

HP Broadband Wireless Notebooks Overview

White paper



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Introduction

Over the past 20 years, the evolution of the internet and the advent of wireless technologies have made a tremendous impact on lifestyles around the world. Together, these two factors have changed the way people communicate, work, and get their entertainment. Voice communication, news, electronic messaging, e-mail, music, movies, and games are now available virtually anytime and from anywhere. In fact, these on-demand services have become commonplace and are taken for granted, until Internet access is unavailable.

As the inventor of the portable computer¹ and a creative force behind many industry standards, HP has played a significant role in the wireless technology evolution. HP has been at the forefront of integrating Wi-Fi (802.11) and Bluetooth® technologies into notebooks.

Today HP is fulfilling the promise of a single device for communication, information, and entertainment with HP Broadband Wireless notebooks. HP Broadband Wireless notebooks with fully integrated 3G (third-generation) wireless broadband capability allow users to always stay connected in more places than ever before.

This paper addresses the following topics:

- An overview of wireless technologies
- The broadband wireless technologies in HP Broadband Wireless notebooks
- The features and benefits of HP Broadband Wireless solutions
- Factors to consider when choosing a notebook with embedded 3G wireless

Wireless technologies

Wireless technologies in HP notebook computers include IEEE 802.11 for wireless local area networks (WLANs), Bluetooth for wireless personal area networks (WPANs), and broadband wireless technologies for wireless wide area networks (WWANs).

A WLAN connects computers wirelessly in corporate offices, homes, and public places such as airports, restaurants, coffee shops, hotels, and universities. In a WLAN, each mobile wireless device communicates with one or more wireless access points, which typically have a range of up to 30 meters (100 feet). The predominant WLAN standards (802.11b, 802.11g, 802.11a, and 802.11n) are collectively called Wi-Fi.

A wireless PAN is a collection of mobile devices that make up a “piconet” (tiny network), typically located in one room. The PAN replaces the wires that would normally connect one piece of equipment to another. For example, a PAN may connect a desktop computer to a nearby printer, digital camera, scanner, keyboard, mouse, and PDA. In a PAN, each wireless device communicates directly with other devices, and devices must be relatively close together—typically within about 30 feet of each other. Bluetooth is the most common WPAN technology.

In contrast, a WWAN provides wireless connectivity for a mobile device over a large geographic area. In a WWAN, devices connect through a mobile network operator to the Internet. Mobile network operators, such as Cingular, Verizon, and Vodafone, use their extensive networks of base stations and cellular sites to provide coverage across large regions. WWANs also maintain connection when the device is in motion, such as in a car or train.

¹ Compaq Computer Corporation, now part of Hewlett Packard, was the first company to market an IBM-compatible portable PC, the Compaq Portable PC, in 1982.

Broadband wireless technology²

Broadband wireless technology evolution

Broadband wireless technologies are commonly referred to by the generation (G) of their technology:

- 1G—first-generation, original analog mobile voice networks
- 2G—second-generation, digital circuit-switched mobile voice and data networks.
- 2.5G—digital technology added to 2G networks that provides packet-data service and improved data rates
- 3G—third-generation, high-speed digital mobile voice and data networks

1G wireless data networks were first developed in the 1980s using analog technology. Although 1G technology was a major innovation, it inefficiently used the range (spectrum) and capacity (bandwidth) of available frequencies, and it was prone to problems with speed, quality of transmissions, and security. Also, the three competing 1G technologies (TACS, AMPS, and NMT) were not interoperable in various parts of the world.

2G networks (Figure 1) introduced digital circuit-switched technology, which used the spectrum much more efficiently. Two types of multiplexing architectures were used on 2G networks:

- CDMA (code division multiple access) transmits streams of bits over channels that are divided using codes. CDMA permits several radios to share the same frequencies.
- TDMA (time division multiple access) also allows several radios to share the same frequencies, but does it by defining different timeslots. Each radio transmits in rapid succession, each using its own timeslot.

In the United States, three competing TDMA standards were deployed: cdmaOne, D-Amps, and iDEN. However, in Europe, all networks standardized on a single TDMA technology called GSM, for Global System for Mobile Communications. 2G networks supported more concurrent users, offered higher quality service at lower network operating costs, and improved security and speed. However, there continued to be several competing, non-interoperable networks built upon either CDMA or TDMA architectures.

