SPECTRUM SIGNAL PROCESSING BY VECIMA

SDR-4803

SATCOM Embedded Radio Module

Custom

flexComm

A low power embedded radio module based on reconfigurable System-on-Chip (SoC) technology that enables cost-effective satellite communications on a variety of SATCOM networks.

Your Challenges Do you face any of these challenges developing a satellite communications (SATCOM) terminal?	Spectrum's Solution Spectrum's SDR-4803 SATCOM Embedded Radio Module can help you overcome your challenges:
• You need an L-Band modem transceiver for use in your SATCOM terminal	• A single card "RF to Ethernet" solution covering 800 MHz to 2.4 GHz that can be integrated into your terminal system and connect to an existing power amplifier and LNA or LNB antenna assembly
• You must support SATCOM waveform standards such as INTELSAT Business Services (IBS), DVB-S2 or INMARSAT BGAN	• Designed to support commercial standards such as INTELSAT Business Services waveforms (IESS-309 and IESS-315), DVB-S/S2 and INMARSAT BGAN • Designed to support Tactical Military SATCOM (MILSATCOM) waveforms, including the MIL-STD-188-165 and MIL-STD-188-181/182/183
• You have significant constraints on size, weight and power	• The single board radio module is designed to operate at less than 15 watts combined for RF, IF and baseband signal processing
• You have custom RF, processing, I/O or software requirements that cannot be met by traditional COTS suppliers	• Modular hardware and software architecture that can be rapidly customized to meet your specifications in as little as 90 calendar days
• Your platform needs to operate in a harsh environment	• Operates at temperature ranges from -40 to 70 degrees C and altitudes of up to 10,000 ft

Description

The SDR-4803 is a small single card embedded radio module designed specifically for deployment in Satellite Communications (SATCOM) applications. The SDR-4803 has been architected to support RF, IF, and baseband signal processing of military and commercial satellite waveforms standards. The SDR-4803 can be tailored to meet program and application specific size, weight, power, and cost targets.

The SDR-4803 is conduction-cooled, supporting a single RF input/output channel, an internal or external 10 MHz reference, Gigabit Ethernet, RS232, and USB connectivity. Equipped with reusable system examples and supported by an industry-leading suite of application development tools, the SDR-4803 is ready to help you accelerate your time-to-deployment.

Figure 1. SDR-4803 SATCOM Embedded Radio Module

RF and Modem Processors

[Embedded RF – L-Band]

The SDR-4803 features an embedded single-input, single-output channel RF stage to provide a wide operating frequency range between 800 MHz and 2.4 GHz. The SDR-4803 RF covers the L-Band frequency range and is designed to meet the phase noise, power level, and frequency stability requirements of many of the satellite waveform standards including IBS (Intelsat IESS 308/309) and DVB-S/S2 waveforms, supporting modulation formats up to 32 APSK. The SDR-4803 RF stage is designed to interface directly to an LNA/LNB antenna assembly and an external 10 MHz reference, if necessary.

