

## VPX3-ZU1B-SDR Products Brief

*3U OpenVPX Solutions for SDR/EW with ADI's RadioVerse RF Transceivers*

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Version 2.2

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# Overview

**PanaTeQ's VPX3-ZU1B-SDR** are 3U OpenVPX modules based on the Zynq UltraScale+ MPSoC device from Xilinx coupled to RadioVerse Analog Devices RF Wideband Transceivers **AD9361**, **AD9371**, **AD9375**, **ADRV9009**, **ADRV9029** or **ADRV9002** for a broad range of applications such as Software Defined Radio, MILCOM, massive MIMO, Phase Array Radar and Electronic Warfare.

PanaTeQ provides solutions for **Ruggedized Air-Cooled** and **Conduction Cooled** systems.

These VPX3-ZU1B-SDR modules are based on the following PanaTeQ's sub-modules (boards):

The **VPX3-ZU1B** is a 3U OpenVPX module based on a Xilinx Zynq Ultrascale+ MPSoC with a FMC 57.1 site, HW/SW compatible with ZCU102 Evaluation board from Xilinx.

The **FMC-ZU1RF-A** is a FMC based on an Analog Devices AD9371, HW/SW compatible with ADRV9371 Evaluation Board from Analog Devices.

The **FMC-ZU1RF-B** is a FMC based on an Analog Devices AD9375, HW/SW compatible with ADRV9371 Evaluation board from Analog Devices.

The **FMC-ZU2RF-A** is a FMC based on an Analog Devices ADRV9009, HW/SW compatible with ADRV9009 Evaluation board from Analog Devices.

The **FMC-ZU3RF-A** is a FMC based on an Analog Devices ADRV9029.

The **FMC-ZU4RF-A/B** is a FMC based on dual Analog Devices Single/Dual ADRV9002.

The **FMC-SDR400-D** is a FMC based on an Analog Devices AD9361.

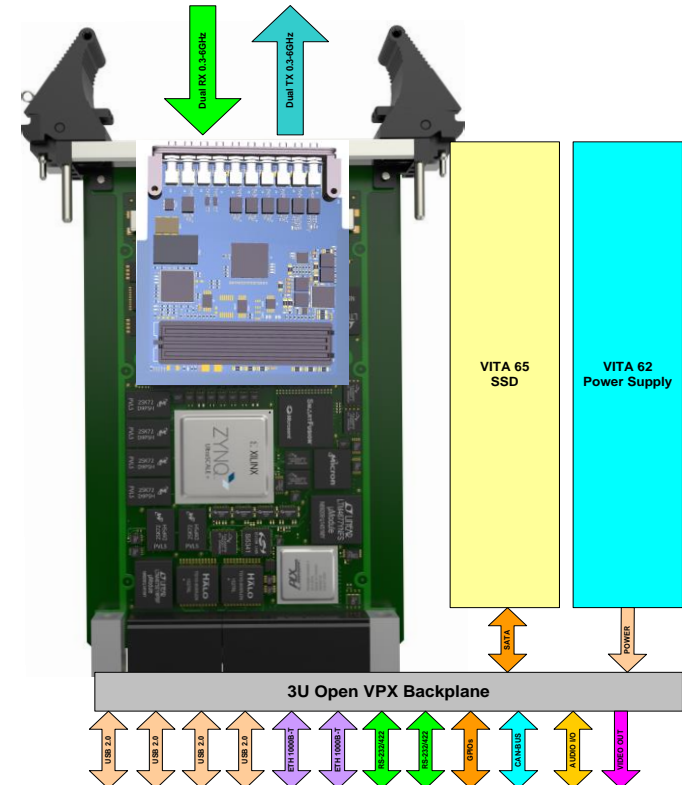
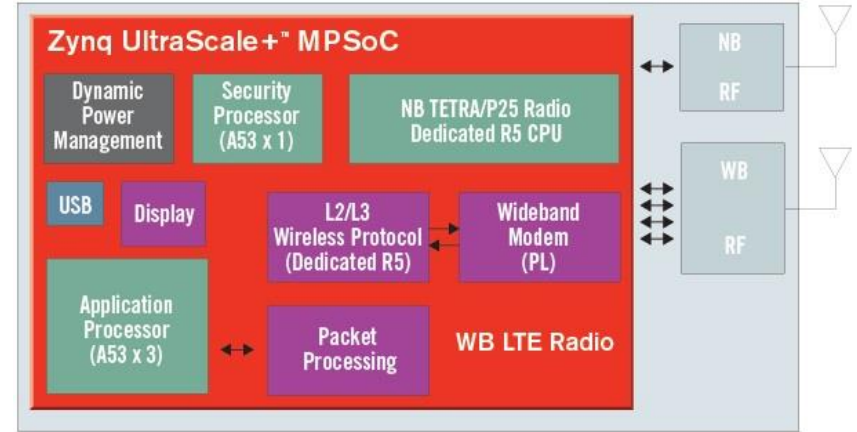
# Typical Application : Software Defined Radio System (SWaP-C)

**VPX3-ZU1B-SDR-A/B/C/D/E/F**

**Air Cooled Development Systems**



**Conduction Cooled**



# Analog Devices RF Transceivers Comparison

Part #	RF Tuning Range	Channels	Tunable Channel Bandwidth	Interface	Digital Pre Distorsion (DPD)	TDD/FDD
AD9361	70MHz - 6GHz	2Rx, 2Tx	200KHz - 56MHz	LVDS JESD207	N/A	Both
AD9371	300MHz - 6GHz	2Rx, 2Tx	8MHz - 100MHz	6Gbps JESD204B	N/A	Both
AD9375	300MHz - 6GHz	2Rx, 2Tx	8MHz - 100MHz	6Gbps JESD204B	Linearization BW up to 40MHz	Both
ADRV9009	75MHz - 6GHz	2Rx, 2Tx	200MHz	12Gbps JESD204B	N/A	TDD Only
ADRV9029	75MHz - 6GHz	4Rx, 4Tx	200MHz	24Gbps JESD204C	DPD + DPE	Both
ADRV9002	30MHz – 6GHz	2Rx, 2Tx	12 KHz - 40 MHz	LVDS	Linearization BW up to 20MHz	Both

