The Global Language of Business

2D Barcodes in Retail test suite

Capability test

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Table of Contents

1 Executive summary

This *2D Barcodes in Retail test suite* is focused on the considerations and implications of utilising 2D barcodes encoded with GS1 barcode syntaxes at retail point-of-sale (POS) for brand owners, manufacturers, retailers and solution providers. This 2D barcode test suite is to provide GS1 compliant sample 2D barcodes for industry to accurately determine their current scanning capability and determine how systems interact with 2D barcodes approved for use in the GS1 System and the data they contain. This 2D barcode test suite is intended to be used to assess system readiness and determine updates that need to take place.

This 2D barcode test suite was developed in collaboration with Member Organisation colleagues and outside the Global Standards Management Process.

1.1 How to use this document

This is an informative and practical retail barcode test suite for brands, manufacturers, retailers, suppliers, distributors, warehouse operators and solution providers to understand process changes and requirements needed to implement GTIN, GS1 Application Identifiers (AIs), GS1 DataMatrix, GS1 Digital Link URI syntax in QR Code or Data Matrix and linear barcodes at point-of-sale (POS) and in manufacture of trade items. For those interested in moving to 2D barcodes the 2D Barcodes at Retail Point-of-Sale Implementation Guideline is an excellent to understand business opportunities, process changes and requirements needed to implement 2D barcodes at point-of-sale (POS).

Information sections:

Section 1 through 6 focus on the "why, who and what" for the users of this barcode test suite.

- Section 1 and 2 supply foundational background information on the migration to 2D barcode in retail and the scope of this document
- Section 3, 4 and 5 review the type of systems, barcodes and the barcode data structures (syntaxes) in scope.
- Section 6 focuses on the scanner considerations and the scanner updates that need to be applied to enable compliant retail 2D barcodes at POS.

Practical sections:

Section 7,8 and 9 are the required material to perform the 2D barcode tests to determine the scanning systems capability.

- Section 7 is the MUST updates to enable the test, the "how to use the barcode test suite" and high-level results interpretation for the 2D barcode tests.
- Section 8 are the test barcodes to be printed.
- Section 9 is the template for collecting the results of the tests.

1.2 The changing landscape of the retail industry

To better enable the digital consumer and unlock current and emerging business use cases, such as sustainability and circular economies, the retail industry is embarking on one of the biggest changes since the original introduction of the EAN/UPC barcode: the adoption of 2D barcodes. 2D barcodes, like GS1 DataMatrix, Data Matrix or QR Codes, can be encoded with more data than the EAN/UPC linear barcode. Within these 2D barcodes, both additional data and links to web-enabled information can be included through the use of GS1 Digital Link URI in Data Matrix and QR Codes. Data might, for example, include the product's expiry date, batch/lot number or serial number. Additionally, access to additional information on the web can include ingredient and allergen information, product pictures and videos, consumer reviews, recycling information services related to the product and more. Access to this additional information and data enhances the experiences of consumers, brands, retailers and everyone in between.

1.3 Ambition 2027

Industry has set the ambitious goal of transitioning from linear, 1D barcodes to more capable 2D barcodes on-pack. The initial goal is for retail point-of-sale (POS) scanning to be globally capable of reading and processing the GTIN from both existing linear and 2D barcodes by the end of 2027. The Ambition 2027 will require software upgrades and may require equipment upgrades if the POS scanner is not already imager capable. GS1 and industry are working together to support this migration and generate globally consistent guidance for business use cases. As there is no expectation that there will be a single 2D barcode selected for all industries, GS1 standards are enabling options that empower each industry to choose how they evolve towards more capable 2D barcodes while ensuring globally consistent implementations now and in the future. For example, in healthcare the journey towards 2D started in the early 2000s when industry chose GS1 DataMatrix as the single 2D barcode for product identification. Today there are billions of products with GS1 DataMatrix encoding the GS1 element string syntax. For healthcare products GS1 DataMatrix is the 2D barcode of choice for point-of-sale scanning. Linear barcodes (e.g., EAN/UPC and GS1 DataBar) will not go away and will coexist with 2D barcodes for as long as there are uses for them. During the dual-marking transition phase, the trade item will feature both the current linear (i.e., EAN/UPC or GS1 DataBar retail POS family) barcode and either a GS1 DataMatrix or QR Code with GS1 Digital Link URI syntax, or a Data Matrix with GS1 Digital Link URI syntax. For more information on the retail 2D barcode see section 4.1. Figure 1.1 below illustrates how to use a 2D barcode in addition to the linear barcode for companies and users who are ready to unlock opportunities enabled by 2D showing the minimum human readable interpretation (HRI) for retail.

Figure 1-1 2D barcode co-located transition

Note: Once 2D barcodes at POS have achieved pervasive adoption, brand owners and manufacturers can choose to use only the 2D barcode, continue with the retail POS linear barcode in combination with the 2D barcode or stay with only the POS linear barcode.

Note: Not all imaging scanners will be capable of the Ambition 2027 goal, therefore collaborating with the point-of-sale solution provider will be essential for accepting 2D barcodes at POS. See section 6.1 2D in retail barcode scanning considerations for more information.

For further information, contact your local GS1 Member Organisation.

2 Background

The Universal Product Code barcode (UPC-A and UPC-E) and European Article Number barcode (EAN-13 and EAN-8) have been trusted and ubiquitous data carriers for facilitating the price look-up function at retail point-of-sale (POS) since the early 1970s. This innovation automated a critical business process for retail POS everywhere.

The EAN/UPC family of barcodes carries only the Global Trade Item Number® (GTIN®) associated with a product. Due to this data capacity limitation, the GS1 DataBar Expanded barcodes were introduced to meet business requirements for more data, such as batch/lot number and expiration date. However, GS1 DataBar Expanded barcodes still have limited data capacity, and can become too large to fit on many packages. As linear barcodes require a mobile device app to access online information, they are not as consumer friendly as other data carriers, such as QR Codes, that allow consumers and business users alike to access additional product data and online information directly.

The momentum for change, to use more capable 2D barcodes, is driven by industry's need to encode more data on-pack and to allow consumer engagement through links to web-enabled information. This meets the growing information demands of consumers and regulators, enables additional supply chain efficiencies, facilitates new circular economies and builds brand trust by providing more accurate, complete and up-to-date product information, all the while enabling existing POS processes.

2.1 Purpose

The purpose of this 2D barcode test suite is to provide GS1 compliant sample 2D barcodes for industry to accurately determine their current scanning capability and determine how systems interact with 2D barcodes approved for use in the GS1 System and the data they contain. This document will provide a high-level knowledge of the:

- compliant retail 2D barcodes
- barcode data structures (syntaxes)
- ecosystems that used the 2D barcodes
- and scanners

For more information see the 2D Barcodes at Retail Point-of-Sale Implementation Guideline.

Important: **This barcode test suite is intended to be used to assess system readiness and determine updates that need to take place.**

This document is expected to expand over time based on growing user implementations and as the standards are updated.

3 Testing overview

3.1 Systems for testing

This barcode test suite is designed to provide an understanding of baseline capabilities for any system that is interacting with retail compliant 2D barcodes containing a Global Trade Item Number® (GTIN®) and additional data. Systems can be in the retail or in the retail supplier (manufacturer) ecosystem.

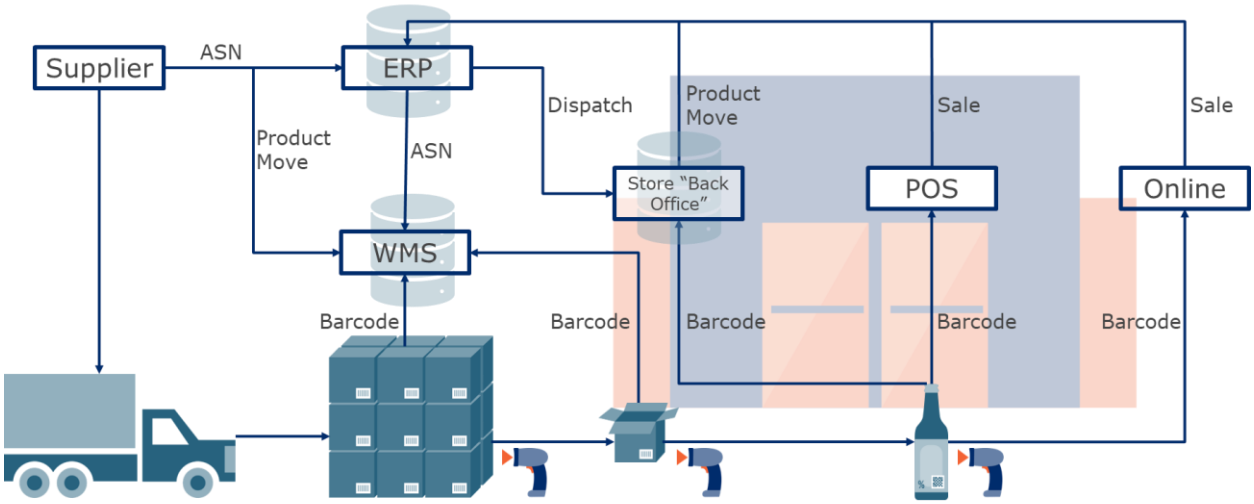

Figure 3-1 Example of a retail ecosystem

While point-of-sale (POS) is mainly referred to as being enabled by fixed or hand-held scanners at the front of the store, retail POS can happen in multiple locations and ways, including utilising scanners in POS lanes, at self-checkout or using mobile devices on the sales floor and the backroom.

