

# MULTIBAND ANTENNA SOLUTIONS FOR RELIABLE PUBLIC TRANSPORTATION COMMUNICATIONS



## Wireless Networking: Driving Mass Transit Communications into the 21st Century

Today, public transportation agencies face a unique set of challenges. They are being asked to do more: serve a growing ridership, improve system-wide efficiency and safety, and reduce operating costs – with increasingly limited resources.

A reliable wireless network that supports data, voice, and video offers an effective solution. Rugged, multiband antennas are critical components in this network architecture. The latest antenna technology is designed to greatly increase the volume and speed at which data is transferred while also improving connections to central, mesh, and GPS/GNSS networks.

For example, multiband antennas – which provide connection to a range of frequencies including 4G LTE, Wi-Fi, UHF, and the 900 MHz spectrum – increase the network's available bandwidth. And MIMO multiband antennas multiply transmitted RF signals to maximize the volume of data that can be sent and received at one time.

Equipped with these high-speed wireless connections, public transportation agencies are better prepared to meet the challenges they face. On the operational side, wireless networks support more accurate GPS and AVL mapping; advanced vehicle telemetry and asset management; cutting-edge warning, alert, and IP surveillance systems; and faster, real-time data sharing, through on-board video, vehicle-to-vehicle voice, and on-board Wi-Fi. Passengers, too, benefit from high-speed wireless in the way of more reliable on-board connectivity and expanded services.

## Reliable Wireless to Respond to Ridership Growth

Public transportation ridership is booming globally. Since 1995, public transit ridership has grown by nearly 40 percent in the U.S., according to the American Public Transportation Association.<sup>1</sup> Americans took 10.8 billion trips in 2014, the highest total in nearly 60 years. In the European Union, ridership is at its highest levels since 2000.<sup>2</sup>

For public transportation authorities, access to real-time data is critical for addressing congestion, delivering new services to sustain future demand, and increasing reliability and routing tools to serve new customers. High-quality multiband antenna solutions that increase data transfer speed and bandwidth capacity facilitate more reliable, real-time data analysis, helping agencies to address these unique challenges:

**Improved Services:** Today's transit passengers demand connectivity and fast, reliable access to information. Wireless networking – both on-board and in-station – is critical for delivering these connected rider experiences. Transit vehicles fitted with powerful multiband antennas that support voice, data, and video connectivity deliver reliable on-board Wi-Fi and mobile services. In addition, these high-bandwidth connections allow information to be shared with passengers via on-board messaging systems like digital signage and audio alerts.



APPLICATION  
**NOTE**

**Faster Data Sharing:** The volume of data that transit agencies process is rapidly expanding. Real-time video surveillance, GPS data, passenger counts, fare tracking, and ticketing data are all being logged on-board, and agencies must have a solution for sharing this data in real-time. **Multiband 4G LTE antennas** address this issue. 4G networks deliver the best mobile data transfer speeds, up to 10 times that of 3G networks. When MIMO technology is added to the equation, data transfer speed increases further. MIMO antennas enable multiple 4G signals to be sent simultaneously without requiring additional bandwidth. MIMO antennas, in turn, greatly improve link capacity and transfer speeds. As transit agencies require greater volumes of data to be shared in real-time, 4G LTE MIMO antennas provide an effective solution.

**Enhanced Security:** Modern security features like real-time surveillance, passenger alert systems, emergency response, and public safety interoperability are necessary to enhance system-wide safety protocols. Often, though, transit agencies deliver these solutions through multiple single-purpose systems, like a stand-alone antenna for UHF radio and another for mobile connectivity. Multiband antennas, though, merge single-purpose systems onto one platform, allowing users to connect to a range of frequencies. This functionality quickly improves interoperability between agencies, which is critical for effective emergency response. Additionally, legacy communications systems rely on SISO – or single-input single-output – technology, meaning the antennas sends a single signal. This limits data transfer capacity and speeds, which could impact real-time video

surveillance and passenger alert systems. MIMO antennas, though, multiply the signals that are sent and received, allowing more reliable connectivity and faster data rates for more effective video transfer and passenger alert notifications.

