*Product Bulletin*

# Small Form Factor Software-Defined Radio Development Tools

## Overview

The TI Small Form Factor (SFF) Software-Defined Radio (SDR) development platform supporting the Software Communications Architecture (SCA) framework enables the rapid development and optimization of robust, multi-protocol radios that can cost-effectively meet the needs of the public safety and commercial applications. The SFF SDR development platform (SDRDP) combines the flexibility of a modular, scalable hardware architecture with the easy to use software design flow incorporating SCA core framework, middleware and model-based design tools to substantially reduce design complexity. At the heart of the SDRDP is the digital baseband processing hardware combining the flexibility of programmable digital signal processors with the reconfigurable logic of an FPGA.

Many commercial applications, such as public safety, professional radios and industrial radios require the ability to handle different protocols with the same base hardware in order to eliminate design complexity, and the SCA framework provides a solid foundation upon which to ensure component robustness, interoperability and portability.

The SDRDP provides complete flexibility in hardware/software co-development across a wide range of wireless communication applications. Developers can quickly design single- and/or multi-protocol radios for the various applications that are cost- and power-optimized.

The SDRDP is extremely versatile, covering a wide range of applications. With support for part of the UHF band (360 MHz to 960 MHz), high-performance data converters, a combined ARM9 plus TMS320C64x+™ DSP SoC and Xilinx FPGA, developers can achieve the optimal and most efficient partitioning of processing resources. Waveforms can be executed efficiently with signal processing streamlined using the DSP, hardware-intensive functions processed on the FPGA, and network protocols implemented on a flexible RISC processor.

## Complete Antenna-to-Baseband Functionality

The SDRDP incorporates a modular scalable hardware architecture that extends from the antenna to baseband with dedicated RF, data conversion and digital processing sections. This modular approach allows for customization of the development environment by

### Key Benefits
- Rapid proof of concept designs with complete antenna-to-baseband hardware and software co-development tools
- Highly integrated system on-chip products for reduction of cost and size of radios
- Real-time embedded power consumption monitoring of individual processing elements
- Portability of waveforms with Software Communications Architecture (SCA) framework and ORB middleware

### Applications
- Public safety radios
- Professional mobile radios
- RFID readers
- Emerging wireless technology applications

enabling custom developed RF and data conversion hardware specific to an application to be integrated with the base digital processing hardware.

## Board Support Design Kit

Included with the hardware is the board support design kit (BSDK) that includes the software drivers to support TI Code Composer Studio™ (CCStudio) Integrated Development Environment (IDE) and Green Hills INTEGRITY™ RTOS and MULTI™ IDE for TMS320DM6446 DSP SoC and Xilinx ISE foundation development tool for the FPGA. Support for these tools through the BSDK enables application development partitioned and targeted independently for the DSP SoC and the FPGA. The BSDK is included as part of the SDR evaluation module (SDREVM) product for

processor-specific software development and debug support.

## Model-Based Design Kit

The support for high-level model-based software design flow using the model-based design kit (MBDK) allows for ease of development and easy partitioning of software functions across a multi-processing architecture and takes the board support package to the next level. The SDRDP includes both the BSDK and the MBDK that enables seamless integration of The MathWorks model-based design tools to the lower level DSP tools (CCStudio) and FPGA tools (ISE Foundation). With the model-based flow, developers can use either C/HDL or MATLAB® to rapidly develop and test proof-of-concept designs and then optimize the architecture for cost and power for a specific application.

## SCA-Compliant SDR Development Platform

In the SCA-enabled version of the SDRDP, users will have access to the SCA framework, as well as the tools supplied by Canadian Research Corporation to generate SCA-compliant components of a wireless protocol waveform or algorithm. Integrated along with the SCA framework is the Object Request Broker (ORB) middleware that simplifies the development of distributed software applications.

Combining a complete software communications framework, as well as the entire signal chain from antenna to baseband in a single integrated development platform, the SDRDP empowers developers to quickly design and test single- or multi-protocol radios.

