Endura™ Space Products

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Endura™ Space Products Software Development Unit (SDU)

Modern, Low-Power RAD510™ System on Chip (SoC)-Based Software Development Unit

The Endura SDU provides a platform to enable migration of existing PowerPC application software to more modern hardware and leverages the RAD510™ SoC. The RAD510 SoC is a modern low-power processor. Leveraging a RAD5500™ processor core (a single core configuration of the quad core in the RAD5545® SoC), the Endura single board computer (SBC) provides greatly improved performance, a complete set of interfaces, and enables lower system power as compared to the RAD750® processor.

The 3U version of the Endura SBC design is based on the 3U RAD750 SBC product line, with the radiation-hardened RAD510 SoC as its primary processing component. The 3U SBC is designed for use in command & data handling (C&DH), payload, or bus systems. To support an efficient transition from the 3U RAD750 SBC to the 3U RAD510 SBC, the 3U SDU design is based on the commercial CompactPCI® backplane interface, facilitating early software development in existing test fixtures.

The 3U Endura SDU chassis features the Endura software development computer which has two SpaceWire ports through the cPCI backplane and two SpaceWire ports through separate nine pin micro-miniature D-type connectors on the front panel. The SDU also includes common control and debug interfaces on the backplane, including a SPI controller, universal asynchronous receiver/transmitter (UART) interface, joint test action group (JTAG) initiator interface, and twenty-six backplane general purpose input outputs (IO). A rear transition module (RTM) breaks out the cPCI backplane signals for use during debug and integration. A separately pluggable cPCI Ethernet card provides a standard Ethernet interface to interact with the RAD510 SDU SBC module. An external Black Box provides switch settings to interface with the Endura SBC front panel test connector and breaks out UART and JTAG for debug and test.

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Features and benefits

- A complete SDU including Endura software development computer, chassis, cPCI Ethernet support module, RTM, and black box reset module allows a customer to begin development right away
- Low-cost SDU allows users to get an early start on code development before flight modules are available
- Common test and debug ports aid in software development
- An RTM is included to speed up debugging efforts by making backplane signals accessible in a lab environment
- RAD5500 processor core operating frequency ranges from 66MHz to 462MHz and up to 1386 MIPS, supporting both low power and high-performance applications for enhanced versatility
- Available memory includes SDRAM, MRAM, and NAND flash for program storage and execution
- 26 programmable inputs, outputs, and interrupts provide customers with the flexibility to optimize their mission needs
- 4 accessible ports from the 8-port SpaceWire router supports high transmission speeds of data, up to 396 Mbps on each link

Specifications

Form Factor	6 Slot 3U CompactPCI® Backplane 32-bit/33MHz Parallel PCI Interface
Power Supply	300W Capacity +5V@35A, +3.3V@28A, +12V@18A, -12V@1A
Power Input	120VAC@15A
Processor Modules	Endura™ 3U CompactPCI Software Development Computer (SDC) 2xSpaceWire, 1xTest Interface
Expansion Modules	IO Expansion Rear Transition Module for Endura 3U SDC 2xSpaceWire, 2xSPI, 23xGPIO
Communication Modules	ADLINK cPCI-3E10/3E12 Gigabit Ethernet Peripheral Card 2x1Gb Ethernet
Test Equipment	Endura™ Black Box with USB Interface and Processor Test Connector Cable
Software	VxWorks™ 7 Board Support Package and Startup-ROM