Multiband antennas and wireless networking help address the challenges posed by a growing rider base. But this growth is driving another issue for public transportation agencies. Fleets around the world are being pushed to the limits; vehicles must stay in operation longer and accommodate more passengers, all while staying in efficient and reliable operating condition. Fortunately, many of the same antenna technologies used to address a ridership growth can be utilized in intelligent fleet management systems.

## Connectivity to Optimize Asset Management and Improve Efficiency

Across the U.S., public transportation fleets are in a state of decline. The U.S. Department of Transportation estimates American mass transit providers have a combined \$86 billion maintenance backlog.<sup>3</sup> In spite of aging assets, agencies are being pushed to adopt green fleet mandates like reduced emissions and optimized fuel consumption.

To meet these demands, agencies are turning to connected solutions that provide real-time vehicle and operational data. Reliable wireless solutions are critical for delivering this data, and often, agencies must update existing network



**PCTEL's SkyLink™ GNSS Multiband Antenna Platform**

infrastructure to enable greater bandwidth sharing. Multiband MIMO antennas are one solution, enabling faster, more reliable data transfer. With more robust connections, transit authorities are in a position to deploy:

- **Advanced On-Board Telemetry:** Transportation vehicles are exposed to the elements and experience everyday wear and tear. Real-time vehicle data is critical for delivering a 360-degree view of the fleet. Sensors equipped to vehicles wirelessly transmit a range of data: fuel consumption, idling time, location and speed, status and condition of the vehicle. Remote access to this data enables transit authorities to deliver preventative maintenance and optimize their operations.
- **Connected Asset Management:** Processing and analyzing telemetry data in real-time is at the heart of smart asset management systems. But data can also come from connected systems in the field that enable workers to collect and share data via tablet computers. Analyzing this data in real-time, transit authorities can extend the life of their fleet and move from a mileage-based maintenance program to a use-based program. Additionally, in-depth analysis of data provided by on-board telemetry systems provides the insights needed – i.e., a vehicle is consuming an above-average amount of fuel – to spot maintenance and efficiency issues faster.
- **Asset Tracking:** In urban locations, antennas are at a greater risk for out-of-band interference from nearby radio and satellite systems. High-rejection Global Positioning System (GPS) antennas are designed to minimize radio interference, resulting in maximum signal reliability. Additionally, multiband GNSS antennas that cover multiple satellite signals (GPS L2, Galileo, and Glonass) improve asset tracking by providing precise vehicle monitoring regardless of the satellite signal it utilizes. This minimizes the number of antennas needed on a vehicle.

## Technology and Network Architecture to Facilitate Greater Data Sharing Demands

Designing and deploying wireless networks for transportation agencies poses a unique set of challenges. All components must be rugged and able to withstand extreme weather conditions while providing seamless, reliable coverage for mission-critical performance.

PCTEL develops and manufactures a range of performance-critical wireless networking equipment well-suited for the unique needs of public transit authorities. Our products are built in low-profile, ruggedized housing, ideal for operation in public transit lines with limited overhead. PCTEL products consistently deliver optimal performance.

PCTEL's customers include cellular carriers, public transportation agencies, and radio manufacturers. PCTEL's antennas aligned for use in public transportation include:

- **4G LTE MIMO Antennas**
- **High-Rejection GNSS Antennas**
- **Multiband, Wide-Band Antennas**
- **Wi-Fi MIMO Antennas**

As a leading supplier of antennas for wireless mobile and fixed networks, PCTEL utilizes the latest technologies and engineering design tools to create high-performance products that support mission-critical communications worldwide. For more than 30 years, PCTEL's base station, mobile, and portable antennas and accessories have been used for Public Safety, Emergency Response, and Mass Transit Fleet Management applications.

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## REFERENCES

- 1 American Public Transportation Association. *Record 10.8 Billion Trips Taken On U.S. Public Transportation In 2014*. 9 Mar. 2015.
- 2 International Association of Public Transport. *New Statistics Brief: Public Transport Ridership in EU Highest Since 2000*. 6 Sept. 2015.
- 3 Federal Transit Administration. *National State of Good Repair Assessment 2010*. June 2010.

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