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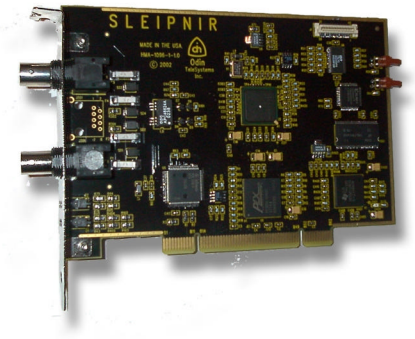

Sleipnir-1-PCI
Technical Description

Doc. No. 1111-1-HAA-1051-1

Rev. 1.0-P1

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Table of Contents

1 Abstract

This document provides a technical description of Odin TeleSystems' Sleipnir-1-PCI adapter card. This presentation is targeted to systems integrators and application developers who are developing telecommunications systems and/or software applications using the Sleipnir-1-PCI platform. The purpose of this document is to provide the needed information about the hardware to allow software developers to efficiently integrate Sleipnir-1-PCI into their overall system under design.

For information on how to develop host applications utilizing the OTX Hardware Device Driver Application Programming Interface (API), please refer to the "Programmer's Guide for OTX Hardware API" document (Odin TeleSystems Inc. document number 1411-1-SAA-1006-1). For information on how to develop custom DSP applications, please refer to "Programmer's Guide for OTX C54x DSP Software Development Kit" (Odin document number 1412-1-SAA-1007-1). And finally, for help on how to install the Sleipnir-1-PCI card and the OTX Device Driver Software, please refer to the Installation Guide for OTX PCMCIA Adapters (Odin TeleSystems Inc. document number 1512-1-HCA-1003-1).

2 Sleipnir-1-PCI Overview

Sleipnir-1-PCI is single span T1/E1/J1 adapter for the PCI Local bus. It is available in two different configurations:

- LAN (Local Area Network) and WAN (Wide Area Network) configuration
- Telecom configuration.

The Sleipnir LAN and WAN configuration is supplied with a network driver and supporting software to allow high speed PPP and Frame Relay connectivity. No programming is needed in this configuration.

The Sleipnir telecom configuration is a member of the Odin Telecom frameworX (OTX) product family. It is supported by the OTX device driver and by the OTX Hardware Application Programming Interface (API). It is populated with a Texas Instruments TMS320VC5510 400 Mips DSP and 16MB external memory. Equipped with the appropriate OTX software modules, Sleipnir-1-PCIcan be utilized in a variety of T1/E1, Integrated Services Digital Network (ISDN), Frame Relay, and Signaling System #7 (SS#7) applications.

The Sleipnir-1-PCI supports a single T1/J1 or E1 interface at the speeds of 1.544 Mbps and 2.048 Mbps, respectively. The same board supports both T1/J1 and E1. The Sleipnir-1-PCI is available with two different connector options:

- RJ45 connector with line terminating impedance of 100 / 120 ohms
- BNC connectors (TX and RX) with line terminating impedance of 75 ohms

