



SONET Chipset Evaluation Module User Guide

REVISION HISTORY

Revision Number	Date	Author(s)	Comments
0.1	3/23/2001	Hong Truong	Initial release.

I. Scope

The goal of this document is to explain how to use the SONET Chipset Evaluation Module (part number CN00-D400-001). An evaluation module (EVM) is intended to provide the customer with a vehicle to test product features, to measure product performance, and to help them design the product into their application. Therefore, in addition to the EVM board and the required software and user guide for the operation of the EVM, schematics of circuit boards and modules, database required for producing the raw PCB (Gerber file), a bill of materials (B.O.M.), and supporting documents are provided.

II. Reference Documents

The following reference documents are provided as electronic copies on the accompanied CD.

Table 1: Datasheets

Product Name	Datasheet Reference Number	Brief Description of Device
CX29610 OptiPHY-M622	100518p2.pdf	CX29610 is a highly integrated, multi-port chip that provides SONET/SDH processing and multiplexer/demultiplexer functions for a single STS-12/STM-4 data stream or four STS-3/STM-1 data streams. All mappings are compliant with SONET/SDH standards, including Bellcore GR-253, ANSI T1.105, and ITU G.707.
CX29503 BAM-3	29503_100702a.pdf	CX2503 is a highly integrated cost-effective, monolithic device which performs the mapping, multiplexing, demultiplexing, and framing of three STS-1, AU-3, DS3, E3, or one AU-4 inputs to any valid combination of 84 DS1 or 63 E1 signals.
CX28500 MUSYCC-1024	100579b-2.pdf	CX28500 is an advanced Multi-channel Synchronous Communications Controller. It formats and de-formats up to 1024 High-level Data Link Control (HDLC) channels in a CMOS integrated circuit.

Table 2: Driver Software User Guides

Product Name	Reference	Document Type	Operating Systems Supported
CX29610	CX29610_ddpi_design_spec.doc	Device Driver Programming Interface design specification	VxWorks
	CX29610_ddpi_fnc_spec.doc	Device Driver Programming Interface functional specification	
	CX29610_hpi_design_spec.pdf	Hardware Programming Interface specification	
CX29503	CX29503_ddpi_fnc_spec.doc	Device Driver Programming Interface functional specification	VxWorks
	CN29503_hpi_fnc_spec.doc	Hardware Programming Interface functional specification	
	CN29503_CSP_fnc_spec.pdf	Functional specification for the Control/ Status Processor	
CX28500	CX8500_ddpi_hpi_fnc_spec.doc	Device Driver Programming Interface and Hardware Programming Interface functional specification	VxWorks
	CX8500_BDTM_Spec.doc	Buffer Descriptor Table Manager specification	
	CX28500_DMA_Alloc_Calc.doc	DMA buffer allocation calculations	

III. Item Checklist

Please check that your package is complete. If you discover damaged or missing items, please contact Mindspeed Technologies.

Table 3: Package Contents

√	Quantity	Item
	1	IBM-compatible PC (case, floppy, ASUS CUBX motherboard, Intel Pentium III 600 MHz (running at 450 MHz), 32 MB 133 MHz ram, and Intel Ethernet Card) *Note: mouse, keyboard, and monitor are not included. Mouse is not used in VxWorks Application.
	1	Category 5 cable for Intranet/LAN connection
	1	One pair of SMA to BNC thin coax cables for the serial DS3/E3 ports
	1	SONET Evaluation Module Board (PCI slot)
	1	SONET Evaluation Module User Guide (this document)
	1	CD containing installation software for “Host” and “Target” computers, and supporting documents mentioned in the Scope Section
	1	Floppy containing VxWorks loader/boot image

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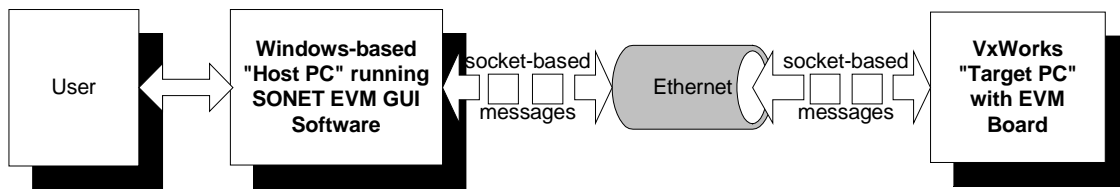
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1 Introduction

The SONET Evaluation Module (SONET EVM) consists of two subsystems. The first subsystem consists of an IBM-compatible PC, which is supplied by Mindspeed Technologies, containing the SONET Evaluation Module Board. This “Host PC” and its application software run on VxWorks, a real-time operating system. The second subsystem consists of the SONET EVM GUI software running on a Windows-based PC, which the user must supply. This “Host PC” provides the user an interface to the “Target PC” through the SONET EVM GUI software. Communication between the two subsystems is through Ethernet. Socket-based messages originating from the SONET EVM GUI software residing on the host PC are processed by the VxWorks application residing on the target PC. The target PC responds to the host PC’s messages, or requests, by sending back request status and requested information, if any. The SONET Evaluation Module Platform is illustrated in the figure below. High-level details of the software architectures are shown in Figure 2.

