BAE SYSTEMS

SpaceVPX SDR

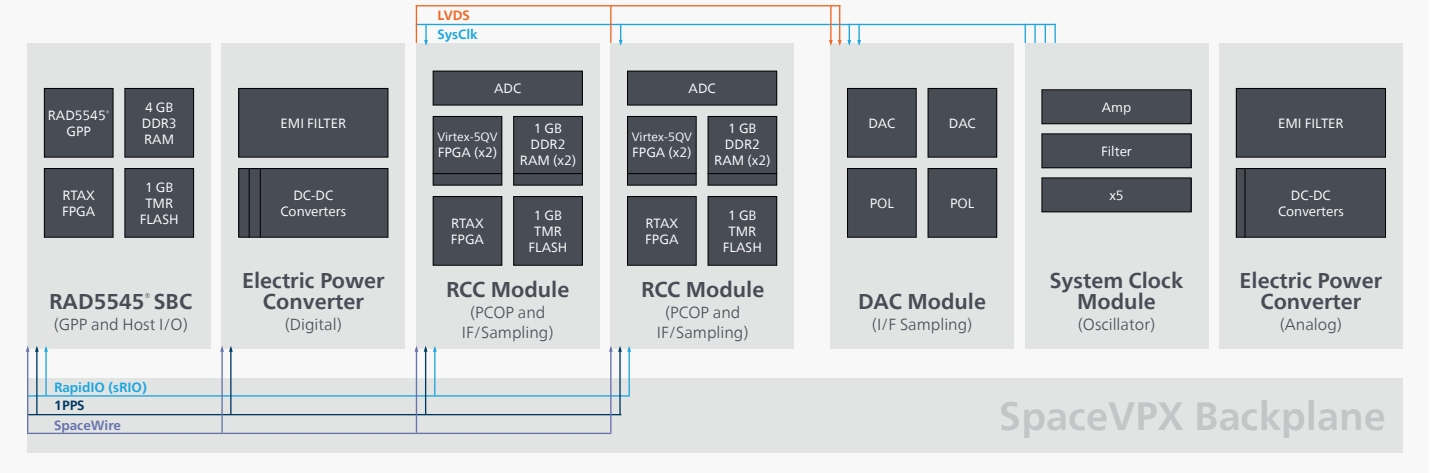
Modular software defined radio (SDR) payload for space

BAE Systems' SpaceVPX is a radiation-hardened, customizable SDR supporting pre- or post-delivery hosting of data and signal processing applications. The modular payload contains slots for seven SpaceVPX cards, which can be occupied by the cards listed below, or other compatible SpaceVPX cards. Along with modularity, the system is designed to be flexible with its easily modifiable backpanel. This platform utilizes the RAD5545® quad-core single board computer (SBC) for core general purpose processing, along with BAE Systems' reconfigurable computing modules (RCM) to provide high speed data processing to accomplish next-generation advanced space missions.

The SDR consists of the following modules that are interconnected through a SpaceVPX backplane:

- RAD5545® SBC
- Field programmable gate array (FPGA) based reconfigurable computing modules for parallel processing
- Digital to analog converter (DAC) module
- Clock module
- Two SpaceVPX power supply modules

Hardware block diagram:



Module key features and benefits

RAD5545® SBC

- High performance and I/O throughput via a RAD5545® radiation-hardened system-on-chip quad core processor provides the highest performance and reliability combination on the market.
- 4GB of dual data rate synchronous dynamic random access memory with error correcting code enables greater single event effect mitigation.
- 1GB of triple modular redundant flash memory for reliable storage of large amounts of data.
- Optional 4MB MRAM provides non-volatile memory for boot sequences.
- Four serial rapidIO fat pipe ports at 10 Gbytes/s each enable high-speed data transfer.
- 12 SpaceWire links supporting up to 320 Mbits/s each are provided to the SpaceVPX backplane, which enables communication between modules and to external sources.
- RTAX FPGA included on the SBC simplifies user configurations for customers.
- An optional daughter card with PCI, RapidIO and/or SpaceWire interfaces can be used to personalize the SBC for unique needs.

RCM

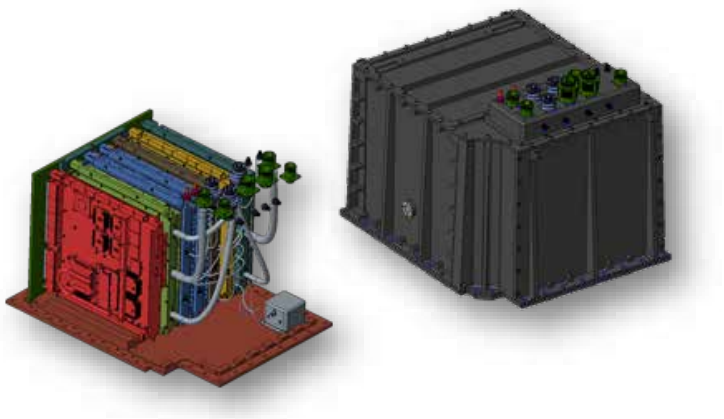
- Contains the in flight reprogrammable Xilinx V5QV FPGAs, which convert, decimate, filter, and measure high-speed data from input sources prior to using storage devices or general purpose processors.
- Provides an additional external source for manipulation of high speed data taken from storage or received from processing engines.
- An integrated, fuse-based RTAX FPGA handles TMR flash control and V5QV configuration.

DAC Module

- Exists as an extension of the RCMs, providing an extra source of DAC functions.
- Separation from the RCM provides accurate and clean signal integrity.

Specifications

Size	16.770" x 12.750" x 12.630"
Weight	<70.0Lbs (31.75Kg)
Operational Power	<175 Watts
Processing Capacity	5600 million instructions per second (MIPS)
Temperature Range	-34 to 61 degrees celsius
Radiation-Hardness	Total ionizing dose: 40-50 Krad (Si)
	Single event upsets: 3e-6 events/ year requiring ground intervention
Payload Card Form Factor	6U - 220 SpaceVPX
Interfaces	1553 Interface (x2)
	SpaceWire (x2)
	If AUX out (x2)
	1PPS Interface
	Telemetry ports (x3) (2 digital, 1 analog)
	Digital and analog Power Inputs
	If IN (x2)
	If OUT (x2)
	Test port (JTAG)



External and internal view of the BAE Systems' SpaceVPX SDR

For more information contact:
Sean O'Brien
9300 Wellington Road
Manassas, Virginia 20110-4122
T: 571 364 7777
E: sean.obrien2@baesystems.us
W: baesystems.com/spaceelectronics

Cleared for open publication on 3/9/2020

CS-20-A39
ES-C4ISR-022020-0027