MCH for µTCA Chassis

UTC001

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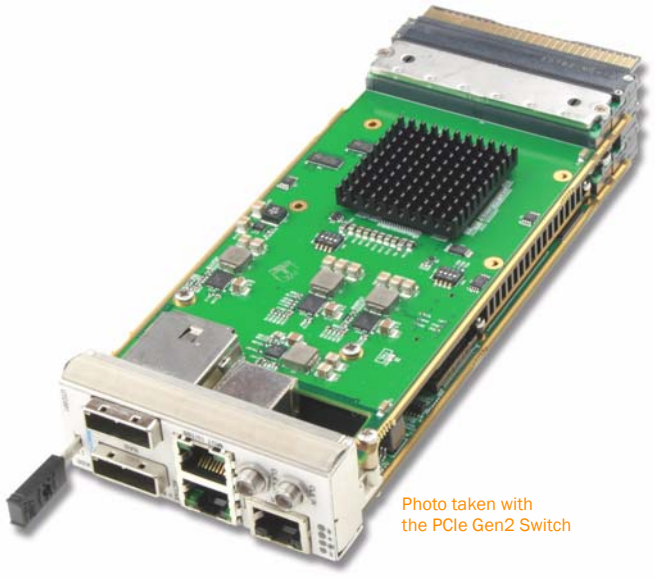

Photo taken with
the PCIe Gen2 Switch

KEY FEATURES

- Single-width, full-height module per AMC.0
- 400MHz RISC CPU with 64MB DDR for MCMC (MicroTCA Carrier Management Controller) and Shelf Manager
- Redundant boot system to ensure fail-safe upgrades
- Fail-over with dual UTC001 in system
- GbE to each AMC (layer two managed)
- SAS/SATA to each AMC
- Non-blocking PCIe x4 Gen 2 to each AMC slot with option for SRIO or 10GbE (layer three managed)
- Telcom/GPS clock (Stratum-3)
- Fabric clock with Spread Spectrum capability
- Blue, Red, Amber and Green LEDs
- Linux 2.6 embedded OS
- IPMI 2.0 compliant
- HPM.1 compliant
- UTC001 can run as an IPMI protocol analyzer to monitor all the I^2C Busses

The VadaTech UTC001 is the most feature-rich MCH (MicroTCA Carrier Hub) for the µTCA chassis in the market. It's management software is based on VadaTech's robust Carrier Manager and Shelf Manager which have been deployed for many years with proven results. The MCMC manages the power modules, the two CU (Cooling Units) and the 12 AMCs within the µTCA chassis. It also interfaces to and manages the on-board fabric interfaces. The module is available with PCIe, SRIO, 10GbE layer three managed, GbE layer two managed and SAS fabric interfaces.

The UTC001 runs Linux 2.6 on it's MCMC CPU and is hot-swappable and fully redundant when used in conjunction with a second instance of the module. The firmware is HPM.1 compliant which allows for ease of upgrade.

The UTC001 has sophisticated clocking features. It has options for Telcom, GPS and/or Fabric clocks. Stratum-3 TCXO and VCTCXO is the default configuration.

VadaTech can modify this product to meet special customer requirements without NRE (minimum order placement is required).

