



Global 2D Programme - Foundational FAQs for Retail

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General FAQs on the Global Migration to 2D programme and general barcode FAQs

1. What are the benefits of 2D barcodes over EAN/UPC (1D) barcodes?

1D barcodes provided value over the last 50 years. 2D barcodes can expand on those capabilities to include solutions for traceability, supply chain visibility, consumer engagement, recall readiness and waste prevention.

1D barcodes, such as EAN/UPC, are only capable of carrying a product identifier known as the [Global Trade Item Number®](#) (GTIN®). 2D barcodes can carry additional data, such as expiration date, batch/lot number, serial number and more. Having this additional data in the barcode adds value by allowing the information to be automatically captured and acted on.

Some 2D barcodes, like QR Codes with GS1 Digital Link syntax, can carry additional data while also connecting consumers and other users to online resources and experiences. In addition to carrying more data, 2D barcodes are smaller than 1D barcodes and also include features like built-in error correction, which adds to their reliability. Examples of 1D and 2D barcodes that use GS1 standards are shown below (note that the text under or next to the 2D barcodes shows the example information inside the barcodes, and is not necessarily the text that would be displayed along with the 2D barcode on a product).

1D barcode example	2D barcode examples	
	 <p>(01)09526000134367</p> <p>Example with GTIN text underneath the barcode</p>  <p>(01)09526000134367 (17)301231 (10)ABC123</p> <p>Example of another way the full data can be displayed next to a GS1 DataMatrix barcode</p>	 <p>(01)09506000134352 (01)09506000134352</p> <p>Examples with GTIN text underneath the barcodes</p>  <p>(01)09506000134352 (01)09506000134352 (10)ABC123 (10)ABC123</p> <p>Examples with optional additional data underneath the barcodes</p>
<p>EAN/UPC Product identifier only</p>	<p>GS1 DataMatrix Product identifier + more data</p> <p>Full string inside the barcode: (01)09526000134367(17)301231(10)ABC123</p>	<p>QR Code & Data Matrix with GS1 Digital Link Product identifier + more data + web connectivity</p> <p>Full string inside the barcodes: https://example.com/01/09506000134352/10/ABC123</p>

2. Is the EAN/UPC barcode going away?

No, EAN/UPC and other 1D barcodes, such as GS1 DataBar, are not going away anytime soon. 1D barcodes will exist along with 2D barcodes wherever they are still needed or preferred. If there is no need to add data beyond the [Global Trade Item Number](#) (GTIN) to the barcode (e.g., batch/lot number or expiry date) or enhance consumer engagement through connection to the web, a 1D barcode (EAN/UPC) may still be used.

At a minimum, the GTIN must be in every barcode on-pack that is intended for scanning by consumers or at retail point-of-sale.




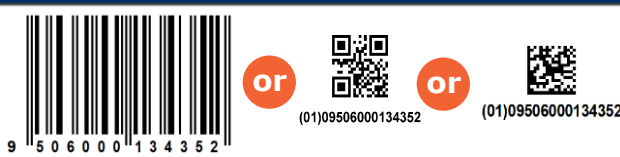
3. Why can I not remove the 1D barcode now?

When using a 2D barcode, a 1D barcode like the EAN/UPC is still needed on-pack for a transition period. This is because not all systems are currently capable of scanning and processing 2D barcodes. This is partly because

2D barcodes cannot be scanned by linear scanners that have been used for 1D barcodes – optical scanning technology is needed. Fortunately, optical scanners are becoming more common in retail, but linear scanners are still in use. For the systems that already have optical scanners, additional updates may be needed to read, process and use the data the 2D barcodes hold.

Point-of-sale systems must be updated to scan 2D barcodes and process, at minimum, the GTIN. Until these updates have been made across all retailers, a dual-marking transition period with a 2D barcode and the existing EAN/UPC barcode is required. This will ensure that advanced use cases can be implemented by retailers who have upgraded their hardware and software, while the existing price lookup function will still work for retailers who have not.

Industry has set the ambitious goal of retail POS scanners globally being capable of scanning and processing 2D barcodes by the end of 2027.

Transition Period	Ambition for 2027
	
Dual-marking transition phase EAN/UPC <i>and</i> a 2D barcode	EAN/UPC <i>or</i> a 2D barcode

4. What do we expect to see in 2027?

The industry-defined goal is to enable the use of 2D barcodes, in addition to existing 1D barcodes, at retail point-of-sales across the globe by the end of 2027. Different regions of the world will move at different paces towards this goal. The Global 2D Programme is working with global communities to coordinate these activities and provide updates on the progress being made.

5. Which 2D barcode should I use?

Organisations looking to implement 2D barcodes need to select a data carrier and syntax based on their business needs and stakeholder capabilities. GS1 recommends actively engaging with partners to ensure the path forward is collaborative and the solutions are capable and compliant.

