** Select if the device you are testing is a router.
DLCI	The Data Link Connection Identifier for this PVC.

Defining WAN Port Parameters

As part of configuring a WAN port, you must specify the port's physical parameters. You do this using WAN Port Setup window. This window includes the following tabs:

Encapsulation
Use to select either Frame Relay or Point-to-Point Protocol (PPP).

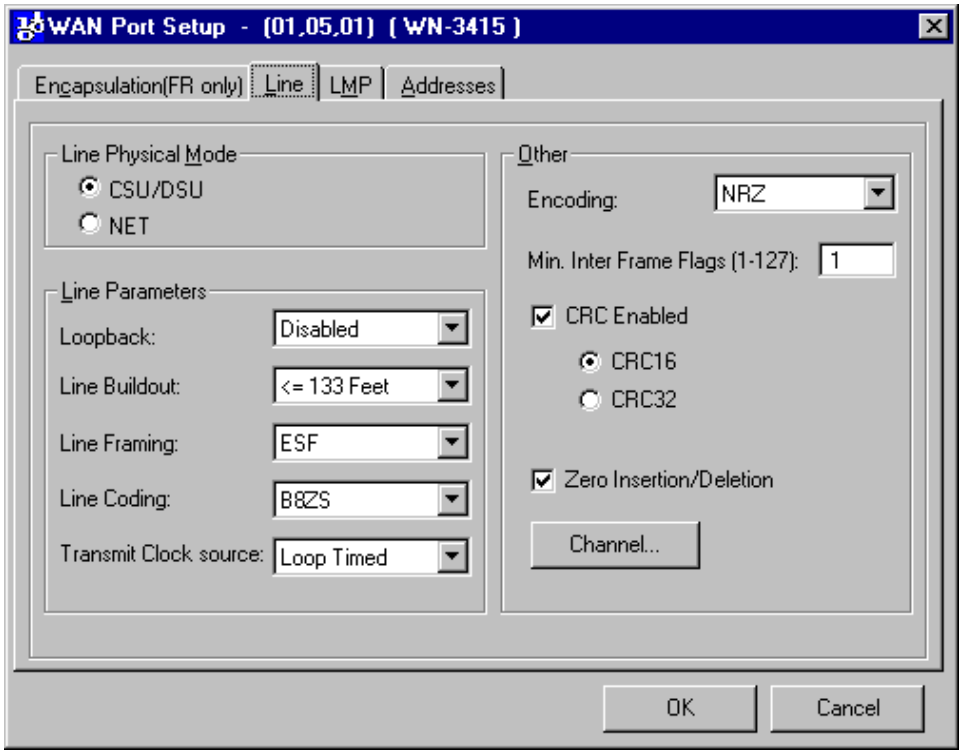
Line (WN-3405, WN-3415 T1, WN-3420 E1)
Use to configure the physical characteristics of the port.

EIA Leads (WN-3405 only)
Use to select or deselect control signals on the V.35 line interface.

LMI (Frame Relay only)
Use to select a Link Management Interface (LMI) signaling protocol.

Address
Use to configure protocol addresses.

Line tab in WAN Port Setup window for WN-3415 SmartCard



Line Tab (WN-3405)

With a WN-3405 Frame Relay SmartCard, use the *Line* tab of the WAN Port Setup window to define the line rate and other physical characteristics.

Specify the line mode (DTE or DCE) first, then line encoding. If you use the WAN SmartCards to both send and receive data, use the Line Clock options to synchronize the sending SmartCard's data with the receiving SmartCard's clock.



Note: In a SmartCard test pair, you must configure one card as a DCE and one as a DTE.

Line Physical Mode

Select how you want to define the equipment mode (according to the V.35 specification) within the Frame Relay User/Network interface. Normally you configure the SmartCard as a DTE.

- **DTE**

  User side (also referred to as CPE or Customer Premises Equipment).

- **DCE**

  Network side

Line Clock

Select these radio buttons to synchronize the sending card with the clock on the receiving card on a WN-3405 SmartCard.

- **Tx Clock Src**

  Select the transmit clock source for the SmartCard. *SmartApplications* automatically selects the **External** (default) radio button for Clock if you select **DTE** or the **Internal** radio button if you select *DCE*.

- **Rx Clock Src**

  Select the type of clock source for the receiving SmartCard. If you select **DTE** *SmartApplications* automatically selects the **External** radio button for the Line Clock. If you select **DCE** you must select which source you want for the clock.

  - **Internal** – The SmartCard provides the clock internally for the receiving SmartCard.
  - **External (SCTE - 113)** – Circuit 113 by default, a function (signal) on a V.35 connector pin, provides the clock for the receiving SmartCard.

- **Tx Clock Polarity**

  Select how you want the source port to transmit data in relation to clock timing. Since the HDLC controller transmits data on rising edges only, when you change the clock polarity to Falling Edge, the clock phase shifts 180 degrees with respect to the data.

  - **Rising Edge** – Rising edge of the transmit clock coincides with the boundary of a bit cell.
  - **Falling Edge** – Rising edge of the transmit clock coincides with the middle (center) of a bit cell. Select this option only if you use an external or isolated (buffered) copy of the transmit clock.

- **Rx Clock Polarity**

  Select the edge of the receive clock on which to sample received data.

  - **Rising Edge** – Samples received data on the rising edge of the receive clock.
  - **Falling Edge** – Samples received data on the falling edge of the receive clock.

Line Rate (kbps)
Select a line rate from 19.2 to 8192 Kbps. This value applies to the V.35 interface. The value in this field sets the internal clock rate.

Other

Use these fields to specify additional parameters, such as line encoding and CRC, on a WN-3405 SmartCard:

- **Encoding**

  Select the encoding type for the V.35 interface. Possible values:

  - **NRZ** – Non-return to zero.
  - **NRZI** – Non-return to zero inverted.

- **Min. Flags Between Frames**

  Select the number of flags (7E hexadecimal pattern) to be inserted between transmitted frames. The maximum value is 127.

- **CRC Enabled**

  Check this box to enable HDLC frame CRC generation. This field applies to transmitting traffic only. When receiving traffic, the SmartCard always checks for CRC characters.

  - **Checked** – Enables the CRC (cyclic redundancy check). If checked, you can select either 16-bit or 32-bit CRC generation.
  - **Unchecked** – Disables CRC generation. The SmartCard's receive path still looks for CRCs at the selected (but greyed out) size.

- **Zero Insertion/Deletion**

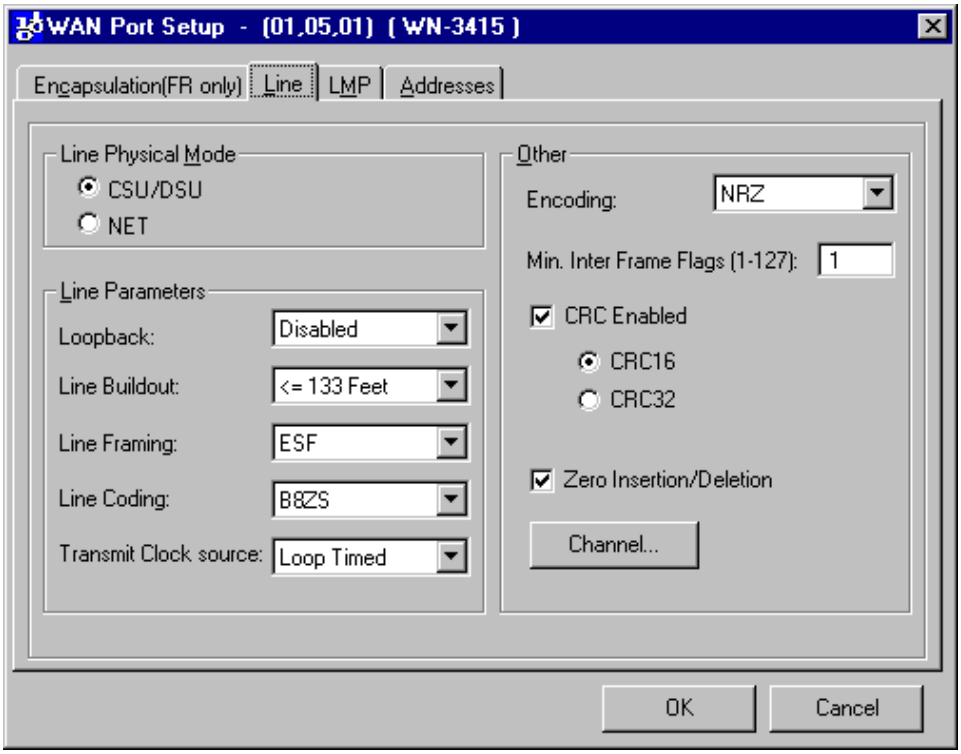
  Check this box to enable HDLC bit stuffing. This field applies to transmitting traffic only. When receiving traffic, the SmartCard always performs bit unstuffing.

  - **Checked** – Enables HDLC zero-bit stuffing for transmitting data and zero-bit unstuffing for receiving data, to help distinguish a byte of data from a flag byte.
  - **Unchecked** – Disables zero-bit stuffing and transmits raw (unencoded) data. The SmartCard's receive path still performs bit unstuffing.

Line Tab (WN-3415 / WN-3420)

With a WN-3415 or WN-3420 SmartCard, use the *Line* tab of the WAN Port Setup window to define the physical characteristics of the port.

In a SmartCard point-to-point test pair, you must configure one card as a CSU/DSU and one as a NET. Specify the line mode (CSU/DSU or NET) first, then line encoding.



Line Physical Mode

Select how you want to define the equipment mode within the Frame Relay User/Network interface. Normally, the SmartCard is configured as CSU/DSU.

- **CSU/DSU**

  Channel Service Unit/Data Service Unit (also known as Customer Premises Equipment). Defines the SmartCard port as residing on the customer (subscriber) side of the T1/E1 connection.

- **NET**

  Network side. Defines the SmartCard port as residing on the network side of the T1/E1 connection.

Line Parameters

- **Loopback**

  Specifies the type of loopback to be used.

  - **Disabled** – No loopback is used. This is the normal operating mode of the device.
  - **Local** – Loops the SmartCard's output back to the SmartCard's input.
  - **Remote** – Loops the SmartCard's input back to the SmartCard's output.

- **Buildout**

  Select to change the electrical output of the SmartCard to either 1) accommodate the length of the cable with which you are testing or 2) specify the amount of attenuation to apply to the signal.

  For the WN-3420 only: Select the type of cable with which you are testing: **Coax Normal**, **Cat-5 Normal**, **Coax High Loss**, **Cat-5 High Loss**.

  Possible values for Buildout Cable Length:

<=133 Feet	Pulse shaping for cable lengths up to 133 feet.
>133, <=266 Feet	Pulse shaping for cable lengths more than 133 ft. and up to 266 ft.
>266, <=399 Feet	Pulse shaping for cable lengths more than 266 ft. and up to 399 ft.
>399, <=533 Feet	Pulse shaping for cable lengths more than 399 ft. and up to 533 ft.
>533, <=655 Feet	Pulse shaping for cable lengths more than 533 ft. and up to 655 ft.

  Possible values for Buildout Attenuation:

-7.5 dB	Pulse shaping to generate -7.5 dB of attenuation.
-15.0 dB	Pulse shaping to generate -15.0 dB of attenuation.
-22.5 dB	Pulse shaping to generate -22.5 dB of attenuation.

- **Line Framing**

  Select the framing mode for the physical layer. Possible values:

  - **D4** – Uses D4 (Super Frame) line framing.
  - **ESF** – Uses Extended Super Frame line framing.

- **Line Encoding**

  Select the type of encoding to be used for the line. Possible values:

  - **AMI** – Uses AMI (Alternate Mark Inversion) line encoding.
  - **B8ZS** – Uses B8ZS line encoding. (WN-3415 only)
  - **HDB3** – E-1 mode using HDB3 line encoding. (WN-3420 only)

Transmit Clock Source

Specifies the clock against which you want to run the tests.

- **Internal** – Uses the SmartCard's internally generated clock as the transmit clock.
- **Loop Timed** – Uses the received clock as the transmit clock.

Other

Use these fields to specify additional parameters, such as line encoding and CRC.

- **Encoding**

  Select the type of encoding to be used for the line. Possible values:

  - **NRZ** – Non-return to zero.
  - **NRZI** – Non-return to zero inverted.

- **Min. Flags Between Frames**

  Select the number of flags (7E hexadecimal pattern) to be inserted between transmitted frames. The maximum value is 127.

- **CRC Enabled**

  Check this box to enable HDLC frame CRC generation. This field applies to transmitting traffic only. When receiving traffic, the SmartCard always checks for CRC characters.

  - **Checked** – Enables the CRC (cyclic redundancy check). If checked, you can select either 16-bit or 32-bit CRC generation.
  - **Unchecked** – Disables CRC generation. The SmartCard's receive path still looks for CRCs at the selected (but greyed out) size.

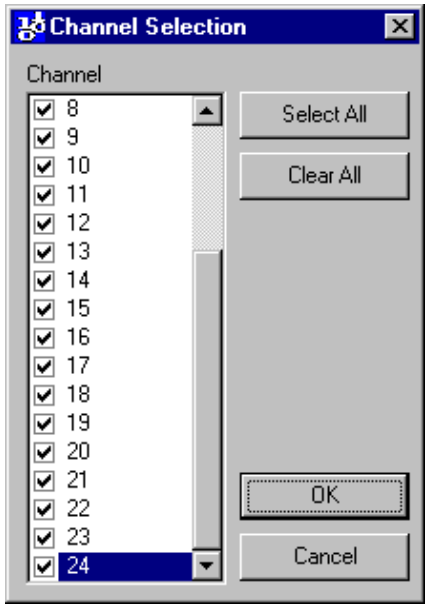
- **Zero Insertion/Deletion**

  Check this box to enable HDLC bit stuffing. This field applies to transmitting traffic only. When receiving traffic, the SmartCard always performs bit unstuffing.

  - **Checked** – Enables HDLC zero-bit stuffing for transmitting data and zero-bit unstuffing for receiving data, to help distinguish a byte of data from a flag byte.
  - **Unchecked** – Disables zero-bit stuffing and transmits raw (unencoded) data. The SmartCard's receive path still performs bit unstuffing.

Channel Selection

Use the Channel Selection dialog box for Fractional T1 and E1. Select up to 24 channels per SmartCard pair. This is the maximum number of 64 kbps circuits allowed on the T1 line to transmit and receive frames. If you select all of the channels, the line's entire bandwidth is used.



To select all channels

Click the **Select All** button.

To clear all channel selections

Click the **Clear All** button.

To select a range of channels

- Hold down the left mouse button and drag the mouse.
- Right click within the highlighted area. Use the popup menu to check or uncheck the items you wish.

Synchronizing WAN SmartCard Clocks

To transmit data, you must synchronize the clocks in the sending and receiving ports in the test pair. Lack of synchronization can cause aborted frames and/or CRC errors when transmitting flags, because the receiving SmartCard can mistake the flags for a frame or abort sequence.

The following conditions can disrupt clock synchronization:

- Two ports in a test pair not set to the same clock polarity
- Delays from mismatched cables
- Induced noise
- Internal delays
- Long cables (over 10 feet)



Note: Bit cell width shrinks as frequency rises. Since cable and internal delays are a function of the cable length, they are constant.

In DTE mode, some routers may try to recover their transmit clocks based on incoming data. If this occurs, the falling edges of the transmit clock (which is derived from the receive clock) may have excessive jitter. To avoid this, select **Falling Edge** for the receive clock so that the sampling edge coincides with the middle of the bit cell period.

LMP Tab

Use the *LMP* tab of the WAN Port Setup window to define the characteristics of the Link Management Interface protocol. All the displayed values are industry-standard defaults. If you modify these default values, you can restore them by clicking the **Defaults** button.

Table 5-17 lists the options on the *LMP* tab of the WAN Port Setup window.

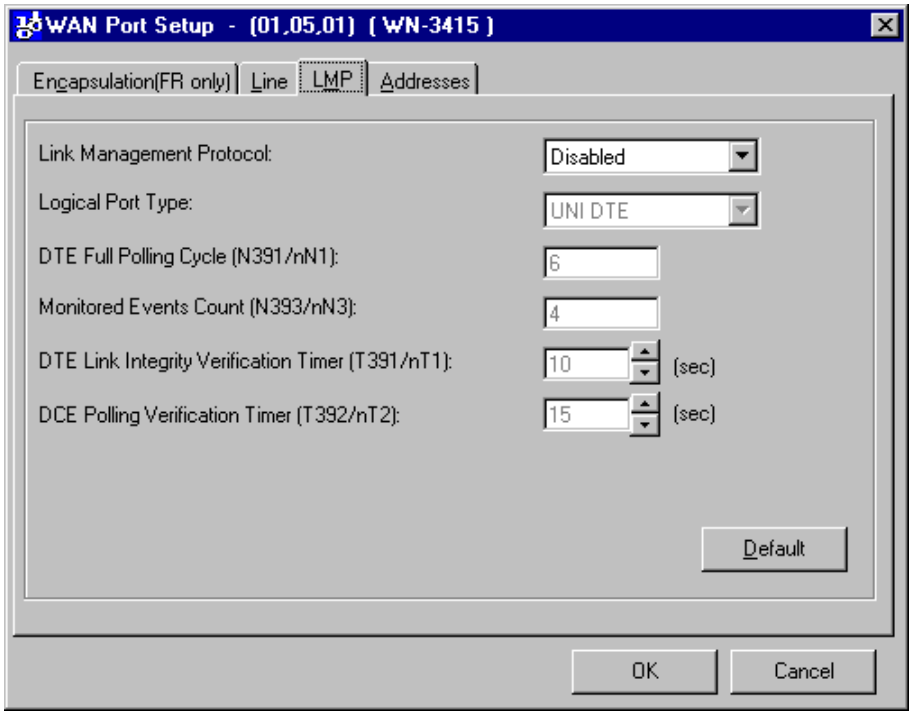


Table 5-17. LMP Tab (WAN Port Setup Dialog)

Field	Description
Link Management Protocol	Select an LMP signaling method. The signaling method must match what is configured in the connected device.
Logical Port Type	Select the UNI DTE (User Side) or the UNI DCE (Network Side). When connecting to a Frame Relay Switch, this value normally will be UNI DTE. If LMP is enabled and you configure the port as CSU/DSU, set this field to UNI DTE. If you configure the port as NET, set this field to UNI DCE.
DTE Full Polling Cycle	Sets the number of polling cycles to complete before a Full Polling Status Inquiry Message is sent by the DTE.

Table 5-17. LMP Tab (WAN Port Setup Dialog) (continued)

Field	Description
Monitored Events Count	Sets the number of Reliability Error events or In-Channel Signaling Protocol Error events that can occur before a link is considered inactive.
DTE Link Integrity Verification Timer	Sets the frequency in seconds that Status Inquiry Messages are sent when configured as a DTE.
DCE Polling Verification Timer	Sets the time that the interface waits for a Status Inquiry Message before counting an error when configured as a DCE.

EIA Leads (WN-3405)

These radio buttons correspond to the physical pins on the connector.

Table 5-18 describes these options.

Table 5-18. EIA Leads Tab (WAN Port Setup Window)

Field	Description
DCE	Use these radio buttons to turn on or off: • Data Set Ready (DSR) • Clear to Send (CTS) • Data Carrier Detect (DCD). These signals apply only when *Physical Line Mode* is set to **DCE**.
DTE	Use these radio buttons to turn on or off • Data Terminal Ready (DTR) • Request to Send (RTS) These signals apply only when *Physical Line Mode* is set to **DTE**. **Note:** The following signals are currently not supported: • Test Mode (TM) • Remote Loopback (RL) • Local Loopback (LL)

Address Tab

Use the *Addresses* tab to define IP and MAC addresses for the port and gateway.