# PanaTeQ 3U VPX3-ZU1B-SDR Products Table

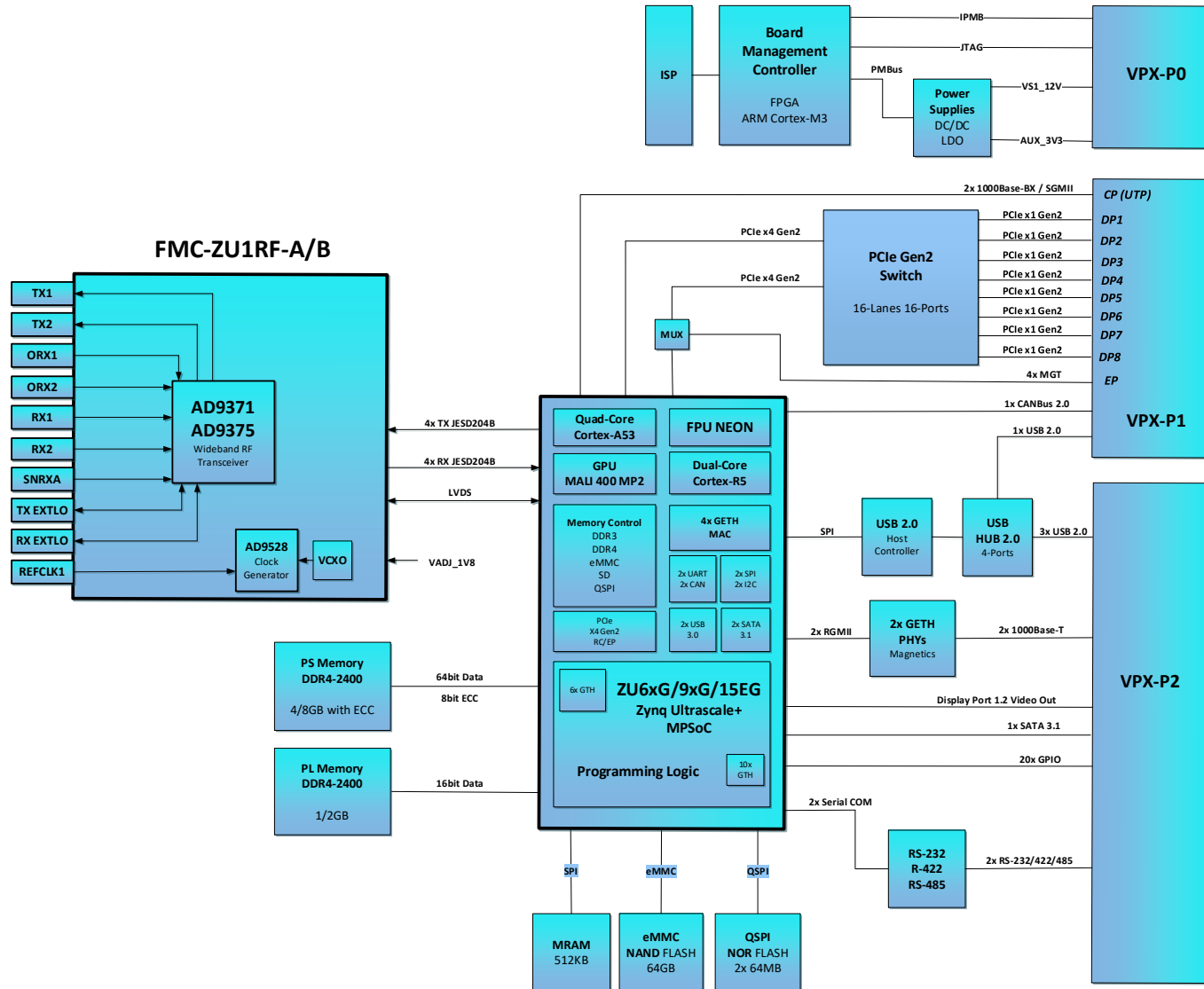
Product Name	Zynq MPSOC	RF Transceiver	MIMO	ADI Eval Board	Availability
VPX3-ZU1B-SDR-A	ZU6/ZU9/ZU15	AD9371	2T2R	ADRV9371-W	Now
VPX3-ZU1B-SDR-B	ZU6/ZU9/ZU15	AD9375	2T2R	ADRV9375-W	Now
VPX3-ZU1B-SDR-C	ZU6/ZU9/ZU15	ADRV9009	2T2R	ADRV9009-W	Now
VPX3-ZU1B-SDR-D	ZU6/ZU9/ZU15	ADRV9029	4T4R	ADS9-V2EBZ	Contact Us
VPX3-ZU1B-SDR-E	ZU6/ZU9/ZU15	AD9361	2T2R	AD-FMCOMMS3-EBZ	Now
VPX3-ZU1B-SDR-FA VPX3-ZU1B-SDR-FB	ZU6/ZU9/ZU15	Single/Dual ADRV9002	4T4R	EVAL-ADRV9002	Contact US

# VPX3-ZU1B-SDR-A/B Features

## Technical Specifications

- 3U VPX (**VITA 46.0**) and OpenVPX (**VITA 65**) specifications compliant
- Compatibility with ADI Eval boards **ADRV9371** (-A model), **ADRV9375** (-B model)
- **AD9371** (-A model), **AD9375** (-B model) RF Wideband Transceivers
- Two TX and Two RX coherent channels synchronized in frequency and phase
- Wide tuning range 300MHz to 6GHz
- Max receiver BW 100MHz. Up to 200MHz using 2 receivers
- Max transmitter synthesis BW 250MHz
- On-board Xilinx **Zynq UltraScale+ MPSoC** as Baseband processor
- Compatibility with Xilinx Eval Board **ZCU102**
- **ZU6/ZU9/ZU15** FFVC-900 Package
- Up to 8GB DDR4-2400 64-bit Processing System (PS) memory with 8-bit ECC
- Up to 2GB DDR4-2400 16-bit Programmable Logic (PL) memory
- eMMC 64GB (V4.51), MRAM 512KB
- On-board **PCIe Gen2 Switch** PEX8619, 16-Ports 16-Lanes. No SBC required in the VPX System
- 2x 1000Base-T on VPX-P2 and 2x 1000Base-X/SGMII on VPX-P1
- 2x RS-232/422/485, 2x CAN 2.0B and 20x GPIOs (LVCMOS 2.5V or LVDS 2.5V) on VPX-P2
- 4x USB 2.0, 1x SATA 3.1 and DisplayPort 1.2 Video Out on VPX-P2
- Advanced PanaTeQ Board Management Controller (BMC) ARM M3 based and Power Management Bus (PMBus)
- Industrial Air Cooled and Conduction Cooled (**VITA 48.0**) versions available

