Europe Needs New RFID Regulations

Global companies are moving rapidly to adopt RFID systems that operate in the UHF spectrum. But the dream of a single worldwide standard can be realized only if countries around the world allocate a suitable part of the radio spectrum for UHF systems. The problem is Europe hasn’t done this, and while

changes proposed by the European Telecommunications Standards Institute (ETSI) will improve the situation, they won't enable European companies to use UHF systems for supply chain management.

In the United States, the Federal Communications Commission (FCC) allows U.S. companies to deploy RFID readers that emit 4 watts effective isotropic radiated power in the Industrial, Scientific, and Medical (ISM) band from 902 to 928 MHz. This is ample, both in terms of power and bandwidth.

In Europe, ETSI allows only half a watt of effective radiated power (ERP) in a narrow 250 kHz band from 869.4 MHz to 869.65 MHz. This allocation is for nonspecific short-range devices, which can be on only 10 percent of the time (this is called their duty cycle).

New Regulations

Companies and organizations, such as UCC-EAN, lobbied ETSI to change the rules because the restrictions do not provide for the same read range that is achievable under U.S. regulations. ETSI responded with a proposed set of new regulations, which say:

1. Companies can use readers that emit 2 watts of ERP between 865.6 MHz and 867.6 MHz. The band is divided into 10 channels

of 200 kHz. Readers would have to listen for other transmitters using the same channel before trying to communicate with tags. (This is called listen before talk, or LBT.) The regulations set the LBT sensitivity at -96 decibels. If another transmitter is detected, the reader has to try another channel until it finds a free channel. This is called Adaptive Frequency Agility (AFA).

2. Companies can use readers that emit half a watt of ERP between 867.6 MHz and 868 MHz. The band is divided into two channels of 200 kHz. The LBT sensitivity would be -90 decibels.

3. Companies can use readers that emit a tenth of a watt of ERP between 865.0 MHz and 865.6 MHz. The band is divided into 3 channels of 200 kHz channels. The LBT sensitivity would be -83 decibels.

In order to ensure equitable access to the spectrum, AFA with LBT would be mandatory. Readers with LBT would be allowed to emit energy for a maximum period of 4 seconds at a time and would be required to be off for at least 0.1 second. Readers without LBT are limited to a 0.1 percent duty cycle. The new proposed regulations leave the current allocation at 869.4 MHz to 869.65 MHz intact for nonspecified short-range devices, but it’s not clear whether existing and/or future RFID applications will still be allowed to use this band.

The new proposal is based on the findings of Electronic Communication Commission (ECC) Report 37, which is based on a study of the whole short-range device band from 863 MHz to 870 MHz. The study analyzes the compatibility between existing and proposed new systems and calculates interference probabilities between the different systems that make use of this band. What’s critical are the assumptions made about interference probabilities between UHF RFID systems themselves and the probability of UHF RFID systems interfering with the other users of this spectrum.

The report is very thorough and comprehensive, but the assumptions made for UHF RFID are outdated and extremely conservative. One assumption is that UHF RFID readers will interfere with each other and that only one RFID reader can be operated in one channel at a time. This is true of some UHF RFID systems in use today, but newer systems, some of which are currently being deployed widely, can have several readers operating simultaneously at the same frequency.

Other assumptions are that tag prices will reach €1.00 by 2010, reader prices will reach €1,000.00 by 2010, and that Europe will account for a quarter of the estimated €3,400 million global RFID market. Factoring in the total area and estimated urban area of Europe, as well as reader/tag ratios, these numbers result in an overall reader density figure of 0.9 readers per square kilometer and an average hot-spot reader density estimate of 25 readers per square kilometer. But reader and tag prices are already below the figures used, and the prices are likely to be significantly less than 10 percent of the estimates for 2010 by that time.

A duty cycle of 0.1 percent and 70 channels were used when calculating interference probabilities. In practice, users will probably need to keep readers on nearly all the time (a 100 percent duty cycle), and the current channel allocation is only 15 .

The report comes to the conclusion that interference levels will be acceptable in Europe if readers use AFA/LBT or a 0.1 percent duty cycle. ETSI is proposing that that LBT be made mandatory and that a reader must move to the next available channel when detecting a transmission in the current channel.

Implications

At an LBT level of –96 decibels, a 2-watt reader will detect another 2-watt reader (worst case) at a range of nearly 200

km. The AFA/LBT requirements of the current proposals will therefore make it very unlikely that two readers will be able to share a channel in one facility or even in one industrial area. Given the availability of just ten 2-att ERP channels, the regulations could limit the number of readers in a given area to a level that would make it impossible to use a UHF RFID system to track goods in a high-throughput distribution center.

Even the figure of 0.9 reader per square kilometer that is used in ECC Report 37 is still several orders of magnitude lower than what will surely be required by industry. Large distribution centers might need to run as many as 250 readers with a 100 percent duty cycle simultaneously at one site. With several distribution centers in one industrial neighborhood, the reader density at hot spots could easily exceed 1,000 readers per square kilometer.

In addition, the proposed requirement that the reader be off for 100 milliseconds could mean that 10 items will be missed when items pass a reader at a rate of 100 items per second. This would be totally unacceptable in an industry that requires an accuracy of 99.9 percent or better.

What to do

The current proposals will severely limit the rollout of UHF RFID in Europe and put European companies at a serious disadvantage compared with U.S. companies in terms of supply chain management productivity. Here are some suggestions for correcting the situation:

1. ETSI should review the proposed European spectrum allocation for UHF RFID.

2. The study that led to ECC Report 37 should be repeated with updated assumptions for reader densities and should include

the possibility of allowing multiple UHF RFID readers in one channel.

3. The current proposals should be adapted to allow narrow-band UHF RFID readers to operate at 866.6 MHz without LBT and with a 100 percent duty cycle.

4. Passive and semi-active UHF RFID tags employing back-scatter for communications should be considered to be wide-band, low-power, low-duty cycle devices for which no compliance testing is necessary.

5. UHF RFID reader compliance testing should simulate practical RFID environments—i.e., reader emissions should be characterized with a continuous stream of tags (100 tags per second) with uncorrelated ID numbers, with the reader achieving better than 95 percent singulation success.

Failure by ETSI to act will not only harm European companies; it will needlessly slow the adoption of RFID systems, which could improve supply chain efficiencies, reduce waste and lower the cost of goods for consumers.

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