RichardsonRFPD
An Arrow Company

Design
Accelerators
ENGINEER EDITION

About Richardson RFPD

Richardson RFPD, an Arrow Electronics company, is an electronic component distributor focused on Radio Frequency, IoT, and Power Conversion products. With our global reach and extensive technical capability, we serve our customers through component selection and development, technical support, and world-class logistics and supply chain capabilities.

The Richardson RFPD Advantage
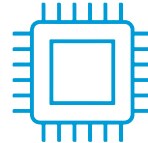### A lot of Capability to Leverage

RF Technical Sales Team

RF System Application Engineering

Strategic Supplier Relationships

Product Development, Customization, and Component Screening

3rd Party Alliances for Design Services

A Capable Partner to Solve Complex Challenges
Providing Expertise and Support for Successful Integration of Products

RF/Wireless Design Experts

7,300
RF/Wireless Customer Programs
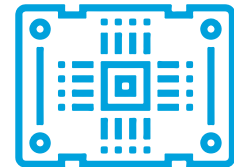
>300
Years of RF/Wireless Design Experience

Global
FAE Team and Ecosystem Support

Technical Expertise & Support

- Component-level
- System-level
- Obsolescence
- Design trends
- Market trends

Products & Solutions

- RF Actives
- DAC/ADCs
- RF Interconnect
- RF Passives
- Modules and Assemblies

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Design Accelerators

RF and Microwave Development

RF and wireless communication system development is resource intensive, in both effort and materials. Typical programs can take months to years to develop and bring to market. Richardson RFPD has assembled a suite of solutions to both accelerate and lower the cost of radio system development. These solutions include off-the-shelf hardware, hardware customization, licensable design files, and open-source software.

Featured Design Accelerator Platforms:
Leveraging Fundamental Radio Elements

RadioCarbon: A radio development platform that incorporates an SDR System on Module and an integrated high power RF front end, including digital predistortion. The SDR system can support 2T2R configuration from 30-6000 MHz. The RF front end could be optimized for specific frequency bands and applications in the 30-6000 MHz range.

RadioThorium: A wideband frequency converter module family covering 6-44 GHz. Intended for test setups or as an OEM module, the platform operates in either FDD or TDD mode, and can be combined to create a multi channel, phase synchronous radio system. RadioThorium can be interfaced with any general purpose baseband system.

RadioOxygen: A programmable 8 output frequency synthesizer, that can be operated as a standalone signal source or in combination with the RadioThorium frequency converter platform to enable multi-channel phase synchronous systems.
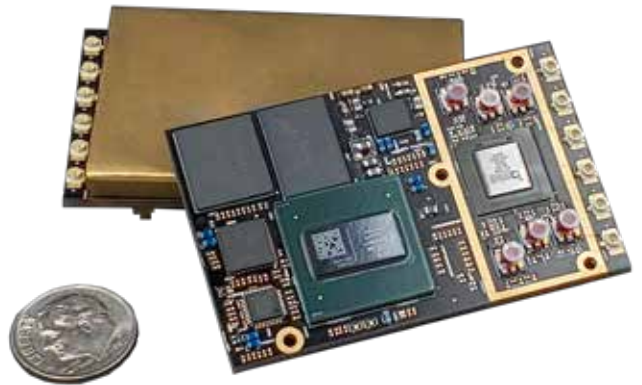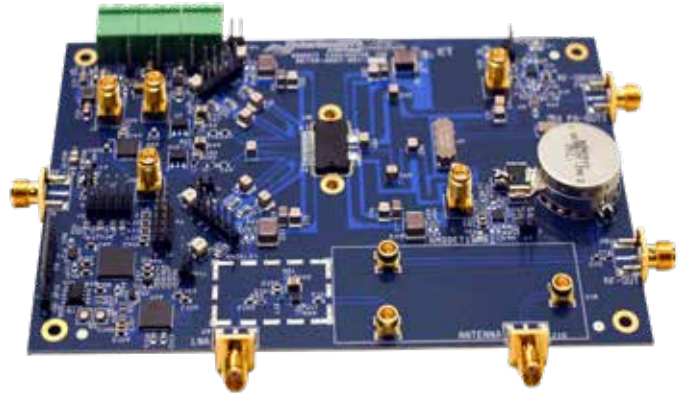
BytePipe™: Credit card sized radio subsystem based on a wideband 2T2R transceiver IC, this capable SoM enables quick development of any sub-6 GHz SDR application. On-board ARM CPUs (2), embedded in the FPGA enable real-time modem development and straightforward Linux application development, with high-level API support.

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Radio Design Accelerator Ecosystem

Hardware, Software, Support, Design Partners

- Off-the-shelf solutions
- Hardware, software, and support
- Licensable and customizable designs
- Suitable for R&D, prototyping, or proving concepts
- Ideal for Communications, Radar, Electronic Warfare, and Instrumentation

Design Accelerators Can Improve Your Time-to-Market

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FREQUENCY CONVERTERS

General purpose, high performance, stand-alone frequency converter

Summary

- RF Input/Output frequency range: 6 to 26 GHz
- LO Input frequency range: 6 to 26 GHz
- IF Input/Output frequency range: 2 to 6 GHz
- I/Q baseband frequency range: DC-700 MHz
- Instantaneous bandwidth: 1.4 GHz
- Supports TDD and FDD operation
- Output power (P1dB): +21dBm (FDD) and +17dBm (TDD)
- External LO: User provided or RFPD-RO-0126-8
- Multi-channel MIMO support up to 4T4R
- Power: external +12V AC-DC adapter included

Typical Applications

- Aerospace & Defense
- Radar
- Satellite communications
- Software defined radio
- Test & Measurement
- Wireless communications, 5G

