

## AMC Module Xilinx Zynq UltraScale+ RFSOC

### Overview

PanaTeQ's AMC-RFSOC-A is an AMC module based on the Zynq UltraScale+ RFSoc device from Xilinx.

The Zynq® UltraScale+™ RFSoc family integrates key subsystems for multiband, multi-mode cellular radios and cable infrastructure (DOCSIS) into an SoC platform that contains a feature-rich 64-bit quad-core ARM® Cortex™-A53 and dual-core ARM Cortex-R5 based processing system.

Combining the processing system with UltraScale™ architecture programmable logic and RF-ADCs, RF-DACs, and soft-decision FECs, the Zynq UltraScale+ RFSoc family is capable of implementing a complete software-defined radio including direct RF sampling data converters, enabling CPRI™ and gigabit Ethernet -to-RF on a single, highly programmable SoC.

Zynq UltraScale+ RFSocs integrate up to 16 channels of RF-ADCs and RF-DACs. The RF-ADCs can sample input frequencies up to 4GHz at 4GSPS with excellent noise spectral density. The RF-DACs generate output carrier frequencies up to 4GHz using the 2nd Nyquist zone with excellent noise spectral density at an update rate of 6.554GSPS.

The RF data converters also include power efficient digital down converters (DDCs) and digital up converters (DUCs) that include programmable interpolation and decimation, NCO, and complex mixer. The DDCs and DUCs can also support dual-band operation.

The board can be ordered with different versions of the Zynq UltraScale+ RFSoc family of devices, coupled 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 signal processing applications. 64GB of soldered eMMC managed NAND Flash is available for local data storage.

Front-end Analog I/O interfaces are available using on-board **SSMC connectors**.

A large number of the Zynq Ultrascale+ PS peripherals are available on the Front Digital I/O connectors: USB 3.0, RS-232/422/485, DisplayPort 1.2, GPIOs.

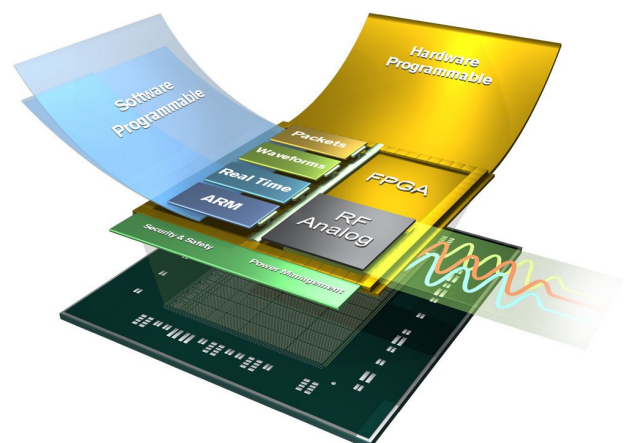
PanaTeQ's AMC-RFSOC-A-PSDK is also available for developers