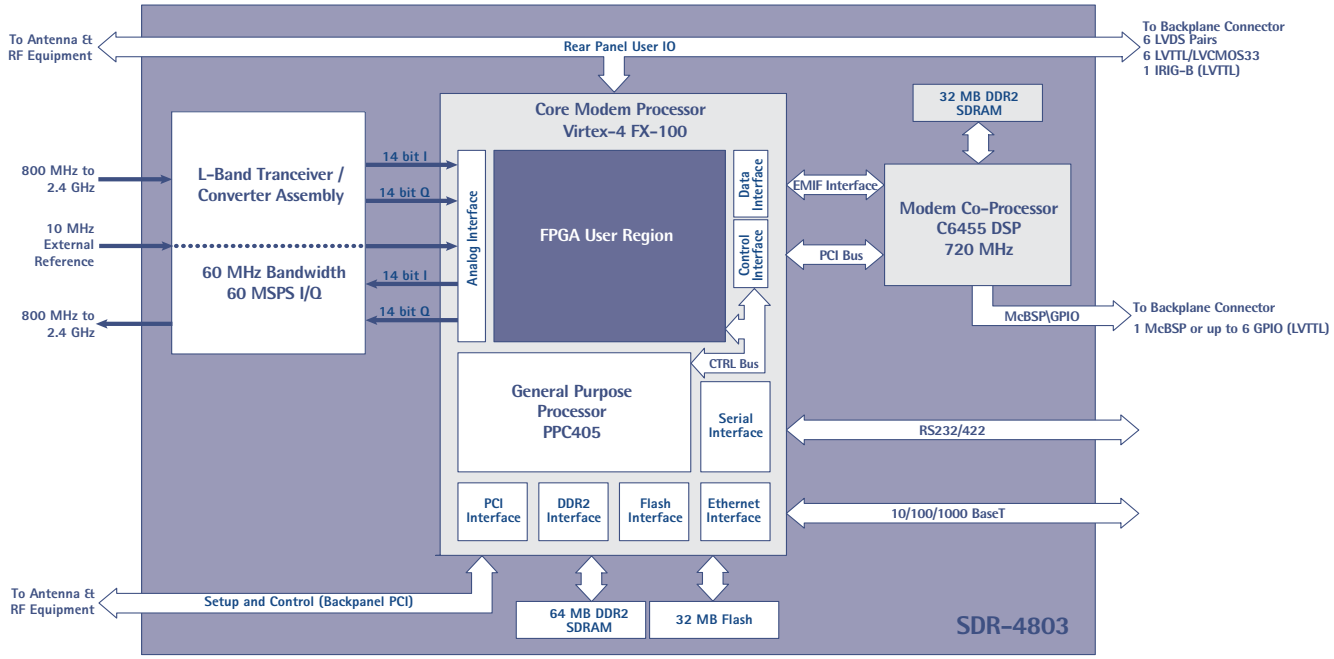

Figure 2. SDR-4803 SATCOM Embedded Radio Module Block Diagram

[Core Modem Processor – Xilinx® Virtex-4™ XC4VFX100]

The core modem processor on the SDR-4803 is a Virtex-4 XC4VFX100 System-On-Chip FPGA featuring the integrated PowerPC 405 cores. The Virtex-4 processor provides FPGA resources to carry out the most bandwidth-intensive physical layer processing of SATCOM waveforms. By default, one of the embedded PPC405 general purpose processors (GPP) is enabled and operates at 300 MHz to provide over 467 DMIPS of processing power for network or payload processing functions. Enabling the second PPC405, or higher processor speeds are also available as options. A summary of the approximate resources available to the user with one PPC405 enabled is shown in Table 1.

Device	XCV4FX100	Resources Available to Application
Logic Cells	94,896	75,096 (est)
Block RAM	376	317 (est)
DSP Slices	160	155 (est)
Embedded Processor	2	1 processor (467 DMIPS)

Table 1. Available resources for the PPC405

Refer to the Xilinx website at www.xilinx.com for more details on the Virtex-4 FX family.

[Modem Co-Processor – Texas Instruments TMS320C6455 DSP]

A Texas Instruments TMS320C6455 DSP provides additional processing resources to offload physical or MAC layer processing functions and to support legacy DSP waveform code. The DSP features a high-performance fixed point TMS320C64x+ DSP core running at 720 MHz and contains a built-in enhanced Viterbi decoder co-processor (VCP2) and Turbo decoder co-processor (TCP2). The DSP modem co-processor also has 32 MB of DDR2 SDRAM.

[Operation in Rugged Environment]

The SDR-4803 is designed in accordance with ANSI VITA 47 ECC3 to support conduction cooling, extended temperature range, and increased shock and vibration immunity using embedded stiffening, heat sinks and wedge locks. For protection against high levels of humidity and other environmental contaminants, the SDR-4803 can be conformally coated with a protective sealant. Temperature sensors are mounted to allow the software application to monitor and manage the temperature of the "hot" components.

[Modified COTS Optimizations]

The SDR-4803 hardware and software is designed to be rapidly customized to meet the size, weight, power, cost and ruggedization characteristics of a specific program. Using the Modified COTS (MCOTS) process, Spectrum works with its customers to provide a customized solution while substantially accelerating the time-to-deployment. Some of the options available for customization to the SDR-4803 are listed in the table 2.