# VPX3-ZU1B-SDR-A/B Block Diagram

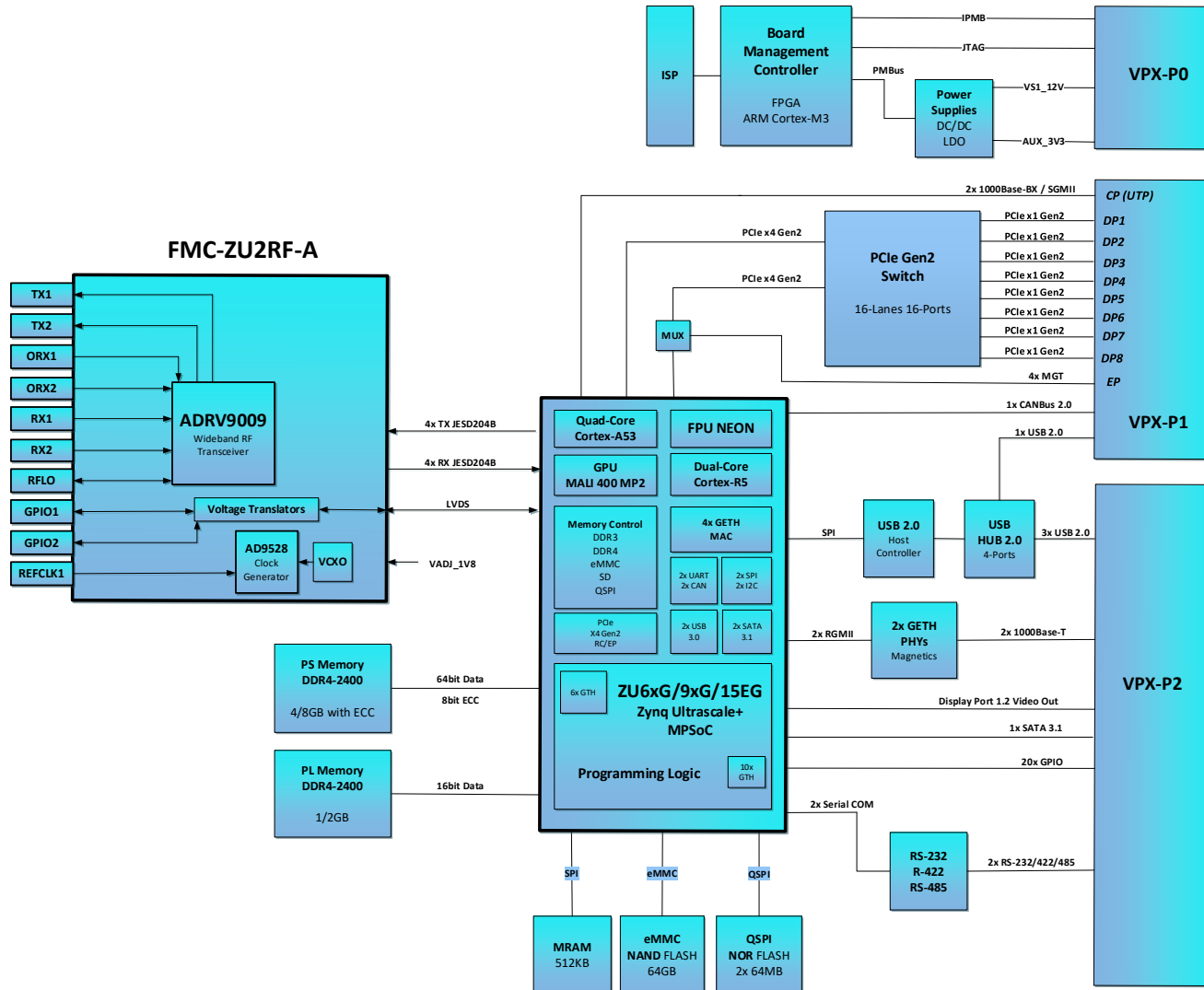


# VPX3-ZU1B-SDR-C Module Features

## Technical Specifications

- 3U VPX (**VITA 46.0**) and OpenVPX (**VITA 65**) specifications compliant
- Compatibility with ADI Eval boards **ADRV9009**
- **ADRV9009** RF Wideband Transceiver
- Two TX and Two RX coherent channels synchronized in frequency and phase
- Wide tuning range 75MHz to 6GHz
- Max receiver BW 200MHz. Up to 400MHz using 2 receivers
- Max transmitter synthesis BW 450MHz
- On-board Xilinx **Zynq UltraScale+ MPSoC** as Baseband processor
- Compatibility with Xilinx Eval Board **ZCU102**
- **ZU6/ZU9/ZU15** FFVC-900 Package
- Up to 8GB DDR4-2400 64-bit Processing System (PS) memory with 8-bit ECC
- Up to 2GB DDR4-2400 16-bit Programmable Logic (PL) memory
- eMMC 64GB (V4.51), MRAM 512KB
- On-board **PCIe Gen2 Switch** PEX8619, 16-Ports 16-Lanes. No SBC required in the VPX System
- 2x 1000Base-T on VPX-P2 and 2x 1000Base-X/SGMII on VPX-P1
- 2x RS-232/422/485, 2x CAN 2.0B and 20x GPIOs (LVCMOS 2.5V or LVDS 2.5V) on VPX-P2
- 4x USB 2.0, 1x SATA 3.1 and DisplayPort 1.2 Video Out on VPX-P2
- Advanced PanaTeQ Board Management Controller (BMC) ARM M3 based and Power Management Bus (PMBus)
- Industrial Air Cooled and Conduction Cooled (**VITA 48.0**) versions available

