

# ATC500

## Base Board for Wideband Massive MIMO Software Defined Radio



ATC500

## Key Features

- Dual Virtex UltraScale+ VU13P provides massive DSP power using over 24,000 FPGA DSP slices to deliver up to 12TMACs per second/per board
- Backplane connections support full mesh fabric at 100G
- Network synchronization distributes reference and radio frame clocks across multiple ATC500 boards
- Built-in TX and RX reference for antenna port phase alignment and calibration to support massive MIMO
- Highly integrated patent-pending radio modules built using four ADRV9009 enhanced by RF DSPs advanced algorithms
- Each board supports dual high-performance radio modules and scalable to 12 boards with super low jitter among all RF ports

## Benefits

- Integrated platform for Wideband MIMO Software Defined Radio
- Wideband TDD or FDD MIMO scalable from 4T4R to 128T128R and continuous signal bandwidth from 200 MHz to over 2 GHz of programmable modulation and waveform
- Airborne MIMO radio applications, satellite communication, ultra-wideband RF playback and recording, spectrum monitoring, fully digital phased array and direction finding
- Beamforming for highly efficient simultaneous jamming and secure communication
- Complete integrated solution available from a single vendor
- Electrical, mechanical, software, algorithm and system-level expertise in house
- AS9100 and ISO9001 certified company

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# ATC500

The ATC500 is an AdvancedTCA Blade whose patent-pending architecture supports a scalable and flexible integrated platform for Wideband Massive MIMO Software Defined Radio.

The two XCVU13P FPGAs provide 100GbE connections to the backplane for full mesh connectivity, plus 100GbE connections to the Zone 3 RTM for further I/O expansion. The FPGAs can be used to implement MIMO PHY processing including FFT, channel estimation, FEC En/Decode and MU-MIMO beamforming. Applications include:

- Airborne MIMO radio for secure, high reliability, high spectrum efficiency and high throughput wireless communication.
- Recording and playback of sixteen 200 MHz RF paths per blade.
- Zero-forcing coding to defeat eavesdropping
- Beamforming for highly efficient, simultaneous jamming and secure communication
- Fixed wireless access by massive MIMO spatial multiplexing
- 5G/LTE/4G networks

The ATC500 is also excellent for ASIC verification, AI-Machine learning inference, configurable and dynamically allocable DSP processing for Software Defined Network (SDN).

When fully populated, each ATC500 supports 16T16R TDD or 8T8R FDD, frequency agile from 300 MHz to 6 GHz. On-board synchronization, calibration circuits and algorithms support phase alignments across all RF ports, which can be extended across multiple carriers to provide over 2 GHz bandwidth of modulation and waveform.

When used in a 6-slot full mesh chassis (such as VT830) the system can be scaled up to 64T64R with only four blade or 192T192R with 12 blades in the system such as VadaTech VT820/VT822/VT825. It supports sub 6 GHz bands out-of-box and can function as the IF to support mmwave with custom radio frontend, with bandwidth from 400 MHz to over 2 GHz.

RF DSP Inc ([www.rfdsp.com](http://www.rfdsp.com)) can provide a 5G NR MIMO Radio unit which supports ORAN/XRAN flexible PHY partition with FEC encoding/decoding and DSP offload that features:

- From 4T4R and 8T8R small cell to massive MIMO 64T64R and 128T128R macro cell.
- Multi-Channel signal generators and signal analyzers up to 2 GHz modulation bandwidth from 8 -192 channels.
- Massive Data Acquisition Systems in one compact form factor with full scalability.

The ATC500 supports two Radio Modules (each has four ADRV9009) and can be configured with single or dual FPGAs. It has an option for a Rear Transition Module (RTM), ART500A. The modules provide QSFP28 ports, GPS receiver, GbE, and other I/O via the rear. Please consult the ART500 data sheet for more information.

The ATC500 implements IPMI 2.0 for its management and payload.



