

NIST Measures Challenges for Wireless in Factories

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Factories have much to gain from wireless technology, such as robot control, RFID tag monitoring, and local-area network (LAN) communications. Wireless systems can cost less and offer more flexibility than cabled systems. But factories, such as auto production plants, are challenging environments for wireless systems, as verified by tests conducted recently by the National Institute of Standards and Technology (NIST).

Heavy industrial plants can be highly reflective environments, scattering radio waves erratically, and interfering with or blocking wireless transmissions. Electromagnetic interference may hinder the auto industry and other manufacturing sectors in trying to take full advantage of wireless networking.

The NIST tests aim to quantify what has been, until now, a nebulous problem. In a partnership with the U.S. Council for Automotive Research (USCAR), NIST plans to develop a statistical representation of the radio propagation environment of a production floor as a basis for developing standards to pre-qualify wireless devices for factories. NIST researchers conducted the initial tests at an auto assembly plant in August 2006, and completed additional tests this month at an engine plant and a metal stamping plant.

The manufacturing plants that NIST tested were crowded with stationary and mobile metal structures, such as fabrication and testing machinery, platforms, fences, beams, conveyors, mobile forklifts, maintenance

vehicles and automobiles in various stages of production. NIST monitored frequencies below 6 gigahertz (GHz) for 24-hour periods to understand the background ambient radio environment. This spectrum survey showed that interference from heavy equipment (“machine noise”) can impair signals for low-frequency applications such as those used to in some controllers on the production floor.

A detailed analysis of a common wireless LAN frequency band (channels from 2.4 to 2.5 GHz) found heavy, constant traffic by data transmitting nodes, wireless scanners and industrial equipment. And signal-scattering tests showed the potential for high levels of “multipath” interference, where radio signals travel in multiple complicated paths from transmitter to receiver, arriving at slightly different times.

NIST researchers will use these data in studies aimed at pre-qualifying wireless devices for use in industrial environments. In the meantime, NIST researchers have identified a number of steps that can be taken to minimize radio interference on the factory floor, including use of licensed frequency bands where possible, and restrictions on use of personal electronics in high-traffic frequency bands such as 2.4 GHz. Other suggestions include installing absorbing material in key locations, use of wireless systems with high immunity to electromagnetic interference, use of equipment that emits little machine noise, and use of directional antennas to help mitigate multipath interference when transmitter and receiver are close together.

Source: NIST

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