µTCA™

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SPECIFICATIONS

Architecture		
Physical	**Dimensions**	Width: 2.89in. (73.5 mm)
		Depth:7.11 in. (180.6 mm)
Type	**Controller**	µTCA Carrier Hub
Standards		
Module Management	**IPMI**	IPMI Version 2.0
	ATCA	PICMG 3.0 Revision 2.0 (AdvancedTCA)
	AMC	PICMG AMC.0 Revision 1.0 (AdvancedMC)
	µTCA	PICMG MicroTCA.0 Revision 1.0
	HPM	HPM.1 Revision 1.0
Configuration		
Power	**UTC001**	Option load dependent (as the MCMC and shelf only < 3 W)
Environmental	**Temperature**	Operating Temperature: 0° to 65° C with 400 LFM
		Storage Temperature: -40° to +90° C
	Vibration	1G, 5-500Hz each axis
	Shock	30Gs each axis
	Relative Humidity	5 to 95 percent, non-condensing
Features	**External interface**	RS-232 console port (RJ-45)
		Out-of-band LAN 10/100 from MCMC/Shelf Manager (RJ-45)
		In-band 10/100/1000 from GbE Switch Fabric (RJ-45)
		External Ref Clock (SMA)
		SAS/SATA Expander (I-Pass)
		Fabric - PCIe, SRIO or XAUI (I-Pass)
	LEDs	IPMI Management Control Blue, Red, Amber, Green, LNK/ACT, BIST pass, Clock: Ref Good, Freq Lock, Phase Lock
	Switch	Hot-swap switch input with +/-15KV ESD protection
	Temp Sensor	Multiple temp sensors on-board
Other		
MTBF	MIL Spec 217-F TBD	
Certifications	Designed to meet FCC, CE and UL certifications where applicable	
Standards	VadaTech is certified to both the ISO9001:2000 and AS9100B:2004 standards	
Compliance	RoHS and NEBS	
Warranty	Two (2) years	
Trademarks	The VadaTech logo is a registered trademark of VadaTech, Inc. Other registered trademarks are the property of their respective owners. AdvancedMC™, AdvancedTCA™ and µTCA™ logo are trademarks of the PCI Industrial Computers Manufacturers Group. All rights reserved. Specification subject to change without notice.	