Figure 1: ATC500

# System and Firmware

We provide complete, flexible and scalable complete systems including ACTA chassis, ATC500 blades with highly integrated MIMO radio modules, Xeon computing blades, storage blades and system management blades. In cooperation with RF DSP Inc. ([www.rfdsp.com](http://www.rfdsp.com)), available firmware and software options include

- Radio clock sync and IQ interface
- TDD and FDD configuration management
- Expanded bandwidth to over 2 GHz
- MIMO channel estimation
- RF playback and recording
- Multi-channel signal generator and analyzer
- Massive Data Acquisition Systems
- MIMO calibration and antenna phase alignment
- Multi-User MIMO (MU-MIMO) beamforming
- Digital phased array and direction finding
- Advanced precoding for highly efficient simultaneous jamming and communication, etc.
- These firmware and software options are scalable from 4T4R to 128T128R and from 200 MHz to over 2 GHz contiguous signal bandwidth



# 5G NR MIMO Radio Unit

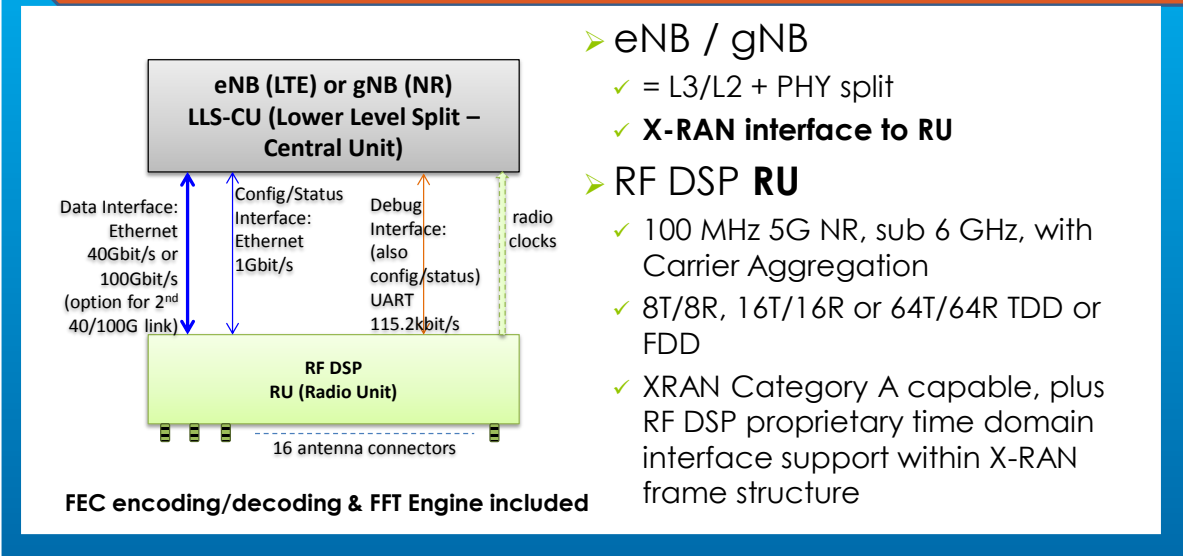


Figure 2: 5G NR MIMO Radio Unit

# Test-Integrated Complete Development Platform

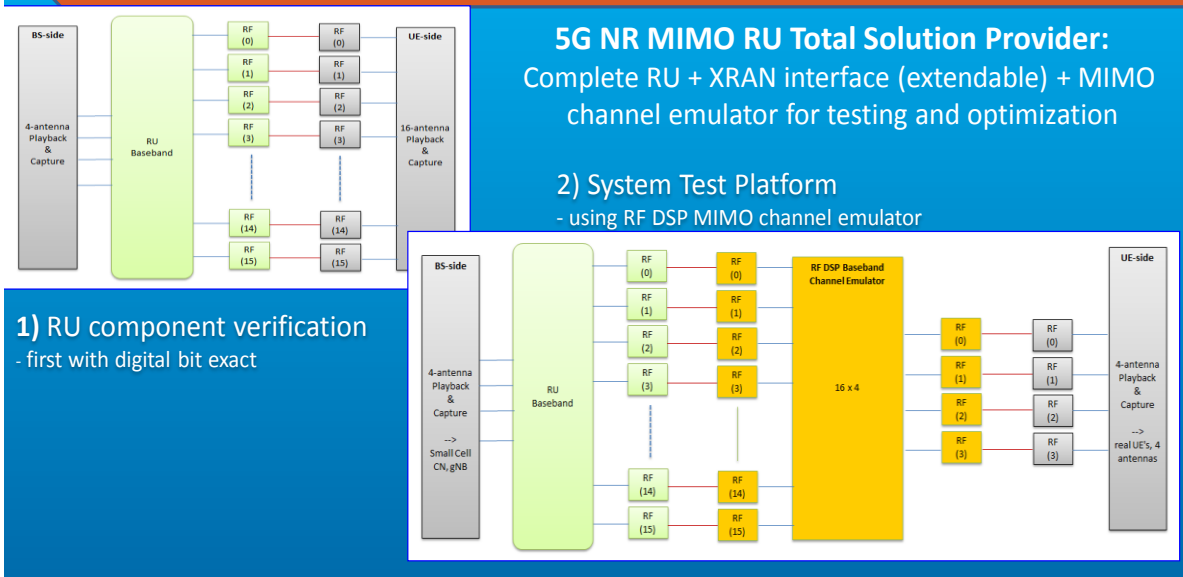


Figure 3: Test-Integrated Complete Development System

# Block Diagram

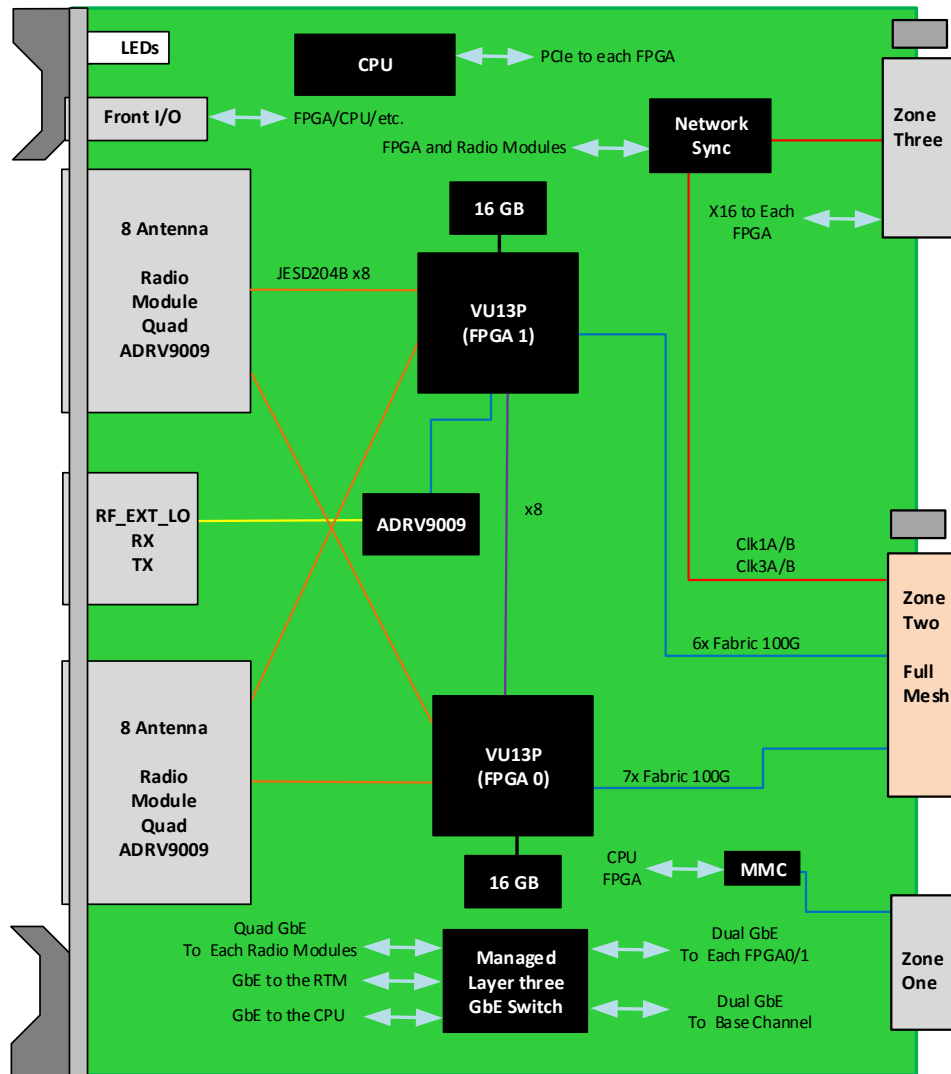


Figure 4: ATC500 Functional Block Diagram

# Front Panel



Figure 5: ATC500 Front Panel

# Specifications

Architecture		
<b>Physical</b>	<b>Dimensions</b>	Width: 12.69" (322.25 mm) Depth: 11.02" (280 mm)
<b>Type</b>	<b>ATCA MIMO Radio</b>	Massive MIMO SDR
Standards		
<b>Module Management</b>	<b>IPMI</b>	IPMI v2.0 and PICMG 3.0
