

# DHS Science and Technology Directorate

## Standardized Tests for Personal Alert Safety Systems

Unique test methods allow consistent evaluation of diverse, RF-based emergency beacons used by firefighters

### A new type of emergency beacon for firefighters

When firefighters need rescue due to a medical or other emergency, fire department protocols and technologies help get them out, quickly and alive. The Personal Alert Safety System (PASS) is a wearable technology used to send an alert should a firefighter be incapacitated. In traditional PASS, if a firefighter is motionless for 30 seconds, a personal audible alarm alerts nearby firefighters. Some manufacturers now also include wireless transceivers in PASS units.

Radio-frequency-based (RF) PASS units extend the reach of wearable beacons beyond the immediate area to a fire truck or incident command station. They also let incident commanders send an “evacuate” command to all firefighters in a structure, in case of imminent danger.

Improvements to PASS gear increase firefighter safety. However, until recently, there were no standardized test procedures to verify the performance of RF-based PASS.

### Standardized testing levels the playing field

Since 2008, Department of Homeland Security-funded researchers from the National Institute of Standards and Technology (NIST) have supported development of standard test methods for RF-based PASS systems. As a result of this work, five new test methods have been submitted for the NFPA 1982 standard to assess performance of RF PASS under representative environmental conditions.

### Developing tests requires data

NIST researchers performed several field tests to characterize RF propagation channels in representative firefighting conditions where RF-based PASS communication was expected to be poor (e.g., point-to-point signal penetration into and out of medium-sized and large structures).

Researchers conducted side-by-side tests of the RF channel and of RF PASS, to determine parameters and metrics for laboratory-based tests.

With that data in hand, the researchers began to develop laboratory-based test methods, to produce a compact and repeatable test environment. The methods developed allow the RF PASS system to operate in its “native” state, with the portable unit transmitting to the base station in the same over-the-air configuration used in the field.



Testing replicates the path loss associated with a high-rise building using repeatable, lab-based test procedures.



### Testing wireless devices with various form factors in a range of operating conditions

The new, over-the-air tests effectively bring the complex wireless environment of the field into the laboratory so that system performance can be tested in a controlled and repeatable manner. Designed to allow testing of any shape or size of RF PASS, this same test configuration could be used to verify many types of wireless equipment.

### Partner/Customers

- National Fire Protection Association (NFPA)
- First responder teams in cities across the United States

### NIST Technical Notes

- “Measurements to Support Public Safety Communications: Attenuation and Variability of 750 MHz Radio Wave Signals in Four Large Building Structures,” NIST Technical Note 1552, August 2009.
- “Measurements and Models for the Wireless Channel in a Ground-Based Urban Setting in Two Public Safety Frequency Bands,” NIST Technical Note 1557, January 2011.
- “Propagation Environments to Support Standards Development for RF-Based Electronic Safety Equipment,” NIST Technical Note 1559, December 2011.
- “Performance Analysis of RF-Based Electronic Safety Equipment in a Subway Station and the Empire State Building,” NIST Technical Note 1792, March 2013.
- “Development of Laboratory Test Methods for RF-Based Electronic Safety Equipment: Guide to the National Fire Protection Association 1982 Standard,” NIST Technical Note 1937, November 2016.



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To learn more about RF-based emergency equipment test methods, see <http://nist-takingmeasure.blogs.govdelivery.com/smoke-signals-ensuring-clarity-emergency-communications/> or contact Office of Standards Director Philip Mattson at [standards@hq.dhs.gov](mailto:standards@hq.dhs.gov).