# VPX3-ZU1B-SDR-C Block Diagram

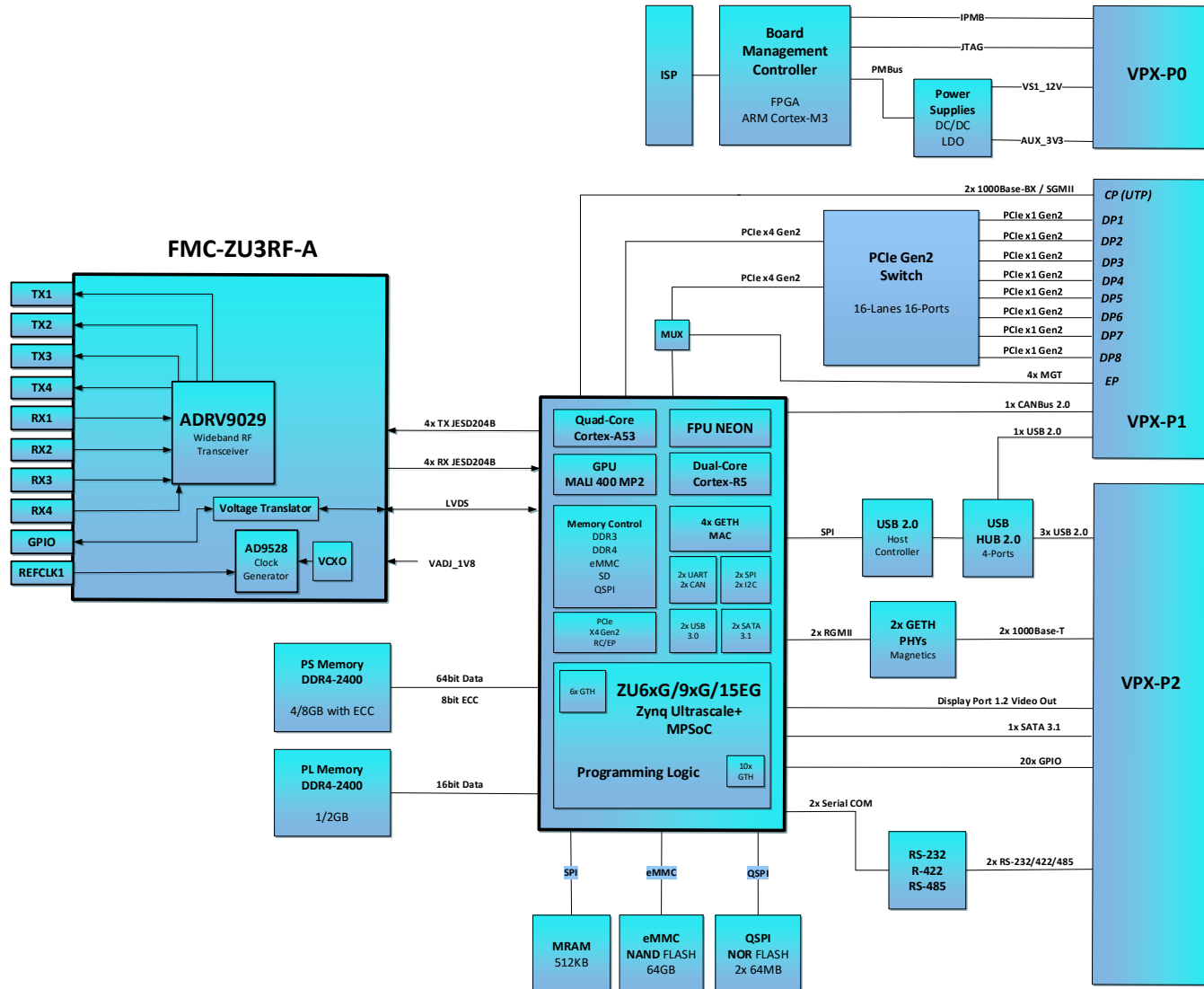


# VPX3-ZU1B-SDR-D Module Features

## Technical Specifications

- 3U VPX (**VITA 46.0**) and OpenVPX (**VITA 65**) specifications compliant
- Compatibility with ADI Eval boards **ADRV9029** (single Transceiver)
- **ADRV9029** RF Wideband Transceiver
- Four TX and Four RX coherent channels synchronized in frequency and phase
- Wide tuning range 75MHz to 6GHz
- Max receiver BW 200MHz
- Max transmitter synthesis BW 450MHz
- On-board Xilinx **Zynq UltraScale+ MPSoC** as Baseband processor
- Compatibility with Xilinx Eval Board **ZCU102**
- **ZU6/ZU9/ZU15** FFVC-900 Package
- Up to 8GB DDR4-2400 64-bit Processing System (PS) memory with 8-bit ECC
- Up to 2GB DDR4-2400 16-bit Programmable Logic (PL) memory
- eMMC 64GB (V4.51), MRAM 512KB
- On-board **PCIe Gen2 Switch** PEX8619, 16-Ports 16-Lanes. No SBC required in the VPX System
- 2x 1000Base-T on VPX-P2 and 2x 1000Base-X/SGMII on VPX-P1
- 2x RS-232/422/485, 2x CAN 2.0B and 20x GPIOs (LVCMOS 2.5V or LVDS 2.5V) on VPX-P2
- 4x USB 2.0, 1x SATA 3.1 and DisplayPort 1.2 Video Out on VPX-P2
- Advanced PanaTeQ Board Management Controller (BMC) ARM M3 based and Power Management Bus (PMBus)
- Industrial Air Cooled and Conduction Cooled (**VITA 48.0**) versions available