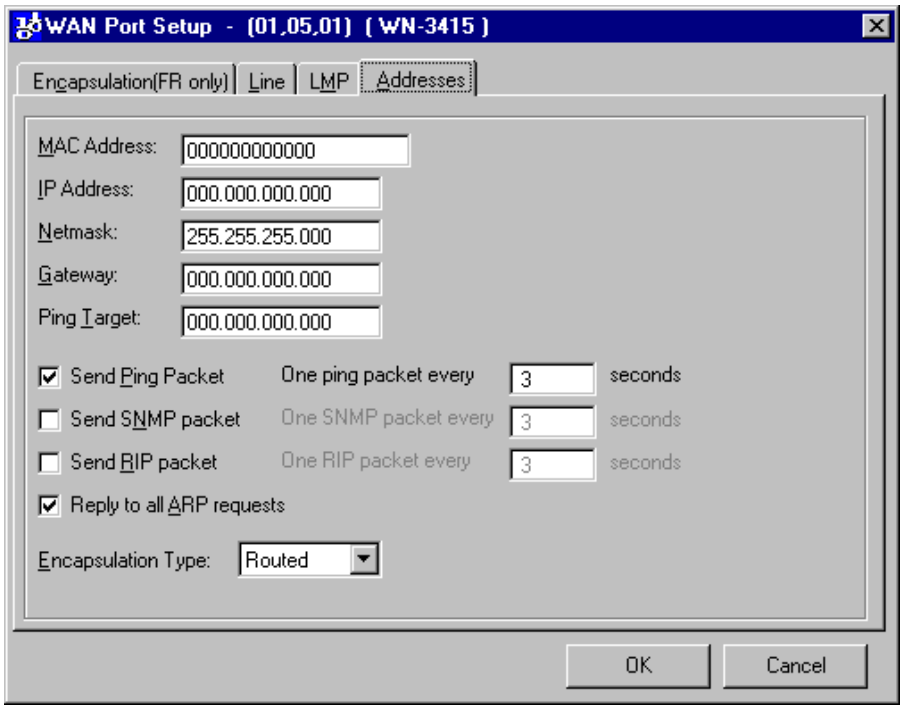


Table 5-19 lists the options on this tab.

Table 5-19. Address Tab (WAN Port Setup Window)

Field	Description
MAC Address	Enter a source MAC address for sending Ethernet protocol frames, when the selected encapsulation type is **Bridged** (Ethernet).
IP Address	Enter an IP address for sending IP protocol frames.
Netmask	Enter a subnet mask.
Gateway	Enter the next hop IP address for the network.
Ping Target	Enter the target IP address for the Ping packets.
Send Ping packet	When checked, Ping packets will be sent to the *Ping Target* at the rate in seconds that you enter in the a *Ping Freq* field.
Send SNMP packet	When checked, SNMP Management packets will be sent to the *Gateway* at the rate (in seconds) you enter in the *SNMP Freq* field.

Table 5-19. Address Tab (WAN Port Setup Window) (continued)

Field	Description
Send RIP packet	When checked, RIP broadcast packets will be sent to out on all PVCs on the above subnet at the rate (in seconds) you enter in the *RIP Freq* field.
Reply to all ARP requests	When checked, ARP replies will be sent in response to all ARP requests not destined for configured streams on the specified IP address or the IP address configured for the card.

Encapsulation (FR only) Tab

Use the *Encapsulation (FR only)* tab to select the encapsulation type as Frame Relay or PPP.

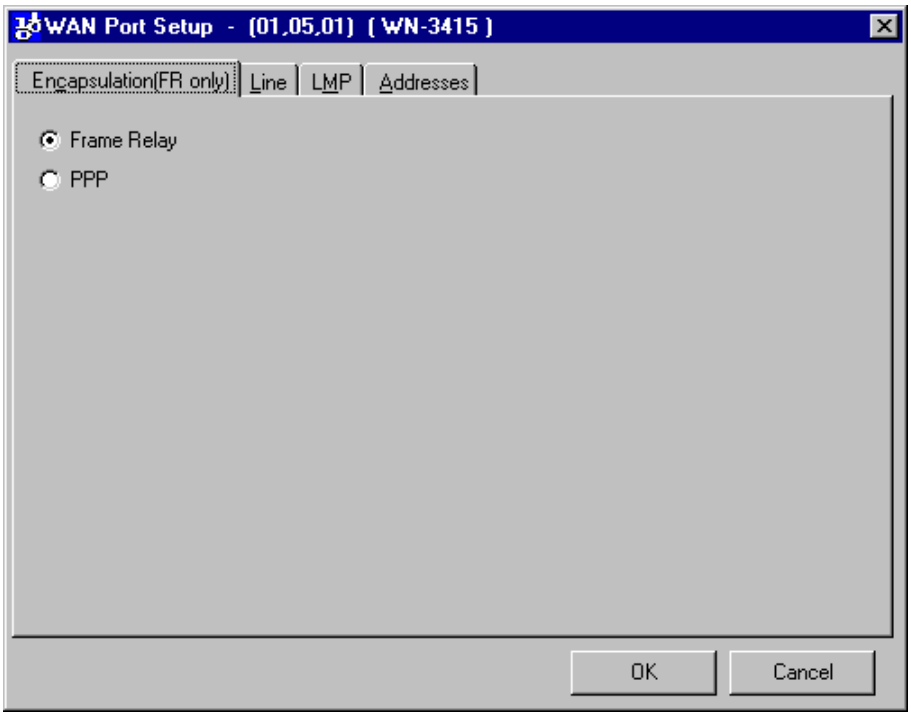


Table 5-20 lists the options on this tab.

Table 5-20. Encapsulation (FR only) Tab (WAN Port Setup Window)

Field	Description
Frame Relay	Click to select Frame Relay.
PPP	Click to select Point-to-Point Protocol (PPP).

Router Testing

To test routers with *SmartApplications*, you use procedures that are similar to those used to test other devices, with the following differences:

Switch Testing

When testing a switch, you select the test ports in the card attribute tab of the main window. Normally you can use the default protocol settings. This is not true for router devices.

Router Testing

SmartApplications needs more information since the DUT is routing the IP/IPX packets routed to the destination port. To test routers successfully, you must manually edit the IP/IPX headers by using the Network IPs window. The Next Hop test is an additional test you can perform with a router.

Preliminary Setup for Router Testing

Before testing a router, do the following:

- Check **Router Test** on the *Preference* tab in the Test Setup window.
- If you want to do a Next Hop test:
  1. Check the **Next Hop Test** box in the on the *Preference* tab.
  2. Click the **Network IPs** button on the card attributes tab to access the Network IPs window, where you enter next-hop IP addresses.
- Obtain the MAC and IP addresses of the router ports involved in the test, and enter them on the port attributes tab in the main window.

Router Test Configuration Fields

The port attributes tab contains fields that are specific to router tests. These are described in *Table 5-21 on page 116*.

Table 5-21. Router Test Configuration Fields

Field	Description
Protocol	The protocol for the port. Your selection here shows or hides other options, as follows: • If you select **IP** for the *Protocol* field, the *SmartCard's IP* field appears. • If you select **IP** or **UDP**, the *Router's IP* fields appears. • If you select **IPX**, the *Source Net* and *Destination Net* fields appear. For router testing, select either **IP**, **UDP**, or **IPX**.
SmartCard's IP	This field appears when you select **IP** or **UDP** for the *Protocol* field. The IP addresses are entered in this field using dotted decimal notation. The SmartCard IP address must have the same network address, with a different host address, as the router port to which the SmartCard is connected. For example, the SmartCard IP might be 192.168.100.2 for the transmitter and 146.72.1.2 for the receiver.
Router's IP	This field appears when you select **IP** or **UDP** for the *Protocol* field. The DUT IP address must be the IP address of the router port connected to the card—for example, the DUT IP address for the transmitter matches the router port IP, which is 192.168.100.1. Also, the DUT IP for the receiver matches the IP of the connected router port, which in this example is 146.72.1.1.
Source Net	The 4-byte network address of the transmitting card.
Destination Net	The 4-byte network address of the router port (for router testing) or receiving card.
Destination MAC	The SmartCard's MAC destination address must be set to the MAC address of the router port to which the card is connected.

How the Router Test Runs

ARP learning packets

At the beginning of each test repetition, every port involved in the test sends out a packet to its test pair partner (using the test pair's MAC address). This should cause the router under test to initiate an ARP exchange on the receiving ports to determine their MAC addresses. All involved ports are set to recognize this ARP request when it comes in (by using SmartCard triggers), and to respond with an appropriate ARP Reply (by using the SmartCard Echo transmission mode). From that point, the router tables should be updated and the test can continue.

Traffic through the router

The transmitting port routes IP, UDP or IPX packets to the receiving port via the router to the MAC and IP addresses specified on the card attributes tab on the main window.

Set up Next Hop Tests

The Next Hop test assesses a router's ability to recognize the next hop address in packets and update its routing table accordingly. In Next Hop tests, all receiving ports act as virtual router ports whose IP addresses you define in the Network IPs window.

How the Test Works

Figure 5-8 illustrates the topology for a Next Hop test.

At the start of each test, the receiving port sends the router a RIP packet. This contains the virtual router port (host) addresses you defined in the Network IPs window. These are the addresses of the networks you want the card to advertise. The router updates its routing table with these IP addresses (this is known as the *learning phase*).

Once the router's has updated its routing table, the transmitting SmartCard sends packets containing the host addresses (from the Network IPs) window to the router.

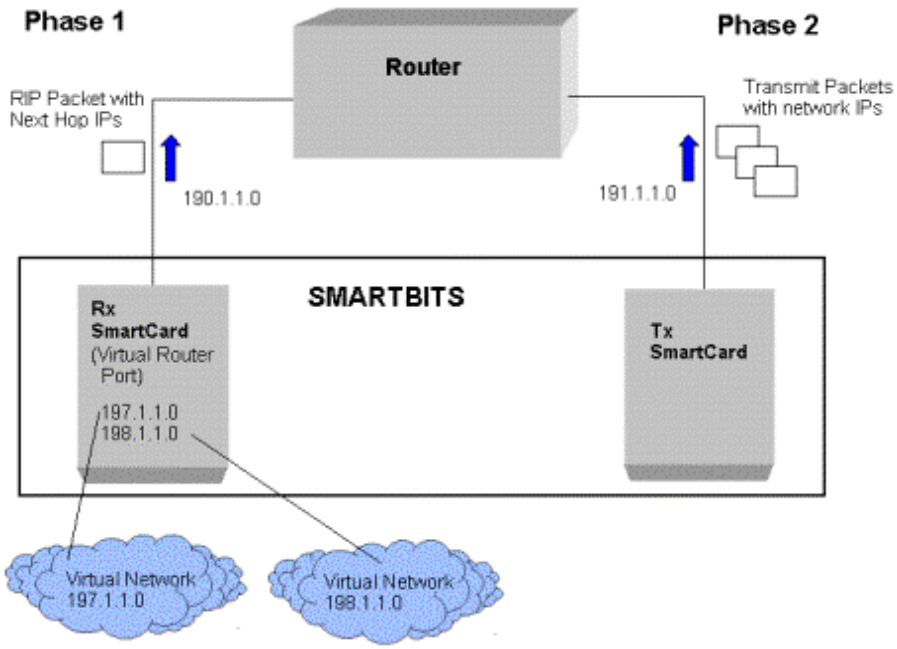


Figure 5-8. Diagram of Next Hop Topology

Setting up the Test

To run a Next Hop test, you must enter the network IPs of the virtual routers (receiving ports). Use these steps:

1. Check the **Next Hop Test** box in the Test Setup window.
2. In the *SmartApplications* main window, select **IP** or **UDP** or for the *Protocol* field.
3. Click the **Network IPs** button on the port attributes tab.

   The Network IPs window displays.
4. Enter up to 15 valid network IP addresses. The network IP is formatted as a RIP packet. The first three bytes represent a network address for a Class C IP address. The last byte represents the host address and is not modifiable.

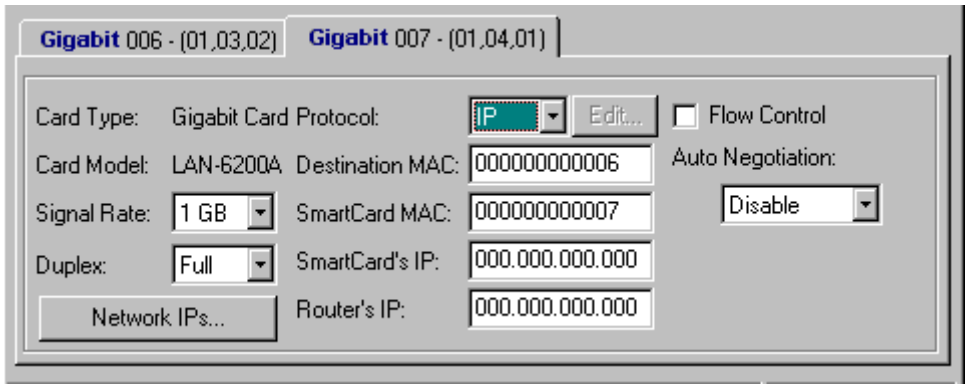
Set Up IP/UDP/IPX Protocols

When you select a Layer 3 protocol of IP, UDP, or IPX in the *Protocol* field on a port attribute tab, you must specify IP addresses for additional fields.

- If you select IP or UDP protocols, these fields are:
  - *SmartCards's IP*
  - *Router's IP*
- If you select IPX protocol, these fields are:
  - *Source Net*
  - *Destination Net*

For example, the figure below shows the *SmartCard's IP* and *Router's IP* fields in the port attributes tab for a Gigabit card when IP has been set as the port protocol.

The following sections describe how to set IP addresses in different test situations.



To set up a Layer 3 protocol address

1 **For routers:**
Determine the MAC and IP addresses for each router port you are using in the test. Enter them into the *Destination MAC* and *Router IP* fields respectively. MAC addresses are in hexadecimal.

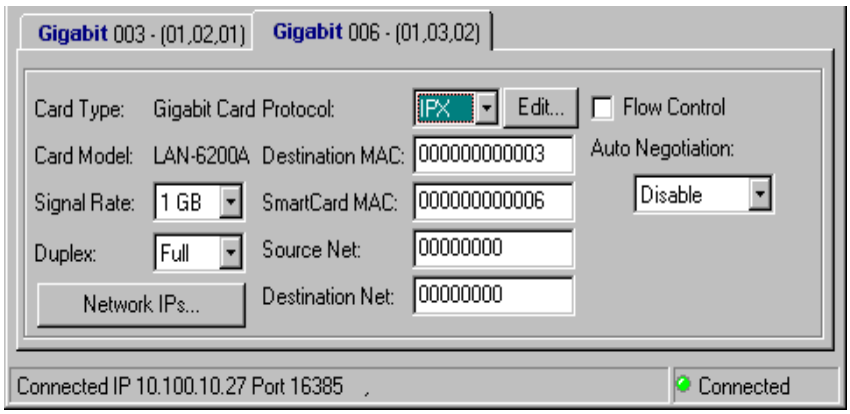
For switches:
You can use the default values.

Note: You must set the same protocol for a port pair. For example, you cannot configure the transmitting port for IP and the receiving port for UDP.

2 Enter the *SmartCard's IP*. Use the same network address as for the attached router port, but with a different host address.

Editing IPX Frame Format

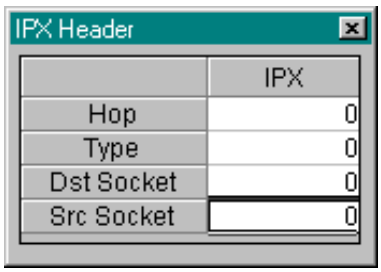
You can customize IPX frame formats to define distant MAC addresses with distant IPX network addresses, by using the port attributes tab in the main window:



Follow these steps:

1 Select **IPX** from the protocol pull-down menu.

2 Click the **Edit** button. The IPX Header window displays:



3 Enter the appropriate *Hop* type and socket values.

4 Close the IPX Header window by clicking the **X** button.

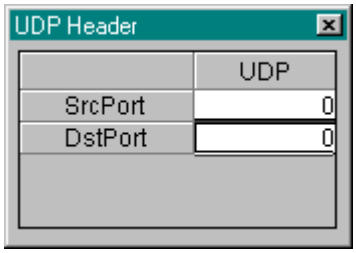
IPX requires that you provide a full address, including the distant network and the distant MAC.

Editing UDP Frame Format

To customize the UDP format, follow these steps:

1 Select **UDP** from the protocol drop-down menu.

2 Click the **Edit** button. The UDP Header window displays:



3 Enter the source (SrcPort) and destination (DstPort) port numbers in the corresponding *UDP* fields.

4 Close the UDP Header window by clicking the **X** button.

Example of Assigning Addresses for Protocols

Let us say you want to connect two SX-7410 SmartCards in Ports 1 and 2 to two ports of a router. This example demonstrates how you might assign addresses for the protocols on the card attribute tab.

1 Obtain the following addresses for the router's Port 1:

MAC address:	00 00 A5 E3 91 00
IP address:	146.72.1.1

2 Enter the router's IP and MAC Destination on the appropriate port attribute tab.

3 Attach the SmartCard in Port 1 to the router's Port 1.

4 Assign the SmartCard's Port 1 IP address with the same network address but with a different host address as the router's Port 1. *SmartApplications* automatically assigns the SmartCard's MAC address.

SmartCard Port 1:	146.72.1.2
Smart Card MAC address:	00 00 00 00 00 01

5 You obtain the following addresses for the router's Port 2:

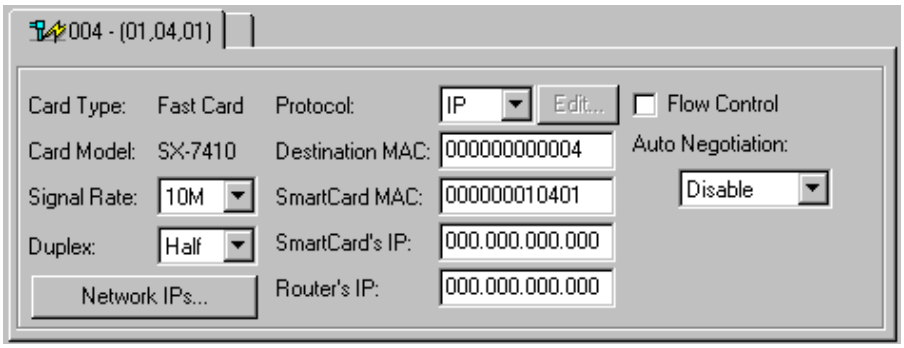
MAC address:	00 00 A5 E2 91 00
IP address:	192.168.100.1

6 Enter the router's IP and MAC Destination on the appropriate port attribute tab.

7 Assign the SmartCard's Port 2 these addresses (for consistency):

SmartCard Port 2:	192.168.100.2
Smart Card MAC address:	00 00 00 00 00 02

SmartApplications automatically issues the ARP exchanges to set up the router's ARP table. The port attribute tab for Port 1 would look like this:



Set up ATM 1-to-Many/Many-to-1 Tests with PVC CLIP

SmartApplications can perform 1-to-Many or Many-to-1 tests using ATM PVCs with Classical IP encapsulation. When you set key parameters on the transmitting and receiving cards correctly, *SmartApplications* will automatically generate the needed streams, incrementing the VPI-VCI value and the Source IP Address in each stream.

Here is an example, with one transmitting port sending to three receiving ports.

