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# Antennas for Positive Train Control (PTC) System

Technology exists to design a system that can start applying a train's brakes should an engineer fail to obey stop signals. Positive Train Control (PTC), a system that monitors railroads through a wireless network, can help prevent train crashes and enhance railroad safety in other ways. Currently used in several pilot programs, PTC systems are required to be implemented under the federal Railroad Safety Improvement Act (RSIA) of 2008. Antennas will be a critical component to the PTC system. With its extensive design and manufacturing capabilities, PCTEL, Inc. is well-positioned to meet the antenna requirements for this market.

Transportation officials look to technology for further gains in railroad safety – a way to correct the human error now responsible for most train crashes. The National Transportation Safety Board has had PTC on its "Most Wanted List" since 1990. Some experts said the technology could have prevented a horrific crash in California in September 2008, for example, when the engineer of a commuter train was reportedly text messaging and failed to yield. The commuter train slammed into a freight train northwest of Los Angeles, killing 25 people and injuring hundreds. RSIA, approved in October, 2008, requires the biggest (Class I) freight companies, inter-city passenger and commuter trains, to implement PTC systems by 2015.

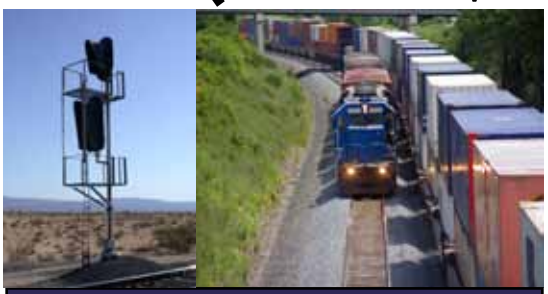
PTC refers to a flexible wireless system of monitoring train data including location, speed, track information and equipment functioning. Information, often gathered with the help of a Global Positioning System (GPS), is used to warn train operators about safety hazards. If necessary, the PTC system can automatically slow or stop trains. With PTC, information is sent from the train to antennas placed trackside where the data is relayed through another wireless system to the dispatch control center. According to the Federal Railroad Administration (FRA), a variety of components ranging from the digital data network to GPS systems, to on-board and dispatch computers and throttle-brake interfaces, are needed.

Railway Office Server

Communications Network

GPS Satellite transmit signals from antenna to the train's location

Control Room and Dispatching System



Specially designed antennas are placed on the locomotive and at regular intervals trackside to provide a continuous wireless data link with the control center

The term “positive train control system” means, per the FRA, a system designed to prevent train-to-train collisions, over-speed derailments and incursions into established work zone limits and the movement of a train through a switch left in the wrong position.

Systems similar to PTC are already in use for controlling air traffic. Nine different railroad companies have PTC pilot programs in the United States, including an Amtrak route between Chicago and Detroit, and a Chicago area Metra commuter line. Implementing the system nationwide in accordance with RSIA will require installing antennas in most railroad systems. Interoperability is also essential to developing a nationwide PTC system in order to allow different railroad companies to communicate and share tracks.

Omnidirectional (left) and offset dipoles (right) serve as data receptors for the dispatch control center

Rugged low profile mobile GPS antennas are required for locomotive placement to support tracking

Several wireless communication links are involved in a typical PTC system. A GPS antenna placed on top of the locomotive receives location information which is passed onto the core PTC module. The core PTC module interfaces with the rest of the control systems in the locomotive. It also collects other pieces of information, such as speed, engine performance, driver awareness, etc., combines it with location information from GPS, and sends it over a wireless communication link through an antenna placed over the roof of the locomotive, to the control center. Specially designed antennas are placed at regular intervals on trackside to provide a continuous wireless data link with the train. Data received by these antennas is then funneled over to the control center, either through a wire-line connection or through a point-to-point wireless backhaul link. Data from the control center is sent back to the train via the same route.

All of these links require high performance and robust antenna systems to enable accurate and timely transmission of appropriate data. Most of the antenna systems in PTC get deployed in harsh environments, particularly those deployed on locomotives which experience heavy vibration and temperature variations. In addition to mechanical robustness, these antennas need to be designed to optimize coverage and minimize interference. GPS antennas deployed on locomotives face significant Radio Frequency (RF) interference from RF noise generated by the locomotive engines and from other data link antennas, particularly those operating in 212 MHz-222 MHz range that has been dedicated for PTC. For the PTC system to work properly, the GPS antennas will be designed with appropriate filtering, and the trackside antennas will incorporate a pattern designed to provide continuous uninterrupted coverage over the tracks.

PCTEL designs and manufactures a number of antenna products that will be required to deploy PTC systems. In particular, it has a wide selection of wideband / multiband transit and base station antennas that can serve the needs of PTC systems. The company has extensive environmental testing capabilities to produce antennas able to withstand extreme weather conditions and high vibration exposure.

Parabolic reflector antenna for backhaul communications

PTC will offer safety improvements at a time when train use and congestion is expected to rise. In addition to helping protect railroad workers and passengers from collisions or derailments, the system is expected to provide more reliable scheduling and increased energy efficiency through maintenance alert features. As railroads work to meet these new federal requirements, PCTEL can provide antennas and other equipment for the potentially life-saving system.

Editorial contributions made by Josh Singer.

**For your PTC antenna application needs, contact PCTEL Sales at antenna.sales@pctel.com.**