# VPX3-ZU1B-SDR-D Block Diagram

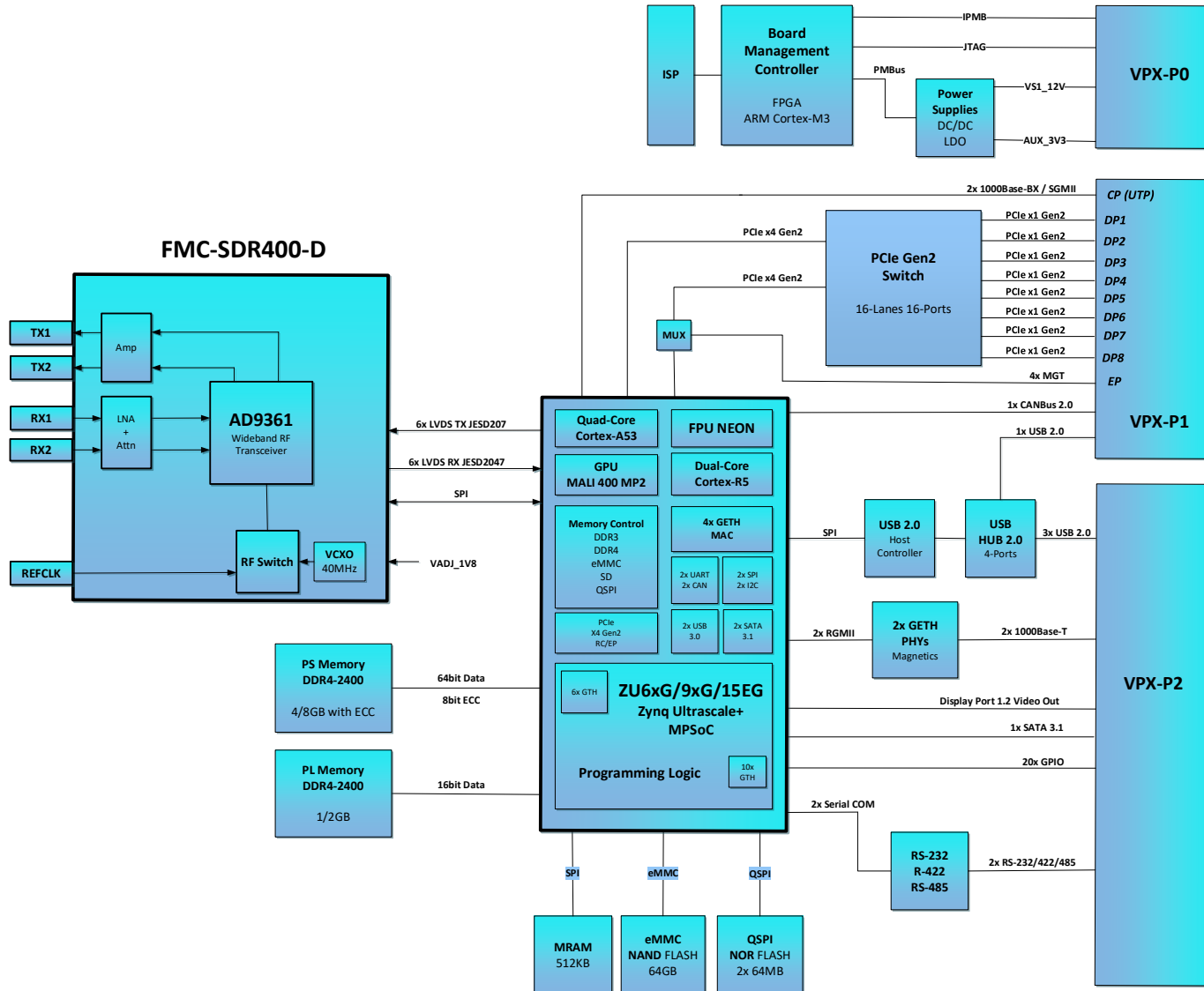


# VPX3-ZU1B-SDR-E Module Features

## Technical Specifications

- 3U VPX (**VITA 46.0**) and OpenVPX (**VITA 65**) specifications compliant
- Compatibility with ADI Eval boards **AD9361** (single Transceiver)
- **AD9361** RF Wideband Transceiver
- Dual TX and Dual RX coherent channels synchronized in frequency and phase
- Wide tuning range 70MHz to 6GHz
- Min receiver BW 200KHz. Max receiver BW 56MHz
- On-board Xilinx **Zynq UltraScale+ MPSoC** as Baseband processor
- Compatibility with Xilinx Eval Board **ZCU102**
- **ZU6/ZU9/ZU15** FFVC-900 Package
- Up to 8GB DDR4-2400 64-bit Processing System (PS) memory with 8-bit ECC
- Up to 2GB DDR4-2400 16-bit Programmable Logic (PL) memory
- eMMC 64GB (V4.51), MRAM 512KB
- On-board **PCIe Gen2 Switch** PEX8619, 16-Ports 16-Lanes. No SBC required in the VPX System
- 2x 1000Base-T on VPX-P2 and 2x 1000Base-X/SGMII on VPX-P1
- 2x RS-232/422/485, 2x CAN 2.0B and 20x GPIOs (LVCMOS 2.5V or LVDS 2.5V) on VPX-P2
- 4x USB 2.0, 1x SATA 3.1 and DisplayPort 1.2 Video Out on VPX-P2
- Advanced PanaTeQ Board Management Controller (BMC) ARM M3 based and Power Management Bus (PMBus)
- Industrial Air Cooled and Conduction Cooled (**VITA 48.0**) versions available

