

# 2.4 GHz Wireless Technology

A Logitech white paper





## **Executive Summary**

Over the last 20 years, a succession of wireless standards has raised the benchmark of cordless performance and reliability. Radio Frequency (RF) has emerged as the preferred medium for cordless peripherals, with the 27 MHz band becoming the industry standard for mice, keyboards, and other devices. Improving upon the success of 27 MHz, Logitech has introduced some new peripherals with 2.4 GHz wireless technology. This technology enables a virtually interference-free performance with dependable encryption, greater reliability, and longer battery life.

Logitech Pro 2400™ Cordless Desktop® is the latest offering designed specifically for a high concentration of commercial users in a small environment. This achievement is made possible because of Logitech's 2.4 GHz technology, which uses sophisticated techniques to optimize wireless transmissions. With features including frequency agility, TDMA data transfer protocol, ID matching and encryption, the Logitech Pro 2400 Cordless Desktop delivers a seamless user experience for the corporate environment.

## Brief History of Logitech RF Technology

The first generation of cordless mice, pioneered by Logitech in 1981, used infrared technology (IR) to communicate with receivers connected to PCs. While an infrared mouse provided a relative measure of freedom, it required a direct line of sight to an IR receiver. It also failed to approach the transmission rates of a corded mouse. Looking for ways to improve cordless performance, Logitech led the move from corded to cordless technology in 1984 with the revolutionary Infrared cordless desktop. In 1991, Logitech introduced the first RF cordless mouse quickly followed in 1994 with a 27MHz cordless mouse. 27 MHz products did not require a direct line-of-sight between the transmitter and receiver, and devices could send or receive waves that bounced off different surfaces. In 20XX (use MX 700 date) Logitech further improved the wireless performance of its products with its proprietary FastRF™ 27 MHz technology.. The enhancements offered by FastRF included an increased reporting rate that is similar to the rate of corded USB devices. The technical advantages of FastRF gave users their first glimpse of a cordless experience that approached the performance of corded mice and keyboards. Once again taking the lead, Logitech has introduced 2.4 GHz wireless technology into some of its premium cordless products.

## Delivering Commercial Peripheral Technology

The business world is becoming untethered. Increasingly, wireless technology is cutting the cords that bind us to fixed locations. Today's workers rely on an array of cordless devices: mobile phones, two-way pagers, Wi-Fi enabled laptops and PDAs. Cordless peripherals such as mice and keyboards, offer conveniences at the desk while reducing cable clutter. Compared to traditional corded devices, cordless devices offer clear advantages and can increase business productivity. The absence of tangled cords contributes to a cleaner work desk environment, which could in turn influence employees' mood and creativity.

However, until now, cordless solutions for keyboards and mice did not always adhere to the demanding requirements by businesses. Through everyday usage models, professional users have realized they want to eliminate problems related with interference, greater reliability and better power management. To answer these and other specific business needs, Logitech has brought to market the Pro 2400 Cordless Desktop.



Image 1. Logitech Pro 2400 Cordless Desktop

# Peripherals

Architecture for Business  
*Designed to optimise the workspace*

## The Pro 2400 Cordless Desktop Advantage

The Logitech Pro 2400 Cordless Desktop employs a suite of advanced technologies in response to specific business needs. The new Cordless Desktop delivers the following key advantages:

### i. Interference Free

- With 27 MHz, computer users working within 3 meters of each other have an interference free environment. Such range has made 27 MHz technology generally acceptable for many years. Diagram 1 below demonstrates how 2.4 GHz inside a 10 metre range will increase user proliferation to 78 persons, i.e. 36 times more powerful than 27 MHz.