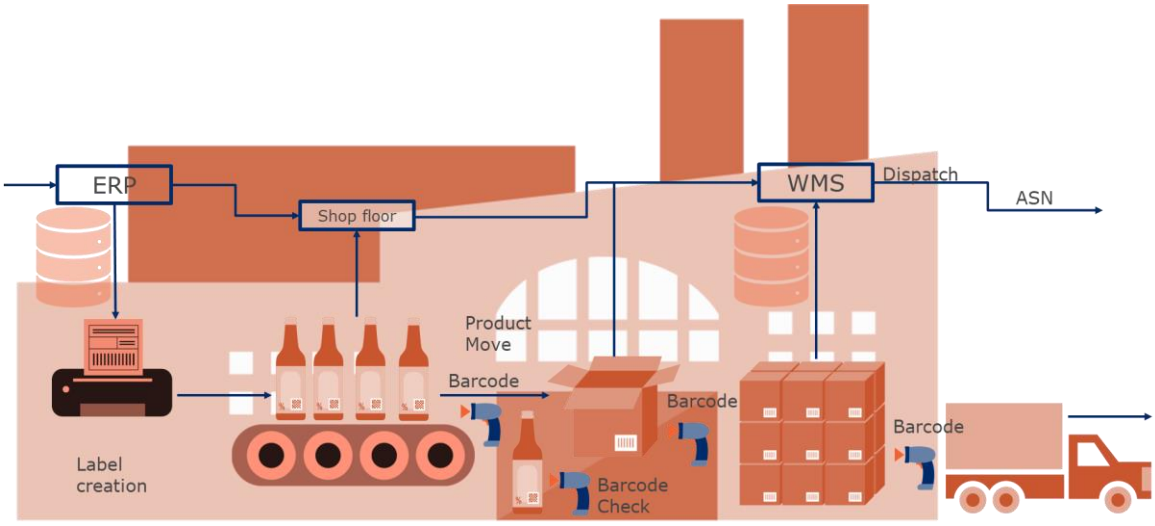

Figure 3-2 Example of a suppler (manufacturer) ecosystem

While this document focuses on 2D barcodes, RFID data carriers that use GS1 standards are seeing increasing use in the supply chain to improve inventory management – especially in the apparel sector – they will not be addressed in this document. For more information on RFID, see EPC/RFID standards and guidance.

3.2 In scope

Each barcode is intended to determine how systems scan the barcode, process encoded information, and store data by examining the following questions:

1. **Can the system read the barcode?**

   Control tests using GTIN-8, GTIN-12 and GTIN-13 will confirm if the system can process different types of linear and 2D barcodes.

   - EAN-8
   - UPC-E
   - UPC-A
   - EAN-13
   - GS1 DataBar Expanded Stacked
   - GS1 DataMatrix
   - QR Code with GS1 Digital Link URI
   - Data Matrix with GS1 Digital Link URI

   Note: The only GS1 DataBar Expanded Stacked from the GS1 DataBar family of retail barcodes was included in this test suite. See the GS1 General Specifications for all GS1 DataBar barcode options

2. **How does the system process the encoded data?**

   Tests will confirm if a system can process GTIN-8, GTIN-12 and GTIN-13 in different data formats/syntaxes.

   Separate tests confirm how GS1 Application Identifiers (AIs) are processed.

3. **How is the processed data stored?**

   Testing should include analysis of how the processed data is stored in systems.

   For example, is the GTIN stored in a 14-digit format?

4. **Can systems appropriately handle multiple barcodes on the same package?**

   Tests will confirm whether systems can identify and process multiple barcodes on a package.

   These tests focus on ensuring the item is captured in the transaction once, the barcode type/data is being captured, and system processing time is acceptable.

The systems in scope include, but is not limited to:

- Fixed check-out POS
- Self-checkout POS
- POS systems with middleware
- Receiving, inventory, stocking
- Consumer mobile scan and go
- Distribution centres
- Manufacturing
- Specialised mobile device apps

Imaging scanners includes, but is not limited to:

- Handheld

- Presentation
- Bi-optic
- Smart device/mobile scanner
- Inline production scanner
- Verifier

This barcode test suite is intended to determine how a system processes GS1 compliant 2D barcodes approved for use in retail applications. This includes understanding capabilities relating to the type of barcode and the contained data only. The test is intended to be used from manufacturing to retail POS.

3.3 Out of scope

Related items to barcode capabilities that are **not** in scope include:

- Barcode size and quality testing
- Barcode placement
- Barcodes printed on products
- Different printing technologies
- Systems optimised for long range scanning
- Use of human readable text related to the barcode in applications
- Restricted circulation numbers (RCNs)

To learn more about RCN, barcode placement, barcode size and other rules see the GS1 General Specifications

4 Retail POS compliant barcodes

Retailers, brands, solution providers and GS1 collaborated to reach consensus on the future of barcodes in retail. The resulting GS1 barcode standards and guidance provide the size, quality, placement, syntax and human readable text criteria for 2D barcodes used on retail consumer trade items scanned at point-of-sale (POS).

While the POS linear barcode is not going away, 2D barcodes cannot immediately be the only barcode on-pack until ubiquitous global scanning of 2D barcodes is achieved. Therefore, industry needs a transition period. The new standards and Ambition 2027 allow retailers and other parties throughout the supply chain time to plan for being able to scan and process different barcodes through their POS and facilities. With planning, this will ensure the ability to support the evolution of existing systems to unlock these additional capabilities by 2027.

Until 90% of POS scanning solutions are capable of using GS1 compliant POS 2D barcodes and at minimum capture the GTIN, any products using retail 2D barcodes on-pack will need to be accompanied by a POS linear barcode.

4.1 Retail barcodes options

The point-of-sale (POS) linear barcode choices include the EAN/UPC and GS1 DataBar POS family of barcodes.

Figure 4-1 Example of POS linear barcodes

The POS 2D barcode choices, for future state implementations including the transition period, are the QR Code with GS1 Digital Link URI syntax, Data Matrix with GS1 Digital Link URI syntax and GS1 DataMatrix

Figure 4-2 Example of POS 2D barcodes

Important: Once 2D barcodes at POS have achieved pervasive adoption the brand owner can choose to use only the 2D barcode, continue with the retail POS linear barcode in combination with the 2D barcode or stay with only the POS linear barcode.

The GS1 General Specifications have a sections devoted to Application Standard Profiles (ASP) that helps navigate adopting 2D barcodes. The ASPs provide an overview of what is conformant for current and future state implementations to facilitate the transition period. These ASPs are designed for all stakeholders involved in the implementation process to access the application standards, barcode choices, barcode standards (e.g., ISO specifications, X-dimension, size, quality specifications), barcode syntaxes and more.

For examples and 2D in retail uses cases see the 2D Barcodes at Retail Point-of-Sale Implementation Guideline.

5 GS1 barcode syntaxes used in retail POS

GS1 has three syntaxes suitable for encoding in barcodes scanned at retail point-of-sale (POS):

5.1 Plain syntax

Plain syntax is a GS1 data structure containing GS1 identification key with no additional characters or syntactic features. Plain syntax encoded barcodes used in the context of EAN, UPC, and ITF-14 barcodes, refers to the way numeric data is encoded without special characters like FNC1 or additional application identifiers (AI). In plain syntax, the GS1 identification key's numeric data itself represents the information without specific markers for different data elements.

For example, each digit sequence in the plain syntax corresponds directly to the Global Trade Item Number (GTIN) in the EAN-13 barcode, the plain syntax for GTIN-13 (9526064055028) would be encoded as follows:

Figure 5-1 Example in an EAN-13

5.2 GS1 element string syntax

The GS1 element string syntax is widely used throughout the supply chain and supports the ability to provide important data where it is needed, e.g., in healthcare, food, and logistics. The majority of barcode creation and scanning solutions on the market already have the capability to encode and decode GS1 element strings used with linear barcodes such as the GS1 DataBar family and GS1-128, as well as the GS1 DataMatrix which is a retail POS compliant 2D barcode.