# VPX3-ZU1B-SDR-E Block Diagram

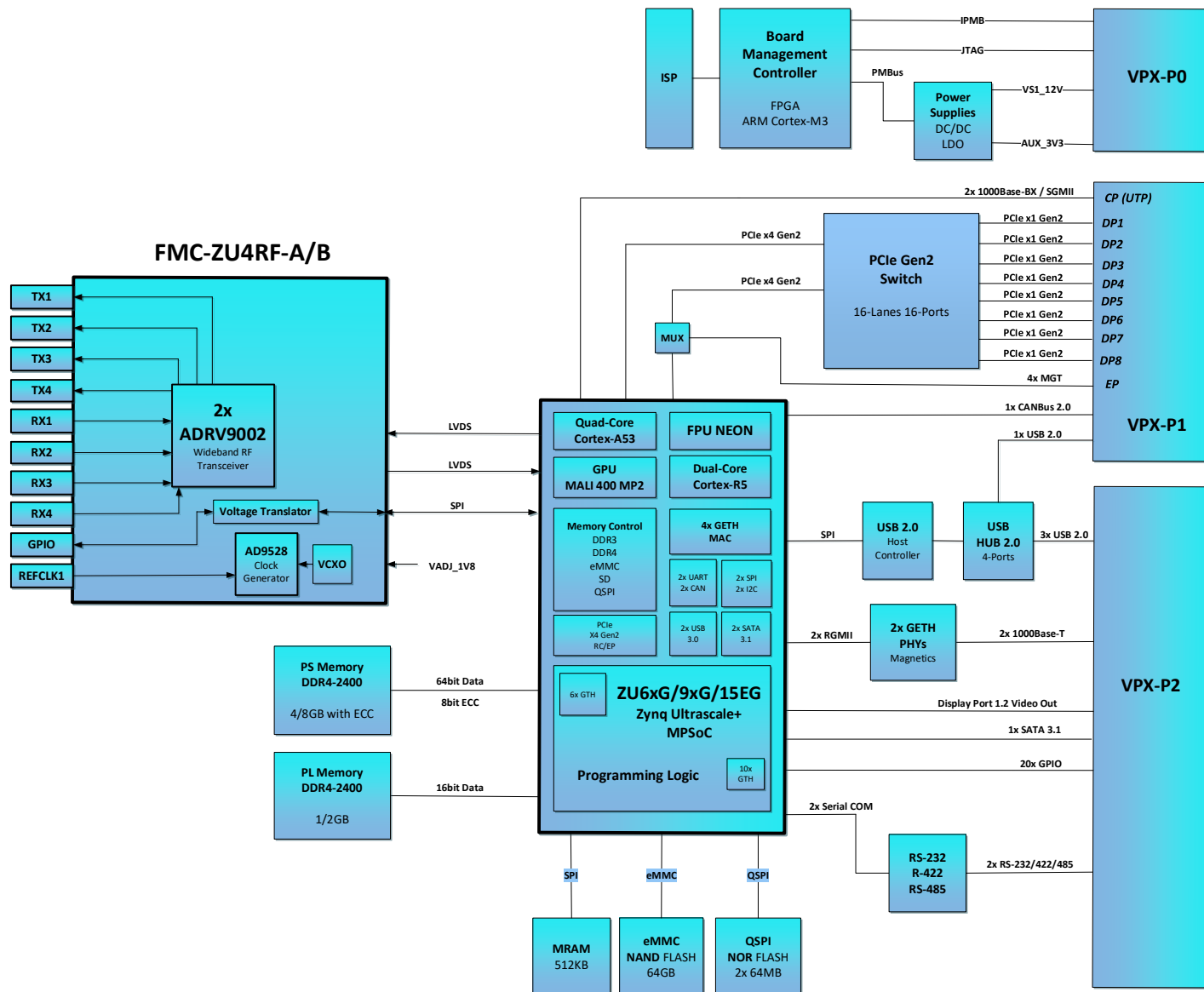


# VPX3-ZU1B-SDR-FA/FB Module Features

## Technical Specifications

- 3U VPX (**VITA 46.0**) and OpenVPX (**VITA 65**) specifications compliant
- **Single ADRV9002 (FA) or Dual ADRV9002 (FB)** RF Wideband Transceiver
- Dual TX and Dual RX coherent channels synchronized in frequency and phase
- Wide tuning range 30MHz to 6GHz
- Min receiver BW 12KHz. Max receiver BW 40MHz
- On-board Xilinx **Zynq UltraScale+ MPSoC** as Baseband processor
- Compatibility with Xilinx Eval Board **ZCU102**
- **ZU6/ZU9/ZU15** FFVC-900 Package
- Up to 8GB DDR4-2400 64-bit Processing System (PS) memory with 8-bit ECC
- Up to 2GB DDR4-2400 16-bit Programmable Logic (PL) memory
- eMMC 64GB (V4.51), MRAM 512KB
- On-board **PCIe Gen2 Switch** PEX8619, 16-Ports 16-Lanes. No SBC required in the VPX System
- 2x 1000Base-T on VPX-P2 and 2x 1000Base-X/SGMII on VPX-P1
- 2x RS-232/422/485, 2x CAN 2.0B and 20x GPIOs (LVCMOS 2.5V or LVDS 2.5V) on VPX-P2
- 4x USB 2.0, 1x SATA 3.1 and DisplayPort 1.2 Video Out on VPX-P2
- Advanced PanaTeQ Board Management Controller (BMC) ARM M3 based and Power Management Bus (PMBus)
- Industrial Air Cooled and Conduction Cooled (**VITA 48.0**) versions available

# VPX3-ZU1B-SDR-FA/FB Block Diagram



# Estimated Power Budget (VPX 12V)

## Estimated Worst Case Power Budget

- Xilinx Zynq UltraScale+ ZU9G = 10-30 W
- 6 x 4 Gbit DDR4-2400 (2 GB + 512MB) = 4W
- PCIe Switch = 3W
- Miscellaneous = 4W
- DC/DC = 4W
- FMC RF = 10W

## Summary

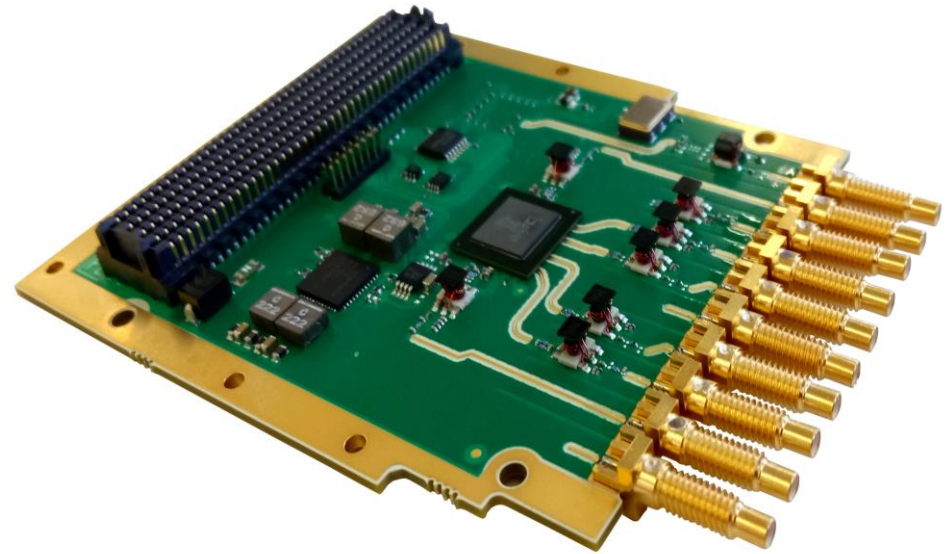
- Low Power configuration = 35 W
- Standard configuration = 45W
- High-performance configuration = 55W

# FMC-ZU1RF-A/B

## FMC Wideband RF Transceiver AD9371/AD9375 based

### Technical Specifications

- Vita 57.1-2010 specification compliant
- FMC High Pin Connector (HPC)
- Analog Devices AD9371 (-A) or AD9375 (-B) RF Transceiver
- JESD024B interface up to 6144 Mbps (4x TX, 4x RX)
- LA Bus LVDA and Single-Ended
- Operates with  $V_{Adj} = 2.5V$  to  $1.8V$
- ADRV9371 (-A) ADRV9375 (-B) ADI eval boards HW/SW
- Dual Receivers (Rx)
- Observation Receiver (ORx) with two input
- Sniffer Receiver (SnRx) with 1 input
- TX Ext LO Input/Output. RX Ext LO Input/Output
- Reference Clock Input
- RF Coverage 300MHz to 6.0 GHz. Tx Synthesis Bandwidth (BW) to 250MHz. Rx Bandwidth: 7MHz to 100MHz
- Industrial Air Cooled and Conduction Cooled versions