Endura™ 3U CompactPCI®

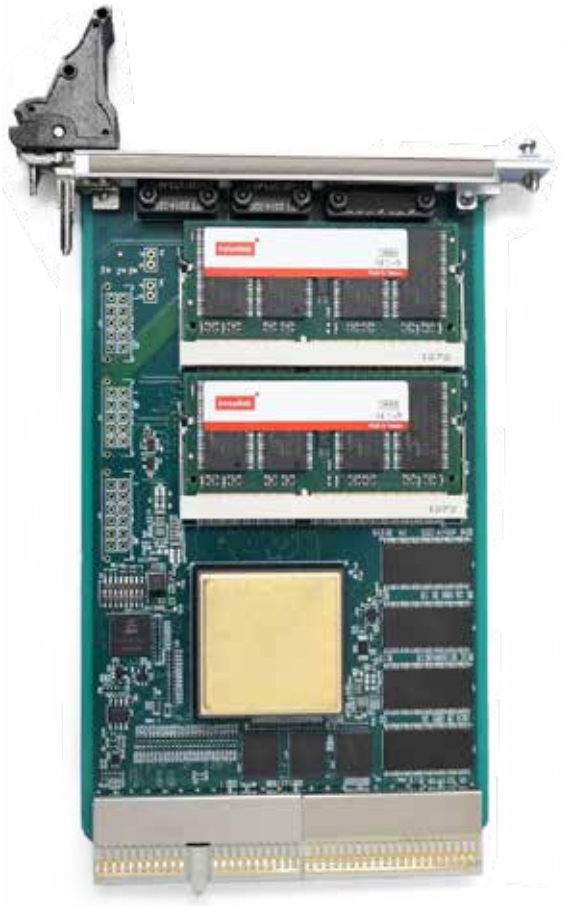
Software Development Computer

The modern, low-power RAD510 SoC-based single-board computer

The Endura 3U software development computer provides a low cost, room temperature version of the standard Endura 3U SBC. The RAD510™ system on chip (SoC) is a modern low-power, light performance processor. Leveraging a RAD5500™ processor core (a single core configuration of the quad core in the RAD5545® SoC), the Endura single board computer (SBC) provides greatly improved performance, a complete set of interfaces, and enables lower system power as compared to the RAD750® CPU.

The 3U version of the Endura SBC design is based on the 3U RAD750 SBC product line, with the radiation-hardened RAD510 SoC as its primary processing component. The 3U SBC is designed for use in command & data handling (C&DH), payload, or bus systems. In support of an easy transition from the 3U RAD750 SBC to the Endura 3U software development computer, the Endura 3U software development computer design is based on the commercial CompactPCI® backplane interface, facilitating early software development in existing test fixtures.

The Endura 3U cPCI software development computer has two SpaceWire ports through the cPCI backplane and two SpaceWire ports through separate nine pin micro-miniature D-type connectors on the front panel. The software development computer also includes common control and debug interfaces on the backplane, including a SPI controller, UART interface, JTAG initiator interface, and twenty-six backplane general purpose IOs.



Key features and benefits

- Providing all functionality afforded by the flight module, prototype SBC allows users a low-cost vehicle to get an early start on code development before flight modules are available
- Common test and debug ports aid in software development
- RAD5500 processor core operating frequency ranges from 66MHz to 462MHz and up to 1386 MIPS, supporting both low power and high-performance applications for enhanced versatility
- Available memory includes SDRAM, MRAM, and NAND Flash for program storage and execution
- 26 programmable inputs, outputs, and interrupts provide customers with the flexibility to optimize their mission needs
- 4 accessible ports from the 8-port SpaceWire router supports high transmission speeds of data, up to 396 Mbps on each link

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Specifications

Architecture	Power Architecture e5500, 32/64 bits	
Floating Point Unit	IEEE 754 Double Precision Floating Point Unit (2 op/cycle)	
Instruction Processing	Multiple Issue, Out-of-order	
Form Factor	CompactPCI 3U (100mm x 160mm)	
Interfaces	32-bit, 33MHz PCI interface with central resource capability 396Mbps 4-Port SpaceWire Router(2x Backplane, 2x Front Panel) 1x SPI, 1x JTAG Initiator , 1x UART	
Memory	Volatile memory: Non-volatile memory:	1GB SDRAM with Reed-Solomon ECC 1GB TMR NAND Flash 2MB MRAM including SECDED for SUROM
Performance	3 MIPs/MHz 198 MIPS @ 66 MHz 1,386 MIPS @ 462 MHz	
Power Supply Input	3.3V ±4%, 5.0V ±5%	

Endura™ 3U CompactPCI®

Single-Board Computer

The 3U CompactPCI® single-board computer (SBC) employs the RAD510™ system on a chip (SoC) featuring a radiation-hardened RAD5500™ processor core, built on Power Architecture® technology.

The Endura SBC is a modern alternative to the RAD750® SBC product line, delivering SBC double the RAD750 performance for similar power.