The GS1 element string syntax requires an understanding of GS1 Application Identifiers (AI) and their conformance requirements, as listed below.

Key considerations for element string syntax:

- Selecting the correct GS1 AI to represent the encoded data, for example
  - USE BY OR EXPIRY (17) vs BEST BEFORE or BEST BY (15)
  - ORIGIN (422) vs COUNTRY - PROCESS (424)
- Data format
  - data length, fixed or variable
  - character sets e.g., numeric, alphanumeric, or restricted character set
  - data components or segments e.g., check digits/characters, indicator digits or characters, ISO code lists, piece number and total count etc.

  Whether a Function 1 symbol character (FNC1) is required as a separator character

  Most AIs require a FNC1 to indicate the end of the AI data field and the start of the next AI. These are defined by GS1 standards as "non-predefined length" AIs, whereas the AIs that do not require FNC1 are defined as "predefined length" AIs. For information on "predefined length" AIs see section 7.8.5 of GS1 General Specifications.
- Data relationships
  - Mandatory pairs of AIs e.g., if serial number (21) is encoded, it must be encoded with GTIN to be meaningful
  - Invalid pairs of AIs e.g., if country of origin (422) is encoded, it cannot be encoded with country of full processing (426) as it can lead to ambiguous data

For example, a GS1 DataMatrix encoded with (01) GTIN-13 (09504000059118), (10)batch/lot number (7654321D), (17)expiration date (December 31, 2027) and (21)serial number (10987) and

the Function Code 1 (**FNC1**) would be encoded with the following:
FNC101095040000591181727123110765432 1D**FNC1**2110987.

Figure 5-2 Example of a GS1 DataMatrix

For details on data relationship requirements, see section 4.13 of the GS1 General Specifications.

5.3 GS1 Digital Link URI syntax

The GS1 Digital Link URI syntax can fulfil the exact same business processes that are fulfilled by a GS1 element string syntax today and well into the future (provided that the capability to recognise, use or convert a GS1 Digital Link URI has been enabled). However, a GS1 Digital Link URI has the added benefit of behaving like a Web URL to provide digital content about the data encoded in the 2D barcode. It can also provide different types of digital content to different users. See Connecting barcodes to related information for more information on this topic.

For example, consider a GS1 Digital Link URI with GTIN and batch/lot number, encoded in a QR Code or Data Matrix on a pack of steaks. When a consumer scans the 2D barcode with their mobile device's camera without any app, detailed traceability information about that specific batch of steaks can be provided, with web content possibly showing where the cow may have been born, raised, slaughtered and processed. Whereas for retail staff, the same 2D barcode can be scanned with a specialised app to retrieve traceability information about that specific batch of steaks, but this information is provided as structured master data which can be used for other business purposes, including those which may need to be automated or machine-readable.

Implementing or enabling capability to use a GS1 Digital Link URI requires knowledge of the syntax structure, subdomains and back-end coordination, when compared to GS1 element strings. See Best practices for creating your QR Code powered by GS1 and the GS1 Digital Link quick start guide for more.

GS1 Digital Link URI is not normally used as the address of a web page, rather, it should ***redirect*** to digital information about the identified product.

- **Scheme (Protocol)**: The URI begins with a scheme, which specifies the protocol to be used. In GS1 Digital Link, the scheme is typically "https".
- **Domain**: The domain represents the web domain (e.g., a website) hosting the information related to the product.
- **Path**: The path provides a structured way to convey information about the product. It may include elements such as identifiers, attributes, or other parameters. The structure of the path aligns with GS1 Digital Link URI syntax rules.
  - **Primary key**: The "id" parameter represents the actual GS1 identification key, such as the GTIN, GRAI, or SSCC.
  - **Key qualifier**: This parameter is used to specify the GS1 identification key qualifier. In the case of GTIN, the key qualifiers are consumer product variants (22), batch/lot (10) and serial number (21) indicating more granular versions of the identifier.
  - **Additional parameters**: Additional parameters may be included to convey more information, such as expiration date, weight or specific attributes related to the product. GS1 Digital Link URI syntax places GS1 Application Identifiers (AI) into three categories that dictate where they are placed in the data string.

Table 5-1 Examples of Primary Keys, Key qualifier and Additional parameters

Primary Key	Key qualifier	Additional parameter (data attribute)
(00) Serial Shipping Container Code	(22) Consumer product variant	(17) Expiration date
(01) Global Trade Item Number	(10) Batch/lot number	(243) Packaging component number
(8006) Individual Trade Item Piece	(21) Serial number	(30) Variable count of item
(414) Physical location GLN	(254) GLN extension component	(320n) Net weight, pounds

Important: GS1 Digital Link URI syntax order of elements follows a hierarchy, unlike GS1 element strings. For example, the primary key and key qualifier order for GTIN is GTIN > consumer product variant > batch/lot number > serial number.

As an example of using GS1 Digital Link URI syntax see Figure 5-3, which encodes:

https://example.com/01/09520123456788/10/ABC123/21/456789A?3103=000195&3922=0299&17=201225

1. Scheme: http:// or https:// (use of HTTPS is more secure and is therefore recommended as best practice)
2. Host name: typically, a registered Internet domain name or a subdomain of such a registered domain name (e.g., example.com/)
3. Path information:
   a. Primary key such as GTIN, SSCC, GLN, GMN (e.g., 01/09520123456788/)
   b. Key qualifiers such as consumer product variant, batch/lot and serial number (e.g., 10/ABC123/21/456789A)
4. Query string: the data attributes such as production date, expiration date, count, price, net weight (e.g., ?3103=000195&3922=0299&17=201225)

Important: The key qualifiers follow the order of increasing granularity while the additional parameters in the query string can be in any order.

(01)09520123456788

Figure 5-3 Example of a QR Code encoded with GS1 Digital Link URI syntax

Important: It is important that a GS1 Digital Link URI is not used as the address of a web page. Rather, it is recommended to ***redirect*** to digital information about the identified product. There are two reasons for this. First, a GS1 Digital Link URI identifies the product itself, not the digital information about the product. Secondly, GTINs are allocated and managed according to the GS1 Allocation Rules whereas digital content, especially marketing-driven websites, are managed by brand marketing teams who will follow different procedures with different priorities. For more on this topic see Best practices for creating your QR Code powered by GS1.

The figure below provides a summary of the barcode and syntax options that can be used at retail POS as outlined above, noting where data beyond GTIN is supported in the GTIN attribute column and which device types can support decoding.

Table 5-2 Retail barcode syntax comparison

Barcode	Syntax	Additional data	Mobile device default camera app	Smart device app	POS scanner status
EAN/UPC	Plain	No	No	Yes	Laser or imaging ready
GS1 DataBar Omnidirectional versions	GS1 element string	No	No	Yes	Laser or imaging ready
GS1 DataBar Expanded versions	GS1 element string	Yes	No	Yes	Laser or imaging ready
GS1 DataMatrix	GS1 element string	Yes	No	Yes	Imaging ready, updates may be required
Data Matrix	GS1 Digital Link URI	Yes	Some	Yes	Imaging software updates required
QR Code	GS1 Digital Link URI	Yes	Yes	Yes	Imaging software updates required

For further information on GS1 standards, see Best practices for creating your QR Code powered by GS1, the GS1 General Specifications, the 2D Barcodes at Retail Point-of-Sale Implementation Guideline and GS1 Digital Link URI Standard.

6 Scanning

Imaging scanners are engineered to accurately decode 2D barcodes, tailoring their performance to meet diverse application requirements. These specifications encompass factors such as the module size of the 2D barcode, the scan rate, the context in which the barcode is being decoded—whether for consumer engagement, point-of-sale transactions, production line operations, or general distribution. The environmental conditions, including lighting, dust levels, and moisture presence are also important design considerations. The GS1 General Specifications define a barcode's X-dimensions (bar width or module size), Quiet Zone requirements, and minimum barcode quality based on where the barcode is being scanned and/or what type of object is being barcoded. See symbol specification addendums for tables 1 and 3 for 2D retail applications.

Major imaging scanner types include:

- **Bi-optic scanners** are a type of barcode scanner equipped with two sets of scanning components. These scanners often have two imagers (i.e., cameras) and multiple mirrors, allowing them to read barcodes from different angles. Bi-optic scanners are commonly used in high-volume retail environments for fast and efficient checkout processes.
- **Presentation scanners** are designed for hands-free operation, typically used in retail or point-of-sale settings. They are often mounted or placed on a counter and the user presents the barcode to the scanner. These scanners quickly capture barcodes, making them suitable for fast-paced point-of-sale scenarios.
- **Handheld scanners** are portable devices held by the user for scanning barcodes. They are versatile and can be used in various industries, including retail, logistics and healthcare.
- **Mobile computer scanners** are portable devices, often integrated with mobile computers or smartphones. These scanners are ideal for applications where mobility is crucial, such as inventory management, field service or asset tracking. They may use built-in cameras for 2D barcode scanning.
- **Fixed scanners** are stationary devices installed along a production line for automated barcode scanning. They are commonly used in manufacturing, logistics, and distribution environments to efficiently scan products as they move along the production line. These scanners can be integrated into conveyor systems.

