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1. SmartClass Ethernet Tester User's Guide 2. SmartClass Ethernet Tester User's Guide 3. ii SmartClass Ethernet Tester User's Guide Notice Every effort was made to ensure that the information in this document was accurate at the time of printing. However, information is subject to change with- out notice, and JDSU reserves the right to provide an addendum to this docu- ment with information not available at the time that this document was created. JDSU, Enabling Broadband and Optical Innovation, Communications Test and Mea- surement Solutions, and the JDSU logo are trademarks of JDS Uniphase Corporation ("JDS Uniphase"). All other trademarks are the property of their respective owners. No part of this guide may be reproduced or transmitted electronically or otherwise without written permission of the pub- lisher. Trademarks JDS Uniphase, JDSU, and SmartClass are trademarks or registered trade- marks of JDS Uniphase Corporation in the United States and/or other coun- tries. Microsoft and Excel are either trademarks or registered trademarks of Microsoft Corporation in the United States and/or other countries. PDF is a trademark of Adobe Systems in the United States and/or other coun- tries. Energizer is either a trademark or registered trademark of Eveready Battery Company, Inc. in the United States and/or other countries. Specifications, terms, and conditions are subject to change without notice. All trademarks and registered trademarks are the property of their respective companies. Ordering information This guide is a product of JDSU's Technical Information Development Depart- ment, issued as part of the SmartClass Ethernet Tester. The catalog number for a printed guide is ML-5053901. The catalog number for a CD containing all user documentation and utilities is CML-21099708. Federal Communications Commission (FCC) Notice This product was tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to pro- vide reasonable protection against harmful interference when the equipment is operated in a commercial or residential environment. This product generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. The authority to operate this product is conditioned by the requirements that no modifications be made to the equipment unless the changes or modifications are expressly approved by JDSU. Industry Canada Requirements This Class B digital apparatus complies with Canadian ICES-003. Cet appareil numérique de la classe B est conforme à la norme NMB-003 du Canada. EMC Directive Compliance This product was tested and conforms to the EMC Directive, 89/336/EEC as amended by 92/31/EEC and 93/68/EEC for electromagnetic compatibility. 4. SmartClass Ethernet Tester User's Guide iii Low Voltage Directive Compliance This product was tested and conforms to the Low Voltage Directive, 73/23/EEC as amended by 93/68/EEC. Conformity with this directive is based upon com- pliance with the harmonized safety standard, UL61010-1. WEEE and Battery Directive Compliance JDSU has established processes in compliance with the Waste Electrical and Electronic Equipment (WEEE) Directive, 2002/96/EC, and the Battery Direc- tive, 2006/66/EC. This product, and the batteries used to power the product, should not be dis- posed of as unsorted municipal waste and should be collected separately and disposed of according to your national regulations. In the European Union, all equipment and batteries purchased from JDSU after 2005-08-13 can be returned for disposal at the end of its useful life. JDSU will ensure that all waste equipment and batteries returned are reused, recycled, or disposed of in an environmentally friendly manner, and in compliance with all applicable national and international waste legislation. It is the responsibility of the equipment owner to return equipment and batteries to JDSU for appropriate disposal. If the equipment or battery was imported by a reseller whose name or logo is marked on the equipment or battery, then the owner should return the equipment or battery directly to the reseller. Instructions for returning waste equipment and batteries to JDSU can be found in the Environmental section of JDSU's web site at www.jdsu.com. If you have questions concerning disposal of your equipment or batteries, contact JDSU's WEEE Program Management team at WEEE.EMEA@jdsu.com. 5. iv SmartClass Ethernet Tester User's Guide 6. SmartClass Ethernet Tester User's Guide v Table of Contents

10. SmartClass Ethernet Tester User's Guide ix About this Guide This chapter describes how to use this guide. Topics discussed in this chapter include the following: – "Purpose and scope" on page x – "Assumptions" on page x – "Safety and compliance information" on page x – "Technical assistance" on page x – "Conventions" on page xi 11. About this Guide Purpose and scope x SmartClass Ethernet Tester User's Guide Purpose and scope The purpose of this guide is to help you successfully use the features and capabilities of the SmartClass Ethernet Tester. This guide includes task-based instructions that describe how to configure, use, and troubleshoot the general functions of the SmartClass Ethernet Tester. Additionally, this guide provides a description of JDSU's warranty. Assumptions This guide is intended for novice, intermediate, and experienced users who want to use the SmartClass Ethernet Tester effectively and efficiently. We are assuming that you have basic computer experience and are familiar with basic telecommunication concepts, terminology, and safety. Safety and compliance information Safety and compliance information are contained in a separate guide and are provided in printed format with the product. Technical assistance If you need assistance or have questions related to the use of this product, use the information in Table 1 to contact JDSU's Technical Assistance Center (TAC) for customer support. During off-hours, you can request assistance by doing one of the following: leave a voice message at the TAC for your region; email the North American TAC (tac@jdsu.com); submit your question using our online Technical Assis- tance request form at www.jdsu.com. Table 1 Technical assistance centers Region Phone Number Americas 1-866-ACTERNA 1-866-228-3762 301-353-1550 tac@jdsu.com Europe, Africa, and Mid-East +49 (0) 7121 86 1345 (JDSU Germany) hotline.europe@jdsu.com Asia and the Pacific +852 2892 0990 (Hong Kong) +8610 6833 7477 (Beijing-China) 12. About this Guide Conventions SmartClass Ethernet Tester User's Guide xi Conventions This symbols and safety terms used in this guide are described in the following tables. Table 2 Symbol conventions Table 3 Safety definitions This symbol represents a general hazard. This symbol represents a risk of electrical shock. This symbol represents a risk of explosion This symbol represents a Note indicating related information or tip. This symbol, located on the equipment, battery, or packaging indicates that the equipment or battery must not be disposed of in a land-fill site or as municipal waste, and should be disposed of according to your national regulations. DANGER Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. WARNING Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. CAUTION Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. 13. About this Guide Conventions xii SmartClass Ethernet Tester User's Guide 14. 1 SmartClass Ethernet Tester User's Guide 1 Chapter 1 Getting Started This chapter provides a general description of the SmartClass Ethernet Tester. Topics discussed in this chapter include the following: – "Ship list" on page 2 – "Features and capabilities" on page 2 – "What's new" on page 3 – "Options and accessories" on page 3 – "Preparation for use" on page 5 – "Exploring the front panel" on page 6 – "Exploring the connector panel" on page 8 – "Exploring the bottom panel" on page 8 – "Powering ON your tester" on page 9 – "Powering OFF your tester" on page 9 – "Navigating the user interface" on page 9 – "Using the keypad" on page 13 15. Chapter 1 Getting Started Ship list 2 SmartClass Ethernet Tester User's Guide Ship list The Ethernet Tester typically ships in anti-static packing material to stabilize the tester inside the box. The following items ship standard with the Smart- Class Ethernet Tester: – SmartClass Ethernet Tester tester. – Universal Power Adapter — A power adapter designed specifically for the SmartClass Tester is included. When supplying power to the SmartClass Tester using an adapter, you must use the adapter supplied with your tester. Additional AC line plug adapters are also included. – Carrying Bag – 4 AA Rechargeable NiMH Batteries – Shielded Ethernet Cable – USB Cable – Documentation CD. The User's Guide is included as a PDF on the CD. The Download Manager utility is also provided on this CD. Safety and compliance information is provided separately, in printed format. When unpacking the tester, verify that each of the standard items, and any optional items you ordered, are included in the package. Features and capabilities Features and capabilities of the SmartClass Ethernet Tester include the following: – Single RJ-45 port for electrical testing – Single SFP port for optical testing – Optical power measurement – Line rate throughput testing – Loopback testing – RFC 2544 testing – Layer 2 and 3 statistics – Packet jitter measurements – Ping testing – Traceroute testing – DHCP support – VLAN and Q-in-Q support – Cable diagnostics – Reports in PDF format – Field replaceable batteries 16. Chapter 1 Getting Started What's new SmartClass Ethernet Tester User's Guide 3 What's new This release of the SmartClass Ethernet tester includes the following new features: – Lockable keypad. You can lock your keypad during testing to prevent unin- tentional key presses that might disrupt or end the test. – Multiple traffic streams. The tester can now transmit and analyze up to eight independent streams of layer 2 or layer 3 traffic. When configuring the traffic, you can optionally assign a unique source MAC or IP addresses to each individual stream, or you can use the same source address for all streams. – Configurable Acterna Test Packets (ATPs). You can now specify a fill byte pattern for Acterna Test Packets. The pattern is used to populate the payload. – MPLS encapsulation.The tester now allows you to transmit layer 3 IP traffic over a MPLS network by specifying MPLS label settings when you configure traffic for single stream tests. – IP Filter results. The source and destination addresses carried in filtered layer 3 IP traffic now appear as test results when running single stream layer 3 tests. – Asymmetrical RFC-2544. An asymmetrical RFC-2544 script is now avail- able which allows you to run the script in an end-to-end configuration at different upstream and downstream line rates. The script is initiated by a master tester on the near end. The master tester then automatically configures the slave tester on the far end. – Layer 4 loopbacks. You can loopback received layer 4 traffic when running Layer 3 Traffic tests. Traffic is not analyzed for layer 4 statistics, the tester simply swaps the source and destination port numbers carried in the received traffic before looping it back to the source device. Options and accessories Each SmartClass Ethernet Tester provides one RJ-45 and one SFP jack on the left side of the tester. The standard tester allows you to loopback 10/100/ 1000 Base-T/TX Ethernet traffic from an electrical interface. Software options When you order your tester, you can order the following software options to expand your testing capability: – TRAFFIC (TRF). The TRAFFIC software option allows you to generate and transmit traffic over a 10/100/1000 Base-T/Tx electrical interface. If you purchase the OPTICAL software option too, your tester can also generate and transmit traffic over a 1000Base-X optical interface. – OPTICAL (OPT). The OPTICAL software option allows you to use the SFP jack on your tester to loopback 1000Base-X optical Ethernet traffic. If you purchased the TRAFFIC software option too, your tester can also generate and transmit traffic over a 1000Base-X optical interface. – MPLS (MPL). The MPLS software option allows you to tag and analyze MPLS encapsulated traffic. For details, see "Specifying VLAN, Q-in-Q, or MPLS settings" on page 45. 17. Chapter 1 Getting Started Options and accessories 4 SmartClass Ethernet Tester User's Guide – STREAMS (STR). The STREAMS software option allows you to transmit and analyze up to eight individual streams of traffic. For details, see Chapter 5 "Multiple Streams Testing". – ASYMETRICAL RFC (ASY). The ASYMETRICAL RFC software option allows you to run an RFC test in an end-to-end configuration with different uplink and downlink speeds. For details, see the "New asymmetrical RFC 2544 test" on page 66. You should also purchase a JDSU recommended SFP for optical testing. Each of the SFPs offered by JDSU as an option is MSA compliant. Please refer to your SFP manufacturer's site for detailed specifications. Accessories Table 4 lists the accessories offered for the Ethernet Tester. To order accessories for your Ethernet Tester, or for a list of currently supported SFPs, contact JDSU Customer Care, your JDSU TAC representa- tive, or your local JDSU sales office. You can also contact JDSU through the company web site, www.jdsu.com. Table 4 SmartClass Ethernet Tester accessories Catalog Number Accessory AC-SFP-1000SX 1G Ethernet/1G/2G FC (850nm) multimode SFP AC-SFP-1000LX 1G Ethernet/1G/2G FC (1310nm) singlemode SFP AC-SFP-1000ZX 1G Ethernet (1550nm) singlemode SFP AC-SFP-1000BX1 1G Ethernet (1310nm TX, 1490nm RX) singlemode SFP AC-SFP-1000BX2 1G Ethernet (1490nm TX, 1310nm RX) singlemode SFP AC-SFP-CWDM 1G Ethernet varying wavelengths SFP CB-019011 Singlemode Duplex SC-LC CB-019013 Multimode Duplex SC-LC CB-019052 Singlemode Simplex SC-LC CB-019054 Multimode Simplex SC-LC CB-019055 Multimode Simplex LC-LC CB-019056 Multimode Duplex LC-LC CB-019057 Singlemode Simplex LC-LC CB-019058 Singlemode Duplex LC-LC CB-50747 10' Ethernet cable CB-50759 USB cable 3010-12-0101 Carrying Bag SC1WALLCHARGER Universal AC Power Adapter BATTAA25AHNIMH4PACK NiMH Rechargeable batteries, 4-pack C11-0155765 Replacement AC Adapter 18. Chapter 1 Getting Started Preparation for use SmartClass Ethernet Tester User's Guide 5 Preparation for use This section explains how to start using your Ethernet Tester. General preparation When you unpack the Ethernet Tester, do the following: – Inspect the tester for damage. – If undamaged, save the box and packing materials in case you need to ship the tester in the future. Before using the Ethernet Tester for the first time, do the following: – If you are using alkaline batteries, verify that your tester is OFF, and then install fresh batteries in the tester. – If you are using rechargeable batteries, verify that your tester is OFF, and then install the batteries in the tester. Before testing, make sure the batteries have been fully charged (see "Recharging the batteries" on page 92). – Turn the tester ON (see "Powering ON your tester" on page 9). – When prompted, specify the type of battery you installed. – Verify that your tester is operating properly by navigating through a few menus. – If the Batt LED is red, replace the batteries (see "Replacing the batteries" on page 93). If you suspect that the batteries are fine, and the batteries are fully charged, it's possible the charger has detected a fault condition. See "Resolving problems" on page 96 for details. Changing the AC line plug fitting The Ethernet Tester's AC Adapter/Charger allows different AC line plug fittings. To change the AC line plug fitting 1 If an AC line plug fitting is already installed, do the following: 2 Press and hold the button just below the fitting. 3 Slide the fitting out of the slot. 4 Select the appropriate AC line plug adapter. 5 Slide the AC line plug adapter into the slot. You will hear a click when the fitting is fully inserted. The AC Adapter is ready for use. 19. Chapter 1 Getting Started Exploring the front panel 6 SmartClass Ethernet Tester User's Guide Exploring the front panel The controls and LEDs on the SmartClass front panel, shown in Figure 1, are used to operate the tester, set up tests, and view data. The following paragraphs describe each of the controls and LEDs on the front panel. Status LEDs These indicators report the status of the tester. The function of each LED is described in "LEDs" on page 76. LCD The SmartClass Ethernet tester currently ships with a 320 x 240 pixel color display with contrast control and backlight. Older testers with the black and white 240 x 160 pixel transflective display are still supported, and software upgrades are available for these testers. Due to the lower resolution of the black and white display, in rare instances, the final character of a label on the user interface is not visible, or it is only partially visible. When this occurs, the text displayed is sufficient to communicate the purpose of the element on the user interface. This is expected behavior, and it does not occur on black and white displays of testers running software versions prior to 2.0.1. Cancel key Use the Cancel key to exit a data entry screen without changing your settings, or to return to the previous menu. Figure 1 SmartClass front panel LCD Status LEDs Arrow keys Keypad (includes *Action and #Start keys) OK key Cancel key Backlight key Power key 20. Chapter 1 Getting Started Exploring the front panel SmartClass Ethernet Tester User's Guide 7 OK key Use OK to accept a changed setting or to proceed to the next menu. Arrow keys Use the arrow keys to navigate through menu selections. Keypad Use the keypad to enter numbers, make menu selections, enter alphabetic characters, and so on. Throughout the menus, the numbers associated with each function provide a quick way to perform tests with simple numerical sequences. Action key Use the Action key to display a menu listing a variety of actions required during testing such as starting traffic or looping up a tester. Start key Use the Start key to: – Start your test and transmit traffic immediately after you configure your test. After starting the test, the tester automatically displays test results associated with your application. – Stop traffic and freeze the display of test results. Backlight key Use the backlight key adjust the brightness on a color display, or if you have a black and white display, to turn the LCD backlight on or off or adjust the contrast. – If you have a tester with a color display, pressing the button increases or decreases the brightness by a step. – If you have a tester with a black and white display, pressing the button turns the backlight on or off. You can also adjust the contrast on your LCD by pressing and holding the backlight key, and then simultaneously pressing the right arrow (to increase contrast), or the left arrow (to decrease contrast). Power key Use the power key to turn power ON (see "Powering ON your tester" on page 9), put the tester into sleep mode, or turn power OFF (see "Powering OFF your tester" on page 9). 21. Chapter 1 Getting Started Exploring the connector panel 8 SmartClass Ethernet Tester User's Guide Exploring the connector panel The SmartClass connector panel is used to connect the Ethernet Tester to the circuit for testing. Figure 2 shows the connector panel. Use the RJ-45 jack when connecting to 10/100/1000Base-T/TX electrical circuits. If your tester supports optical testing (see "Software options" on page 3), use the SFP jack to connect to 1000Base-X optical circuits using a JDSU-approved SFP. See "Accessories" on page 4 for a list of SFPs offered by JDSU. Exploring the bottom panel The SmartClass AC adapter and USB device ports are located on the bottom panel. The USB device port is used to establish connections that allow you to run reports from a remote device (typically a PC or laptop) or update the soft- ware using the Download Manager utility. Figure 2 SmartClass Ethernet Tester connector panel RJ-45 ConnectorSFP Connector CAUTION: HAZARDOUS LIGHT EXPOSURE Do not look into the SFP connector when the tester is powered ON. Figure 3 SmartClass bottom panel USB device portAC adapter port 22. Chapter 1 Getting Started Powering ON your tester SmartClass Ethernet Tester User's Guide 9 Powering ON your tester The following procedure describes how to power ON the Ethernet Tester. To power ON your tester – Press and hold the Power key for 1 second. The JDSU and SmartClass Ethernet splash screens appear in succession, and then one of the following occurs: – If Auto Resume is OFF, the Main Menu appears. – If Auto Resume is ON, the screen for the application that you were running before you put the tester into sleep mode or turned the tester OFF completely appears. For example, if you were running the L2 Traffic Test application, and you were specifying the required link settings when you put the tester into sleep mode, the Link Settings configuration menu appears when you power on the tester. Powering OFF your tester The following procedure describes how to power OFF the Ethernet Tester. To power OFF your tester 1 Press and hold the Power key for 1 second. The Power Control menu appears. 