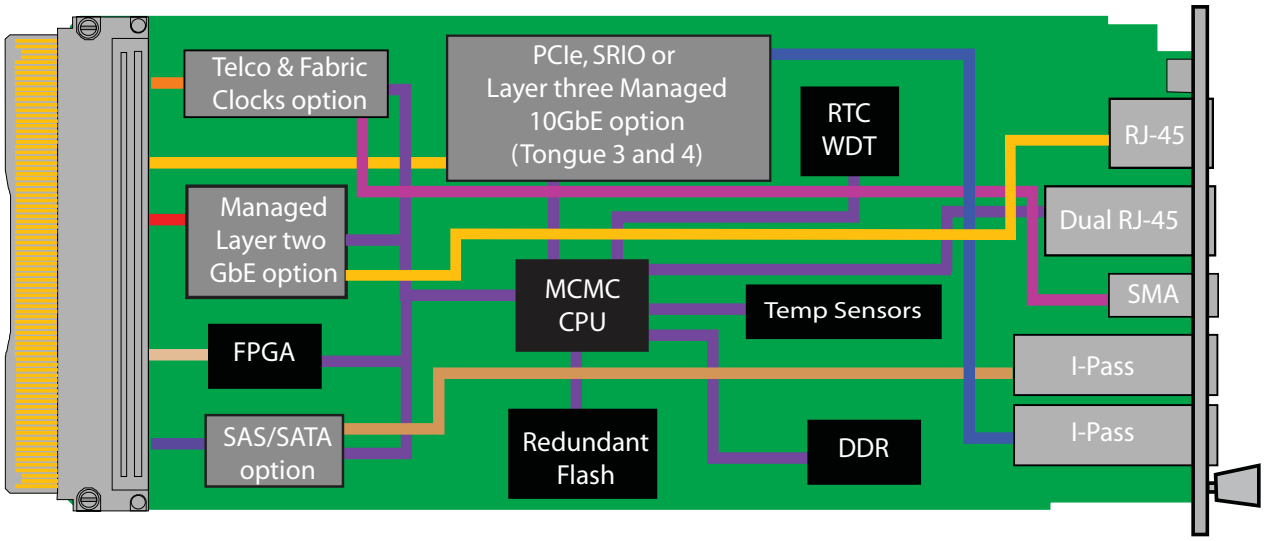


FIGURE 1. UTC001 Functional Block Diagram

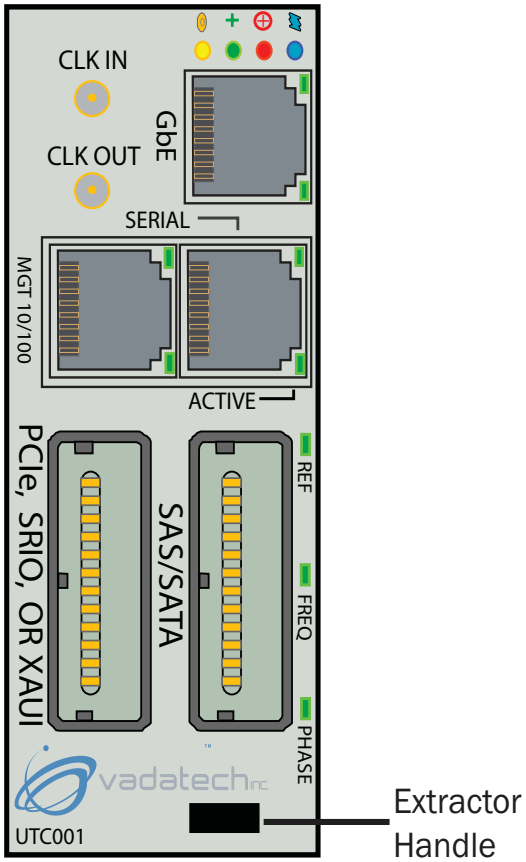


FIGURE 2. UTC001 Front Panel Diagram

Key Software Features

- Linux 2.6 embedded OS
- IPMI version 2.0
- Interface to Sensor Data Record repositories, System Event logs, FRU inventory storage devices
- Monitors temperature, voltage and current sensors
- Shelf cooling policy
- Shelf activation and power management
- Alarm controls
- Event notification and flexible alerting policies
- E-Keying
- CLI, SNMP, RMCP+, HTTP and HPI
- IPMI 1.5 compatibility
  - IPMI device global
  - Watchdog timer
  - Session management
  - Event management
  - PEF and alerting
  - Sensor device
  - FRU device access and update
  - SDR device access and update
  - SEL device access and management
  - LAN device configuration
- IPMI 2.0 extension
  - Enhanced encryption
  - Firmware firewall
  - Enhanced authentication

Carrier Manager Functions

- Dual-redundant CM with negotiation and fail-over
- Support for dual-redundant Power Modules
- Cooling Management
- LED Controls
- AMC Management
  - Radial IPMB-L
  - Support for 12 AMCs
  - AMC Payload Control
  - Electronic Keying
- Power and Cooling Management

Shelf Manager Functions

- Sensor monitoring and alerting
  - Actively monitors local and remote temperature, voltage and current sensors on the shelf FRUs
  - Access to raw sensor readings
  - Logs all critical events reported by shelf FRUs
  - Events are processed using Platform Event Filtering (PEF)
  - Alerts using SNMP trap and PEF alert policy
  - Capability to reset major/minor alarms with timeout
  - Controls major/minor/critical alarm LEDs

- Shelf manager interface
  - Command Line Interface (CLI)
    - CLI connects to the Shelf Manager and the boards on the shelf
    - IPMI-based library of commands
    - Accessible via telnet, SSH or shelf serial port
    - Commands provide access to information such as the current state of the system, sensor values, events, health, fan speeds, FRU storage, etc.
  - SNMP
    - Supports v1 and v3 of the Simple Network Management Protocol (SNMP)
    - The Shelf Manager can support SNMP queries and send SNMP traps in either v1 or v3
    - Provides custom *Management Information Base (MIB)* tree accessed using SNMP
    - The MIB hierarchy is defined in a text file that describes the shelf and platform objects to be managed and can be used by a remote application such as an SNMP/MIB manager
  - HPI
    - Provides HPI interface to the shelf resources
    - Access to resource tables to enable applications to discover, manage, and monitor the resources in the system:
      - Reset state management
      - Power state management
      - Managed hot swap
      - Alarm management
      - Management instruments associated with entities
      - Event notifications
      - Configuration
      - System and resource event logs

Layer Two Managed GbE

The GbE layer two managed switch fabric routes GbE to each of the AMC slots. The GbE fabric has an interface to the onboard Carrier/Shelf manager. It also has a port routed to the front for uplink.