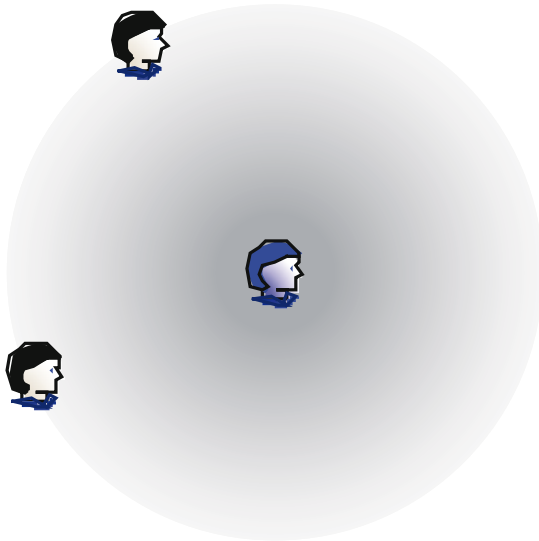


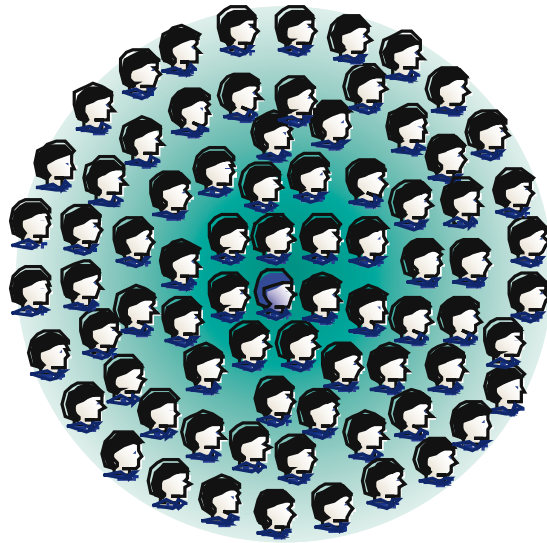
Diagram 1: User proliferation range diagram: 27 MHz allows up to 3 users in a 3 metre range (3 metres from any 1 user)

### iv. Pre-Pairing

- To enhance the plug-and-play experience, every Pro 2400 Cordless Desktop is paired at the point of assembly to have instant on. If the devices to disconnect, press the mini-receiver green connect button once and then press the keyboard green connect button to continue use.

### v. Intelligent Battery Management

- LED battery status with ON / OFF switches enabling Intelligent Battery Management to all devices, leveraging of these features will enhance battery life.



User proliferation range diagram: 2.4 GHz allows up to 78 users in a 10 metre range (10 metres from any 1 user)

### ii. Frequency agility

- The RF solution transparently changes frequencies to ensure normal connectivity

### iii. Plug-and-Play

- Cordless Keyboard – No drivers are necessary to install
- Cordless Mouse – No drivers are necessary, with the exception of the tilt wheel on Windows 2000 and XP, to leverage all functionality offered. Microsoft's new Vista operating system contains OS native wheel tilt making the Cordless Mouse driver free in Vista.

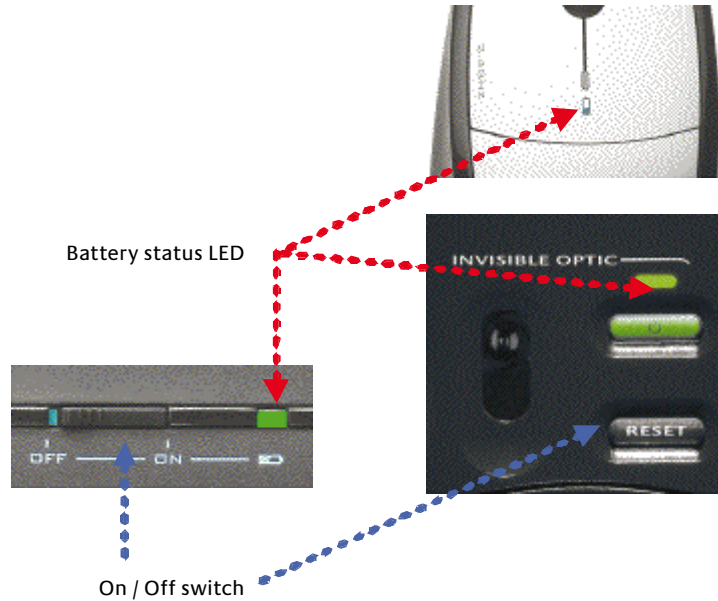


Diagram 2. Keyboard and Mouse Intelligent Battery Management

Battery Status	Scheme	Timing
<b>Battery Good</b>	Green LED Turn On Timing at Power On	10 Seconds
<b>Battery Low</b>	Green LED Turn On Timing at Power On	10 Seconds
	Red LED Blinking On Time	1/10 Seconds
	Red LED Blinking Off Time	9/10 Seconds
	Red LED Blinking Counter	120 Times
<b>Battery Cut Off</b>	Red LED Blinking On Time	55/1000 Seconds
	Red LED Blinking Off Time	110/1000 Seconds
	Red LED Blinking Counter	15 Times
	Red LED Blinking Counter at Power On	30 Times
<b>Pairing</b>	Pairing LED (Green LED) Blinking On Time	1/10 Seconds
	Pairing LED (Green LED) Blinking Off Time	9/10 Seconds

## 2.4 GHz

27 MHz and FastRF raised the standards of wireless performance, but still did not systematically meet the specific requirements of the business environment, where too many people working in close proximity to each other generated some interference between their devices. To eliminate the frustration of possible interference of devices, Logitech selected 2.4 GHz as the RF performance standard for commercial usage models (see Table 1 below). Allocated for public communications, the 2.4 GHz wavelength is ideal for cordless operations. Its relatively short wavelengths permit signals that can more easily

navigate obstructions. Taking advantage of the wave characteristics of the 2.4 GHz band, a cordless device can transmit large amounts of data in rapid bursts, making it faster and less susceptible to interference. As the 2.4 GHz band is also used by Bluetooth and Wi-Fi (802.11) devices, the FCC (regulatory body) limited power output of the 2.4 GHz band to a maximum of one watt in order to restrain 2.4 GHz systems from overpowering each other. This limit established a safeguard for multiple 2.4 GHz solutions to function seamlessly in the same environment.