Figure 1: SONET Evaluation Module Platform

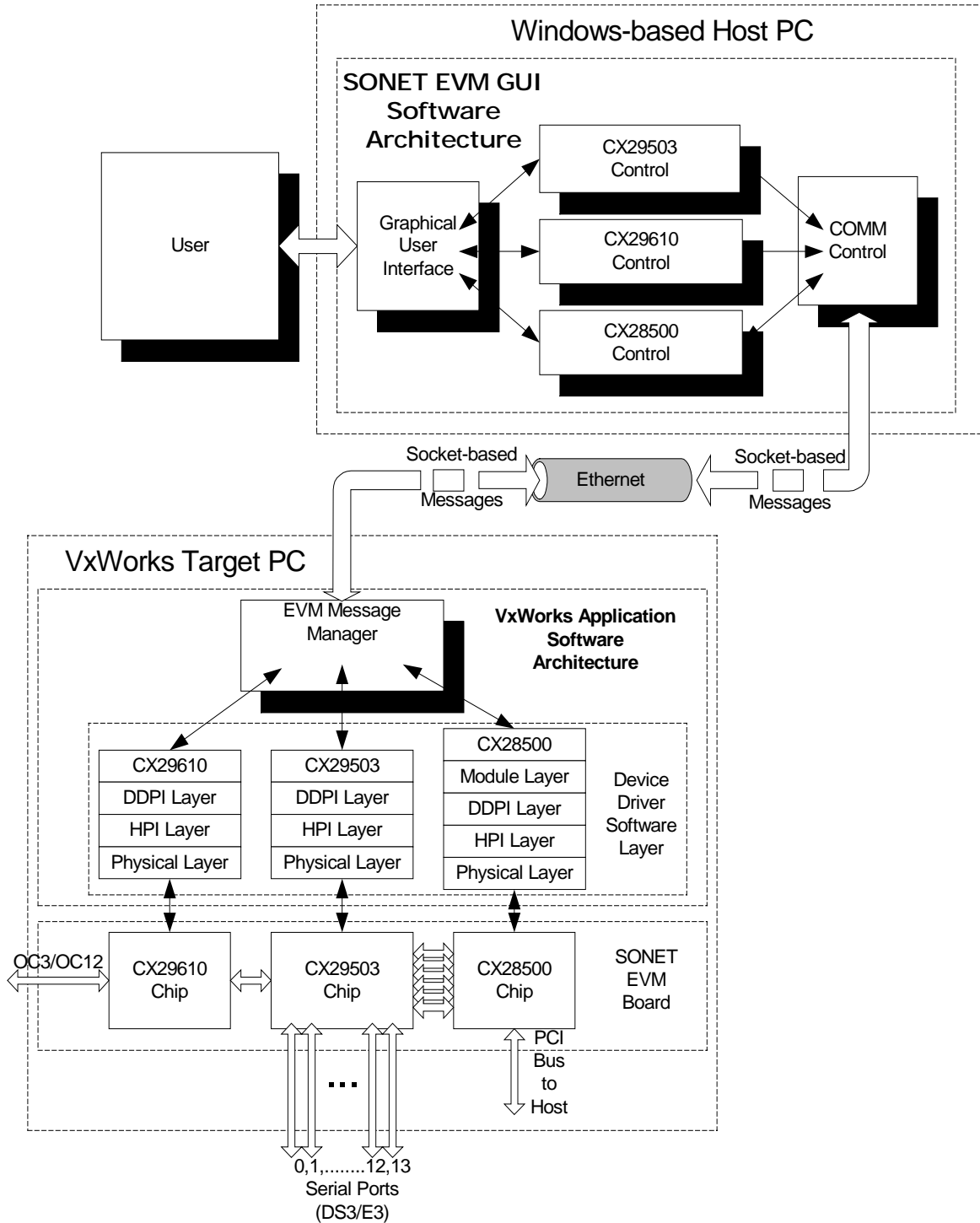


As shown in figure 2, the SONET EVM GUI software consists of three software layers. The highest layer is the Graphical User Interface. The GUI allows the user to execute device-driver commands and operate the EVM at a higher level of abstraction, or without the need to know all the details of the device drivers. Messages of the chosen operations or commands are passed down to the second layer for processing. The second layer consists of software modules, whose jobs are to service the messages from the GUI. Messages from the GUI are translated into specific socket-based messages to be sent to the target PC. In most cases, these socket-based messages are one-to-one mapping to the device driver functions residing on the target (VxWorks) PC. As such, each device, or chip, on the SONET EVM Board has a “Control” module that is dedicated to translating, forming, and sending messages from the GUI on the Windows-based PC to the VxWorks Application on the target PC, and vice versa. The lowest layer is the COMM Control, who is responsible for opening and closing TCP/IP sockets, and sending and receiving message across the communication port.

On the target (VxWorks) PC, the EVM Message Manager is the first to receive messages from the host (Windows) PC. It deciphers received messages and processes them according to the request. As shown in Figure 2, the EVM Message Manager calls on the corresponding device driver functions directly to perform the requested actions from the SONET EVM GUI software. As a side note, the device drivers are fully functional drivers. As aforementioned, the second layer of the SONET EVM GUI software, or the individual control modules, exposes the device driver interfaces. The full SONET GUI EVM software will allow the user to directly access these driver entry points. Figure 2 also shows the different levels of abstraction that each device driver has. Once the requests are processed, their status and requested information, if any, are passed upstream from the device driver, to the EVM Message Manager, through the

Intranet/LAN, to the COMM Control, back to the control module that requested the information, and finally displayed in the GUI in the proper format.

