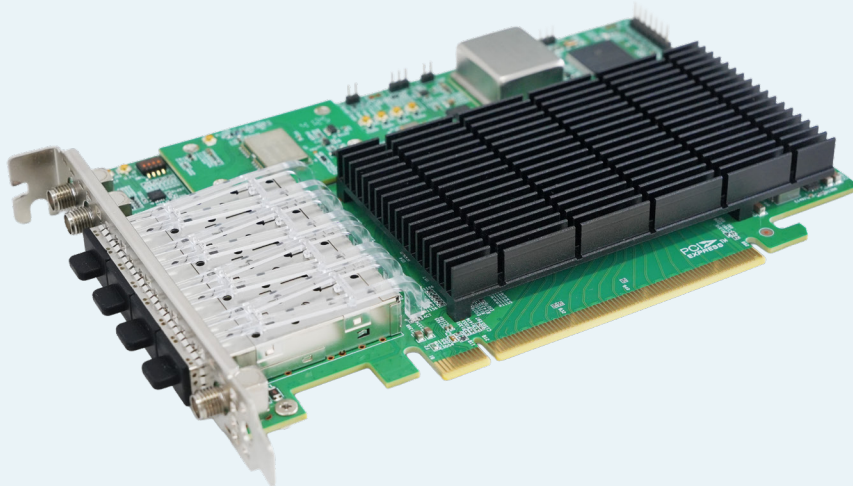


T221-N Time-Synchronized Ethernet Network Card

IEEE 1588 PTP, SyncE, and GNSS enable high-precision timing synchronization.

The T221-N Time-Synchronization Ethernet Network Card is a professional-grade PCIe network interface card designed for next-generation high-precision time synchronization networks. Based on the Intel® Ethernet Controller E810 architecture, it integrates IEEE 1588v2 PTP, SyncE, GNSS time source inputs, and a high-precision DPLL clock system, enabling nanosecond-level time alignment capabilities in complex network environments.

This product is designed for 5G fronthaul/medium-haul networks, high-frequency trading systems in the financial sector, power synchronization systems, industrial automation, and distributed computing infrastructure in data centers. It can be deployed as a PTP master clock (GM), a boundary clock (BC), or a time slave clock (Slave/Time Receiver).



core advantage

- ✓ **Multi-protocol unified time synchronization architecture**
 - Simultaneously supports IEEE 1588v2 PTP, SyncE, and GNSS, with L2/IPv4/IPv6 PTP transmission capabilities.
 - Supports deployment in multiple roles: GM / BC / TC / Slave
- ✓ **Multi-Physics Synchronization Interface**
 - SMA1/SMA2 dual-channel, configurable for 1PPS / 10MHz
 - U.FL1 / U.FL2 onboard sync interface (independent input/output)
 - GNSS external antenna, SMB interface (optional module)
- ✓ **Ultra-High-Precision Hardware Clock Architecture**
 - Integrated PHC (PTP Hardware Clock)
 - The built-in high-precision DPLL dual-loop architecture (EEC / PPS)
 - supports OCXO high-stability clocks and holdover mode.
- ✓ **Industrial-grade time recovery capability**
 - Maintains high stability even after GNSS loss, utilizing a hybrid redundant time source of Holdover
 - SyncE + PTP.
 - Automatic optimal DPLL input source switching mechanism

basic feature

Supported data rates	25/10/1 GbE per port
Bus Type and Dimensions	PCIe 4.0 x16, 167.17 × 110.7 (total height, half length)
Connector	Two coaxial connectors, each configurable for 1PPS (one pulse per second) input or output.
	A coaxial connector is used to connect an external active GNSS antenna.
Controller	Intel E810–CAM1

