

Gen 2

There's Standard, and Then There's Excellence

by John Burnell

The EPCglobal UHF Generation 2 RFID protocol is now a standard. Leading organizations have committed to the technology, and very soon new standardized and innovative Gen 2 products will reach the market. It is important to understand Gen 2 is a starting point and is not the end of RFID supply chain innovation. Potential users may be surprised to learn there will be significant disparities in performance and capability among Gen 2-compliant products.

Gen 2 creates a foundation on which to build interoperable RFID products and systems that will improve inventory management, logistics and retail operations around the world. However, standard-based products may not provide standard performance. Wireless LAN technology users know this well. There are enormous differences in features and performance among the hundreds of products that comply with the IEEE 802.11b wireless networking standard. Some products are intended for families to use in the home, while others are engineered to support simultaneous transmissions from dozens of warehouse workers who complete thousands of transactions per day. Security ranges from practically none to encryption strong enough to protect government secrets. There also are major differences in the time and effort required to set up, configure and maintain 802.11b-standard equipment.

Gen 2 RFID technology will follow a similar development path. The standard specifies basic RFID communications performance required for common supply-chain business processes. There are six key user requirements for Gen 2 performance: speed, efficiency, reliability, range, security and cost. Gen 2-standard products satisfy these needs. However, although companies may have similar information requirements and may have comparable business practices, usage environments are anything but standardized or homogeneous. Gen 2 or any RFID technology won't provide exactly the same performance at any two facilities. That is why it is important to understand the difference between what Gen 2 specifies and the range of performance that compliant Gen 2 products could provide in real-world use.

Many organizations know they need Gen 2. But how can they know they will get what they need out of it? By understanding the Gen 2 performance specifications and how different features will impact real-world performance, users can specify Gen 2 systems that provide the functionality and benefits they need.

Speed

There is no firm or minimum speed specification within the Gen 2 standard, because reading speed depends on many variables, including power output, tag density and the RF environment. Gen 2 technical specs should enable readers to perform up to 1,500 tag readings per second in North America, and 600 reads per second in Europe, where RF power, bandwidth and duty cycle are more restricted. These speeds support the ability to identify objects on conveyor belts moving 650 feet per second, and those being carried by forklifts that pass through reader portals at eight miles per hour.

Users need to be assured that all tags will be identified as they pass through the read field; it is more important for reads to be correct than to be fast. Reliable systems make efficient use of their speed and identification protocols to constantly monitor the read field to ensure that tags that enter late are still identified. This functionality, which is not referenced in the Gen 2 spec, is called persistence.

Bandwidth efficiency

The Gen 2 standard defines three modes of Gen 2 product operation—single reader, multi-reader and dense reader. Specifications for readers operating in each of these environments are intended to provide improved performance. EPC Gen 2 tags are not made specifically for different reader modes and can be read and written to by products from each category.

Dense reader mode is the safest choice for implementing EPC equipment. It provides the most focused and efficient use of bandwidth, which optimizes performance and protects against interference. Single reader operation is like blasting music from a boom box—it's acceptable if you're by yourself, but not if you're on a crowded airplane.

Gen 2 technology customers need to be aware of the modes and their differences and plan accordingly, especially when considering system upgrades. Single-reader mode products are the easiest to design and cheapest to produce. Legacy RFID equipment that is said to be software upgradeable to comply with the Gen 2 standard may only be upgradeable to single reader operation. There are limited opportunities to use single reader model products in real-

world environments, so it is important for customers to specify dense reader capability where it is called for, keeping potential future system expansion in mind.

Reliability

The Gen 2 standard includes several improvements over Generation 1 specifications to eliminate false positive tag readings and make reading performance more reliable. There also are ways to implement the standard within compliant equipment to further improve data integrity. Not all compliant devices will verify that data is written and encoded properly. Insist on products that can verify the integrity of data written to tags.

