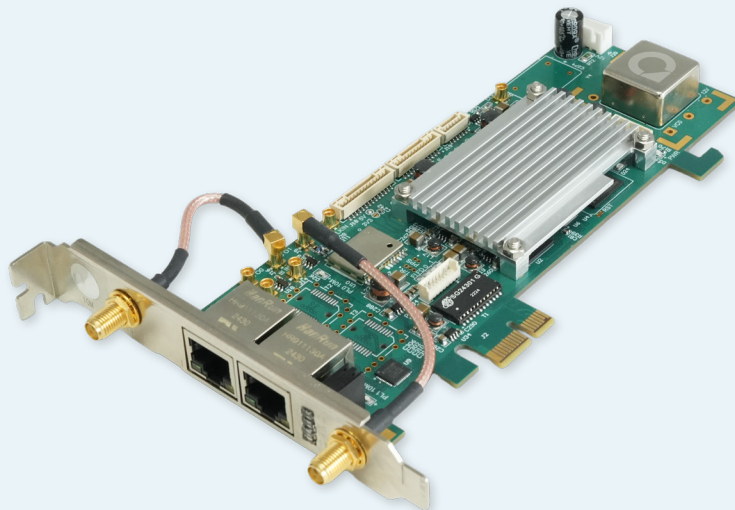


T220-C PCIe Timing Card

Half-height PCIe card, PTP master-slave clock, NTP/B-code/PPS/TOD synchronization

Modern computer systems perform real-time processing, data acquisition, communication control, and task scheduling, which imposes higher requirements on time synchronization. The T221 PCIe Timing Card is designed for servers, industrial PCs, and embedded computing platforms; it can be directly inserted into standard PCIe slots to provide the host system with accurate time, timing interrupts, and a variety of timing interfaces. The product supports satellite timing and can connect to reference sources such as B-code, PPS+TOD, or PTP; in the event of a reference failure, it automatically switches to other valid sources, ensuring continuous synchronization capability in field deployments.

The T220-C PCIe card supports PTP master-slave clocking, NTP services, SyncE, PPS pulses, TOD time information, IRIG-B codes, and optional frequency outputs. The card features a high-stability, temperature-stabilized crystal oscillator that can be synchronized with an external reference; in the event of satellite signal loss, network anomalies, or reference interruptions, it enters a time-keeping state to continue providing a reliable time reference. Via the PCIe bus, applications can read the card's time, synchronize their local time, and invoke APIs to implement periodic interrupts and timed alarm interrupts. This card is suitable for applications in communications, rail transit, industrial automation, aerospace, radio monitoring, and time-frequency comparison scenarios.



our advantages

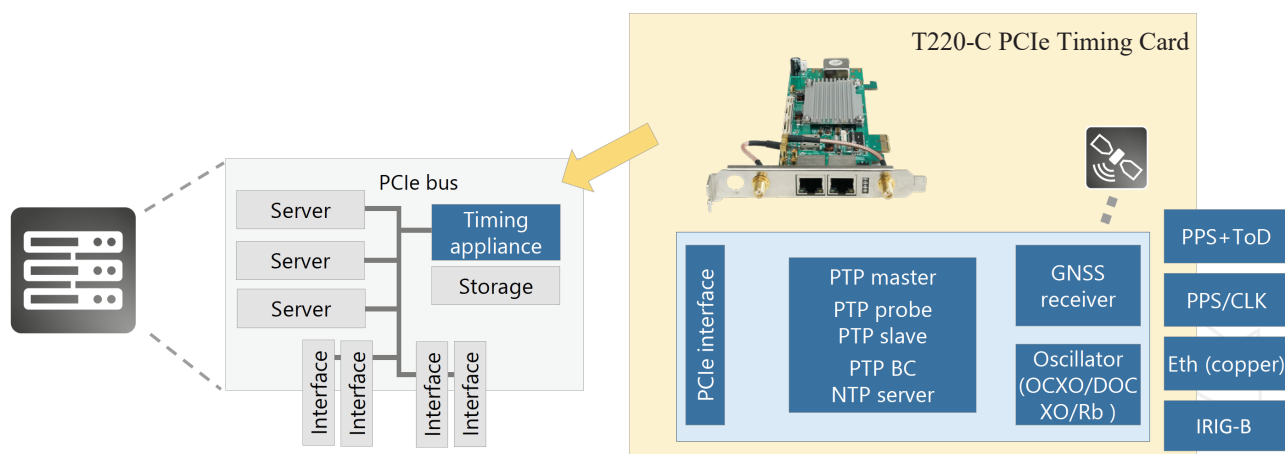
- ✓ **Standard PCIe timing card**
Mid-height, elongated design; PCIe x1 compatible with x4/x8/x16 slots; suitable for servers, industrial PCs, and embedded computing platforms.
- ✓ **Extensive synchronous interfaces**
Supports PTP, NTP, SyncE, 1PPS, TOD, IRIG-B, and optional 10 MHz output, meeting the unified timing requirements of diverse devices.
- ✓ **Multi-source automatic switching**
GPS/BD, PTP, B-DC, or 1PPS+TOD may be used as time references, with the reference source automatically switching from an abnormal to a valid source.
- ✓ **High reliability and punctuality**
Features a built-in high-stability temperature-stable crystal oscillator with clock discipline support; continues to operate continuously even when triggered by an external reference interrupt, thereby enhancing system reliability.
- ✓ **Open software interfaces**
Provides drivers, API interfaces, and test utilities, supporting card time reading, PC synchronization, periodic interrupts, and timer alarm interrupts.
- ✓ **Flexible customization and domestic adaptation**
Supports Windows, Linux, and Kylin operating systems; enables custom driver development for VxWorks, Windows RTX, and other platforms; and supports domestic manufacturing.

