The latest generation of RFID components from Siemens, the SIMATIC RF660 Portal Readers, now also support the GEN-2 EPC standard. EPC stands for Electronic Product Code — but what does it actually mean?

EPC is synonymous with a new level of development in the field of RFID systems: spectacularly inexpensive tags (price < 0.15 EUR for large quantities), excellent performance data and worldwide standardization of the protocols and applications are enabling new applications for RFID in intralogistics, supply chain management and trade. The Electronic Product Code (EPC) itself is only one part among a large number of activities and technologies.

EPC is the brainchild of EPCglobal, located in the U.S. EPCglobal mainly consists of a series of bodies which promote and lend impetus to the development and standardization of all the technologies needed for RFID in logistics and trade. All well-known manufacturers of RFID systems, including the large software companies, and many RFID users (e.g. METRO or Walmart), are members of EPCglobal. Apart from technical standardization, there are so-called “Business Action Groups”, which deal with the use of EPC in different branches of industry.

EPCglobal is sponsored by GS1 International and its national off-shoots. The main task of GS1 is the administration and allocation of internationally used numbering systems such as the European Article Number (EAN). Companies which want to introduce such numbering systems must obtain a license from GS1 for a specific range of numbers. GS1 also participates in projects for the further integration (of data) in trade, e.g. through the ECR Initiative. The ranges of EPC numbers are allocated by GS1.

For manufacturers of RFID systems, the radio standards of EPCglobal are extremely important. In this context, a series of RFID technologies are defined which were once based on proposals by members but are now being developed by EPCglobal’s own special action groups. EPC divides the tag specifications and the standards for the air interface into different classes:

- CLASS 0: passive, read-only tags (programming is carried out by the semiconductor manufacturer)
- CLASS 1: passive tags which can only be written once
- CLASS 1 GENERATION 2: passive tag which can be written several times
- CLASS 2...4: other definitions for semiactive and active systems

Tags of CLASS 1 GENERATION 2 (usually abbreviated to GEN-2) are the most important data carriers. This standard has contributed to a considerable increase in the recognition rate and reading speed. In addition, the multi-tag reading capability (several tags are in the field at the same time) has been improved and can cope with over 100 tags simultaneously.

In the past, EPCglobal had only used the UHF band but this band cannot be used worldwide on a uniform frequency. The UHF frequencies are also used for cell phone, military and civil radio applications as well as for short range devices (e.g. baby-phones). Therefore, there are considerable differences in regional and national implementation.

Fig. 1: GEN-2 inlay from Texas Instruments. This inlay is attached to the paper label to form the RFID label i.e. the tag.
The current GEN-2 tags can be used in all internationally released frequencies. Therefore, there are no longer any reasons why it should not be introduced in international logistic chains. Readers and antennas, however, must still comply with national regulations.

Adherence to the standards is an important prerequisite for the creation of inter-company logistics systems which are currently being planned in business today. For this reason, EPCGlobal maintains its own certification and accreditation offices, where RFID system components (i.e. tags and readers) are certified independently according to EPC standards. These test series include e.g. the "hardware compliance test", in which RFID readers are examined. In addition, EPCglobal issues accreditation to test laboratories which, for example, investigate the way in which tags work and their optimum positioning on the case or pallet ("sweet spot"). In Germany, EECC is the first laboratory which has received an EPCglobal accreditation.

Another element is the EPC itself, i.e. the Electronic Product Code. This EPC is part of the data format on the chip of the RFID tag. The EPC is mainly designed for storing manufacturer and product IDs as well as a serial number. In this combination, the EPC is interpreted as a serial global trade item number (SGTIN, corresponds to the European EAN + serial number).

**Electronic Product Code-96**

<table>
<thead>
<tr>
<th>dataheader</th>
<th>EPC manager</th>
<th>object class</th>
<th>serial number</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 bit</td>
<td>28 bit</td>
<td>24 bit</td>
<td>36 bit</td>
</tr>
</tbody>
</table>

Fig. 2: The EPC code in the form of a 96-bit SGTIN. The "EPC Manager" is the manufacturer of the product.

However, there are no current plans to introduce EPC in trade and therefore EPCglobal has defined algorithms for converting many other coding schemes. The latter include, for example, the Serial Shipping Container Code (SSCC, also known as the "number of the dispatch unit" = "Nummer der Versandeinheit" NVE in Germany) and the Serial Global Location Number (SGLN), which now also enables identification of locations (e.g. storage locations) within a company.

Usually, the EPC is 96 bits long. The first 8 bits in the dataheader define the length and format of the subsequent code. In order to use the memory reserved for the actual EPC for the company’s own data, the dataheader must be coded correctly as "proprietary". In the case of a 96-bit EPC, therefore, there are only 88 bits available for the company's own use. Apart from such data, GEN-2 tags can also store user data. The size of this user memory depends on the manufacturer; the formatting is still in the process of being standardized.

Finally, EPCglobal is also participating in the definition of future software structures. EPC has proposed that product manufacturers install so-called "information servers" (EPC IS). These are databases which provide further information on each product type or, on the basis of the serial number, on each individual product, e.g. product characteristics, certifications, use-by date etc.

In order to track down the relevant database, an "Object Name Service" (EPC ONS) converts the manufacturer ID stored in the EPC into a web address. These ONS servers work analogously to the Domain Name Services used in the Internet.

EPCglobal only defines roles and interfaces for individual components. These modules are implemented and sold by major software companies (e.g. Oracle).

In practice, the interfaces for linking up the RFID devices (reading protocol) as well as the functions and interfaces of the RFID filter middleware (Application Level Events) have been implemented specifically for manufacturers. However, in the case of the filter middleware, there is an additional number of concurrent concepts and products (e.g. from SAP, IBM, Microsoft). However, it is not yet clear which architecture will prove itself as the leading solution. Other software levels of the EPC architecture, in contrast, are not very important since they are still in the development stage.

More information in the internet:

www.siemens.com/simatic-sensors/RF

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