- **Mobile device scanners** refer to barcode scanning functionality integrated into smartphones or tablets. Modern smartphones come equipped with built-in cameras capable of scanning barcodes. Apps and software use the camera to capture and decode barcode information. This approach is common for inventory management and consumer engagement applications.

6.1 2D in retail barcode scanning considerations

There are thousands of POS host software solutions in the global marketplace. Adding a new syntax such as the GS1 Digital link URI to them presents a challenge. To alleviate this challenge, it is recommended that POS scanners convert the GS1 Digital Link URI syntax to the well-established GS1 element string syntax. To make the transition to accepting 2D barcodes at point-of-sale (POS), scanner software will need to be updated:

1. To process trade items that may have multiple barcodes encoded with GS1 data structures and identification keys, for example a GS1 DataMatrix and an EAN-13 can be on the same trade item and will have the same GTIN.
2. To identify GS1 DataMatrix barcodes, Data Matrix encoded with GS1 Digital Link URI syntax

   and QR Code encoded with GS1 Digital Link URI syntax
3. To convert GS1 Digital Link URI syntax to GS1 element string syntax

Note: Not all imaging scanners will be capable of the above updates, therefore collaborating with the scanner solution provider will be essential for accepting 2D barcodes at POS.

For the 2D barcode Ambition 2027, retail POS needs to be able to identify, decode, "beep" once and transmit one GTIN from any GS1 compliant general retail linear and 2D barcode:

- EAN/UPC family of barcodes (plain syntax) is standard
- GS1 DataBar retail family (GS1 element string syntax) is standard and may need to be enabled
- GS1 DataMatrix (GS1 element string syntax) is standard and may need to be enabled
- Data Matrix (GS1 Digital Link URI syntax) will require a software update to identify the syntax and convert to GS1 element string
- QR Code (GS1 Digital Link URI syntax) will require a software update to identify the syntax and convert to GS1 element string

To unlock new retail use cases beyond just GTIN, imaging scanners need additional software modes.

When there is more than one barcode with GTIN on trade items, it is essential that the POS systems will ensure:

- The system SHALL only process one set of the desired data in the final transaction.
- Scanning systems SHOULD only produce one acknowledgement (e.g., beep) when multiple barcodes encoded with the same GTIN are scanned from the trade item.

Important: If the points above are not implemented, unintended POS transactions may occur.

6.2 2D in Retail scanning modes

Industry has agreed on three primary software modes that should be implemented in scanners:

6.2.1 Mode 1

All POS systems can process GTIN from EAN/UPC family of barcodes (plain syntax). Many POS systems can process the GTIN and some additional data (e.g., lot/batch, expiration date) from GS1 DataBar retail family and GS1 DataMatrix that use GS1 element string syntax. Updated POS

systems can process the GTIN from Data Matrix with GS1 Digital Link URI syntax and QR Code with GS1 Digital URI syntax.

Once the first GTIN is identified in a linear or 2D barcode, irrespective of the presence of multiple GS1-compliant retail barcodes on-pack, the scanner promptly process and transmits the GTIN with a single audible (e.g., beep) or visual signal, and awaits subsequent product.

Note: This minimum requirement for the Ambition 2027 is software Mode 1

6.2.2 Benefits of Mode 1

Mode 1 is an advanced scan and transmit mode that requires the host POS system to recognise and utilise the 14-digit. When the scanner decodes and transmits the linear or 2D barcode, it enables the host POS system to:

- Process only the linear or 2D barcode GTIN data, therefore simplifying the software updates.
- Can speed up POS as the scanner delivered the first GTIN found and waits for the next trade item.
- If the scanner's decoding and transmission process is further modified to convert 14-digit GTINs into GTIN-8, GTIN-12, or GTIN-13 formats, no update to the host POS system software will be necessary.

6.2.3 Mode 2

Prioritise GS1 compliant general retail 2D barcodes, decode, "beep" once and transmits GTIN and any additional data (e.g., lot/batch number, expiration date) in the common format of GS1 element string syntax and, if one cannot be found, transmit data from the linear barcode. Any data that the system is not able to store or use can be dropped.

Figure 6-1 Example of Mode 2

QR Code encoded data

https://id.dalgiardino.com/01/09506000134352/10/ABC?17=231231

Independent of the direction of travel the scanner transmits:

0109506000134352 10ABC^17231231

In this example, the "^" replaces the unprintable hex 1D (Group Separator) character

6.2.4 Benefits of Mode 2

Mode 2 is an advanced scan and transmit mode that requires the host POS system to recognise and utilise the 14-digit GTIN and process any prioritise additional data. When the scanner decodes and transmits 2D barcode, it enables the host POS system to:

- Process only the linear or 2D barcode data, therefore simplifying the software updates.
- Host POS system that already process GS1 DataBar Expanded Stacked or GS1 DataMatrix will seamlessly handle QR Codes and Data Matrix encoded with GS1 Digital Link URI as all compliant retail 2D barcodes will be transmitted in a GS1 element string format, thanks to Mode 2's functionality.

6.2.5 Mode 3

Identify, decode, and transmit all GS1 compliant general retail barcodes (linear or 2D) on a product, while generating an **8-digit label identification** to associate multiple barcodes with the same trade item. Upon capturing the first GTIN from either a linear or 2D barcode, the scanner promptly provides a single audible (e.g., beep) or visual signal. The scanner will generate an **8-digit label identification** in a common format header of the barcode's Plain & GS1 element string syntax.

Figure 6-2 Example of Mode 3

QR Code encoded data

https://id.dalgiardino.com/01/09506000134352/10/ABC?17=231231

Independent of the direction of travel the scanner transmits:

12345678~01095060001343521OABC^17231231

12345678~9506000134352

In this example, the "^" replaces the unprintable hex 1D (Group Separator) character and the "~" is not transmitted but shows the end of the label identification.

Note: All scanner software solution can benefit by leveraging GS1's Barcode Syntax Resources.

6.2.6 Benefits of Mode 3

Mode 3 is an advanced scan and transmit mode that requires the host POS system to recognise the scanner generated 8-digit label identification and utilise the 14-digit GTIN and process any prioritise additional data. When the scanner decodes and transmits 2D barcode, it enables the host POS system to:

- Process the first barcode GTIN transmitted (e.g. EAN-13), and begin the price lookup transaction and process any additional data when the next data from the same product is transmitted.
- Identify if the GTIN should have additional data from a 2D barcode and instruct the operator to present the 2D barcode to the scanner to complete the transaction.
- Identify if the product has different GTINs and therefore avoid unintended POS transactions. During the transition phase unintended error could happen as 2D barcodes with GTIN are added to products.
- Host POS system that already process GS1 DataBar Expanded Stacked or GS1 DataMatrix will seamlessly handle QR Codes and Data Matrix encoded with GS1 Digital Link URI as all compliant retail 2D barcodes will be transmitted in a GS1 element string format, thanks to Mode 3's functionality.

Note: When there is more than one barcode with GTIN on trade items, it is essential that the POS systems will ensure:

- The system SHALL only process one set of the desired data in the final transaction.
- Scanning systems SHOULD only produce one acknowledgement (e.g., beep) when multiple barcodes are scanned from the same trade item.

Important: If the points above are not implemented, unintended POS transactions may occur.

6.3 2D in Retail scanners with limited capabilities

In cases where the imaging scanner cannot be updated with the required modes, the POS solution provider may implement a middleware solution, also known as a shim library. This solution can transparently intercept and enable the system to identify, decode, and "beep" once, transmitting one GTIN from any GS1-compliant general retail linear or 2D barcode, similar to Mode 1. Other solutions include using the POS front end software to translate the transmitted GS1 element string or GS1 Digital Link URI 2D barcode data to the POS required data structure.