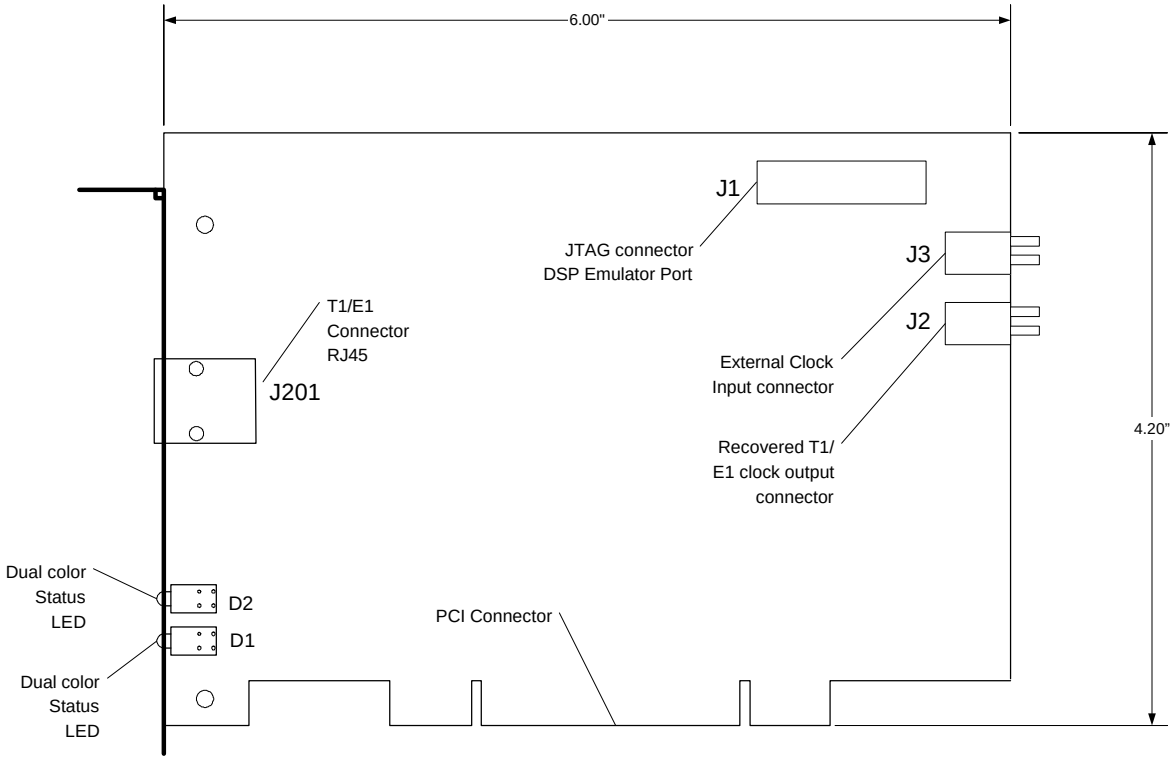
Sleipnir-1-PCI supports all popular frame formats and line coding.

3 Physical specifications

Sleipnir-1-PCI is a half-length PCI board available with two different T1/E1/J1 connector options. The two different connector options are listed in the chapters below.