Software Operating Environment

[Hardware Abstraction Layer - *quic*Comm Software Development Kit (SDK)]

The SDR-4803 GPP uses the *quic*Comm API library software to abstract the underlying hardware providing users with basic transport level access and control. This significantly accelerates user application development. This software includes a board support package for control and data handling which allows configuration and control of the data links between processors, initiates and manages data transfers, manages interrupt, and is used to load applications onto the DSP and user programmable FPGA. Further information on *quic*Comm is available at http://www.spectrumsignal.com/products/sdr/quiccomm.asp.

Core Processor	Xilinx® Virtex-4™ FX SoC with Two Embedded PowerPC™ 405 Processors			Xilinx® Virtex™-5 FXT SoC with Two Embedded PowerPC™ 440 Processors		
RF/Analog	L-Band SATCOM, L-Band Terrestrial	UHF SATCOM, UHF Terrestrial		VHF	HF	Custom
Modem Co-Processor	TI C6455 DSP	Virtex-4 LX or SX	Virtex-5 LX, LXT, or SXT	Freescale	ASIC	Other
External Interfaces	10/100/1000BT Ethernet		PCI	Serial	USB	
Form Factors	3U CompactPCI	AdvancedMC	MicroTCA		VPX	Custom
Operating System	Green Hills® INTEGRITY® 5.0.8		Wind River® VxWorks® 5.5.1 or 6.6		Linux	

Table 2. Available options for the SDR-4800 family. For more information, please contact Spectrum Sales.

[FPGA Wrappers]

As a part of Spectrum's *quic*Comm SDK, an FPGA wrapper is provided to abstract all board level interfaces on the Virtex-4 FPGA, including the interfaces to the analog converters, the DSP modem co-processor and the embedded 405GP general purpose processor. The SDR-4803 utilizes Open Cores Protocol (OCP) (http://www.ocpip.org/home) compliant interfaces between FPGA wrapper interface and the user application space. By using an industry standard interface such as OCP, users can expedite the integration of third-party or custom FPGA IP cores into the SDR-4803.

[FPGA Tool Flow]

FPGA application development on the SDR-4803 uses the Xilinx ISE Foundation™ tool flow (http://www.xilinx.com/products/design_resources/design_tool/index.htm). ISE is an integrated programmable logic design environment that includes schematic capture, power analysis tools, physical synthesis for FPGAs, advanced place and route algorithms, and COREgenerator, and a graphical interactive design entry tool that is used to create high-level modules. Xilinx's System Generator tool can also be used to graphically design and simulate FPGA-based algorithms within the Simulink environment from The MathWorks. Other FPGA tools that are supported include ModelSim PE.

[DSP Software]

DSP application development on the SDR-4803 is supported by TI's Industry Standard eXpressDSP™ as the application programming interface (API) and application framework. By using eXpressDSP, developers will have access to hundreds of 3rd Party eXpressDSP modules and algorithms, and maximize application interoperability and reuse. For more information on eXpressDSP refer to http://focus.ti.com/dsp/docs/dspsupportnp.tsp?sectionId=3&tabId=2089&familyId=44.

[Operating System]

The embedded GPP processor supports the Green Hills® INTEGRITY® real-time operating system (RTOS) with MULTI® Integrated Development Environment (IDE), and the Wind River® VxWorks® RTOS with Tornado®. Both of these operating systems are designed for use in embedded systems that require maximum reliability. Linux support is also available as a future option.

[Software Communications Architecture]

The SCA is an open specification sponsored by the U.S. Department of Defense Joint Tactical Radio System (JTRS) program. It specifies software, hardware, security and networking architecture requirements for open, programmable software defined radio (SDR) systems with flexible, re-programmable communication capabilities. The SCA specifies a common framework to build-up, configure, connect and tear down distributed, embedded radio applications while maximizing waveform portability. The SDR-4803 is designed to support a complete SCA-compliant software stack including CORBA middleware. This is available as an option.

Additional Services

[Customer Training]

Spectrum's training workshops are designed to get your team up and running in the shortest time possible by using a combination of lectures and at least 60% hands-on experience with your system. Experience thus far has shown this service to be invaluable and provides significant cost savings and risk reduction for Spectrum customers.

[Application Services and Waveform Development]

Spectrum's Application Engineering team can assist in the development of your custom application software, including U.S. Department of Defense and ITAR-controlled projects. The scope of these services is tailored to the customers' needs, ranging from complete subsystem development to support for SCA operating environment and waveforms. Spectrum's Application Engineering team partners with customers' internal application development engineers to augment their development resources.