2 Do one of the following: – If you want to be able to restart the tester quickly, select Enter Sleep Mode. The test stops, and then the user interface disappears. If the backlight is ON, the tester automatically turns it OFF. When you are ready to resume testing, press the Power key for 1 second to redisplay the user interface. NOTE: If your tester is in sleep mode for more than two hours, it will automatically turn itself OFF. – To conserve power and completely power OFF your tester, select Shut Down. A message briefly appears informing you that the tester is shut- ting down. Power is OFF. Navigating the user interface The user interface of the SmartClass is designed to be intuitive and easy to use. Using the LCD and keypad, you can set up the tester, configure test parameters, and view test results. This section describes the user interface, and explains how to navigate through the menus and screens. There are 3 types of screens on the user interface: – Menus – Data entry screens – Results screens 23. Chapter 1 Getting Started Navigating the user interface 10 SmartClass Ethernet Tester User's Guide When you power up the SmartClass Ethernet Tester, the Main Menu of the user interface appears. Figure 4 illustrates the Main Menu for a fully optioned tester with a color display. Battery icon A battery icon appears at the top right of each screen to indicate how much of a charge remains on your battery. Figure 4 SmartClass Ethernet Tester Main Menu Table 5 Battery icons Icon Indicates ... The battery charge is greater than or equal to 5 volts. The battery charge is between 4.4 and 5 volts. The battery charge is less than or equal to 4.4 volts. 24. Chapter 1 Getting Started Navigating the user interface SmartClass Ethernet Tester User's Guide 11 Menu screens Figure 5 illustrates a menu screen for a fully optioned tester. Menu screens provide a series of selections that take you to another menu screen, a data entry screen, or a results screen. For example, if you select the L2 Traffic Test illustrated in Figure 5, the Configuration menu illustrated in Figure 6 appears, listing each of the available configuration screens. Figure 5 SmartClass Ethernet Tester Optical Ethernet Test Menu Figure 6 SmartClass Ethernet Tester Configuration Menu 25. Chapter 1 Getting Started Navigating the user interface 12 SmartClass Ethernet Tester User's Guide Data entry screens Data entry screens provide a list of selectable options, or allow you to enter data using the keypad. Figure 7 illustrates the Save Config screen, used to specify a filename for a configuration that you are saving so you run tests using the same settings in the future. Result screens Figure 8 illustrates a Result screen. These screens display test results. The results are split into categories. Press the arrow keys to navigate through the result categories (screens). Figure 7 SmartClass Ethernet Tester Data Entry screen Figure 8 SmartClass Ethernet Tester Link Stats Result screen 26. Chapter 1 Getting Started Using the keypad SmartClass Ethernet Tester User's Guide 13 Using the keypad Use the keypad to enter alpha-numeric values, or to navigate to different screens by specifying the menu number corresponding to the screen. When entering alpha-numeric values for a test setting: – The left arrow positions the cursor one position to the left. – The down arrow operates as a Backspace key, and typically clears the character one position to the left of the cursor. If the cursor is on the first character of a text entry field, the down arrow deletes the first character. – If you are on a configuration or results screen, the left and right arrows let you navigate between the configuration or result categories for your test. – If you are entering text, the up arrow serves as a Caps Lock key. – If you are entering an IP address, use the up arrow to clear the entire field before entering a new address. Selecting a menu option or a configuration setting There are two ways to select a menu option or configuration setting. – Use the arrow keys to scroll to the desired option then press the OK key. – Press the number associated with the menu option. Returning to a previous menu Use the Cancel key to return to the previous menu. Entering numeric values To enter numeric values 1 Use the arrow keys to scroll to and highlight the setting you want to specify. 2 Press OK. 3 Use the keypad to type the numeric value. 4 If you want to move to the next field, use the right arrow key. 5 If you want to enter a minus sign (-), and the setting accepts negative values, press the # key. 6 If you want to enter a decimal point, and the setting accepts floating decimal values, press the asterisk (*) key. Typing text To type text 1 Use the arrow keys to scroll to and highlight the setting you want to specify. 2 Press OK. 27. Chapter 1 Getting Started Using the keypad 14 SmartClass Ethernet Tester User's Guide 3 Use the keypad to type the text. – Repeatedly pressing a key scrolls through the selections for that key. For example, repeatedly pressing the 2 key will scroll through A, B, C and 2. – To toggle between upper and lower case, press the up arrow. – To delete the previous character, press the down arrow. – Use the left and right arrow to navigate through typed text. – To enter a space between characters, press the 0 (zero) key once. – To scroll through and select a special character such as: . @ / , ' - ? ! _ 1 press the 1 (one) key. Locking the keypad You can lock your keypad at anytime to prevent unintentional key presses that might disrupt or end the test. To lock the keypad – Press the Backlight key and 8 key simultaneously. A message appears indicating that the keypad is locked. The following excep- tions occur: – You can still use the Backlight key in combination with the left and right arrow keys to adjust the brightness on a color display. For details, see "Backlight key" on page 7. – If you have a black and white display, you can still use the Backlight key to turn the LCD backlight on or off, or in combination with the left and right arrow keys to adjust the contrast. – You can still turn the tester off by pressing the Power key continuously for 7 seconds. To unlock the keypad – Press the Backlight key and 8 key simultaneously. A message appears indicating that the keypad is unlocked. NOTE You can not enter a space when specifying a filename. 28. 2 SmartClass Ethernet Tester User's Guide 15 Chapter 2 Instrument Settings This chapter describes how to configure the basic settings of the instrument. Topics discussed in this chapter include the following: – "Setting the language" on page 16 – "Viewing software versions" on page 16 – "Setting the date and time" on page 16 – "Adjusting the contrast" on page 17 – "Loading software upgrades" on page 17 – "Enabling options" on page 18 – "Verifying enabled options" on page 18 – "Determining the specified battery type" on page 18 – "Restoring factory defaults" on page 18 29. Chapter 2 Instrument Settings Setting the language 16 SmartClass Ethernet Tester User's Guide Setting the language The following instructions explain how to specify the language for your SmartClass Ethernet Tester. To specify the language for the SmartClass Ethernet tester 1 Power ON your tester by pressing and holding the key for 1 second. The SmartClass Ethernet splash screen appears briefly, and then the SmartClass Ethernet main menu appears. 2 Select 5 System Settings. A menu appears listing each of the system settings. 3 Select 3 Language. A menu appears listing the available languages. 4 Select the language. After a brief moment, the main menu appears, and options appear in the language you selected. The language for the SmartClass Ethernet tester is specified. Viewing software versions The Version Info screen displays the current version of the software loaded on your tester. It also displays the factory-assigned SCE ID number. To view internal software versions 1 Select System Settings from the Main Menu. 2 Select Version Info. The software version and SCE ID Number appear. Setting the date and time The Ethernet Tester has an internal clock that you can set to provide accurate time stamps for test results. By default, the clock uses a 12-hour format and presents dates in a MM/DD/YYYY format. You can optionally configure your tester to use a 24-hour time format or a DD/MM/YYYY date format. Changing the date or time format The following procedure describes how to change the date or time format on your tester. To change the date or time format 1 Select System Settings from the Main Menu. 2 Select Set Time/Date Format. NOTE: If you select the wrong language by mistake, you can return to the language selection menu by selecting the last item on the Main Menu, and then 3. 30. Chapter 2 Instrument Settings Adjusting the contrast SmartClass Ethernet Tester User's Guide 17 3 Do one of the following: – To change the format used to display the time, select Time Format, and then select the new format. – To change the format used to display the date, select Date Format, and then select the new format. The format is changed. Setting the date or time The following procedure describes how to set the date or time. To set the date or time 1 Select System Settings from the Main Menu. 2 Select Set Time/Date. 3 Do one of the following: – To set the time, select Set Time, and then enter the time. – To set the date, select Set Date, and then enter the date. The date or time is set. Adjusting the contrast The following procedure describes how to adjust the contrast. To adjust the contrast 1 Select System Settings from the Main Menu. 2 Select Control Contrast. 