Interfaces

- USB-C - Console API
- Auxiliary Control Interface - Console API via UART (TTL Levels)
- Expansion Port - Binary via SPI (Mode 1), Console API via RS485
- T/R Interface – Binary via SPI
- RF Interfaces - Tx, Rx, TDD, Tx LO, Rx LO, IF input/output, I/Q input/output

Product Ecosystem

- RFPD-RT-2444-1
- RFPD-RO-0126-8
- FPGA baseband solution, SDR Transceiver

Block Diagram

Radio Path - Simplified Block Diagram
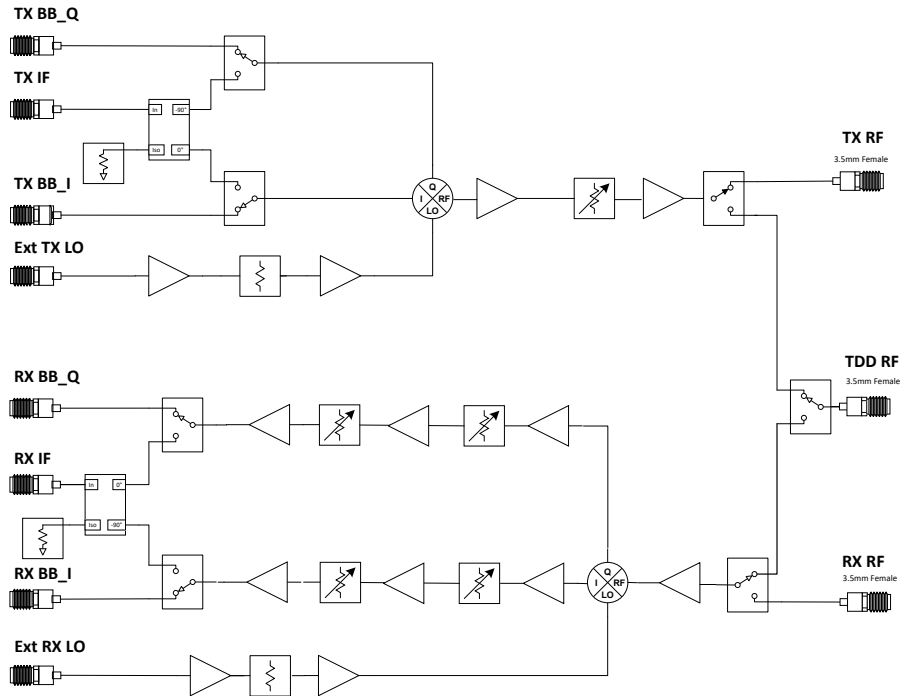
Physical Characteristics

- Size (W x L x H): 7.6" x 5.12" x 1.35" (193mm x 130mm x 34.3mm)

FREQUENCY CONVERTERS

General purpose, high performance, stand-alone frequency converter

Summary

- Output frequency range: 24 to 44 GHz.
- Input frequency range: 2-6 GHz (IF mode)
- I/Q baseband DC-700 MHz
- IBW to 1.4GHz
- Supports TDD and FDD operation
- Output power (P1dB): +19dBm (FDD) and +16dBm (TDD)
- Internal frequency reference and LO generation
- External reference and LO support
- Multi-channel MIMO (up to 4 channels)
- Integrated IF filter with selectable bandwidth
- Power – external +12V AC-DC adapter (included)

Typical Applications

- Aerospace & Defense
- Satellite communications
- Software defined radio
- Test & Measurement
- Wireless communications, 5G

Interfaces

- USB-C - Console API
- Auxiliary Control Interface - Console API via UART (TTL Levels)
- Expansion Port - Binary via SPI (Mode 1), Console API via RS485
- Antenna Interface – Binary via SPI
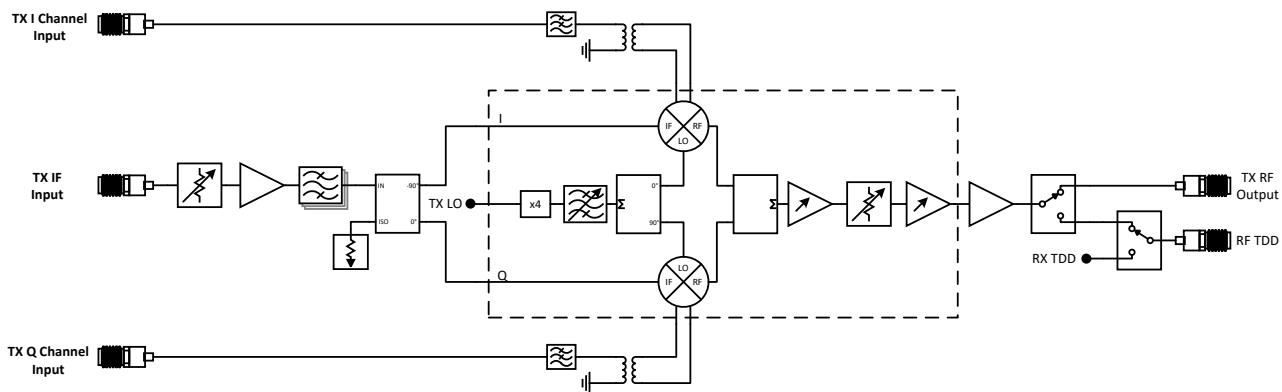- RF Interfaces - Tx, Rx, TDD, Tx Ext LO, Rx Ext LO, Reference input/output, IF input/output, I/Q input/output