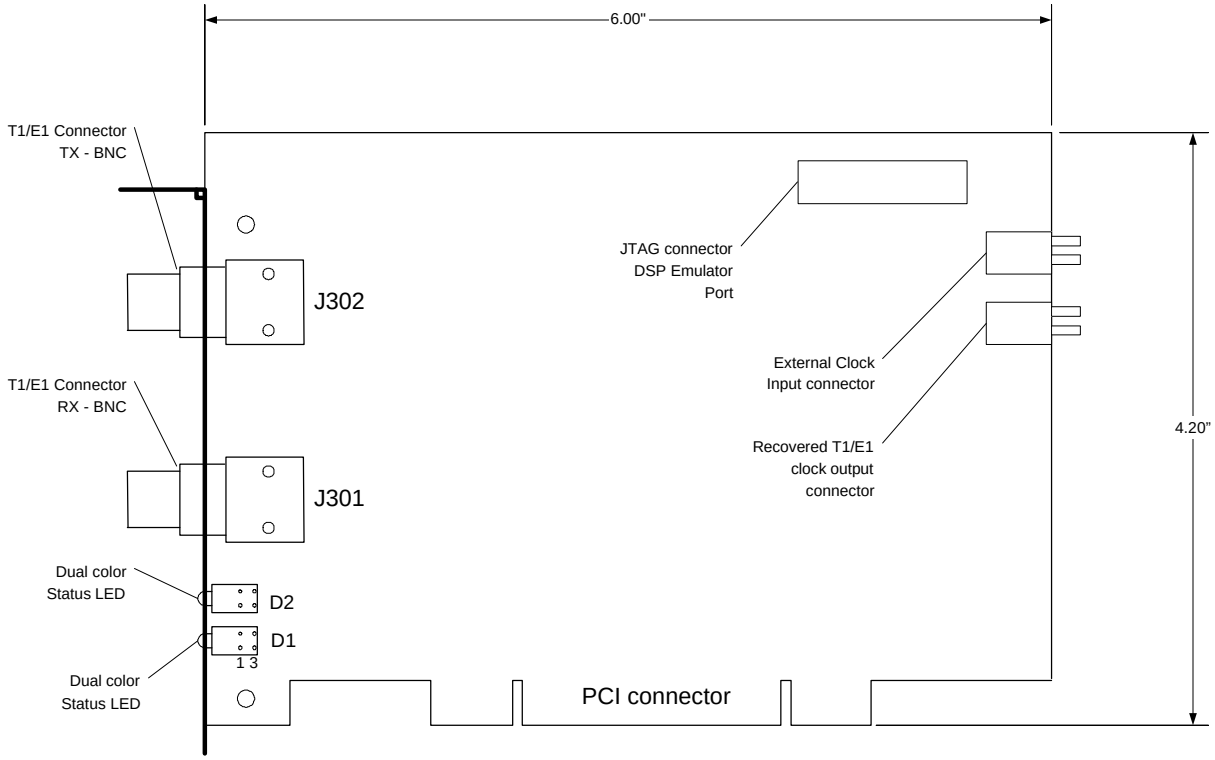
3.1 RJ45 connector option

The Sleipnir-1-PCI with the RJ45 connector option is shown in the figure below.



3.2 BNC connector option

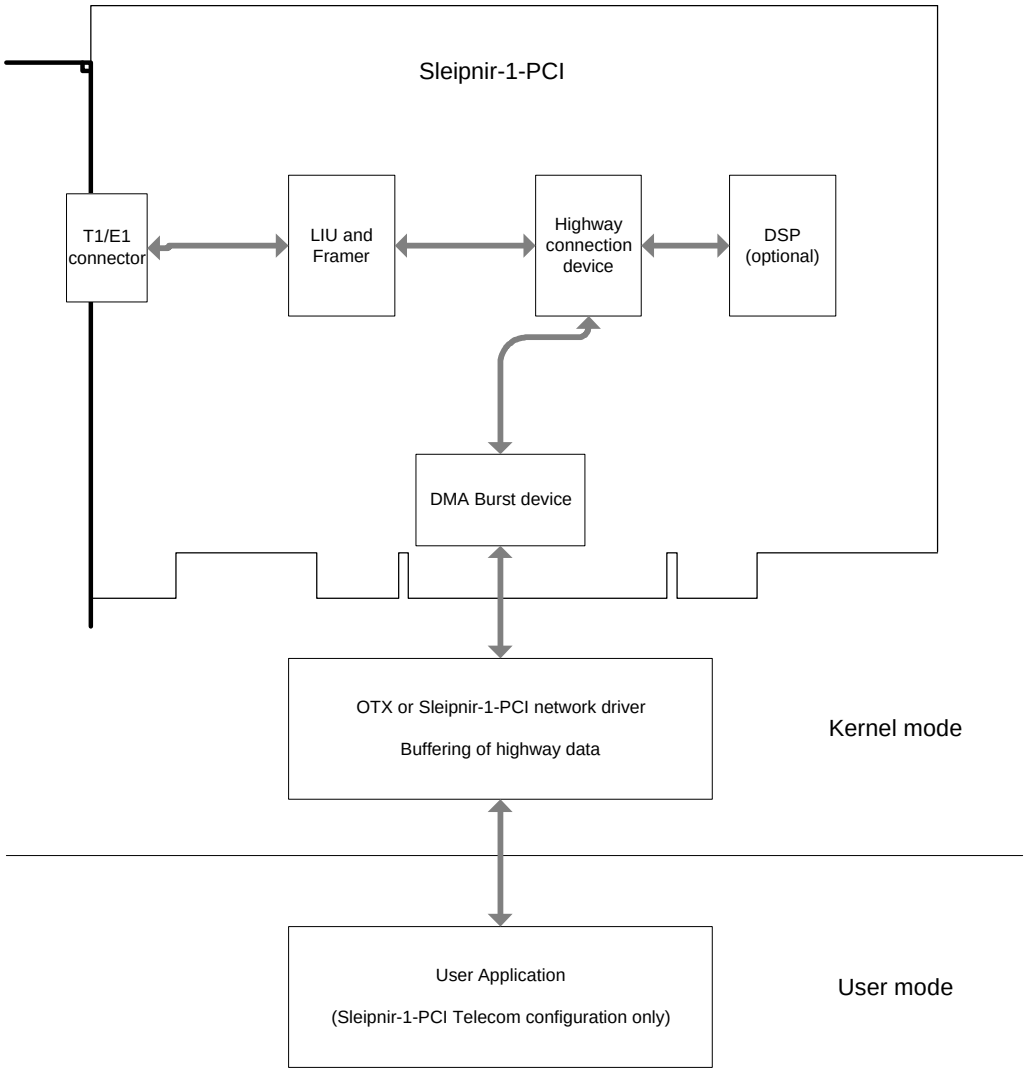
The Sleipnir-1-PCI with the BNC connector option is shown in the figure below.



