

## Introduction

The LogiCORE™ IP Common Public Radio Interface (CPRI™) core is a high-performance, low-cost flexible solution for implementation of the CPRI interface. It uses state-of-the-art transceivers to implement the Physical Layer. A compact and customizable Data Link Layer is implemented in the FPGA logic.

## Additional Documentation

A product guide is available for this core. Access to this material can be requested by going to the [CPRI Documentation Lounge](#).

## Features

- UltraScale™ architecture-based device designs operate at line rates of 614.4, 1,228.8, 2,457.6, 3,072, 4,915.2, 6,144, 8,110.08, 9,830.4, 10,137.6, 12,165.12, and 24,330.24 Mb/s using GTHE3, GTYE3, GTHE4 or GTYE4 transceivers. 24,330.24 Mb/s line rate with optional RS-FEC supported using GTYE3 or GTYE4 transceivers, or optional 100G Ethernet RS-FEC using GTYE4 transceivers on selected UltraScale+ parts.
- Zynq®-7000, Virtex®-7, and Kintex®-7 device designs operate at line rates of 614.4, 1,228.8, 2,457.6, 3,072, 4,915.2, 6,144, 9,830.4, 10,137.6, and 12,165.12 Mb/s using GTXE2, GTHE2 transceivers.
- Artix®-7 devices designs operate at line rates of 614.4, 1,228.86, 2,457.6, 3,072, 4,915.2, and 6,144 Mb/s using GTPE2 transceivers.

LogiCORE IP Facts	
Core Specifics	
Supported Device Family <sup>(1)</sup>	UltraScale+™ <sup>(2)</sup> UltraScale™ Zynq®-7000 All Programmable SoC <sup>(2)</sup> 7 Series <sup>(3)</sup>
Supported User Interfaces	Generic data, status, configuration and management interfaces, AXI4-Lite management interface
Provided with Core	
Design Files	Encrypted register transfer level (RTL)
Example Design	VHDL
Test Bench	VHDL
Constraints File	Xilinx Design Constraints (XDC)
Simulation Models	VHDL, Verilog
Supported S/W Drivers	N/A
Tested Design Flows <sup>(4)</sup>	
Design Entry	Vivado® Design Suite
Simulation	For supported simulators, see the <a href="#">Xilinx Design Tools: Release Notes Guide</a> .
Synthesis	Vivado Synthesis
Support	
Provided by Xilinx at the <a href="#">Xilinx Support web page</a>	

### Notes:

- For a complete list of supported devices, see the Vivado IP catalog.
- Excludes Zynq-7000 007, 010, 014 and 020 devices. Excludes Zynq UltraScale+ devices 2cg, 2eg, 3cg and 3eg.
- Excludes the Artix-7 100T device in CSG324, FTG256 and CS 324 packages. Excludes Spartan®-7 devices
- For the supported version of the tool, see the [Xilinx Design Tools: Release Notes Guide](#).

## Features (continued)

- Automatic speed negotiation
- Supports both Fast (Ethernet) and Slow High-Level Data Link Control (HDLC) Control and Management (C&M) channels per the *CPRI Specification v7.0* [\[Ref 1\]](#).
- Can be configured as a master or slave at generation time. Master core can be switched to operate as a slave through a configuration port.
- Suitable for use in both Radio Equipment Controllers (RECs) and Radio Equipment (RE), including multi-hop systems.
- Easy-to-use interface for in-phase (I) and quadrature-phase (Q) data and synchronization together with optional modules for UMTS terrestrial radio access - frequency division duplexing (UTRA-FDD) and Evolved UMTS Terrestrial Radio Access (E-UTRA) data mappings.
- Supports vendor specific data transport including support for the passing of control AxC information in global system for mobile communications (GSM) systems
- Delay measurement capability meets CPRI Requirement 21 per *CPRI Specification v7.0* [\[Ref 1\]](#)
- Includes the necessary clocking and transceiver logic to enable easy integration into your design
- Synthesizable example design and simple demonstration test bench provided
- Optional Reed-Solomon Forward error correction (RS-FEC) supported at 8,110.08, 10,137.6, 12,165.12 and 24,330.24 Mb/s line rates
- Optional 100G Ethernet RS-FEC supported at a fixed 24,330.24 Mb/s line rate on selected UltraScale+ devices using GTYE4 transceivers
- CPRI core can be converted into a four lane Receiver Hard FEC IP running at a fixed 24,330.24 Mb/s line rate, on UltraScale+ devices with 100G Ethernet RS-FEC support
- UTRA-FDD in-phase and quadrature-phase data (I/Q) module supporting 1 to 48 Antenna-Carriers per core

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## Overview

The CPRI core implements Layer 1 and Layer 2 of the CPRI specification in UltraScale architecture-based, Zynq-7000, Virtex-7, Kintex-7, and Artix-7 devices. The CPRI core provides these client-side interfaces.

- **I/Q Interface.** Consists of a stream of radio data (I/Q samples) that is synchronized to the Universal Mobile Telecommunications System (UMTS) radio frame pulse.
- **Synchronization Interface.** Provides the means for the client logic to synchronize to the network time by transmitting the UMTS radio frame pulse and clock frequency.
- **High-Level Data Link Control (HDLC) Interface.** Transports management information between master and slave. The HDLC interface is serialized and synchronous.

