

*FLEXIBLE, SCALABLE, PERFORMANCE OPTIMIZED, HIGHLY INTEGRATED PORTFOLIO FOR BACKHAUL NETWORKS*

# WIRELESS

## Backhaul Solutions



### NEXT-GENERATION ALL PROGRAMMABLE BACKHAUL

Integrated microwave and millimeter wave modems with network aware high-speed packet processing

Most mobile backhaul networks have evolved into complex combinations of legacy voice-centric networks and new data-centric packet-switched IP networks. Stringent and varied deployments require flexible, scalable, and high-capacity modems that can support multiple bands, modulation rates, and LoS/non-LoS connections. Integrated hierarchical traffic management, switching, packet processing, and OAM functionalities have also become vital for meeting strict service-level agreements and for efficiently rolling out new services that effectively monetize investments in wireless infrastructure.

There has been innovation of various technologies to address capacity and coverage challenges. Primary among these are Cloud-RAN and small cells – both of which require hauling capabilities. It is being increasingly viewed that wireless fronthaul and small cell backhaul can be best served with millimeter wave links, in both point-to-point and mesh topologies. Xilinx's wireless backhaul solution has advanced modems and packet processing elements specifically designed to meet those market needs.

Xilinx All Programmable FPGAs and SoCs and proven IP put wireless network designers a generation ahead. Our industry-leading 28nm portfolio helps meet fast-changing our market requirements with high-performance, low-power silicon and productivity-boosting design tools. Lower geometry nodes such as 20nm and 16nm bring significant increase in performance and decrease in power dissipation.

Design integration is increasingly becoming a top priority for vendors. Xilinx devices are highly integrated to enable designers to implement more functions using fewer chips. As many as seven discreet devices can be replaced with a single Xilinx Zynq™-7000 All Programmable SoC and MPSoC in 16nm. Xilinx FPGAs and SoCs are ideally suited for multi-gigabit wireless modem solutions meeting the power and performance requirements at right price points.

#### Industry Challenges

- Exploding mobile data traffic requires increased network intelligence and aggregation capability
- Co-existence of IP-based and TDM legacy networks calls for a number of devices on the backhaul modem baseband board
- Moving to all outdoor units poses power challenges
- Network equipment OEMs are pressed for year-to-year price decreases

#### Xilinx Connectivity Platforms

- Flexible and programmable high-bandwidth modem and packet-processing solutions for varied and fast-changing backhaul networks
- Single-chip solution replacing 7 chips, for lower power, smaller form factor, and lower BOM costs
- Ease of deployment with support for multiple bands, line of sight (LoS), and non-LoS (NLoS) connections
- Productivity-increasing design tools to speed time to market

## Next-Generation Scalable Millimeter Wave Modem

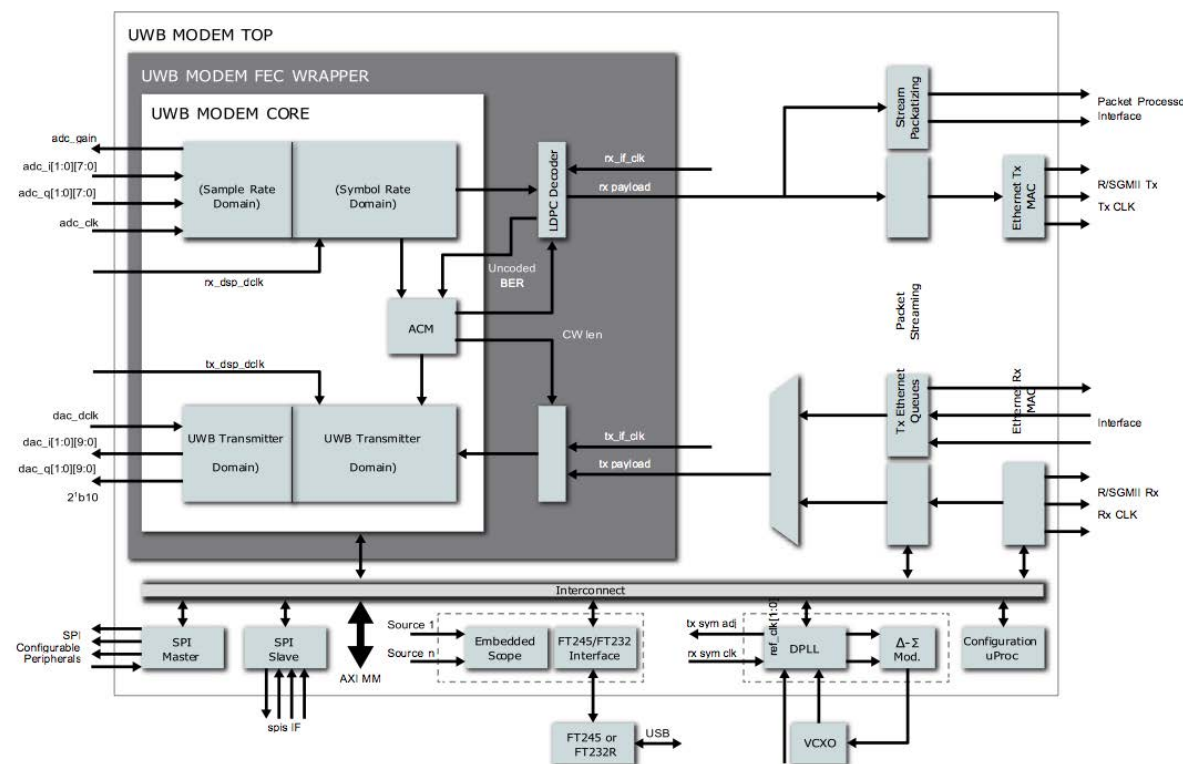
The challenge for product designers is to support a range of different products with increasing complexity and productivity while maintaining lower costs. The platform-based approach seems to be best at addressing those requirements. At the core of those platforms, All Programmable devices offer flexibility, migration options and scalability across different applications.