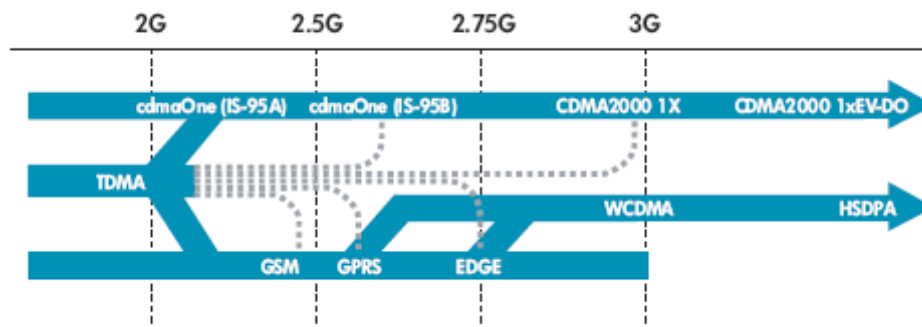
Global Packet Radio Service (GPRS) is a 2.5G digital technology that adds packet-data service to the existing 2G network. EDGE (enhanced data rates for global evolution) is a software/hardware enhancement for GPRS networks that is designed to provide higher data rates to enhance the delivery of multimedia and other broadband programs for wireless devices.

3G networks, which were broadly launched starting in 2004, deliver higher peak data transmission rates, greater system capacity, and improved spectrum efficiency, among other capabilities. 3G broadband packet-switched networks provide speeds that can enable a range of features, from mobile email to large file transfers. 3G networks are described in more detail in the following section.

Broadband wireless technology continues to evolve. 4G technology is being applied to emerging technologies that promise higher speed wireless networks focused on data and multimedia streaming. However, mainstream adoption of 4G technologies is still several years away.

² Source www.QUALCOMM.com

Figure 1. Broadband wireless technology evolution



3G WWAN technologies

Two 3G WWAN technology standards have emerged as the clear choices among mobile network operators: CDMA2000 and Wideband CDMA (WCDMA). These standards provide high-speed data services over a wide coverage area, provide investment protection through backward compatibility to previous standards, and allow roaming among domestic and international markets³. 3G WWAN technologies have been instrumental in making business applications, such as email and network connectivity, accessible to a larger number of mobile professionals outside the constraints of WLANs and Wi-Fi hotspots. 3G technologies also allow consumers to download music, play online games, and enjoy other entertainment applications.

CDMA2000 is the 3G technology chosen by most CDMA mobile network operators to digitally transmit voice and data. CDMA2000 standards include the QUALCOMM CDMA2000 1x and 1xEV-DO technologies. WCDMA (also known as UMTS) is the 3G technology chosen by most GSM/GPRS mobile operators. Universal Mobile Telecommunications System (UMTS) can deliver information at speeds of up to 384 kilobits per second (Kbps). Besides voice and data, UMTS delivers audio and video to wireless devices in much of the world through fixed, wireless, and satellite systems.

The advent of 3G networks has decreased the fragmentation of network technologies around the world. Today the majority of 3G networks are deployed with either 1xEV-DO or HSDPA, which are based on the CDMA2000 and WCDMA standards, respectively.

1xEV-DO

CDMA2000 1xEV-DO (Evolution Data Optimized) is an evolution of the CDMA2000 standard that provides up to 2.4 Mbps downlink and 150 Kbps uplink speeds. 1xEV-DO uses a separate channel from voice traffic to improve network efficiency and insulate it from the effects of heavy voice traffic. 1xEV-DO networks are now widely deployed in North America and in various countries around the world, such as Brazil, Japan, and Korea. Future revisions of 1xEV-DO will enhance both downlink and uplink speeds as well as quality of service.

HSDPA

A technology upgrade to current UMTS networks, High Speed Downlink Packet Access (HSDPA) is a packet-based data service feature of the WCDMA standard that provides improved downlink data rates. Initial implementations of HSDPA were introduced commercially in 2005 at 1.8 Mbps peak downlink data rates and will evolve to higher rates over successive generations. HSDPA's peak uplink speed is currently 384 Kbps. Some networks began to support 3.6 Mbps downlink data rates in

³ Dependent upon roaming agreement between the user's local mobile network operator and the mobile network operator being accessed.

2006. The future evolution of HSDPA will consist of successive improvements in downlink data rates and, with the introduction of High Speed Uplink Packet Access (HSUPA), substantial improvements in uplink data rates and quality of service as well.