3 Change the contrast level using the right or left arrow key. 4 Press the Cancel key to return to the previous Menu. The contrast is set. You can also press and hold the Backlight key, and then press the right and left arrows to adjust contrast of the display. Loading software upgrades You can upgrade the software on your tester using the Download Manager utility. Instructions for loading software upgrades are provided in the Smart- Class Ethernet Tester Download Manager and Upgrade Instructions, which are provided as a PDF with the utility. 31. Chapter 2 Instrument Settings Enabling options 18 SmartClass Ethernet Tester User's Guide Enabling options The following procedure describes how to enable software options. To enable software options 1 Select System Settings from the Main Menu, then select Set Options. 2 Use your keypad to enter the JDSU provided option code. 3 Press the OK key. The option is enabled. Verifying enabled options After options are enabled, they are listed on the Set Options screen. To verify which options are enabled – Select System Settings from the Main Menu, then select Set Options. The installed options are listed under Installed:. For a list of available options, see "Options and accessories" on page 3. Determining the specified battery type The following procedure describes how to determine the type of battery you specified when you installed batteries in your tester (see "Replacing the batteries" on page 93). To determine the specified battery type 1 Select System Settings from the Main Menu. 2 Select Battery Type. A screen briefly appears indicating the type of battery you specified, and then the System Settings menu appears. Restoring factory defaults The following procedure describes how to restore the Ethernet Tester to use factory default test application and system settings. To restore factory default settings 1 Select System Settings from the Main Menu. 2 Select Restore Factory Defaults. 3 Select Yes to restore the settings, or No to keep the current settings. Factory defaults are restored. 32. 3 SmartClass Ethernet Tester User's Guide 19 Chapter 3 Ethernet Testing This chapter provides task-based instructions for turning up and trouble- shooting Ethernet service using the SmartClass Ethernet Tester. Topics discussed in this chapter include the following: – "About Ethernet testing" on page 20 – "Cable diagnostics" on page 20 – "Measuring optical power" on page 21 – "Launching an Ethernet test application" on page 22 – "Initializing the link" on page 22 – "Specifying L2 test application settings" on page 24 – "Transmitting layer 2 traffic" on page 33 – "BER testing" on page 34 – "Measuring service disruption time" on page 34 – "Inserting errors or pause frames" on page 35 – "Transmitting layer 2 patterns" on page 35 – "Loopback testing" on page 36 – "Starting or restarting a test" on page 38 – "Stopping traffic" on page 38 – "Running a timed test" on page 38 33. Chapter 3 Ethernet Testing About Ethernet testing 20 SmartClass Ethernet Tester User's Guide About Ethernet testing Using the SmartClass Ethernet Tester, you can turn up and troubleshoot Ethernet service by verifying connectivity, measuring throughput, and verifying that quality of service statistics conform to those specified in a customer's Service Level Agreement. When testing in an end-to-end or loopback configuration, you can use a second SmartClass Ethernet Tester at the far end, or you can use another JDSU compliant Ethernet test set (a test set marketed by JDSU and designed to transmit an Acterna Test Packet payload). These packets carry a time stamp used to calculate a variety of test results. The FST-2802 TestPad, the T-BERD/ MTS 8000 Transport Module, the SmartClass Ethernet tester, and the HST with an Ethernet SIM can all be configured to transmit and analyze ATP payloads. Before running Ethernet tests, consider the following: – If you are preparing to run an electrical Ethernet test, you can optionally run diagnostics to determine the type of cable used to connect to the circuit (see "Cable diagnostics" on page 20). – If you are preparing to run an optical Ethernet test, you can determine whether a signal is present, the optical receive level (in dBm), and the type of SFP you are using (see "Measuring optical power" on page 21). Ethernet testing involves the following key steps: 1 Launching a test application (see "Launching an Ethernet test application" on page 22). 2 Initializing the Ethernet link (see "Initializing the link" on page 22). 3 Specifying settings for the test application (see "Specifying L2 test applica- tion settings" on page 24). 4 Starting or restarting the test (see "Starting or restarting a test" on page 38). 5 Observing the results associated with your test (see "Viewing test results" on page 76). Cable diagnostics Before testing 10/100/1000 electrical Ethernet or IP, you can use the Ethernet Tester to examine the state of the cables used to transmit traffic on a 10/100/1000 electrical Ethernet circuit. Typically this involves out-of-service testing to determine the link status, the pair status of each MDI or MDI-X pair, the pair assignments for 1000M links, the polarity for each MDI pair, and the pair skew. If the link is inactive, you can also use the tester to determine the nature of the fault. For details on the test results associated with cable diagnostics, see "Cable Diagnostics results" on page 88. 34. Chapter 3 Ethernet Testing Measuring optical power SmartClass Ethernet Tester User's Guide 21 Running cable diagnostics To run cable diagnostics 1 Power on the Ethernet Tester, and connect it to the link. 2 On the Main Menu, select Electrical Ethernet or Electrical IP. A menu of test applications for testing 10/100/1000 Mbps electrical Ethernet appears. 3 Select the Cable Test. A message briefly appears stating that the tester is launching the test application, then a test menu appears. 4 Select Results, and then select one of the following: – Link Status to determine whether or not the link is active, and, if so, what speed (line rate) is detected for traffic on the link. – Cable Diagnostics to observe the link results associated with the diag- nostics, such as the MDI/MDIX Status or Pair Skew. For details, see "Cable Diagnostics results" on page 88. Cable diagnostics are complete. Measuring optical power Before testing 1000Base-X optical Ethernet or IP, you can use the Ethernet Tester to determine whether a signal is present, the optical receive level (in dBm), and the type of SFP you are using. To measure optical power 1 Power on the Ethernet Tester, and connect it to the link. 2 On the Main Menu, select Optical Ethernet or Optical IP. A menu of test applications for testing 1000Base-X optical Ethernet appears. 3 Select the Optical Pwr Test. A message briefly appears stating that the tester is launching the test application, then the Optical Signal result category appears, indicating whether a signal is present, the optical receive level, and the type of SFP detected by the tester. Optical power is measured. 35. Chapter 3 Ethernet Testing Launching an Ethernet test application 22 SmartClass Ethernet Tester User's Guide Launching an Ethernet test application The following procedure describes how to launch an Ethernet test. To launch an Ethernet test 1 On the Main Menu, select one of the following: – Electrical Ethernet. Launches a menu of test applications for testing 10/100/1000 Mbps electrical Ethernet. – Optical Ethernet. Launches a menu of test applications for testing 1000 Mbps optical Ethernet. 2 Select one of the following test applications: – L2 Traffic Test – L2 RFC-2544 Test – L2 Asymmetric RFC-2544 Test – L2 Loopback Mode – L2 Pattern Test (Optical only) A message briefly appears stating that the tester is launching the test application, and if you selected an optical test application, turns the laser ON. A test menu appears for the application, listing the following options: – Configuration. Select this option to configure your test. – Results. Select this option to observe test results associated with your test. – Action (*). Select this option to perform key actions required for your test, such as starting or restarting a test, starting traffic or looping up a tester. You can also press the *Action button at any time to view a menu of actions applicable to your test. – Error. Select this option to insert errors or pause frames as you test. You are ready to initialize the Ethernet link (see "Initializing the link" on page 22). Initializing the link Initializing an Ethernet link involves specifying the settings required to establish connectivity with another Ethernet device on a circuit (link), such as auto-nego- tiation, flow control, and speed and duplex settings (for 10/100 electrical Ethernet traffic only). After specifying the link initialization settings, you are ready to connect the Ethernet Tester (or testers) to an access element on the circuit. – If you enabled auto-negotiation on the Ethernet Tester, and another Ethernet device is on the circuit, the tester and the device automatically go through the auto-negotiation process. After auto- negotiation is complete, an Ethernet link is established, and idle traffic is transmitted over the circuit. – If you disabled auto-negotiation on the Ethernet Tester, it immediately transmits idle traffic over the circuit. 36. Chapter 3 Ethernet Testing Initializing the link SmartClass Ethernet Tester User's Guide 23 To initialize an Ethernet link 1 Launch your test application: – For Ethernet tests, see "Launching an Ethernet test application" on page 22. – For IP tests, see "Launching an IP test application" on page 42. 2 Select Configuration, and then select Link Settings. A menu of link initialization settings appears. 