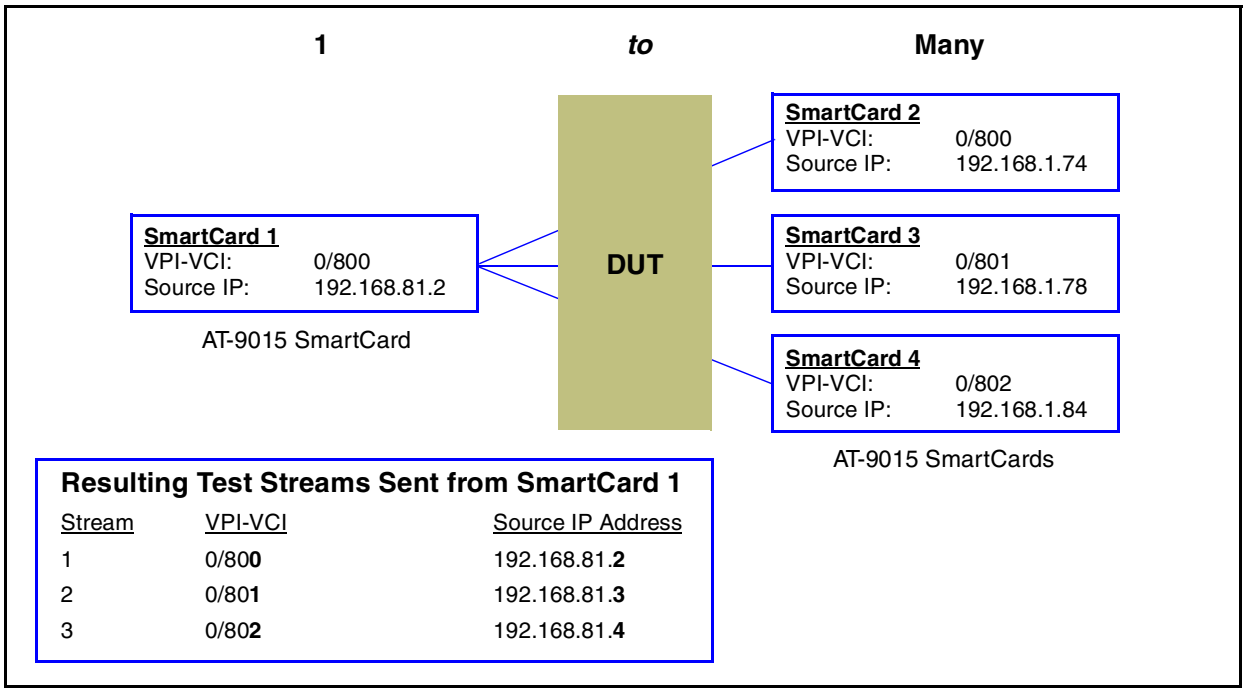


Figure 5-9. Setting up PVC CLIP 1-to-Many or Many-to-1 Tests

With this one port-to-three-port configuration, *SmartApplications* will generate three streams from the transmitting Card 1. In each stream, it will automatically increment the VPI-VCI value in the cell header and the last octet of the Source IP address.

Setup Example

To set up this kind of test, use the parameters on the card attribute tab.

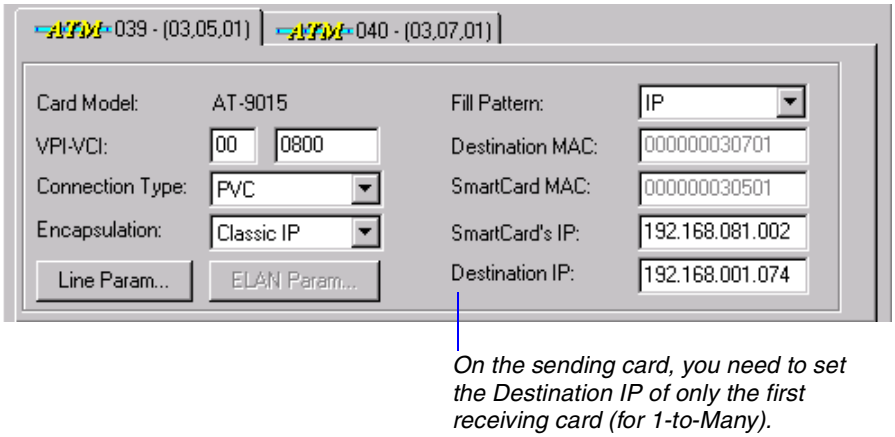
Figure 5-10 on page 124 illustrates the card attributes tab for the sending SmartCard and the first receiving SmartCard. The following values have been set for the sending card:

- *Connection Type* = **PVC**
- *Encapsulation* = **Classic IP**
- *VPI-VCI* = **00 0800**
- *SmartCard's IP* = **192.168.81.2** (Source IP address)
- *Destination IP* = **192.168.1.74** (Target IP address for the first receiving card)

In the setup for the sending SmartCard, you need to set the Destination IP Address of only the first receiving SmartCard (in this example, Card 2).

In this example, the transmitting SmartCard will generate three streams. For each stream, it will automatically increment the VPI-VCI value in the cell header and the last octet of the Destination IP Address.

SmartCard 1 - Sending SmartCard



SmartCard 2 - 1st Receiving Card

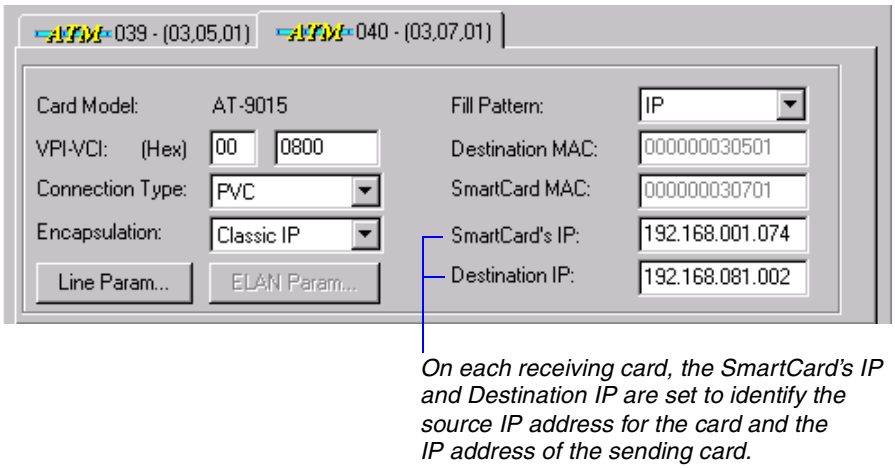


Figure 5-10. Parameter Settings for 1-to-Many / Many-to-1 Tests with PVC CLIP (Example)

6 Run Tests

This chapter explains the different phases of the test process and how to view, save, or print test results.

In this chapter...

This chapter contains the following sections:

- *Test Phases.....126*
- *Viewing Test Results.....127*
- *Generating HTML Test Reports.....133*
- *Viewing and Printing ASCII Text Report Files.....136*
- *Viewing Log Contents.....149*

Test Phases

When you start a test, it goes through several phases, including:

- Initialization of the DUT
- Learning phase
- Load generation

Device Under Test Initialization

When the test starts, *SmartApplications* first sends out learning packets so that the switch or bridge can learn which addresses are local and which addresses need to be forwarded. After the learning sequence, the actual load testing begins.

Learning Phase Adjustments

Some DUTs fail to update forwarding tables when the default number of learning packets is sent (the default is **3**). If the DUT does not update the forwarding table correctly using the default number of packets, you can increase the number of learning packets that are sent through the DUT, between the SmartBits transmitting and receiving ports.



To increase the number of learning packets:

1. Select **Setup > Test Configuration**.
2. In the *Test Configuration* window, increase the value in the **Learning Retries** field. (The default value is **3**.) This parameter determines how many retries will be made (with a one-second delay between retries) before determining if a single packet can be forwarded correctly.



Note: When testing routers, *SmartApplications* initiates an ARP exchange to update the router's ARP table before starting the learning phase.

Load Generation

The test now runs on the DUT, starting with the first selected packet size and following the defined test methodology.

All selected ports run concurrently.

Viewing Test Results

You can view test results on the *Results* window in several ways:

- *Individual test tab* — View results by test as the test runs.
- *Reports tab* — View a report of the test once it finishes.
- *Log tab* — View a running record of all repetitions of each trial of all tests.

Results Window by Test Tab

As soon as a test starts, *SmartApplications* displays the *Results* window for that test. *Figure 6-1* is an example of the *Results* window for the Acceptable Loss Throughput test, with a chart showing test results.

Note: You can also open the *Results* window by selecting **File > View Results File** from the main menu.

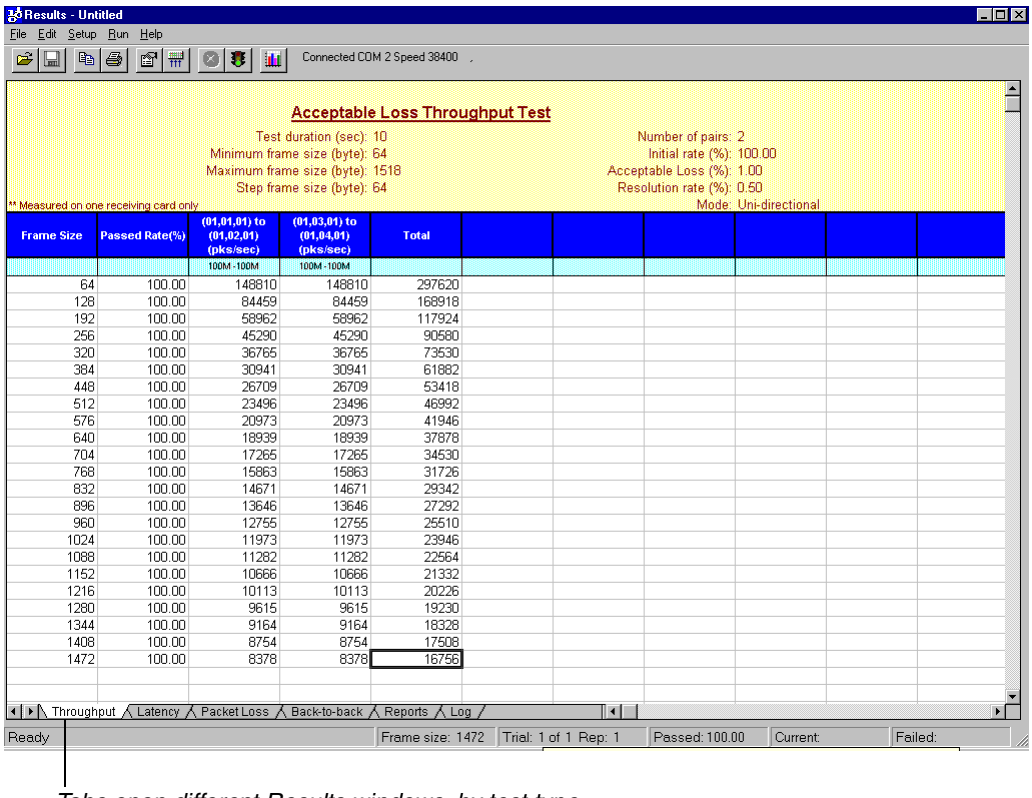


Figure 6-1. Results Window

The *Results* window displays results as the test runs and until it finishes. It shows:

- The test setup, as specified in the *Test Configuration* window (upper part of window)
- Test counters (middle part)
- Overall test results (status bar at bottom of window)

To view the results of a different test:

Click one of tabs at the bottom of the *Results* window.

Note: For latency test results, *SmartApplications* measures and yields results for both store-and-forward devices and bit-forwarding (cut-through) devices, regardless of the DUT's actual characteristics. Use the results that are appropriate for the device type.

When the test is complete, the word `Ready` displays in the lower-left corner of the window, and final results display in the lower-right portion.

Results Window — Menu Options and Buttons

You can use the following menu options and buttons in the *Results* window.

Table 6-1. Results Window — Menu Bar Options

Action	Menu Bar Option	Button
Opens a previously saved Results file.	Open Results File	
Saves the information in the *Results* window to a file.	Save Results File	
Copies the information in the *Results* window to the clipboard. You can paste the information to an application such as MS Notepad ™ or MS Excel™.	Copy Result	
Prints the contents of the active tab on the *Results* window.	Print Result	
Stops the test.t	Stop Test	
Starts the test running.	Start Test	
Opens the *Chart Wizard* window, after you have selected data to chart.	Create Chart	

Results Window — Status Bar Fields

Table 6-2 lists the fields on the status bar of the *Results* window.



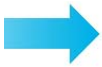
Note: The *Passed* and *Failed* fields are not used in the Latency and Packet Loss tests.

Table 6-2. Results Window — Status Bar Fields

Field	Description
Frame size	Size of frames being sent in this test.
Trial	Number of the current trial.
Rep	Number of repetition for the current trial.
Passed	Percentage of traffic that passed the test without any packet loss.
Current	Rate at which the current trial/repetition is being run.
Failed	Last rate at which packet loss occurred.

Viewing the Results of Previous Configurations

You can view and print the test results that you saved from other configurations while still in the current configuration.



To view the results of previous configurations:

1. Select **File > View Results File** from the menu bar. The *Results* window displays.
2. Select **File > Open**.
3. Select the .vts file containing the test results you want to view.
4. Click the **Open** button.
5. Click on a test tab to view test results.
   Or, click one of the other tabs at the bottom of the *Results* window.

Viewing and Printing Test Reports

SmartApplications provides two types of report for each test type you run in a session:

- Detail report
- Summary report

In both report types, results are appended by packet size following each test trial. You can produce individual reports for just one packet size.

Detail Reports

The detail report contains *all* results for every trial of each test type run during the test session. For every packet size tested, *SmartApplications* appends the results of each trial to a report table when the trial completes. You can view this table online or print it.

If you run all tests at once, the detail report contains results for all four tests. One report table can hold up to 16384 rows (equivalent to many reports).

What the detail report shows

Detail reports show, by packet size, the test progress including:

- Current trial number
- Operation in process (transmitting, receiving, retrieving data)
- Current rate
- Passed rate
- Approximate percent of completion

Detail report formats

Detail reports are available in two formats:

- *Tabular (default)*
  Displays results in columns by frame size.
- *Non-tabular*
  Displays results in sequence by frame size.

To change to the non-tabular report format:

- Select **Setup > Test Configuration** from the main menu (see *Figure 6-2 on page 131*).
- Open the *Preference* tab.
- Uncheck the **Create Tabular Report** checkbox.

Uncheck **Create Tabular Report** to generate reports in the non-tabular format (see *"Viewing and Printing Test Reports" on page 130* for examples for each test type.

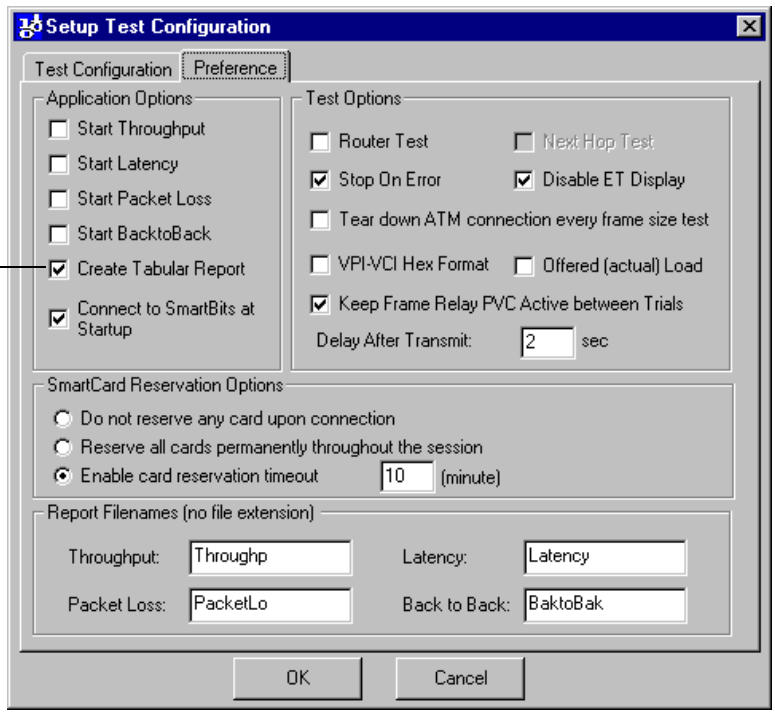


Figure 6-2. Specifying the Non-tabular Report Format

To view a detail report online

- Click the **Reports** tab of the *Results* window.

To print a detail report

- Select **File > Print** from the menu bar.

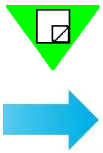
Note: *For tabular reports only:* You can only print data that is visible on your screen. If the visible data on your screen exceeds physical page parameters, select **File > Page Setup** from the menu bar and adjust your margins.

Summary Reports

SmartApplications also generates a summary report for each test type run during a session. These reports summarize the results for each packet size (as in the Scott Bradner result format).

For each test setup, *SmartApplications* appends the results by packet size to the summary report at the end of a trial.

See *Figure 6-9 on page 139* for an example of the summary report for a Throughput test.



Note: You must use an editor such as MS Notepad™ to view or print summary reports.

To create a separate report for each packet size:

1. Select **Setup > Test Configuration...**
2. Rename the file in the *Report Filenames* pane of the *Preference* tab.

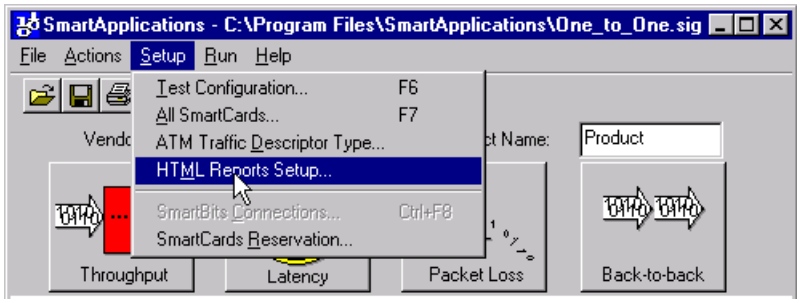
Generating HTML Test Reports

You can generate test results in HTML format.

To generate an HTML Report:

1 Select **Setup > HTML Reports Setup...** from the main menu.

2 Use the *HTML Reports Setup* dialog to set up the report output.



3 Check the **Enable HTML Report** checkbox to enable the HTML report.

The *HTML Report Output Path* field specifies the default location of the generated HTML files. By default, these files are placed into a folder named **html** in the same directory that contains the *SmartApplications* executable. You can also have them written to another directory, if you wish. To do this, enter the desired path in the **HTML Report Output Path** field.

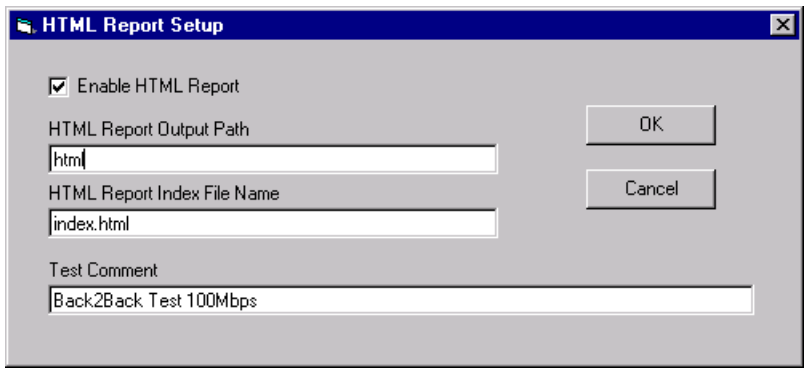


Figure 6-3. Setting the Path for an HTML Report

The *HTML Report Index File Name* identifies the default index file, *index.html*. This file contains links to the individual test result files. These are the files that are created each time the test is run, or for each test iteration by packet size.