Product Ecosystem

- RFPD-RT-0626-1
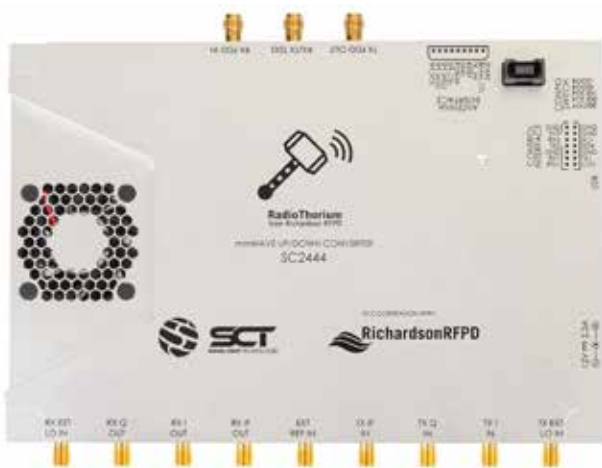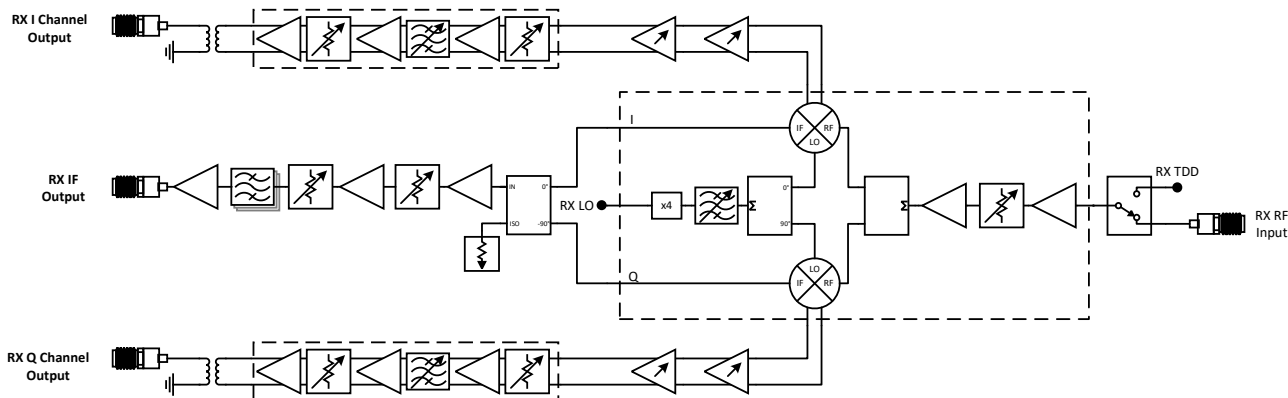- RFPD-RO-0126-8
- FPGA baseband solution, SDR Transceiver

Block Diagram

Transmit Channel

Receive Channel

Physical Characteristics

- Size (W x L x H): 7.6" x 5.12" x 1.35" (193mm x 130mm x 34.3mm)

FREQUENCY SYNTHESIZER

RFPD-RO-0126-8

General purpose, Dual-Channel, Quad-Output

Summary

- Two separate programmable channels - 4 outputs per channel
- Output frequency range: 0.8 to 25.6 GHz
- Input reference frequencies: 10 or 100 MHz
- Multi-channel MIMO support (up to 4 channels)
- Frequency doubler for higher frequencies with harmonic filtering
- Phase synchronizable LO's
- Power – from a 12V adapter (included in the kit)

Typical Applications

- Aerospace & Defense
- Software defined radio
- Test & Measurement
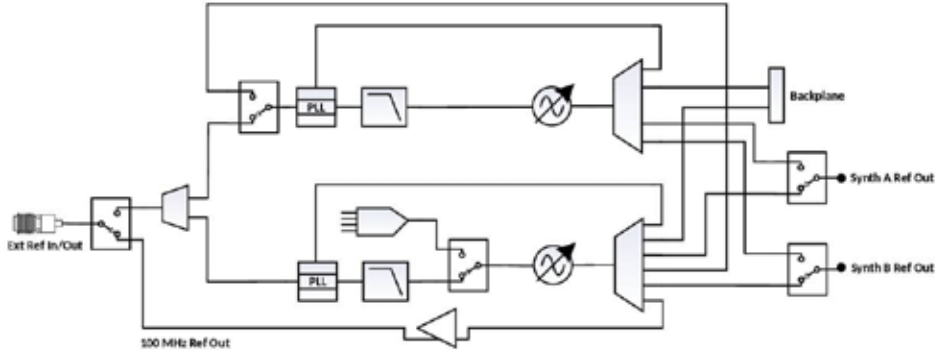- Wireless Communications, 5G

Interfaces

- USB-C - Console API
- Auxiliary Control Interface - Console API via UART (TTL Levels)
- Expansion Port - Binary via SPI (Mode 1), Console API via RS485
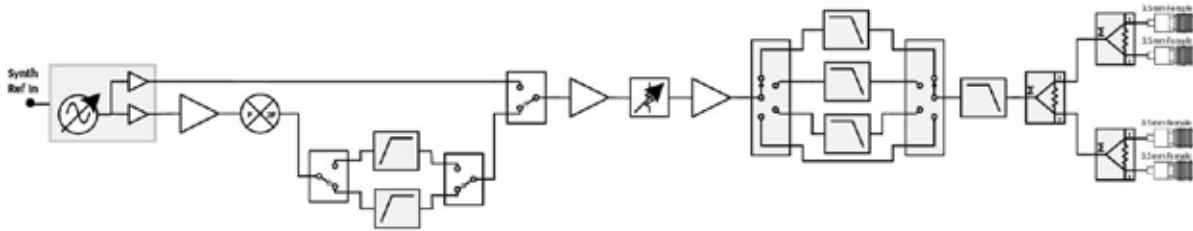
Product Ecosystem