3 Specify values for the following: Setting Parameters Description/Applicability Auto Neg – Enabled – Disabled Enables the tester to auto-nego- tiate it's capabilities with a link partner. This setting is always available. NOTE: Auto-negotiation must be enabled when testing 1000 Mbps electrical Ethernet. Auto Neg Duplex – Half – Full During auto-negotiation, the tester advertises it is half or full duplex capable. Available if Auto-Neg is enabled. Auto Neg Rate – 10 – 100 – 1000 When testing electrical Ethernet, the tester advertises this as the maximum rate supported during auto-negotiation. Available if Auto-Neg is enabled. Pause Capability – Neither – Both – Tx Only – Rx Only When testing optical Ethernet, during auto negotiation, the tester advertises this as its capability to support pause frames. Neither advertises it can not transmit or detect received pause frames. Both advertises the tester can transmit and detect received pause frames. Flow Control – On – Off Indicates whether you want the tester to detect or ignore received pause frames. Avail- able only if Auto Neg is disabled and Duplex setting is Full. Speed – 10 – 100 Indicates the speed supported (10 Mbps or 100 Mbps). Avail- able only if Auto Neg is disabled for a 10/100 electrical test. Duplex – Half – Full Indicates whether half or full duplex traffic is supported. Avail- able only if Auto Neg is disabled for an electrical test. 37. Chapter 3 Ethernet Testing Specifying L2 test application settings 24 SmartClass Ethernet Tester User's Guide 4 If you need to specify other settings for the test, press Cancel to return to the Configuration menu; otherwise, proceed to step 5. 5 Verify that the Sync LED is green (indicating that the link is active). 6 Observe the Link Status results category for test results associated with link initialization (see "Link Status results" on page 78). The link is initialized. Specifying L2 test application settings Before transmitting traffic over a link, you can specify settings that characterize the traffic and indicate the type of traffic load to transmit. You can also specify settings that filter received traffic for analysis. RJ-45 Port Setting – MDI – MDI-X – Auto Sensing Indicates whether the RJ-45 port on your tester should oper- ate as an MDI or an MDI-X (crossover) port. If you select Auto Sensing, the tester deter- mines what type of port is con- nected at the far end of the link, and then configures the RJ-45 port on your tester to be com- patible with the port on the far end. For example, if the port on the far end is a MDI port, your tester configures its RJ-45 port to operate as a MDI-X crossover port. Available only when configuring electrical tests. Laser Enable – On – Off When testing optical Ethernet, the laser is automatically on by default. You can turn the laser off using this setting. Pause Quanta User specified Enter the quanta to be carried by transmitted pause frames. To determine the pause duration, the receiving device performs the following calculation: 10 Mbps electrical: – Quanta x 51.2 ms 100 Mbps electrical: – Quanta x 5.12 ms 1000 Mbps electrical and 1 GigE optical: – Quanta x 512 ns Setting Parameters Description/Applicability 38. Chapter 3 Ethernet Testing Specifying L2 test application settings SmartClass Ethernet Tester User's Guide 25 When you specify L2 settings for one test application, your tester retains the settings if you run a different test application. For example, if you turn auto-negotiation OFF and flow control ON for a L2 Traffic Test, auto-negotia- tion will be OFF, and flow control will be ON by default when you run a L2 Pattern Test. Specifying Ethernet settings Before you transmit layer 2 traffic, you can specify the frame characteristics of the traffic, such as the frame type and frame length. You also specify the desti- nation address, and optionally, the source address for the transmitted traffic. To specify Ethernet settings 1 If you haven't already done so, launch a layer 2 test application (see "Launching an Ethernet test application" on page 22), and then establish a link (see "Initializing the link" on page 22). 2 On the Configuration menu, select Ethernet Settings, and then specify values for the following: Setting Parameters Dest Addr Type – Unicast - sends traffic to a single destination address and network device. – Multicast - sends traffic to a sin- gle destination address which then distributes the frames to multiple network devices, each with its own destination address. – Broadcast - sends traffic to all network devices on the link. Dest MAC Addr (applicable only if you specified a Unicast or Multicast address type) Type the address for Unicast or Mul- ticast destinations. – If you specified Unicast as the address type, the left most byte in the address defaults to 00. – If you specified Multicast as the address type, the left most byte in the address defaults to 01. Frame Type – DIX – 802.3 Frame Length – Undersized – User Defined – Jumbo – Random. Select Random to send frames with randomly generated, predefined RFC 2544 traffic lengths. User Length Undersized Length Jumbo Length If you specified Undersized, User Defined, or Jumbo as the Frame Length, specify a value falling within the range displayed on the user inter- face. 39. Chapter 3 Ethernet Testing Specifying L2 test application settings 26 SmartClass Ethernet Tester User's Guide 3 If you need to specify other settings for the test, press Cancel to return to the Configuration menu; otherwise, proceed to step 4. 4 Press the Start key. A message appears indicating that traffic has started. The tester transmits traffic with the frame characteristics you specified. Specifying payload settings Before you transmit layer 2 traffic, you can specify whether the traffic should carry a BERT payload or an Acterna payload. You must transmit an Acterna payload to measure round trip delay or service disruption time. To specify payload settings 1 If you haven't already done so, launch a layer 2 test application (see "Launching an Ethernet test application" on page 22), and then establish a link (see "Initializing the link" on page 22). 2 On the Configuration menu, select Payload Settings, and then specify values for the following: Src MAC Type – Default - sends traffic with the factory assigned MAC address as the source address. – User Defined - sends traffic with the user assigned MAC address as the source address. If you select User Defined, be certain to specify the Usr Src Addr. Usr Src Addr Type the source address to be car- ried in transmitted frames. Unit Identifier Enter an ID for the tester using up to ten characters. This ID appears in the Link Status result category during loopback testing. Setting Parameters Setting Parameter Payload – Acterna – BERT NOTE: If you indicated that you want to trans- mit undersized frames when you specified the Ethernet settings, you can not transmit an Acterna payload. Fill Byte (applicable only if you speci- fied an Acterna payload) Enter the fill byte pattern carried in the pay- load of the Acterna test packets using a hexa- decimal format. 40. Chapter 3 Ethernet Testing Specifying L2 test application settings SmartClass Ethernet Tester User's Guide 27 3 If you need to specify other settings for the test, press Cancel to return to the Configuration menu; otherwise, proceed to step 4. 4 Press the Start key. A message appears indicating that traffic has started. The tester transmits traffic with the payload you specified. Specifying VLAN or Q-in-Q settings Before transmitting layer 2 traffic, you can specify settings that indicate the tester should transmit VLAN (virtual LAN) or Q-in-Q tagged frames. This allows you to verify that an Ethernet link supports VLAN or Q-in-Q tagging. The tester can also analyze received traffic to verify that the required bandwidth is allo- cated to tagged frames on a link and determine that VLAN or Q-in-Q (SVLAN) prioritization is functioning properly. To specify VLAN or Q-in-Q settings 1 If you haven't already done so, launch a layer 2 test application (see "Launching an Ethernet test application" on page 22), and then establish a link (see "Initializing the link" on page 22). 2 On the Configuration menu, select Tagging Settings, and then specify values for the following: BERT Pattern (applicable only if you speci- fied a BERT payload) – 2^23-1 – 2^23-1 Inv – 2^31-1 – 2^31- Inv – All Ones – All Zeros – User Defined, and then enter the pattern in hexadecimal format. User BERT Patt (applicable only if you speci- fied a User Defined BER pat- tern). Enter the BERT pattern carried in the payload of the frames in hexadecimal format. Setting Parameter Setting Parameters Tagging – If you do not want to transmit VLAN tagged frames, select Non-Tagged. – To transmit VLAN tagged frames, select Tagged, and then specify the VLAN ID and User Priority for the tagged frames. – To transmit Q-in-Q tagged frames, select Q-in-Q, and then specify the SVLAN ID, Priority, DEI, and TPI for the frames. VLAN ID (available if Tagging is set to Tagged or Q-in-Q) Specify the VLAN ID for tagged frames, or the CVLAN ID for Q-in-Q tagged frames. 41. Chapter 3 Ethernet Testing Specifying L2 test application settings 28 SmartClass Ethernet Tester User's Guide 3 If you need to specify other settings for the test, press Cancel to return to the Configuration menu; otherwise, proceed to step 4. 