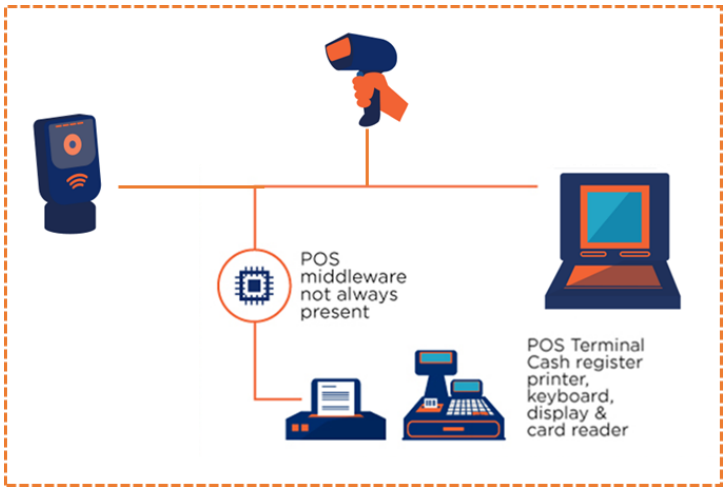

Figure 6-3 POS system with middleware feature

6.4 Verification

A barcode verifier is a specialised device designed to assess and grade the quality of printed barcodes. Unlike barcode scanners that are focused on reading barcodes for data capture, verifiers are specifically used to ensure that a printed barcode meets industry standards, and the barcode is encoded with a compliant data structure.

Verification scanners are generally used as offline auditing devices and have portable or desktop models to test for all barcode quality requirements. Inline fixed verification scanners are becoming more popular and allow manufacturing to track the quality of every barcode in real time, however they may not test all quality requirements.

Common features of barcode verification scanners include:

- **Verification grades** or quality assessment of the barcode based on industry standards, such as the ISO (International Organisation for Standardisation) specifications. Verification scanners analyse various aspects of the printed barcode, including line contrast, edge contrast, symbol contrast, and Quiet Zones. These factors contribute to the overall print quality and readability of the barcode. See the GS1 General Specifications for barcode quality parameters used in verification processes.
- **Compliance checking** of the printed barcode's compliance with specific symbology standards, encoding rules and dimensions.
- **data accuracy** of the encoded data within the barcode. This ensures that the information encoded in the barcode matches the intended data structure.
- **Reporting and documentation** about the quality of the scanned barcode. This information is valuable for quality control, compliance and troubleshooting purposes.

6.5 Point-of-sale (POS) host systems

A POS host solution is a comprehensive, hardware and software solution that facilitates the processing of sales transactions, inventory management and related retail operations. It serves as a central hub for managing various aspects of the retail business, providing tools to enhance customer service, optimise inventory and improve overall operational efficiency. It is commonly used in brick-and-mortar stores as illustrated in the retail ecosystem example in section 3.1, but it can also integrate with online sales channels for omnichannel retail experiences.

POS host systems generally facilitate:

- **Processing of sales transactions,** including the calculation of variable weight items, monitoring of expiry dates, sales totals, taxes, and discounts.
- **Inventory management** in real-time, enabling businesses to optimise stock levels and prevent stockouts.
- **Product (trade item) database** with detailed information about items, including prices, descriptions, and stock levels.
- **Integration with hardware** components such as barcode scanners, weight scales, receipt printers, and cash drawers.
- **Payment processing** for various payment methods, including credit/debit cards, cash, and mobile payments.
- **Reporting and analytics** for sales, inventory turnover, and other key metrics to make informed decisions.

POS host systems are often tailored to the retailers needs to realise other business use cases such as managing operations across different stores.

6.6 2D in retail barcode POS host system considerations

There are thousands of POS host software solutions in the global marketplace. Adding a new syntax such as the GS1 Digital link URI to them presents a challenge. To alleviate this challenge, it is recommended that POS scanners convert the GS1 Digital Link URI syntax to the well-established GS1 element string syntax.

POS host systems will need software updates to enable and manage advanced retailer use cases. The three possible scanning modes detailed in section 4.2 offer levels of functionality for the POS host system:

- Mode 1 allows the POS host system to still manage the solution with only GTIN.
- Mode 2 requires the POS host system to be configured to manage more granular data such as expiry date and weight.
- Mode 3 requires the POS host system to be configured to manage more granular data such as expiry date and weight, and also label identification numbers.

A best practice recommendation is to update any POS host system with all possible GS1 Application Identifiers (AI) relating to retail GTIN applications when a retailer is looking to unlock use cases beyond price lookup.

7 How to use the 2D barcode test suite

The 2D Barcodes in Retail test suite is intended to be used with and test the 2D capabilities of any system expected to interact with 2D barcodes approved for use within the GS1 General Specifications retail application standards that containing a GTIN.

7.1 Determine which systems to test

When determining which systems will be tested, consider all scan environments where barcodes containing GTIN are or may be used. While some organisations will only have a single system to

test, others may need to conduct the tests multiple times using different combinations of hardware and software.

Note: It is not uncommon for scanning system components used in the same environment to have different capabilities.

For example:

- A linear LASER handheld scanner and 2D imager bi-optic scanner are used together at retail point-of-sale.
- A distribution centre uses different software and systems than the retail store.
- A test environment may have more functionality enabled than a retail store environment.

7.2 Add test GTINs to host systems

To determine how data is being processed, the GTINs encoded in the test barcodes must be added to systems (e.g., Host POS system, ERP, …). If the test GTINs are not added, systems will fail to find a match and most commonly, return an error stating that the product cannot be found.

GTIN-12 (00012345000058) is used as the control for these tests and is critical for assessing system capabilities.

The following GTINs need to be added:

- **00000095200125**: GTIN-8
- **00012345000058**: GTIN-12
- **09521101530018**: GTIN-13

Note: Systems may display or label GTINs differently than what is shown above. GTINs provided are displayed in the recommended 14-digit format. Systems that do not use a 14-digit format may require the GTINs above to be modified for use. What modifications are required will be dependent on specific system nuances. For questions, please contact the system owner or contact your local GS1 Member Organisation (www.gs1.org/contact) for assistance.

7.3 Print the barcode test suite

Before scanning can occur, the test barcodes must be printed. The barcodes have been printed using home office and industrial equipment. In both cases, the scans occurred without issue. Scanning the barcodes directly off a screen may be attempted but is not recommended. Scanning printed barcodes is a more reliable method.

The following should be considered when determining how to print the barcode test suite:

- Linear barcode's target X-dimension for printing is 0.330mm (0.0130")
- 2D barcode's target X-dimension for printing is 0.495mm (0.0195")
- Ensure that the printer is working properly, and the ink is not low.
- Shiny or glossy paper will be more difficult to scan from than a matte or less reflective alternative.
- Printing on both sides of a page may be problematic if a scanning system reads from multiple angles.
- Avoid using paper that is thin or otherwise transparent. This is especially important if printing on both sides of a page where opaque paper is required.
- Damage may occur during mailing. If mailing is required, caution must be taken throughout the process.

To save paper, consider only printing *section 8*.

7.4 Test and capture results

Not all barcodes must be scanned, though it is recommended to complete the data structure and GTIN only tests 1-12 in sections 8.1 and 8.2 to establish which linear and 2D barcodes are enabled in the system and which types of GTINs can be processed. It is not uncommon for unexpected barcode types to be enabled.

Section 8.3 contains the same GS1 Application Identifiers (AIs) in different types of barcodes. This is done to allow testing of how systems process data based on their capabilities and data of interests.

- **GS1 DataMatrix** – Best for those that need more data for business use cases but are not enabling a consumer experience. No imaging scanner software updated required and requires specialised mobile device app to scan with smartphone.

  The ability to scan and process the GTIN from GS1 DataMatrix is a required capability for Ambition 2027.

- **QR Code with GS1 Digital Link** – Best for those that need more data for business use cases but are not enabling a consumer experience. Imaging scanner software updated required and scannable with mobile device's default camera app.

  The ability to scan and process the GTIN from a QR Code with GS1 Digital Link URI is a required capability for retail POS Ambition 2027.

- **Data Matrix with GS1 Digital Link** – Best for those that are enabling business use cases and a consumer experience but cannot fit a QR Code on-pack. Imaging scanner software updated required and requires specialised mobile device app to scan with smartphone.

  The ability to scan and process the GTIN from a Data Matrix with GS1 Digital Link URI is a required capability for Ambition 2027.

Important: Data Matrix with GS1 Digital Link is not the same as the GS1 DataMatrix used in regulated healthcare. If seeking to test systems scanning regulated healthcare items, GS1 DataMatrix tests should be used in addition to AI tests in other barcode types.

Note: If corresponding tests in section 8.1 fail, it is highly likely the tests in section 8.2 using the same barcode types will also fail.

- **Co-Located barcode scenarios** – It is common for a single object to have multiple barcodes on it that systems must be able to process. The co-located barcode tests found in section 8.3 include combinations of barcodes likely to be encountered on a trade item. It is recommended that all tests are completed as unexpected combinations of barcodes may occur during pilots and implementations.

  These tests are best conducted after systems are confirmed to have all appropriate barcodes and syntaxes enabled correctly.