<b>10GbE</b>	<b>KR4/XAUI</b>	100/40/10GbE to the fabric channel
<b>GbE</b>	<b>1000-BaseT</b>	GbE 1000-BaseT 10/100/1000 to the Base Channel
	<b>Type</b>	FPGA
<b>PICMG</b>	<b>ATCA</b>	PICMG 3.0 R3.0
Configuration		
<b>Power</b>	<b>ATC500</b>	~250W
<b>Environmental</b>	<b>Temperature</b>	See <a href="#">Ordering Options</a> Storage Temperature: -40° to +85°C
	<b>Vibration</b>	1G, 5 to 500 Hz each axis
	<b>Shock</b>	30G on each axis
	<b>Relative Humidity</b>	5 to 95% non-condensing
<b>Front Panel</b>	<b>Interface Connectors</b>	USB, RS-232, JTAG, etc.
	<b>LEDs</b>	Activity/Link, User defined and health management IPMI Management Control
<b>Software Support</b>	<b>Operating System</b>	Linux
Other		
<b>MTBF</b>		MIL Hand book 217-F@ TBD hrs
<b>Certifications</b>		Designed to meet FCC, CE and UL certifications, where applicable
<b>Standards</b>		VadaTech is certified to both the ISO9001:2000 and AS9100B:2004 standards
<b>Warranty</b>		Two (2) years, see <a href="#">VadaTech Terms and Conditions</a>

## INTEGRATION SERVICES AND APPLICATION-READY PLATFORMS

VadaTech has a full ecosystem of OpenVPX, ATCA and MTCA products including chassis platforms, shelf managers, AMC modules, Switch and Payload Boards, Rear Transition Modules (RTMs), Power Modules, and more. The company also offers integration services as well as pre-configured Application-Ready Platforms. Please contact VadaTech Sales for more information.

# Ordering Options

## ATC500 – A00-D00-00J

A = Number of FPGAs	D = FPGA Speed	
0 = Two VU13P 1 = One VU13P	1 = High (-2)* 2 = High (-2LE) 3 = Highest (-3E)*	