- **Ethernet Interface.** When configured to support speeds of up to 3,072 Mb/s, the Ethernet interface is presented as a Media Independent Interface (MII); this allows a 100 Mb Ethernet Media Access Controller (MAC) to be attached to the core to provide a high-speed channel for management information. When speeds over 4,915.2 Mb/s are supported, a Gigabit Media Independent Interface (GMII) option is available. This allows a 1 Gb Ethernet MAC to be attached to the core. The core includes an Ethernet frame buffer in both transmit and receive directions.
- **Vendor-Specific Data Interface.** Provides client logic access to the vendor-specific sub-channels in the CPRI stream.
- **Management Interface.** Provides control and status registers that allow management of the entire design from a supervisory processor. An AXI4-Lite option is available.

The architecture of the core is shown in [Figure 1](#). In addition to the interfaces described previously, the core contains these blocks:

- **Status/Alarm Block.** Reflects the internal state of the core and the state of the link.
- **Start-up Sequencer.** Performs line-rate negotiation and Control and Management (C&M) parameter negotiation at link start-up. This block continuously monitors the state of the link and sends the status to the alarm block.
- **UMTS Terrestrial Radio Access - Frequency Division Duplexing (UTRA FDD) I/Q Module:** A pluggable I/Q module to support multiplexing and demultiplexing of I/Q samples in UTRA FDD systems (shown in [Figure 1](#)).
- **Evolved UMTS Terrestrial Radio Access (E-UTRA) I/Q Module:** A pluggable I/Q module to support multiplexing and demultiplexing of I/Q samples in E-UTRA systems (not shown in [Figure 1](#)).
- **Legacy raw I/Q Module:** A pluggable I/Q Module for backward compatibility with the raw interfacing timing for v1.x CPRI cores (not shown in [Figure 1](#)).