Figure 2: Software Architectures



2 Requirements

2.1 Target (VxWorks) PC with SONET EVM Board

2.1.1 Hardware

The following devices are required to provide interaction and feedback between the user and the provided Target PC running the SONET EVM Board:

- Monitor for text output
- PS2 keyboard

2.1.2 Target (VxWorks) IP Address

One IP address is required for the Target PC to establish communication with the Host PC.

2.2 Host (Windows) PC running SONET EVM GUI Software

2.2.1 Supported Operating Systems

The SONET EVM GUI Software has been tested to be compatible with the following operating systems:

- Windows 98/98Second Edition
- Windows NT 4.0 with Service Pack 6.0 (NT Server may conflict with the FTP server used to download the VxWorks application onto the target PC.)
- Windows 2000.

Note: Software installation requires the user to have administrative rights.

2.2.2 Software Requirements

The host (Windows) PC must have Internet Explorer 5.x installed. The SONET EVM GUI software uses some resources included in Internet Explorer 5.x.

2.2.3 Hardware Requirements

An IBM-compatible PC with Pentium II class processor (or faster) with the following minimum configurations:

- 64 MB RAM for Windows 98, 128 MB RAM for Windows NT/Windows 2000
- 20 Megabytes free disk space on C: drive (hard drive must be C: drive)
- Mouse

- VGA video card and monitor must be capable of displaying 1024x768 resolution with small fonts
- Ethernet/Network Card (PC must be network ready, or have access to the Intranet/LAN)
- CD-ROM Drive

2.3 Host (Windows) IP Address

One IP address is required for the Host PC to establish communication with the Target PC.

3 Hardware Setup

3.1 Target (VxWorks) PC

Please follow the following instructions to set up the Target PC:

1. Open the cover of the supplied IBM-compatible PC and plug in the SONET EVM Board into one of the empty PCI slots.
2. Connect keyboard, monitor, and power cable to the “Target PC”.
3. Connect the Target PC to the intranet via a Category 5 cable.

Note: Ethernet/Network Card is already installed for in the target (VxWorks) PC.

4. Connect power cables for the monitor and the target PC into the electrical outlets, and proceed to the Software Setup instructions.

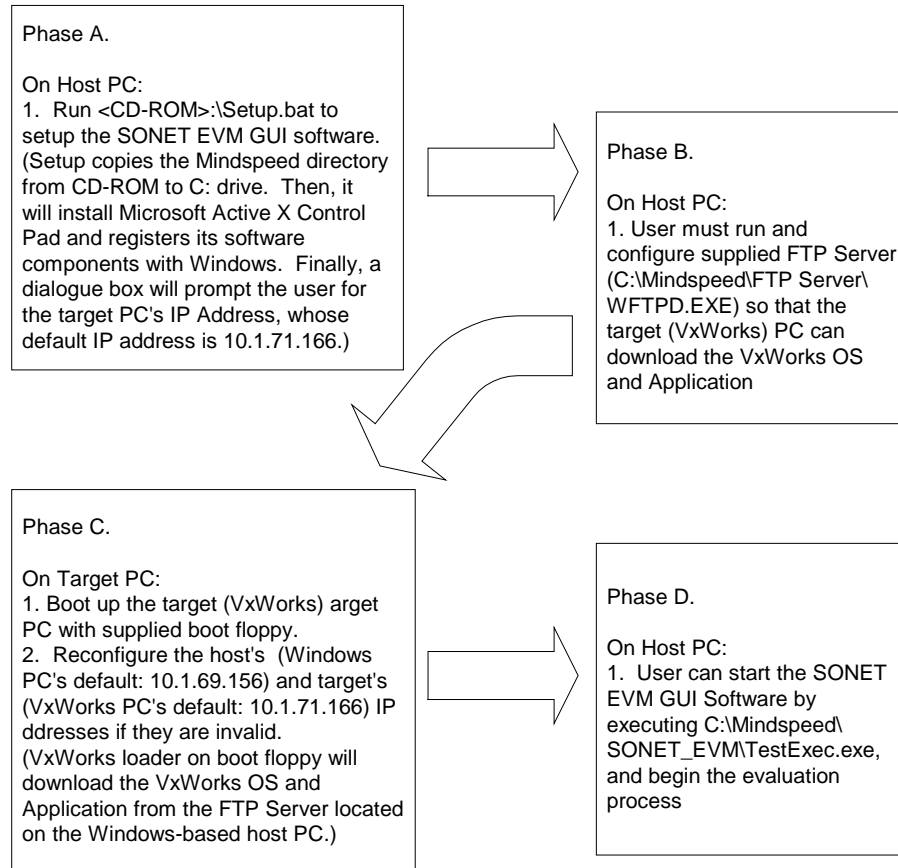
3.2 Host (Windows) PC

None. Make sure the Windows-based PC chosen as the “Host PC” meets all aforementioned requirements. It must have access to the Intranet/LAN, and have Internet Explorer 5.x installed. The video card and monitor must be set to 1024x768 resolution with small fonts. Failure to do so will result in the GUI page not displayed correctly.