Key features:

- Configuration
  - Ethernet/IEEE 802.3 Packet size (64 bytes to 1522 bytes)
  - Jumbo packets up to 9216 bytes
- L2 Switching
  - Supports up to 8K MAC address
  - Line rate switching for all packet sizes
  - Independent VLAN learning
  - VLAN flooding for broadcast and DLF packets
  - Hardware-based address learning
  - Six CPU-managed learning (CML) modes per port
  - Hardware-and-software-based aging
  - Software insertion/deletion/lookups of the L2 table
  - Same port bridging supported
  - Station movement control
- L2 Multicast
  - 4K VLANs
  - Protocol-based VLANs
  - IEEE 802.1p
  - IEEE 802.1Q
  - Independent VLAN learning (IVL)
  - Ingress filtering for IEEE 802.1Q VLAN security
  - VLAN-based packet filtering
  - MAC-based VLAN
- Source Port Filtering
  - Egress port block masks
  - Trunk group blocking masks
- Storm Control Per-Port:
  - Unknown unicast packet rate control
  - Broadcast packet rate control
  - Multicast packet rate control
- Spanning Tree:
  - IEEE 802.1D spanning tree protocol (single spanning tree per port)
  - IEEE 802.1s for multi spanning trees
  - IEEE 802.1w rapid spanning tree protocol-delete and/or replace per:
    - Port
    - VLAN
    - Port, per VLAN
  - Spanning tree protocol packets detected and sent to the CPU
- Double-Tagging:
  - Unqualified learning/forwarding
  - IEEE 802.1 Q-in-Q
- Mirroring
  - Ingress/egress mirroring support
  - Mirror-to-port receives the unmodified packet for ingress mirroring
  - Mirror-to-port receives the modified packet for egress mirroring

- Content Aware Filter Processing
  - Intelligent Protocol Aware processor with backward-compatible, byte-based classification option
  - Parses up to 128 bytes per packet
  - -512 ACL rules support
  - Multiple matches and actions per packet
  - ACL-based policing
  - Ingress/egress port based filtering
  - MAC destination address remarking
  - Traffic class definition based on the filter
  - Programmable meters allows policing of flows
  - Metering granularity from 64 Kbps to 1Gbps
  - Multiple look-ups per packet
  - Metering support on ingress ports and CPU queues
- QoS Features
  - Four CoS queues per port
  - Per-port, per CoS drop profiles
  - Port level shaping
  - Traffic shaping available on CPU queues
  - Programmable priority to CoS queue mapping
  - Provides two levels of drop precedence per queue
  - Strict Priority (SP), Weighted Round Robin (WRR), and Deficit round Robin (DRR) mechanisms for shaped queue selection
- DSCP
  - DSCP-based prioritization
  - Back pressure metering
  - DSCP to IEEE 802.1p mapping
- Port Security
  - Per port blocking
  - Supports IEEE 802.1x
  - MAC address blocking
- DoS Prevention
  - Denial of Service detection/prevention
- Management Information Base
  - SMON MIB, IETF RFC 2613
  - RMON statistics group, IETF RFC 2819
  - SNMP interface group, IETF RFC 1213, 2836
  - Ethernet-like MIB, IETF RFC 1643
  - Ethernet MIB, IEEE 802.3u
  - Bridge MIB, IETF RFC 1493

Enhanced 1.5 Gbps and 3.0 Gbps SAS/SATA Expander

The on-board SAS Expander fabric routes a SAS port to each of the AMC slots. The SAS Expander fabric also has an interface on the front for the expansion to a JBOD via the front panel I-PASS connector. The Embedded enclosure Management Controller (EMC) configures and monitors the fabric and provides status to the Carrier Manager.

