

# Embedded Radio Module for Wideband Tactical MILCOM



A low power embedded radio module (IF-to-Ethernet) based on reconfigurable system-on-a-chip (SoC) technology that enables you to build cost-effective, deployed radio systems for wideband tactical military communication (MILCOM) applications.



## Your Challenges

Do you face any of these challenges developing a radio for operation in a tactical environment?



- You need to build a Wideband Tactical Radio, and have an existing RF front-end



- You have significant constraints on size, weight, and power



- Your platform needs to operate in a harsh environment



- You need to reuse existing waveform application code, such as the Wideband Networking Waveform (WNW)



- You have demanding processing requirements, needing both FPGA processing and a powerful Vector Processing Engine on a PowerPC



- You have custom RF, processing, I/O or software requirements that cannot be met by traditional COTS suppliers

## Spectrum's Solution

Spectrum's embedded radio modules can help you overcome your wideband tactical MILCOM challenges:

- "IF-to-Ethernet" solution: Bridges your existing RF front-end with an IF frequency of 70 MHz (software reconfigurable) or Zero IF to your battlefield network's Ethernet interface to support battlefield communications at up to 20 Mbps

- The single board radio module is designed to draw less than 25 watts combined for RF, IF and baseband signal processing

- Operate at temperature ranges from -40 to 70 degrees C and altitudes of up to 40,000 ft with shock and vibration tolerance

- The embedded radio module includes integrated tools that significantly simplify porting of code to the transceiver system

- The embedded radio module includes a Xilinx® FPGA and a Freescale™ PowerPC™ general purpose processor (GPP) with an integrated AltiVec Vector Signal Processing Engine

- Modular hardware and software architecture that can be rapidly customized to meet your specifications in as little as 90 calendar days

## Description

Spectrum's embedded radio module technologies can be tailored specifically for deployments in tactical military communication (MILCOM) applications. Based on Spectrum's MILCOM reference designs, Spectrum can design a single card solution to support black-side (IF-to-Ethernet) digitization and processing of complex waveforms requiring low latency deterministic operation to maintain synchronization on a time synchronous network. The solution can be conduction-cooled for rugged configurations, support a dual IF input/output, an internal or external 10 MHz reference or high-speed sample clock, Gigabit Ethernet, RS-232 and USB connectivity. Equipped with reusable system examples, the module is ready to immediately commence application development. The rugged single-card configuration is size, weight, power and cost optimized for production deployments in harsh environments.

For details on other embedded radio module options, please refer to the SDR-4800 family datasheet at [www.spectrumsignal.com/products/soc/sdr\\_4800.asp](http://www.spectrumsignal.com/products/soc/sdr_4800.asp).

