

## XMC Zynq MPSoC + Dual ADRV9009 module

### Overview

PanaTeQ's XMC-SDR-A is a XMC module based on the Zynq UltraScale+ MultiProcessor SoC device from Xilinx and two ADRV9009 RF Wideband Transceivers from Analog Devices for a broad range of applications such as Software Defined Radio, MILCOM, massive MIMO, Phase Array Radar and Electronic Warfare.

It is HW/SW compatible with ADRV9009-ZU11EG RF SoM from Analog Devices.

The baseband processor is a Zynq UltraScale+ MPSoC that integrates a Quad-core ARM Cortex-A53 based Application Processing Unit (APU), a Dual-core ARM Cortex-R5 based Real-Time Processing Unit (RPU), a ARM Mali-400 based Graphic Processing Unit (GPU), a Video CODEC H.264/H.265 (EV devices only) and an UltraScale+ Programmable Logic (PL) in a single device. It also includes on-chip memory, external memory interfaces, and a rich set of peripheral connectivity interfaces.

The board can be ordered with different versions of the Zynq UltraScale+ MPSoC family of devices, coupled with up to 8GB 64-bit DDR4-2400 Processing Memory with 8-bit ECC.

Up to 4GB 32-bit of DDR4-2400 is also available as the Programmable Logic Memory, allowing data streaming applications such as video CODEC and signal processing. 64GB of soldered eMMC managed NAND Flash is available for local data storage.

The XMC-SDR-A provides a front-end RF interface using 10 SSMC connectors.

The board can act as a **PrPMC** in the system. When the XMC-SDR-A is System Controller. There is no need to add any SBC in the System, improving **Size, Weight, Power and Cost (SWaP-C)**.

A large number of the Zynq Ultrascale+ PS peripherals are available on the XMC connectors: 1x ETH 1000Base-T, 2x USB 3.0/2.0, 2x USB 2.0, 1x SATA 3.1, 2x CAN-2.0B, 2x RS-232/422/485, 4x MGT, 24x GPIO, Video Out Display Port 1.2.

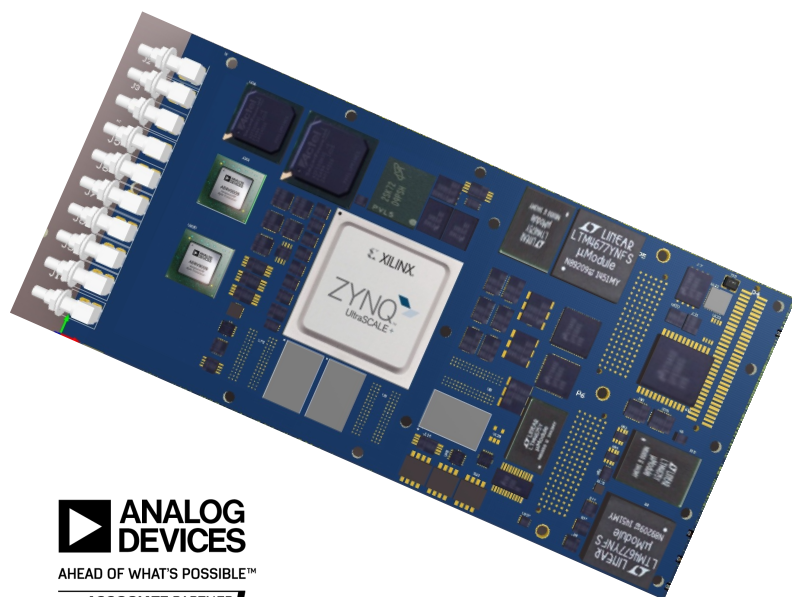
PanaTeQ offers a System Development Kit **XMC-SDR-A-PSDK** for the developers and that includes the **XMC-SDR-A-D1N-AS** and **IO-XMC-SDR-A** boards, a PetaLinux BSP, the PanaTeQ FPGA Design Kit (**PAN-FDK**) and cables.

