



The easy-to-deploy PacketWave 1000 base station unit delivers scalable broadband wireless coverage that meets the performance, reliability, and QoS requirements of carriers serving a broad range of subscribers—even in challenging environments.

### Key Benefits

#### Scalable, flexible, cost-effective

TDMA/TDD system with industry leading cell coverage, excellent spectral efficiency, advanced interference mitigation based on RapidBurst® bandwidth-on-demand technology, which delivers an unprecedented level of scalability and flexibility at a low cost per subscriber.

#### Per-Subscriber link optimization

OptimaLink® wireless link adaptation technology improves bandwidth, robustness, and overall performance for each subscriber. OptimaLink automatically adapts ten different MAC and PHY parameters, including modulation and antenna polarization – to create the most robust link and highest data throughput, whether the path is line-of-sight, obstructed-line-of-sight, or non-line-of-sight.

#### Multiservice delivery

ServiceQ® technology lets service providers set up different service classes for subscribers on an application-by-application basis, making it possible to maximize revenue by providing multi-tiered data, voice, and video services using a single wireless platform.

#### Rapid deployment

Easy installation and configuration with built-in antenna alignment tools, automated subscriber provisioning, and end-to-end IP architecture.

#### Ease of management

Standards-based SNMP, Web and Java-based tools simplify the complex task of managing the network.

#### Complete system solution

The fully integrated PacketWave system provides a complete broadband wireless solution, including base station, subscriber units, radios, and antennas that accommodate a variety of frequency bands—2.5, 3.3, 3.5, 5.3, and 5.8 GHz.

## PacketWave® 1000 Base Station Unit

*Scalable, multiservice broadband wireless technology for service provider points of presence*

Aperto® Networks' PacketWave® system gives service providers a fully-integrated service intelligent platform for building high-density broadband wireless networks for personalized service delivery. PacketWave system architecture features an innovative multiservice design, highly scalable capacity and coverage, dynamic per-subscriber link optimization technology, rapid deployment and ease of management.

The PacketWave 1000 base station unit lets service providers quickly and easily deploy multiservice broadband wireless networks in multi-cell, multi-sector topologies. Located at each point of presence, the stackable PacketWave 1000 unit is designed to deliver services to subscribers in suburban and urban areas where foliage and buildings can make line-of-sight access a problem. The unit easily integrates with wireline network infrastructures to maintain Quality of Service (QoS).

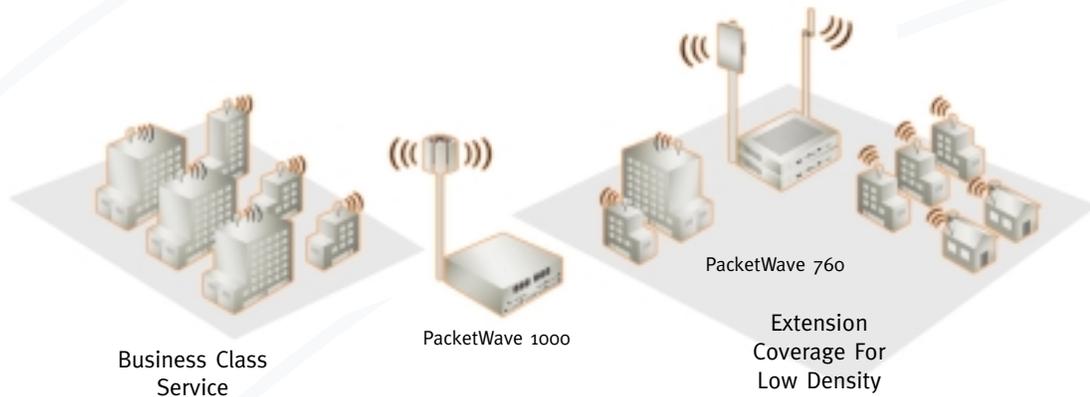
### Scalable Architecture

The service intelligent PacketWave system can handle thousands of subscribers, whether they're spread out in suburban neighborhoods or located in densely populated urban areas.

Combining high-frequency reuse with advanced interference management and mitigation techniques, the PacketWave system conserves valuable spectrum by allowing the service provider to cover an extensive geographical area with a minimum number of channels.

As bandwidth and subscriber needs increase, network operators can easily add channels or new sectors within the cell. Multiple PacketWave 1000 base station units can be stacked to provide additional bandwidth using multiple channels per sector. And additional cells can be deployed to extend the service capacity and coverage footprint.

## PacketWave Broadband Wireless System



The PacketWave system is a complete multiservices solution that includes base station, subscriber units, radios, and antennas.