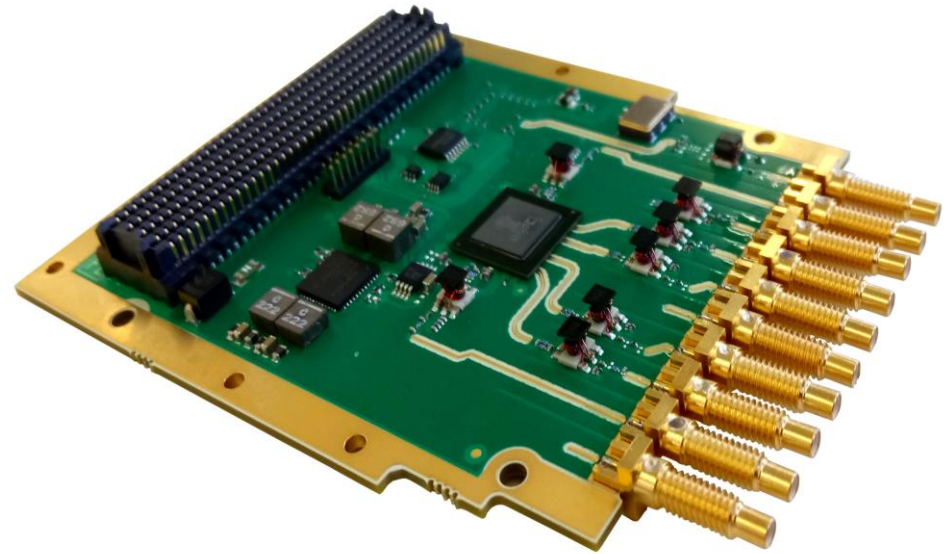


# FMC-ZU2RF-A

## FMC Wideband RF Transceiver ADRV9009 based

### Technical Specifications

- Vita 57.1-2010 specification compliant
- FMC High Pin Connector (HPC)
- Analog Devices ADRV9009 RF Transceiver
- JESD024B interface up to 12288 Mbps (4x TX, 4x RX)
- LA Bus LVDA and Single-Ended
- Operates with  $V_{Adj} = 2.5V$  to  $1.8V$
- ADRV9009 ADI eval board HW/SW compatible
- Dual Transmitters (Tx)
- Dual Receivers (Rx)
- Observation Receiver (ORx) with two input
- RF Ext LO Input/Output. RX Ext LO Input/Output
- Dual FPGA GPIO Input/Output 3.3V to/from FMC
- Reference Clock Input
- RF Coverage 75MHz to 6.0 GHz. Tx Synthesis Bandwidth (BW) to 450MHz. Rx Bandwidth: 7MHz to 200MHz
- Industrial Air Cooled and Conduction Cooled versions

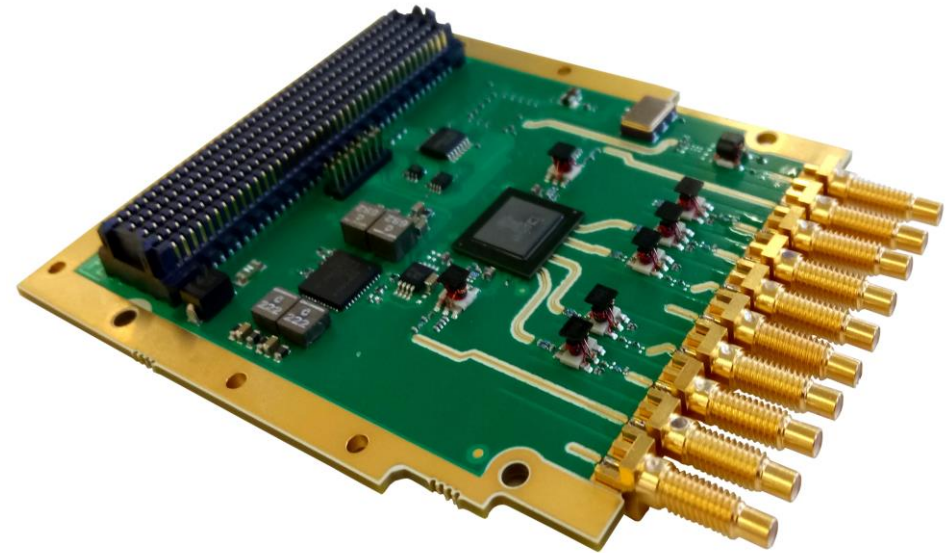


# FMC-ZU3RF-A

## FMC Wideband RF Transceiver ADRV9029 based

### Technical Specifications

- Vita 57.1-2010 specification compliant
- Analog Devices ADRV9029 RF Transceivers
- FMC High Pin Connector (HPC)
- JESD024B interface up to 12288 Mbps (4x TX, 4x RX)
- LA Bus LVDA and Single-Ended
- Operates with  $V_{Adj} = 2.5V$  to  $1.8V$
- ADRV9029 (single chip) ADI eval board HW/SW compatible
- Quad Transmitters (Tx)
- Quad Receivers (Rx)
- Four TX and Four RX coherent channels synchronized in frequency and phase
- RF Ext LO Input/Output. RX Ext LO Input/Output
- Reference Clock Input
- RF Coverage 75MHz to 6.0 GHz. Tx Synthesis Bandwidth (BW) to 450MHz. Rx Bandwidth: 7MHz to 200MHz
- Industrial Air Cooled and Conduction Cooled versions

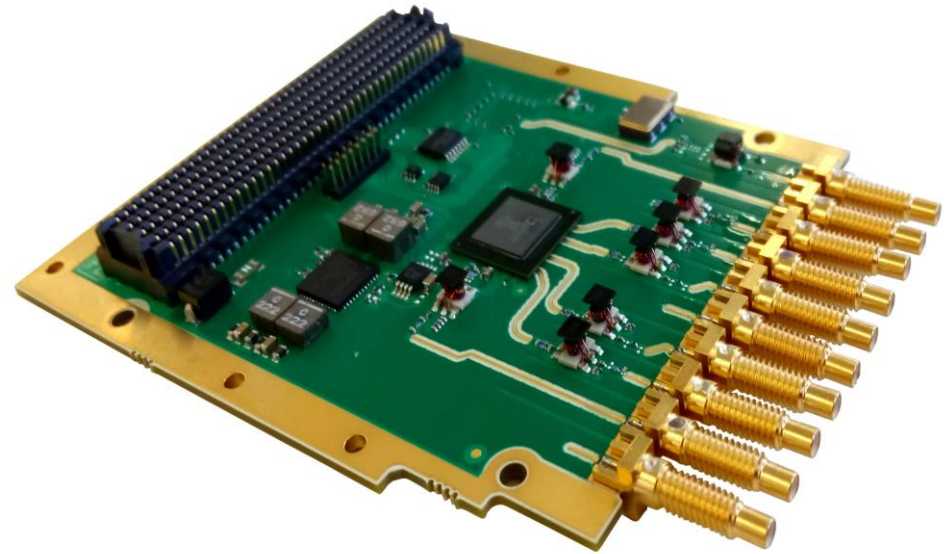


# FMC-ZU4RF-A/B

## FMC Wideband RF Transceiver ADRV9029 based

### Technical Specifications

- Vita 57.1-2010 specification compliant
  - Single or Dual Analog Devices ADRV9002 RF Transceivers
  - FMC High Pin Connector (HPC)
  - LVDS (4x TX, 4x RX)
  - LA Bus LVDA and Single-Ended
  - Operates with  $V_{Adj} = 2.5V$  to  $1.8V$
  - Dual or Quad Transmitters (Tx)
  - Dual or Quad Receivers (Rx)
- 
- Four TX and Four RX coherent channels synchronized in frequency and phase
  - Reference Clock Input
  - RF Coverage 30MHz to 6.0 GHz. Tunable Bandwidth: 12KHz to 40MHz
  - Industrial Air Cooled and Conduction Cooled versions