These links are in the following format (see *Figure 6-4 on page 134* for an example):

<month><date><hour><minutes><seconds>

Test Type	Test Results
Through Put	Nov27100201
Through Put	Nov27160534
Through Put	Dec17094743

Figure 6-4. Example of HTML File Name Links

4 Use the **Test Comment** field to specify a *Test Comment* (see *Figure 6-4 on page 134*). The contents of the *Vendor Name* and *Product Name* fields can be set in the *SmartApplications* main window (*Figure 6-5*). (These fields also are used for ASCII test reports.)

SmartApplications generates all other field information automatically.

Use these fields to set a "Vendor Name" and "Product Name" to appear in test reports.

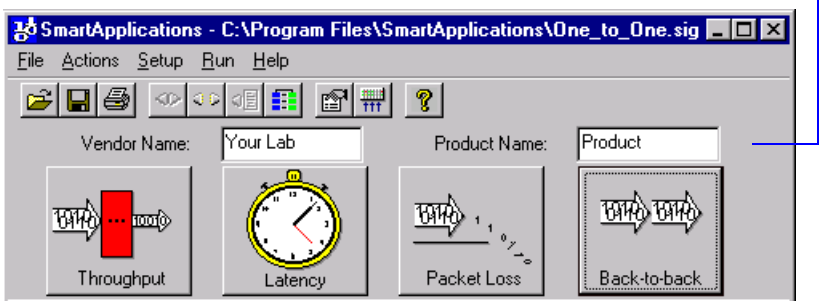


Figure 6-5. Setting the Vendor Name and Product Name for Reports

Figure 6-6 on page 135 shows a sample HTML test report.

Test Comment:	Throughput Test 121801

Vendor Name:	Vendor
Product Name:	Product
Software Version:	SmartApplications V 2.50
Test Configuration:	C:\Program Files\SmartBits\SmartApplications\Result\Bill.sig
Date Tested:	Mon Dec 17 09:48:16 2001
Library Version:	3.12-112
Firmware Version:	6.61
Serial Number:	63661500

Test duration (seconds):	10	Number of pairs:	2	Mode:	Uni-directional

Throughput Measurements

Frame Size	Passed Rate(%)	(1, 1, 1) to (1, 2, 1)(pks/sec)	(1, 3, 1) to (1, 4, 1)(pks/sec)	Total
		100M-100M	100M-100M	
64	100.00	148810	148810	297620
128	100.00	84459	84459	168918
192	100.00	58962	58962	117924
256	100.00	45290	45290	90580
320	100.00	36765	36765	73530
384	100.00	30941	30941	61882

Figure 6-6. Sample HTML Test Report

Viewing and Printing ASCII Text Report Files

You can print a detail report that contains the results of one test at a particular packet size. *SmartApplications* assigns default filenames to individual report files (*Table 6-3*).

Table 6-3. Default File Names for SmartApplications Tests

Test Type	Default File Name
Throughput	`THROUGHP.nnn`
Latency	`LATENCY.nnn`
Packet Loss (Ethernet only)	`PACKETLO.nnn`
Back-to-Back (Ethernet only)	`BAKTOBAK.nnn`

In each file name **`.nnn`** is a hexadecimal number representing the test frame size. For example, if you run a Packet Loss test in which packet size is 64 bytes, the filename will be `PACKETLO.040` where `040` is the hexadecimal equivalent of 64 decimal.

To change the default file names:

You can change these default names (excluding the file extension):

1. Select **Setup > Test Configuration...**
2. Rename the file in the *Report Filenames* pane of the *Preference* tab.

Notes:

1. Summary reports use the file extension `.ndt`.
2. If you repeat a test at the same packet size, *SmartApplications* overwrites the first detail report. To avoid this, rename the report file before repeating the test.

To print an individual test report (including a summary report):

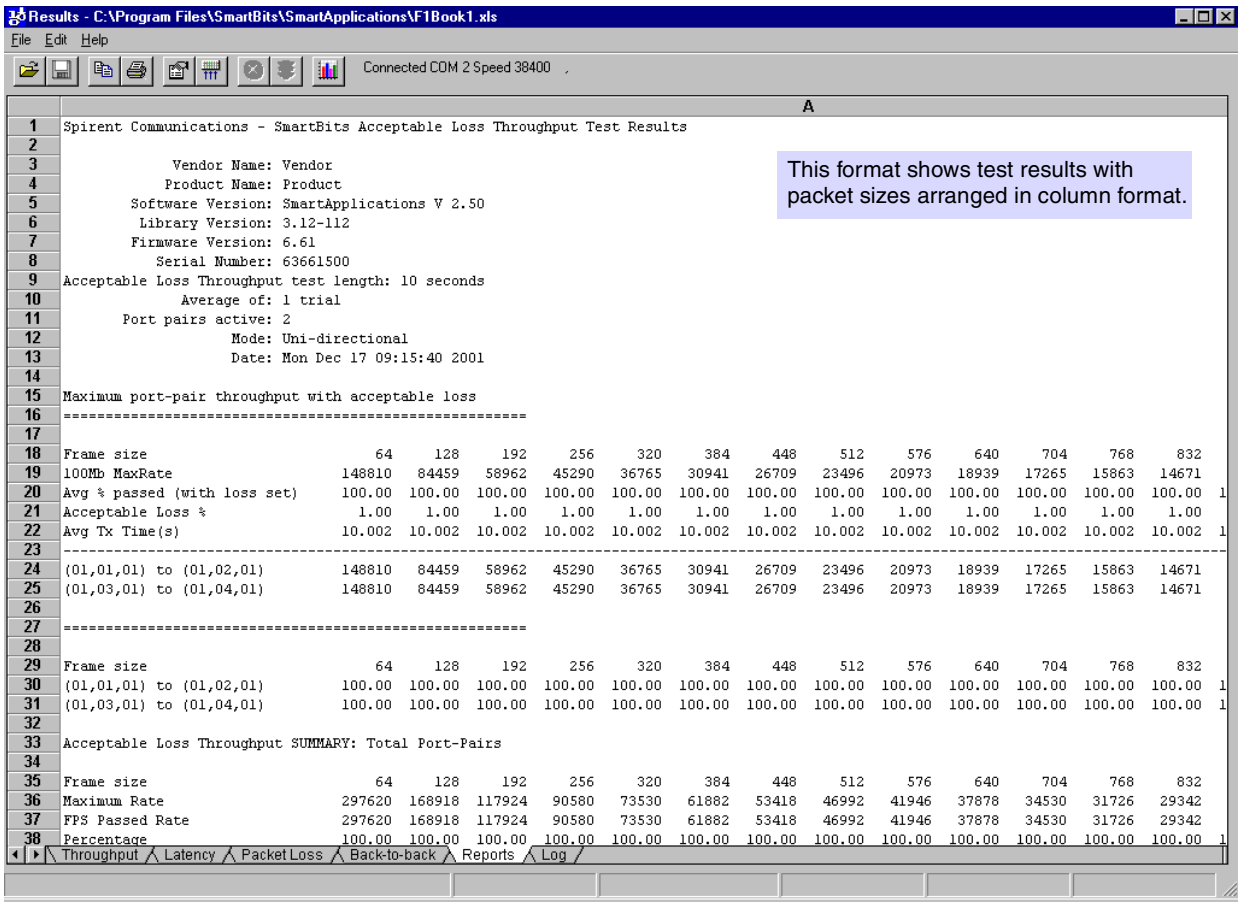
1. Open an editor such as MS Notepad™.
2. Select the file you want to print using **File > Open**.
3. Select **File > Print**.

Sample Reports – Throughput Test

Figure 6-7 is an example of the report for the *Acceptable Loss* Throughput test in the tabular format.

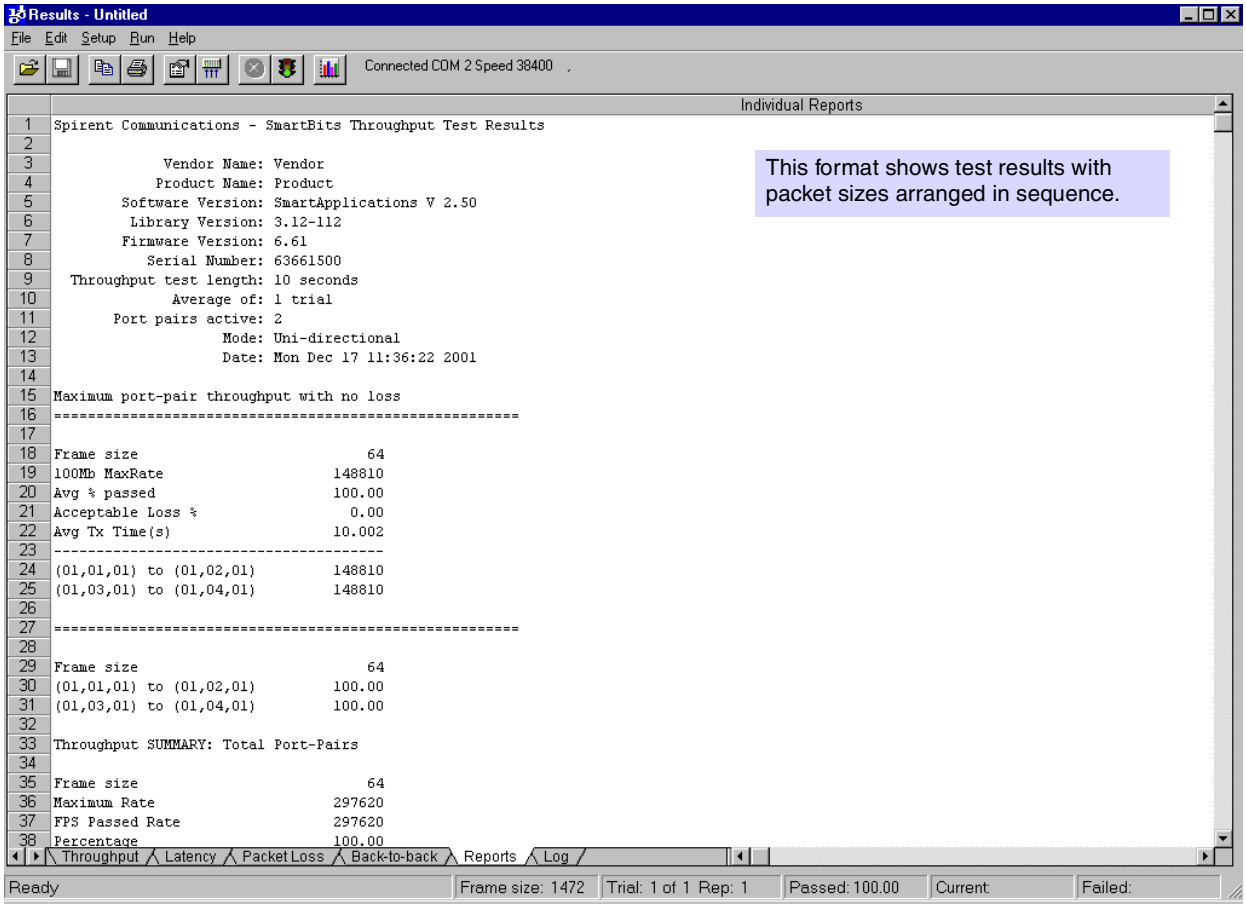
Figure 6-8 on page 138 shows the test report in the non-tabular format.

Figure 6-9 on page 139 is an example of the summary report.



	A
1	Spirent Communications - SmartBits Acceptable Loss Throughput Test Results
2	
3	Vendor Name: Vendor
4	Product Name: Product
5	Software Version: SmartApplications V 2.50
6	Library Version: 3.12-112
7	Firmware Version: 6.61
8	Serial Number: 63661500
9	Acceptable Loss Throughput test length: 10 seconds
10	Average of: 1 trial
11	Port pairs active: 2
12	Mode: Uni-directional
13	Date: Mon Dec 17 09:15:40 2001
14	
15	Maximum port-pair throughput with acceptable loss
16	==========
17	
18	Frame size 64 128 192 256 320 384 448 512 576 640 704 768 832
19	100Mb MaxRate 148810 84459 58962 45290 36765 30941 26709 23496 20973 18939 17265 15863 14671
20	Avg % passed (with loss set) 100.00 100.00 100.00 100.00 100.00 100.00 100.00 100.00 100.00 100.00 100.00 100.00 100.00 1
21	Acceptable Loss % 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
22	Avg Tx Time(s) 10.002 10.002 10.002 10.002 10.002 10.002 10.002 10.002 10.002 10.002 10.002 10.002 10.002 1
23	----------
24	(01,01,01) to (01,02,01) 148810 84459 58962 45290 36765 30941 26709 23496 20973 18939 17265 15863 14671
25	(01,03,01) to (01,04,01) 148810 84459 58962 45290 36765 30941 26709 23496 20973 18939 17265 15863 14671
26	
27	==========
28	
29	Frame size 64 128 192 256 320 384 448 512 576 640 704 768 832
30	(01,01,01) to (01,02,01) 100.00 100.00 100.00 100.00 100.00 100.00 100.00 100.00 100.00 100.00 100.00 100.00 100.00 1
31	(01,03,01) to (01,04,01) 100.00 100.00 100.00 100.00 100.00 100.00 100.00 100.00 100.00 100.00 100.00 100.00 100.00 1
32	
33	Acceptable Loss Throughput SUMMARY: Total Port-Pairs
34	
35	Frame size 64 128 192 256 320 384 448 512 576 640 704 768 832
36	Maximum Rate 297620 168918 117924 90580 73530 61882 53418 46992 41946 37878 34530 31726 29342
37	FPS Passed Rate 297620 168918 117924 90580 73530 61882 53418 46992 41946 37878 34530 31726 29342
38	Percentage 100.00 100.00 100.00 100.00 100.00 100.00 100.00 100.00 100.00 100.00 100.00 100.00 100.00 1

Figure 6-7. Sample Detail Report for Throughput Test – Tabular Format




```
Spirent Communications - SmartBits Throughput Test Results

            Vendor Name: Vendor
           Product Name: Product
       Software Version: SmartApplications V 2.50
        Library Version: 3.12-112
       Firmware Version: 6.61
          Serial Number: 63661500
  Throughput test length: 10 seconds
             Average of: 1 trial
      Port pairs active: 2
                   Mode: Uni-directional
                   Date: Mon Dec 17 11:36:22 2001

Maximum port-pair throughput with no loss
=========================================================

Frame size                          64
100Mb MaxRate                   148810
Avg % passed                    100.00
Acceptable Loss %                 0.00
Avg Tx Time(s)                  10.002
-----------------------------------------
(01,01,01) to (01,02,01)        148810
(01,03,01) to (01,04,01)        148810

=========================================================

Frame size                          64
(01,01,01) to (01,02,01)        100.00
(01,03,01) to (01,04,01)        100.00

Throughput SUMMARY: Total Port-Pairs

Frame size                          64
Maximum Rate                    297620
FPS Passed Rate                 297620
Percentage                      100.00
```

Figure 6-8. Sample Detail Report for Throughput Test – Non-tabular Format

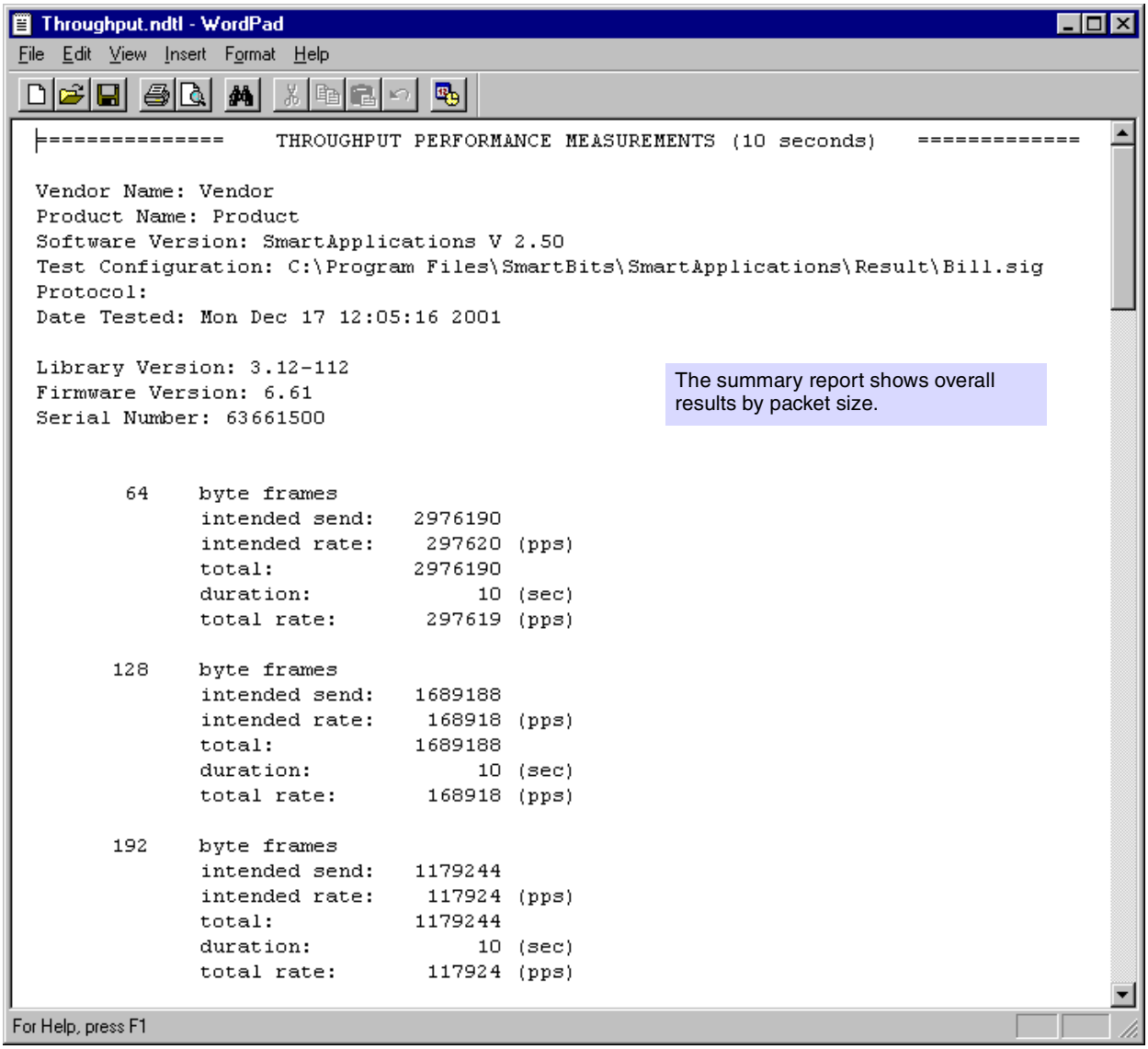


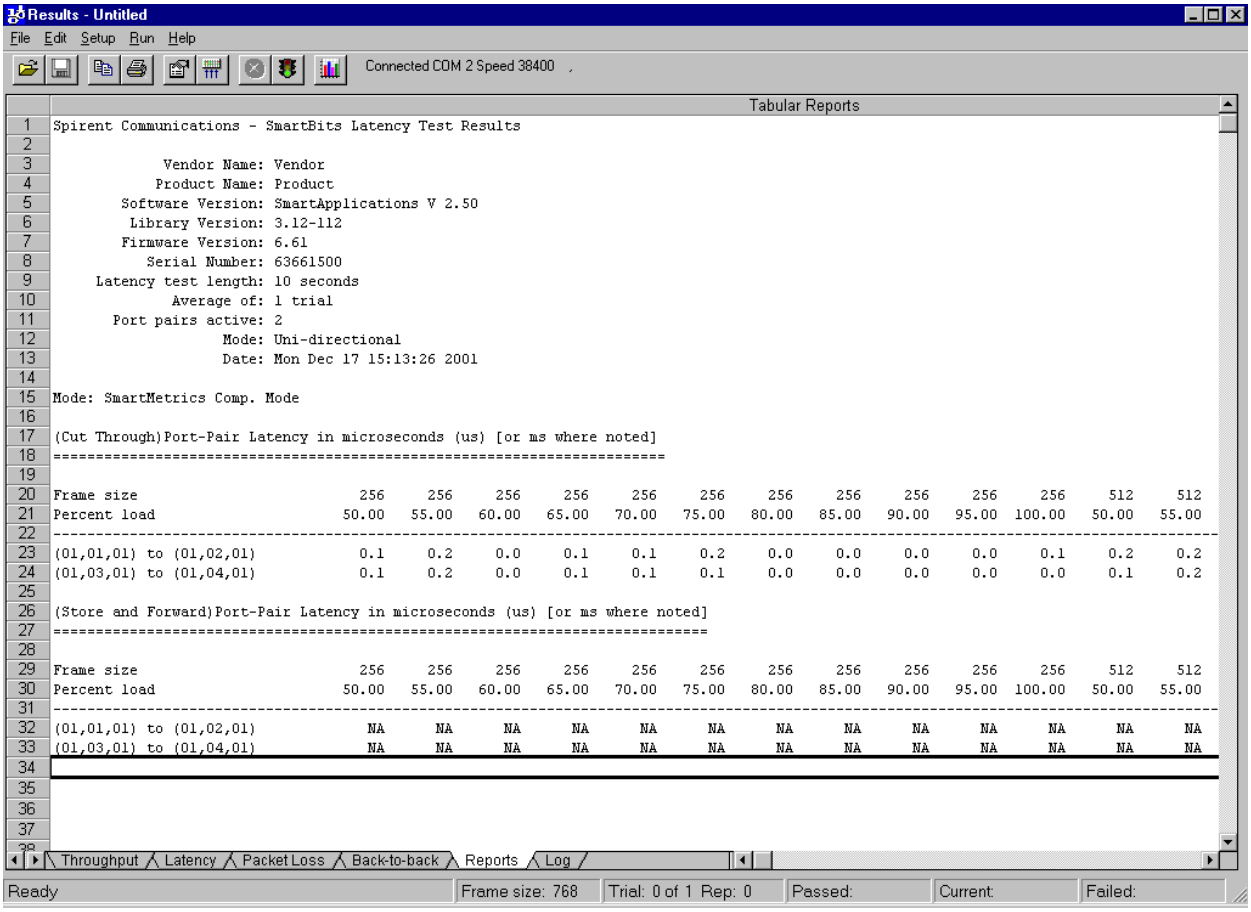
Figure 6-9. Sample Summary Report for Throughput Test

Sample Reports – Latency Test

Figure 6-10 is an example of the Latency test report in the tabular format.