The RAD510 SoC delivers state-of-the-art radiation-hardened processing via a high-performance PCI version 2.2 backplane bus-compatible SBC in a 3U profile.

Key features and benefits

- RAD5500 processor core operating frequency ranges from 66MHz to 462MHz, supporting both low-power and high-performance applications for enhanced versatility.
- Non-volatile and volatile memory protects and maintains data in the most demanding environments.
- 26 programmable inputs, outputs, and interrupts provide customers with the flexibility to optimize their mission needs.
- Adaptable non-volatile memory configuration to meet mission needs.
- 4 accessible ports from the 8-port SpaceWire router supports high transmission speeds of data, up to 396Mbps on each link.
- Error correction on all internal RAD510 SoC memories including L1 and L2 caches for robust and dependable execution.
- VxWorks™ 7 Operating System support with complete Board Support Package (BSP) and RAD510 SoC device drivers.

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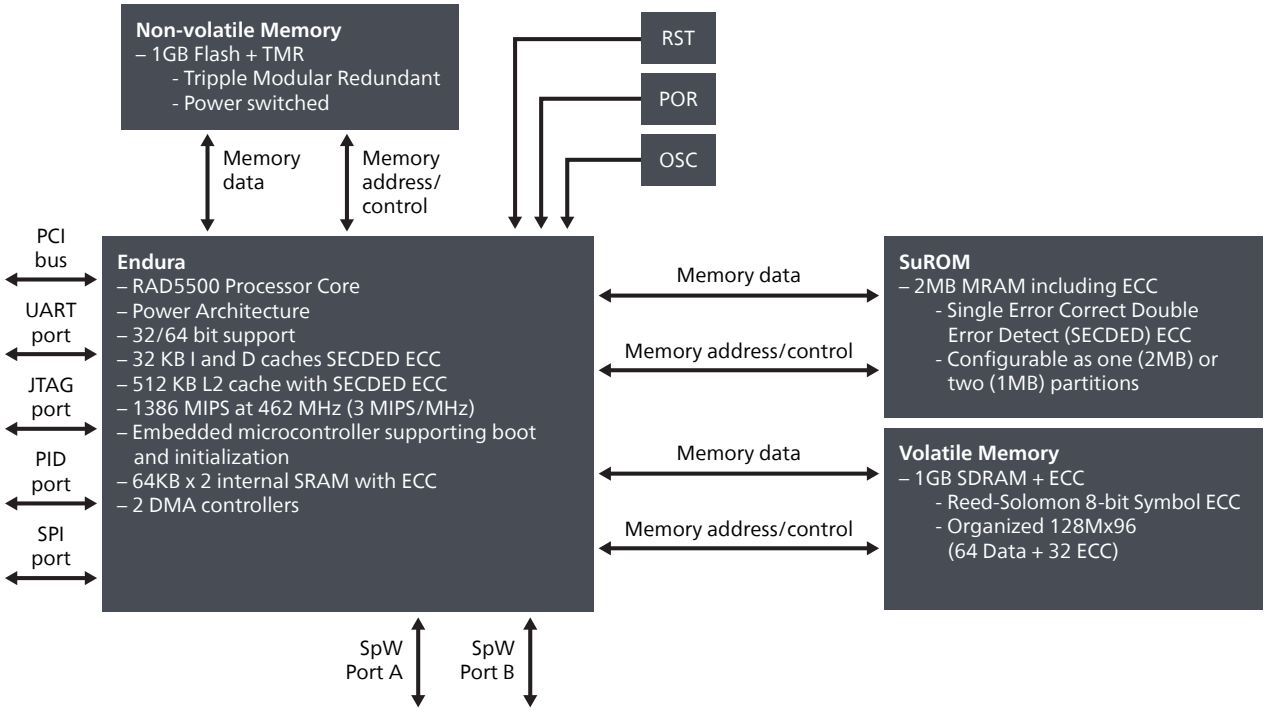
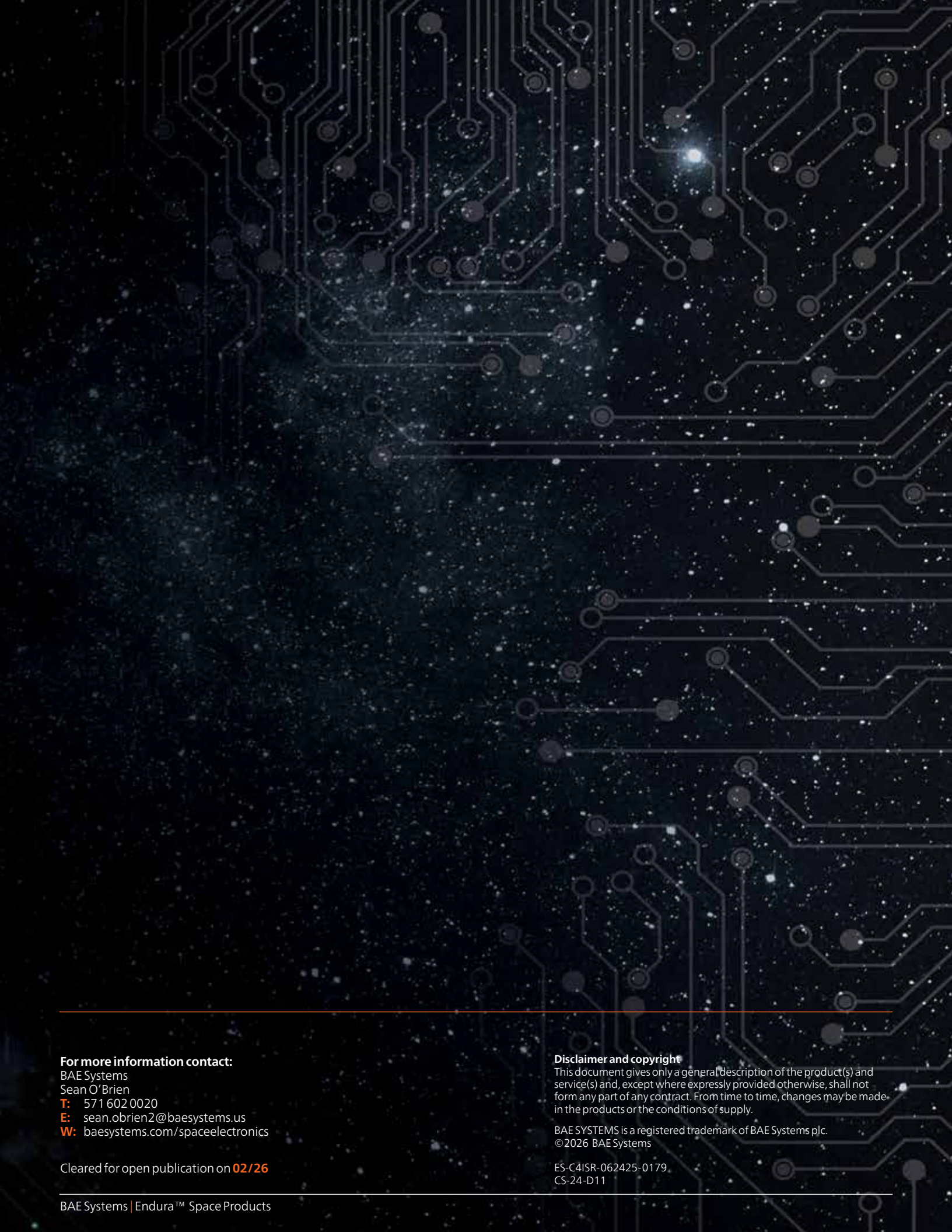
Memory	Volatile memory: Non-volatile memory:	1GB SDRAM with Reed-Solomon ECC 1GB TMR NAND Flash 2MB MRAM including SECDED for SUROM
Radiation-Hardness	Total dose: 100 Krad (Si) (TBR) Latch-up immune to 85MeV-cm2/mg (TBR)	
Performance	3 MIPs/MHz 198 MIPS @ 66 MHz 1,386 MIPS @ 462 MHz	
Power Supply Input	3.3V ±4%, 5.0V ±5%	
Card Power	14.5W (Est)	

Endura 3U flexible architecture





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Cleared for open publication on **02/26**

ES-C4ISR-062425-0179
CS-24-D11