7.4.1 Explanation of barcodes used

As this barcode test suite is intended for use by any organisation looking to understand their scanning capabilities, it has not been customised to reflect industry-specific requirements.

Barcodes in this test suite may be used to test any scanning system, however it is important to note that not all the test barcodes are recommended for use in all industries.

The human readable text may also appear differently than application specific requirements. The possible differences in the human readable text will not impact the barcode scan results.

7.4.2 Time commitment

Scanning the test barcodes takes approximately 30 minutes once set-up is complete. Testing may be stopped and resumed at a later point if no changes occur to the system.

7.4.3 Testing process

Once the set-up process is completed, the testing process can begin. To track your test results, section 9 has a barcode tracking spreadsheet. The spreadsheet captures what system was being tested, if the GTIN look-up function worked as intended, which GS1 Application Identifiers (AIs) are captured, and other notes.

If a scan takes place and the GTIN processes as expected in the system, the "Did GTIN lookup work?" column should be marked 'Y' (Yes). An example of this might be having a GTIN added to a point-of-sale transaction, appear correctly on a picklist, or successfully populate a master data file.

For GS1 Application Identifier (AI) Tests, a column is available to note which AIs were processed. This column is not applicable (N/A) for sections *8.1* and *8.2* tests where AIs beyond GTIN are not present.

In addition to seeing if GTIN and other AIs are processed, review how the data is being captured and/or stored. For example, all types of GTIN should be stored in a 14-digit format.

Test Number	Test Description	Test System Description	Did GTIN lookup work? (Y/N)	Which AI(s) worked?	Test notes if successful or unsuccessful
1	Barcode:EAN-8 GTIN Only	Retail Grocery store, Brussels Belgium, Self-check system 3	Y	N/A	After adding GTIN to host system sample look up worked.

Figure 7-1 Tracking spreadsheet example

This process should be repeated with a different tracking spreadsheet for all systems being tested.

Important: Test 1 is designed to be a system control test. If test 1 fails, confirm that the GTINs provided in section *7.2* have been added to the system. If test 1 is successful, continue with remaining tests and record results in the tracking spreadsheet.

7.5 Review the findings

After testing is complete, review and analysis are needed to understand baseline capabilities and plan next steps. Below are additional details on scenarios that may occur during testing.

7.5.1 Data transmitted

Scanner can be configured to transmit the barcode data to suit the requirements of the host system. Therefore, involving the scanner solution provider and host system administrator may be required to understand the transmitted data. The minimum transmitted data is supplied in the section 8 tests, however the data will often have additional data before and after to indicate the host system, type of barcode, data structure, data type, end of data string or only accept the data in a hexadecimal format.

Example of GS1 DataMatrix transmitted data configured to various systems:

Figure 7-2 Example of retail POS GS1 DataMatrix

GS1 DataMatrix encode data (01)0952481000339(10)YA12AB(17)271231

- System 1 requires standard data transmission with barcode symbology identifier
  -]d2^010952481000033910YA12AB^17271231
    -]d2 is the symbology identifier for GS1 DataMatrix, which indicates that the decoded data came from a GS1 DataMatrix symbol
    - ^ = FNC1is the start character that instructs the decoder that the following characters are GS1 AI
- System 2 requires the minimum data transmitted
  - 010952481000033910YA12AB^17271231
- System 3 requires the GTIN and a G prefix indication
  - G9524810000339
- System 4 requires Mode 3 data transmission
  - 12345678~010952481000033910YA12AB^17271231
- System 5 requires Hex tags
  - For example 5Dh 64h 32h =]d2

7.5.2 The barcodes will scan, but the data is not processed

When scanners pass data received from barcodes into a receiving system, the software powering the receiving system must be able to process it. If the barcode can be scanned, but the data does not appear correctly, how the scanning and receiving systems integrate must be investigated.

7.5.3 White on black barcodes not processed

White on black or reversed reflectance 2D barcodes often requires a specific barcode function to be enabled in the scanner, often call reverse video in the scanners.

7.5.4 Different installations of the same hardware are getting different results

Scanning hardware is powered by customisable software that allows certain barcode types and functions to be enabled. If the same hardware is producing different results, it is likely that the software is configured differently.

7.5.5 GTIN-8, GTIN-12, or GTIN-13 were unsuccessful

If GTIN-8, GTIN-12 or GTIN-13 in tests 1, 2 or 3 fail, it likely means that the system is unable to handle these types of GTINs. To check this:

Confirm that test suite GTINs provided in section *7.2* were added to the system

Confirm that the full EAN/UPC symbology is enabled in the scanning software.

If both the 14-digit GTIN-12 or GTIN-13 tests in 5, 6 and 7 fail, then the system is likely unable to process the data. To check this:

Confirm that test suite GTINs provided in section *7.2* were added to the system.

Confirm that the host system can process 14-digit GTINs.

Confirm the scanner and host software has been updated to accept all compliant retail 2D barcodes and encoded data

7.5.6 An imaging scanner is being used, but 2D barcode tests were unsuccessful

If 2D barcodes are not being recognised by an imagining (camera based) scanner, then the functionality would need to be enabled within its software. To adjust the scanner settings, refer to the user manual and/or the manufacturer of the device for support.

7.5.7 GS1 Application Identifier (AI) tests were all unsuccessful

If barcodes can scan with only GTIN, but fail when AI(s) are added, it means that systems are missing the logic needed to parsed, process, and/or store the AI data formats/syntax or may have nowhere to map the data to.

7.5.8 Only some of the GS1 Application Identifier tests were unsuccessful

Systems may not be configured to process all AIs used in the tests. Other systems may have limitations in the type of data they can process from an AI.

7.5.9 GTIN not first

Some systems may require GTIN to come first in the data string in order to process the barcode correctly. If the first test where GTIN comes before expiration date works, but the reverse test does not, then the system likely has incorrect GS1 element string syntax processing logic.

7.5.10 GS1 DataMatrix AI test were successful, but QR Code or Data Matrix AI test were not

GS1 DataMatrix encodes AIs using a different data format/syntax than QR Code and Data Matrix. Although both syntaxes contain the same set of AIs, the logic required to interact with the two syntaxes is unique. Systems would need to have QR Code/Data Matrix and GS1 Digital Link URI syntax enabled to process AIs correctly.

7.6 The non-GS1 barcodes are causing issues

Non-GS1 versions of barcodes and/or barcodes that do not contain data structured in a GS1 barcode syntax can cause errors to occur if systems are not properly set-up to handle them. For example, a QR Code with data not in a GS1 Digital Link URI format can cause an error if the scanning system is looking for any QR Code without applying additional logic to only process data in the specific, GS1 Digital Link URI format. For these situations, it is recommended that the hardware/software providers be contacted to optimise the process.

7.7 Reviewing co-located barcode test Findings

How the co-located barcode tests perform will intentionally vary based on how scanning systems are programmed. Some systems may only look for GTIN (Mode 1), some may always prioritise the 2D barcode (Mode 2) such as QR Code, others may ignore everything other than GS1 DataMatrix, and there could be some systems designed to transmit all barcode data (Mode 3) to the host system. How barcodes and the data they contain are processed is dictated by a wide array of factors. This section is focusing on the capability requirements for Ambition 2027 for retail applications, which is being able to, at minimum, process GTIN from GS1 DataMatrix, QR Code (GS1 Digital Link URI),

and Data Matrix (GS1 Digital Link URI). For additional information on the Ambition 2027 barcode scenarios and troubleshooting application specific requirements, please see the 2D Barcodes at Retail Point-of-Sale Implementation Guideline, the 2D in Retail Next generation barcodes site or contact your local GS1 Member Organisation for support.

7.7.1 The GTIN is being captured from more than one barcode – it looks like two, separate products when scanned

Multiple factors may be causing this occurrence. Check with those responsible for scanning system hardware and software configurations, such as barcode prioritisation/auto discrimination, timeout windows, and how the encoded data is being processed.

7.7.2 Data beyond GTIN is expected to come through, but it is not

If additional data beyond the GTIN was captured correctly in single barcode test, but not in co-located tests, it is likely that the scanning system is recognising the UPC-A barcode first and sending the data or prioritising the data from the UPC-A over the 2D barcode. System configurations should be reviewed and updated appropriately.

