BAR CODED BOARDING PASS (BCBP)

IMPLEMENTATION GUIDE

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Seven Edition

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ACRONYMS

Please refer to the glossary in the Appendix A.1 for definitions.

1D	One dimension
2D	Two dimensions
ADL	Additions and Deletions List
ASCII	American Standard Code for Information Interchange
ATB	Automated Ticket/Boarding Pass
BCBP	Bar Coded Boarding Pass
BGR	Boarding Gate Reader
CMOS	Complementary Metal Oxide Semiconductor
CRS	Computerised Reservation System
CUPPS	Common Use Passenger Processing Systems
CUSS	Common Use Self Service
DCS	Departure Control System
DfT	Department for Transport
DPAF	Direction de la Police aux Frontières
DPI	Dots per inch
e-BP	Electronic Boarding Pass
ET	Electronic Ticketing
GPP	General Purpose Printer
IATA	International Air Transport Association
IEC	International Electrotechnical Commission
I.D.	Identification
ISO	International Organisation for Standardisation
PDF417	Portable Data File 417
PECTAB	Parametric Table
PNL	Passenger Name List
PNR	Passenger Name Record
RFID	Radio Frequency Identification
RFP	Request for Proposals
TSA	Transportation Security Administration

1. INTRODUCTION

The content of this BCBP Implementation Guide is intended to be used as guidance material when airlines would like to implement Bar Coded Boarding Pass (BCBP). Please note that this implementation guide should be considered when applicable subject to local requirements.

Additionally, this document complements Resolution 792 by providing further information and examples.

*Note: Version 6th of the implementation guide was omitted to match the RESO792 current version. RESO792 version 7 and Implementation Guide 7th edition are now aligned.

This guide is not a definitive or binding document. In this context, any comments, suggestions or proposals for enhancements are welcome and should be directed to the BCBP group of experts.

1.1. Background

Bar Coded Boarding Pass (BCBP) started as a project as part of the Simplifying the Business program. IATA concentrated its efforts originally on five core projects:

- E-ticketing (ET)
- Bar-Coded Boarding Pass (BCBP)
- IATA e-freight
- Common Use Self-Service (CUSS) Check-in
- Radio Frequency ID (RFID) for aviation

1.2. About Bar Coded Boarding Pass

1.2.1. The BCBP standard

The Passenger Service Conference 2004, in unanimously approving Resolution 792, set BCBP as an industry standard.
The IATA standard known as “Resolution 792 Bar Coded Boarding Pass” defines “the required characteristics of the elements and format of the Bar Code on the Boarding Pass”. Its purpose is to provide solutions for an Electronic Ticket world and to fully replace the previous standard for boarding passes known as “Resolution 722c Automated Ticket/Boarding Pass – Version 2”. The Passenger Services Conference approved in 2008 a sunset date of 31 December 2010, which corresponded to the mandate for 100% BCBP set by IATA’s Board of Governors. It confirms that 100% BCBP corresponds to the elimination of mag stripes for boarding passes.

The BCBP standard defines PDF417, Aztec, Datamatrix and QR code as the symbologies to be used to encode the data on paper boarding passes. The BCBP standard assumes the above symbologies conform to the ISO specification available in the public domain. It also defines that a mobile phone can be used as a boarding pass (mobile BCBP) provided that it can display one of three selected 2D matrix codes (Aztec, Datamatrix and QR code).

1.2.2. The rationale for BCBP

Boarding passes are delivered through four channels: check-in desks, self-service kiosks, web sites and mobile phones. A BCBP can be obtained through each channel (see fig. 1).

Availability of boarding passes per check-in channel	BCBP
Desk	X
Kiosk	X
Web site	X
Mobile	X

Figure 1 - Availability of boarding passes per check-in channel

With the elimination of paper tickets, the boarding document does not carry a flight coupon anymore. This allows a more flexible format for the boarding pass.

The passenger can now print a boarding pass at home, as the document can be printed on simple paper. Passengers can either go to the “bag drop” area or bypass the check-in desks and go directly to security.

Moreover, the boarding pass may now contain all the legs of the journey, instead of one document per leg, as was previously the case.

The main benefits come from the change in the check-in process which:

- Allows passengers to check-in online,
- Simplifies the passenger’s experience and removes airport check-in hassles,
- Relieves congested airport check-in halls,
- Creates new marketing opportunities.

There are also savings coming from the change in the coding technology:

- General Purpose Printers replace boarding passes printers
- Bar code readers replace magnetic stripe readers

1.2.3. Comparison between BCBP and other solutions

There are two main business cases for the adoption of the BCBP standard:

- Either the airline is using boarding passes with magnetic stripes
- Alternatively, the airline is using boarding passes with 1D bar codes.