- RFPD-RT-0626-1
- RFPD-RT-2444-1

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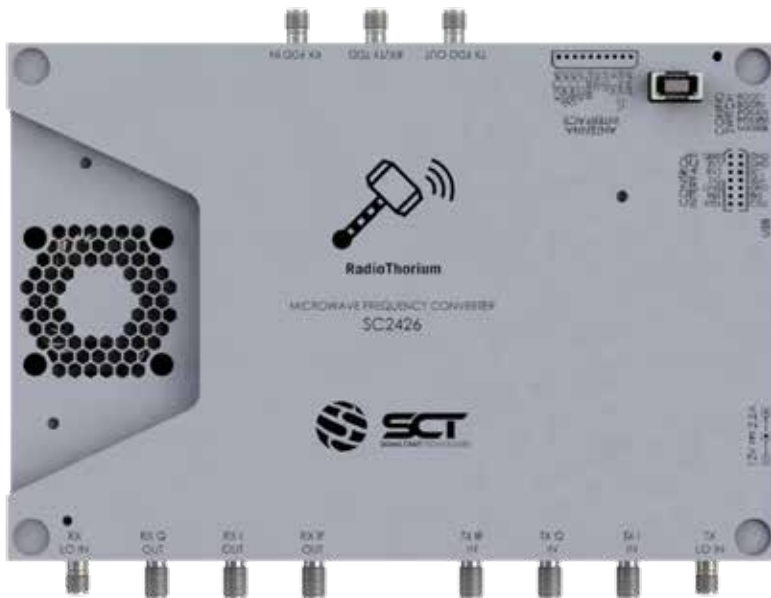
Block Diagram

Reference Generation/Recovery Circuit

Main Synthesizer (1 of 2)

Physical Characteristics

- Size (W x L x H): 7.6" x 5.12" x 1.35"
  (193mm x 130mm x 34.3mm)

SDR SYSTEM ON MODULE (SOM)

BytePipe™

2T2R, 30-6000 MHz with DPD

Summary

- Frequency range: 30 – 6000 MHz
- Supports TDD and FDD operation
- Output power: 7.5 dBm maximum
- Narrow and wideband channel support from 12.5 kHz to 40 MHz
- Independent frequency generation allow per-channel frequency control
- Native Fast-frequency hopping capability
- Multi-channel MIMO support (up to 4 channels)
- Power from a 12V adapter (included in the kit)
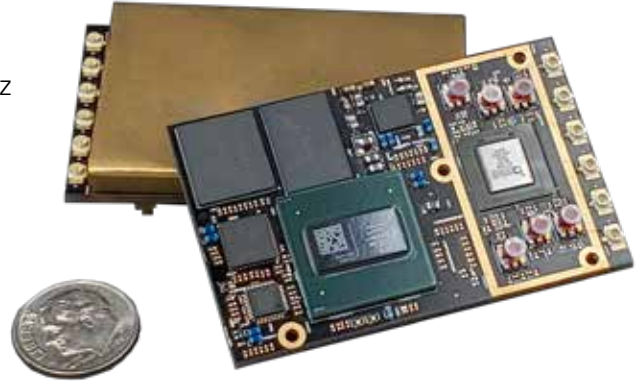
Typical Applications

- Aerospace & Defense
- Satellite communications
- Public safety/FirstNet
- Software defined radio
- Wireless communications

Interfaces

- Fast serial communications; GbE, USB3.0, SATA & Display Port available on the digital connector
- Tx ports (2), Rx ports (2), GPIO, I2C

Software Ecosystem

- Easy integration into MatLab, Simulink & GNU Radio design flow
- C-source code API available to have straightforward high-level set-up of a radio channels
- Open-source Linux enables quick adoption & integration of pre-developed features
- Documentation and software available at GitHub

Product Ecosystem

- BP-KIT BytePipe™ Hardware Developers kit
- RFPD-RC-4450-50
- DE705
- RADIOCARBON-13