Figure 6-8 on page 138 shows an example of the test report in the non-tabular format.

Figure 6-9 on page 139 is an example of the summary report.




```
Spirent Communications - SmartBits Latency Test Results

             Vendor Name: Vendor
            Product Name: Product
        Software Version: SmartApplications V 2.50
         Library Version: 3.12-112
        Firmware Version: 6.61
           Serial Number: 63661500
     Latency test length: 10 seconds
              Average of: 1 trial
       Port pairs active: 2
                    Mode: Uni-directional
                    Date: Mon Dec 17 15:13:26 2001

Mode: SmartMetrics Comp. Mode

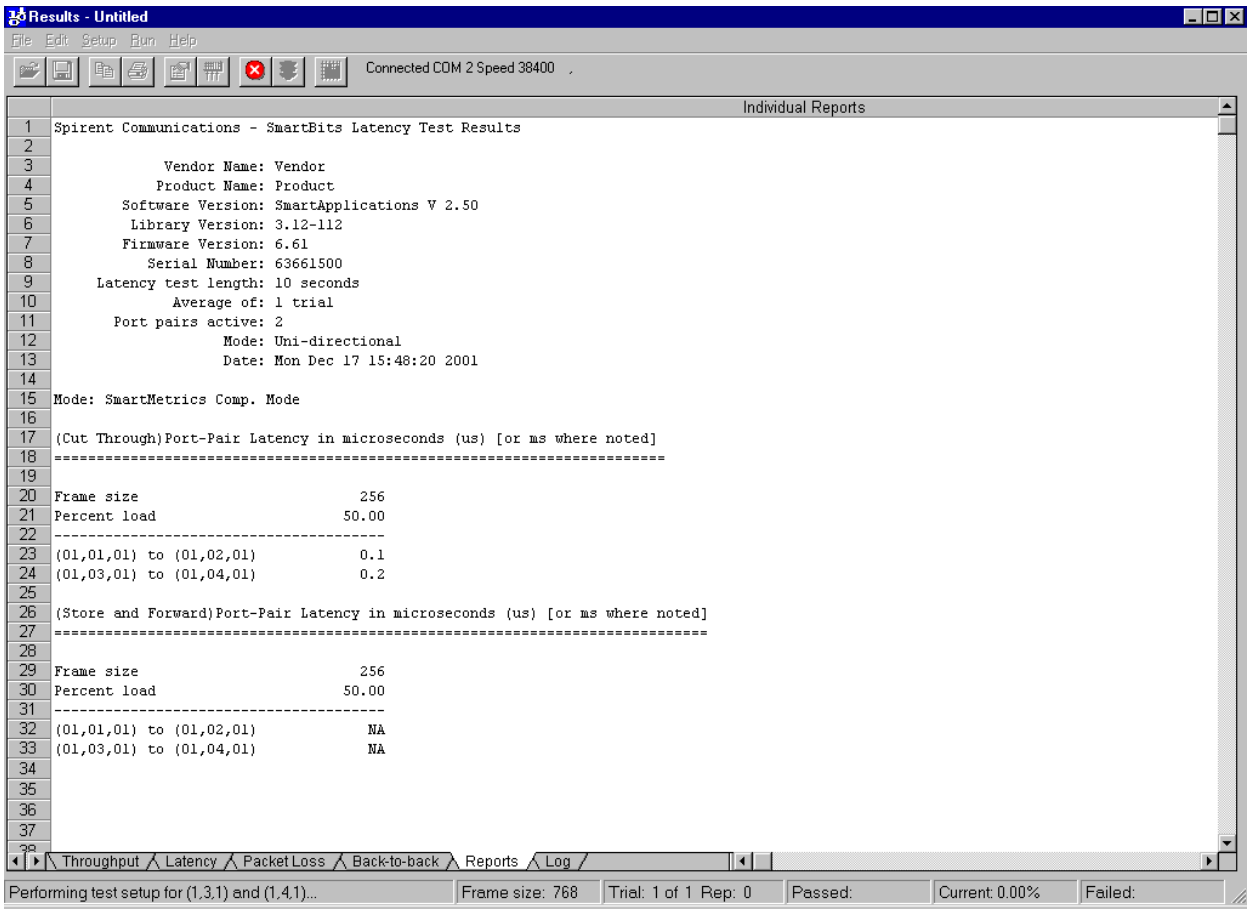
(Cut Through)Port-Pair Latency in microseconds (us) [or ms where noted]
=========================================================================

Frame size                        256    256    256    256    256    256    256    256    256    256    256    512    512
Percent load                    50.00  55.00  60.00  65.00  70.00  75.00  80.00  85.00  90.00  95.00 100.00  50.00  55.00
-------------------------------------------------------------------------------------------------------------------------
(01,01,01) to (01,02,01)          0.1    0.2    0.0    0.1    0.1    0.2    0.0    0.0    0.0    0.0    0.1    0.2    0.2
(01,03,01) to (01,04,01)          0.1    0.2    0.0    0.1    0.1    0.1    0.0    0.0    0.0    0.0    0.0    0.1    0.2

(Store and Forward)Port-Pair Latency in microseconds (us) [or ms where noted]
=============================================================================

Frame size                        256    256    256    256    256    256    256    256    256    256    256    512    512
Percent load                    50.00  55.00  60.00  65.00  70.00  75.00  80.00  85.00  90.00  95.00 100.00  50.00  55.00
-------------------------------------------------------------------------------------------------------------------------
(01,01,01) to (01,02,01)          NA     NA     NA     NA     NA     NA     NA     NA     NA     NA     NA     NA     NA
(01,03,01) to (01,04,01)          NA     NA     NA     NA     NA     NA     NA     NA     NA     NA     NA     NA     NA
```

Figure 6-10. Sample Detail Report for Latency Test – Tabular Format




```
Spirent Communications - SmartBits Latency Test Results

             Vendor Name: Vendor
            Product Name: Product
        Software Version: SmartApplications V 2.50
         Library Version: 3.12-112
        Firmware Version: 6.61
           Serial Number: 63661500
     Latency test length: 10 seconds
              Average of: 1 trial
       Port pairs active: 2
                    Mode: Uni-directional
                    Date: Mon Dec 17 15:48:20 2001

Mode: SmartMetrics Comp. Mode

(Cut Through)Port-Pair Latency in microseconds (us) [or ms where noted]
================================================================================

Frame size                          256
Percent load                      50.00
----------------------------------------
(01,01,01) to (01,02,01)            0.1
(01,03,01) to (01,04,01)            0.2

(Store and Forward)Port-Pair Latency in microseconds (us) [or ms where noted]
================================================================================

Frame size                          256
Percent load                      50.00
----------------------------------------
(01,01,01) to (01,02,01)             NA
(01,03,01) to (01,04,01)             NA
```

Figure 6-11. Sample Detail Report for Latency Test – Non-tabular Format

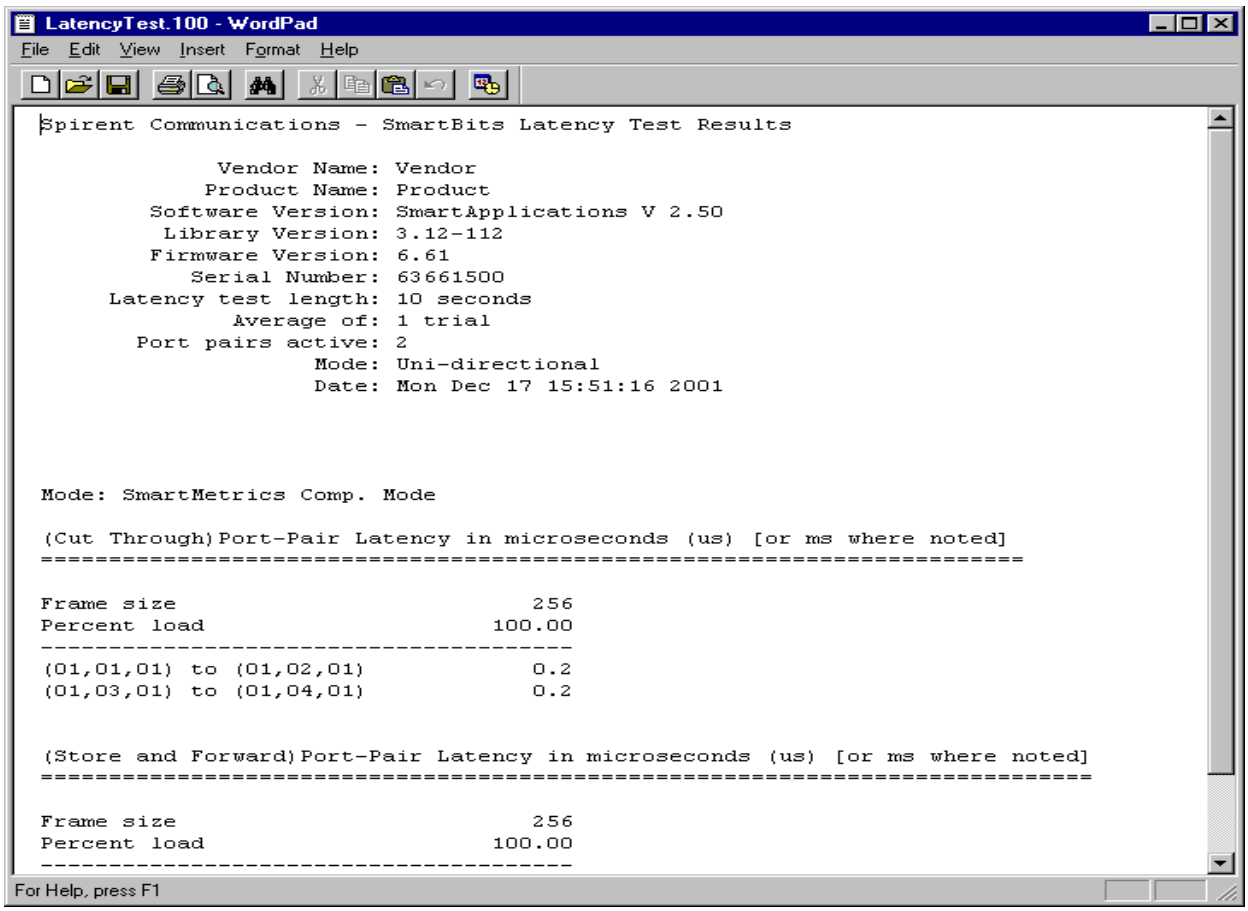


Figure 6-12. Sample Summary Report for Latency Test

Sample Reports – Packet Loss Test

Figure 6-13 is an example of the Packet Loss test report in the tabular format.

Figure 6-14 on page 144 shows the test report in the non-tabular format.

Figure 6-15 on page 145 is an example of the summary report.