### Key Features

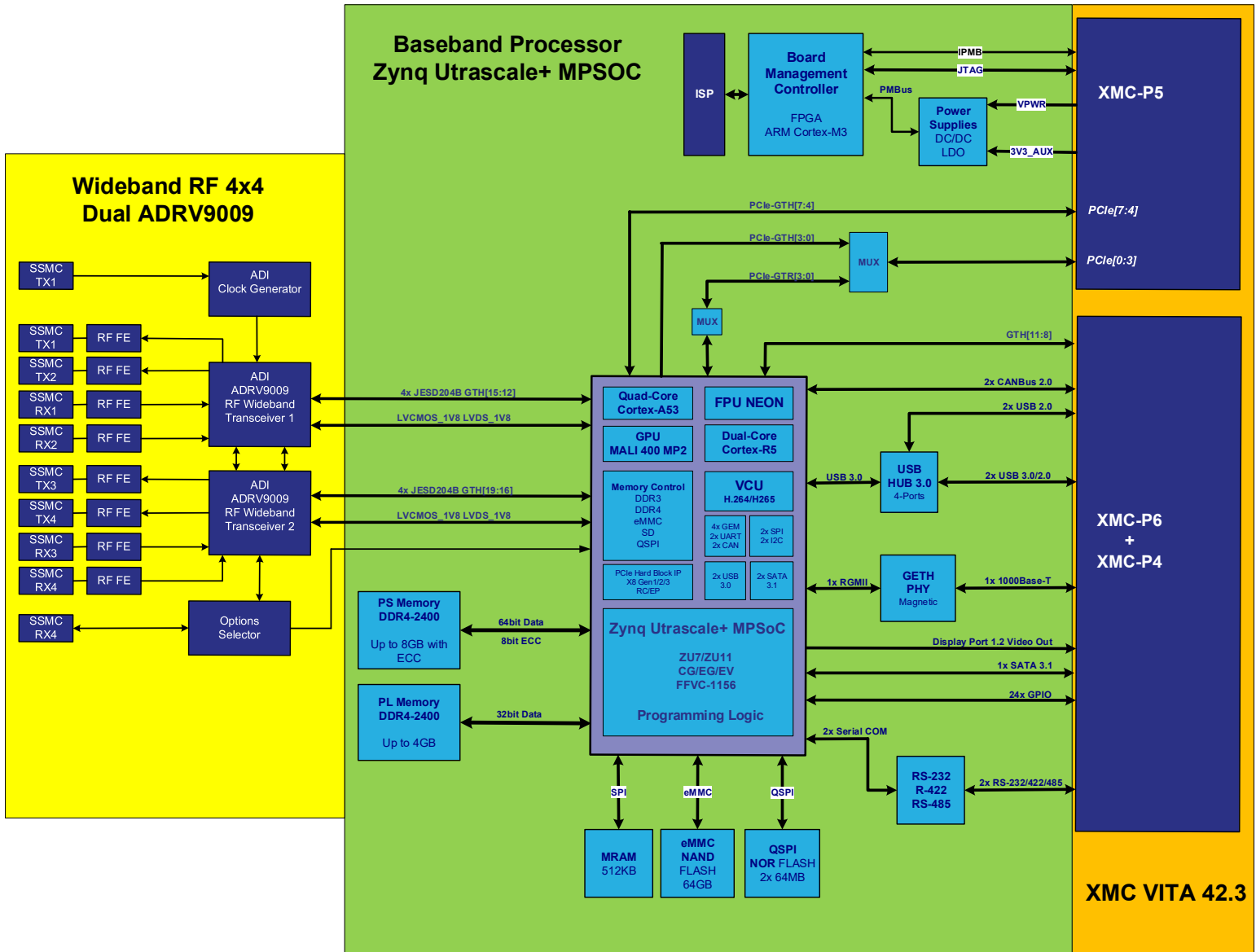
- Vita 42.3 XMC Compliant
- Compatibility with ADI ADRV9009-ZU11EG RF SoM
- Dual ADRV9009 RF Wideband Transceivers
- Four TX and Four RX coherent channels synchronized in frequency and phase
- Wide tuning range 75MHz to 6GHz
- Max receiver BW 200MHz. Up to 800MHz using 4 receivers
- Max transmitter synthesis BW 450MHz
- Integrated LO and Phase sync between all channels
- On-board Xilinx Zynq UltraScale+ MPSoC as Baseband processor
- ZU7CG/ZU7EG/ZU7EV/ZU11EG FFVC-1156 Package
- Up to 8GB DDR4-2400 64-bit PS memory with 8-bit ECC
- Up to 4GB DDR4-2400 32-bit PL memory
- eMMC 64GB (V4.51), MRAM 512KB
- PCIe x8 Gen 1/2/3 on XMC-P5
- 4x User Defined MGT on XMC-P6
- 1x Display Port 1.2 Video Out on XMC-P6
- 1x ETH 1000Base-T on XMC-P4
- 2x USB 3.0/2.0, 2x USB 2.0, 1x SATA 3.1 on XMC-P6
- 24x LVCMOS or 12x LVDS GPIO on XMC-P6
- 2x RS.232/422/485, 2x CAN 2.0B on XMC-P4
- Board Management Controller ARM Cortex-M3 based
- Air Cooled and Conduction Cooled