SoM Block Diagram
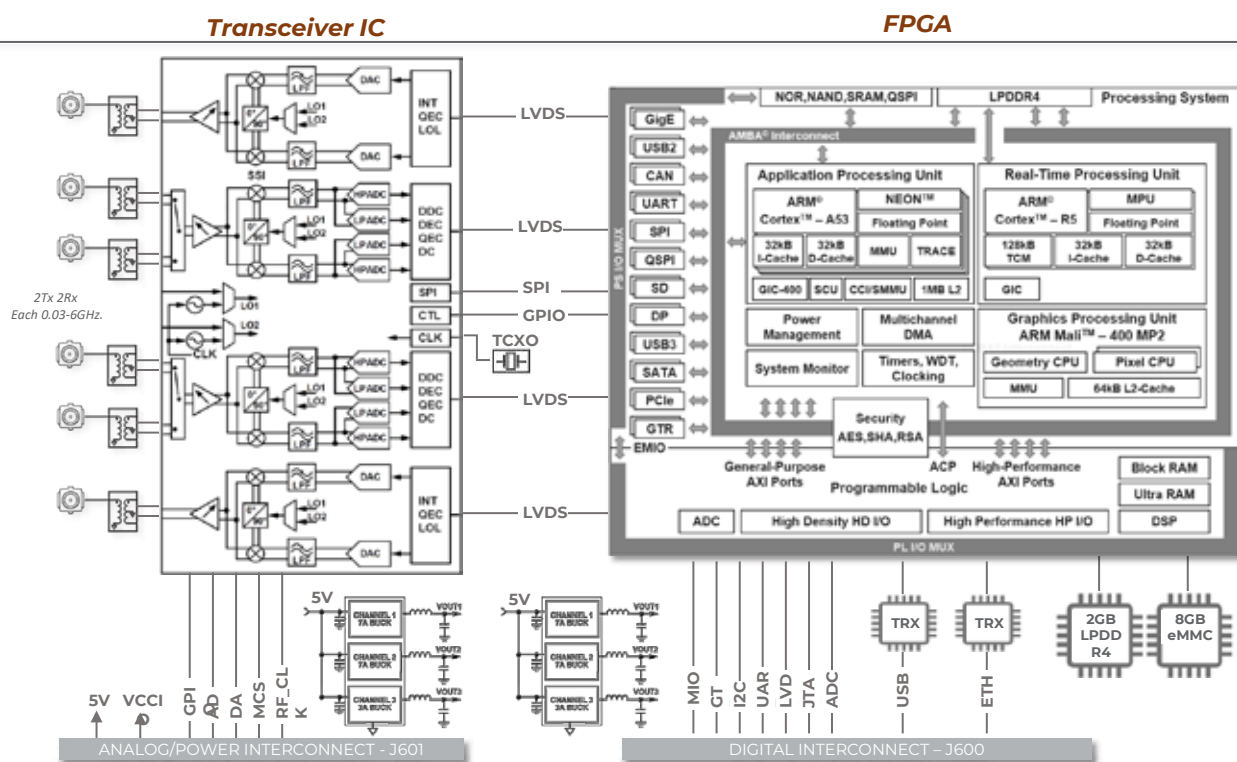
Mechanical Dimensions

- 1.65" x 2.40" (41.91mm x 60.96mm)

Summary

- RF Frontend with single channel transmit and receive
- RF operating frequency: 4.4 to 5.0 GHz.
- High-Efficiency GaN on SiC power amplifier line-up
- High performance receiver with 2.1dB NF and 23dB gain
- Optional tunable bandpass filter in Rx chain
- Onboard power management with GaN PA bias sequencing and control
- Configurable for stand alone operation or with BytePipe™ SDR System on Module (SoM)
- Software GUI for system configuration (stand alone)
- Compatible with integrated wideband transceivers
- Supports pulsed and CW operation (heatsink included for CW)
- Dimensions (mm): 203 x 121.5 x 33.8 (with heatsink)
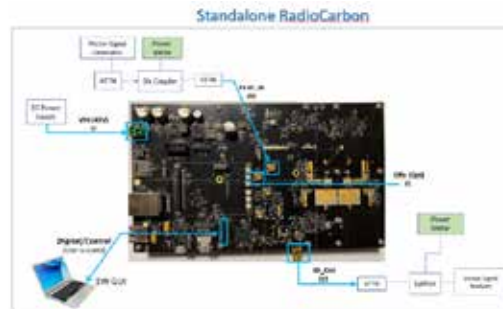
Typical Applications

- Aerospace & Defense
- Satellite communications
- Software defined radio
- Troposcatter communications
- Wireless communications, 5G

Product Ecosystem

- BytePipe™ SDR System on Module (SoM)

Modes of Operation

- System with BytePipe™ SDR SoM or as standalone operation

Radio Carbon with BytePipe SoM

Standalone RadioCarbon

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Block Diagram

MilComm band4: 4400 – 5000 MHz

Interface Ports

RF FRONT END DEVELOPMENT BOARD   DE705
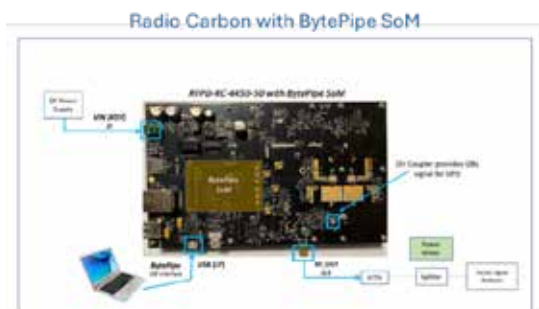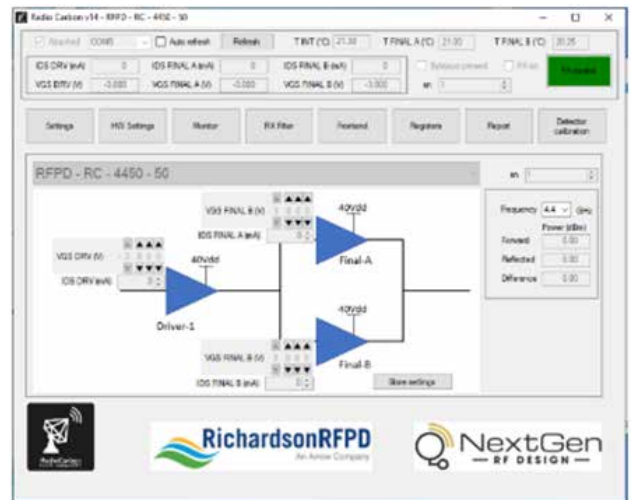
1T1R, 698-960 MHz, 5W Pout (Avg @ Antenna)

Summary

- Frequency range: 698 – 960 MHz
- Single channel transmit lineup with 57dB gain
- High performance Doherty PA linearized to -50dBc ACLR or better with DPD
- 37dBm Pavg (Ant Port), 46dBm Psat
- Programmable Doherty alignment IC simplifies production tuning
- Programmable integrated PA bias controller IC
- Single channel Rx with 18dB Gain, 2.5dB N, > 39dBm OIP3
- Onboard DC Power regulation circuitry
- High performance ceramic monoblock duplexer
- Mechanical dimensions (Lx W): 6.2" x 4.2" (157.5 mm x 106.7 mm)
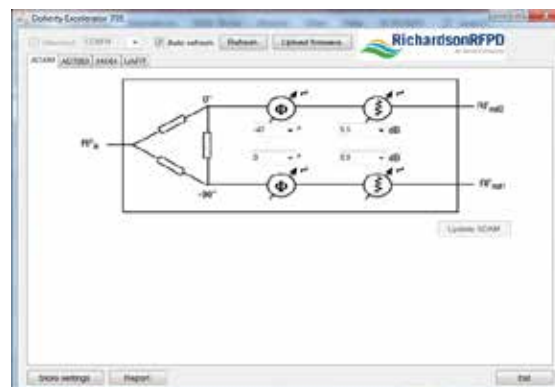