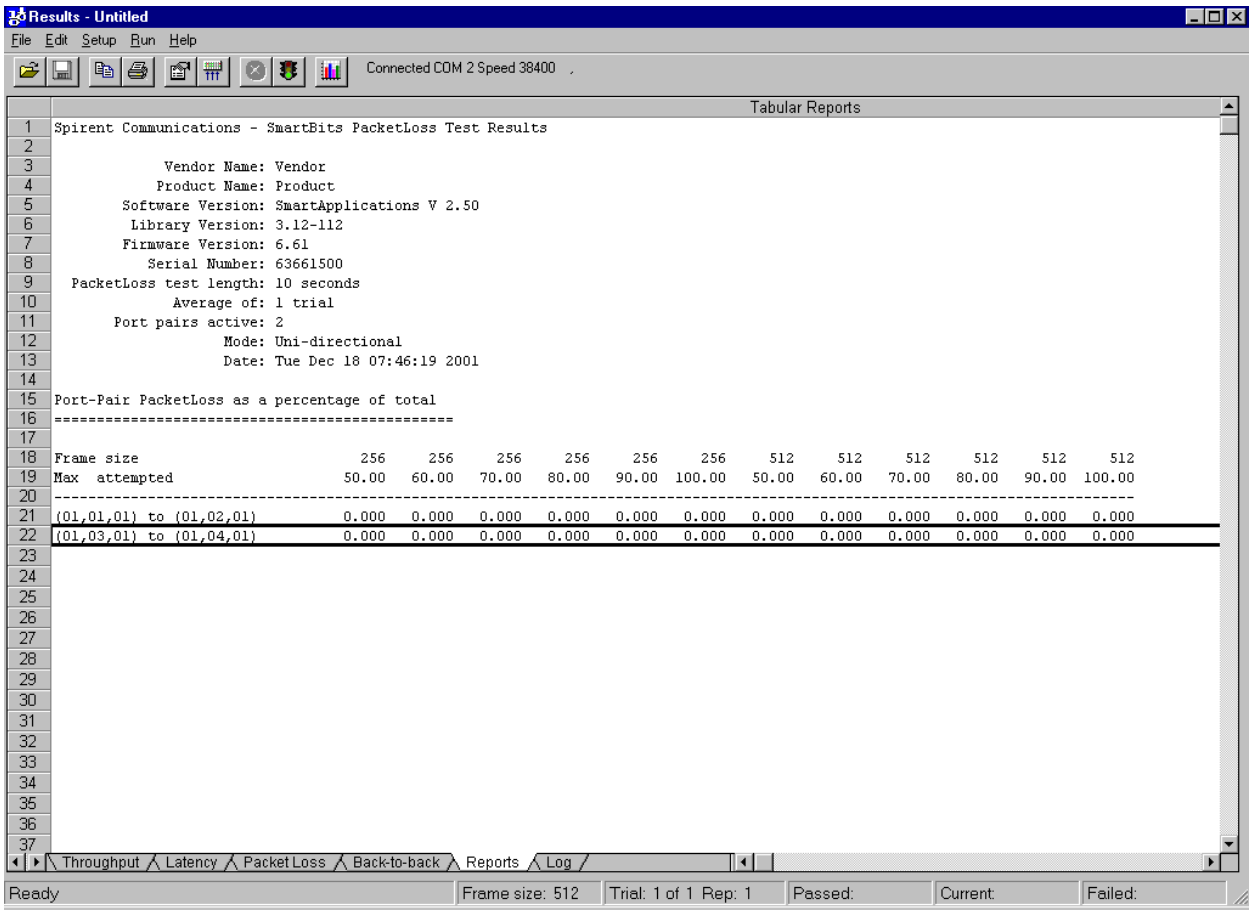


Figure 6-13. Sample Detail Report for Packet Loss Test – Tabular Format

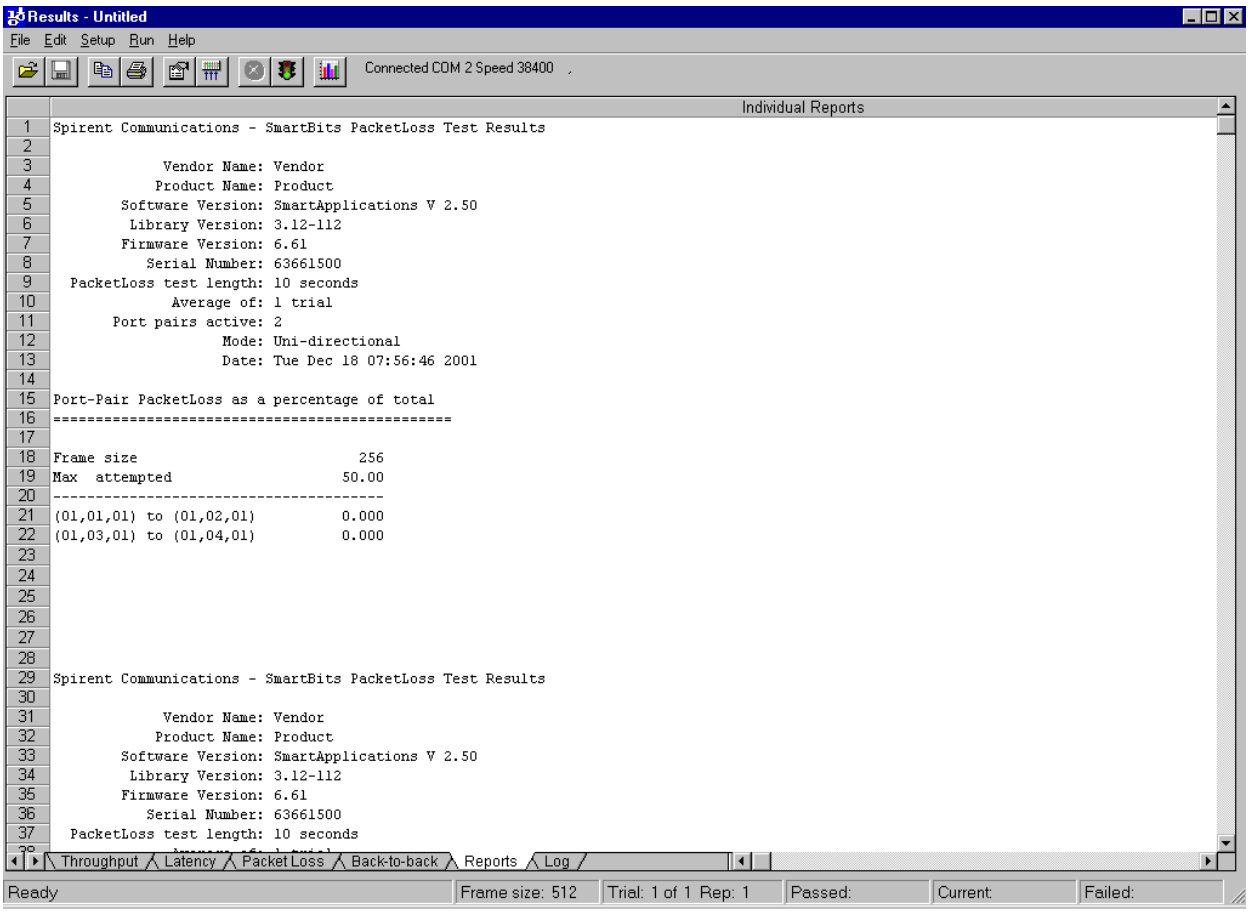


Figure 6-14. Sample Detail Report for Packet Loss Test – Non-tabular Format

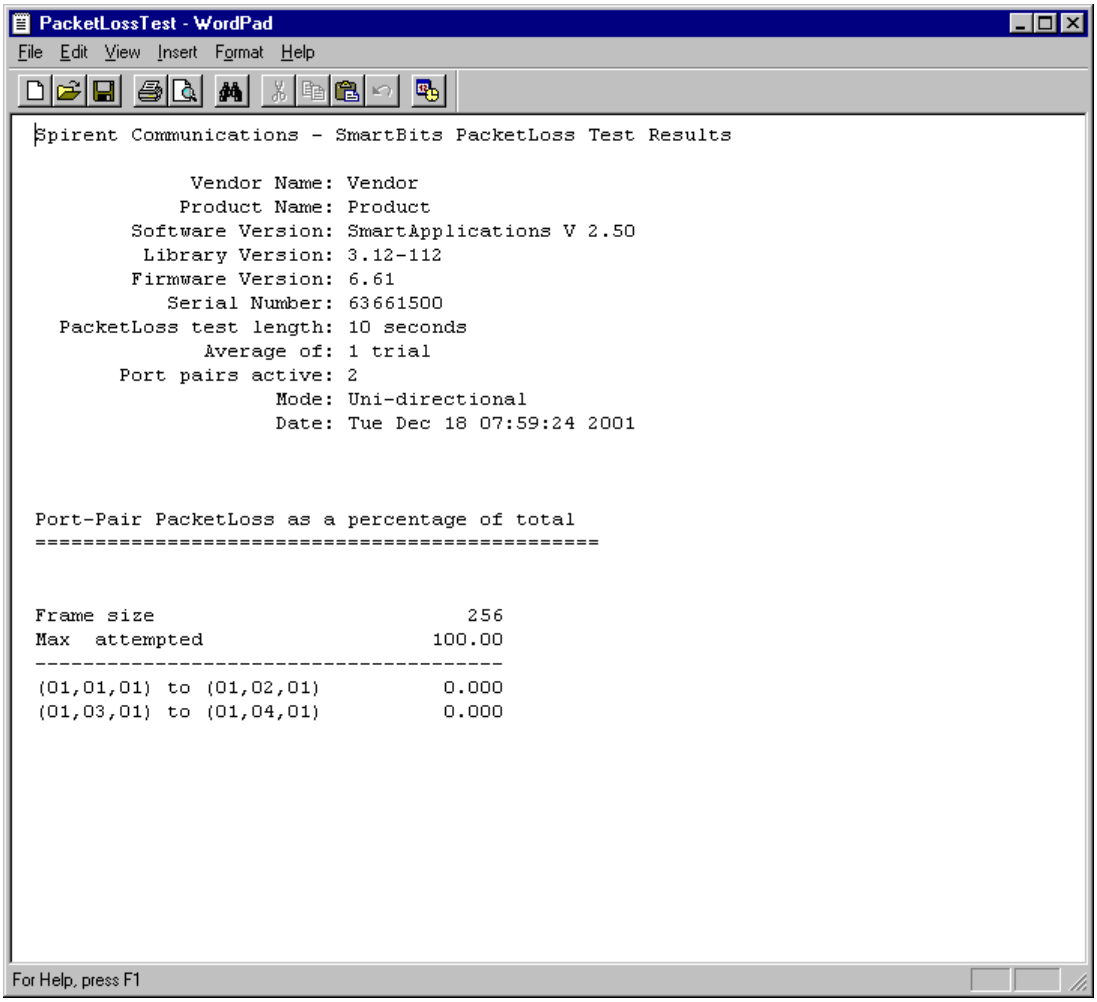


Figure 6-15. Sample Summary Report for Packet Loss Test

Sample Reports – Back-to-Back Test

Figure 6-16 is an example of the Back-to-Back test report in the tabular format.

Figure 6-17 on page 147 shows the test report in the non-tabular format.

Figure 6-18 on page 148 is an example of the summary report.

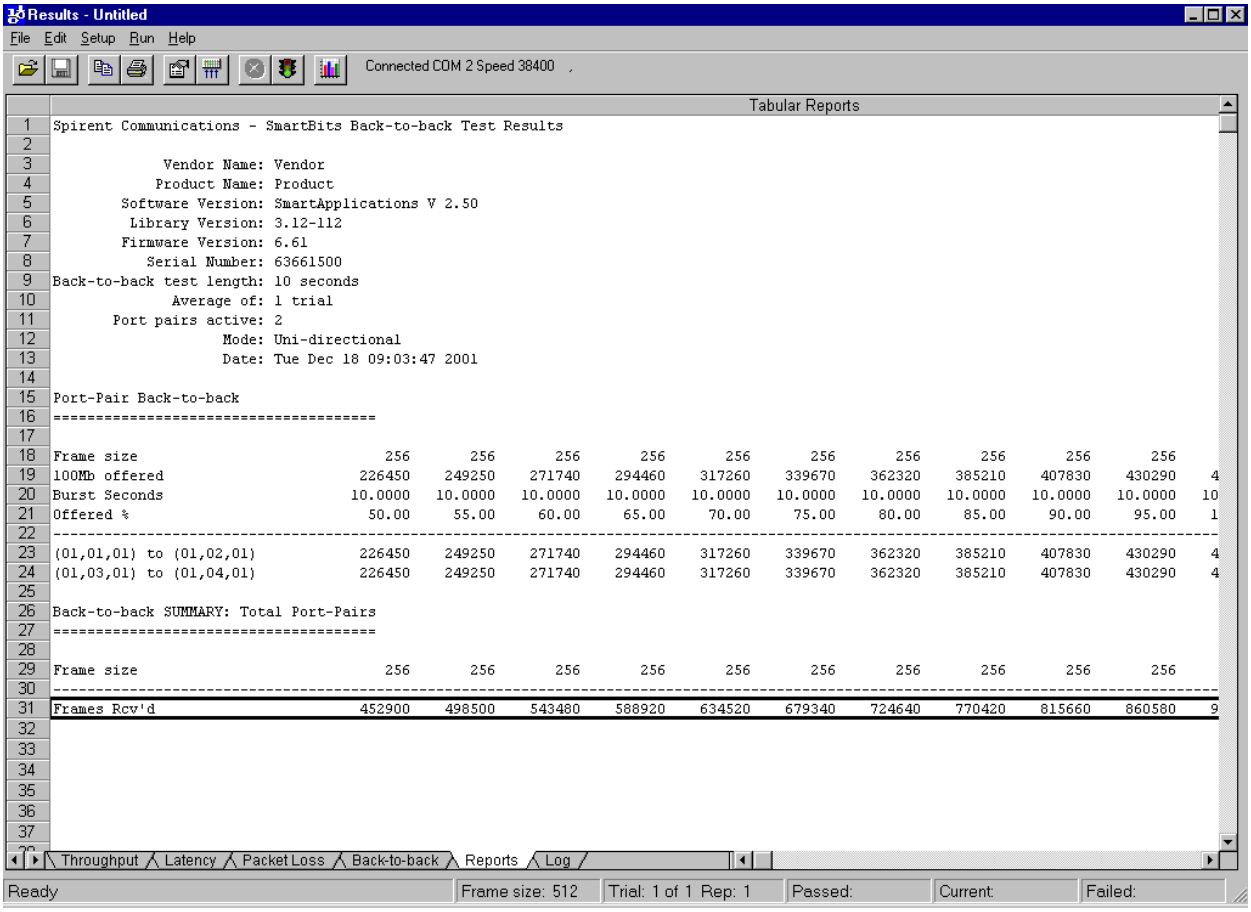
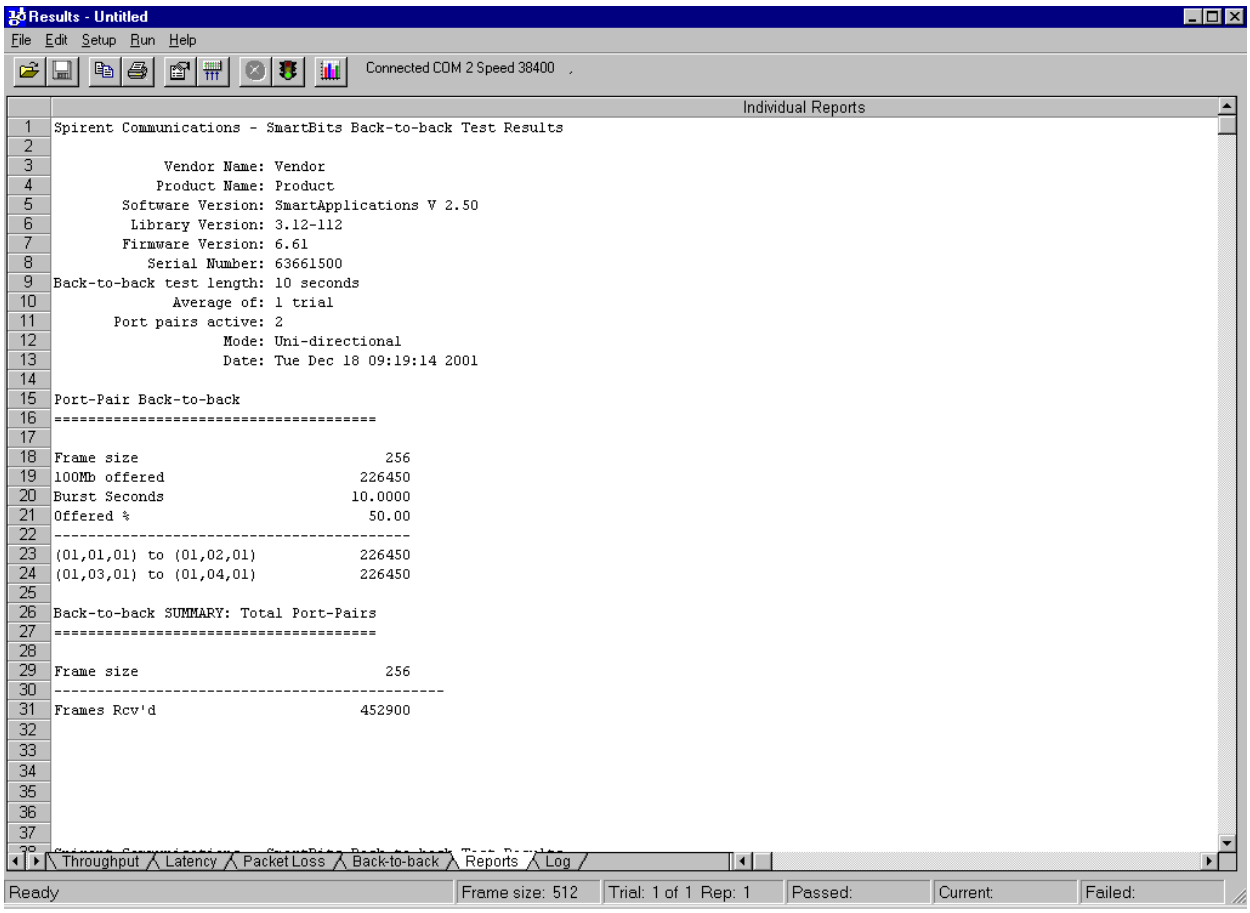


Figure 6-16. Sample Detail Report for Back-toBack Test – Tabular Format




```
Spirent Communications - SmartBits Back-to-back Test Results

             Vendor Name: Vendor
            Product Name: Product
        Software Version: SmartApplications V 2.50
         Library Version: 3.12-112
        Firmware Version: 6.61
           Serial Number: 63661500
Back-to-back test length: 10 seconds
             Average of: 1 trial
       Port pairs active: 2
                    Mode: Uni-directional
                    Date: Tue Dec 18 09:19:14 2001

Port-Pair Back-to-back
======================================

Frame size                            256
100Mb offered                      226450
Burst Seconds                     10.0000
Offered %                           50.00
----------------------------------------
(01,01,01) to (01,02,01)           226450
(01,03,01) to (01,04,01)           226450

Back-to-back SUMMARY: Total Port-Pairs
======================================

Frame size                            256
------------------------------------------------
Frames Rcv'd                       452900
```

Figure 6-17. Sample Detail Report for Back-toBack Test – Non-tabular Format

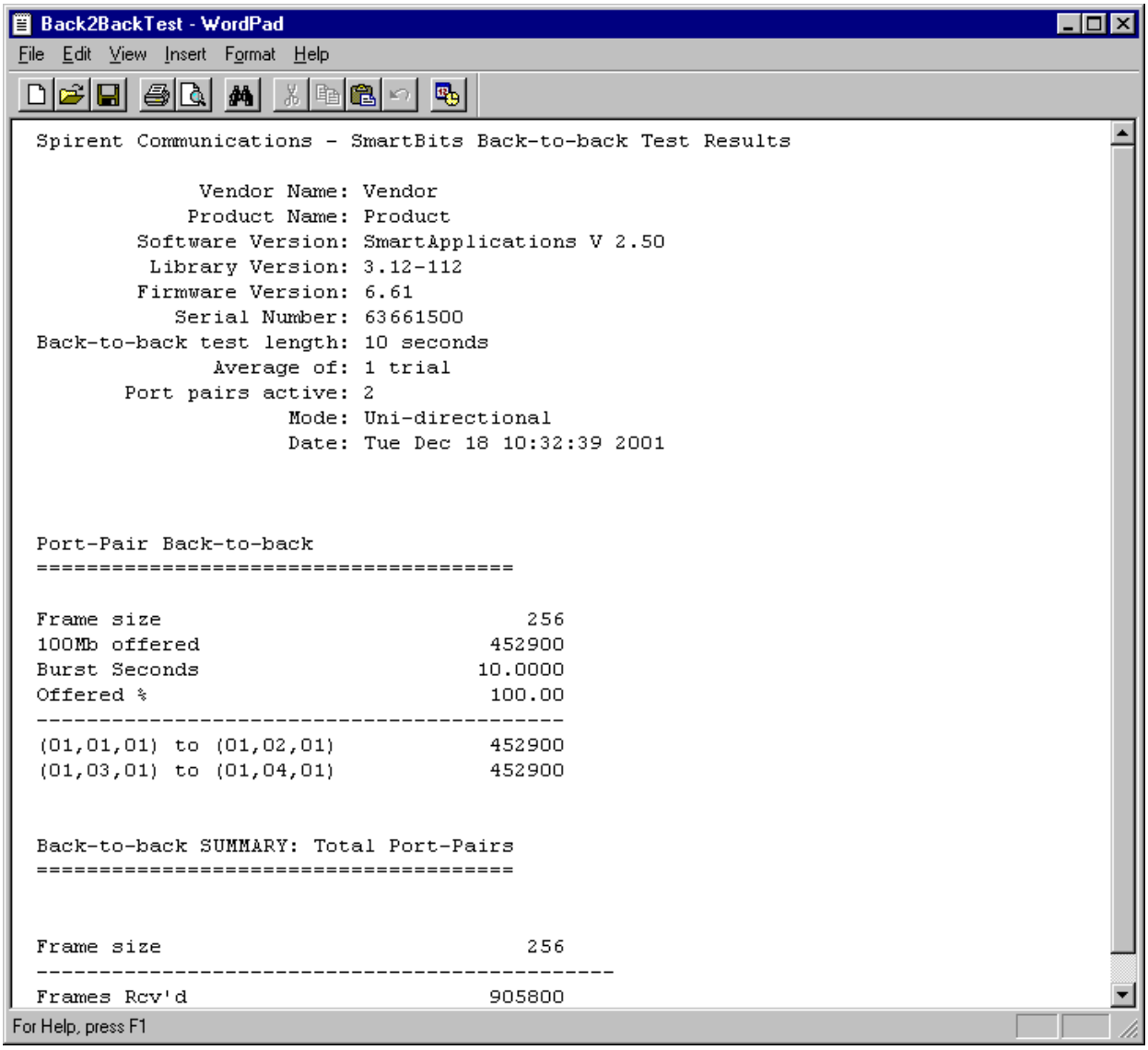


Figure 6-18. Sample Summary Report for Back-toBack Test

Viewing Log Contents

The *SmartApplications* log file provides detailed results for each test, as well as a running record of what happened during the test. See *Figure 6-19* for an example.

To view the log file, open the *Log* tab of the *Results* window.

Note: Always check the test log to make sure that the test has run correctly.

Results - C:\Program Files\SmartBits\SmartApplications\MyResultsLog.xls

File Edit Setup Run Help

Connected COM 2 Speed 38400

PkSize	Hub	Slot	Port	Gap (Bit Times)	Percent(%)	Rate	Burst	RcvPkt	XmtPkt	Collision	RcvTrig	RcvByte	CRC	Align
PkSize	Hub	Slot	Port	Gap (Bit Times)	Percent(%)	Rate	Burst	RcvPkt	XmtPkt	Collision	RcvTrig	RcvByte	CRC	Align
Trial: 1	Repetition: 1	Frame Size: 256	Trial Duration(sec):	10.00										
256	1	1	1	2304	500.00	226450	226450	0	226450	0	0	0	0	0
256	1	2	1	2304	500.00	226450	226450	226450	0	0	226450	57971200	0	0
256	1	3	1	2304	500.00	226450	226450	0	226450	0	0	0	0	0
256	1	4	1	2304	500.00	226450	226450	226450	0	0	226450	57971200	0	0
Trial: 1	Repetition: 1	Frame Size: 256	Trial Duration(sec):	10.00										
256	1	1	1	1900	550.34	249250	249250	0	249250	0	0	0	0	0
256	1	2	1	1900	550.34	249250	249250	249250	0	0	249250	63808000	0	0
256	1	3	1	1900	550.34	249250	249250	0	249250	0	0	0	0	0
256	1	4	1	1900	550.34	249250	249250	249250	0	0	249250	63808000	0	0
Trial: 1	Repetition: 1	Frame Size: 256	Trial Duration(sec):	10.00										
256	1	1	1	1568	600.00	271740	271740	0	271740	0	0	0	0	0
256	1	2	1	1568	600.00	271740	271740	271740	0	0	271740	69565440	0	0
256	1	3	1	1568	600.00	271740	271740	0	271740	0	0	0	0	0
256	1	4	1	1568	600.00	271740	271740	271740	0	0	271740	69565440	0	0
Trial: 1	Repetition: 1	Frame Size: 256	Trial Duration(sec):	10.00										
256	1	1	1	1284	650.17	294460	294460	0	294460	0	0	0	0	0
256	1	2	1	1284	650.17	294460	294460	294460	0	0	294460	75381760	0	0
256	1	3	1	1284	650.17	294460	294460	0	294460	0	0	0	0	0
256	1	4	1	1284	650.17	294460	294460	294460	0	0	294460	75381760	0	0
Trial: 1	Repetition: 1	Frame Size: 256	Trial Duration(sec):	10.00										
256	1	1	1	1040	700.51	317260	317260	0	317260	0	0	0	0	0
256	1	2	1	1040	700.51	317260	317260	317260	0	0	317260	81218560	0	0
256	1	3	1	1040	700.51	317260	317260	0	317260	0	0	0	0	0
256	1	4	1	1040	700.51	317260	317260	317260	0	0	317260	81218560	0	0
Trial: 1	Repetition: 1	Frame Size: 256	Trial Duration(sec):	10.00										
256	1	1	1	832	749.99	339670	339670	0	339670	0	0	0	0	0
256	1	2	1	832	749.99	339670	339670	339670	0	0	339670	86955520	0	0
256	1	3	1	832	749.99	339670	339670	0	339670	0	0	0	0	0
256	1	4	1	832	749.99	339670	339670	339670	0	0	339670	86955520	0	0
Trial: 1	Repetition: 1	Frame Size: 256	Trial Duration(sec):	10.00										
256	1	1	1	648	800.00	362320	362320	0	362320	0	0	0	0	0
256	1	2	1	648	800.00	362320	362320	362320	0	0	362320	92753920	0	0
256	1	3	1	648	800.00	362320	362320	0	362320	0	0	0	0	0
256	1	4	1	648	800.00	362320	362320	362320	0	0	362320	92753920	0	0

Throughput | Latency | Packet Loss | Back-to-back | Reports | Log

Ready | Frame size: 512 | Trial: 1 of 1 Rep: 1 | Passed: | Current: | Failed:

Figure 6-19. Sample Log File


SPIRENT
Communications

7 Test Examples

This chapter presents examples of the four *SmartApplications* tests, illustrating sample test configurations for routers or switches. Although they will not match your test environment exactly, they demonstrate how to run a test and how results should look. Naturally, you should set up your test configurations to meet your specific requirements.