### Typical Applications

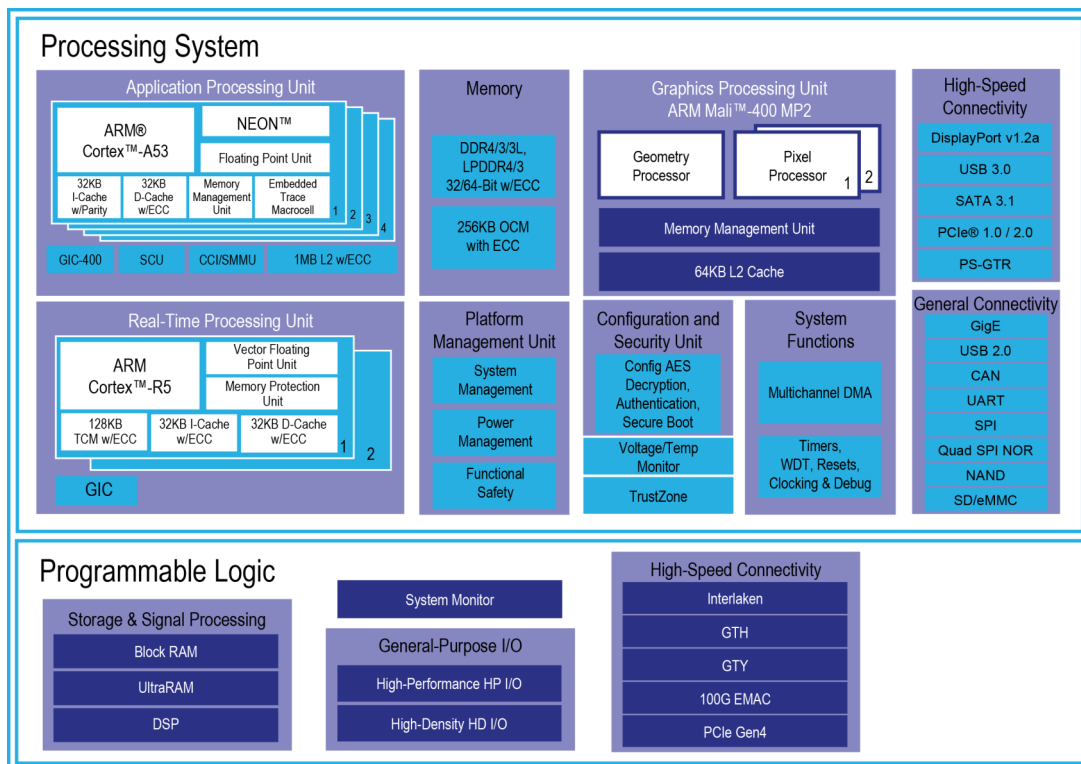
- Software Defined Radio, MILCOM, DataLink
- Massive MIMO
- Electronic Warfare, Signal Intelligence
- Phase Array RADAR Systems