Typical Applications

- Public Safety/FirstNet
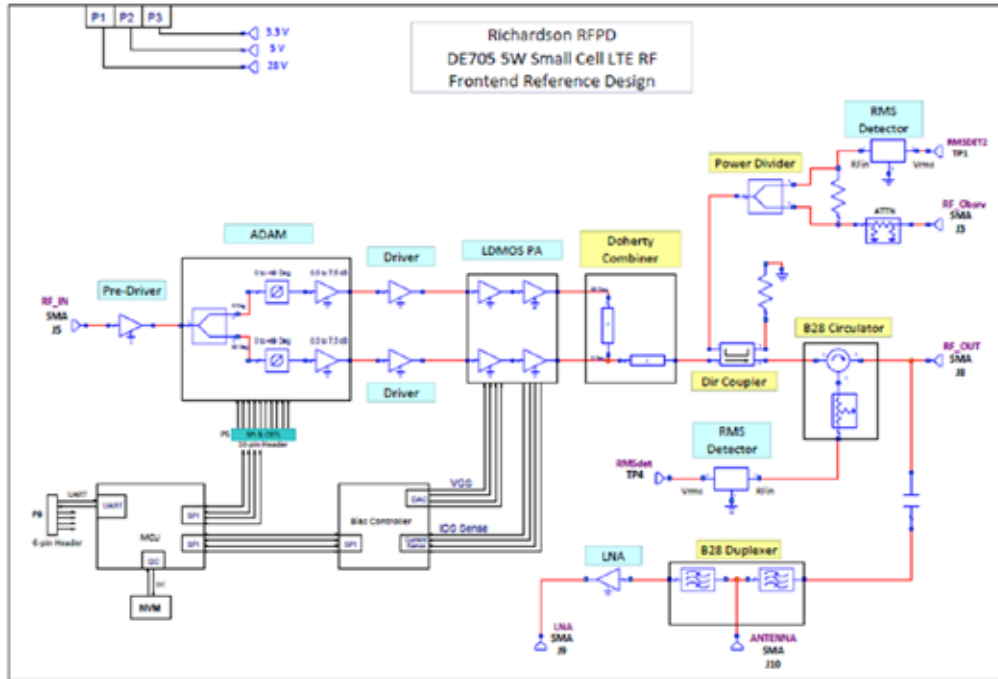- Software defined radio
- Wireless communications

Interfaces

- USB/UART Serial Comms (SW GUI)
- DC Power input
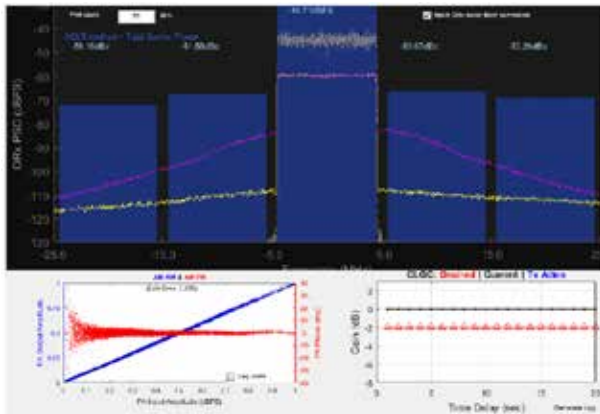- SMA RF Ports - Tx RFin, RFout/Ant, LNAin, RFDetect

Product Ecosystem

- BytePipe™ SoM
- BytePipe™ Hardware Development Kit
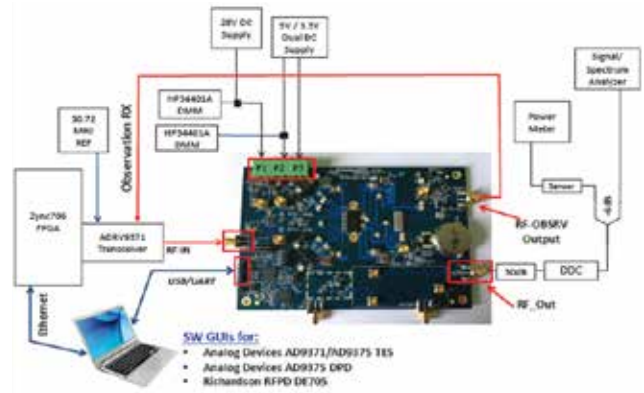- Integrated transceivers with DPD

Block Diagram

DPD Performance

790 MHz, 10MHz ETM3.1, after DPD　　　　　　　　　　Bench Setup for DE705

MODULAR WIDEBAND FREQUENCY CONVERSION SYSTEM

RadioThorium 6-44 GHz RadioThorium & RadioOxygen

Summary

- Output frequency range: 6 to 44 GHz
- Input IF: 2 to 6 GHz or baseband I/Q
- Supports TDD and FDD operation
- Instantaneous signal bandwidth: up to 1.4 GHz

Typical Applications

- Commercial and military communications
- Electronic warfare
- Microwave imaging
- Radar
- Satellite communications
- Test & Measurement
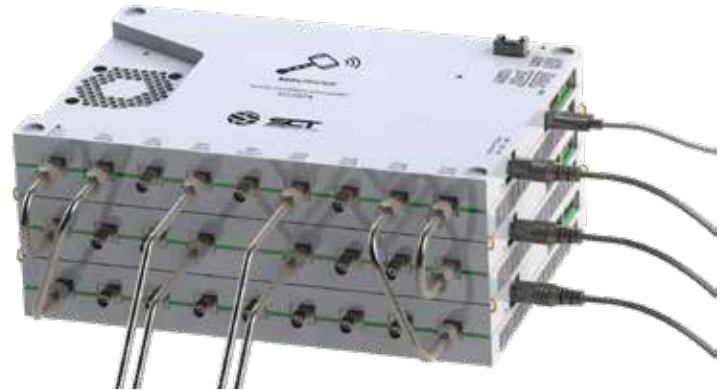
System Hardware

