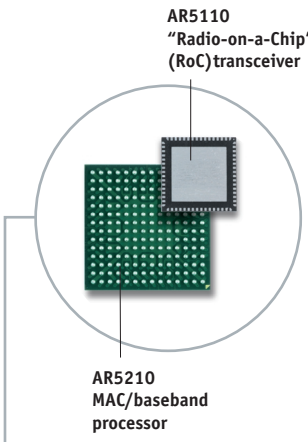
Driving the wireless future™

ATHEROS™ COMMUNICATIONS

AR5000

High-Speed, High-Capacity Wireless LAN Connectivity



- **Highly Integrated IEEE 802.11a 5GHz Wireless LAN Solution**
- **Complete Two-Chip System in Mainstream Digital CMOS**

The Atheros AR5000 Wireless LAN Solution

The Atheros AR5000 solution provides full wireless LAN (WLAN) connectivity based on the IEEE 802.11a 5GHz standard. The highly integrated two-chip set comprises the world's first complete 5GHz "Radio-on-a-Chip" (RoC) and MAC/baseband processor that rely exclusively on standard-process Digital CMOS. As a result, the AR5000 solution delivers cost-effective, robust connectivity at far higher data rates than were possible with previous WLAN technologies.

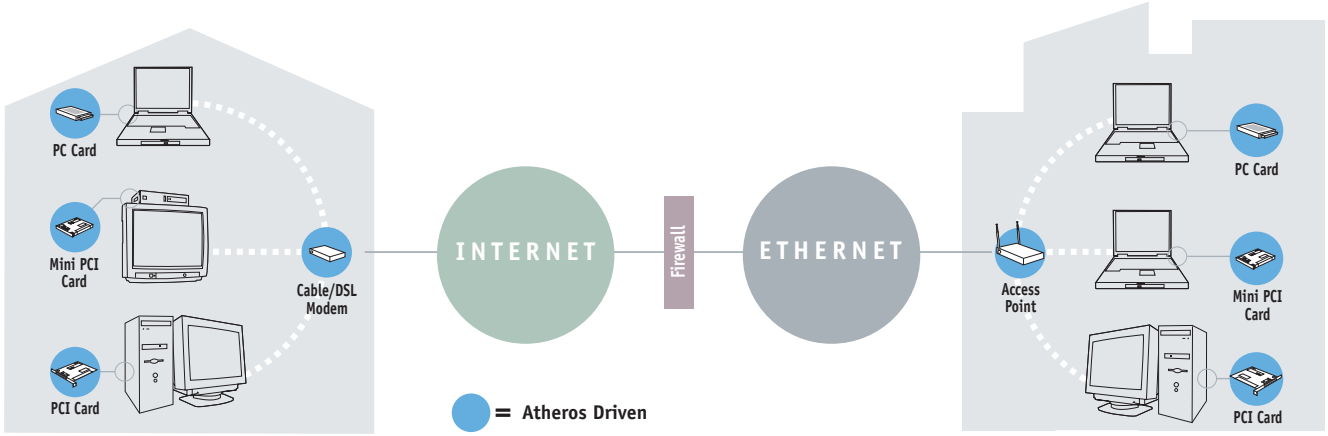
The IEEE 802.11a standard specifies data rates up to 54Mbps, and connectivity is reliable because the 5GHz band has little interference and regulations that prohibit common interferers. Products based on the AR5000 thus furnish an ideal drop-in solution for next-generation wireless networking in businesses, homes and public areas or 'hot-spots' such as airports and hotels.

High Speeds and Increased System Capacity Support More Users and Applications

The AR5000 chipset supports all IEEE 802.11a standard data rates up to 54Mbps as well as extended rates up to 72Mbps in Atheros Turbo Mode™. In addition, the broad spectrum allocation at 5GHz allows for more non-overlapping channels and less co-channel interference. The combination of high speeds and additional channels results in increased WLAN system capacity to support many users and a wide variety of high bandwidth applications.

High Integration in CMOS Reduces Cost and Complexity

By packing a complete WLAN solution into two chips, the AR5000 solution significantly reduces system design time, manufacturing costs and board real estate. Cost is further minimized through the use of standard-process Digital CMOS—the technology used for manufacturing 95% of all chips today.



Low-Power Design Lengthens Battery Life

The AR5000's low-power design brings high-speed wireless connectivity within easy reach for portable products. Working at higher data rates than other WLAN technologies yet keeping power consumption the same or lower, the AR5000 provides for better battery life at any data rate.

Built-in Encryption Supports Secure Communications

The AR5000 chipset features 152/128, 128/104 and 64/40-bit WEP encryption at full line speed without performance degradation, as well as unique per link keys, dynamic key exchange and IEEE 802.1x Security. The flexible AR5000 architecture can be configured and upgraded to meet future Security requirements.

Quality of Service Enables Multimedia

The AR5000 supports Quality of Service (QoS) for realtime multimedia applications. This allows multiple video, audio, voice, data and telephony applications to coexist on the same radio channel. The AR5000 chipset is compatible with CableLabs CQoS, Microsoft GQoS and IEEE 802.1p/q Quality of Service. Future QoS requirements can be addressed in the flexible and configurable AR5000 architecture.