**Block Diagram**



## Xilinx Zynq Ultrascale+ MPSoC Processing System Highlights



### Applications processing unit (APU) with quad-core ARM® Cortex™-A53 processors up to 1.5GHz:

- Next-generation ARMv8 architecture supporting 32- or 64-bit data widths
- Ideal for Linux and bare-metal SMP/AMP application systems

### Real-time processing unit (RPU) with dual-core ARM Cortex-R5 processors up to 600MHz:

- Low-latency, highly deterministic performance APU offloading

### New integrated hardened multimedia blocks up to 667MHz:

- Graphics processing unit (GPU) [ARM Mali™-400MP2]
- 4Kx2K 60fps video encoder/decoder (VCU) [in select devices]
- 4Kx2K 30fps DisplayPort interface

### New integrated high-speed peripherals:

- PCIe® Gen1 or Gen2 root complex and integrated Endpoint block in x1, x2, and x4 lanes
- USB 3.0/2.0 with host, device, and OTG modes
- Gigabit Ethernet with jumbo frames and precision time protocol
- SATA 3.1 host
- Dedicated quad transceivers up to 6Gb/s

### General and boot peripherals:

- CAN, I2C, QSPI, SD, eMMC, and NAND flash interfaces
- GPIO, UART, and trace ports
- 6-port DDR controller with ECC, supporting x32 and x64 DDR3, DDR3L, LPDDR3, LPDDR4, DDR4
- Integrated platform management unit (PMU) supporting multiple power domains
- Integrated configuration security unit (CSU)
- TrustZone support
- Peripheral and memory protection

## Board Specifications

### XMC Interfaces

- VITA 42.3 Specifications compliant
- XMC P5: 8 lanes PCIe Gen1/2/3
- XMC P6: 4x MGT GTH @ up to 16.3 Gb/s connected to/from Zynq Ultrascale+ Programming Logic
- XMC P4: 1x ETH 1000BASE-T, 2x RS-232/422/485
- XMC P6: 1x SATA 3.1, 1x Display Port 1.2 VIDEO OUT, 2x USB 3.0/2.0, 2x USB 2.0, 12x LVDS
- XMC P5: IPMI EEPROM, Temperatures, Voltages, Currents, Board Management Controller (BMC), JTAG

### Xilinx Zynq Ultrascale+ MPSoC

- Supported Devices: **ZU7CG/ZU7EG/ZU7EV/ZU11EG** FFVC1156 (Speed Grade –1/2/3)
- Processing System : Quad-Core ARM A53, Dual-Core ARM R5, GPU Mali-400, 2x SATA, 2x USB, 4x GETH MACs
- Programmable Logic: 504K Logic Cells (ZU7CG/EG) / 504K Logic Cells (ZU7EV) / 653K Logic Cells (ZU11EG)
- On-Chip Memories: 38Mb (ZU7CG/EG) / 38Mb (ZU7EV) / 43.6Mb (ZU11EG)
- DSP Slices: 1728 (ZU7CG/EG) / 1728 (ZU7EV) / 2928 (ZU11EG)
- High Speed Serial Links: 16 full duplex, high performance, GTH Multi-Gigabit Transceivers (MGT) @ up to 16.3 Gb/s
- 2x 10-bit, 1MSPS ADCs for System Monitoring
- Supported by PanaTeQ's FPGA Development Kit (**PAN-FDK**)

### External Memories

- Up to 8GB of DDR4-2400 Processor System (PS) memory, 64-bit data, 8-bit ECC
- Up to 4GB of DDR4-2400 Programmable Logic (PL) memory, 32-bit data, no ECC
- 64GB eMMC v4.51 of managed NAND Flash memory. HS200 support @ up to 100MB/s
- 512KB of SPI MRAM (NVRAM)
- 2x 512Mb of QSPI NOR Flash memory for booting Zynq MPSoC Programmable Logic and Firmware Processing System