		<b>J = Temperature Range and Coating</b> 0 = Commercial (-5° to +55°C), No coating 1 = Commercial (-5° to +55°C), Humiseal 1A33 Polyurethane 2 = Commercial (-5° to +55°C), Humiseal 1B31 Acrylic 3 = Industrial (-20° to +70°C), No coating 4 = Industrial (-20° to +70°C), Humiseal 1A33 Polyurethane 5 = Industrial (-20° to +70°C), Humiseal 1B31 Acrylic 6 = Extended (-40° to +85°C), Humiseal 1A33 Polyurethane 7 = Extended (-40° to +85°C), Humiseal 1B31 Acrylic

Notes: \*Minimum Order Quantity applies for these FPGA SKU's.

For operational reasons VadaTech reserves the right to supply a higher speed FPGA device than specified on any particular order/delivery at no additional cost, unless the customer has entered into a Revision Lock agreement with respect to this product.

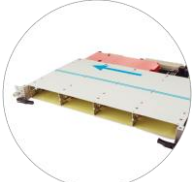
## Related Products

ATC122



- ATCA Processing Carrier with a standard PCIe edge Module
- Xeon E3-1268L V3 Processor with 32 GB ECC
- Quad Core @ 2.3 GHz or Turbo Frequency @ 3.3 GHz

ATC133



- 10G ATCA Carrier
- Xilinx Virtex-7 FPGA (XC7V690T in FFG1761 package)
- Crossbar switch to connect FPGA to full mesh of backplane fabric

VT830



- 19" rackmount 6U ATCA Chassis with integrated Switch and Shelf Manager
- 10GbE/GbE Managed Layer 2
- 40GbE/10GbE/GbE Managed Layer 3

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- Partnerships power innovation
- Collaborative approach
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## We deliver complexity

- Complete signal chain
- System management
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