- RFPD-RT-2444-1
- RFPD-RT-0626-1
- RFPD-RO-0126-8

Programming and Control Interfaces

- USB-C - Console API
- Auxiliary Control Interface - Console API via UART (TTL Levels)
- Expansion Port - Binary via SPI (Mode 1), Console API via RS485

Power

- 12V adapters

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Recommended Configuration for Ka-Band Satellite System
(Consult Richardson RFPD for more configurations)

RadioThorium Up/Down Converter System

Orderable Configurations

Part Number	Description
RFPD-RS-0644-1	RadioOxygen, RadioThorium 6-24 GHz and 24-44 GHz
RFPD-RS-0626-1	RadioOxygen, RadioThroium 6-24 GHz
RFPD-RS-2444-1	RadioOxygen, RadioThorium 24-44 GHz

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Summary

- SDR system with 1Tx/1Rx Radio + Baseband + DPD
- Operating Frequency: 4.4 to 5.0 GHz
- Tx and Rx bandwidths: 12.5 kHz to 40 MHz
- Supports TDD and FDD operation
- High performance GaN on SiC RF power amplifier lineup
- Tx signal chain with 42 dB linear gain and 30W Psat
- Rx signal chain with 23 dB small signal gain and 2.1 dB noise figure
- Linearized DPD performance with > 50dBC ACLR @ 4W avg. power
- Single positive voltage input only
- Onboard DC power regulation with power management
- PA Bias controller and sequencer circuitry
- Supports pulsed and CW operation
- Dimensions (mm): 203 x 121.5 x 33.8 (with heatsink)

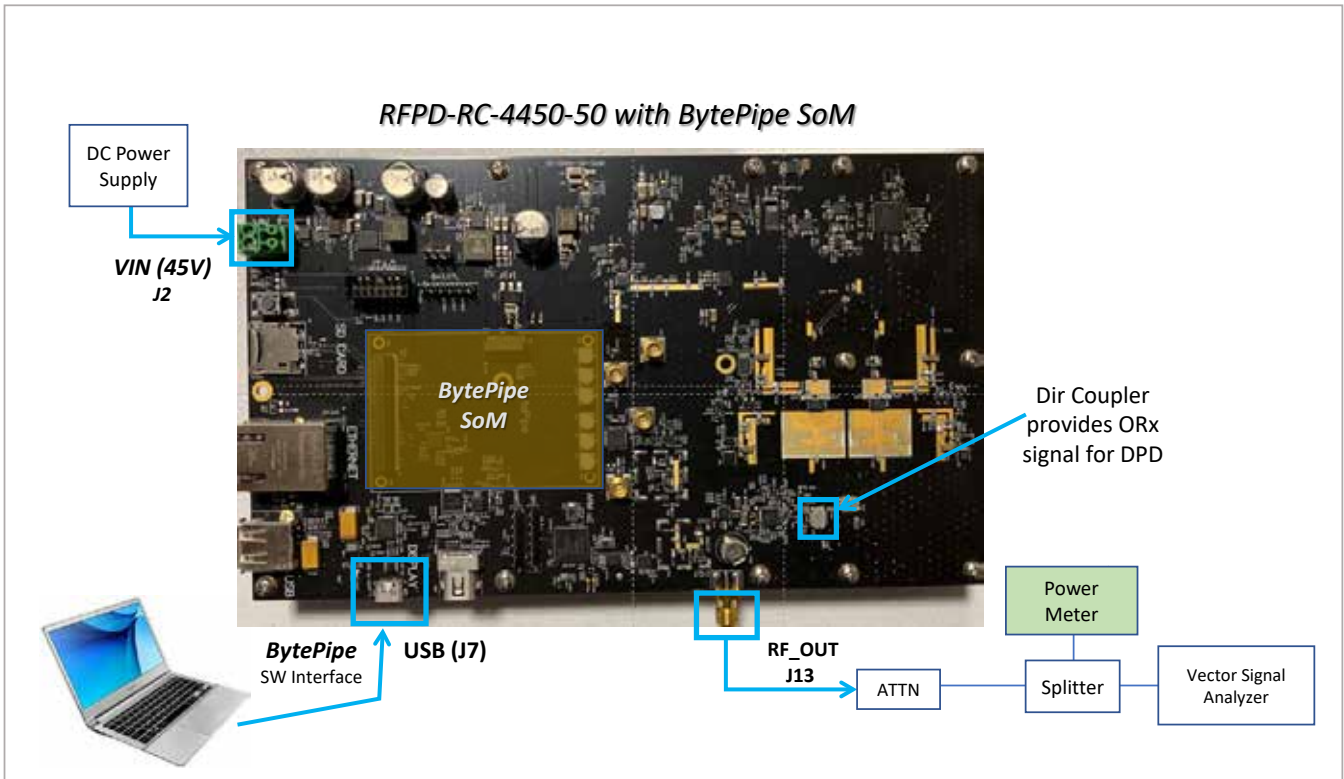## System Hardware

- BytePipe™ SDR SoM
- RFPD-RC-4450-50

Typical Applications

- Commercial and military communications
- Public safety/FirstNet
- Satellite communications
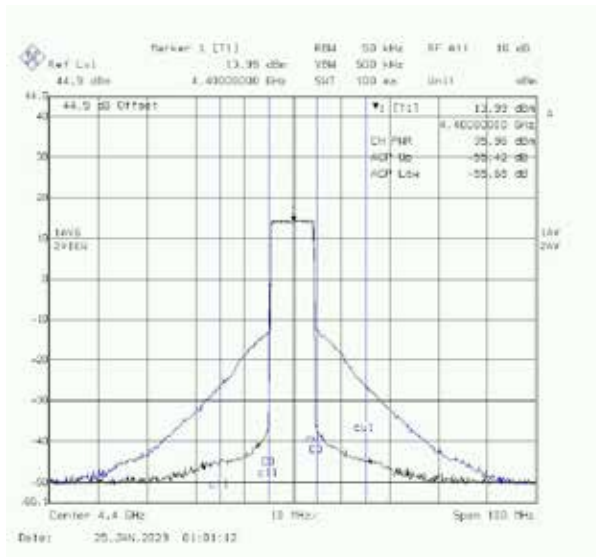- Software defined radio
- Troposcatter communications