### Breakthrough Technologies

Aperto Networks' PacketWave products feature three market-leading technologies: RapidBurst advanced Time Division Multiple Access (TDMA) protocol, OptimaLink dynamic per-subscriber link optimization, and ServiceQ per-flow QoS and bandwidth management.

*RapidBurst technology* enables the PacketWave system to achieve low latency and unprecedented spectral efficiency. With RapidBurst, the PacketWave system delivers burst rates up to 20 Mbps over a 6 MHz channel.

In addition, RapidBurst dynamic bandwidth allocation enhances efficiency by assigning time slots and packet sizes according to actual demand and service levels. An advanced TDMA burst mode ensures maximum flexibility and bandwidth efficiency in both upstream and downstream transmissions. Time Division Duplexing (TDD) technology maximizes flexibility and enables adjustable allocations of upstream and downstream bandwidth depending on traffic requirements.

*OptimaLink technology* performs dynamic control of link parameters to optimize each subscriber's connection in a multiuser, cellular network. The OptimaLink adaptive algorithm dynamically selects and adjusts PHY and MAC-layer parameters, including antenna diversity, modulation, transmit power, retransmission policy, and frame size. The benefit to network operators is increased capacity and broader coverage that includes obstructed-line-of-sight and non-line-of-sight subscribers.

*ServiceQ technology* provides different service classes to subscribers on an application-by-application basis. This means personalized services can be delivered intelligently, allowing the service provider to maximize revenue opportunities with differentiated service offerings and effective management of Service Level Agreements (SLAs).

With ServiceQ, service providers can set up multiple QoS profiles for each PacketWave 100 Series subscriber unit. Each profile contains various QoS metrics (such as maximum and minimum bandwidth) based on Class of Service (CoS) requirements like Constant Bit Rate (CBR), Committed Information Rate (CIR), or Best Effort (BE). Using a highly advanced scheduling mechanism, the PacketWave system enforces the metrics in each profile. The result is that service providers can offer tiered services that help differentiate their offerings in the marketplace.

Some of the advanced technologies that are used to implement ServiceQ include:

- **Per Flow Queueing:** This enables separate buffering of voice and data, so that voice packets are not queued behind a line of data packets.
- **Weighted Fair Queueing:** Enables the system to provide minimum rate guarantees for business class data services.
- **Unsolicited Grant Service:** Enables the system to provide low jitter and latency service for voice.
- **Leaky Bucket Based Peak Rate Regulator:** Enables the system to throttle data flows to operator configured limits.

In addition, the intelligent ServiceQ packet classifier can associate end-user applications to QoS profiles by mapping existing indicators such as IP ToS, as well as data packet header information such as IP or MAC addresses and port numbers. Consequently, the PacketWave system can identify applications such as Web browsing, telephony, and video streaming – providing the appropriate QoS, resulting in a more personalized and valuable service to each subscriber.

### Multiple Frequency Bands

Because the PacketWave system can accommodate a variety of frequency bands, it gives service providers the flexibility to pursue opportunities across the globe using a single service intelligent platform, minimizing capital and operating costs. PacketWave 1000 base station units can simultaneously support Aperto radios and antennas operating in 2.5 GHz, 3.3 GHz, 3.5 GHz, 5.3 GHz, and 5.8 GHz frequency bands.

### Comprehensive IP Functionality

The PacketWave system provides a single platform for delivering converged data, voice, and video services over an IP network. The IP-based system design allows service providers to develop end-to-end applications, such as Virtual Private Networks (VPNs) and web hosting, without the complexity of intervening transport protocols. And, it fits seamlessly into the service provider's overall network architecture without altering the existing routing and server infrastructure.

The PacketWave system leads the industry in implementing advanced IP features and services. Packet filtering, Dynamic Host Configuration Protocol (DHCP), and Trivial File Transfer Protocol (TFTP) configuration download give service providers maximum flexibility in provisioning secure services for customers. The PacketWave 1000 performs bridging, routing, or VLAN to offer a complete set of IP networking with QoS. In conjunction with Aperto subscriber units, the PacketWave 1000 enables the following IP networking applications.

**Routing** of multiple subnets on the wireless port provides efficient utilization of wireless bandwidth and additional security. Routing information can be configured either statically or dynamically using the RIPv2 routing protocol.

**NAT/PPPoE** protocol on subscriber units conserves the number of public IP addresses necessary to implement large-scale networks, while providing security and control for billing.

**VLAN** is provided in multiple modes: tagged, double-tagged, and pass-through, with three separate VLANs per CPE for management, NAT/PPPoE, and bridged IP traffic. Special modes enable reselling of wireless bandwidth and VoIP bridging in conjunction with NAT/PPPoE.