Diagram 2. Keyboard and Mouse Intelligent Battery Management

Battery Status	Freq.	Range	Speed	Power use	Cost	Direction	Devices
<b>FastRF</b>	27 MHz	2 m	2.4 kbps – 9.6 kbps	16 milliwatts (Tx) 45 milliwatts (Rx)	\$	Unidirectional	Multiple
<b>2.4 GHz</b>	2.4 GHz	10 m	300 kbps	39 milliwatts	\$ \$	Bidirectional	Multiple
<b>Bluetooth</b>	2.4 GHz	3 m (C-III) 10 m (C-II) 30 m (C-I)	750 kbps (v1.2) 3000 kbps (v2.0)	100 milliwatts	\$ \$ \$ \$	Bidirectional	Multiple
<b>Zigbee</b>	2.4 GHz	10 m	250 kbps (max.)	90 milliwatts	\$ \$	Bidirectional	Multiple
<b>UWB</b>	3.1-10.6 GHz	1 - 10 m	480 Mbps –	Unknown	?	Bidirectional	Multiple

## Frequency agility

Logitech 2.4 GHz Digital Cordless for Business features frequency agility. With this technology, the Logitech mouse or keyboard that encounters any interference from another cordless device will automatically identify and switch to a more “quiet” location in the band to transmit data. Furthermore, this process is so fast that most users will not notice it. This frequency agility ensures that virtually no device operating in the 2.4 GHz band will interfere with the optimal performance of the Logitech mouse and keyboard. Wi-Fi (802.11) network clients and servers, Bluetooth-enabled devices, and cordless phones are all competing for bandwidth in this popular region of the radio spectrum. However, Logitech Pro 2400 Cordless Desktop confines its communications to channels unused by the majority of 802.11 solutions, further reducing possible interference from Wi-Fi devices. With a total of 78 discreet channels and over 65,000 possible ID codes, Logitech 2.4 GHz Digital Cordless for Business can easily support multiple 2.4GHz devices at a single location.

### TDMA spells error-free communications

To further guard against signal interference, Logitech Pro 2400 Cordless Desktop uses a TDMA (Time Division Multiple Access) protocol to transmit packets. Widely used for cellular communications, TDMA sends data in small bursts rather than continuous streams, making its transmissions less prone to disturbances. The burst technique also permits multiple devices to use the same channel without interfering with each other. Logitech boosts the TDMA protocol with a send-acknowledgment technique that ensures that a base station receives all the packets sent to it.

### Pre-Pairing

Logitech pairs each mouse and keyboard with the companion receiver during final manufacturing

assembly. By matching ID numbers, the receiver knows which connections to accept and will simply not “listen” to other mice and keyboards that do not possess this ID. Thus, Logitech 2.4GHz Cordless Technology virtually eliminates dropped connections resulting from interference, giving users the increased confidence that comes with fault-free operation. This ID matching also allows a seamless installation. Simply plug the USB receiver into the PC and start working. Logitech Pro 2400 does not require the installation of any software or the establishment of the cordless connection through pressing buttons.

### Encryption

Another benefit of Logitech 2.4 GHz Digital Cordless for Business is that it gives one of the fastest and most efficient cryptographic algorithms for keyboards and mice on today’s market. Thanks to a 64-bit equivalent, proprietary TEA encryption algorithm, Logitech 2.4 GHz Digital Cordless for Business shows itself to be highly resistant to differential cryptanalysis, making it very difficult to break, even for an experienced hacker.

### Future directions

Like other technologies, cordless is continually evolving. Logitech is committed to technologies that offer its customers the best performance benefits. With the Logitech Pro 2400 Cordless Desktop, Logitech demonstrates one of its core competencies—the ability to enhance and extend the value of a platform technology with expertise tightly focused on improving the user experience. This same competency has allowed Logitech to stay at the forefront of the personal peripheral industry for over 20 years. As cordless technology continues to liberate users and transform social interactions, Logitech will remain at the leading edge.

**Your Notes:**



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