Interfaces - DPD Operation

- BytePipe™ SoM Plug-in
- Control Interface – USB/UART
- SW Control via Command Line Interface (CLI)
- DC Power input
- RF SMA Output/Antenna port

DPD Bench Set-up

RFPD-RC-4450-50 with BytePipe SoM

DPD Performance

Summary

- Development kit for BytePipe™ family SoMs
- Breaks out many hardware interfaces
- Delivers power to SoM
- Platform to support development & testing of FPGA code
- Intended as a development platform
- Open-source software development environment.
- USB 2.0/3.0 Host/Device/OTG connector
- 10/100/1000 Ethernet connector
- Display Port connector
- SATA interface connector
- JTAG/UART interface
- RF Device Clock & MCS
- SD card slot
- AC power supply and power regulators
- SoM heatsink and fan

Typical Applications

- Commercial and military communications
- Modem Development
- Satellite communications
- Software defined radio

Interfaces

In addition to those in the Features there are:

- Tx ports (2)
- Rx ports (2)
- RF Observation ports enabling DPD support
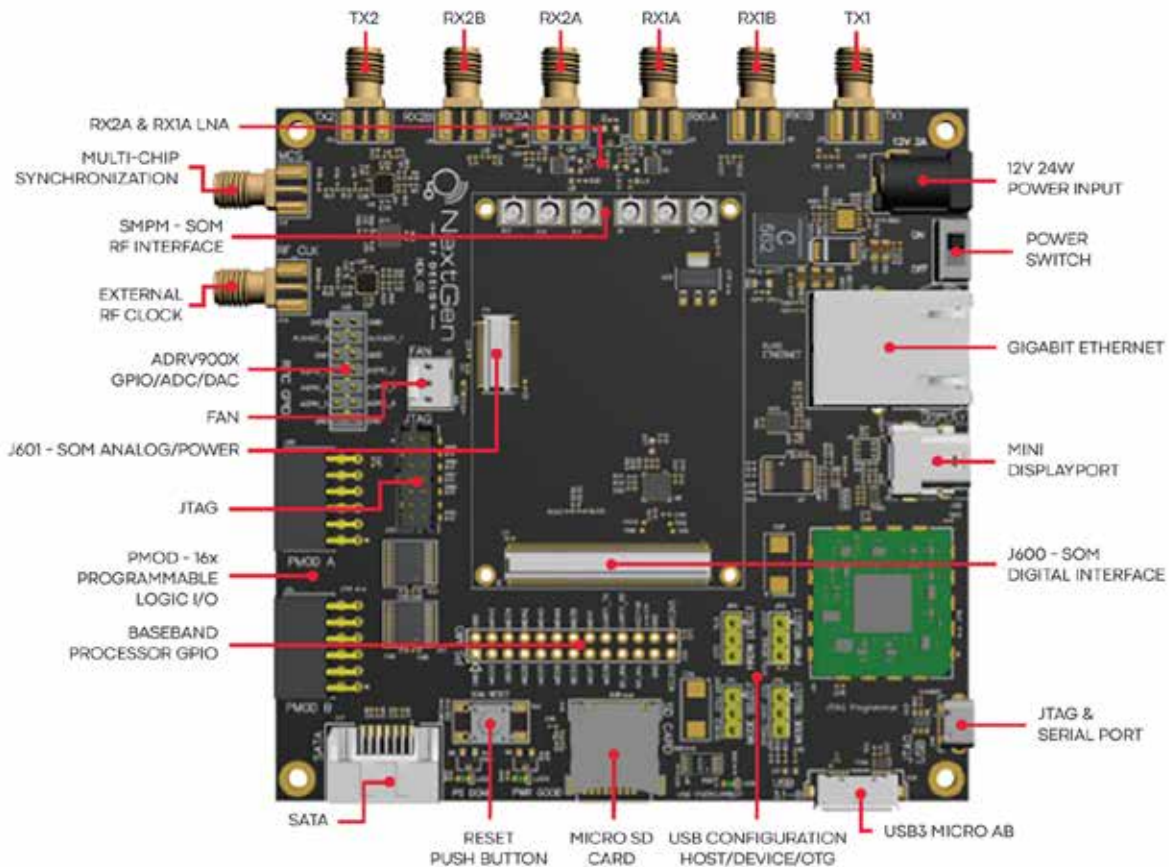- Documentation and software at GitHub

Software Ecosystem

- Easy integration into MatLab, Simulink & GNU Radio design flow
- C-source code API available to have straightforward high-level set-up of a radio channels
- Open-source Linux enables quick adoption & integration of pre-developed features

Product Ecosystem

- BytePipe™ SDR SoMs

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HDK Block Diagram

Package Contents

- Developer kit main board
- 6 - SoM RF interconnects
- SoM heatsink & fan
- Power supply
- USB & Ethernet cables
- SD Card with link to startup guide and pre-installed software
- 6 Hours NextGen RF engineering support

NOTE: BytePipe™ SoM is ordered separately

Mechanical Dimensions

- HDK 4.25" x 4.25" (108 x 108mm) [PCB Only, RF connector protruding]

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Customers in Scandinavia should contact our office in the United Kingdom.

AUSTRALIA & NEW ZEALAND

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