Key Features • Integrated GPS/BD satellite timing • Supports PTP master/slave clocks • Integrate NTP time synchronization service • Supports SyncE synchronous Ethernet • B-DC, 1PPS+TOD: optional input/output • Optional local high-precision 10 MHz frequency output	PCIe card physical dimensions • PCIe X1 compatible with X4 / 8 / 16 slots • Supports Gen2, while also supporting Gen1/Gen3 bus speeds • Half-height, half-length configuration, compatible with servers, industrial PCs, and embedded hosts.	PTPfunction • Supports the IEEE1588v2-2008 protocol • Supports PTP master and slave clock configurations • Default single master-single slave operation mode • Supports UDP and ETH transmission modes • Supports E2E and P2P time-sync modes • RJ45 interface, with customizable SFP interface
Synchronization accuracy • GNSS satellite timing accuracy ≤ 20 ns • The timing accuracy of PTP is better than 100 ns. • The B-DC input synchronization accuracy exceeds 100 ns. • 1PPS output precision ≤ 20 ns • Supports ± 1000 ns phase adjustment	Management and Software Interface • Provide drivers, API functions, and test utilities • Support for API to read board time • Supports automatic synchronization of computer system time • 4-channel periodic interrupt; 4-channel alarm interrupt • Supports web-based configuration and online firmware updates.	Built-in GNSS and timing • Supports GPS/BD multi-mode receiver • Supports L1 and B1 frequency bands • Built-in high-stability temperature-stabilized crystal oscillator

Application in networks

PCIe timing card

- PCIe can be directly inserted into server, industrial PC, or embedded host PCIe slots, providing standardized, reliable, and high-precision time synchronization for computer systems.
- Achieve precise synchronization of critical equipment and time-sensitive software applications in domains such as mobile networks, critical infrastructure, power facilities, and specialized broadcasting.
- Perform time, frequency, and phase synchronization with PTP, NTP, SyncE, and TOD.
- No external synchronization equipment required
- The optimal choice for achieving direct management integration through open-mode control.



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Should there be any changes to the product specifications, Nu will not provide separate notice.

timekeeping performance

	Clock	Aging / Day 30	Temperature stability
Standard OCXO	Standard punctual type	$\pm 5 \times 10^{-10}$	$\pm 50 \times 10^{-10}$
Ultra-high stability DO-CXO	High-stability environment type	$\pm 5 \times 10^{-11}$	$\pm 1 \times 10^{-11}$
Rubidium atomic clock	Punctual type	$\pm 8 \times 10^{-12}$	$\pm 5 \times 10^{-10}$

* Note: Effective daily aging is conducted one month after the equipment is energized.

	200nsec	400nsec	1.1usec	1.5usec	5usec	10usec	16ppb
StandardOCXO	1 hours	2 hours	4 hours	5 hours	8 hours	1 days	1 month
Ultra-high stability DO-CXO	5.5 hours	8.5hours	15 hours	18 hours	1.4 days	2 days	10 month
Rubidium atomic clock	12 hours	1days	3days	4days	8days	10days	5 years

* Note: The above values represent typical values (1 σ confidence level) assuming a controlled temperature environment after the device has been powered on and the GNSS72 has been locked for 72 hours. Due to the superior temperature stability of the High-Stability Environment Model, when significant temperature fluctuations occur, the retention rate of the High-Stability Environment Model will exceed that of the rubidium clock.

Primary Applications

- 1588v2 PTP Master and Slave Clocks
- PTP to Sync-E
- A GNSS receiver operating in both PRTC and PRC modes
- NTP server

PTP Master Clock Operation Mode

- PTP Telecommunications Configuration File:
 - ITU-T G.8265.1 & Telecom 2008: Frequency Transport Functions
 - ITU-T G.8275.2: Time/Phase Transport Functions
 - ITU-T G.8275.1 Time/Phase Transport Function (Full time-domain support) for DOCSIS 3.1
- PTP Enterprise Functions (Hybrid IP Multicast and Unicast)
- PTP for power and public utilities:
 - IEC/IEEE 61850-9-3
 - IEEE C37.238-2011
 - IEEE C37.238-2017
- PTP Broadcast and Media Functions:
 - SMP TEST 2059-2
 - AES67 media profile

