

## COVERAGE SYSTEMS

## Barcelona Metro

### Barcelona Metro Undergoes Historic Wireless Facelift

*Passengers have uninterrupted access to wireless voice and data services delivered via multi-band, multi-operator system.*

Wireless technology helps us connect with friends, family and business associates at work, at home and en route. As such, a growing number of airports, train stations and subway systems are leveraging wireless coverage and capacity solutions to deliver the needed wireless services; the Barcelona Metro is one of the latest metropolitan subways to get a “wireless facelift.”

The Transports Metropolitans de Barcelona, one of two companies operating the Barcelona Metro, serves nearly one million passengers daily via ten rail lines and 152 stations located underground beneath the Barcelona metropolitan region. As of 2014, the network will be made up of 11 lines with 209 stations, for a total route length of approximately 124 miles (200 km).

#### Now Departing to a Wireless Future

In 2004, Barcelona’s three major wireless operators – Orange, Telefonica and Vodafone – came together to formulate a plan to bring wireless coverage to the Barcelona Metro for the first time in the railway’s history. The Barcelona Metro was divided into three zones, and each operator became responsible for providing wireless voice and data coverage for all three operators in its respective zone.

The operator, Vodafone, contracted with Powerwave Technologies to design the in-building distributed antenna system (DAS) for Phase One of the project, which consisted of eight stations located along Line 3 of the Barcelona Metro. The oldest line in the Barcelona Metro network, Line 3, often referred to as Linia verde, or “green line,” opened in 1924 under the name Gran Metro de Barcelona. Today, Line 3 encompasses 26 stations covering a V-shaped area and serves the University of Barcelona campus, located in the western end of Avinguda Diagonal in the Les Corts district, and Trinitat Nova in Nou Barris.

#### Staying on Track

As part of the initial phase of the Barcelona Metro project, which began in early 2005, Powerwave Technologies worked with Vodafone on the DAS system design, creating a custom configuration for the master base station units. During the second phase of the project, which began in March 2006, Powerwave delivered a series of repeaters, and verified the design to ensure support for wireless coverage in an additional nine stations located along Line 3. Phase Three of the project, completed in 2008, involved the delivery of repeater units to seven stations in Line 5, as well as the commissioning and optimization of the system by Powerwave. By November 2009, Powerwave had delivered wireless coverage hardware to an additional five railway stations located along the Barcelona Metro’s Line 1.



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“We are pleased to participate in bringing wireless voice and data services to the Barcelona Metro as part of this historic, ground-breaking project,” said David N. Bacino, vice president, Sales – Global Wireless Solutions, Powerwave Technologies, Inc. “Together with the customer, Powerwave designed the multi-band, multi-operator in-building DAS using our innovative, repeater-based distributed antenna system technology, which expands the reach of the wireless base stations placed throughout the railway system, while delivering a high quality of service, low operating costs and a reduced environmental impact.”

In designing, commissioning and optimizing the in-building DAS for the Barcelona Metro, Powerwave faced several challenges. Because the Barcelona Metro wireless coverage system is based on a series of antennas that support multiple commercial wireless services, the design plan had to be very detailed and accurate, as even the slightest mistakes in the planning phase could cause serious signal degradation. Additionally, the installation of the coverage system in the rapid transit tunnels, underground stations and station passageways presented its own challenges including limited work hours and strict safety regulations.

### Arriving at Wireless Access

Powerwave’s wireless coverage system currently provides customers of the Barcelona Metro with access to GSM900, GSM1800 and UMTS2100 wireless voice and data services, and offers a migration path to future technologies, services and carriers.

Consisting of a series of indoor antennas and repeaters with hubs discretely located throughout the underground railway system’s communications closets, Powerwave’s wireless coverage system also leverages other components residing outside of public view, including a fiber optic conversion module located within the centralized base station units.

Leveraging a common fiber-optic and coaxial backbone among operators, the system is highly efficient and provides substantial cost savings over competitive solutions due to fewer initial infrastructure requirements and maintenance routines, shorter installation times, and more streamlined technology upgrades.

In addition to the Barcelona Metro, Powerwave has expertise in creating in-building DAS systems for airports and other rail transportation venues such as the Chicago Transit Authority (CTA), São Paulo Metro and Rio Metro.

### About Powerwave Technologies

A global leader in end-to-end wireless coverage and capacity solutions, Powerwave Technologies, Inc. offers cutting edge wireless infrastructure to address the demands of enterprise and commercial customers. Powerwave offers a comprehensive suite of solutions, including Antennas, Base Station Solutions and Coverage Solutions. Powerwave’s product line supports all wireless network protocols and frequencies including Next Generation Networks in 4G technology such as WiMAX and LTE. Powerwave solutions, products and services also help wireless operators and OEMs reduce capital and operating expenses, speed rollout of services, improve coverage and capacity, and reduce environmental impact. For more information, visit us at [www.powerwave.com](http://www.powerwave.com).



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