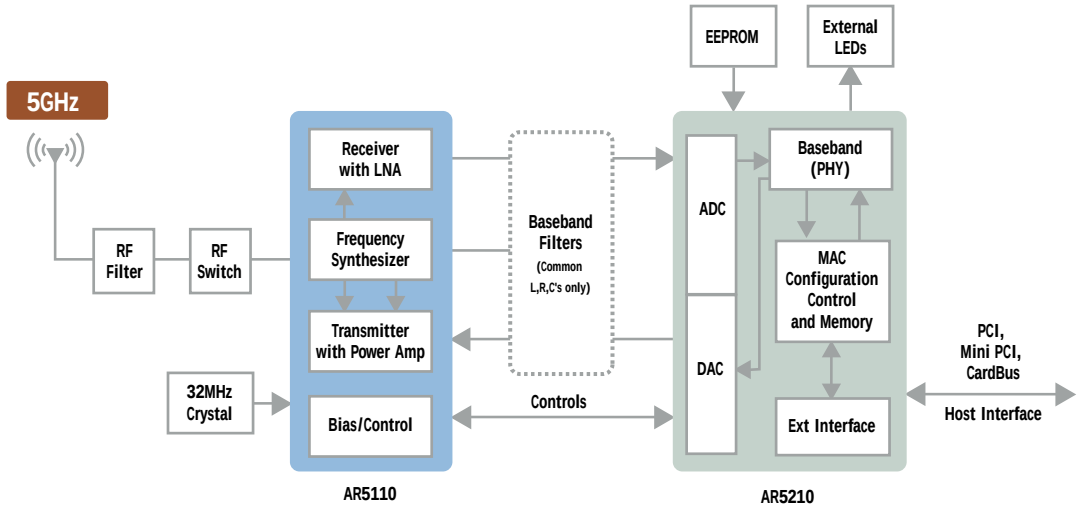
OFDM Modulation Boosts Range and Reliability

By implementing Orthogonal Frequency Division Multiplexing (OFDM) modulation scheme specified by the IEEE 802.11a standard, the AR5000 solution has distinct advantages over previous-generation technologies. OFDM mitigates multipath intersymbol interference at high data rates by simultaneously transmitting multiple subcarriers on orthogonal frequencies. Because this approach is tolerant of many common channel impairments and severe multipath, OFDM improves range and reliability, making it the ideal choice for supporting multiple high-bandwidth tasks.

AR5000 Application Examples

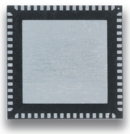
- **PCI, Mini PCI and CardBus clients for desktops and laptops**
- **Large and small enterprise access points**
- **Access points for 'hot-spots' or public-area LANs in locations such as airports and hotels**
- **Home residential gateways to support devices such as set-top boxes and game consoles**
- **Consumer electronic devices for video, audio, and telephony**
- **High-speed wireless bridging between buildings**
- **Embedded devices such as POS terminals and bar code scanners**
- **Telematics applications such as vehicular data and fleet management**

Typical AR5000 WLAN System Architecture



The AR5000 architecture incorporates a high-performance DMA engine that extends the frontier in WLAN system speed and power efficiency. The architecture provides a MAC that is made both flexible and fast through a combination of hardware data operations and host-based software modules that can be configured to support new standards and technologies. By eliminating the general-purpose embedded processor and its associated memory, the AR5000 enables vendors to reduce the cost of WLAN designs.

The AR5110 "Radio-on-a-Chip" (RoC)



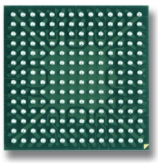
Complete with power amplifier and low-noise amplifier, the fully integrated Atheros AR5110 single-chip transceiver eliminates the need for external voltage-controlled oscillators (VCOs), phase lock loops (PLLs) and surface acoustic wave (SAW) filters.

The transmitter combines baseband in-phase (I) and quadrature (Q) signals, up-converts them to the desired frequency channel, and drives the RF signal off-chip through the integrated power amplifier. The receiver uses an integrated architecture and requires no off-chip intermediate frequency (IF) filters. An on-chip oscillator generates the necessary clocks for the AR5000 chipset with the addition of a single external crystal.

The AR5110 operates in the 5.15-to-5.25GHz indoor and 5.25-to-5.35GHz indoor/outdoor frequency bands. The AR5110's frequency synthesizer supports the frequency channels defined by IEEE 802.11a in the United States and by MMAC in Japan. The transceiver also supports Atheros Turbo Mode™, which increases overall data rates to as high as 72Mbps by encoding pairs of channels into aggregated data streams.

The Air is Cleaner at 5GHz™

Because 802.11a networks operate in the 5GHz frequency band, they don't interfere with existing 802.11b WLANs or other networking technologies that share bandwidth in the 2.4GHz Industrial, Scientific and Medical (ISM) frequency band such as Bluetooth and HomeRF. In addition, at 5GHz there are no problems with other devices that operate at 2.4GHz like microwave ovens, cordless phones and wireless security systems. Power regulations at 5GHz also limit interference from future narrow band wireless devices. Therefore 802.11a networks offer an easy and robust upgrade path for expanding bandwidth and supporting more users.