4 Software Setup

Because it is not plausible to load the VxWorks OS and Application from a hard drive or a CD-ROM, software installation on the Target PC is achieved by downloading it from a FTP server. This dependency requires software installation and setup to proceed in the illustrated order, as shown in Figure 2.

Figure 3: Software Setup Flow



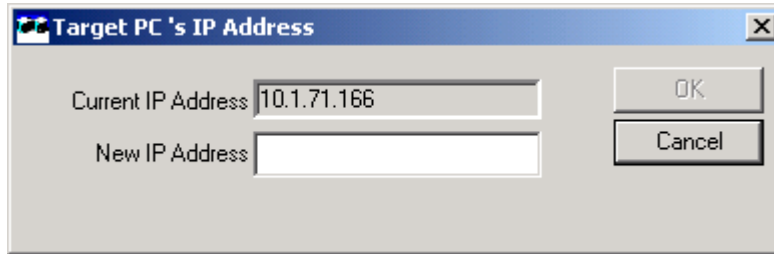
4.1 SONET EVM GUI Software Manual Setup on Host (Windows) PC

To manually install the SONET EVM GUI Software onto the host (Windows) PC, please take the following steps:

1. Make a directory on the C: drive called "Mindspeed". (C:\Mindspeed)
2. Put the Mindspeed CD into the CD-ROM drive and copy the content of the Mindspeed directory on the CD to the Mindspeed directory on the PC's C: drive.
3. Run C:\Mindspeed\SONET_EVM\setuppad.exe to install the Microsoft Active X Control Pad, which provides Forms and other resources for the SONET EVM GUI Software.

4. Run C:\Mindspeed\SONET_EVM\SONETEVMReg.bat to register some software components with Windows' registry.
5. Run C:\Mindspeed\SONET_EVM\SONETIpConfig.exe to update the target (VxWorks) PC's IP address, if the default IP address of 10.1.71.166 is not valid. The following dialogue box will prompt the user for the IP address of the Target PC.

Figure 4: Target (VxWorks) PC's IP Address Dialogue Box



Note: IP address must be in the form xxx.xxx.xxx.xxx.
Default IP address for the target (VxWorks) PC is 10.1.71.166.

6. Click "Cancel" if the current IP address is valid, otherwise enter the new IP address for the Target PC, and press the "O.K." to confirm the change.

Note: To change the IP address assigned to the target (VxWorks) PC in the future, please follow steps 5 and 6.

4.2 SONET EVM GUI Software Setup on Host PC (Windows 98/98SE, NT 4.0 with Service Pack 6.0, and 2000)

To install the SONET EVM GUI Software onto the host (Windows) PC, who is running Windows NT 4.0 or Windows 2000, please take the following steps:

1. Put the Mindspeed CD into the CD-ROM drive. The installation process should automatically run. If it does not automatically run, then execute "Setup.bat" located on the CD (i.e. <cd-rom>\Setup.bat). The setup batch file will copy the content of the Mindspeed directory on the CD to the PC's C: drive. It will also register its software components with Windows' registry. Additionally, it will install Microsoft Active X Control Pad, which provides Forms and other resources for the SONET EVM GUI Software.
2. Once the tasks in step one are carried out, the dialogue box as shown in Figure 4 will prompt the user for the IP address of the Target PC.

To change the IP address assigned to the target (VxWorks) PC in the future, please take the following steps:

1. Run C:\Mindspeed\SONET_EVM\SONETIpConfig.exe. The same dialogue box as shown in Figure 5 and 6 will pop up.
2. Enter the new IP address assigned to the target (VxWorks) PC, and press the “O.K.” button to confirm the change.

4.3 Creating Windows Shortcut to the SONET EVM GUI Executable

To create a Windows Shortcut to the SONET EVM GUI software executable, please take the following steps:

1. With cursor pointing to the Windows Desktop, right-click the mouse.
2. Select “New” from the pop-up menu.
3. Select “Shortcut” from the expanded pop-up menu. A dialogue box with the caption “Create Shortcut” will pop up.
4. In the edit box, type in: C:\Mindspeed\SONET_EVM\TestExec.exe, and click “Next”. The current “Create Shortcut” dialogue box will change to a dialogue box titled “Select a Title for the Program”.
5. Enter the name “SONET EVM GUI” without quotation marks, and click “Finish”. As shown in Figure 5, an icon with the Mindspeed logo will appear on the Windows Desktop.

Figure 4: SONET EVM GUI Shortcut Icon



4.4 VxWorks Application Setup on Target (VxWorks) PC

To install the VxWorks Application onto the target (VxWorks) PC, please take the following steps:

1. Run the supplied FTP server located on the Client PC, at C:\Mindspeed\FTP Server\WFTPD.exe.
2. Insert the boot floppy containing the boot image into the target (VxWorks) PC.
3. Power up the target (VxWorks) PC.