### Key Features

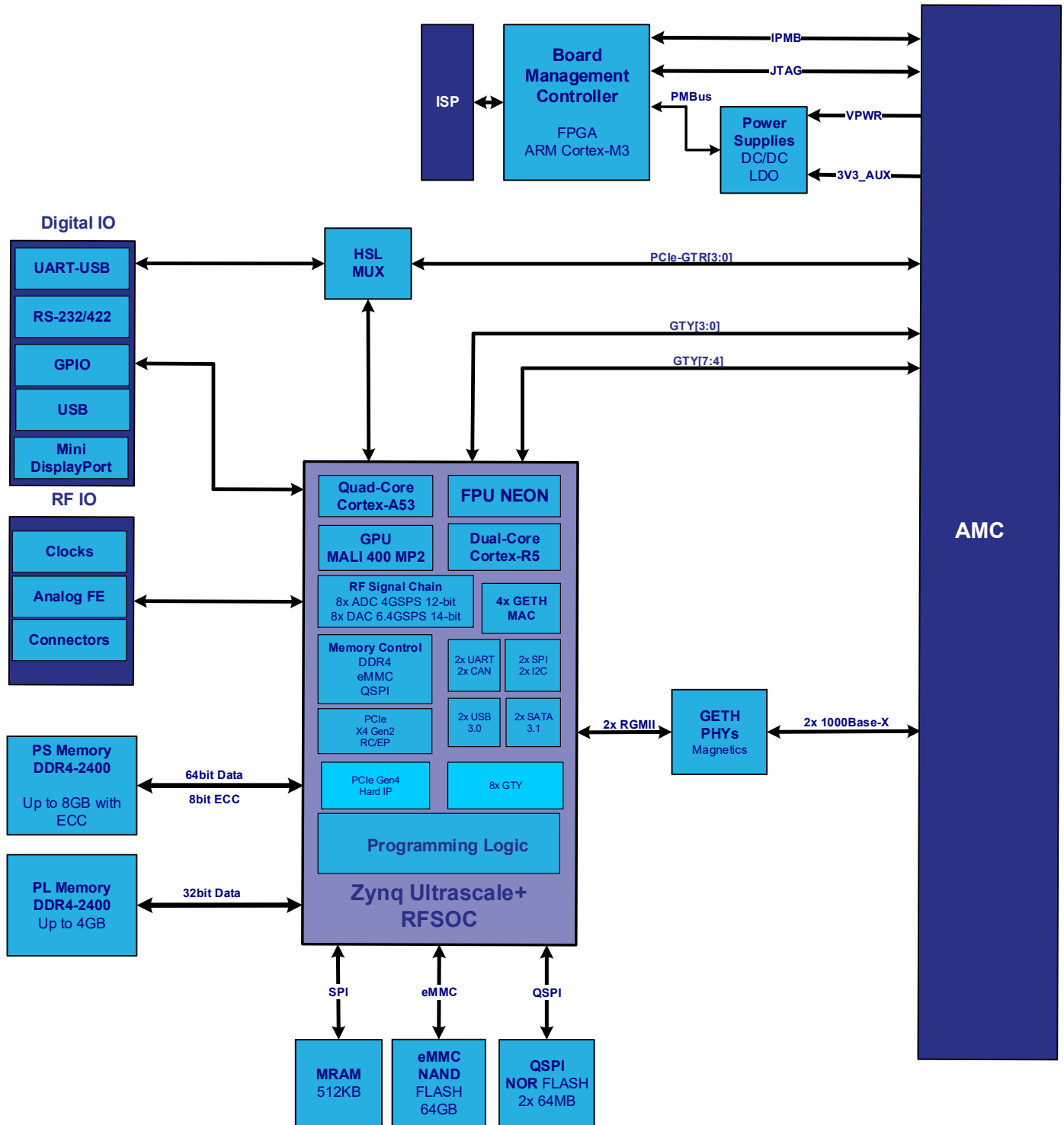
- AMC Single Width, Mid-Size of Full-Size compliant
- Xilinx Zynq UltraScale+ RFSOC
- ZU25DR/ZU27DR/ZU28DR FFVE-1156 Package
- Up to 8GB DDR4-2400 64-bit PS memory with 8-bit ECC
- Up to 4GB DDR4-2400 32-bit PL memory
- eMMC 64GB (V4.51), MRAM 512KB
- Up to PCIe x4 Gen2 (Processing System) on AMC
- 8x MGT GTY up to 28Gb/s on AMC
- 2x ETH 1000Base-X on AMC
- mini Display Port 1.2 Video Out on Front Digital I/O
- USB 2.0 and UART-USB on Front Digital I/O
- RS.232/422/485, GPIO on Front Digital I/O
- Up to 20x Front Panel RF IO
- MMC with IPMI 1.5
- Air Cooled and Conduction Cooled