HSDPA networks have been commercially deployed by over 55 mobile network operators around the world.⁴

The widespread introduction of enhanced 3G networks has been a key factor in driving adoption of 3G technologies in notebooks. The slower data rates of the previous technologies, while adequate for simple text messages and devices that required less bandwidth, ranged from inadequate to marginal for use in notebooks. However, the higher data rates of 1xEV-DO and HSDPA have crossed a threshold where the user experience for email and internet access is now viewed as acceptable, often perceived similar to some home DSL experiences.

HP Broadband Wireless notebooks

HP Broadband Wireless notebooks feature fully integrated 3G WWAN technology⁵, Wi-Fi,⁶ and Bluetooth, enabling you choose the most appropriate wireless technologies for your immediate need. These technologies can be used concurrently in situations such as downloading a document over a WWAN connection and then printing it using a Bluetooth-enabled HP printer. All HP Broadband Wireless notebooks provide the following benefits:

- Ability to connect at broadband speeds outside of WLANs and Wi-Fi hotspots
- No protruding PC cards that can damage the notebook
- Dual high-performance antennas for a more reliable connection
- Easy sign-up process for service with HP's mobile network operator partners
- Fast connection capabilities with preloaded software
- Enhanced security through HP ProtectTools Security Manager and built-in support for VPN applications
- Enhanced battery life through smart power controls that can automatically turn off the wireless devices when they are not in use

HP Broadband Wireless Modules

WWAN capability is provided by an HP Broadband Wireless Module that can be preinstalled in the notebook or purchased separately in an option kit. HP offers two broadband wireless modules: the ev2200 that supports CDMA2000 1xEV-DO, and the hs2300 that supports WCDMA/HSDPA. Both modules share the following characteristics:

- PCI Express minicard form factor (51 x 30 x 4.5 mm)
- USB 2.0 interface
- Based on QUALCOMM technology
- Network certifications by HP's partner mobile network operators

HP ev2200 1xEV-DO Broadband Wireless Module

The HP ev2200 1xEV-DO Broadband Wireless Module is an integrated WWAN modem for select HP notebooks that provides connection to the Verizon Wireless BroadbandAccess and

⁴ Source: <http://www.gsacom.com/>

⁵ Wireless use requires a separately purchased service contract. Access is limited to the coverage area of the service provider. Check with the service provider for availability and coverage in your area.

⁶ Wireless access point is required and is not included. Availability of public wireless access points is limited. Wireless Internet use requires a separately purchased Internet service contract.

NationalAccess networks⁷. The Verizon Wireless BroadbandAccess network provides average download speeds of 400 to 700 Kbps.⁸ With an HP Broadband Wireless notebook and Verizon Wireless service, users can check e-mail, browse the Internet, and connect to corporate networks from anywhere within the Verizon Wireless coverage area.

The HP ev2200 module is built upon the QUALCOMM MSM6500 chipset, which has the following features:

- Support for cellular frequency bands used in North America (850 and 1900 MHz)
- Receive diversity (uses two separate antennas to improve signal reception)
- Support for the CDMA2000 1xEV-DO air interface

HP hs2300 HSDPA Broadband Wireless Module

The HP hs2300 HSDPA Broadband Wireless Module is an integrated WWAN modem for select HP notebooks that provides connection to various mobile operator networks around the world that support HSDPA, UMTS, EDGE, or GPRS. In addition to the hs2300 module, a Subscriber Identity Module (SIM) issued by a mobile network operator is required to connect to their network. Most HP Broadband Wireless notebooks come with a preinstalled SIM from a partner mobile network operator. When it is convenient, the user can activate service with the mobile network operator by using preloaded HP software.

The HP hs2300 module is built upon the QUALCOMM MSM6280 chipset, which has the following features:

- Compatibility with mobile networks in many countries through quadband GPRS and EDGE frequency support (850/900/1800/1900 MHz).
- Support for high speed 3G networks in many countries in the Americas, Europe, and Asia through tri-band UMTS/HSDPA support (850, 1900, 2100 MHz).
- Support for 3GPP HSDPA Category 6 air interface (3.6 Mbps peak data rate)

The support for 3GPP Category 6 air interface and for tri-band UMTS/HSDPA are significant enhancements over previous HSDPA chipsets. Furthermore, the MSM6280 chipset is capable of supporting 3GPP Category 8 (7.2 Mbps nominal peak downlink data rate) with future QUALCOMM firmware releases.

Table 1 compares the features of 3G WWAN technologies available in HP Broadband Wireless notebooks.

Table 1 – Comparison of HP Broadband Wireless Modules.