Then, take the following steps to configure the IP addresses, if they are not valid:

4. When the boot countdown starts, press any key to stop the boot.
5. Type: 'c' (to enter configuration)
6. Press: Enter
7. Press the Enter key five times, or until you get to the field:

Inet on Ethernet (e): 10.1.71.166
(10.1.71.166 is the default IP address for the target, or VxWorks, PC)

8. Enter the IP Address assigned to the target (VxWorks) PC.
9. Press the Enter key three times, or until you get to the field:

Host Inet (h): 10.1.69.156
(10.1.69.156 is the default IP address for the host, or Windows-based, PC)

10. Enter the IP Address assigned to the host (Windows) PC.
11. Press: Enter
12. Press the key combination: "Ctrl" + 'd' (to exit configuration).
13. Type: '\$'
14. Press: Enter
15. The machine will now boot.

Note: Steps 4 through 15 do not have to be followed if the current IP address settings are valid. However, in subsequent boots, steps 1 through 3 have to be followed since the target (VxWorks) PC needs the FTP server who is running on the host (Windows) PC to download the VxWorks OS and Application.

4.5 FTP Server Configuration

During the target (VxWorks) PC boot-up, it will ftp into the host (Windows) PC as "anonymous" to download the VxWorks OS and Application. Please take the following steps to enable the FTP server to allow anonymous login:

1. Execute the FTP server located at: C:\Mindspeed\FTP Server\WFTPD.exe

2. Once the FTP server is up and running, click on the “Security” menu item and select “General...” from the drop-down list. A dialogue box with the caption “General Security” will pop up.
3. Check the “Allow Anonymous” box at the upper-left hand corner of the dialogue box, and click the “O.K.” button on the upper-right hand corner to make the change effective.
4. Click on the “Security” menu item again, and select “Users/rights...” from the drop-down list. A dialogue box with the caption “User/Rights Security Dialog” will pop up.
5. Select “anonymous” from the User Name list box, if it is not already selected.
6. Type the following in the Home edit box: C:\Mindspeed. This will restrict access by an anonymous login to the C:\Mindspeed directory.
7. Click the “Done” button to confirm the changes.

5 Using the SONET EVM GUI Software

The following sections describe the usage of the SONET EVM GUI Software. This beta release of the SONET EVM GUI (Version 0.1) contains a subset of the full set of functionalities that will be supported in the final release. The current release consists of the General Status page. The General Status page allows the user to configure the SONET Chipset to one of the pre-defined chipset configurations, to get status, to activate and deactivate channels, and to read and write registers.

5.1 Starting Up

Once the hardware and software installations and setup are completed, please follow these steps to start the evaluation process:

1. Run the supplied FTP server on the host (Windows) PC located at: C:\Mindspeed\FTP Server\WFTPD.exe. Please refer to Section 4.5 *FTP Server Configuration* for more details on configuring the FTP server.
2. Put the boot-up floppy into the target (VxWorks) PC and power up the target PC. Please refer to steps 4 through 15 in Section 4.4 *VxWorks Application Setup on Target (VxWorks) PC* for more details on configuring the VxWorks boot-up image.

Note: step 2 depends on step 1, because the target (VxWorks) PC depends on the FTP server on the host (Windows) PC to download the VxWorks OS and Application.

3. Run the SONET EVM GUI software by executing the executable C:\Mindspeed\SONET_EVM\TestExec.exe. Alternatively, if a Windows Shortcut was created, then execute the Windows Shortcut. Please refer to Section 4.3 *Creating Windows Shortcut for SONET EVM GUI Executable* for more details.
4. Once the SONET EVM GUI is running, select one of the pre-defined chipset configurations and click the “Start Monitor” button to configure the SONET chipset and begin monitoring status. The user can activate or deactivate a logical channel on the CX28500 in the Message group box located in the lower-right hand to begin and stop transmission.

