



**RFX-8440A**  
PCIe RFSoc Card



## RFSoc Data Acquisition Card

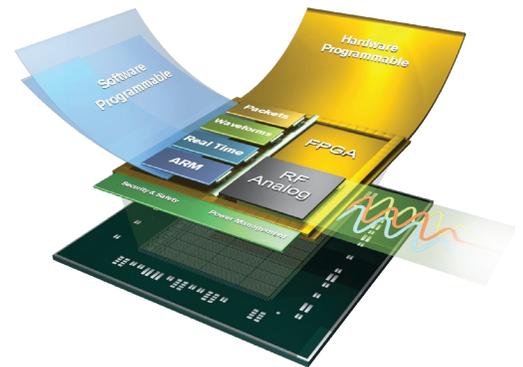
Seamlessly cross between analog and digital at up to S-Band rates

The BittWare RFX-8440A data acquisition card features the third generation AMD Zynq® UltraScale+™ RFSoc. This data acquisition solution is capable of addressing a wide frequency spectrum – a critical need for applications such as 5G, LTE wireless, phased array RADAR and satellite communications. The RFX-8440A transfers digital data over QSFP at twice the rate of RFSoc cards that move data only over PCIe.

The RFX-8440A does not require any power or signals from a PCIe slot. This allows deployment of a stand-alone RFX-8440A near an antenna where it converts analog data into a long-range optics, exchanging packets with a distant data center. Alternatively, it can be installed into a server PCI slot if needed. In this configuration it is wired to a dual 100 GbE NIC or to a separate FPGA card like our IA-440i. BittWare can deliver the RFX-8440A in a standard server or a chassis enclosure which provides power, cooling and interface to the RFX-8440A via RJ45.

The AMD Zynq® UltraScale+™ RFSoc integrates RF-class A/D and D/A converters into the Zynq® FPGA fabric and multi-core ARM processor subsystem, creating a multi-channel data conversion and processing solution on a single chip.

With 200 Gbps of digital I/O available on the FPGA side of the RFSoc, the card supports twice the bandwidth of RFSoc implementations that depend upon PCIe for data transfer. This I/O is available through two QSFP28 ports. Customers have implemented transports using Aurora, Ethernet MAC frames, and UDP.