Note: All the examples described here apply to a router or switch. If the device under test is a router, be sure to select **Router Test** on the *Preference* tab of the *Test Setup* window.

In this chapter...

This chapter contains the following sections:

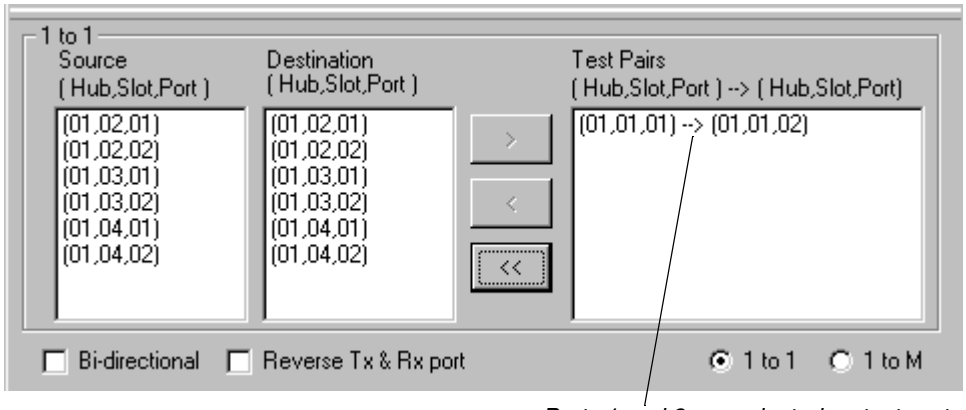
- ***Throughput Test — Example.....152***
- ***Latency Test — Example.....157***
- ***Packet Loss Test — Example.....159***
- ***Back-to-Back Test — Example.....161***

Throughput Test — Example

The Throughput test measures the fastest rate at which a device can forward frames without error. If even a single frame is dropped, the test fails and is repeated at a lower rate.

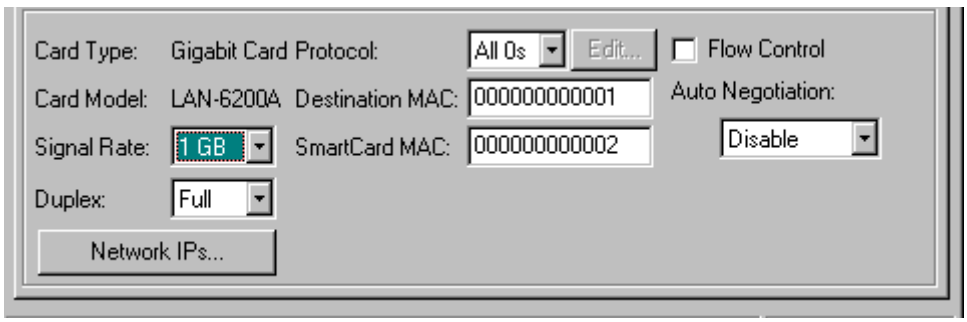
Setup — Throughput Test Example

In this example, we select Port 1 and Port 2 for testing, as shown below.



Ports 1 and 2 are selected as test ports.

In the port attributes tabs for the selected ports, the values for *Destination MAC* and *SmartCard MAC* correspond to the sending and receiving port numbers.



Note: In this example, the DUT is a switch. If we were testing a router, the *Protocol* field would have to specify a Layer 3 protocol, rather than **All 0s** as shown here.

Figure 7-1 on page 153 illustrates the overall test configuration used for this example:

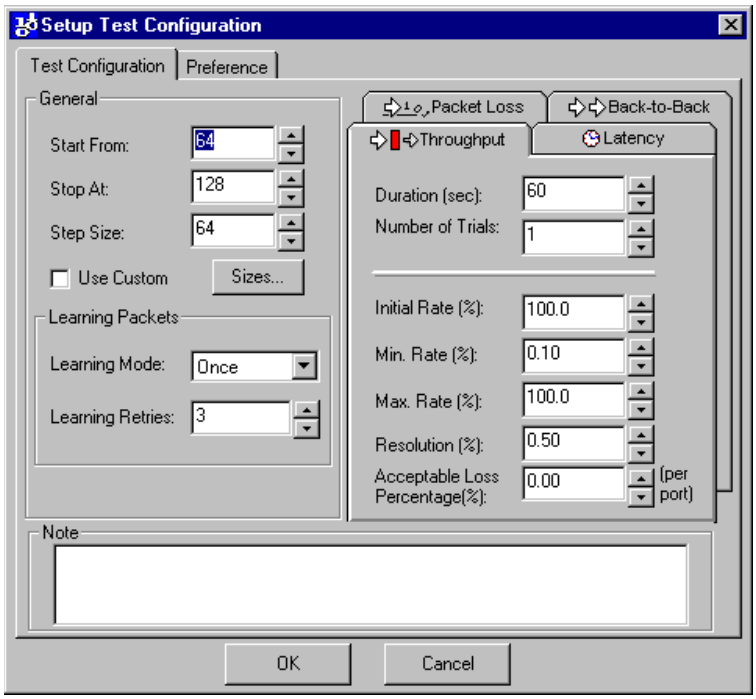


Figure 7-1. Test Configuration for Example

Test setup

This example uses the following setup:

- Initial Rate is 100%.
- Maximum rate is 100%.
- Minimum rate is 50%.
- Resolution is .5%.
- Acceptable Loss Percentage is not enabled (zero value).

To save time, frame sizes vary from a minimum of 64 bytes to a maximum of 128 bytes, with a step size of 64.

How the test runs

The test will run twice: once with 64-byte packets, and once with 128-byte packets. It will start running at 100% and fall back if any packets are lost. The minimum rate is 50%.

Note: The rates in this example were selected to minimize the number of tests run. For Ethernet, RFC 1242 actually recommends frame sizes of 64, 128, 256, 512, 1024, 1280, and 1518 bytes (these are the default sizes in the *Sizes* list when you select *Use Custom*).

Results — Throughput Test Example

The *Results* window appears as soon as the test starts. *Figure 7-2* is an example of the *Results* window for the Throughput test. In this case, it shows that the trial succeeded at the first frame size and is continuing with the second frame size.

Because we selected two packet sizes (64 and 128 bytes), only two trials are shown.

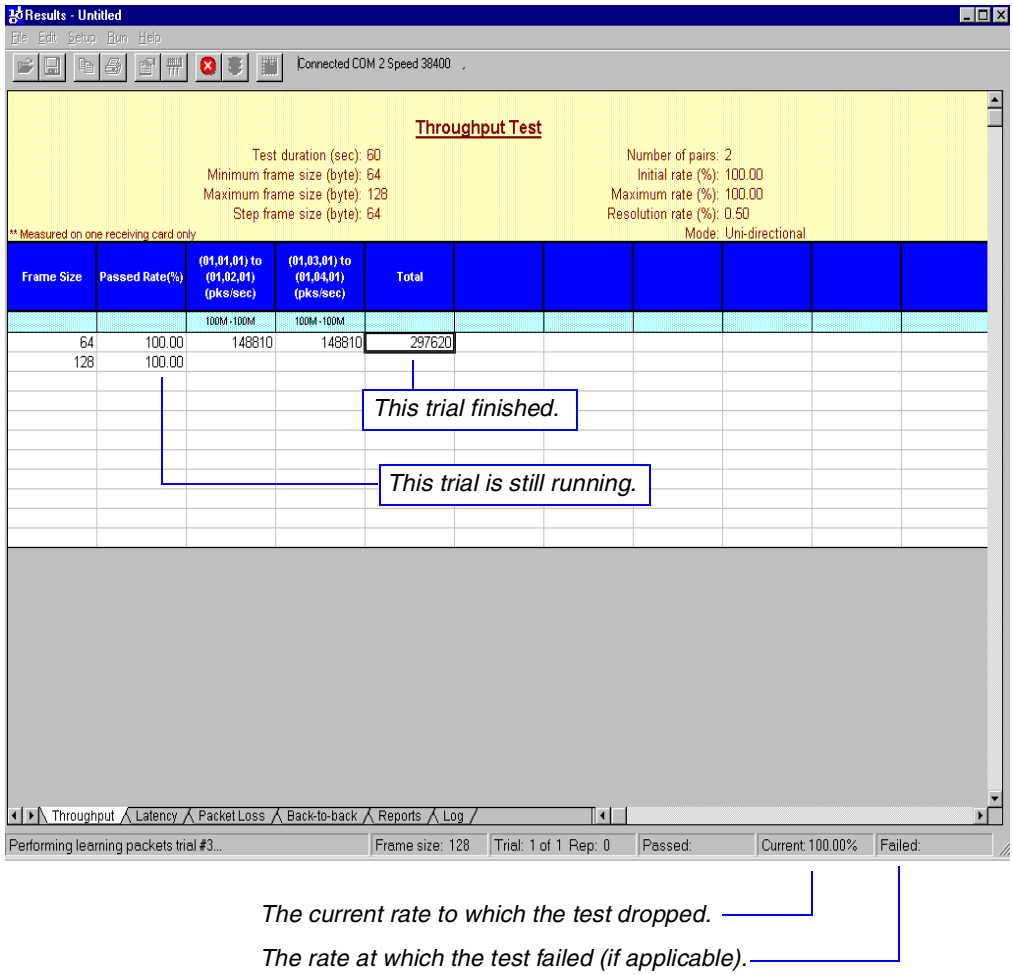


Figure 7-2. Throughput Test Results *Window (Example)*

Sample Test Log

The test log shows packets received and packets transmitted. *Figure 7-3* illustrates the log for this example. When there is a failure in a trial iteration, that field is shown in red.

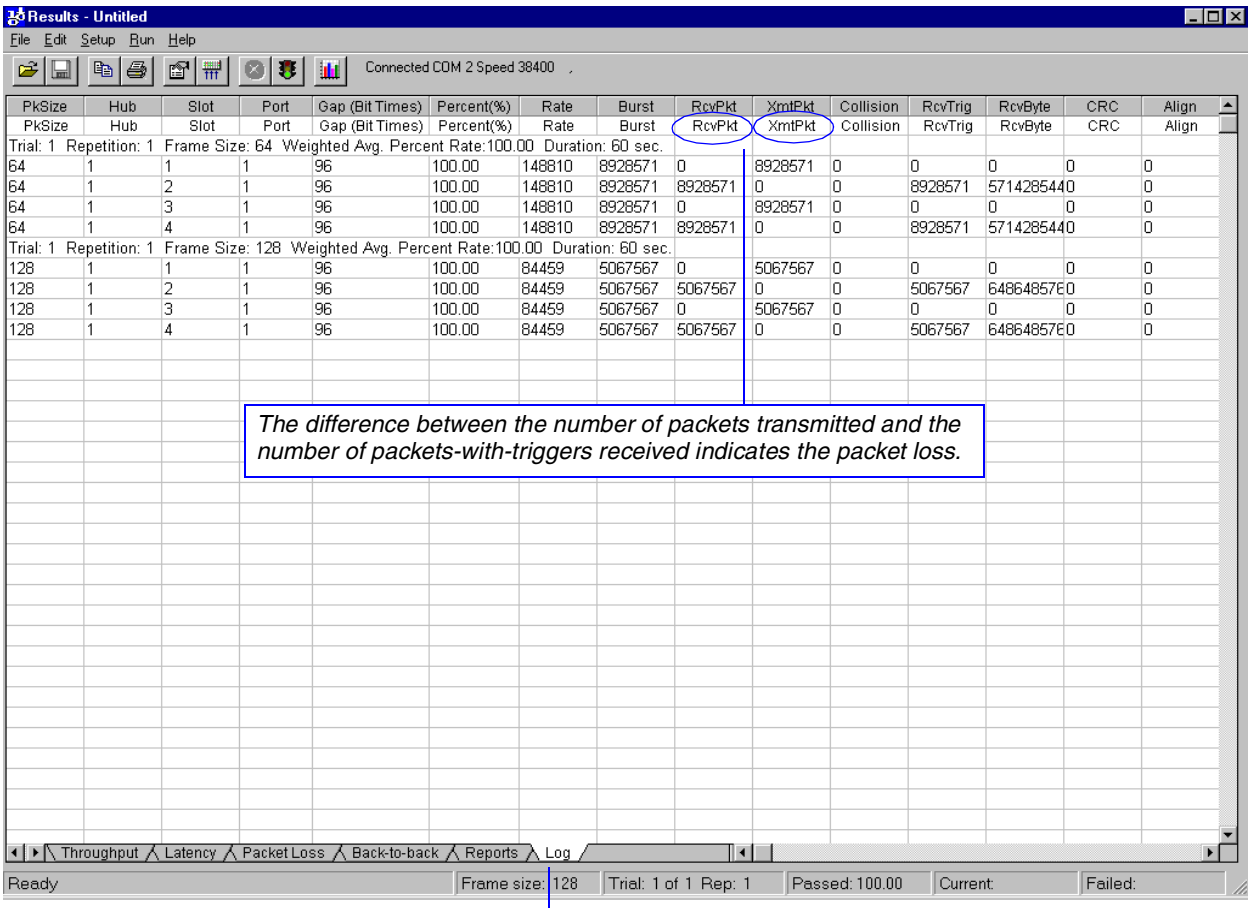
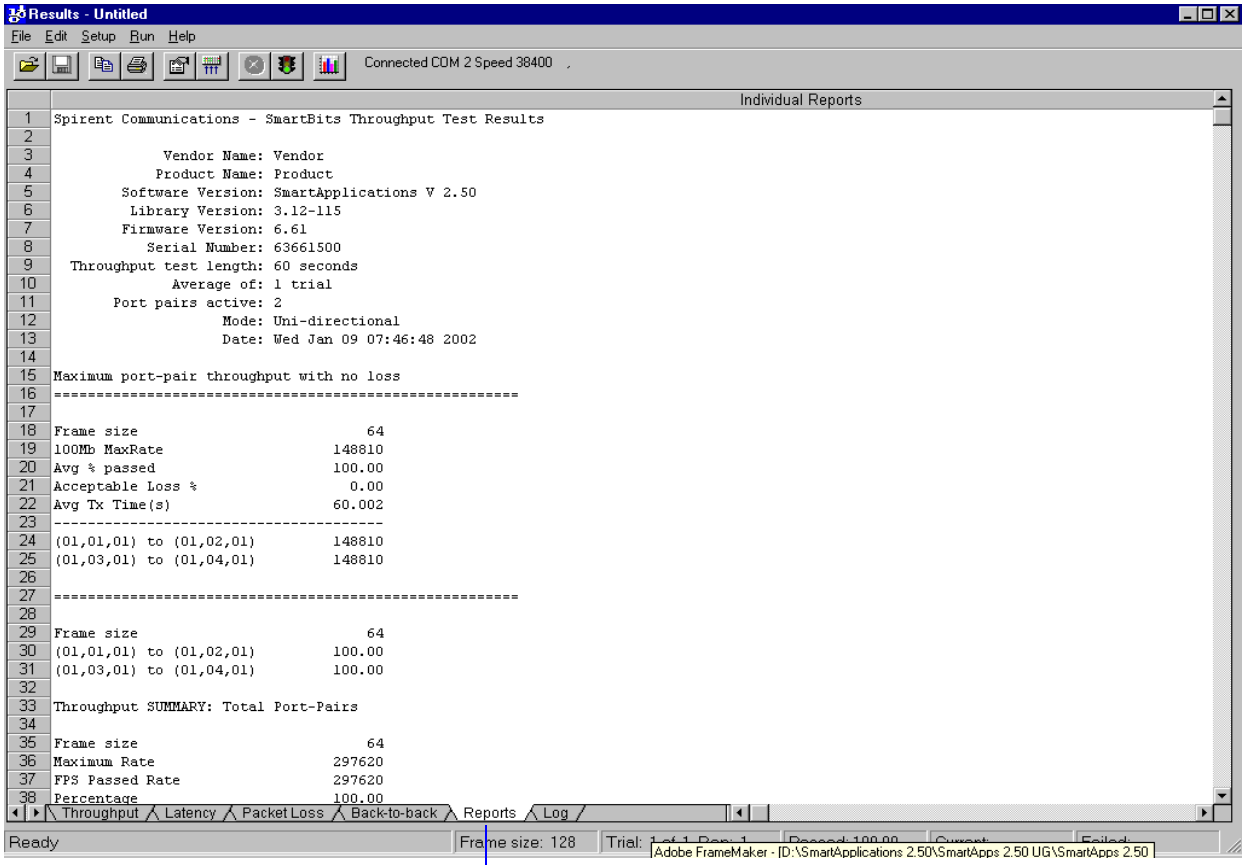


Figure 7-3. Sample Test Log for Throughput Test

Sample Test Report

Figure 7-4 illustrates the Test Report for the Throughput test example.



Click on the Reports *tab to open the test report.*

Figure 7-4. Sample Test Report

Latency Test — Example

In Latency tests, the *Min. Rate* field does not apply.

Sample Test Configuration

The *Setup Test Configuration* dialog (*Figure 7-5*) shows the settings used in this example.

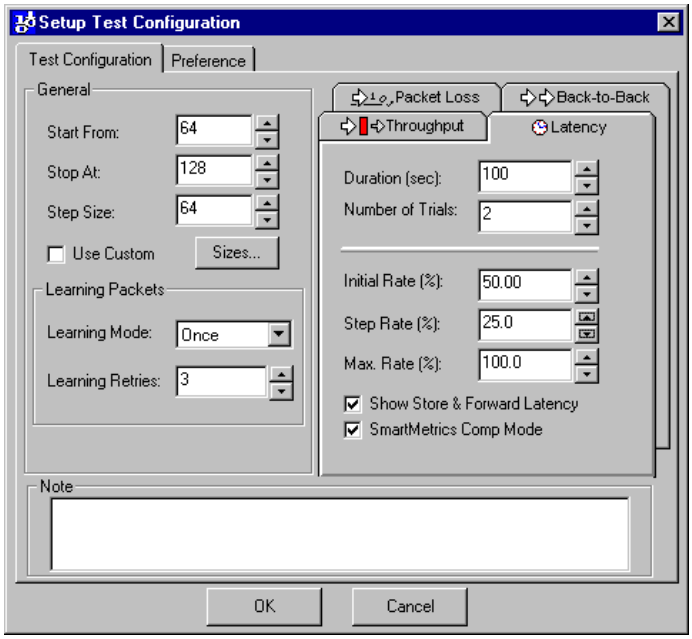


Figure 7-5. Test Setup for Latency Test Example

Test setup

This test uses the following setup:

- 64-byte packets and 128-byte packets.
- Each trial will last 100 seconds (the RFC default), and there will be two trials (the RFC default is 20).
- Learning Packets will be sent once before each test.
- Initial Rate is 50%, Step Rate is 25%, and Max Rate is 100%.