8 Test barcodes

8.1 GTIN only barcode and data structure Tests

Test 01: Baseline linear reference GTIN-8 control barcode,

- Linear barcode: EAN-8,
- Barcode data 00000095200125: GTIN-8
- Minimum transmitted data: 95200125

Test 02: Baseline linear reference GTIN-12 control barcode,

- Linear barcode: UPC-A,
- Barcode data 00012345000058: GTIN-12
- Minimum transmitted data: 012345000058

Test 03: Baseline linear reference GTIN-13 control barcode,

- Linear barcode: EAN-13,
- Barcode data 09521101530018: GTIN-13
- Minimum transmitted data: 9521101530018

Test 04:

- 2D barcode: GS1 DataMatrix,
- Barcode data: 00012345000058: GTIN-12
- Minimum transmitted data: 0100012345000058
- Parsed data: (01)00012345000058

Test 05:

- 2D barcode: QR Code (GS1 Digital Link URI),
- Barcode data: https://example.com/01/09521101530018: GTIN-13
- Minimum Mode 1 transmitted data: 09521101530018
- Parsed data: (01)09521101530018

(01) 09521101530018

Test 06:

- 2D barcode: Data Matrix (GS1 Digital Link URI),
- Barcode data: https://example.com/01/09521101530018: GTIN-13
- Minimum Mode 1 transmitted data: 09521101530018
- Parsed data: (01)09521101530018

(01) 09521101530018

Test 07:

- 2D barcode reverse reflectance: QR Code (GS1 Digital Link URI),
- Barcode data: https://example.com/01/09521101530018: GTIN-13
- Minimum Mode 1 transmitted data: 09521101530018
- Parsed data: (01)09521101530018

(01) 09521101530018

Test 08:

- 2D barcode reverse reflectance: GS1 DataMatrix,
- Barcode data: 00012345000058: GTIN-12
- Minimum transmitted data: 0100012345000058
- Parsed data: (01)00012345000058

Test 09: Baseline linear reference GTIN-12 control barcode,

- Linear barcode: UPC-E,
- Barcode data 00012345000058: GTIN-12
- Minimum transmitted data: 012345000058

Test 10: Baseline linear reference GTIN-13 control barcode,

- Linear barcode: GS1 DataBar Expanded Stacked,
- Barcode data 09521101530018: GTIN-13
- Minimum transmitted data: 0109521101530018
- Parsed data: (01)09521101530018

8.2 Non-retail barcode tests

Test 11: Non-retail barcodes Data Matrix,

- 2D barcode: Data Matrix,
- Barcode data: Non-GS1 data
- Minimum transmitted data: No transmission

1234ABCD

Test 12: Non-retail barcodes QR Code,

- 2D barcode: QR Code(URL),
- Barcode data https://example.com/2S7jw6: Non-GS1 data
- Minimum transmitted data: No transmission

Scan Me!

8.3 GTIN + additional data Application Identifier (AI) tests

8.3.1 GTIN + additional data AI tests: GS1 DataMatrix

Test 13:

- 2D barcode: GS1 DataMatrix,
- Barcode data:
  - 00012345000058: GTIN-12
  - 31 DEC 2027: Expiration date
- Minimum transmitted data: 010001234500005817271231
- Parsed data:
  - (01) 00012345000058
  - (17)271231

(01) 00012345000058

Test 14:

- 2D barcode: GS1 DataMatrix,
- Barcode data:
  - 31 DEC 2027: Expiration date
  - 00012345000058: GTIN-12
- Minimum transmitted data: 17271231010000123450000 58
- Parsed data:
  - (17)271231
  - (01)00012345000058

(01) 00012345000058

Test 15:

- 2D barcode: GS1 DataMatrix,
- Barcode data:
  - 00012345000058: GTIN-12
  - 31 DEC 2027: Expiration date
  - ABC123: BATCH/LOT
- Minimum transmitted data: 010001234500005817271231 10ABC123
- Parsed data:
  - (01)00012345000058
  - (17)271231
  - (10)ABC123

(01) 00012345000058

Test 16:

- 2D barcode: GS1 DataMatrix,
- Barcode data:
  - 00012345000058: GTIN-12
  - ABC123: BATCH/LOT
  - 31 DEC 2027: Expiration date
  - 123456: Serial Number
- Minimum transmitted data: 0100012345000058 10ABC123^17271231 21123456
  - "^" = FNC1 or {GS}
- Parsed data:
  - (01)00012345000058
  - (10)ABC123
  - (17)271231
  - (21)123456

(01) 00012345000058

Test 17:

- 2D barcode: GS1 DataMatrix,
- Barcode data:
  - 00012345000058: GTIN-12
  - 12.56 lbs: Net Weight
  - 31 DEC 2027: Expiration date
- Minimum transmitted data: 0100012345000058230300125617271231
- Parsed data:
  - (01)00012345000058
  - (3202)001256
  - (17)271231

(01) 00012345000058

8.3.2 GTIN + additional data AI tests: QR Code with GS1 Digital Link URI

Test 18:

- 2D barcode: QR Code (GS1 Digital Link URI),
  - Barcode data: https://example.com/01/09521101530018?17=271231
  - 09521101530018: GTIN-13
  - 31 DEC 2027: Expiration date
- Minimum Mode 2 transmitted data: 010952110153001817271231
- Parsed data:
  - (01)09521101530018
  - (17)271231

(01) 09521101530018

Test 19:

- 2D barcode: QR Code (GS1 Digital Link URI),
  Barcode data: https://example.com/01/09521101530018/22/ABC?17=271231
  - 09521101530018: GTIN-13
  - ABC: Product Variant
  - 31 DEC 2027: Expiration date
- Minimum Mode 2 transmitted data: 0109521101530018 22ABC^17271231
- Parsed data:
  - (01)09521101530018
  - (22)ABC
  - (17)271231

(01) 09521101530018

Test 20:

- 2D barcode: QR Code (GS1 Digital Link URI),
  Barcode data: https://example.com/01/09521101530018/10/ABC123?17=271231
  - 09521101530018: GTIN-13
  - ABC123: BATCH/LOT
  - 31 DEC 2027: Expiration date
- Minimum Mode 2 transmitted data: 0109521101530018 10ABC123^17271231
- Parsed data:
  - (01)09521101530018
  - (10)ABC123
  - (17)271231

(01) 09521101530018

Test 21:

- 2D barcode: QR Code (GS1 Digital Link URI),
  Barcode data: https://example.com/01/09521101530018/10/ABC123/21/123456?17=271231
  - 09521101530018: GTIN-13
  - ABC123: BATCH/LOT
  - 123456: Serial Number
  - 31 DEC 2027: Expiration date
- Minimum Mode 2 transmitted data: 010952110153001810ABC123^21123456^17271231
- Parsed data:
  (01)09521101530018
  (10)ABC123
  (17)271231
  (21)123456

(01) 09521101530018

Test 22:

- 2D barcode: QR Code (GS1 Digital Link URI),
  Barcode data: https://example.com/01/09521101530018?17=271231&3202=001256
  - 09521101530018: GTIN-13
  - 12.56 lbs: Net Weight
  - 31 DEC 2027: Expiration date
- Minimum Mode 2 transmitted data: 0109521101530018172712313202001256
- Parsed data:
  - (01)09521101530018
  - (3202)001256
  - (17)271231

(01) 09521101530018

8.3.3 GTIN + additional data AI tests: Data Matrix with GS1 Digital Link URI

Test 23:

- 2D barcode: Data Matrix (GS1 Digital Link URI),
  - Barcode data: https://example.com/01/09521101530018?17=271231
  - 09521101530018: GTIN-13
  - 31 DEC 2027: Expiration date
- Minimum Mode 2 transmitted data: 010952110153001817271231
- Parsed data:
  - (01)09521101530018
  - (17)271231

(01) 09521101530018

Test 24:

- 2D barcode: Data Matrix (GS1 Digital Link URI),
  Barcode data: https://example.com/01/09521101530018/22/ABC?17=271231
  - 09521101530018: GTIN-13
  - ABC: Product Variant
  - 31 DEC 2027: Expiration date
- Minimum Mode 2 transmitted data: 0109521101530018 22ABC^17271231
- Parsed data:
  - (01)09521101530018
  - (22)ABC
  - (17)271231

(01) 09521101530018

Test 25:

- 2D barcode: Data Matrix (GS1 Digital Link URI),

  Barcode data: https://example.com/01/09521101530018/10/ABC123?17=271231
  - 09521101530018: GTIN-13
  - ABC123: BATCH/LOT
  - 31 DEC 2027: Expiration date
- Minimum Mode 2 transmitted data: 0109521101530018 10ABC123^17271231
- Parsed data:
  - (01)09521101530018
  - (10)ABC123
  - (17)271231

Test 26:

- 2D barcode: Data Matrix (GS1 Digital Link URI),
  Barcode data: https://example.com/01/09521101530018/10/ABC123/21/123456?17=271231
  - 09521101530018: GTIN-13
  - ABC123: BATCH/LOT
  - 123456: Serial Number
  - 31 DEC 2027: Expiration date
- Minimum Mode 2 transmitted data: 0109521101530018 10ABC123^21123456^17271231
- Parsed data:
  (01)09521101530018
  (10)ABC123
  (17)271231
  (21)123456