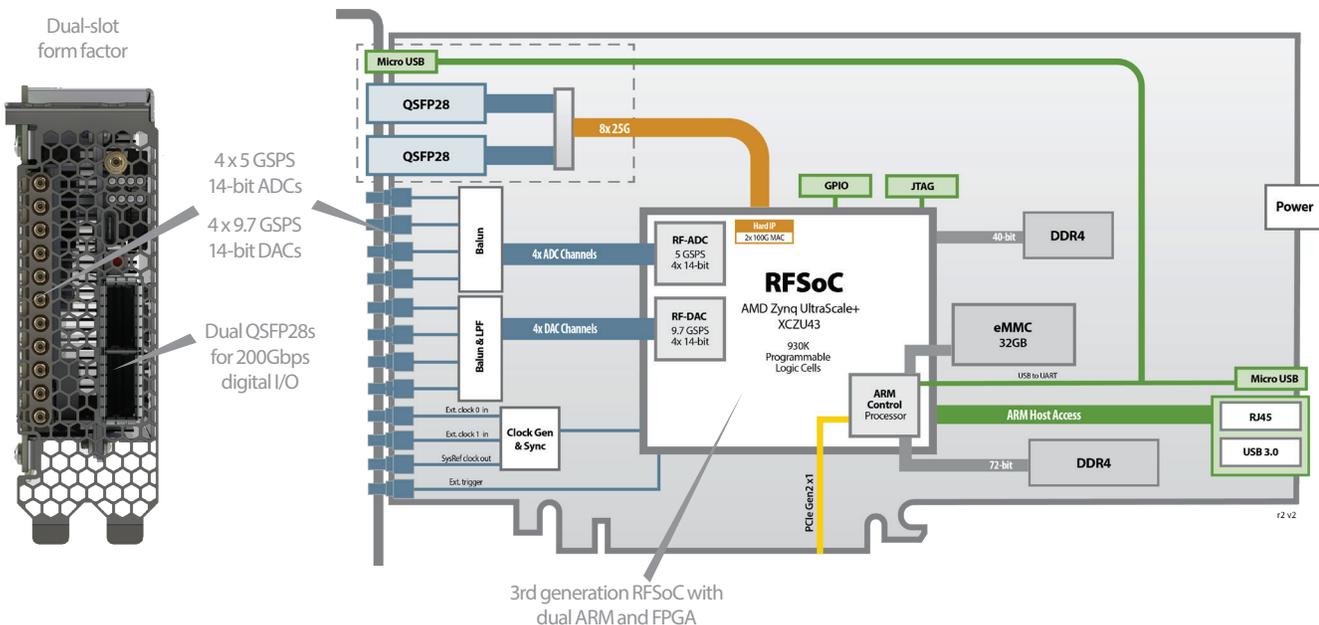


## key features

Third Generation  
AMD Zynq® Ultra-  
Scale+™ RFSoc

Standalone  
Capable

200 Gbps  
Digital I/O



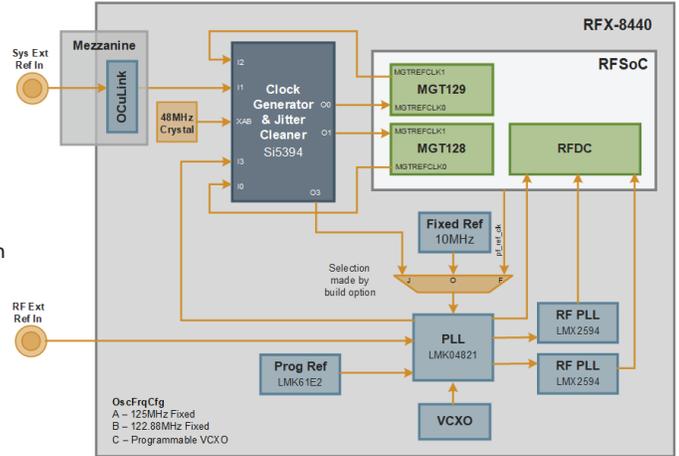
## Clock Tree

The RFX-8440A card offers a very flexible clock tree. It can accommodate reference clock inputs from Synchronous Ethernet, eCPRI, CPRI, as well as reference clocks fed in directly over coax cables. In addition, the default card configuration has a 10 MHz OCXO and a 125 MHz fixed VCXO. Some of the RFX-8440A clock tree flexibility is established through build options when the card is manufactured. BittWare will configure optimized cards for each customer, with a minimum quantity requirement in each order.

## Included IP

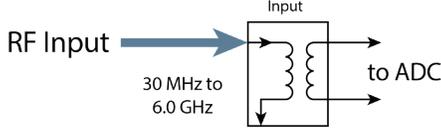
BittWare RFX cards ship with an application that converts between analog data and timestamped, VITA-49.2 packets. It works in both ADC and DAC directions. The application also transfers raw data between the RFSoc and the ARM memory or eMMC. The RFSoc's ARM Processing System runs Linux and acts as a control plane. More specifically, BittWare has integrated card management functions through customized Linux drivers. BittWare has also ported AMD's RF Tool application, a socket library that configures an RFSoc chip. Above both Linux and RF Tool, BittWare provides its own RFUtils commands and examples. RFUtils can generate synthetic waveforms as well as load and stream waveforms from files. All of this is fully supported by BittWare and we provide source code.

BittWare also supplies an unsupported port of AMD's RF Analyzer which we use to help characterize our cards.

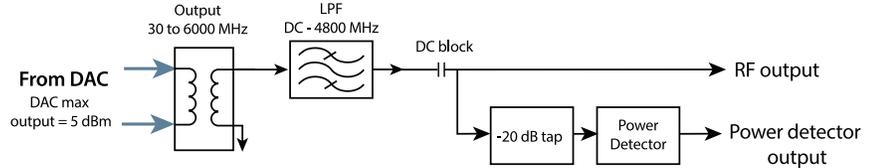


## Analog Front End Block Diagram

The RFX-8440A provides a direct connection supporting inputs up to 6 GHz.



## Transmit Side Block Diagram



## Board Specifications

<b>FPGA</b>	<ul style="list-style-type: none"> <li>AMD Zynq UltraScale+ RFSoc <ul style="list-style-type: none"> <li>XCZU43 in an E1156 package</li> <li>Core speed grade -2</li> </ul> </li> <li>Contact BittWare for other FPGA options</li> </ul>
<b>Analog</b>	<ul style="list-style-type: none"> <li>Direct 6 GHz input</li> <li>4x 5 GSPS 14-bit ADCs: -64 to +38 dB gain</li> <li>4x 9.7 GSPS 14-bit DACs: -32 to 0 dBm output</li> <li>30 MHz to 6 GHz but optimized for flat response 1 GHz to 4 GHz. Characterization data available.</li> <li>Programmable clocks</li> <li>External reference and triggers</li> <li>SSMC style connectors</li> </ul>
<b>On-board flash</b>	<ul style="list-style-type: none"> <li>PS connects to a 2Gb QSPI part configured in "Single" mode. The PS boots from the QSPI to configure itself, then pulls the logic bitstream from the QSPI and configures the PL</li> <li>32GB eMMC for ARM disk</li> </ul>
<b>External memory</b>	<ul style="list-style-type: none"> <li>Processing system: 16GB, 64-bit DDR4-2100 with ECC</li> <li>Programmable logic: 10GB, single bank 40-bit DDR4-2666*, no ECC</li> </ul>

\* DDR4 speed is 2666 on Rev 2 cards and 2400 on Rev 0 and 1

### External digital interfaces

- Processing system
  - PCIe Gen2 x1
  - RJ45 Ethernet
  - USB UART, USB 3.0
- Programmable logic:
  - Up to 200 Gb/s available via front panel 2x QSFP28
  - AMD Hard IP support for dual 100GbE

### Cooling

- Standard: double-width passive heatsink
- Contact BittWare for other cooling options

### Electrical

- On-board power derived from 6-pin AUX connector
- Power dissipation is application dependent
- Typical max power consumption 50W

### Environmental

- Operating temperature: 5°C to 35°C

### Quality

- Manufactured to IPC-A-610 Class 2
- RoHS compliant
- CE, FCC, UKCA & ICES approvals

### Form factor

- ¾-length, standard-height PCIe dual-slot card (x16 mechanical)
- Supports standalone operation
- RFX-8440 can be ordered as a TeraBox™ [integrated server platform](#)

## Sales Part Numbers

RFX-8440-0014	RFX-8440A card with 4 GHz input and QSFP28 mezzanine
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More detailed analog specifications are available upon request, and a full characterization report is available under NDA.

To learn more, visit [www.BittWare.com](http://www.BittWare.com)

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## Development Tools

### FPGA development

BittWare provides interface software support for an example bitstream that fully configures the RFSoc chip using a scripting language running on the FPGA's ARM. AMD Vivado development tools are fully supported for development of custom designs.

## Deliverables

- RFX-8440 Analog Data Acquisition Card
- Data capture and relay example - Full source code
- 1-year hardware warranty

**BittWare**  
a **molex** company