The fabric is fully non-blocking and supports independent connections on all PHYs simultaneously. The 64-bit SAS destination address for each PHY is initially determined automatically by the link layer identification sequence following link reset. By default, the Expansion Connection Manager (ECM) connection table is configured to use the direct routing attribute for connection to devices identified as end devices.

The fabric also supports table routing, which requires the expander to configure and report its routing table contents during the discovery process.

Key features:

- ANSI T10 SAS 1.1 compliant
- Non-blocking switching architecture
- Flexible address based zoning compliant withT10 SAS 2.0 (March 2006)
- Table routing (up to 512 destination addresses), supporting expander device sets (simple cascades)
- SMP and SSP virtual PHY target/initiator capability
- STP/SATA bridging (one per PHY)
- STP Initiator capability
- Variable wide-port capability

Telcom, GPS and Fabric Clocks

The µTCA specification defines a set of clocks for Telcom and non-Telcom applications. The VadaTech UTC001 has the most sophisticated clocking distribution in the market to meet the most stringent requirements such as wireless infrastructure, high speed A/D, etc. The UTC001 has three types of clocks defined:

- Telcom clock
- GPS clock
- Fabric clock

The UTC001 has two SMA clock connectors on the front panel. One is used as an external reference clock and the second one is an output for expansion. This provides the most flexibility to the overall system architecture.

Telcom Clock T1/E1/SDH Stratum 3 Redundant System Clock Synchronizer

The SDH/PDH System Synchronizer contains a DPLL which provides timing and synchronization for SDH and T1/E1. The module generates SBI, ST-Bus and other TDM clock and framing signals that are phase locked to any of the AMC clocks, BITS via the front panel SMA connector or to the system master-clock. The reference clock is a Stratum-3 TCXO. The module monitors its references for frequency accuracy and stability and by maintaining tight phase alignment between the master-clock and slave-clock outputs even in the presence of high network jitter.

Key features:

- Synchronizes to clock-and-sync pair to maintain minimal phase skew between the master-clock and the redundant slave-clock
- ITU G.813 option 1, G.823 for 2048 kbit/s and G.824 for 1533kbit/s interfaces
- Telcordia GR-1244-Core stratum 3/4/4E
- ANSI T1.403 and ETSI ETS 300 011 for ISDN primary rate interface
- Accepts three input references and synchronized to any combination of 2 KHz, 8 KHz, 1.544 MHz, 2.048 MHz, 8.192 MHz, 16.384 MHz or 19.44 MHz inputs
- Provides a range of available clock outputs to the backplane and front panel connector: 1.544 MHz (DS1), 2.048 MHz (E1), 3.088 MHz, 16.384 MHz, and 19.44 MHz (SDH), and either 4.096 MHz and 8.192 MHz or 32.768 MHz and 65.536 MHz, and a choice of 6.312 MHz (DS2), 8.448 MHz (E2), 44.736 MHz (DS3) or 34.368 MHz (E3)
- Provides 5 styles of 8 KHz framing pulses and a 2 KHz multi-frame pulse
- Holdover frequency accuracy of $1x10^{-8}$
- Selectable loop filter 1.8 Hz, 3.6 Hz or 922 Hz
- Less than 24 psrms intrinsic jitter on the 19.44 MHz output clock, compliant with GR-253-CORE OC-3 and G.813 STM-1 specifications
- Less than 0.6 nspp intrinsic jitter on all output clocks and frame pulses
- Manual or Automatic hitless reference switching between any combination of valid input reference frequencies
- Provides Lock, Holdover and selectable Out of Range indication
- Front panel Reference Good and PLL Locked LED indicators

GPS Clock

The UTC001 can take GPS 1 PPS in and create a 30.72MHz clock (Frequencies from 8MHz to 52MHz are available, default is 30.72MHz) which is phased aligned. The clock complies with Telcordia's GR-1244-Core for Stratum 3 applications which ensures precise network timing and synchronization. It can be utilized in wireless applications such as Worldwide Interoperability for Microwave Access (WiMAX). The module can output any of the available clocks via the front panel clock output at the customer's request.