5.2 SONET EVM GUI – General Status Window

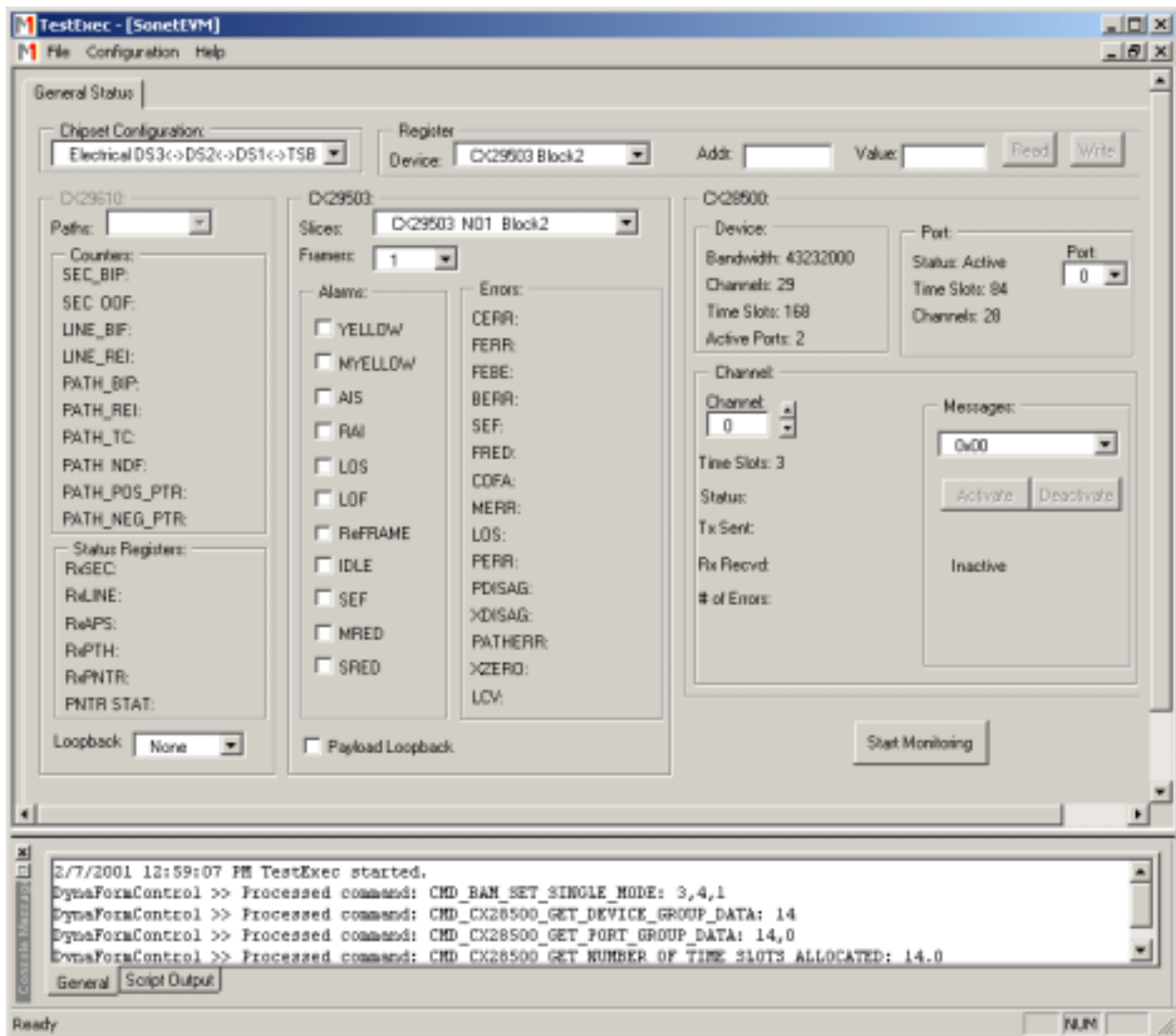
The General Status page, as shown in Figure 5, allows the user to:

1. Configure the SONET Chipset to run in one of the pre-defined chipset configurations. Please refer to Section 5.2.1 and Table 4 for more details regarding the pre-defined chipset configurations.

2. Get operational status from each of the active device in the current configuration (alarms, error counts, and number of messages received and transmitted successfully and unsuccessfully).
3. Activate and deactivate logical channels on the CX28500.
4. Choose the type of message pattern to send out from the system host.
5. Read and write registers.

The succeeding sub-sections will explain the various group boxes on the GUI page.

Figure 5: SONET EVM GUI with the General Status page showing



5.2.1 Pre-defined Chipset Configurations Group Box

The Chipset Configuration group box allows the user to select one of the pre-defined chipset configurations, as defined in Table 4. Table 4 shows the pre-defined chipset configurations supported by the SONET EVM GUI software. Currently, the SONET EVM GUI software supports only one chipset configuration. This configuration de-multiplexes electrical DS3 data paths into DS1 data paths, and multiplexes DS1 data paths into DS3 data paths. Only one serial DS3 port is supported in this current release.

Table 4: Pre-defined Chipset Configurations

Pre-defined Configuration(s)	PDH Multiplexing		Device(s) Used				Supported Port(s)		
	Single	Mixed	CX29610	CX28333	CX29503	CX28500	OC12	OC3	DS3/E3
Electrical DS3<->DS2<->DS1<->TSB	√			√	√	√			√

Note(s):

- 1) This is the only supported operational mode for the current release of the software. This minimal software release does not indicate or reflect the limitation of the SONET Chipset.
- 2) Single mode means channelized data paths are of DS1, DS2, or DS3 signal.
- 3) Mixed mode means data paths can contain a mixture of DS1, DS2, and DS3 signals.

The following figures present simplified views of the SDH and SONET multiplexing structures, respectively.