4 Press the Start key. A message appears indicating that the test has started. The tester transmits traffic with the VLAN or Q-in-Q settings you specified. Configuring the traffic load Before transmitting traffic, you can specify the type of traffic load the tester will transmit (Constant, Bursty, Ramp, or Flood) in 0.001% increments. The settings vary depending on the type of load. Transmitting a constant load With a constant load, the Ethernet Tester transmits frames continuously with a fixed bandwidth. See Figure 9. When you setup a constant traffic load, you can specify the bandwidth as a percentage of the line rate (Percent) or in total Mbps (Bit Rate). User Priority (available if Tagging is set to Tagged or Q-in-Q) Specify the priority for the tagged frames, or the CVLAN priority for Q-in-Q tagged frames. SVLAN ID (available if Tagging is set to Q-in-Q) Specify the SVLAN ID for the frames. SVLAN Priority (available if Tagging is set to Q-in-Q) Specify the SVLAN priority for the frames. SVLAN DEI (available if Tagging is set to Q-in-Q) Specify the SVLAN DEI for the frames. SVLAN TPI (available if Tagging is set to Q-in-Q) Specify the SVLAN TPI for the frames. Setting Parameters NOTE: If you configure the Ethernet Tester to transmit a constant, bursty, or ramped load of 100%, the tester is designed to transmit slightly less than 100% traf- fic (99.99% for 1G optical Ethernet, 99.98% for 10/100/1000 electrical Ether- net) as a safeguard against overrunning network elements that can not sup- port 100%. If you are certain the elements can support true 100% traffic, configure your tester to transmit a flood load (see "Transmitting a flooded load" on page 31). Figure 9 Constant traffic Bandwidth (configurable either as% or in Mbps) Time 42. Chapter 3 Ethernet Testing Specifying L2 test application settings SmartClass Ethernet Tester User's Guide 29 To transmit a constant load of traffic 1 If you haven't already done so, launch a layer 2 test application (see "Launching an Ethernet test application" on page 22), and then establish a link (see "Initializing the link" on page 22). 2 On the Configuration menu, select Traffic Settings, and then specify values for the following settings: 3 If you need to specify other settings for the test, press Cancel to return to the Configuration menu; otherwise, proceed to step 4. 4 Press the Start key. A message appears indicating that traffic has started. The tester transmits a constant rate of traffic. Transmitting a bursty load With a bursty load, the tester transmits frames at up to 100% bandwidth for a specific time interval, followed by no frame transmissions for an interval (gap) calculated by your tester. See Figure 10. When you configure bursty traffic, you specify the burst bandwidth (as a percentage of the duty cycle), and the number of frames per burst. The tester then automatically calculates the burst gap for you. To transmit a bursty load of traffic 1 If you haven't already done so, launch a layer 2 test application (see "Launching an Ethernet test application" on page 22), and then establish a link (see "Initializing the link" on page 22). Setting Parameters Load Type Constant Load Unit – Percent – Bit Rate Load Percent (if Load Unit is Percent) Enter the bandwidth to transmit as a percentage of the line rate. Load Bit Rate (Mbps) (if Load Unit is Bit Rate) Enter the bandwidth to transmit in Mbps. Figure 10 Bursty traffic Time Gap between bursts Bandwidth 100% 43. Chapter 3 Ethernet Testing Specifying L2 test application settings 30 SmartClass Ethernet Tester User's Guide 2 On the Configuration menu, select Traffic Settings, and then specify values for the following settings: 3 If you need to specify other settings for the test, press Cancel to return to the Configuration menu; otherwise, proceed to step 4. 4 Press the Start key. A message appears indicating that traffic has started. The tester transmits a bursty load of traffic. Transmitting a ramped load With a ramped load, the Ethernet Tester gradually ramps (increases) the transmitted traffic load by 1 percent every 1 second until it detects errored, dropped, or pause frames. This allows you to easily verify the maximum throughput of a link. When you verify throughput by transmitting a ramped load, be certain to configure your tester to transmit an Acterna payload, and loop the far-end device back to the traffic originating tester (see "Using the automatic loopback feature" on page 37). Acterna frames carry a number which the tester uses to determine whether frames were dropped. Setting Parameters Load Type Burst Burst Load % Enter the load to transmit during bursts as a percentage of the line rate. Burst Size Select the number of frames to trans- mit in each burst of traffic, or select User Defined. User Burst Size If you selected a User Defined burst size, enter the number of frames to transmit in each burst of traffic, rang- ing from 1 to 16,500,000. Burst Type Select Fixed to specify a fixed num- ber of bursts, or select Continuous. Burst Quantity If you specify a Fixed Burst Type, enter the number of bursts to trans- mit, ranging from 1 to 65,535. 44. Chapter 3 Ethernet Testing Specifying L2 test application settings SmartClass Ethernet Tester User's Guide 31 The load increments to 100%, and then the tester continues to transmit traffic at 100% for the duration of your test. See Figure 11. To transmit a ramped load of traffic 1 If you haven't already done so, launch a layer 2 test application (see "Launching an Ethernet test application" on page 22), and then establish a link (see "Initializing the link" on page 22). 2 On the Configuration menu, select Traffic Settings, and then specify Ramp as the load type. 3 If you need to specify other settings for the test, press Cancel to return to the Configuration menu; otherwise, proceed to step 4. 4 Press the Start key. A message appears indicating that traffic has started. The tester transmits a ramped load of traffic. Transmitting a flooded load With a flooded load, the module transmits traffic at 100% of the interface rate. To transmit a flooded load of traffic 1 If you haven't already done so, launch a layer 2 test application (see "Launching an Ethernet test application" on page 22), and then establish a link (see "Initializing the link" on page 22). 2 On the Configuration menu, select Traffic Settings, and then specify Flood as the load type. Figure 11 Ramped traffic Time Bandwidth Time Step: 1 Second Load step: 1% NOTE: If you configure your tester to transmit undersized frames, the ramp will not stop when the frames are dropped because undersized frames are not looped back to the traffic originating tester. NOTE: True 100% traffic transmission may overrun certain network elements if the elements can not support it. If you are certain the elements can support 100% transmission, configure a flood load of traffic; otherwise, configure a constant load of traffic at 100% (see "Transmitting a constant load" on page 28). The RFC 2544 test transmits a constant load of traffic. 45. Chapter 3 Ethernet Testing Specifying L2 test application settings 32 SmartClass Ethernet Tester User's Guide 3 If you need to specify other settings for the test, press Cancel to return to the Configuration menu; otherwise, proceed to step 4. 4 Press the Start key. A message appears indicating that traffic has started. The tester transmits a flooded load of traffic. Specifying Ethernet filter settings Before transmitting layer 2 traffic, you can specify settings that indicate the expected received payload and determine which frames will pass through the receive filter and be counted in the test result categories for layer 2 traffic. For example, if you specified a particular VLAN ID as filter criteria, only incoming frames for the VLAN you specified will pass the filter and be analyzed. Local loopback will also only be performed on frames that pass the filter. To specify filter settings 1 If you haven't already done so, launch a layer 2 test application (see "Launching an Ethernet test application" on page 22), and then establish a link (see "Initializing the link" on page 22). 2 On the Configuration menu, select Ethernet Filter, and then specify values for the following settings: NOTE: If you want to analyze all received traffic, verify that each of the filter settings is set to Don't Care. Setting Parameters Rx DA Type To analyze frames for a specific type of destination address, select: – Unicast – Multicast – Broadcast If you do not want to filter frames based on the destination address type, select: – Don't Care Rx Dest MAC (if Rx DA Type is Unicast or Multi- cast) To analyze frames sent to a specific Unicast or Multicast address, enter the destination address. Rx SA Type To analyze frames sent from a spe- cific address, select: – Unicast If you do not want to filter frames sent from a specific address, select: – Don't Care Rx Src MAC (if Rx SA Type is Unicast) To analyze frames sent from a spe- cific address, enter the source address. 46. Chapter 3 Ethernet Testing Transmitting layer 2 traffic SmartClass Ethernet Tester User's Guide 33 3 If you need to specify other settings for the test, press Cancel to return to the Configuration menu; otherwise, proceed to step 4. 4 Press the Start key. A message appears indicating that the test has started. The tester filters traffic using the settings you specified. Transmitting layer 2 traffic After you specify the test application settings, you are ready to transmit traffic over the link. To transmit traffic 1 If you haven't already done so, launch a layer 2 test application (see "Launching an Ethernet test application" on page 22), and then establish a link (see "Initializing the link" on page 22). 2 Configure the test (see "Specifying L2 test application settings" on page 24). 3 Do one of the following: – Press the Start key. – Press the Action key, and then select Start Traffic or Start Ramp. A message appears indicating that traffic has started. The tester transmits traffic over the link. Rx Tagging To analyze VLAN tagged frames, select: – Tagged, and then