## Embedded Power Measurement and Monitoring Tools

Further improving efficiency is the embedded power monitoring

| Feature | Benefit |
|---|---|
| Flexible open development platform | TI SDRDP is a full development environment, complete with the necessary hardware and software support to create operational multi-protocol radios quickly and easily. Facilitates the efficient creation, addition, modification and reuse of IP. |
| High-performance digital processing hardware | Programmable DSP technology and reconfigurable FPGA provide the powerful yet flexible foundation required to create robust, efficient multi-protocol radios |
| Optimized for cost and power consumption | The use of innovative DSP SoC, FPGA and power management technology enables reduction in cost and power consumption<br>Real-time power measurement support allows developers to re-architect and optimize design to manage system power |
| Board support design kit | API and drivers are included as part of board support design kit to support CCStudio for DSP SoC, ISE Foundation for FPGA and INTEGRITY™ RTOS and MULTI™ IDE development and debugging tools |
| Model-based design support | MBDK provides the support for The MathWorks model-based software development environment allowing developers to use and create libraries and application software in an accelerated fashion that generates production code |
| Integrated with version 2.2 of the SCA version 2.2 compliant architecture framework | Support for SCA framework to guarantee the interoperability of software and hardware components along with Object Request Broker middleware that facilitates distributed processing between the GPP and DSP and FPGA |
| World-class customer support | Comprehensive customer support for the SDR development platform is available through Lyrtech, developer of the SDR Development Platform and one of the industry's leading DSP + FPGA design companies |

function. Traditional power measurement techniques require external measurement of power consumption that offers rough estimates at best. The power monitoring feature extends visibility into the system to allow precise power measurements and logging of power data such as burst and peak power as well as draw current of individual processing components. This allows developers to not only accurately estimate battery life but to achieve the optimal power balance in the system while maximizing performance between the different SDR components.

## Versatility for Accelerated Time-to-Market

The SFF SDRDP provides everything developers need to significantly reduce development time, not only for first designs but subsequent generations as well. The hardware design and

hardware software system integration was carried out by TI third party and industry-leader in DSP+FPGA designs – Lyrtech, who also integrated all hardware and software components. Full specifications, as well as a complete bill-of-materials, are available at **www.ti.com/sdr**.

**SCA-enabled SFF SDR Development Platform – Please contact Lyrtech at support@lyrtech.com**

## Get Started Today

For more information and to order the SFF SDR Evaluation Module or Development Platform, visit our web site at **www.ti.com/sdr** or contact your TI salesperson.

## Supported Software and Development Tools

The SFF SDR development platform supports the following software development tools:

- Texas Instruments Code Composer Studio™ Integrated Development Environment
- Xilinx ISE Foundation and System Generator
- Green Hills Software MULTI™ IDE for TMS320DM6446 DSP SoC
- Green Hills POSIX-compliant INTEGRITY™ real-time operating system
- The MathWorks MATLAB® and SIMULINK®
- CRC SCA development tools
- Objective Interface CORBA middleware
- Standard C/VHDL coding tools

| Contents | SDR EVM | SDR DP | SDR SCA |
|---|---|---|---|
| **HARDWARE** | | | |
| Digital Processing Module | X | X | X |
| Data Conversion Module | – | X | X |
| Radio Frequency Module | – | X | X |
| JTAG Emulators | – | – | – |
| **BOARD SUPPORT PACKAGE** | | | |
| Board Support Design Kit (BSDK) | X | X | X |
| Model Based Design Kit (MBDK) | – | X | X |
| **SOFTWARE TOOLS *** | | | |
| TI Code Composer Studio™ IDE | X | X | X |
| Xilinx ISE Foundation | X | X | X |
| Green Hills INTEGRITY™ RTOS | X | X | X |
| Green Hills MULTI  IDE | X | X | X |
| The MathWorks Tools | – | X | X |
| Object Interface CORBA | – | – | X |
| CRC SCA Framework | – | – | X |
| | | | |
| Sales Channel | TI | TI | Contact |
| Kit Price in US$ | $2,900.00 | $9,900.00 | Lyrtech |

*\* The EVM and DP packages of the development platform include free evaluation copies of the software tools. The SCA package will include licensed copies of the software and tools.*

## Specifications

### Digital Processing Module

- Texas Instruments TMS320DM6446 DSP system-on-chip
- Xilinx Virtex-4 SX35 FPGA
- Texas Instruments MSP430 MCU
- 128-MB DDR2 SDRAM and NAND flash memory
- Texas Instruments Stereo Audio codec (8 kHz to 48 kHz)
- 10/100-Mbps Ethernet
- High-speed USB (USB 2.0)
- HMI (LED, push buttons, dip switches)