Figure 6: A simplified view of the SDH multiplexing structure

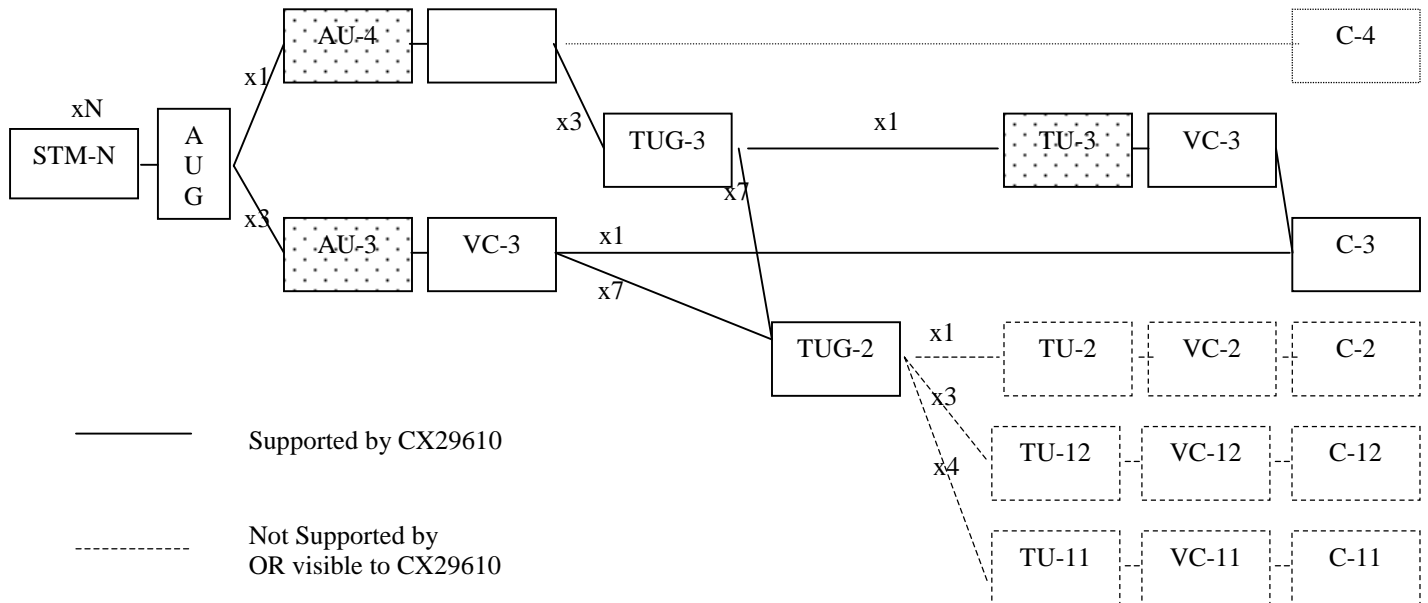
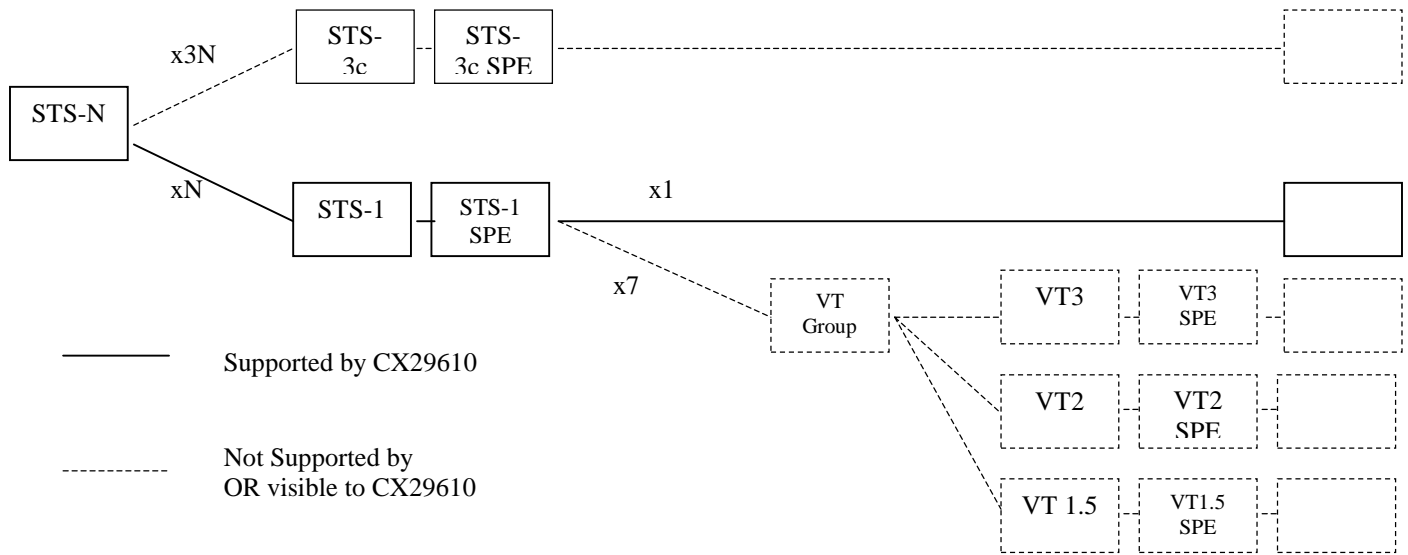


Figure 7: A simplified view of the SONET multiplexing structure

5.2.2 Register Group Box

The Register group box, located on the upper-right hand, allows the user to read and write device registers directly. The user can choose the device to access from the Device list box, which contains all the devices currently active. Registers are specified by their address offsets as defined in the respective device's datasheet.

To read a register's current content:

1. Specify the offset of the register interesting in reading into the Address edit box.
2. Click the "Read" button to request the content of that register.

To write a new value to a register:

1. Specify the offset of the register interesting in writing into the Address edit box.
2. Enter the new value into the Value edit box.
3. Click the "Write" button to update the content of the specified register.

5.2.3 CX29503 Group Box

The CX29503 group box enables the user to display CX29503's operational status, in terms of alarms and error counts per block-frame. Tables 5 and 6 define the meanings of alarm indicators and error counters. For more detailed descriptions, please refer to the CX29503 Datasheet. Additionally, there is a check box at the bottom of the group box that enables or disables payload loop-back.