PTP feature

- Up to 64 unicast PTP clients, with a rate of 128 pps
- Complete IEEE 1588-2008 PTP master and slave clock
- Auxiliary Partial Timing Support (APTS) – PTP input: used when GNSS signals are lost or unavailable.
- Dedicated or generic IP PTP interface
- Sync-E to PTP output (frequency) conversion
- Conversion between PTP configuration files
- Maintain PTP from the list

PTP slave operation mode

- PTP for power and public utilities:
 - IEC/IEEE 61850-9-3
 - IEEE C37.238-2011
 - IEEE C37.238-2017
- PTP Telecommunications Configuration File
 - ITU-T G.8265.1 & Telecom 2008: Frequency Transfer Function
 - ITU-T G.8275.1 Time/Phase Transfer Function (APTS: partial timing support in BMCA and automatic asymmetric compensation between two remote hosts)
 - ITU-T G.8275.1 Time/Phase Transport Function (full time-domain support)
- IEEE 1588v2 default PTP configuration profiles: L3 (Appendix D) and L2 (Appendix F)
- PTP Enterprise Functions (Hybrid IP Multicast and Unicast)

SyncE

- Complies with the relevant provisions of ITU-T G.8261 / G.8262 / G.8264
- Supports input and output ports
- G.811 Compliant Sync-E Master Reference Clock (PRC) when locked to GNSS
- Ethernet Synchronous Message Channel (ESMC)
- The SyncE input provides holdover functionality in the event of a GNSS interruption.



NTPserve

- The smallest NTP server
- NTP server with hardware-based security
- GNSS Tier-1 time server
- NTP v1, v2, v3, v4, and SNTP IPv4/IPv6
- Time & Date Agreement
- NTP responder with hardware-based DoS protection
- Up to 10,000 responses per second
- Supports both PTP and NTP services on the same port
- Transition from PTP to NTP
- PTP backup in the event of a GNSS interruption
- Fixed or mobile platform

GNSSreceiver

- Supports single-mode, dual-mode, and multi-mode operation with BDS/GPS (including QZSS), GLONASS, and GALILEO; defaults to dual-mode operation with BDS+GPS.
- Supports BDS B1I+B1C+B2a, GPS/QZSS L1+L5, GLO L1, and GAL E1+E5 frequency bands.
- Supports AGNSS-assisted positioning
- Features interference detection and alert functionality.
- Positioning accuracy: horizontal <2 m; vertical <3 m
- Cold start: 30s; Hot start: 2s; Recapture: 1s; Timing accuracy: <20 ns

External antenna

- Users can configure antenna cable delay compensation.
- Antenna voltage: +3.3 VDC
- Antenna connector: SMA-F (50 Ω)

Time and phase accuracy

- G.8272/G.8273.1: Compatibility with PRTC ((±100 nsec relative to UTC; MTIE <100 nsec) when locked to GNSS)
- During GNSS interruption: use the G.811PRC/G.8272 PRTC SyncE input for time transfer.
- Traceable to G.811PRC: Time error <UTC ±1 μs over 24 hours
- Traceable to G.8272PRTC: time error <UTC ± 1 μs over 72 hours

IRIG-B Input/Output (Optional)

- Route: Route 1 (DC);
- Interface: RS422;
- Standard: IEEE Std 1344-1995/GJB 2991A-2008;
- Phase shift: ±1000 (ns);
- Synchronization accuracy: better than 100 ns;
- Connection type: Remo interface.

1PPS+TOD output (optional)

- Route: Route 1;
- Interface: TTL (1PPS), RS232 (TOD);
- Port rates: 1200/2400/4800/9600/38400/57600/115200 can be configured;
- Synchronization accuracy: better than 100 ns;
- Format: ZDA statement, NMEA 0183 protocol; Connection method: REMO interface.

meet a criterion

- ITU-T G.8261, G.8262, G.8264
- ITU-T G.8265.1, G.8275.1, G.8275.2
- IEEE 1588v2 (PTP)
- RFC 1059 (NTPv1), RFC 1119 (NTPv2),
- RFC 1305 (NTPv3), RFC 5905 (NTPv4),
- RFC 4330 (SNTPv4)
- RFC868 (TIME), RFC867(DAYTIME)
- EN 55024
- EN 55022 Class-B
- IEC/EN 61000-3-2
- IEC/EN 61000-3-3
- IEC/EN 61000-4-3 (RI)
- IEC/EN 61000-4-4 (EFT): 1 kV / 50 A (5/50 ns)
- IEC/EN 61000-4-5 (Surge): 4kV (10/700 μs)
- IEC/EN 61000-4-6 (CI)

Physical and environmental parameters

- Power supply: 12V, gold-plated header connection;
- Power consumption: ≤ 15 W;
- Dimensions: half-height, half-length specification, 68.9 × 167.65 mm;
- Humidity: ≤ 95%, no condensation;
- Operating temperature: -30 °C to +60 °C;
- Storage temperature: -40 °C to +80 °C.

