



Serial Numbers for RFID and 2D Barcodes at Point of Sale in General Merchandise Retail

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GTIN Serial Numbers with 2D Barcodes and RFID in Retail

Let's begin with the bottom line. Two-dimensional (2D) barcodes on the consumer package at Point of Sale (POS) are coming and RFID has seen an increase in adoption in general merchandise retail. Both data carriers require a unique serial number (SN) for every item. To comply with industry GS1 standards, only one serial number can be assigned to an individual item and that serial number is used in both barcodes and RFID. Barcodes include linear barcodes such as GS1-128, and two-dimensional barcodes such as QR or Data Matrix.

Barcodes can accommodate a longer, alphanumeric, variable length serial number. The RFID chips commonly used today are restricted in the amount of data they can hold and use only numeric data. To use the same serial number in both technologies, the simple answer is to use a numeric serial number that works with today's RFID tags. Even if you are not currently tagging your products with RFID, that may not always be the case.

But with any technological decision there are factors to consider. Please read on for more information.

Definitions from the [GS1 General Specifications](#) for GTIN and Serial Number:

Global Trade Item Number (GTIN): *"A Global Trade Item Number (GTIN) is used to identify any trade item (product or service) upon which there is a need to retrieve predefined information and that may be priced or ordered or invoiced at any point in any supply chain. A separate, unique GTIN is required whenever any of the trade item declarations are different in any way that is relevant to the trading process."*

Serial Number *"A code, numeric or alphanumeric, assigned to an individual instance of an entity for its lifetime. Example: a unique individual item may be identified with the combined Global Trade Item Number (GTIN) and serial number."*

Serial Numbers

Numeric only serial numbers are a best business practice in Automatic Identification and Data Capture for ID numbers. This avoids confusion with zero's and oh's; el's, i's, ones; esses and fives, etc. Numbers can take up less space in either an RFID chip or a barcode. Depending on the technology, they can be communicated in 4 bits rather than 8 and they can be "stacked" in a barcode. It is also a best practice to avoid creating an ID number that carries intelligence within the number itself. An example would be "all numbers starting with 52 have a specific characteristic such as place of manufacture." Simply make all ID numbers unique and look them up in a database for associated attributes and information.

Using serial numbers with a Global Trade Item Number (GTIN)

- A GTIN plus a serial number (SGTIN) identifies an individual item.
- A Batch/Lot number identifies a sub group of GTINs, but not down to the individual level.
- A serial number is required in an RFID tag to singulate (isolate) it so it can be identified and read.
- Serialized GTINs (SGTIN) are the key to looking up information about an individual item such as batch/lot, date and country of manufacture, expiry date, etc.
- For healthcare and food products, SGTINs are used for traceability, in some instances, per government regulation.

- SGTINs may be used for product recalls, expired products, theft prevention, identifying stolen items, counterfeit identification and returns.
- When used at Point of Sale (POS) they can prevent the sale of recalled or expired product.

RFID Serial Numbers

At this time, the retail sector primarily uses SGTIN-96 for RFID, however [EPC Tag Data Standards](#) (Electronic Product Code) defines four types: SGTIN-96, SGTIN-198, SGTIN+ and DSGTIN+. These configurations differ in their serial number type and length.

1. In SGTIN-96, the Serial Number is **numeric only** and **cannot exceed 12 digits with 274,877,906,943 as the highest value**. This allows encoding the SGTIN in a fixed 96-bit string.
2. In SGTIN-198, the Serial Number can be any string of up to 20 alphanumeric characters. To encode the Serial Number, the string is 198-bits long. It is worth noting that not all RFID chips on the market support an SGTIN this long.
3. SGTIN+ and DSGTIN+ are variable length. This means that the length of the data string to be encoded in the RFID chip depends on the length of the serial number. In addition, it allows for appending data like a batch number or a country of origin. DSGTIN+ differs from SGTIN+ in that it includes a date (expiry, best before, etc.) which can be useful for fresh food products.

Barcode Serial Numbers

SGTIN can be encoded in several GS1 barcode symbologies used in the supply chain and now on the consumer package to be used at POS. It can be numeric or alphanumeric, including a small subset of special characters. The serial number is variable length and can be up to 20 characters.

1. GS1 128 linear barcodes can encode a GTIN plus other data such as expiry date, batch, lot, serial number, etc. They are used for carton content labels.
2. [Digital Link](#), designed to support SGTIN on the consumer package and used at POS can be carried in Data Matrix or QR in the digital link format.
3. SGTIN can also be used on the consumer package at POS in GS1 Data Matrix, which allows for the use of Application Identifiers (AI) to identify different data elements. For example, the AI for a GTIN is (01) and for a Serial Number it is (21).

Conclusion

The different bar code symbologies and data formats for 2D on the consumer package can be confusing. GS1-US, RVCF, and label solution providers can help sort it out. But as mentioned at the top, since each GTIN gets one serial number for the life of the product, and since each product may be identified with both an RFID tag and a barcode, take into consideration serial number length and type. Determine how important it is, now and in the future, to have either an alphanumeric, longer, or variable length serial number. If the serial number type and length restrictions (12 numeric digits under 274,877,906,943) currently used for SGTIN-96 RFID tags will work, consider using that serial number structure for 2D barcodes on the consumer package.

For more information on RFID basics in retail, please see the RFID FAQ document co-written by AIM and RVCF: [RFID FAQ's - Retail Basic for Business Operations - RVCF](#)

This document was reviewed by AIM's RFID Experts Group. AIM is the unbiased resource for networking, education, advocacy and standards. AIM helps its members grow their businesses by fostering the effective use of Automatic Identification and Data Capture (AIDC) solutions. info@aimglobal.org.

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