4 Data Architecture

Internally, Sleipnir-1-PCI utilizes serial TDM (Time-Division Multiplexed) data streams for transfer of data or voice. The internal serial TDM data streams are called “Highways.” The external interface is referred to as “span”.

The serial highways provide data paths between physical devices as shown in the figure below.



5 PCM Highways

The Sleipnir-1-PCI utilizes 2 Mbit/sec PCM highways for data routing. When the optional DSP is installed, the DSP can process data from ether the incoming data stream

or from the host by way of DMA transfer. The DSP can supply data to ether the outgoing data stream or the host by way of DMA transfer.

6 API Supported Physical Devices

6.1 Board Devices

The Sleipnir configuration and status registers are accessible by API calls. The board devices include the serial to parallel converters and the DMA controller. The application can read or write the data directly from the Sleipnir buffers, or have the DMA controller place the data in the host memory and notify the application when data is available.

6.2 T1/E1 Line Interface Device

The Sleipnir Line Interface device fully supported by API calls to configure the interface for the required functionality. There is full access to all device registers for monitoring or diagnostics.

6.3 DSP

The optional DSP on the Sleipnir can be used to run Odin provided standard DSP applications or they can be used to run user developed custom applications. The Sleipnir telecom configuration is delivered with a number of Odin's Signal Processing Module (SPM). These SPMs, or DSP application packages, provides supports for many common telecom applications; such as tone detection and generation, FSK detection, and HDLC sending and receiving.

For more information on custom DSP application development, please refer to *"Programmer's Guide for OTX C54x DSP Software Development Kit"* (Odin document number 1412-1-SAA-1007-1)

7 Line Interface Functionality

7.1 Line Configurations

The Sleipnir-1-PCI line interfaces support several different line codes:

- HDB3 - High Density Bipolar 3
- B8ZS - Bipolar 8 Zero Substitution

- AMI - Alternate Mark Inversion
- AMI with NZC

For the T1 operation mode, the following framing formats can be used:

- F4 - 4-frame multiframe
- F12 - 12 frame multiframe (D3/D4, Superframe)
- ESF - Extended Superframe
- F72 - 72 frame multiframe (SLC96 mode)

For the E1 operation mode, Sleipnir-1-PCI supports the following framing formats:

- Doubleframe
- CRC multiframe

7.2 Fault Monitoring

The line interface subsystem supports fault and performance monitoring. The transceiver subsystem detects and reports the following alarms in the receive streams:

- Framing errors
- Cyclic Redundancy Check (CRC) errors
- Code violations
- Loss of frame alignment
- Loss of Signal (LOS)
- Alarm Indication Signal (AIS)
- E bit errors (E1 only)
- Slip
- Remote Alarm Indication (RAI, Yellow Alarm)

The line interface subsystems also supports the transmitting of the following alarms towards the remote end:

- Alarm Indication Signal (AIS)
- Remote Alarm Indication (RAI, Yellow alarm)
- Auxiliary Pattern (AUXP)

7.3 Loop Back

The line interface subsystem implements a remote loop back for line testing. In the remote loop back mode, the clock and data recovered from the line inputs are routed back to the line outputs through the analog transmitter.

8 Testing features

The Sleipnir Telecom configuration offers a variety of features to facilitate low-level T1/E1/J1 testing:

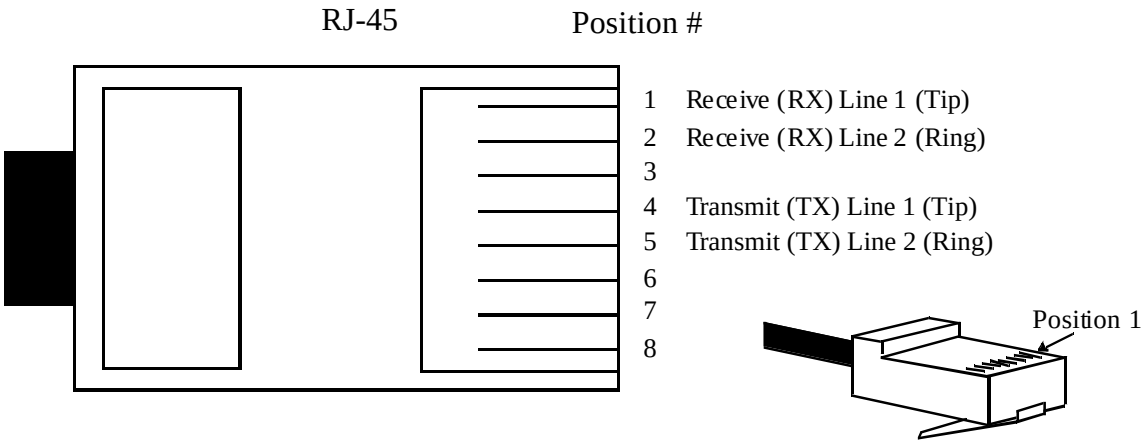
- Full access to F, Y, Si, and Sa bits in E1 mode
- Full access to FS/DL-bits in T1 mode (including support for the DL-channel protocol according to T1.403-1989 ANSI or to AT&T TR54016 specification)
- Programmable line build-out in T1/J1 mode
- Transparent mode
- Programmable transmit pulse shape and receive input threshold
- Insertion and detection of single alarms (e.g. Code Violation, Framing Errors, etc)
- Support for generation and detection of Loop codes
- Support for channel loopback
- Support for PRBS (BERT patterns)

9 PCI Bus

The Sleipnir-1-PCI board is compliant with the PCI 2.1 local bus specification. It is a universal interface, supporting both 3.3 volt and 5 volt signaling. The Sleipnir-1-PCI supports 32 bits at 33 MHz and can be both Slave and Master.

10 T1 / E1 Interface Connections

The back panel of Sleipnir-1-PCI contains ether a RJ45 connector or two BNC connectors. The RJ45 connector provides balanced 100 / 120 ohm transmit and receive connection, while the BNC connectors provide unbalanced 75 ohm connections.



11 Clocks

On the Sleipnir-1-PCI board, all the internal TDM data highways and the all the devices processing TDM data are synchronized to one clock reference. The clock reference can be derived from multiple sources and then routed to all the devices. The following clocking sources are supported by Sleipnir-1-PCI:

- Clock extracted from the incoming T1/E1/J1 span
- External 2.048 kHz clock (J3 connector)
- On-board free running oscillator

The J2 connector can be used to output the Sleipnir-1-PCI clock reference to another device or equipment.

12 JTAG

The JTAG port (reference designator J1) are used for Board Testing, programming of The FPGA PROMS, and Connecting the DSP emulator board for DSP Software Development.

Table x. JTAG Chains

Chain	Parts
TMS0	PROM

TMS1	LIU, PCI
TMS2	FPGA
TMS3	DSP

13 Indicators

The Sleipnir-1-PCI has four dual color LED indicators:

- Loss of signal / Activity
- Framing Error
- Alarm
- Auxiliary

The Auxiliary LED is driven from the (optional) DSP and can be configured arbitrarily.

14 Power

The Sleipnir-1-PCI operates from 3.3 Volt power supplied from the host PC. Power consumption is TBD.

15 Certifications

Final certifications are TBD. The following is a list of planned certifications:

- FCC Part 15 (CFR47, Part 15, Subpart B)
- FCC Part 68
- CE EMC (EN61326-1 Class B Equipment, AS/NZS 2064 Class B Limits)
- Safety EN60950 and UL60950

16 Reference documents

The following documents provide further detailed information related to the Sleipnir-1-PCI board:

- Programmer's Guide for OTX Hardware Driver (Odin document # 1412-1-SAA-1006-1)
- Installation Guide for OTX PCI Adapters (Odin document number 1512-1-HCA-1001-1)
- Programmer's Guide for OTX C54x DSP Software Development Kit (Odin document number 1412-1-SAA-1007-1)

17 Glossary

OTX – Odin Telecom FrameworX

DSP – Digital Signal Processor (optional device on Sleipnir-1-PCI)

SDK – Software Development Kit (supplied with the Sleipnir Telecom configuration)

API – Application Programmer Interface

CPU – Central Processing Unit. Refers to the host PC in this document.

EEPROM – Electrically Erasable Programmable Read Only Memory.

FPGA – Field Programmable Gate Array.

LED – Light Emitting Diode

LS – Least Significant

MS – Most Significant