specify the VLAN ID and user priority for the filtered frames. To analyze Q-in-Q tagged frames, select: – Q-in-Q, and then specify the SVLAN ID, priority, and TPI for the filtered frames. If you do not want to filter frames based on their tagged status, select: – Don’t Care Rx User Priority (if Rx Tagging is Tagged) To filter VLAN tagged frames based on their user priority: – Select the priority from the menu. If you do not want to filter frames based on their user priority, select: – Don’t Care Rx VLAN ID (if Rx Tagging is Tagged) Specify the VLAN ID for analyzed frames. Setting Parameters 47. Chapter 3 Ethernet Testing BER testing 34 SmartClass Ethernet Tester User’s Guide BER testing If you are testing on a switched Ethernet network, when you perform an end-to-end test you can transmit BERT patterns in the frame payload to deter- mine the ratio of erroneous bits to the total bits received. To transmit a BER pattern 1 If you haven’t already done so, launch a layer 2 test application (see “Launching an Ethernet test application” on page 22), and then establish a link (see “Initializing the link” on page 22). 2 On the Configuration menu, select Payload Settings, specify a BERT payload, and then select the pattern to transmit in the payload (see “Spec- ifying payload settings” on page 26 3 If you need to specify other settings for the test, press Cancel to return to the Configuration menu; otherwise, proceed to step 4. 4 Press the Start key. A message appears indicating that the test has started. 5 Verify that the Frame LED is green, indicating that frames have been detected. 6 Optional. If you want to insert a bit error, press the Action key, and then select Insert Bit Error. The tester transmits traffic with the BERT pattern in the payload over the link. Results associated with BER testing appear in the BERT results category (see “L2 BERT Stats results” on page 87). Measuring service disruption time You can use two Ethernet Tester’s in an end-to-end test to measure the service disruption time resulting from a switch in service to a protect line. The testers determine the amount of time it takes to re-establish a layer 2 link by measuring the maximum inter-frame gap that occurred (due to a loss of frames) while the service was disrupted. This allows you to verify that the gap did not exceed the 50 ms duration expected and specified in most service level agreements. To measure service disruption time 1 If you haven’t already done so, launch a layer 2 test application (see “Launching an Ethernet test application” on page 22), and then establish a link (see “Initializing the link” on page 22). 2 Configure the near end tester for your test (see “Specifying L2 test applica- tion settings” on page 24). 3 Configure the far end tester for a CONSTANT load of traffic at the maximum bandwidth. 4 Do the following: a Press the Start key. A message appears indicating that traffic has started. b Press the Action key, and then select Restart. 48. Chapter 3 Ethernet Testing Inserting errors or pause frames SmartClass Ethernet Tester User’s Guide 35 The tester measures service disruption time, and displays the measurement as the Service Disrupt(µs) result in the Link Stats category (see “Link Stats results” on page 81). Inserting errors or pause frames You can use the Ethernet Tester to insert errors or pause frames when you perform end-to-end and loopback tests. The following errors can be inserted when the tester is transmitting traffic: – FCS errors. – Bit errors. If you configured your tester to transmit a BERT payload, you can insert bit errors into the traffic stream. Pause frames can be inserted at any time (the tester does not have to transmit traffic beforehand). To insert errors or pause frames 1 If you haven’t already done so, launch a layer 2 test application (see “Launching an Ethernet test application” on page 22), and then establish a link (see “Initializing the link” on page 22). 2 Configure the near end tester for your test (see “Specifying L2 test applica- tion settings” on page 24), and then do the following: a Press the Start key. A message appears indicating that traffic has started. b Display the Error menu, and then select the option corresponding to the type of error or frame you want to insert. For example, to insert an FCS error, select Insert FCS Error, or to insert a pause frame, select Pause Frame. Errors or pause frames are inserted into the traffic stream. Transmitting layer 2 patterns Using the Ethernet Tester, you can stress the jitter and noise characteristics of optical Gigabit Ethernet components and systems by transmitting continuous random test patterns (CRPAT), continuous jitter test patterns (CJPAT), and the compliant supply noise pattern (CSPAT). To transmit patterns 1 Launch the L2 Pattern Test for Optical Ethernet (see “Launching an Ethernet test application” on page 22), and then establish a link (see “Initializing the link” on page 22). 2 On the Configuration menu, select Pattern, and then specify one of the following patterns for the test: Pattern Emulates CRPAT A worst case scenario for deterministic jitter by transmit- ting frames with a broad spectral content. 49. Chapter 3 Ethernet Testing Loopback testing 36 SmartClass Ethernet Tester User’s Guide 3 If you need to specify other settings for the test (such as enabling a timed test or turning the laser off), press Cancel to return to the Configuration menu; otherwise, proceed to step 4. 4 Press the Start key. A message appears indicating that the test has started. 5 Verify that the Frame LED is green, indicating that frames have been detected. The tester transmits the pattern. Loopback testing Depending on the software options loaded on your Ethernet Tester, you can: – Operate the tester as a loopback device (looping all received traffic through the tester and back to the traffic originating tester) using the dedi- cated L2 Loopback application. This application is provided standard with every Ethernet Tester. – Generate and loop back traffic using the L2 Traffic application for end-to- end testing. The TRAFFIC option must be purchased and installed to generate and loop back traffic using this application. Using the L2 Loopback application You can put your Ethernet Tester into loopback mode to loop traffic through the tester and back to a traffic originating tester. When you select this application, your tester simply operates as a loopback device. To loop traffic through your near end tester 1 Launch the L2 Looback application (see “Launching an Ethernet test appli- cation” on page 22), and then establish a link (see “Initializing the link” on page 22). 2 On the Configuration menu, select Ethernet Settings, and then specify values for the following: CJPAT Stress the timing margins in the received eye by expos- ing the data sampling circuits to large systematic phase jumps. CSPAT Emulate a worse case scenario for power supply noise within network transceivers. Pattern Emulates Setting Parameters Src MAC Type – Factory Default - loops back traffic with the factory assigned MAC address as the source address. – User Defined - loops back traffic with a user assigned MAC address as the source address. If you select User Defined, be certain to specify the Usr Src Addr. Usr Src Addr Type the source address carried in transmitted frames. 50. Chapter 3 Ethernet Testing Loopback testing SmartClass Ethernet Tester User’s Guide 37 3 Optional. You can optionally specify VLAN or Q-in-Q settings for looped back traffic. See “Specifying VLAN or Q-in-Q settings” on page 27. 4 Optional. You can optionally filter the traffic before looping it back. Only traffic that passes the filter criteria will be looped back to the traffic origi- nating tester. See “Specifying Ethernet filter settings” on page 32. 5 Press the Action key, and then select Enable LLB. A message appears indicating that the LLB action has been executed. To verify that the local loopback is up, check the LLB Status result in the Link Status category (see “Viewing test results” on page 76). 6 On the far end tester, specify the near end tester’s source MAC address as the destination address, and then transmit traffic over the link. When the near end tester receives the traffic, it will swap the destination address and the source address of every frame before looping them back to the transmitting tester. 7 On the near end tester, verify that the Frame LED is green, indicating that frames have been detected. Traffic is looped through your tester. Using the automatic loopback feature You can perform an automatic loopback by selecting the Loop Up action on the traffic generating tester. The destination address for traffic generated by the near end tester is automatically populated with the source MAC address of the tester on the far end. When you configure testers for an automatic loopback test, you can optionally specify text identifiers for each tester using up to ten characters (for example, “tester 001” and “tester 002”). The LLB ID appears in the Link Status result category. To perform an automatic loopback 1 On the near end tester, do the following: a Launch a layer 2 test (see “Launching an Ethernet test application” on page 22). b Establish a link (see “Initializing the link” on page 22). c Specify the settings for the traffic you will be looping through the tester on the far end (see “Specifying L2 test application settings” on page 24). 2 On the near end tester, press the Action key, and then do the following: a Select Loop Up to loop up the tester on the far end. A message appears indicating that the Loop Up action has been executed. b Observe the Link Status results to verify that the remote loop status is UP (see “Viewing test results” on page 76). c Select Start Traffic to transmit traffic to the far end. Unit Identifier Enter an ID for the tester using up to ten characters. Setting Parameters 51. Chapter 3 Ethernet Testing Starting or restarting a test 38 SmartClass Ethernet Tester User’s Guide 3 On the far end tester, verify that the Frame LED is green, indicating that the frames transmitted from the near end tester have been detected. Traffic is transmitted and looped through the tester on the far end. To loop down the far end tester 1 On the near end tester, press the Start key to stop traffic. 2 Press the Action key, and then select Loop Down. The tester on the far end is looped down, and the remote loop status in the Link Status results changes to DOWN. Starting or restarting a test After you initialize an Ethernet link and configure your test, you are ready to start or restart the test. To start or restart the test 1 If you haven’t already done so, launch your test application (see “Launching an Ethernet test application” on page 22), initialize the Ethernet link (see “Initializing the link” on page 22), and configure the test (see “Specifying L2 test application settings” on page 24). 