

New Jersey Department of Transportation
Bureau of Research

Technical Brief



Worker Safety Issues of Wi-Fi Devices

The application of Wi-Fi wireless devices for the transmission and reception of electromagnetic (E&M) energy is rapidly expanding. Radio Frequency Electromagnetic Field (RF-EMF) exposure occurs from the use of these devices. The New Jersey Department of Transportation (NJDOT) uses these devices to collect data for travel times on the State's roadways. The research documented in this report answers questions related to the use and repair of these transmitters: (1) What are the RF-exposure health risks to the employee? (2) What steps can be taken to mitigate any risks from RF transmission sources? This research also considers the risk from cell telephone radiators and other equipment now in production. In all cases the levels measured were well below the safe exposure levels established in the United States of America.

Background



The effect on health of non-ionizing radiation from E&M sources has been a public concern for more than 20 years. As a result of new protocols such as Bluetooth, Bluetooth Low Energy (BLE), cellular Long-Term Evolution (LTE), and new Wi-Fi standards, there has been a proliferation of wireless-based sensors, which transmit E&M energy. These sensors have significantly added to the existing radiated Radio Frequency (RF) spectrum, and increased RF E&M field exposure. The NJDOT uses these devices to collect data on the State roadway system to transmit accurate information to the motoring public. During the repair of these sensors, concerns have been raised as to the safety of NJDOT employees in the presence of this increased radiation,

and what actions if any are needed to eliminate possible risk. New research beyond that existing for second generation cellular equipment related to Bluetooth, Bluetooth LE, and new WiFi standards now in production was needed.

Research Objectives and Approach

The objectives of this study were to a) evaluate NJDOT's wireless devices to identify existing and planned E&M sources – accomplished by study of NJDOT records; b) measure E&M power density to which NJDOT employees are exposed - accomplished by direct measurements in the field at selected NJDOT locations; c) map E&M levels by frequency and amplitude, to risk as defined by the standards – the results of the literature search were compared to the measured



results and documented; d) recommend maximum exposure levels – these were based on IEEE standards; e) determine existing wireless hardware that exceeds standards and, if required develop a remediation plan – no equipment was found that exceed standards, however a program for E&M safety was implemented; f) provide specifications to assure new equipment does not exceed standards – based on analysis, recommendations were made; g) develop a systematic plan for periodic monitoring of E&M strength to insure standards are met – recommendations were made and a training program implemented.

Findings and Achievements

In no case was a radiation level measured that exceeded the safe level as documented in IEEE/ANSI C-95 standard, which sets the RF exposure standards for OSHA, NIOSH, ICNIRP and the DOD [10 mW/cm²]. In fact, no level was measured that came close to unsafe with a peak measurement of 0.18 mW/cm². E&M Sources were investigated for Wi-Fi (802.11a, 802.11b, 802.11n Standards), Bluetooth and BLE, and Cellular for both US and European Standards (including LTE). Measurements were made at 17 sites. All known Standards were considered in the analysis. The final level was based accepted Standards supported by a 124 reference literature search. It was recommended that all sensors with embedded interface electronics comply with FCC Part 15 regulations. (Some NJDOT wireless sensors were found not to comply with this requirement). When purchasing new equipment, the equipment should be reviewed to insure it has passed the FCC Part 15 certification. No periodic monitoring of E&M devices was recommended based on the low level of RF emissions observed. There is no reason to expect levels to increase with time. However, recommendations were made and a plan presented. The standard is for extended exposure over time. For repair and maintenance, the exposure should normally be over a limited time period, and thus further insures the conservativeness of the level recommended.

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A final report is available online at <http://www.state.nj.us/transportation/refdata/research/> .
If you would like a copy of the full report, send an e-mail to: Research.Bureau@dot.state.nj.us
and ask for:

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