(01) 09521101530018

Test 27:

- 2D barcode: Data Matrix (GS1 Digital Link URI),

  Barcode data: https://example.com/01/09521101530018?17=271231&3202=001256
  - 09521101530018: GTIN-13
  - 12.56 lbs: Net Weight
  - 31 DEC 2027: Expiration date
- Minimum Mode 2 transmitted data: 010952110153001823020012561727123 1
- Parsed data:
  - (01)09521101530018
  - (3202)001256
  - (17)271231

8.4 Co-Located barcode tests

Test 28: Co-Located UPC-A and GS1 DataMatrix

- Linear barcode: UPC-A
- 2D barcode: GS1 DataMatrix,
- Barcode data: UPC-A
  - 00012345000058: GTIN-12
- Barcode data: GS1 Datamatrix
  - 00012345000058: GTIN-12
- Minimum transmitted data:
  - Mode 1 0100012345000058 or 012345000058
  - Mode 2: 0100012345000058
  - Mode 3:11111111~012345000058 and 11111111~0100012345000058
    - 11111111 could be any numeric combination but both label identifiers should be the same
    - "~" not transmitted
- Parsed data:

  (01)00012345000058

Test 29: Co-Located EAN-13 and QR Code (GS1 Digital Link URI)

- Linear barcode: EAN-13
- 2D barcode: QR Code (GS1 Digital Link URI)
- Barcode data: EAN-13
  - 09521101530018: GTIN-13
- Barcode data: QR Code (GS1 Digital Link URI)
  - 09521101530018: GTIN-13
- Minimum transmitted data:
  - Mode 1 0109521101530018 or 9521101530018
  - Mode 2: 0109521101530018
  - Mode 3:11111111~ 9521101530018 and 11111111~0109521101530018
    - 11111111 could be any numeric combination but both label identifiers should be the same
    - "~" not transmitted
- Parsed data:
  - (01)09521101530018

Test 30: Co-Located EAN-13 and Data Matrix (GS1 Digital Link URI)

- Linear barcode: EAN-13
- 2D barcode: Data Matrix (GS1 Digital Link URI)
- Barcode data: EAN-13
  - 09521101530018: GTIN-13
- Barcode data: Data Matrix (GS1 Digital Link URI)
  - 09521101530018: GTIN-13
- Minimum transmitted data:
  - Mode 1 0109521101530018 or 9521101530018
  - Mode 2: 0109521101530018
  - Mode 3:11111111~ 9521101530018 and 11111111~0109521101530018
    - 11111111 could be any numeric combination but both label identifiers should be the same
    - "~" not transmitted
- Parsed data:
  - (01)09521101530018

Test 31: Co-Located UPC-A and GS1 DataMatrix

- Linear barcode: UPC-A
- 2D barcode: GS1 DataMatrix
- Barcode data: UPC-A
  - 00012345000058: GTIN-12
- Barcode data: GS1 DataMatrix
  - 00012345000058: GTIN-12
  - 31 DEC 2027: Expiration date
  - ABC123: BATCH/LOT
  - 123456: Serial Number
- Minimum transmitted data:
  - Mode 1 0100012345000058 or 012345000058
  - Mode 2: 010001234500005817271231 10ABC123^21123456
  - Mode 3:11111111~ 012345000058 and 11111111~010001234500005817271231 10ABC123^21123456
    - 11111111 could be any numeric combination but both label identifiers should be the same
    - "~" not transmitted
    - "^" = FNC1 or {GS}
- Parsed data:
  - (01)00012345000058
  - (17)271231
  - (10)ABC123
  - (21)123456

Test 32: Co-Located EAN-13 and QR Code (GS1 Digital Link URI)

- Linear barcode: EAN-13
- 2D barcode: QR Code (GS1 Digital Link URI)
- Barcode data: EAN-13
  - 09521101530018: GTIN-13
- Barcode data: QR Code (GS1 Digital Link URI)
  - 09521101530018: GTIN-13
  - 31 DEC 2027: Expiration date
  - ABC123: BATCH/LOT
  - 123456: Serial Number
- Minimum transmitted data:

  Mode 1 0109521101530018 or 9521101530018

  Mode 2: 0109521101530018172712310ABC123^21123456

  Mode 3:11111111~9521101530018 and
  11111111~0109521101530018172712310ABC123^21123456
  - 11111111 could be any numeric combination but both label identifiers should be the same
  - "~" not transmitted
  - "^" = FNC1 or {GS}
- Parsed data:

  (01)09521101530018

  (17)271231

  (10)ABC123

  (21)123456

Test 33: Co-Located EAN-13, QR Code (GS1 Digital Link URI) and Data Matrix (Non-GS1 data)

- Linear barcode: EAN-13
- 2D barcode: QR Code (GS1 Digital Link URI) and Data Matrix (Non-GS1 data)
- Barcode data: EAN-13
  - 09521101530018: GTIN-13
- Barcode data: QR Code (GS1 Digital Link URI)

  09521101530018: GTIN-13
  - 31 DEC 2027: Expiration date
  - ABC123: BATCH/LOT
  - 123456: Serial Number
- Barcode data: Data Matrix (Non-GS1 data)
  - 1234ABCD
- Minimum transmitted data:
  - Mode 1 0109521101530018 or 9521101530018
  - Mode 2: 010952110153001817271231 10ABC123^21123456
  - Mode 3:11111111~9521101530018 and 11111111~010952110153001817271231 10ABC123^21123456
    - 11111111 could be any numeric combination but both label identifiers should be the same
    - "~" not transmitted
    - "^" = FNC1 or {GS}
- Parsed data:
  - (01)09521101530018
  - (17)271231
  - (10)ABC123
  - (21)123456

Test 34: Co-Located EAN-13, QR Code (GS1 Digital Link URI) and QR Code (URL)

- Linear barcode: EAN-13
- 2D barcode: QR Code (GS1 Digital Link URI) and QR Code (URL)
- Barcode data: EAN-13
  - 09521101530018: GTIN-13
- Barcode data: QR Code (GS1 Digital Link URI)
  - 09521101530018: GTIN-13
  - 31 DEC 2027: Expiration date
  - ABC123: BATCH/LOT
  - 123456: Serial Number
- Barcode data: QR Code (URL)
  - https://example.com/2S7jw6
- Minimum transmitted data:
  - Mode 1 0109521101530018 or 9521101530018
  - Mode 2: 0109521101530018172712311 0ABC123^21123456
  - Mode 3:11111111~9521101530018 and 11111111~0109521101530018172712311 0ABC123^21123456
    - 11111111 could be any numeric combination but both label identifiers should be the same
    - "~" not transmitted
    - "^" = FNC1 or {GS}
- Parsed data:
  - (01)09521101530018
  - (17)271231
  - (10)ABC123
  - (21)123456

Test 35: Co-Located EAN-13, QR Code (GS1 Digital Link URI) **with different GTINs**
Both GTIN SHALL be the same on a trade item this is an example of an error

- Linear barcode: EAN-13
- 2D barcode: QR Code (GS1 Digital Link URI) and QR Code (URL)
- Barcode data: EAN-13
  - **09521101530018**: GTIN-13
- Barcode data: QR Code (GS1 Digital Link URI)
  - **09521101530025**: GTIN-13
  - 31 DEC 2027: Expiration date
  - ABC123: BATCH/LOT
  - 123456: Serial Number
- Minimum transmitted data (**BEEP TWICE**):
  - Mode 1 0109521101530025 or 9521101530018
  - Mode 2: 010952110153002517271231 10ABC123^21123456
  - Mode 3:11111111~9521101530018 and 22222222~010952110153002517271231 10ABC123^21123456
    - 11111111 and 22222222 could be any numeric combination but label identifiers should be the different as the GTINs are not the same
    - "~" not transmitted
    - "^" = FNC1 or {GS}
- Parsed data:
  - (01)09521101530025
  - (17)271231
  - (10)ABC123
  - (21)123456

9 Barcode test tracking spreadsheet

Test Number	Test Description	Test System Description	Did GTIN lookup work? (Y/N)	Which AI(s) worked?	Test notes if successful or unsuccessful
1	Barcode:EAN-8 GTIN Only	Retail Grocery store, Brussels Belgium, Self-check system 3	Y	N/A	After adding GTIN to host system sample look up worked.

Figure 9-1 Example spreadsheet data

Table 9-1

Test Number	Test Description	Test System Description	Did GTIN lookup work? (Y/N)	Which AI(s) worked?	Test notes if successful or unsuccessful
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					

Test Number	Test Description	Test System Description	Did GTIN lookup work? (Y/N)	Which AI(s) worked?	Test notes if successful or unsuccessful
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					