Upper millimeter wave bands are a good fit for small cell backhauling, where high capacity LoS links can be used for short-haul data transmission. An efficient way to achieve this is by mesh or multipoint network topologies that can be implemented using Xilinx vBand or eBand TDD modems. 10Gbps wireless fronthauling solutions can be designed leveraging the same platform.

### Features

- 3.5Gbps, scalable to 10Gbps and beyond
- QPSK-256QAM modulation
- Up to 436 Msym/s in 500MHz channel bandwidth
- Software configurable CB: 50/100/125/150/250/375/500MHz
- I/Q baseband or real interface
- Rx analog AGC outputs
- Rx and Tx AFC outputs
- Tx and Rx imbalance correction
- Digital automatic frequency recovery
- LDPC FEC
- Adaptive digital closed-loop pre-distortion
- Adaptive coding and modulation
- RGMII/SGMII, 1/10 GbE interfaces
- SyncE clock synchronization and 1588v2 PHY layer support
- Adaptive Bandwidth
- SPI interface for ATPC messaging between modem and RF microprocessor
- TDD and FDD

## Next-Generation E-Band modem



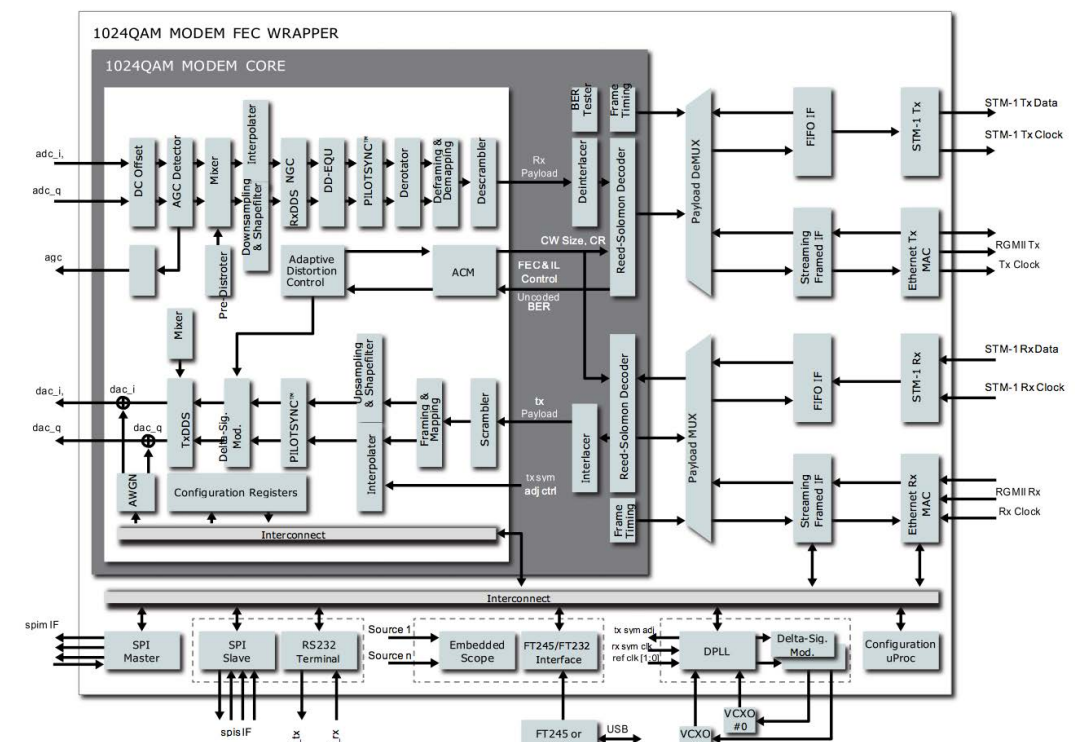
## Point-to-Point Microwave

A 1024QAM modem core is a must have to meet stringent requirements for today's wireless backhaul networks, where reliability, timing, and cost constraints are paramount. The Xilinx solution supports legacy interfaces such as multiple E1/T1 and SDH as well as Gigabit Ethernet. Data rates are scalable up to 1Gbps in a single polarization and 2Gbps in dual-polarized mode. Enhanced phase noise tolerance enables BOM cost reduction and optimization for end equipment and exploits the benefits of higher-order modulations in field.

### Supported Features

- Interface: Parallel I/Q baseband, complex or real interface
- Modulation: QPSK to 1024QAM
- Symbol rate: Software configurable 2-100 Msym/s with sub-MHz precision
- FCC and ETSI channels: Tested for spectral mask compliance
- Bandwidth: Software configurable 3.5 to 112MHz (Symbol rate\* Rolloff)
- Automatic correction of Tx and Rx quadrature impairments in DSP
- Group delay equalizer:  $\pm 600$  ps to correct for analog filter imbalances
- Adaptive coding and modulation, with software-defined profile
- Closed-loop adaptive digital pre-distortion
- Reed-Solomon FEC, with configurable codeword length and payload amount
- Convolutional interleaver, with configurable depth
- Decision-directed equalizer
- DPLL module for synchronizing payload clock over link for SyncE and SDH/TDM
- Analog AGC control through 1-bit delta-sigma output
- No software required for DSP core run-time operation