Spectrum can also help accelerate waveform development and integration by leveraging partnerships with industry-leading waveform IP vendors to provide off-the-shelf IP. More information on waveforms can be found at http://www.spectrumsignal.com/products/waveforms.

Specifications

[general]	RF/IF Conversion & baseband processing	Single channel (1 in/1 out) embedded radio module using software reconfigurable zero IF and baseband processing
	Modem FPGA Processor	Reconfigurable SoC built on Xilinx Virtex-4 FX40 to FX140 technology incorporating an on-board modem general purpose processor (PowerPC 405), and reconfigurable user FPGA region. Virtex-5 FXT upgrade available as a future option.
	DSP Processor	Texas Instruments TMS320C6455, operating 720 MHz with up to 5760 MMACs
	Modem FPGA Co-Processor (Optional)	Xilinx Virtex-4 LX60 to LX160 technology supporting up to 152K logic cells, 5,184 Kbits BRAM, and 96 DSP blocks
	External Reference Oscillator	10 MHz 0.5 – 0.9 Vpp (-2 to +3 dBm) drives sampling clock
	Internal Reference Oscillator	10 MHz drives sampling clock
[buses]	Host (Optional)	3U cPCI bus (32-bit/33 MHz)
[analog I/O]	RX & TX Frequency Range	800 MHz to 2.4 GHz
	Analog Bandwidth	60 MHz
	RX Power Input	-65 dBm to +30 dBm
	TX Power Output	0 dBm
	Synthesizer Step Size	250 kHz
	Conversion Gain (RX)	30 to 60 dB, 1.5 dB step
	Phase Noise	**Receive** / **Transmit**
		-60 dBc/Hz at 100 Hz / -60 dBc/Hz at 100 Hz
		-80 dBc/Hz at 1 kHz / -80 dBc/Hz at 1 kHz
		-98 dBc/Hz at 10 kHz / -98 dBc/Hz at 10 kHz
		-118 dBc/Hz at 100 kHz / -118 dBc/Hz at 100 kHz
		-120 dBc/Hz at 1 MHz / -120 dBc/Hz at 1 MHz
		-125 dBc/Hz at 10 MHz / -125 dBc/Hz at 10 MHz
		-130 dBc/Hz at 20 MHz / -130 dBc/Hz at 20 MHz
	Harmonics	Receive: Better than – 60 dBc / Transmit: Better than –60 dBc
	Noise Figure	Less than 15 dB receive
	Spurious carrier	< -60 dBc transmit
	Spurious non-carrier	< -60 dBm transmit
[external interfaces]	Ethernet	Gigabit Ethernet (10/100/1000 BaseT)
	Serial Interfaces	RS232 data and USB 2.0 via J2
	Analog Input (RX)	1 channel, SMA connector, 50 ohms (75 ohms optional)
	Analog Output (TX)	1 channel, SMA connector, 50 ohms (75 ohms optional)
	External clock/ reference	1 input, SMA connector, 50 ohms (75 ohms optional)
	User I/O	Between core modem processor and backplane connector (6 LVDS pairs, 6 LVTTL/LVCMOS33, 1 IRIG-B/LVTTL)
		Between DSP modem co-processor and backplane connector (1 McBSP or 6 LVTTL)
	JTAG Connection	Flex cable to onboard header
[software]		Please refer to the software section of this datasheet
[electrical]	Supply Voltage (DC)	+3V± 3 % and +5 V± 3%
	Power Estimate	SDR-4803 consumes approximately 15 watts, including RF and FPGA processing for video streaming application. Further power reduction is possible through customizations such as: optimizing RF front-end performance; enabling sleep modes; utilizing lower power Virtex-5 technology; and others.
[mechanical]	Size	100 mm (height) x 195 mm (length)
[environmental]	Temperature	Conduction-cooling card edge temperature range of -40 to 70 degrees C in accordance to VITA47 ECC3 standard
	RoHS	5 of 6 compliant (Pb solder exemption). For other RoHS options, please contact Spectrum Sales
[ordering information]		Contact Spectrum Sales

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Rev 09.10.09_CS.TY.AK.