The following table (see fig. 2) compares the BCBP standard to the 1D bar code, which is not an IATA standard:

Format type	IATA standard 2D bar code	1D bar code
Benefits		
Home Printing	Yes	Yes
Plain paper stock	Yes	Yes
Mobile solution for security points	Yes	Yes
Interlining – through check-in	Yes	No
Multiple segments	Yes	No
Interoperability	Yes	No
Costs		
Low cost equipment	Yes	Yes
Low maintenance	Yes	Yes
Low migration cost	Yes	No
Operations		
Accepted at security in every airport	Yes	No
Installed based in every airport	Yes	Yes
Fall back solution when system fails	Yes	Yes
Innovations		
Allows future use of mobile phones	Yes	Yes
Allows future storage of biometrics	Yes	No

Figure 2 - Comparison table between 2D bar code and 1D bar code

1.2.4. Key differentiators between the IATA 2D standard and the non-standardized alternatives

Differentiator	Description	IATA 2D standard	Non-Standardized Alternatives
Interline through check-in	Boarding passes for the entire journey on interline partner flights	The IATA standard enables each interline through check-in partner to issue a standard boarding pass for another segment on a different carrier.	Issuing a boarding pass for a segment requires knowing the type of bar code used by the carrier. Many types of 1D bar codes are used (e.g. code 128, code 2-of-5) and the layout of the data in each code may vary.
Multiple segments	Enables a single boarding pass valid for multiple flight segments on the same journey.	Fitting several segments on one document saves paper, for the customer and the carrier who have to print one page in total	1D bar code documents can also handle only one segment.

		instead of one page per segment and reduces hassle for the passenger.	
Interoperability	The systems operate together correctly on Common Use systems.	The standard guarantees that when a carrier wants to issue a 2D bar coded boarding pass in an airport, it can rely on an IATA standard.	When issuing a 1D bar code the carrier should make sure that the gate readers and kiosk printers are capable of printing and reading the format and layout of the bar code, as well as check that the local DCS/boarding application will handle the data correctly.
Biometrics	Biometrics enable a secure ID check at boarding. A template containing finger print data is stored on the boarding pass.	Storing the image of the fingerprint is only possible on a smartcard. However a template with 256 characters could be used to represent a fingerprint, which could be stored in a 2D bar code, for instance in the individual airline use field.	A 1D bar code is limited to 30 characters on a typical boarding pass and cannot be used to store biometrics.

1.2.5. Main considerations

- Automated Boarding Control: the solutions selected in this comparison have to meet the pre-requisite of Automated Boarding Control as in Recommended Practice 1789. They also need to rely on a mature technology.
- Acceptance at security check points: agents at the security check points today perform a visual check of the boarding pass. Acceptance may be an issue for home printed boarding passes, which are printed on plain paper. If the security staffs are not trained to recognise such documents, they might not let the passenger go airside.
- System failure: The stub of the ATB is the passenger receipt whereas the main part is for the airline's use. If the system fails, the airline can still rely on a manual count of the boarding passes as a fall back flight closing solution. The home printed boarding pass does not provide such a solution, unless the BCBP includes a tear-off part for the airline to use.
- Mobile phones: Using the mobile phone as a boarding pass involves displaying the bar code on the screen of the mobile phone.

2. KEY BCBP COMPONENTS

The BCBP standard covers the data and symbologies for paper or mobile devices to be used as boarding passes. However, it does not cover the distribution methods (how to send the bar codes to the devices) or other aspects of the implementation.

This section describes the technical data elements contained in the BCBP in addition to the various symbologies used.

2.1. 2D bar codes

2.1.1. PDF417

The major element added by the BCBP standard is the two-dimensional (2D) bar code displayed on the document.

There are several bar code generating algorithms, known as symbologies, to encode data into a bar code that is available for public use. One of those symbologies, called PDF417, widely used for logistics and access control applications around the world, has been selected in the BCBP standard. Read more about PDF417 in the Appendix C.

PDF417 was chosen initially as it was the first open standard that became available and able to cater for multi leg flight information.

Figure 3 shows an actual PDF417 bar code from a British Airways Bar Coded Boarding Pass containing the following data:

M1LEOPOLD/EMR EZQ7O92 GVALHRBA 00723319C002F00009100

Figure 3 - Example of a PDF417 bar code courtesy of British Airways

The BCBP standard enables the encoding up to four flight legs in the same BCBP. The multiple flight capability reduces hassle for the passenger who needs just one document for the whole journey. Multi-leg boarding passes enabled by the M format are explained in more details in the ‘data format’ section.

In order to ensure interoperability, data encoded into the 2D bar code should strictly comply with the IATA standard.

It must be noted that PDF417 is not scalable for large amount of data especially for a trip containing four leg segments with all conditional elements filled-in.

2.1.2. Aztec

Aztec is one of the three symbologies selected in the BCBP standard for mobile and printed boarding passes. The Aztec code is defined in the ISO standard 24778. Aztec codes are square, with a square bullseye pattern in the center.

Figure 4 - Example of an Aztec code courtesy of Air France / KLM

The storage capacity of Aztec enables to encode 900 alphanumeric characters in an 83x83 cells code.

Matrix codes, like Aztec, fit more easily on the screens of mobile phones than linear codes, simply because most screens are squarer than linear. The finding pattern in the center makes it also easier to read because the center of the screen is less likely to be affected by a lens than the edge of the code.