### Board Main ADI Components

- HW/SW compatible with ADI's ADRV9009-ZU11EG RF SOM
- ADRV9009: Integrated, Dual RF Transceiver with Observation Path
- HMC7044: JESD204B Clock Generator with 14 LVDS/HSTL Outputs
- AD7291 : 8-Channel, I2C, 12-bit SAR ADC with Temperature Sensor

### RF Performances

- RF coverage 75MHz to 6.0GHz
- Tx synthesis bandwidth to 450MHz
- Rx bandwidth to 200MHz

### On-board VCXO Options (see ordering information)

- 100.000MHz 122.880MHz 125.000MHz 153.600MHz 156.250MHz

### Front I/O: 10x SSMC Connectors

- TX Transmitter Channel 1 Output (From ADRV9009)
- TX Transmitter Channel 2 Output (From ADRV9009)
- TX Transmitter Channel 3 Output (From ADRV9009)
- TX Transmitter Channel 4 Output (From ADRV9009)
- RX Receiver Channel 1 Input (To ADRV9009)
- RX Receiver Channel 2 Input (To ADRV9009)
- RX Receiver Channel 3 Input (To ADRV9009)
- RX Receiver Channel 4 Input (To ADRV9009)
- Optional Input/Output
- External Reference Clock Input (To AD9578)

### Environmental Specifications

- Commercial Ruggedized 0-50C
- Conduction Cooled –40C to 70C at Thermal Interface

## Product Codification

The XMC-SDR-A can be assembled with different versions of the Zynq Ultrascale+ devices and various amounts of memory storage. The cooling technique et ruggedization level are also available options. The following table shows the product coding for all these options.

# XMC-SDR-A-B 1 N-AS

	Device	ARM A53 Cores	GPU	VCU	System Logic Cells	DSP Slices	Memory
A	XCZU7CG	2	No	No	504K	1728	38 Mb
B	XCZU7EG	4	Yes	No	504K	1728	38 Mb
C	XCZU7EV	4	Yes	Yes	504K	1728	38 Mb
D	XCZU11EG	4	Yes	No	653K	2928	46.3 Mb

	Device Speed Grade
1	Slowest
2	Mid
3	Fastest

	PS / PL Memory Size
N	4GB/1GB
M	8GB/2GB

	Ruggedization Level	VITA 47
AS	Air Standard	EAC4
AR	Air Rugged	EAC6
CC	Conduction Cooled	ECC3
CR	Conduction Rugged	ECC4

## Ordering Information

The following product references are offered by PanaTeQ as standard products. Other combinations of devices, speed grade, memory and cooling can be specially ordered. Please contact us for details

Reference	Device	Speed	Memory	Ruggedization Level
<b>XMC-SDR-A-A1N-AS</b>	ZU7CG	-1	4GB/1GB	Standard Air Cooled
<b>XMC-SDR-A-A1N-CC</b>	ZU7CG	-1	4GB/1GB	Conduction Cooled
<b>XMC-SDR-A-B1N-AS</b>	ZU7EG	-1	4GB/1GB	Standard, Air Cooled
<b>XMC-SDR-A-B1N-CC</b>	ZU7EG	-1	4GB/1GB	Conduction Cooled
<b>XMC-SDR-A-C1N-AS</b>	ZU7EV	-1	4GB/1GB	Standard, Air Cooled
<b>XMC-SDR-A-C1N-CC</b>	ZU7EV	-1	4GB/1GB	Conduction Cooled
<b>XMC-SDR-A-D1N-AS</b>	ZU11EG	-1	4GB/1GB	Standard, Air Cooled
<b>XMC-SDR-A-D1N-CC</b>	ZU11EG	-1	4GB/1GB	Conduction Cooled

Reference	Description
<b>XMC-SDR-A-PDSK</b>	XMC-SDR-A Development System Kit
<b>IO-XMC-SDR-A</b>	IO Carrier board for XMC-SDR-A
<b>VPX3-XMC-SDR-A</b>	3U VPX Carrier board for XMC-SDR-A
<b>PCIe-XMC-SDR-A</b>	PCIe Carrier board for XMC-SDR-A