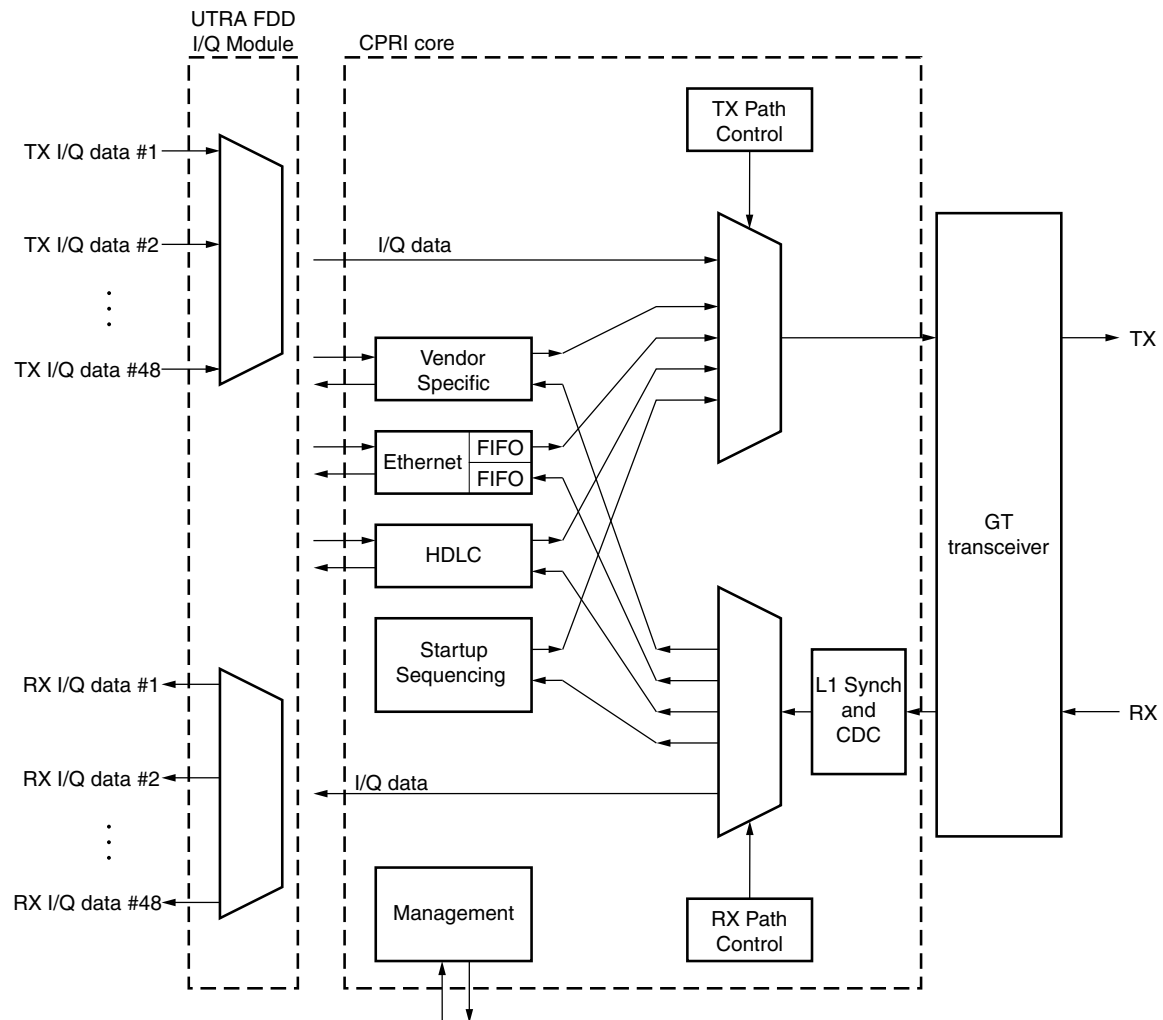


Figure 1: CPRI Top-Level Block Diagram

## References

To search for Xilinx documentation, go to the [Xilinx Support web page](#).

1. [CPRI Specification v7.0](#), October 9, 2015
2. [IEEE Std. 802.3-2005](#) ([standards.ieee.org/getieee802/](http://standards.ieee.org/getieee802/))
3. [Vivado AXI Reference Guide \(UG1037\)](#)
4. [Vivado Design Suite User Guide: Designing with IP \(UG896\)](#)

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For more information about the CPRI core and about obtaining a license, visit the [CPRI product page](#).

For more information about the RS-FEC core and about obtaining a license, visit the [RS-FEC product page](#).

Information about this and other Xilinx LogiCORE IP modules is available at the [Xilinx Intellectual Property](#) page. For information on pricing and availability of other Xilinx LogiCORE IP modules and tools, contact your [local Xilinx sales representative](#).

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## Revision History

Date	Version	Revision
10/4/2017	8.8	<ul style="list-style-type: none"> <li>Added support for 100G Ethernet hard RS-FEC in UltraScale+ parts</li> <li>Replaced fifo generator instance with xpm_fifo</li> <li>Added freerun clock rate field to GUI - used by UltraScale GT wizard reset block</li> </ul>
05/04/2017	8.7	<ul style="list-style-type: none"> <li>Added stat_rx_delay_value port</li> <li>Added 24,330.24 Mb/s support on UltraScale+ -1 speed grade devices</li> </ul>
10/05/2016	8.7	<ul style="list-style-type: none"> <li>Added 24,330.24 Mb/s support for GTYE4-based devices</li> <li>Added Reed-Solomon Forward Error Correction</li> </ul>
04/06/2016	8.6	<ul style="list-style-type: none"> <li>Added 24,330.24 Mb/s support with a 64-bit datapath option</li> <li>Added 12,165.12 Mb/s to Kintex-7, Zynq-7000 and Virtex-7 devices</li> <li>Added debug register and enhanced FIFO transit time registers</li> </ul>
11/18/2015	8.5	<ul style="list-style-type: none"> <li>Added support for UltraScale+ families.</li> <li>Added support for GTYE3, GTHE4, and GTYE4 transceivers.</li> <li>Added 12,165.12 Mb/s support.</li> <li>Replaced <i>CPRI Specification v6.0, August 30, 2013</i> with <i>CPRI Specification v6.1, July 1, 2014</i>.</li> </ul>
09/30/2015	8.5	<ul style="list-style-type: none"> <li>Added UltraScale architecture support for 8,110.08 Mb/s and 12,165.12 Mb/s line rates</li> <li>Added transceiver location selection for UltraScale devices</li> <li>Added Ethernet FIFO Fill Level register</li> <li>Added insertion loss settings for UltraScale device based cores</li> </ul>
04/01/2015	8.4	<ul style="list-style-type: none"> <li>Changed UltraScale device 10,137.6 Mb/s implementation to use the asynchronous gearbox</li> <li>Added a software reset feature</li> <li>Added support for GTYE3 transceivers in Virtex® UltraScale devices</li> </ul>
10/01/2014	8.3	<ul style="list-style-type: none"> <li>Added speed switching to the 10,137.6 Mb/s capable cores</li> <li>Added the watchdog timer register</li> <li>Added the transceiver data monitor interface</li> </ul>
06/04/2014	8.2	Associated Product Guide (PG056) updated with parameter table.
04/02/2014	8.2	Added 10137.6 Mb/s line rate
12/18/2013	8.1	<ul style="list-style-type: none"> <li>Added UltraScale architecture support</li> <li>Added transceiver debug interface</li> </ul>
10/02/2013	8.0	<ul style="list-style-type: none"> <li>Revision number advanced to 8.0 to align with core version number</li> <li>Added option to bypass the Ethernet frame buffers</li> </ul>
03/20/2013	3.0	Updated for Vivado Design Suite and core version 7.0. Removed all ISE design tools and architectures not supported for Vivado.
12/18/2012	2.0	Updated for ISE Design Suite 14.4, Vivado Design Suite 2012.4, and core version 6.1.
07/25/2012	1.0	Initial Xilinx release. Replaces ds611. Data sheet information was incorporated into the new product guide, pg056.

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