Capable

- Is the data carrier capable of encoding a GS1 data syntax/format?
- Can the data carrier be created and/or applied at the speed and quality required for the use case?
- Are those intended to interact with the barcode able to process it?

Compliant

- Does the barcode meet regulatory requirements?
- Is the barcode approved for standardised use for your application?

Collaborative

- Have the data, data carrier, packaging, scanning hardware/software and back-end data systems all been considered?
- Have all internal and external stakeholders been brought together to agree on and enable the transition to the future solution? Stakeholders can include industry/trading partners, solution providers and local GS1 Member Organisations. These stakeholders may include those involved with label design, printing, scanning, data storage, processing, etc.

6. How can I stay up to date on 2D barcode developments?

Retail capabilities and use of 2D barcodes on products are expanding every day. The latest information, best practices, tips on running 2D pilots and recent case studies, as well as links to technical testing and tools, are available at www.gs1.org/2dbarcodes. As always, contact your [local GS1 Member Organisation](#) if you have further questions.






Detailed 2D Barcode FAQs

7. What is the difference between the 2D barcode options (GS1 DataMatrix, Data Matrix with GS1 Digital Link and QR Code with GS1 Digital Link)?

GS1 DataMatrix, Data Matrix with GS1 Digital Link and QR Code with GS1 Digital Link are types of 2D barcodes that are all approved for use within the GS1 system for specific applications. At this time, not all retail systems can scan and process 2D barcodes. If using one of these barcodes on a retail POS product, a 1D barcode will be needed until the transition period is complete. See the [transition FAQ](#) for more detail.

All three barcode types are capable of encoding [GS1 Application Identifiers](#) (AIs) like GTIN, batch/lot number, and expiration number. How those AIs are encoded into the barcode changes how they can be used. GS1 DataMatrix uses a data format, called GS1 element string syntax. QR Code and Data Matrix use the GS1 Digital Link URI syntax. In the examples below, the text next to or under the barcodes shows some of the data that is encoded.

GS1 DataMatrix	QR Code	Data Matrix
 <p data-bbox="293 801 458 824">(01)09526000134367</p>	 <p data-bbox="751 824 975 846">(01)00614141999996</p>	 <p data-bbox="1134 824 1358 846">(01)00614141999996</p>
<p data-bbox="185 857 568 880">Uses GS1 element string syntax</p> <p data-bbox="130 909 628 958">Full string inside the barcode: (01)09526000134367(17)301231(10)ABC123</p>	<p data-bbox="842 857 1241 880">Uses GS1 Digital Link URI syntax</p> <p data-bbox="743 909 1340 958">Full string inside the barcodes: https://example.com/01/00614141999996/10/ABC123</p>	

- **GS1 DataMatrix is a variant of Data Matrix** that uses GS1 element string syntax, which is also seen in other GS1 barcodes like GS1-128. This data format is used extensively throughout the supply chain to support getting important data where it is needed in healthcare, with fresh foods, on logistic units and in a variety of other places. It does not offer the web connectivity of QR Code and Data Matrix to enhance consumer engagement. For more information on structure and characteristics, please refer to the [GS1 DataMatrix Guideline](#).
- **QR Code and Data Matrix** use the GS1 Digital Link URI syntax to put data into a web compatible format that also allows the information to be used for traditional supply chain applications like price lookup, while also connecting to the web.
 - **QR Code** is the current preference for consumer engagement because the default camera application on any mobile device in the world can automatically scan the QR Code and connect the user to the website or other resource.
 - **Data Matrix** can also be used to connect users to the web, but not all mobile device cameras can automatically process this barcode type at this time.


***NOTE: What is encoded in the QR Code and Data Matrix barcode is not fully represented in the text that is required to be printed below these barcodes.**



8. How much space will be required on the package for a 2D barcode?

The amount of space required for a 2D barcode depends on what type of barcode is used, how much data is encoded and whether any modifications must be made to the barcode based on the packaging material or shape.

The [GS1 General Specifications](#) contains the minimum and maximum sizes allowed for 2D barcodes used on products scanned at retail point-of-sale in section 5.12.3.1. The below table shows barcodes at their minimum and maximum sizes based on the standards defined in the GS1 General Specifications.

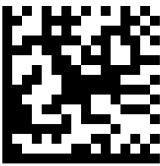


Barcode Type	Encoded Data	Minimum Size	Maximum Size
GS1 DataMatrix	GTIN	 (01)09526000134367	 (01)09526000134367
GS1 DataMatrix	GTIN, sell-by date, batch/lot number	 (01)09526000134367 (16)301231 (10)ABC123	 (01)09526000134367 (16)301231 (10)ABC123
QR Code	GTIN	 (01)00614141999996	 (01)00614141999996
Data Matrix	GTIN	 (01)00614141999996	 (01)00614141999996

Since the size of the barcode will be determined based on the barcode type, amount of data and other factors, the required exact size for your application must be calculated. As mentioned in the FAQ on deciding [which barcode to use](#), it is also recommended that partners are involved to ensure the barcode design, size and quality are capable of serving their purpose.