**Advanced bridging** with thousands of MAC addresses per subscriber unit easily handles IPv4 traffic in conjunction with the extended packet sizes necessary for pass-through of VLAN, PPPoE, MPLS, and IPv6. Additionally, layer 2 and 3 classification may be made for QoS and filtering.

This array of IP capabilities, together with the innovative RapidBurst, OptimalLink, and ServiceQ technologies, make the PacketWave system the most flexible broadband wireless service delivery platform available today.

### Flexible Backhaul

The PacketWave 1000 base station unit provides complete flexibility in connecting to backhaul networks. In its base configuration, the PacketWave 1000 is equipped with a 100 Base-T Fast Ethernet interface. This enables direct connection to a Gigabit or Fast Ethernet-based MAN, or to a variety of other broadband networks through an external router or switch.

### Full-Featured Management

The PacketWave system simplifies subscriber provisioning and network management with GUI-based tools, standard protocols, and industry-standard platforms. Among these tools is the highly scalable, JAVA-based WaveCenter Configuration Manager, which automates the subscriber provisioning process. The PacketWave system also includes Web-based HTML and SNMP-compliant network management software for configuration, fault, performance, and security management.

# PacketWave 1000 Base Station Unit Specifications

## Interfaces

Radio – Four or six Wireless Subsystems (WSS), each with the following Interfaces:

- signal (F connector)
- transmit test (F connector)
- receive test (BNC connector)
- control (RJ-45 connector)

Backhaul Port: 100 Base-T Fast Ethernet

Local Craft Interface: RS-232 serial port (DB9)

Alarm/Control: NO/NC/Common dry contact relay

External Clock Input: optional 10 MHz timing reference (BNC)

Multiple PacketWave 1000 Synchronization:  
2 main and 2 alternate ports (BNC)

Cable Length: up to 825 feet (250 meters)

## Operation

20 Mbps data rate, 14 Mbps net throughput

Frequency Bands Supported (using Aperto Networks' radios and antennas):

- 2.5-2.689 GHz
- 3.3-3.4 GHz
- 3.4-3.8 GHz
- 5.250-5.350 GHz
- 5.725-5.925 GHz

Duplexing Mode: TDD and FDD option

Modulation: QPSK and 16 QAM

Error Correction:

- Reed Solomon FEC with variable block Length and correction factor
- Advanced MAC-layer ARQ

## Networking

Protocols: IP Routing RIPv2, VLSM, CIDR, DHCP (client and relay agent), VLAN, Bridge, PPPoE

Service Classes: CBR, CIR, BE

## Security

Multiple levels of password protection

Wireless signal scrambling

DES Encryption: 56, 112, 168 bit (planned)

## Management

Centralized provisioning using WaveCenter Configuration Manager on Windows 2000 Professional, and Linux

Embedded WaveCenter agent supporting SNMP and Web browser interfaces

SYSLOG interface and email alerts

Advanced installation and alignment tool

SNMP, MIB II (RFC 1213), Aperto Enterprise MIB

Software upgrade tool

## LED Indicators

Power

Radio: transmit, receive, status (for each WSS)

Ethernet: link, transmit, receive

Multi-unit Sync: main and alternate

## Power Requirements

AC Option: 85-265 VAC, 47-63 Hz

DC Option: 40-60 VDC

Power Consumption:

360 watts maximum (base configuration)

## Dimensions and Weight

Width: 16.5 in (41.9 cm)

Height: 5.25 in (13.3 cm)

Depth: 18 in (45.7 cm)

Mounting: standard 19 inch rack

Weight: 38 lbs (17 kg)

## Redundancy

2 load-sharing and hot-swappable power supplies

4 hot-swappable fans

2 power connectors for two separate power sources

## Environmental

Operating Temperature: 32° to 104° F (0° to 40° C)

Humidity: 10% to 90% noncondensing

## Regulatory Approvals

FCC Part 15 Class A, CE, EN

## Ordering Information

PW1000-P-FFDD-M-V-oC

P	Ports
	2 – 2 Ports
	3 – 3 Ports
	4 – 4 Ports
	6 – 6 Ports
FF	Frequency
	25 – 2.5 GHz
	33 – 3.3 GHz
	35 – 3.5 GHz
	53 – 5.3 GHz
	58 – 5.8 GHz
DD	Antenna
	90 – 90° antenna
	60 – 60° antenna
	OM – omni antenna
	00 – no antenna
M	Subscriber Unit Capacity
	Mode Possible Subscriber Units
	A 64 (32 for 2 or 3 port systems)
	B 128
	C 256
	D Product Maximum
V	Power Option
	A – A/C
	D – D/C
C	Power Cord
	1 – US
	2 – Europe
	3 – Italy
	4 – UK
	5 – Australia

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