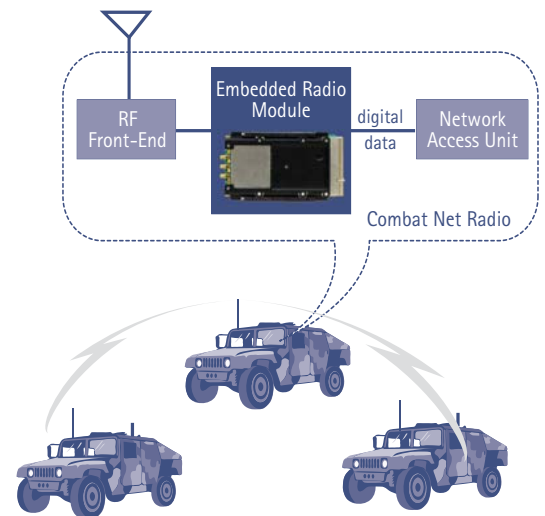


Figure 1. Concept of Operations

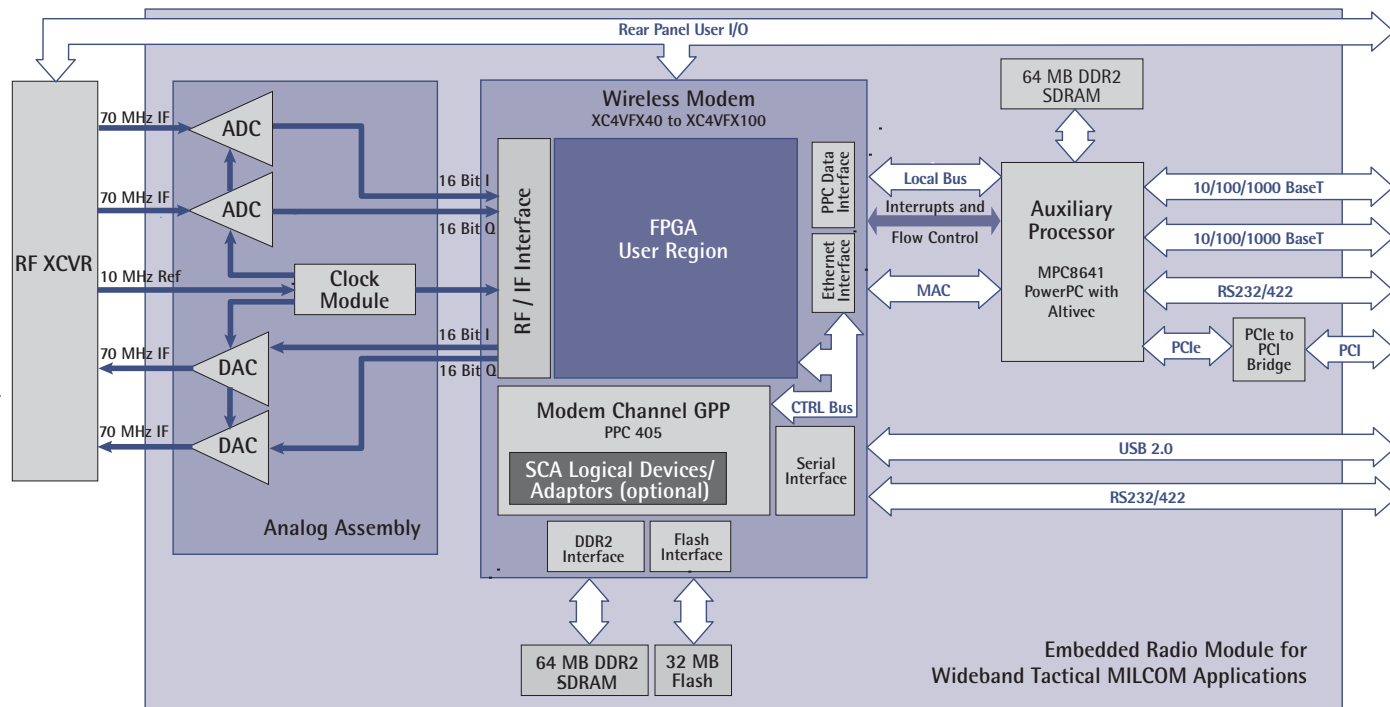


Figure 2. Block Diagram (Dual IF-to-Ethernet and PowerPC variant)

## Specifications

### [ General ]

- RF/IF Conversion and baseband processing:  
A dual channel (2 in/2out) embedded radio module using software reconfigurable IF or zero IF and baseband processing
- Modem FPGA Processor:  
Reconfigurable System-on-Chip (SoC) built on Xilinx Virtex-4 FX40 to FX100 technology, incorporating an on-board modem general purpose processor (PowerPC 405), a partial reconfigurable user FPGA region, and a complete set of modem peripheral interfaces including a DigRF compliant RF/IF interface
- Auxiliary Processor:  
MPC8641 PowerPC with Altivec Vector Processing Engine and 64 MB DDR2 SDRAM
- External Reference Oscillator: 10 MHz 0.5 – 0.9 V<sub>pp</sub> (-2 to +3 dBm) drives sampling clock
- Internal Reference Oscillator: 10 MHz drives sampling clock
- External Sampling Clock: Supports range of 36 MHz to 500 MHz

### [ Buses ]

- Host (Optional): 3U cPCI bus (32-bit/33 MHz)

### [ Analog I/O ]

- High-Speed ADC : Dual analog-to-digital converter operating at 96 MSPS. Options up to 125 MSPS
- ADC Input: AC coupled, full scale 0.7 V<sub>pp</sub> into a 50 ohm load. DC Coupled is available as an option
- High-Speed DAC: Dual digital-to-analog converter operating at 192 MHz. Options up to 500 MSPS are available
- DAC Output: AC coupled, max 0.62 V<sub>pp</sub> into a 50 ohm load. DC Coupled is available as an option
- Jitter: Less than 800 femtoseconds additive jitter through the analog clock distribution circuitry
- Low-Speed ADC: Quad 12-bit @ 100 KSPS
- Low-Speed DAC: Dual 12-bit @ 100 KSPS

### [ External Interfaces ]

- Ethernet: Dual Gigabit Ethernet (10/100/1000 BaseT)
- Serial Interfaces: Dual RS232 data, one to modem processor and one to auxiliary processor, single USB connection to Auxiliary processor
- Analog Input: 2 channels, SMA connector, 50 ohms
- Analog Output: 2 channels, SMA connector, 50 ohms
- External clock/reference: 1 input, SMA connector, 50 ohms
- User I/O: GPIO lines between modem processor and J2 (see General Purpose I/O section of the SDR-4800 family datasheet)
- JTAG Connection: Flex cable to header

### [ Software Operating and Development Environment ]

- Please refer to the software section of the SDR-4800 family datasheet

### [ Electrical ]

- Supply Voltage (DC): +3V  $\pm$ 3 % and +5 V  $\pm$ 3%
- Power Estimate: Spectrum's embedded radio modules consume approximately 25 watts, including RF and FPGA processing. Further power reduction is possible through customizations such as: optimizing RF front-end performance; enabling sleep modes; utilizing lower power Virtex-5 technology. Final power consumption will depend on application requirements.

### [ Mechanical ]

- Size: 100 mm (height) x 160 mm (length)
- Environmental Temperature: Conduction-cooling card edge temperature range of -40 to 70 degrees C
- RoHS: 5 of 6 compliant. For other RoHS options, please contact Spectrum Sales.

### [ Ordering Information ]

- This is a product concept based on an application reference design. Please contact Spectrum Sales to determine the configuration and performance that best matches your application.
- For more options available with the Embedded Radio Modules, please refer to the SDR-4800 family datasheet.