Smartrac's New Passive Sensor DogBone Transmits Moisture Levels

The company has begun shipping the UHF tag to systems integrators to begin proof-of-concepts and the development of applications in the manufacturing, health-care and agriculture sectors.

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Feb 20, 2015—Smartrac has released a moisture-sensing passive ultrahigh-frequency (UHF) RFID tag known as the Sensor DogBone that is intended to launch innovation in moisture sensing. The company began shipping the tag, which complies with the EPC Gen 2 standard, to customers this month, and expects most buyers to be systems integrators developing solutions for industrial environments. The tag is the first in a line of Smartrac sensing passive UHF RFID tags intended to provide sensor-based data, eliminating the need for sensors that require batteries or a wired power source.

Unlike other Smartrac tags, which are made with a passive UHF RFID chip provided by NXP Semiconductors or Impinj, the Sensor DogBone is made with a Magnus S Sensor chip supplied by Smartrac partner RFMicron.

The Sensor DogBone tag is made with RFMicron's Magnus S Sensor, a moisture-sensing passive UHF RFID chip

The IC, which harvests energy from UHF reader transmissions received by the tag's antenna, comes with a self-tuning circuit that keeps the tag tuned under conditions in which the antenna's changing impedance (resistance to current) would reduce or eliminate the ability to transmit a response to a reader. The IC transmits a value indicating the exact amount of correction (identified in a series of what the company calls "steps") that the IC made to match itself to the changed impedance. (The measurement's granularity is still being tested against the read range.) Since a tag antenna's impedance fluctuates according to the amount of moisture in its vicinity, this correction value can thus be used to calculate the humidity or moisture level.

To read the correction value and convert it into a humidity measurement, users would install an application (supplied by RFMicron or Smartrac) to the handheld reader. The measurement range can be set or adjusted according to a particular user's needs. However, a general-purpose version of the tag can sense a complete range from 0 to 100 percent. The sensitivity range would adjust according to how a system is designed for a specific use case or user. For instance, a shorter read range could result in a more precise humidity reading.

In April 2014, Smartrac first announced its plans to develop a line of EPC Gen 2 passive UHF inlays made with RFMicron chips and containing antennas that act as sensors able to detect humidity, pressure and other conditions (see Smartrac Group an RFMicron to Develop Passive Sensor Tags). Samuli Strömberg, Smartrac's global development VP for the industrial segment, says the tag was developed for end users that need sensor-based data but cannot easily deploy an active sensor system that would require wiring or batteries.

Smartrac has been piloting prototypes of the moisture-sensing Sensor DogBone tags with a handful of end users in North America and Europe throughout the past year, Strömberg says. Those pilots, conducted in manufacturing and health-care environments, found that in some cases, customization of a sensor tag was necessary. In other scenarios, however, a universal tag would work, and that led the company to release the Sensor DogBone this month. The Sensor DogBone is designed to be that universal tag, to allow systems integrators to begin developing solutions, conducting proof-of-concepts and pilots, and then modifying or customizing the tags, if necessary, for a specific use case. Such modification could be carried out collaboratively between the integrator and Smartrac.

"We have a product that we feel can be used in many different use cases," Strömberg says. For instance, a tag could be placed

inside a container at the end of an assembly line to automate the testing of whether that container is watertight. A UHF RFID reader could interrogate the tag inside that container, and the tag would use the device's power to send a response that would indicate the presence of moisture if the antenna has experienced a change in impedance.

Although Strömberg declines to provide names or specific descriptions of the pilots underway during the past year, he says several of the pilots were testing the tag for measuring moisture presence in containers. At least one pilot participant was also in the health-care market, though he says he cannot describe how that firm is testing the Sensor DogBone.

Strömberg envisions the tags being used in a variety of other ways as well. The Sensor DogBone can identify moisture presence in a material, such as wet soil or concrete, and future versions of the tag are expected to be able to sense moisture in ambient air. For that reason, the tag could inform users, via an RFID reader, regarding the moisture level in a room or cooler, as well as in construction materials for which moisture must remain at a very specific level. It could also be used in the agriculture industry, to measure moisture levels in soil.

The tag is designed to work with a variety of low- or high-dielectric materials, including wood, cardboard, plastic, stone or construction materials.

Just like Smartrac's standard (non-sensing) DogBone tags, the Sensor DogBone's die-cut size is 97 millimeters by 27 millimeters (3.8 inches by 1.1 inches) and its antenna measures 88 millimeters by 24 millimeters (3.5 inches by 0.9 inch), though the antenna shape is more complex than that of Smartrac's non-sensor DogBone tags. The Sensor DogBone, which ranges from 200 to 300 microns (0.008 to 0.01 inch) in thickness, comes with 64 bits of tag ID (TID) memory, 128 bits of Electronic Product Code (EPC) memory and 144 bits of user memory. Strömberg says the read range is similar to that of a standard UHF DogBone tag.

Because the tag requires a reader to transmit sensor data, it cannot behave as a data logger, and users would thus need to capture periodic reads if they wanted to collect a history of measurements. However, he says, this process would work well for those who wanted to store information on a cloud-based server, since a reader could automatically forward sensor measurements to a server each time a tag was read, thereby creating an electronic record. Because the Sensor DogBone is totally passive, he adds, the company has enabled the tag to be embedded, for example, within a building's structural material—an application that would be impractical for a sensor with batteries that had to be replaced.

Smartrac expects systems integrators to develop solutions for the tag that the technology developers had not even considered. "Time will tell where this goes," Strömberg says, "but it's going to be an interesting ride" as developers create solutions using the tag. Traditionally, he notes, in developing the best RFID tag in terms of transmission reliability and range, Smartrac focused on tuning an antenna according to the materials that the company expects will be in the tag's vicinity. Now, the firm is taking a new approach by using an IC that tunes itself based on the antenna's impedance. "We are climbing our own learning curve now as we have added this new dimension."

According to Strömberg, the Sensor DogBone tag costs about 50 cents apiece.