To ensure that barcodes meet quality needs, it is highly recommended to adopt a barcode verification program. Verification is a process where the barcode is graded based on standardised parameters that determine the likelihood it will scan correctly. Verification can help companies understand the quality of their barcodes, whether trading partners can scan them and what needs to be done to improve them.

9. Can a 2D barcode be GTIN-only?







Yes, 2D barcodes can be GTIN-only. At minimum, a [Global Trade Item Number](#) (GTIN) is necessary in any barcode intended for use at retail point-of-sale. 2D barcodes are smaller than most of their 1D counterparts and can offer a solution for products with limited space. Additionally, putting only the GTIN in a GS1 Digital Link URI syntax format can still provide consumers a connection to the web.

2D Barcodes (GTIN-only examples)	
 (01)09506000134352	 (01)09506000134352
	 (01)09506000134352
GS1 DataMatrix	QR Code & Data Matrix with GS1 Digital Link Full String: https://example.com/01/09506000134352

10. What additional data can be available using 2D barcodes?

The data that is encoded in barcodes and used at point-of-sale will vary based on what use cases are being enabled. At minimum, retail point-of-sale (POS) must be able to process the GTIN from a barcode.

Following is a sample list of applications and the additional data that is commonly used to support industry's retail POS use cases. Syntax and barcode choice may vary depending on your use case. For example, GS1 Digital Link URI syntax is **required** for any use case that includes consumer engagement using a smartphone camera.

Retail POS use case categories	Possible supporting data in addition to the GTIN
 Traceability – product authentication, ingredient sourcing info, supply chain visibility, consumer trust	Batch/lot number, serial number, country of origin
 Sustainability – recycling info, enables circular economy, waste prevention, farm-to-fork	Expiration or best before date
 Inventory management – stock rotation, inventory accuracy, availability and location insight, avoid waste, ensure freshness	Batch/lot number, serial number, expiration or best before date
 Variable measure – account for differences in count, weight, or dimension changes, encode price	Count of Items, net weight, price, expiration or best before date
 Safety – brand integrity, prevent sale of expired or recalled product, fight counterfeiting	Batch/lot number, serial number, expiration or best before date
 Consumer engagement – access to brand authorised info, promotions, recipes, opportunities to engage with the brand	Consumer Product Variant

11. Is there a difference in the way GS1 Application Identifiers are ordered in GS1 element string syntax and GS1 Digital Link syntax? (See question 7 for details on Element string and Digital Link syntax.)

Yes, there is a difference. GS1 Digital Link URI combines existing GS1 identification standards and web standards. This integration of web standards that allows barcodes to link to the web requires GS1 Application Identifiers (AIs) to be in a more specific order than they are in barcodes like GS1 DataMatrix, GS1 DataBar and GS1-128.

While both data formats can encode data such as GTIN, batch/lot number, and serial number, the way the data is encoded is optimised for specific applications. The example below shows how the same data is reordered in the GS1 Digital Link URI to be a web address that can be commonly used everywhere. For more details, see the standard for the [GS1 Digital Link URI syntax](#).

GS1 DataMatrix	Data Matrix w/GS1 Digital Link
	
(01)09506000134352	(01)09506000134352
(17)221225	(17)221225
(10)ABCDEF	(10)ABCDEF
(21)1234	(21)1234

Full String: <https://example.com/01/09506000134352/10/ABCDEF/21/1234?17=221225>

12. What is GS1 Digital Link URI syntax?

The GS1 Digital Link URI syntax standard extends the power and flexibility of GS1 identifiers by defining how to encode the GS1 system of standards into web addresses (URIs/URLs). This makes them natively connected to the web. That means that GS1 identifiers, such as the GTIN, are now a gateway to consumer-facing information that can strengthen brand loyalty, improve supply chain traceability information, business partner APIs, patient safety information and more. The opportunities are limitless!

Where a URL typically points to a single, specific website, the GS1 Digital Link URI syntax enables connections to all types of business-to-business and business-to-consumer information. If you are adding a QR Code to a product, using the GS1 Digital Link URI syntax in barcodes means it will let people easily scan it and be connected to the web. It **also** carries GS1 identifiers – the same identifiers relied on across the supply chain. For more details, see the standard for the [GS1 Digital Link URI Syntax](#).

13. What is error correction?

2D barcodes use what is known as Reed-Solomon error correction. This error correction allows barcodes that have a certain amount of damage or that are otherwise obscured to still be scanned. Error correction is viewed as a benefit of 2D barcodes, as it is not available in 1D barcodes like EAN/UPC or GS1 DataBar.