HP Broadband Wireless Module	Technologies supported	Downlink Throughput (average)	Uplink Throughput (average)	Comment
HP ev2200	1xRTT, 1xEV-DO Rev.0	400-700 Kbps	60-80 Kbps	No SIM required
HP hs2300	GPRS, EDGE, UMTS, HSDPA	400-700 Kbps ⁹	100-120 Kbps	SIM required

⁷ Subject to customer agreement & calling plan. Offers, coverage, and service not available everywhere. BroadbandAccess is available in 181 major metropolitan areas covering over 148 million people, and is expanding coast to coast. BroadbandAccess is available in 72 primary airports in the U.S. Actual coverage may vary. See coverage limitations & maps at <http://www.verizonwireless.com>.

⁸ BroadbandAccess speeds are based on Verizon Wireless network tests with 5-MB FTP data files without compression.

⁹ The Cingular BroadbandConnect (UMTS/HSDPA) network provides average downlink speeds of 400-700 kbps and average uplink speeds of 100-120 kbps. Network speed is no indication of the speed at which your device sends or receives data. Actual speeds depend on distance from cell site, network availability and traffic, device, applications, tasks, file size and other factors. The average speed claim is substantiated by the nationwide average of FTP download/upload tests that are performed in commercially available UMTS/HSDPA markets.

Important considerations

Benefits for business

HP Broadband Wireless notebooks provide several benefits that address business needs for security, reliability, and ease of use:

- A single remote connection method that works in more places and avoids the challenges of setting up public LANs and WLANs
- A completely integrated solution that avoids the potential damage and other issues posed by the use of protruding PC Cards
- Lower total cost for some users compared with multiple public hotspot connection charges
- Enhanced productivity by enabling users to connect quickly and in more places
- Convenient power control for all integrated wireless devices through the HP Wireless Assistant
- Preloaded connection software featuring HP's unique smart power control that turns the HP Broadband Wireless Module on or off automatically to conserve battery power
- High-performance antennas that provide optimum signal strength for a more dependable connection
- Proven solutions that are thoroughly tested by HP and certified by partner mobile network operators
- Trusted CDMA technology that provides authentication and uses spread-spectrum technology to encode your data
- Support for Virtual Private Network (VPN) applications that lets you increase the level of security
- HP ProtectTools Security Manager that offers multifactor authentication, Microsoft® Windows® log-on service, a single sign-on "password vault," and identity storage, backup, and migration

Mobile network operator service

Making a mobile broadband connection using an HP Broadband Wireless notebook requires service from a mobile network operator. HP has mobile network operator partners in North America, Europe, and Asia, and will continue to add more partners.

HP makes it easy to activate service with partner mobile network operators, regardless of the number of notebooks being deployed. Follow the printed instructions that come with your notebook or activate the HP Broadband Wireless Setup Utility to sign up for mobile network operator service and configure the mobile operator's connection manager software.

You should review the customer agreement and available plans before selecting one. Partner mobile network operators provide a variety of plans to suit individual needs, including usage-based plans and plans that allow unlimited access. Unlimited access plans allow you to download complex files and large e-mail attachments without having to worry about a data transfer limit.

To view the current list of mobile network operator partners and supported countries or to get additional information on mobile network operator service see the HP Web site at www.hp.com/broadbandwireless.

Coverage and roaming

Before you purchase an HP Broadband Wireless notebook, HP recommends that you verify that a partner mobile network operator provides service to the locations where you intend to use your notebook most often, also that you review the coverage area and roaming agreements of the HP partner mobile network operator.

As with mobile voice service, mobile data coverage and performance varies and may be limited within buildings or in other environments that block or interfere with radio signals.

If you plan to use your HP Broadband Wireless notebook internationally, notebooks configured with the HP hs2300 HSDPA module allow you to connect in many countries in the Americas, Europe, Asia, and other regions. Notebooks with the ev2200 1xEV-DO module permit roaming primarily in North America.

Upgradeability

Select HP notebooks, such as the HP Compaq nc6400, include the antenna support and available slots for an HP Broadband Wireless Module, so that an HP Broadband Wireless module can be installed by the customer after the initial notebook purchase. This feature provides flexibility to add HP Broadband Wireless capability at a later time, and may permit you to migrate to new modules or to change mobile operators.¹⁰

Electronic tracking numbers

Like cell phones, HP Broadband Wireless Modules and associated SIMs have electronic tracking numbers that are required for service activation. There are three different tracking numbers: ESN, IMEI, and ICCID.

ESN

The ESN (electronic serial number) is a unique identification number stored in CDMA phones and modules, including the HP ev2200 1xEV-DO Broadband Wireless Module. The ESN is paired with a mobile number and activated in the CDMA operator's network and billing system to create an account that allows the device access to the network. Each time a connection is initiated, the ESN is transmitted to the base station so the wireless carrier's mobile switching office can check the connection's validity.