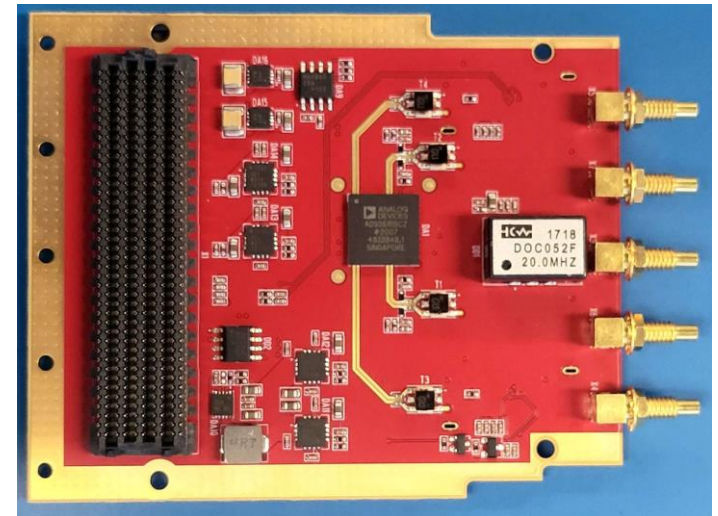


# FMC-SDR400-D

## FMC Wideband RF Transceiver AD9361 based

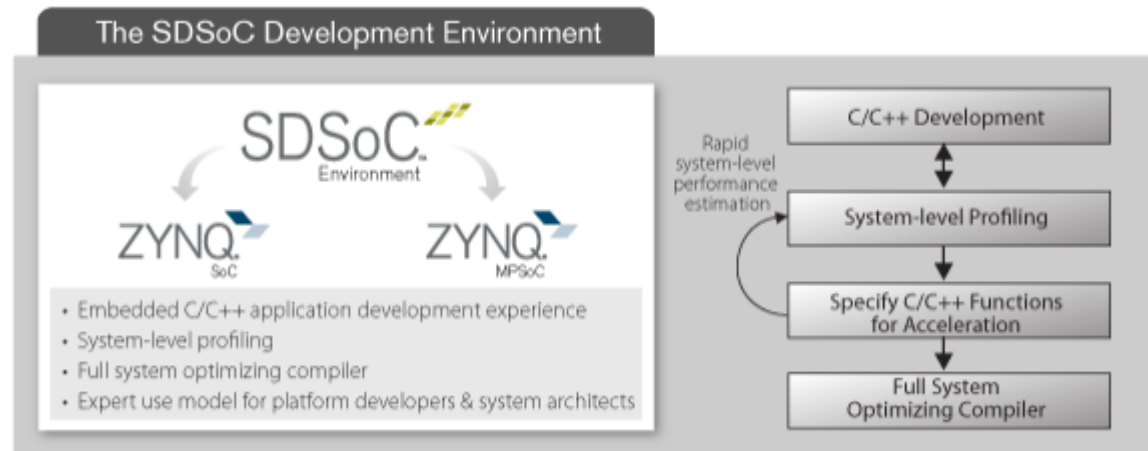
### Technical Specifications

- Vita 57.1 FMC LPC connector for interfacing with VPX3-ZU1B carrier
- 5 SSMC 2x TX, 2x RX, 1x REFCLK In
- RF Input frequency range 0.1 GHz – 6 GHz, input Bandwidth –up to 56 MHz;
- Input LNA HMC8410LP2FE
- Input tunable attenuator is HMC624A
- RF Output specifications: Output frequency range 50MHz – 6 GHz
- TX path contains 22 dB TX amplifier ADL5611
- 1 external reference clock input connector. Input range: 10 – 80 MHz;
- Internal 40 MHz VCXO, +-100ppb, as option can be used 40 MHz TCXO
- Preliminary power consumption: 12V – Max 0.6A, 3V3 – Max 2A, VADJ – Max 0.1A
- VADJ supported 1.8V, 2.5V.



# Xilinx Development Tools Support

**Xilinx SDSoC:** Familiar Embedded C/C++ Application Development Experience for SoCs and MPSoCs



**Xilinx Vivado HLx:** Accelerating High Level Design



# Third Party Development Tools Support

Platform development environment support includes Industry Standard :

- Linux Industrial I/O Applications
- MATLAB
- SIMULINK
- GNU RADIO
- Streaming Interface for custom C, C++ , PYTHON and C#

Analog Devices (Open Source) HDL reference design and driver to allow optimized Time To Market

# Software BSP Support

## **LINUX**

Xilinx PetaLinux (from PanaTeQ and free of charge)

Yocto Linux

Mentor Embedded Linux

Windriver Linux

## **RTOS & Bare Metal**

Xilinx SDK

Green Hill Software Integrity 11

FreeRTOS

Wind River VxWorks 7

Sysgo PikeOS

QNX

# Product Codification for Ordering

## VPX3-ZU1B-SDR- a - b c d – rl

a	RF Tranceiver	b	Device Size	ARM A53 Cores	GPU Mali	Logic Cells	DSP Slices	Memory
A	AD9371							
B	AD9375	A	XCZU6EG	4	Yes	469K	1973	25.1 Mb
C	ADRV9009	B	XCZU9EG	4	Yes	600K	2530	32 Mb
D	ADRV9029	C	XCZU15EG	4	Yes	747K	3528	57.7 Mb
E	AD9361	D	XCZU6CG	2	No	469K	1973	25.1 Mb
FA	1x ADRV9002	E	XCZU9CG	2	No	600K	2530	32 Mb
FB	2x ADRV9002							
c	Speed Grade	d	PS / PL DDR4					
1	Slowest	M	4GB / 1GB					
2	Highest	P	8GB / 2GB					
				rl	Ruggedization Level	Vita 47		
				AS	Air Standard	EAC4		
				AR	Air Rugged	EAC6		
				CC	Conduction Cooled	ECC3		
				CR	Conduction Rugged	ECC4		

# Thank You

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