If the GPS 1 PPS is lost the module will automatically enter a holdover mode to maintain timing.

Key features:

- 30.72MHz* frequency / phase-synchronized based on the GPS 1 PPS
- On board Stratum-3 VCTCXO
- Holdover in case of loss of signal from GPS
- Provides a buffered 1 PPS output
- Front panel Reference Good, Frequency Locked, and Phase Locked LED indicators

*The 30.72MHz is the default configuration for WiMAX applications. Frequencies from 8MHz to 52MHz are available.

Fabric Clock

The UTC001 has the capability to provide Fabric clocks. The Fabric clocks are HCSL and run at 100MHz with a very low Jitter to meet the PCIe Gen 2 specification.

Key features:

- 0.7V Current mode differential HCSL output
- Output frequency of 100MHZ
- RMS period Jitter 3 ps (maximum)
- Cycle-to-cycle jitter: 35 ps (maximum)
- Spread Spectrum capable for EMI reduction

Fabrics on Tongue Three and Four

The UTC001 supports the following fabrics on tongue three and four:

- PCIe Gen 2
- 10 GbE layer three managed (option for unmanaged)
- SRIO

PCIe Gen 2

The PCIe fabric is Gen 2 and is non-blocking on all the ports. It further allows expansion to another µTCA chassis or other systems via the front panel I-PASS connector. PCIe Gen 2 allows 5 Gbps on each link, which is twice the speed of Gen 1 at 2.5 Gbps.

Each of the AMCs receives 4 lanes of PCIe which each AMC can negotiate down to PCIe Gen 1 independent of other ports. This allows modules in the system to be mix of Gen 1 and Gen 2 PCIe.

Key features:

- 48 Lanes with 12 independent ports
- Fully non-blocking
- Dynamic speed negotiation (2.5 or 5.0 Gbps)
- Dynamic link width negotiation
- Non-Transparent bridging capability
- Enable Dual-Host, Dual-Fabric, and Host-Fail-over applications
- 480 GT/s aggregated bandwidth
- Cut-Thru packet latency of less then 140ns

10 GbE Layer 3 Managed switch

The 10GbE switch fabric is layer three managed and each of the AMC modules has a 10GbE interface to the Fabric. Further there is an uplink port on the front I-PASS connector for expansion. This allows expansion to another chassis or uplink to an external switch. This switch has the richest set of features in the market by running carrier grade management software under Linux.

Key features:

- Spanning Tree Protocol (STP)
- Rapid Spanning Tree Protocol (RSTP)
- Multiple Spanning Tree Protocol (MSTP)
- Virtual LANs (VLANs)
- Generic Attribute Registration Protocol (GARP)
- Generic Multicast Registration Protocol (GMRP)
- Generic VLAN Registration Protocol (GVRP)
- Port Authentication
- Internet Group Management Protocol (IGMP) (Version 1, 2, and 3) Snooping/Proxy
- Multicast Listener Discovery (Version 1, 2) Snooping/Proxy
- Provider Bridging IEEE802.1 ad/D6.0
- Multiple Registration Protocol (MRP) IEEE802.1ak/D4.0
- Multiple multicast Registration Protocol (MMRP) IEEE802.1ak/D4.0
- Multiple VLAN Registration Protocol (MVRP) IEEE802.1ak/D4
- Link Layer Discovery Protocol IEEE802.1AB 2005