2 Press the # Start key. The tester clears your test results, the test restarts, and the tester trans- mits the traffic you configured. The test starts or restarts. Stopping traffic To stop traffic – Press the # Start key. The tester stops transmitting traffic and freezes the results display. Running a timed test You can run timed tests by enabling the test, specifying the duration for the test, and then starting the test. The test will run for the number of minutes you specified as the duration, and then it will stop automatically. NOTE You can also start or restart a test by pressing the Action key, and then selecting the corresponding option on the Action menu. NOTE: The Start key is used to START and STOP traffic. 52. Chapter 3 Ethernet Testing Running a timed test SmartClass Ethernet Tester User’s Guide 39 To run a timed test 1 If you haven’t already done so, launch your test application (see “Launching an Ethernet test application” on page 22), initialize the Ethernet link (see “Initializing the link” on page 22), and configure the test (see “Specifying L2 test application settings” on page 24). 2 On the Configuration menu, select Timed Test, and then do the following: a Set the Timed Test Enable setting to ON. b Specify the Time Duration (sec) in seconds. 3 Press the Start key to run the test. 53. Chapter 3 Ethernet Testing Running a timed test 40 SmartClass Ethernet Tester User’s Guide 54. 4 SmartClass Ethernet Tester User’s Guide 41 Chapter 4 IP Testing This chapter provides task-based instructions for turning up and trouble- shooting IP service using the SmartClass Ethernet Tester. Topics discussed in this chapter include the following: – “About IP testing” on page 42 – “Launching an IP test application” on page 42 – “Initializing the Ethernet link” on page 43 – “Specifying L3 test application settings” on page 43 – “Transmitting layer 3 IP traffic” on page 48 – “Inserting errors or pause frames” on page 49 – “Loopback testing” on page 49 – “Ping testing” on page 52 – “Running TraceRoute” on page 54 – “Starting or restarting a test” on page 55 – “Stopping traffic” on page 55 55. Chapter 4 IP Testing About IP testing 42 SmartClass Ethernet Tester User’s Guide About IP testing Using the SmartClass Ethernet Tester, you can turn up and troubleshoot IP services on point-to-point unswitched and switched networks by verifying connectivity, measuring throughput, and verifying that quality of service statis- tics conform to those specified in a customer’s Service Level Agreement. Before running IP tests, consider the following: – If you are preparing to run an electrical IP test, you can optionally run cable diagnostics to determine the type of cable used to connect to the circuit (see “Cable diagnostics” on page 20). – If you are preparing to run an optical IP test, you can determine whether a signal is present, the optical receive level (in dBm), and the type of SFP you are using (see “Measuring optical power” on page 21). IP testing involves the following key steps: 1 Launching a test application (see “Launching an IP test application” on page 42). 2 Initializing the Ethernet link (see “Initializing the link” on page 22). 3 Specifying settings for the test application (see “Specifying L3 test applica- tion settings” on page 43). 4 Starting or restarting the test (see “Starting or restarting a test” on page 38). 5 Observing the results associated with your test (see “Viewing test results” on page 76). Launching an IP test application The following procedure describes how to launch an IP test. To launch an IP test 1 On the Main Menu, select one of the following: – Electrical IP. Launches a menu of test applications for testing 10/100/1000 Mbps electrical IP. – Optical IP. Launches a menu of test applications for testing 1 GigE optical IP. 2 Select one of the following test applications: – L3 Traffic Test – L3 RFC 2544 Test – L3 Loopback Mode – Ping Test – TraceRoute Test 56. Chapter 4 IP Testing Initializing the Ethernet link SmartClass Ethernet Tester User’s Guide 43 A message briefly appears stating that the tester is launching the test application, then a test menu appears for the application, listing the following options: – Configuration. Select this option to configure your test. – Results. Select this option to observe test results associated with your test. – Action (*). Select this option to perform key actions required for your test, such as starting or restarting a test, starting traffic or looping up a tester. You can also press the Action button at any time to view a menu of actions applicable to your test. – Error. Select this option to insert errors or pause frames as you test. The tester launches the test application, and if you selected an optical test application, turns the laser ON. You are ready to initialize the Ethernet link (see “Initializing the Ethernet link” on page 43). Initializing the Ethernet link Initializing an Ethernet link involves specifying the settings required to establish connectivity with another Ethernet device on a circuit (link), such as auto-nego- tiation, flow control, and speed and duplex settings (for 10/100 electrical traffic only). For details on link initialization, see “Initializing the link” on page 22 of Chapter 3 “Ethernet Testing”. Specifying L3 test application settings Before transmitting traffic over a link, you can specify settings that characterize the traffic and indicate the type of traffic load to transmit. You can also specify settings that filter received traffic for analysis. Specifying Ethernet settings Before you transmit layer 3 IP traffic, you can specify the Ethernet characteris- tics of the traffic. This involves indicating whether you want to configure trans- mitted traffic using a frame or packet format, and specifying the frame type and frame or packet length. You can also optionally specify the source address for the transmitted traffic. To specify Ethernet settings 1 If you haven’t already done so, launch a layer 3 test application (see “Launching an IP test application” on page 42), and then establish a link (see “Initializing the link” on page 22). 2 On the Configuration menu, select Ethernet Settings, and then specify values for the following: Setting Parameters Frame Type – DIX – 802.3 Length Type – Frames – Packets 57. Chapter 4 IP Testing Specifying L3 test application settings 44 SmartClass Ethernet Tester User’s Guide 3 If you need to specify other settings for the test, press Cancel to return to the Configuration menu; otherwise, proceed to step 4. 4 Press the Start key. A message appears indicating that the test has started. The tester transmits traffic with the characteristics you specified. Specifying payload settings Before you transmit layer 3 traffic, you can specify whether the traffic should carry an Acterna, or Fill Byte payload. You must transmit an Acterna payload to measure round trip delay, service disruption time, or out of sequence frames. To specify payload settings 1 If you haven’t already done so, launch a layer 3 test application (see “Launching an IP test application” on page 42), and then establish a link (see “Initializing the Ethernet link” on page 43). 2 On the Configuration menu, select Payload Settings, and then specify values for the following settings: Frame Length – User Defined – Jumbo – Random. Select Random to send frames with randomly generated, predefined RFC 2544 traffic lengths. User Length Jumbo Length If you specified User Defined or Jumbo as the Frame Length, specify a value falling within the range displayed on the user interface. Src MAC Type – Default - sends traffic with the factory assigned MAC address as the source address. – User Defined - sends traffic with the user assigned MAC address as the source address. If you select User Defined, be certain to specify the Usr Src Addr. Usr Src Addr Type the source address carried in transmit- ted frames. Unit Identifier Enter an ID for the tester using up to ten char- acters. This ID is used to identify the tester during loopback testing. Setting Parameters Setting Parameter Payload – Acterna – Fill Byte Fill Byte Enter the fill byte pattern carried in the payload using a hexadecimal format. 58. Chapter 4 IP Testing Specifying L3 test application settings SmartClass Ethernet Tester User’s Guide 45 3 If you need to specify other settings for the test, press Cancel to return to the Configuration menu; otherwise, proceed to step 4. 4 Press the Start key. A message appears indicating that the test has started. The tester transmits traffic with the payload you specified. Specifying VLAN, Q-in-Q, or MPLS settings Before transmitting layer 3 traffic, you can specify settings that indicate the tester should transmit VLAN (virtual LAN), Q-in-Q, or MPLS tagged traffic. This allows you to verify that an Ethernet link supports the encapsulated traffic. The tester can also analyze received traffic to verify that the required bandwidth is allocated to tagged traffic on a link and determine that VLAN, Q-in-Q (SVLAN), or MPLS prioritization is functioning properly. For details on VLAN and Q-in-Q tagging, see “Specifying VLAN or Q-in-Q settings” on page 27 of Chapter 3 “Ethernet Testing”. To specify MPLS settings 1 If you haven’t already done so, launch a layer 3 test application (see “Launching an IP test application” on page 42), and then establish a link (see “Initializing the link” on page 22). 2 On the Configuration menu, select Tagging Settings, and then specify values for the following: 3 If you need to specify other settings for the test, press Cancel to return to the Configuration menu; otherwise, proceed to step 4. 4 Press the Start key. A message appears indicating that the test has started. The tester transmits traffic with the MPLS settings you specified. Setting Parameters Tagging Select MPLS. MPLS EtherType Select one of the following: – Unicast – Multicast Num MPLS Labels Indicate whether you want to transmit traffic tagged with one or two MPLS labels. The network will use the label(s) to route the traffic. NOTE: The MPLS 2 settings only appear if you indicate that you want to tag the traffic with two labels. MPLS 1 ID MPLS 2 ID Specify the label ID. MPLS 1 Priority MPLS 2 Priority Specify the label priority. MPLS 1 TTL MPLS 2 TTL Specify the time to live (TTL).

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