5.2.3.1 Alarms Group Box

The table below describes the alarm indicators for the CX29503.

Table 5: Descriptions Alarm Indicators

Alarm Indicators	Descriptions	Applicable Signal Type
YELLOW	Yellow Alarm	DS1/E1
MYELLOW	Multi-frame Yellow Alarm	DS1/E1
AIS	Alarm Indication Signal	DS1/E1, DS2/E2, DS3/E3
RAI	Remote Alarm Indication. Sent upstream after the occurrence of an AIS condition	DS1/E1, DS2/E2, DS3/E3
LOS	Loss of Signal	DS1/E1, DS2/E2, DS3/E3
LOF	Loss of Frame	DS1/E1, DS2/E2, DS3/E3
ReFRAME	Change in Frame Alignment	DS1/E1, DS2/E2, DS3/E3
IDLE	IDLE code detected	DS3
SEF	Severely Erred Frame	DS1/E1, DS2/E2
MRED	Loss of MFAS alignment	DS1/E1/DS3/E3
SRED	Loss of CAS	DS1/E1

5.2.3.2 Errors Group Box

The following table describes the error counters on the CX29503.

Table 6: Descriptions of Error Counters

Error Counters	Descriptions	Applicable Signal Type
CERR	CRC Error	DS1/E1
FERR	Framing Bit (Ft, Fs, FPS, FAS) Error	DS1/E1
FEBE	Far-end Block Error, a.k.a. Remote Error Indication	DS1/E1, DS3/E3
BERR	PRBS (Pseudo-random binary sequence) Bit Error	DS1/E1
SEF	Severely Erred Frame.	DS1/E1, DS2/E2
FRED	Loss of T1/FAS alignment	DS1/E1
COFA	Change Of Frame Alignment Error	DS1/E1, DS2/E2, DS3/E3
MERR	MFAS Error for E1 and FS Bit Error for DS1	DS1/E1
LOS	Loss of Signal.	DS1/E1, DS2/E2, DS3/E3
PERR	Parity Error	DS3/E3
PDISAG	DS3 Parity Bits Disagreement Error	DS3/E3
XDISAG	DS3 X-Bits Disagreement Error	DS3/E3
PATHERR	Path Parity Error	DS3/E3
XZERO	Excessive zeros	DS3/E3
LCV	Line Code Violations	DS1/E1, DS3/E3

5.2.4 CX28500 Group Box

The CX28500 group box contains configuration statistics, operation status, and interfaces for activating logical channels, deactivating logical channels, and configuring the message content for each channel.

5.2.4.1 Device Group Box

The Device group box shows configuration statistics for the CX28500. Since the CX28500 has 4096 assignable timeslots, 1024 configurable logical channels, and 32 serial ports, it is difficult to keep track of them. Hence, these device summary statistics offer an oversight view of total configured device resources.

Table 7: Summary Statistics for CX28500 Configurable Device Resources

Summary Statistics	Descriptions
Bandwidth	Total bandwidth in megabits per second, per direction
Channels	Number of logical channels configure out of 1042 configurable channels
Timeslots	Number of timeslots allocated out of 4096 timeslots possible
Active Ports	Number of active serial ports (32 possible)

5.2.4.2 Port Group Box

This group of statistics gives configuration and status information pertaining to the selected port.

Table 8: Port Statistics

Statistics	Descriptions
Status	Is the selected port “active” or “inactive”?
Time Slots	Number of timeslots allocated to the selected port
Channels	Number of logical channels configured for the selected port

5.2.4.3 Channel Group Box

This group box provides both configuration and operational statistics for the selected channel. In addition, the Message group box allows the user to choose the message pattern to send out from the selected channel.

Table 9: Channel Statistics

Channel Statistics	Descriptions
Timeslots	Number of timeslots assigned to the selected channel
Status	Is the selected channel “active” or “inactive”?
TxSent	Number of message sent by the selected channel
RxRcvd	Number of message received by the selected channel
# of Errors	Number of device (CX28500) errors. (i.e. short and long message errors, FIFO under-runs and over-runs, Out-Of-Frame, Change-Of-Frame-Alignment, Frame Check Sequence, etc.)

5.2.4.3.1 Messages Group Box

The user can choose the message pattern to send by selecting it from the drop-down list box. The transmit buffer in shared memory for this channel gets filled up with the chosen message pattern. The “Activate” and “Deactivate” buttons activates and deactivates channel transmission, respectively.

Note: To activate or deactivate a channel transmission, a pre-defined chipset configuration must have been chosen and made effective by clicking on the “Start Monitoring” button.

5.2.5 Start Monitoring Button

Once a pre-defined chipset configuration has been selected from the Chipset Configuration group box, the user can start the monitoring process by clicking the “Start Monitoring” button. Upon clicking this button, messages with configuration settings are sent to the target (VxWorks) PC to configure the chipset. When the chipset is successfully configured, the SONET EVM GUI queries the target PC for status and statistics at one-second intervals.

5.2.6 Console Message Prompt

The Console Message Prompt located at the bottom of the SONET EVM GUI page displays SONET EVM GUI requests status and other internal messages that are helpful for debugging and keeping track of progress.