- ATPC closed-loop support in hardware
- Dual-modem feature in a single FPGA with XPIC (affordable double data rate)

## Point-to-Point Microwave



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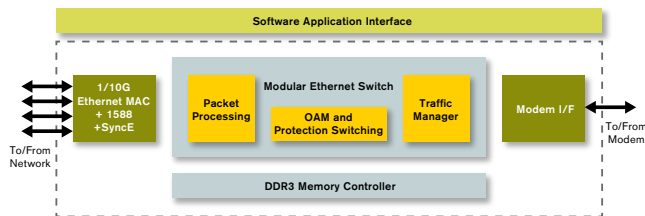
## Packet Processing

Xilinx flexible packet processing is enabled by its innovative Software Defined Specification for Networking (SDNet™) SmartCOREs™ with the ability to support IP transport tunneling, Layer 2 Ethernet or Layer 3 IP/MPLS deterministically in hardware. The SDNet companion core - Hierarchical Traffic Manager -- assures granular QoS, limits network congestion, and enhances per user services quality. Operators could further enhance their ARPU with new monetization services enabled by the SDNet traffic management platform. The programmable aspect of the SDNet tool chain and easily parameterizable traffic management functions meet and exceed diverse mobile backhaul services requirements.

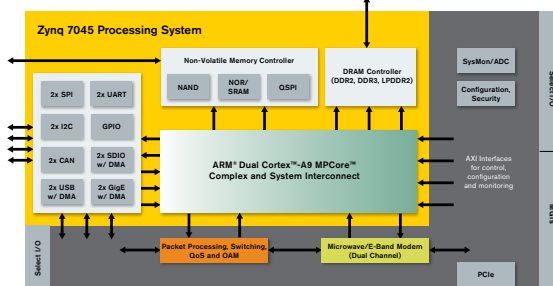
## Scalable Silicon Platform and Ease of Use Drive Functional Consolidation

For mobile backhaul equipment, Xilinx FPGAs and SoCs let designers choose the level of performance, power, and deliver integration that matches the design requirements. Xilinx Silicon technology, advanced design implementation and system integration tools, optimized IP cores, and new design environments like SDNet enables rapid auto-generation of packet processing functions from intuitive high-level specification code. Third-party ecosystem solutions and services also help propel mobile system designs a generations ahead by yielding higher useable bandwidth, advanced network and application intelligence, the ability to deliver flexible per-user QoS, and over the top (OTT) services monetization.

## Packet Processing Solution



## Fully Integrated Mobile Backhaul on a Chip



On a single Xilinx Zynq-7000 All Programmable SoC, designers can implement the functionality that typically spans 2 modem chips (FPGAs, ASICs, or ASSPs), 2 PHY devices, 1 control plane processor, 1 Ethernet switch with integrated traffic management, and 1 timing and synchronization device

## Take the NEXT STEP

Visit [www.xilinx.com](http://www.xilinx.com) to learn more about the Xilinx wireless communications product portfolio and All Programmable FPGAs, 3D ICs and SoCs.

For information on Xilinx backhaul solutions, visit <http://www.xilinx.com/applications/wireless-communications.html>



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