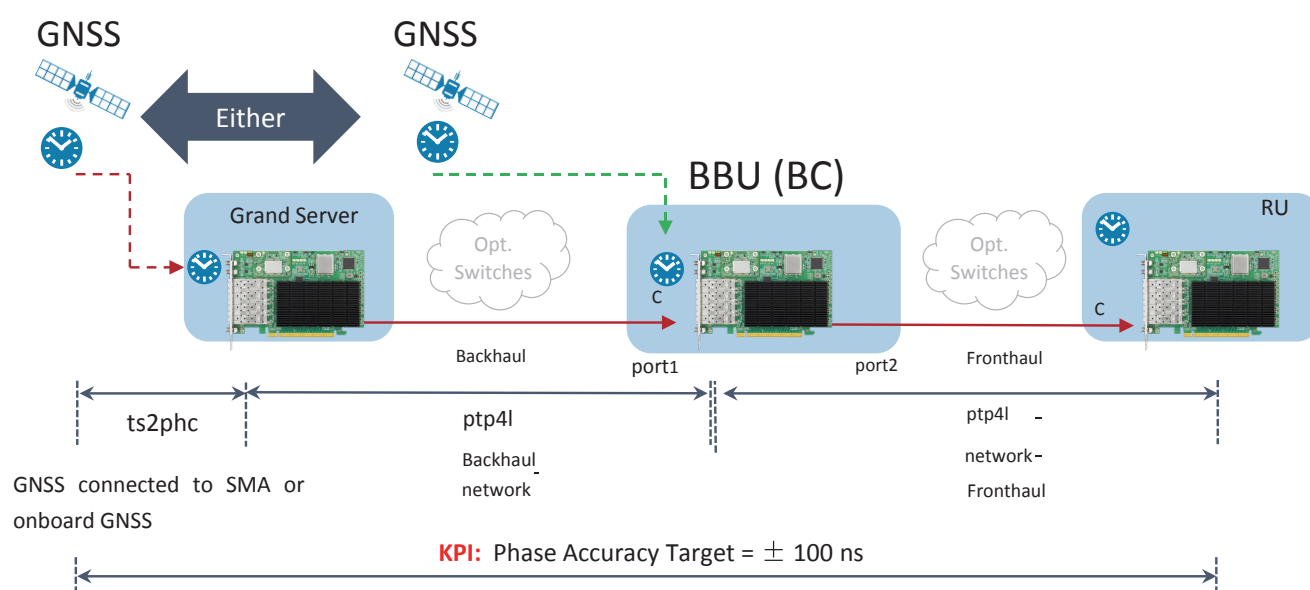
Supported physical layer interfaces

	25Gbps	10Gbps
DACs	25GBASE-CR(802.3by 25Gb Twinax)	SFP+ Twinax
Optics and AOCs	25GBASE-SR 25GBASE-LR	10GBASE-SR 10GBASE-LR

Application in networks

PCIe High-Precision Time-Synchronization Network Card

- PCIe card-based high-performance time synchronization network card, providing servers with a unified time reference featuring nanosecond-level precision.
- Achieve high-precision time, frequency, and phase synchronization among DU/CU/RU devices in 5G fronthaul and midhaul networks.
- Supports PTP (IEEE 1588v2), SyncE, and GNSS multi-source fusion to achieve network-level time consistency.
- Time alignment for AI training, distributed storage, and computing resource scheduling within data centers and cloud computing clusters
- In financial high-frequency trading systems, achieve microsecond-to-nanosecond-level timestamp consistency for order matching, market data reception, and log auditing.



For more information, please visit WWW.BDPNT.COM.
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Should there be any changes to the product specifications, Nu will not provide separate notice.

Clock synchronization

- 4-port SFP28 for 25G/10GbE
- Supports PTP Transparent Clock (TC), Boundary Clock (BC), and OC (Master/Slave)
- PTP Based on IPv4 (IEEE-1588v2) / SyncE
- GNSS integration support enables frequency, phase, and time synchronization across global navigation satellite systems.
- Dual-channel SMA (10 MHz/1 PPS) input and output are configurable.
- Leveraging industry-leading DPLL technology, high-precision clock solutions
- Complete hardware and software time synchronization solution for PTP1588
- High-precision OCXO with a tolerance of ± 5 ppb, maintaining a timing accuracy of $< 1.5 \mu\text{s}$ for 4 hours without the need for an external reference source.

LAN and virtualization features

- RDMA : Supports iWARP and RoCEv2, with the ability to selectively configure each port.
- SR-IOV (Single-Channel I/O Virtualization): 8 PF, 256 VFs, 768 VSI, 256 queues per PF, 2 K queues
- DPDK : Supports advanced packet forwarding and efficient packet processing

Packet Processing

- Enhanced Data Plane Development Kit (DPDK)
- Parser
 - Analyzing up to 504B of data packets
 - Based on Parse Graph
 - Based on Parse Graph
 - Based Programmable Parsing Engine
- Binary Classifier (VEB Switch)
 - 768 switch ports (VSI)
 - Programmable forwarding rules
 - Storm Control
- ACL
 - 8K Programmable TCAM
 - Tiling capability to $n \times 40\text{b}$ width
- Classification Filters
 - Hash-Based Statistical Distribution
 - Flow control based on Intel® Ethernet flow controller
 - Flow identification based on iWARP and RoCE
 - Programmable Rules
- Modifier
 - Insertion (TX), removal (RX), and modification of data packets in VLANs
 - L3 and L4 checksums and CRC

Virtualization

- Perform host virtualization using VMDQ and SR-IOV
- Up to 256 SR-IOV VFs
- Stateless tunnel packet offloading (supported by network virtualization)
- Malicious VF protection
- Virtual Machine Load Balancing (VMLB)
- Advanced Packet Filtering
- VLAN support; can be inserted and stripped. And filter up to 4,096 VLAN tags
- VxLAN, GENEVE, NVGRE, MPLS, VxLAN-GPE

RDMA

- iWARP and RoCEv2
- 256K queue pair
- Send queue push mode
- A WFQ transmitter scheduler with nine programmable levels
- Pipeline sharing and starvation avoidance
- Implement QoS using 802.1p PCP or DSCP values.
- Packet shaping

Manageability

- An SMBus operating at speeds up to 1 Mb/s
- An NC-SI 1.1 interface compliant with the DMTF standard, operating at 100 Mb/s
- Via MCTP over PCIe and SMBus
- Through an enterprise-grade management solution via the local BMC
- SNMP and RMON statistics counters
- PLDM
 - PLDM monitoring via MCTP
 - PLDM firmware update
 - PLDM for RDE
- Firmware management protocol support

technical specifications

- Storage humidity: Maximum relative humidity at 35 °C: 90% (no condensation)
- Storage temperature: -40 °C to 70 °C
- Operating temperature: 0 °C ~ 55 °C
- Maximum power consumption: 23.22 W (25GbE Max)