### Data Conversion Module

- Two 14-bit, 125-MSPS input channels (TI ADS5500)
- Dual-channel 16-bit, 500-MSPS output channels (TI DAC5687)
- Multiple clock sources
  - Two external clock inputs (ADC and DAC)
  - Onboard clock synthesizer
  - Reference clock input for synchronization

### RF Module

- SMA input and output connectors
- Half-duplex transceiver
  - RF frequency range of 360 MHz to 960 MHz
  - Phase noise at 20 kHz from carrier: –70 dBc
  - Selectable IF bandwidth: 5 MHz/20 MHz
  - IF at 70 MHz
- Stackable for full-duplex operation
- RF input
  - Gain: 22 dB
  - Saturation level: –30 dBm
  - Sensitivity: –110 dBm typical (S/N = 10 dB, BW = 1 kHz)
- RF output
  - Gain: 22 dB
  - Power: –5 dBm

### Board Support Design Kit (BSDK)

- Host API and host DSP drivers
- Support for TI Code Composer Studio™ Integrated Development Environment
- Supported Third Party Development Tools
  - Green Hills MULTI IDE
  - ISE Foundation from Xilinx
- Low-level power monitoring tool

### Model-Based Design Kit (MBDK)

- Support for The MathWorks Tools
  - MATLAB®/SIMULINK®
  - Real-Time Workshop™ for TMS320C64x™ DSP
  - System Generator for FPGA
- Interface for The MathWorks to low-level tools
  - DSP link
  - FPGA link
- Power monitoring tool for SIMULINK

## *TI Worldwide Technical Support*

## Internet

**TI Semiconductor Product Information Center Home Page**
support.ti.com

**TI Semiconductor KnowledgeBase Home Page**
support.ti.com/sc/knowledgebase

## Product Information Centers

### Americas

| | |
|---|---|
| Phone | +1(972) 644-5580 |
| Fax | +1(972) 927-6377 |
| Internet/Email | support.ti.com/sc/pic/americas.htm |

### Europe, Middle East, and Africa

Phone

| | |
|---|---|
| European Free Call | 00800-ASK-TEXAS (00800 275 83927) |
| International | +49 (0) 8161 80 2121 |
| Russian Support | +7 (4) 95 98 10 701 |

**Note:** The European Free Call (Toll Free) number is not active in all countries. If you have technical difficulty calling the free call number, please use the international number above.

| | |
|---|---|
| Fax | +(49) (0) 8161 80 2045 |
| Internet | support.ti.com/sc/pic/euro.htm |

### Japan

| | | |
|---|---|---|
| Fax | International | +81-3-3344-5317 |
| | Domestic | 0120-81-0036 |
| Internet/Email | International | support.ti.com/sc/pic/japan.htm |
| | Domestic | www.tij.co.jp/pic |

Technology for Innovators, the black/red banner, Code Composer Studio and DSP/BIOS are trademarks of Texas Instruments.
All other trademarks are the property of their respective owners.

### Asia

Phone

| | | |
|---|---|---|
| | International | +886-2-23786800 |
| | Domestic | Toll-Free Number |
| | Australia | 1-800-999-084 |
| | China | 800-820-8682 |
| | Hong Kong | 800-96-5941 |
| | India | +91-80-41381665 (Toll) |
| | Indonesia | 001-803-8861-1006 |
| | Korea | 080-551-2804 |
| | Malaysia | 1-800-80-3973 |
| | New Zealand | 0800-446-934 |
| | Philippines | 1-800-765-7404 |
| | Singapore | 800-886-1028 |
| | Taiwan | 0800-006800 |
| | Thailand | 001-800-886-0010 |
| Fax | +886-2-2378-6808 | |
| Email | tiasia@ti.com or ti-china@ti.com | |
| Internet | support.ti.com/sc/pic/asia.htm | |

**Important Notice:** The products and services of Texas Instruments Incorporated and its subsidiaries described herein are sold subject to TI's standard terms and conditions of sale. Customers are advised to obtain the most current and complete information about TI products and services before placing orders. TI assumes no liability for applications assistance, customer's applications or product designs, software performance, or infringement of patents. The publication of information regarding any other company's products or services does not constitute TI's approval, warranty or endorsement thereof.

**A062907**

**TEXAS INSTRUMENTS**

SPRT406A