Device reliability can take on added importance in RFID systems, because they tend to feature more unattended operations. A worker with a handheld bar code reader can keep trying to scan a symbol until he or she gets a confirmation beep. Users can also call attention to equipment that may need service or fails altogether. These safeguards aren't available for unattended RFID conveyor, portal and similar systems. Remote monitoring, diagnostic and notification capabilities should be built into the equipment itself so the system can provide the performance, uptime and reliability RFID operations require.

Range

Companies at one point in the supply chain may need only to capture pallet tag information from a few feet away with handheld readers before shipping pallets to a customer. At the next stop, tagged cases might be stacked high on warehouse shelves where much longer read range is required. The Gen 2 specifications enable range to satisfy user-defined supply chain application requirements.

The country in which Gen 2 equipment is used can have a significant impact on range. Power regulations are different around the world. Because of these differences, users can expect more range from Gen 2 systems in North America than some other regions. Therefore it is important to test and evaluate equipment for all the locations and environments in which it will be used.

Manufacturers can take advantage of flexibility within Gen 2 specifications to improve reader range. Gen 2 allows, but does not require, spread spectrum radio transmission. Spread spectrum technology broadcasts over multiple channels, which makes efficient use of bandwidth and provides improved range over other transmission techniques. Under FCC rules, spread spectrum communication also enables

What is Gen 2?

“Gen 2” refers to the Generation 2 RFID standard from EPCglobal. The standard provides specifications so manufacturers can produce RFID chips and readers that can be used anywhere in the world and will be interoperable among vendors. The standard was created to facilitate the use of Electronic Product Code™ (EPC) numbers, which uniquely identify objects, such as pallets, cases or individual products.

Gen 2 and other EPC standards are administered by EPCglobal, which is a subsidiary of GS1, the same not-for-profit organization that issues UPC numbers and manages the EAN.UCC system. For more information, visit www.epcglobalinc.org.

CHECKLIST FOR USER REQUIREMENTS FOR GEN 2 FUNCTIONALITY	Product A	Product B	Product C
Can the product perform in dense reader mode?			
Expected cost to upgrade to dense reader mode?			
Is persistence provided?			
Is group select supported?			
Is continuous operating mode available?			
Is write verification performed?			
Can data be write-protected?			
Is password protection available?			
Is remote management and configuration possible?			

continuous operation and higher power output. Alternative communication methods may use a shorter duty cycle and operate with less power, which can result in slower performance and reduced range.

Security

Standard Gen 2 EPC tags are protected against tampering. Disabling (“killing”) tags in the field so their data can never again be accessed is a requirement in the retail and consumer goods industries to allay customer privacy concerns, so the standard supports this ability as well. It also has authentication requirements to prevent unauthorized and accidental disablement of tags. Additional security needs arise depending on how tags are used, requiring features beyond what’s needed to read standard tags.

There are multiple ways to implement additional security, which will create differentiation among Gen 2–compliant products. “Cloaking” enables tags to be set so that readers must provide a password before the tag will respond with any communication. Passwords may also be required to write to tags or disable them.

Cost

A leading motivation for development of the EPC system was to create RFID technology that was cost-effective for use in supply chain operations. Gen 2 strikes a balance between cost and functionality that should lead to the development of cost-effective products that satisfy real-world application

requirements. Gen 2 represents the first EPC technology that all the leading silicon suppliers, including Impinj, Philips, Texas Instruments and others, have committed to producing. Manufacturers of antennas, read/write equipment, printer/encoders and industrial computers also strongly support the Gen 2 standard in their product lines. Many middleware and software applications are being developed to support Gen 2 data structures. As a result, Gen 2 is expected to become the most competitive product segment within the RFID industry, giving users more product choices and benefits of competition than they have ever enjoyed before.

Product selection tips

Some Gen 2 features are optional and not all products will support them. The checklist above shows some of the many ways EPC Gen 2–compliant products can differ from one another and provides a handy reference to help ensure the Gen 2 products you select will meet your performance requirements.

By understanding the disparities in performance, reliability and ease of use that different standard-compliant products will produce, Gen 2 users can make the best decisions about the products that will form the foundation of their applications. The most important thing to remember about EPC Gen 2 technology is that “standard” does not mean “equal.” ■

John Burnell can be reached at john@burnell.com.