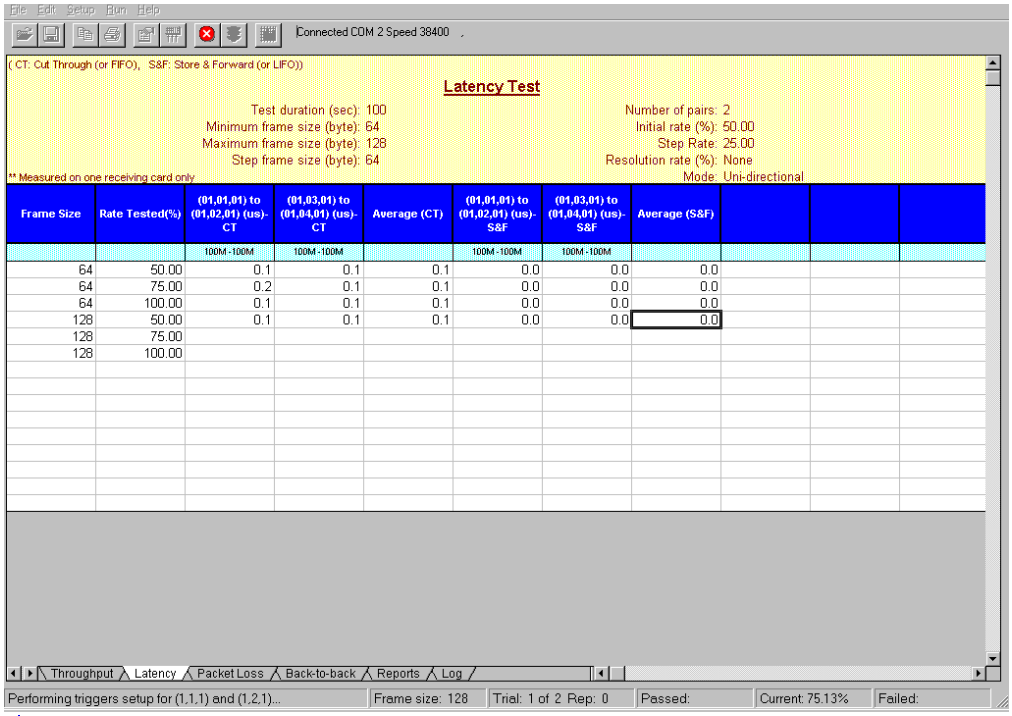
How the test runs

These settings will cause the test to run in six trials: with 64-byte packets at 50%, 75% and 100%, and with 128-byte packets at 50%, 75% and 100%. The Latency test does not step down in percentage of transmission. For example, if *Initial Rate* is 100%, *Minimum Rate* 50%, and *Step Rate* 25%, the test will run only at 100%.

Note: Rates in this example were selected to minimize the number of tests run. RFC 1242 specifies a minimum of 20 repetitions (*Number of Trials*) with a stream duration of 100 seconds. Recommended frame sizes for Ethernet are 64, 128, 256, 512, 1024, 1280, and 1518 (these are the default sizes in the *Sizes* list when you select *Use Custom*).

Sample Test Results Window for Latency

Figure 7-6 illustrates the *Results* window for this example of the Latency test, with the test still in progress. Test results are displayed for both cut-through and store-and-forward devices. Use the measurement that is appropriate for your device type.



Use the Status *bar to view current activity as the test runs.*

These Status *bar fields are not used in a Latency test.*

Figure 7-6. Sample Results Window for Latency Test

The 64-byte tests are complete at 50%, 75% and 100%, with a latency time of 0.1 microseconds for all rates. The 50% test with 128-byte packets is also complete with a latency of 0.1 microsecond.

The status bar at the bottom of the window displays current activity:

- Performing triggers setup for the selected ports.
- Frame size being transmitted (128 bytes)
- Current trial count (1 of 2)
- Current rate (75.13%)

Note: Passed and Failed status indications are not used in the Latency test.

Packet Loss Test — Example

The Packet Loss Test measures the percentage of frames lost by the DUT that should have been forwarded.

Sample Test Configuration

Figure 7-7 shows the settings used for this example of the Packet Loss test.

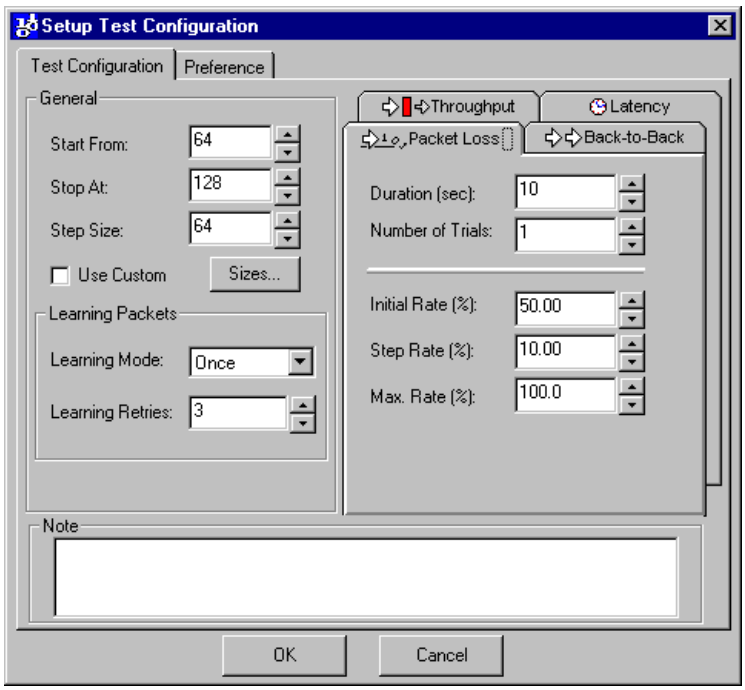


Figure 7-7. Test Setup for Packet Loss Test Example

Test setup

This test uses the following setup:

- 64-byte packets and 128-byte packets.
- Each trial will last 10 seconds, and there will be one trial.
- Learning Packets will be sent once before each test.
- Initial Rate is 50%, Step Rate is 10%, and Max Rate is 100%.

How the test runs

This test setup results in 12 trials: 64-byte packets are sent first at the 50% rate, then at rates that increase in 10% increments. Then 128-byte packets are sent in the same way.

Note: Rates in this example were selected to minimize the number of tests run. The recommended frame sizes for Ethernet are 64, 128, 256, 512, 1024, 1280 and 1518 bytes (these are the default sizes in the *Sizes* list when you select *Use Custom*).

Sample Results Window

Figure 7-8 illustrates the *Results* window for this example of a Packet Loss Test, with the test still in progress.

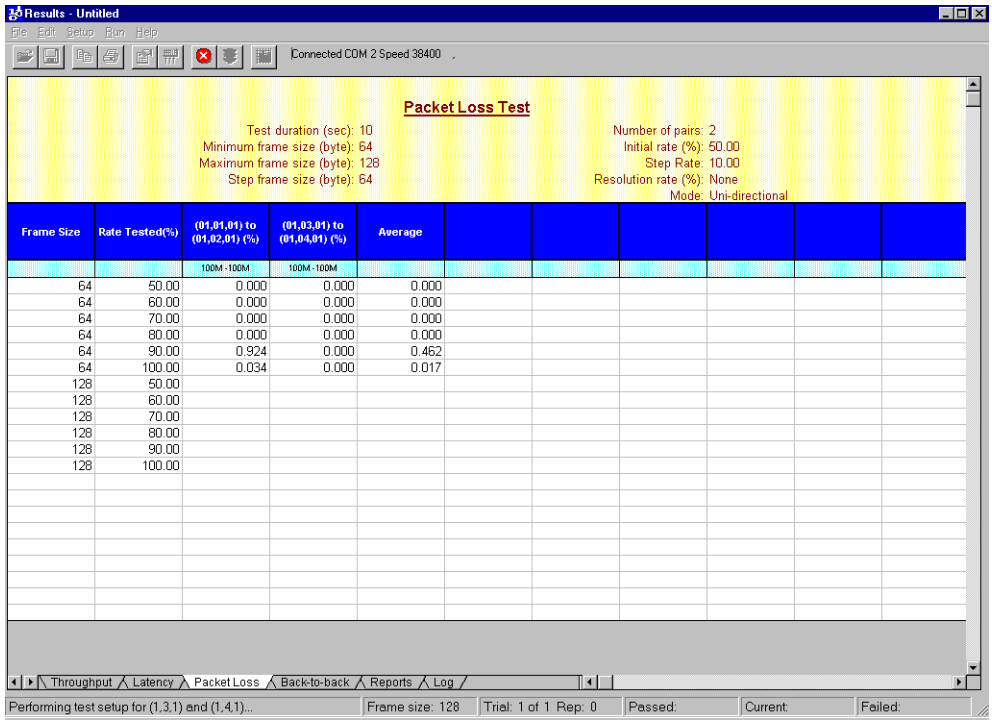


Figure 7-8. Sample Test Results for Packet Loss Test

In this example the first trial ran at 50% with 64-byte packets and no packet loss. The loss rate (0.000% lost) is shown in each this column identifying the port pair.

Subsequent trials ran at 10% higher rates, with 64-byte packets, and there was no packet loss until the 90% rate, when .924% of the transmitted packets were lost. The next rate (with 64-byte frames) also showed packet loss of .034%.

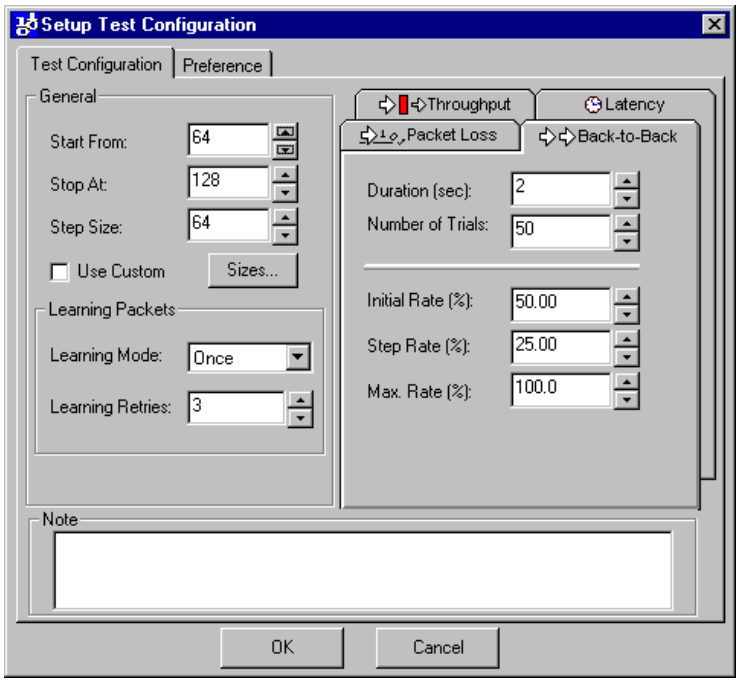
The *Status* bar shows that trials at the 128 frame size are just beginning, with test setup in progress.

Back-to-Back Test — Example

The Back-to-Back test assesses the buffering capability of the device under test.

Sample Test Configuration

Figure 7-8 shows the settings used for this example of the Back-to-Back test.



Test setup

This test uses the following setup:

- 50 trials with a duration of two seconds each trial.
- Start at the 50% rate.
- Increase in 25% steps to a maximum of 100%.
- Start with 64-byte packets.
- Increase by 64 bytes in each trial to a maximum of 128-byte packets.

Note: Rates in this example were selected to minimize the number of tests run. RFC 1242 actually recommends at least 50 trials with a required minimum duration of two seconds with frame sizes for Ethernet of 64, 128, 256, 512, 1024, 1280 and 1518 bytes (these are the default sizes in the *Sizes* list when you select *Use Custom*).

Sample Results Window

Figure 7-9 illustrates the *Results* window for the sample Back-to-Back test, with the test still in progress. For this test, results show the number of frames in the longest burst that the DUT handled without dropping a packet.

In this example, we used a jumper wire to connect the two ports under test. Therefore the results shown here represent only the maximum number of frames of that size that can be transmitted at the test rate.

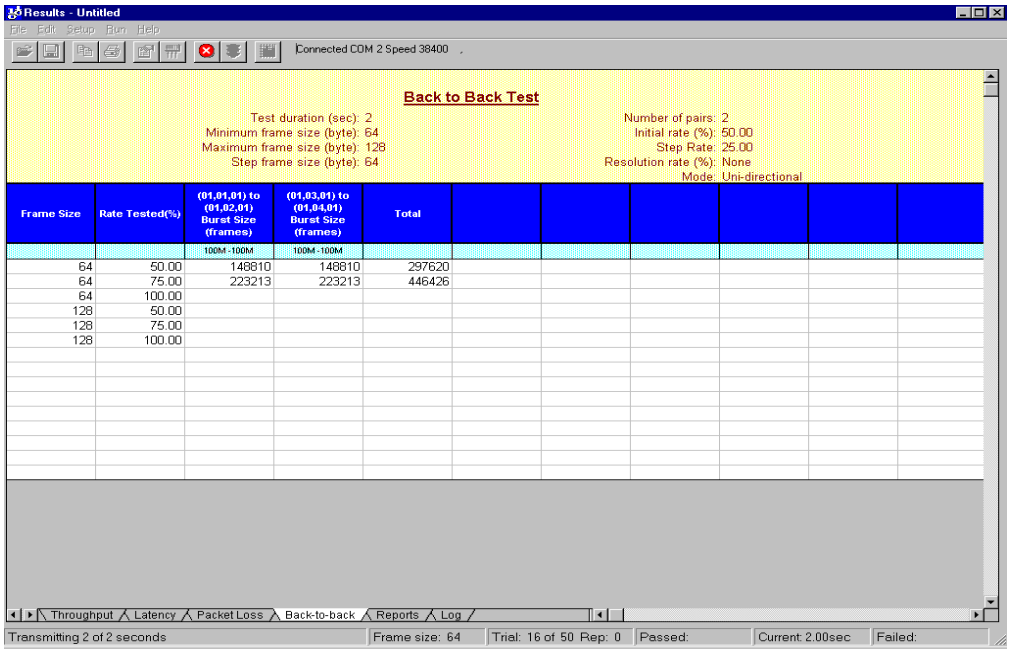


Figure 7-9. Sample Test Results for Back-to-Back Test

Glossary

This glossary has two parts:

- *"Acronyms and Abbreviations"* expands short terms that appear in this document.
- *"Terminology"* defines longer terms in this document, as well as in networking technology and standards generally.

Acronyms and Abbreviations

Acronym / Abbreviation	Definition
AMI	Alternate Mark Inversion.
ATM	Asynchronous Transfer Mode. Transfer mode in which information is organized into cells.
CPE	Customer Premise Equipment.
CRC	Cyclic Redundancy Check.
CSU	Channel Service Unit.
CTS	Clear to Send.
DCD	Date Carrier Detect.
DLCI	Data Link Connection Identifier.
DSR	Data Set Ready.
DSU	Data Service Unit.
DTR	Data Terminal Ready.
DUT	Device Under Test.
ELAN	Emulated Local Area Network. A group of ATM and legacy devices registered with the LES that constitute a logical network.

Acronym / Abbreviation	Definition
ESI	End System Identifier.
FIFO	First in/first out.
GPS	Global Positioning System.
HTML	HyperText Markup Language. A collection of platform-independent styles, indicated by *markup tags*, that define the components of a document on the World Wide Web. You can have *SmartApplications* generate test reports in HTML format. Select **Setup > HTML Reports Setup** from the main menu.
ILMI	Interim Local Management Interface. Discovers and registers ATM addresses of attached hosts.
IP	Internet Protocol. Works in conjunction with TCP and is usually identified as TCP/IP.
IPX	Internetwork Packet Exchange.
LAN	Local Area Network. Designed to move data between stations within a campus.
LEC	Lan Emulation Client. A device such as a server, switch, or workstation that performs ATM signaling and control functions while communicating with other devices in an ELAN. Every LEC Client has an ATM address and a MAC address.
LECS	LAN Emulation Configuration Server. Provides mapping information about ELANs on the ATM network that an LEC may join.
LES	LAN Emulation Server. Registers the MAC addresses of each LEC on the non-ATM LAN and resolves the MAC address to an ATM address.
LIFO	Last in/first out.
LMP	Link Management Protocol.
NRZ	Non-return to zero.
NRZI	Non-return to zero inverted.
PCB	Printed Circuit Board.

Acronym / Abbreviation	Definition
PPP	Point-to-Point Protocol.
PVC	Permanent Virtual Circuit. A dedicated channel between endpoints through an ATM network used for long-term data transfer.
RFC	Request For Comments. Document series used as the primary means for communicating information about the Internet.
RIP	Routing Information Protocol.
RTS	Request to Send.
SMB	SmartBits.
SNAP	Subnetwork Access Protocol.
SRA	Source Route Addressing.
SVC	Switched Virtual Circuit. A connection established through signaling with user-defined endpoints when the call is initiated.
UDP	User Datagram Protocol. Connectionless transport layer protocol in the TCP/IP protocol stack.
VCI/VPI	Virtual Channel Identifier/Virtual Path Identifier. A connection in the form of a channel which has been successfully initialized and on which data is ready to be transmitted and received. Provides mapping information for routing cells from a source to destination.
WAN	Wide Area Network.

Terminology

Acceptable Loss Throughput

A mode for the Throughput test. It enables you to specify how much frame loss should be considered acceptable when judging the trial successful or failed. This makes it possible to compensate for frame loss caused by small differences in clock tolerances between the SmartBits port and the DUT port.

Back-to-Back test

Tests the buffering capability of the device under test (DUT).

bi-directional

Port pairs transmitting simultaneously in both directions, as in full-duplex operation.

card

In this manual, refers generally to any SmartCard or module for a SmartBits system.

frame

A data pattern that a stream transmits.

hub

The SmartBits chassis that contains SmartCards or modules.

iteration

An iteration is when *SmartApplications*, while maintaining the frame size, varies the transmission rate based on the last failed rate. The resolution and number of repetitions determines the accuracy of results.

latency

Delay between the time a device receives a frame and the time that frame is forwarded out the destination port.

MAC address

A 6-byte IEEE identifier for hardware devices, sometimes called a hardware address.

Next Hop test

Tests a router's ability to recognize the next hop address and update its routing table with this address.

Packet Loss test

Measures the percentage of frames lost by the device under test (DUT) that should have been forwarded.

port

In a SmartBits chassis, the port on a SmartCard or module.

slot

On a SmartBits chassis, a slot is where the SmartCard or module is inserted.

stream

A software engine on SmartBits cards that transmits a frame pattern repeatedly.

test

Refers to the test (such as Throughput or Latency) run for a particular frame size.

Throughput test

Tests the fastest rate at which a device can forward frames without error.

trial

One set of iterations for a specific fame size and varying transmission rates. Tests use trials to determine the optimal rate of traffic for that frame size.


SPIRENT
Communications

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