To activate an ev2200 module for Verizon Wireless service you will need to provide your ESN. If you use Verizon Wireless's over-the-air activation service, the ESN is electronically transmitted for you. If you choose to activate service by phone with the HP Wireless call center at (866)890-6938, you will need to provide your ESN to the HP representative. Information on where to find the ESN for your notebook is explained below.

If your notebook's HP Broadband Wireless Module is ever replaced, you should notify Verizon Wireless so that your account can be updated with the ESN of the new module.

IMEI

The IMEI (International Mobile Equipment Identity) is a unique identification number stored in GSM, GPRS, EDGE, UMTS, and HSDPA phones and devices, including the HP hs2300 HSDPA Broadband Wireless Module. The IMEI identifies to the network the device which is attempting to connect. Mobile network operators use the IMEI to verify which devices are connecting and to ensure that these devices meet certain standards of operation.

ICCID

The ICCID (International Circuit Card ID) is a 19- or 20-digit unique identifier number for the SIM. The ICCID identifies the class of device, country of issue, mobile operator, and a unique serial number that is associated with an individual subscriber.

If you are activating an HP Broadband Wireless notebook with an hs2300 for mobile network operator service, you will need to provide both the IMEI of the module and the ICCID of your SIM to the operator or HP agent setting up the account.

¹⁰ Subject to completion of mobile network operator certifications and the availability of supporting HP Broadband Wireless Accessories. HP does not guarantee future accessory support for any specific notebook product, mobile operator, or wireless technology.

Where to locate ESN, IMEI, and ICCID: The required identifier(s) for HP Broadband Wireless notebooks (the ESN for notebooks with the ev2200 and the IMEI and ICCID for notebooks with the hs23000) are available in the following locations:

- On a label on the notebook (usually located under the battery)
- On a label on the notebook shipping box
- From the client manager software application

For large orders of HP Broadband Wireless notebooks, HP can provide a list of these identifiers correlated to notebook serial numbers.

Software

Because the necessary software is loaded on your HP Broadband Wireless notebook's hard drive at the factory, you can begin to use HP Broadband Wireless notebooks quickly and easily. HP provides the mobile operator's software client in addition to the required drivers. Your notebook may also include the HP Broadband Wireless Setup Utility, which will guide you through the steps to activate mobile network operator service and configure the software client.

As always, HP customers can access upgrades to drivers and software through the HP Web site at <http://www.hp.com/support>.

Understanding performance claims

The *data rates* reported for specific wireless technologies do not represent the *throughput* that a user will experience. When peak data rates are reported, this should be understood as the designed maximum data rate for the technology, which a device or radio may achieve on an instantaneous basis for one or several packets at a time. Per packet data rates will vary, and the average data rate will be lower than the peak.

Throughput is generally considered as the usable data rate, which is the data rate less the amount of overhead included in each packet for routing. Throughput is a truer indication of the perceived speed of the connection to the user.

Typical or average speeds are metrics provided by mobile network operators that indicate the performance that a customer should experience on their network. This will vary based on several factors:

- Network loading (the number of concurrent network users)
- Environmental factors (electronic interference, presence of objects nearby that will absorb or reflect radio signals)
- Location (distance from cell tower, whether the customer is located within a building, automobile, etc.)
- Internet congestion
- Bandwidth and loading of the "backhaul," the T1 or other data line connecting the cell site to the network/Internet

When reviewing and comparing technologies and networks, you should consider whether data rate or throughput is reported, whether the metric is peak, average, or typical, and under what conditions the result was obtained.

Conclusion

Taking advantage of 3G cellular technology, HP Broadband Wireless notebooks raise the standard for mobility by providing wireless connectivity at broadband speeds. No longer tied to a hotspot, you can check e-mail, browse the Internet, and connect to corporate networks from more places—whether you are stationary or on the go.

The fully integrated design of HP Broadband Wireless notebooks—coupled with service from partner mobile network operators—delivers an easy-to-use, dependable, and more secure broadband connection.

The benefits of HP Broadband Wireless notebooks for business are compelling: from enhanced productivity, security, and ease of use to reduced support calls and improvements in user satisfaction.

For more information

For more information on HP Broadband Wireless notebooks and partner mobile network operator, see the HP Web site at <http://www.hp.com/go/broadbandwireless>.

For more information on 3G wireless technologies, visit <http://www.QUALCOMM.com>.

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