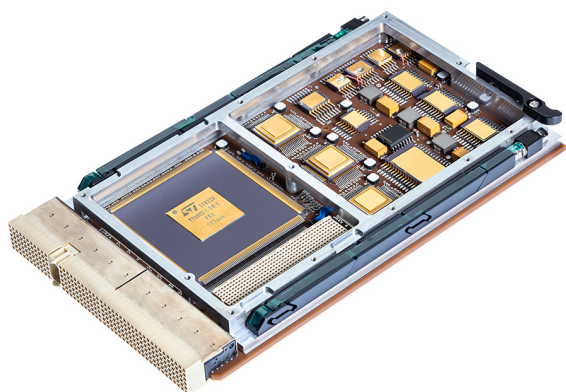




## TTEnd System Space 3U cPCI

TTEthernet® interface card with three Ethernet ports for use in space



### Key Benefits

- ✓ 3x 1000BASE-T/100BASE-TX Ethernet ports
- ✓ Safe partitioning between IEEE 802.3, rate-constrained and time-triggered Ethernet traffic (SAE AS6802)
- ✓ Interfaces TTEthernet® to PCI, SPI or SpaceWire host devices
- ✓ Fault-tolerant communication with high bandwidth utilization

The TTEnd System Space 3U cPCI connects spacecraft subsystems to the TTEthernet® network and was specifically designed to meet the challenges of harsh space environments.

### TTEnd System Space 3U cPCI

The TTEnd System Space 3U cPCI interface card connects user data processing hardware to the TTEthernet® network. The card is built in a compact cPCI 3U form factor as an off-the-shelf product. TTEthernet® permits the use of synchronized and non-synchronized functions of distributed systems in the same Ethernet network. System-critical real-time functions enjoy reserved bandwidth, full determinism and delivery jitter below 1  $\mu$ s. The network can transfer high data rates of non-critical data at the same time – with no impact on critical traffic. This is achieved by a combination of SAE AS6802 time-triggered, rate-constrained and IEEE 802.3 Ethernet. The end system has an internal frame memory of 512 kb to buffer incoming traffic.

### Innovation meets Heritage

This product is designed, qualified, and manufactured with RUAG Space, leveraging on an extensive heritage of successful space products.

### Host Interfaces

The following host interfaces are supported:

- PCI 32 Bit V2.1 33 MHz
- SPI/QSPI up to 250 Mbit/s
- SpaceWire RMAP 100 MHz

A UART/DSU interface is available for debugging and on-ground configuration.

### Built for modular cPCI Architectures

The TTEnd System Space 3U cPCI was designed for maximum ease of use and reduced development cost. In the development phase, it can be placed in an off-the-shelf cPCI rack, enabling access to all interfaces via a rear-I/O break-out board. The PCI slave interface can be accessed as specified in the cPCI standard at the connector J1. The power supply is set up according to PICMG 2.0 R3. The other host interfaces and Ethernet signals are provided at the cPCI J2 Connector and can be routed through a customized backplane for each specific use case.



### Application Fields

- Human Space Flight
- Telecommunication
- Earth observation
- Reconnaissance

## Redundancy

The TTEnd System Space 3U cPCI supports single to triple channel multi-hop Ethernet networks with system synchronization, redundancy management, fault tolerance, fault isolation and recovery capability. TTEthernet® is specifically designed for active-active redundant systems and the handling of redundant frames (e.g. first valid frame, or triple-voting via host software) can be configured for each device. The TTEnd System Space 3U cPCI supports up to 256 “send” and up to 512 “receive” virtual links which can be separated into eight dedicated memory areas.

## Device and Network Management

The TTEnd System Space 3U cPCI provides an integrated LEON2 management CPU to perform diagnostic services. These internal monitoring functions allow the user to continuously assess the system health and the status of the network. Monitored parameters include synchronization state, supply voltage, board temperatures, dropped/rejected frames and built-in self-test results.

### TTE Driver

A device driver is used to access this network device. This driver depends on the operating system and host platform. Contact TTTech for already available software and eventual porting and qualification in the target environment.

## Product Variants

**13586 /14033 - TTEnd System Space 3U cPCI (EDU):** Functionally representative model for laboratory use.

**13550 - TTEnd System Space 3U cPCI (PROTO):** Flight model design that can be used for qualification, but with reduced parts quality.

**13266 - TTEnd System Space 3U cPCI (FLIGHT):** Design qualified according to ECSS and acceptance tested. Flight-grade model for safety-critical space applications. Built with level-1 grade ceramic parts.

## Applicable Documents

**PICMG 2.0 R3** – compact PCI® specification

**S-311-P-822** – NASA specification, connectors, PWB, 2 mm cPCI™ Style

**ECSS-Q-ST-60C Rev.2** – ECSS, Electrical, electronic and electromechanical (EEE) components

**ECSS-Q-ST-70** – ECSS, Qualification of PCBs

**ECSS-E-ST-40C** – ECSS, Software

**ECSS-E-ST-10-03C** – ECSS, Testing

**ECSS-Q-ST-30C Rev.1-** ECSS, Dependability

## Related Products

- TTERearIO 3U cPCI (EDU)
- TTESwitch Space 3U cPCI
- TTETools

Connectors	cPCI Connector J1	cPCI Connector J2
	<ul style="list-style-type: none"> <li>✓ Supply voltage (+3.3 V)</li> <li>✓ PCI bus</li> </ul>	<ul style="list-style-type: none"> <li>✓ 3x 1000BASE-T/100BASE-TX (magnetics not included, for EDU use magnetics are placed in the RearIO)</li> <li>✓ SpaceWire</li> <li>✓ QSPI</li> <li>✓ UART/DSU I/F for laboratory use</li> </ul>
Lifetime	15 years	
Environmental	<b>Vibration (random, all axes, qualification test levels):</b> 20 – 60 Hz: +3 db/oct, 60-1,000 Hz: 0.273 g <sup>2</sup> /Hz, 1,000-2,000 Hz: -6 db/oct <b>Shock, all axes (qualification test levels):</b> 20 Hz: 20 g, 1,000 Hz: 2,000 g, 2,000 Hz: 3,000 g, 10,000 Hz: 3,000 g <b>Qualification temperature range:</b> Operational range: -35 °C to +75 °C <b>Radiation:</b> TID for 15 years cis-lunar environment, all components SEL free up to 60 MeV/cm2/mg & SEE tested up to 60 MeV/cm2/mg <b>EMC:</b> Acc. to PICMG 2.0 R3	
Power supply	Supply voltage: 3.3 V (according to PICMG 2.0 R3) Power consumption: < 6 W	
Dimensions	3U cPCI form factor (PICMG 2.0 R3), conduction-cooled (ANSI/VITA 30.1-2008)	
Mass	400 g	



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