### Typical Applications

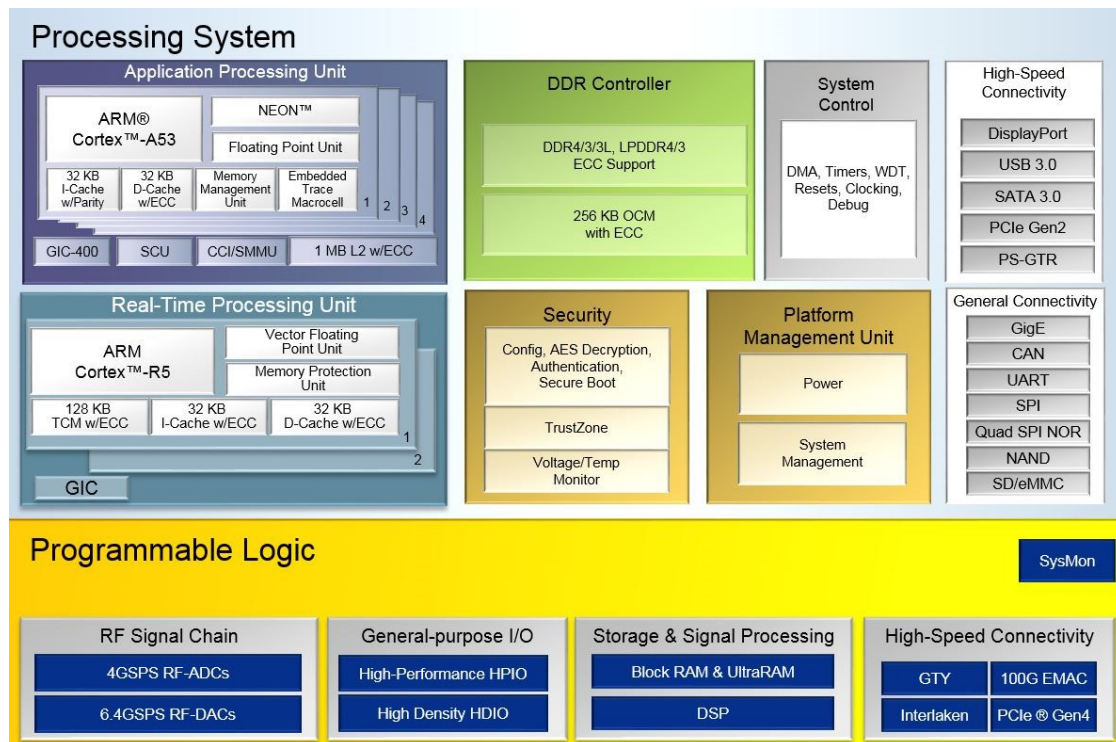
- 4G/5G Base Station
- MILCOM
- Software Defined Radio,
- Massive MIMO
- Electronic Warfare
- Signal Intelligence
- LIDAR/RADAR/SONAR Systems



## Block Diagram



## Xilinx Zynq Ultrascale+ RFSOC 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

### 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

### Integrated RF Signal Chain:

- 8x ADC 4GSPS 12-bit
- 8x DAC 6.4GSPS 14-bit

### 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

### AMC Interfaces

- AMC Single Width / Mid-Size Specifications compliant
- PCIe Gen2 x4 connected to Zynq Ultrascale+ Processing System
- 8x MGT GTY @ up to 28 Gb/s connected to Zynq Ultrascale+ Programming Logic
- 2x ETH 1000BASE-X
- Module Management Control (MMC) Interface implementing IPMI 1.5 for temperature monitoring and hot-wap support
- JTAG

### Xilinx Zynq Ultrascale+ RFSOC

- Supported Devices: **ZU25DR** / **ZU27DR** / **ZU28DR** FFVC1156 package (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: 678K Logic Cells (ZU25DR) / 930K Logic Cells (ZU27DR) / 930K Logic Cells (ZU28DR)
- On-Chip Memories: 41.3Mb (ZU25DR) / 60.1Mb (ZU27DR) / 60.1Mb (ZU28DR)
- DSP Slices: 3145 (ZU25DR) / 4272 (ZU27DR) / 4272 (ZU28DR)
- High Speed Serial Links: 8 full duplex, high performance, GTY Multi-Gigabit Transceivers (MGT) @ up to 28 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 Ultrascale+ Programmable Logic and Firmware Processing System

### Front RF I/O

- Up to 20 RF I/O (8x ADC, 8x DAC, RefClkIn, Trigger)

### Front Digital I/O (Full-Size model only)

- 2x UART USB
- GPIO
- RS-232/422
- USB 2.0
- Mini DisplayPort
- SFP+ Cage for 10Ge Optical link

### Environnemental Specifications

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

## Product Codification

The AMC-RFSOC 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

# AMC-RFSOC-A-B 1 N-F-AS

	Device Size	System Logic Cells	SD-FEC	DSP Slices	Memory
A	XCZU25DR	678K	0	3145	41.3 Mb
B	XCZU27DR	930K	0	4272	60.5 Mb
C	XCZU28DR	930K	8	4272	60.5 Mb

	Device Speed Grade
1	Slowest
2	Mid
3	Fastest

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

	AMC Front Panel Size
H	Half-Size
F	Full-Size

	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>AMC-RFSOC-A-A1N-AS</b>	ZU25DR	-1	4GB/2GB	Standard Air Cooled
<b>AMC-RFSOC-A-B1N-AS</b>	ZU27DR	-1	4GB/2GB	Standard Air Cooled
<b>AMC-RFSOC-A-C1N-AS</b>	ZU28DR	-1	4GB/2GB	Standard Air Cooled

Reference	Description
<b>AMC-RFSOC-A-PSDK-A</b>	AMC-RFSOC-A System Development Kit

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