- Ethernet OAM IEEE 802.3ah -2004 clause 57
- Connectivity Fault Management IEEE802.1ag -d6.0
- Link Aggregation - Static; IEEE802.3ad (2002); IEEE8023 LAG-MIB
- Open Shortest Path First (OSPFv2/OSPFv3)
- Routing Information Protocol (RIP/RIPng)
- Border Gateway Protocol (BGP4/BGP4+)
- Intermediate System-to-Intermediate System (IS-IS)
- Multi Protocol Label Switching (MPLS)
- ReServation Protocol - Traffic Engineering (RSVP-TE)
- Label Distribution Protocol
- Diffserv (RFC 3270 and RFC 4124)
- Layer 3 VPN RFC2547bis: MPlS BGP VPN
- Layer 2 VPNs
- MPLS OAM (RFC 4379)
- Protocol Independent Multicast - Sparse Mode (PIM-SM)
- PIM Boot Strap Router (BSR)
- PIM-source specific Multicast (PIM-SSM)
- PIM-Dense Mode (PIM-DM)
- Distance Vector Multicast Routing Protocol (DVMRP)
- IP Multicast MIBs
- Internet Group Management Protocol (IGMP)
- Multicast Listener Discovery (MLD)
- Virtual Router Redundancy Protocol (VRRP)