The AR5210 MAC/Baseband Processor

The AR5210 chip incorporates media access control (MAC) logic, baseband processing functions, and a PCI/Mini PCI/CardBus host interface, as well as analog-to-digital and digital-to-analog converters (ADC and DAC). This fully integrated digital processor eliminates the need for external RAM and flash memory.

The AR5210 implements an OFDM baseband processor supporting all IEEE 802.11a mandatory and optional data rates using several modulation schemes: binary phase shift keying (BPSK), quadrature phase shift keying (QPSK), 16 quadrature amplitude modulation (16 QAM), and 64 QAM. The chip also supports Atheros Turbo Mode™.

The AR5210 performs receive and transmit filtering, frame encryption/decryption, and error-recovery operations as defined by IEEE 802.11a. Additional features include forward error correction coding at rates of 1/2, 2/3, and 3/4; signal detection; automatic gain control; frequency offset estimation; symbol timing; and adaptive channel estimation.

Together, the AR5210 and AR5110 provide a complete, cost-effective, low-power silicon solution for high-speed, high-capacity WLAN station and access-point applications.

Comprehensive Kits Shorten Time to Market

AR5000 developer's and designer's kits shorten the hardware and software development cycle, thus improving time to market. The kits include complete reference designs for access point and client applications as well as user's and programmer's guides.

AR5000 Key Features

- **Fully complies with the IEEE 802.11a 5GHz standard**
- **Supports all 802.11a data rates of 6, 9, 12, 18, 24, 36, 48 and 54Mbps**
- **Offers extended speeds up to 72Mbps in Atheros Turbo Mode™**
- **Implements OFDM modulation for better multipath tolerance**
- **Supports BPSK, QPSK, 16 QAM, and 64 QAM OFDM modulation schemes**
- **Uses low-cost, mainstream, 0.25-micron Digital CMOS technology**
- **Has a low power design for longer battery life**
- **Provides 152/128, 128/104 and 64/40-bit WEP encryption at full line speed without performance degradation, as well as unique per link keys, dynamic key exchange and IEEE 802.1x Security**
- **Allows for upgrades to new standards and technologies for QoS, Security and DFS/TPC**
- **Includes PCI, Mini PCI and CardBus Host interfaces (PCI 2.2 and PC Card 7.1)**
- **Supports Windows XP, 2000, ME, 98 and NT4; WHQL tested**

AR5000 Chipset Specifications

Frequency Band	5.150-5.350 GHz		
Network Standard	IEEE 802.11a		
Network Architectures	Ad Hoc, Infrastructure		
Modulation Technology	Orthogonal Division Frequency Multiplexing		
Modulation Techniques	BPSK, QPSK, 16 QAM, 64 QAM		
FEC Coding Rates	1/2, 2/3, 3/4		
Encryption Key Lengths	40,104,128 bit		
Initialization Vector Length	24 bit		
Media Access Technique	CSMA/CA		
Host Interfaces	PCI, Mini PCI, CardBus		
Supported Data Rates			
IEEE 802.11a Standard Mode	6, 9, 12, 18, 24, 36, 48, 54 Mbps		
Atheros Turbo Mode™	12, 18, 24, 36, 48, 72 Mbps		
Maximum Power Consumption (CardBus)	**Transmit**	**Receive**	**Sleep**
IEEE 802.11a Standard Mode	1.6W	1.2W	Less than 40mW
Atheros Turbo Mode™	1.9W	1.5W	Less than 40mW
Average Power Consumption (CardBus)	**Transmit**	**Receive**	**Sleep**
11Mbps Sustained Data Rate*	0.33W	0.26W	Less than 40mW
Operational Temperature Range	0-70°		
Operational Humidity Range	0-95% non-condensing		
Chip Specifications	**AR5110**		**AR5210**
Operating Voltage	2.5V +/- 5%		2.5V +/- 10%
	3.3V +/- 10%		3.3V +/- 10%
Package Dimensions	9mm x 9mm		15mm x 15mm
Packaging	64-pin leadless		196-pin BGA
	plastic chip carrier		plastic package
** With 54Mbps IEEE 802.11a Standard Mode Link, 20% Duty Cycle*			

Visit the Atheros web site for resources such as our white paper on 802.11a range and system capacity: www.atheros.com

For detailed product and ordering information, contact Atheros Sales:

ATHEROS™
COMMUNICATIONS

Atheros Communications, Inc.
529 Almanor Avenue
Sunnyvale, CA 94085-3512

Call: 408-773-5200
Fax: 408-773-9940
Email: sales@atheros.com

Atheros Communications, KK
Sanko-biko building 4F,
1-2-6, Uchikanda, Chiyoda-ku,
Tokyo, 101-0047 Japan

Call: +81-3-5282-4111
Fax: +81-3-5282-4116
Email: sales_asia@atheros.com