Implementation and system consideration FAQs

14. Do I have to keep two barcodes on my product for a transition period?

Yes, you can add one of the approved 2D barcodes in addition to your existing linear barcodes (ENA/UPC, GS1 DataBar, etc.) during the transition period.

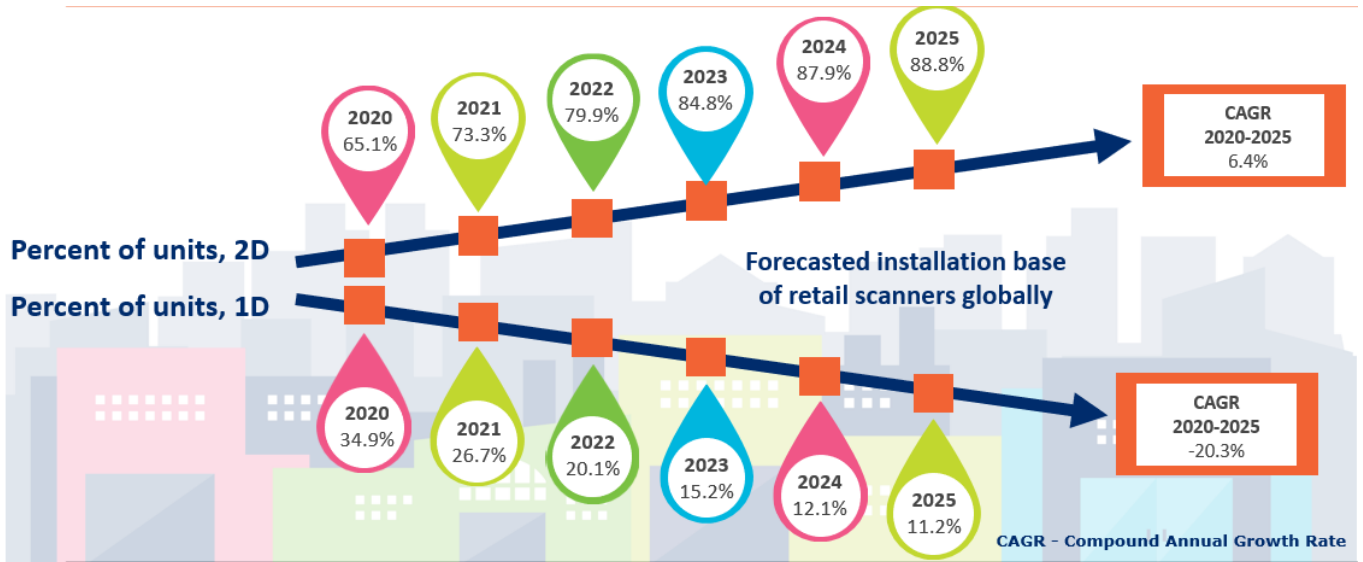
POS systems must be updated to scan 2D barcodes and process, at minimum, the GTIN. Until these updates have been made across all retailers, a dual-marking transition period with a 2D barcode and the existing EAN/UPC barcode is required. This dual marking will not apply to products that are private labels or in scenarios where you are transitioning from a RCN (Restricted Circulation Number) to a GTIN.

15. How will having multiple barcodes on the package and 2D barcodes with more data impact scanning at the checkout?

Results from testing, pilots and implementations have shown that scanning of 2D barcodes with additional data will not cause delays at point-of-sale. To learn more about the latest test results and implementation learnings, visit the [2D in Retail](#) webpage.

16. What are current adoption levels for optical scanners?

A 2021 publication by the technology market intelligence and consulting firm VDC Research forecasts the installed base for 2D stationary POS scanners globally to be over 85% by 2025, with 1D scanners decreasing to less than 15% in the same year (see image below). To read more about scanner adoption levels, visit the [VDC Research homepage](#).



Source: 2021 VDC research for GS1 on global image-based scanner adoption

17. What system updates are needed to scan 2D barcodes?

System updates will vary based on what equipment is already in place and what use cases need to be enabled. Scanning 2D barcodes requires an image-based scanner, so those with older laser-based scanners will need hardware upgrades. GS1 has partnered with scanner manufacturers to ensure that software upgrades ensure optimal processing and scanning speeds. If image-based scanners are already installed, you will need to check with your solution providers to see if software updates can be done to scan the new barcodes and process the data inside of them.

Beyond scanner updates, systems that will store and use the data in the barcode may also need updating. For instance, systems may need modifications to stop the sale of an expired product based on the date in the barcode or they may need to be modified to capture and use a batch/lot number to support recalls.

For resources to help determine what updates may be required, visit [2D in Retail webpage](#) or the [guide](#) for getting started with 2D barcodes at retail point-of-sale. For resources for developers, visit the [GS1 Barcode Syntax Resource](#) page.