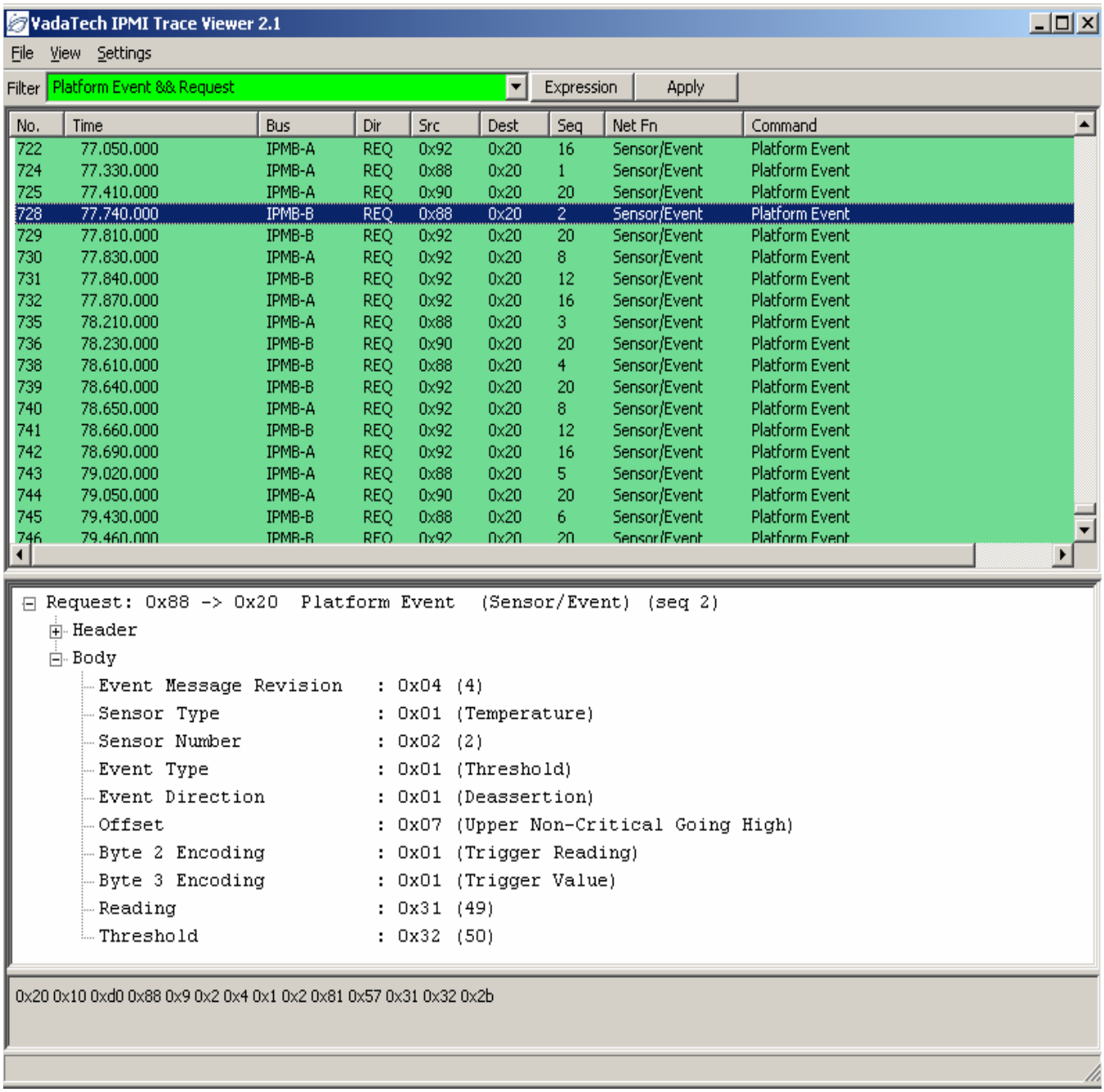
SRIO Fabric

The SRIO switch Fabric supports revision 1.3 of the RapidIO Interconnect Specification. There are two SRIO chips (40 lanes each) on-board connected back to back via x8 lane. All the 12 AMC slots have an x4 connection. Four of the AMC can be configured as four x1 ports or a single x4 ports. Also there is SRIO x4 coming to the front via I-PASS for expansion. Further there is an SRIO x4 lane that goes to the update channel to the second MCH.

Key Features:

- Port frequency configuration from 1.25, 2.5 and 3.125 Gbits/s
- 100Gbps of switching bandwidth per switch Fabric
- 64,000 Endpoints through hierarchical lookup
- Independent unicast and multicast routing mechanism
- Supports up to 40 simultaneous multicast masks per fabric chip
- Error management extensions
- All configurations are via I2C bus
- Packet Trace function: It allows filtering out packets that contain a match

FIGURE 3: Viewing a captured trace when running the UTC001 as an IPMI Protocol Analyzer



Running the UTC001 as the protocol analyzer allows monitoring, injecting, capturing and validating I^2C traffic on any of the Intelligent Platform Management Busses (IPMB). A Graphical User Interface (GUI) validates and displays the IPMI packets or schedules IPMI messages for injection into the system. The GUI application communicates with the integrated UTC001 IPMI controller through an Ethernet port.

ORDERING OPTIONS

UTC001 - ABC - DEF - GHJ

A = Management Software

1 = MCMC
2 = MCMC and Shelf Manager
3 = Protocol Analyzer

B = GbE Switch

0 = None
1 = Managed Layer Two GbE

C = SAS/SATA Switch

0 = None
1 = SAS/SATA

D = Fabric Switch

0 = None
1 = PCIe *
2 = SRIO
3 = Layer 3 Managed 10GbE
4 = Unmanaged 10GbE

E = Telcom/GPS Clock

0 = None
1 = Telcom TCXO**
2 = GPS VCTCXO** 30.72MHz†
3 = GPS VCTCXO** 10.00MHz†
4 = Reserved
5 = Reserved

F = Fabric Clock

0 = None
1 = Fabric 100MHz HCSL
2 = Reserved
3 = Reserved
4 = Reserved
5 = Reserved
6 = Reserved

G = Fabric B ports Configuration

0 = None
1 = Fabric clock shared with Fabric B (SAS)
2 = Telcom clock shared with Fabric B (SAS)
3 = No clocks - all Fabric B (SAS)
4 = Reserved
5 = Reserved

H = Operating Temp

1 = Commercial
2 = Industrial

J = Conformal Coating

0 = None
1 = Humiseal 1A33 Polyurethane
2 = Humiseal 1B31 Acrylic

*When PCIe with expansion to the front is needed the second AMC slot will not have PCIe
**The Crystal Oscillator is Stratum-3; for lower cost solution contact VadaTech Sales.
†Frequencies from 8MHz to 52MHz are available.

Photo taken with the 10GbE Managed Switch

Photo taken with the SRIO Switch

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