Notes

- The three 2D matrix codes selected in the BCBP standard are all ISO standards, in the public domain, that can be used free of charge (no licence fee).
- More details about the symbologies can be found in the Appendices D, E and F.

Recommendations

- Airlines can choose any of the three symbologies for their mobile boarding passes. The choice can be based on regional preferences (e.g. QR in Asia), on technical preferences (e.g. Aztec finding pattern in the centre) or other considerations (e.g. the airline previous experience with one symbology). *Note Airlines can choose any of the four symbologies for the printed boarding passes.
- Scanners used to read mobile boarding passes should support all of the three symbologies.

2.1.3. Datamatrix

Datamatrix is one of the three symbologies selected in the BCBP standard for mobile and printed boarding passes. The Datamatrix code is defined in the ISO standard 16022. Datamatrix codes are square, with a finding pattern on the perimeter.

The storage capacity of Datamatrix enables to encode 862 alphanumeric characters in an 80x80 cells code.

2.1.4. QR code

QR code is one of the three symbologies selected in the BCBP standard for mobile and printed boarding passes. QR code is defined in the ISO standard 18004. QR codes are square, with a finding pattern in three corners of the matrix.

The storage capacity of QR code enables to encode 938 alphanumeric characters in a code size 17 (85x85 cells) with low error correction.

QR code was designed to support Kanji characters (Chinese characters used in the Japanese writing system).

2.1.5. Size of the bar codes

The size of the bar code is not defined in the standard. This section provides recommendations on the size of the bar code printed on paper.

The bar code should be:

- Large enough to cope with the limited resolution capacity of the readers,
- Small enough to fit within the limited scan width or window size of the readers,
- Close enough to the edge of the page as the foot of a mounted scanner may prevent reading

Bar code size	Min	Max	Average
Number of columns	4	12	7
Number of rows	9	34	18
Length (mm)	29	72	50
Height (mm)	9	22	13
Dim (Height/Rows)	0.35	1.11	0.79

Figure 5 - Bar code average size of BCBP samples

For an optimal read rate it is recommended to design bar codes that aim at the average size above, and to ensure that all the equipment used will produce bar codes within the range above.

Care should be exercised to take the above points into consideration when evaluating the overall dimension of the bar code image after factoring in error correction and non BCBP data that impacts bar code size.

2.2. BCBP Standard (Resolution 792)

2.2.1. Data format

Airline issue one boarding pass per passenger. Before the BCBP standard, airlines issued one boarding pass per flight leg (if an itinerary segment contains two legs with the same flight number, one boarding pass per leg is needed to indicate the seat number). The BCBP standard enables airlines to encode either one flight leg or several legs into a single bar code and boarding pass. The format of the data in the 2D bar code is defined in the BCBP standard. For a definition of terms used in the items, refer to the IATA RP 1008 'GLOSSARY OF COMMONLY USED AIR PASSENGER TERMS'.

Definitions

- "OPERATIONAL LEG" means a flight that is physically operated and identified by its airline designator and flight number. Any other airline designators and/or flight numbers associated with the same flight are considered to be non-operational flights.
- "FUNNEL FLIGHT" means a flight composed of two or more member flights, which is identified by the airline designator and flight number of one of the members. Legs AD and DE comprise Segment AE (ADE), and are identified by the member flight number DL 123.

Recommendation

The standard requires that airlines populate:

- All the mandatory items. If an item is not available at time of issuance of the boarding pass (e.g. seat number for a stand-by passenger), the item should be populated with blanks, so that the number of characters is correct.
- The conditional items available in their system. If an item is not used by the airline system for the flight (e.g. document verification or selectee indicator), the item should be populated with blanks. The size of the field can be defined if some of the last fields are not used.
- The airline individual use item at their convenience. An item defined in the mandatory or conditional field should be encoded in those fields, not in the airline field.

The BCBP standard contains fields and items defined and agreed by airlines. It is in the interest of the airline to strictly comply with the data format, so that interline partners and third parties can read the data. If the data do not comply with the standard format, the passenger will face the consequences of the partner or third party requiring the bar code data, e.g. the operator of a lounge or fast track scanning boarding passes not to grant access to the facility.

There are 3 levels of 2D bar code non-compliance with the BCBP standard:

Level	Description	Consequence
1 - Item formatting	The item is not formatted correctly, e.g. leading zeros or trailing blanks missing	Risk of un-readable value
2 - Item value	The value encoded is not defined, e.g. a proprietary value for compartment code or seat number	Un-readable value
3 - Field formatting	The field does not contain the correct items, or items do not have correct lengths	Un-readable bar code

Attachment A in Resolution 792 defines the formatting of each item. Alpha-numerical items are usually left justified with trailing blanks (e.g. passenger name DESMARAIS/LUC_____), whereas numerical items usually have leading zeros (e.g. seat number 001A).

Attachment C in Resolution 792 defines the values acceptable for each item. For example, the values for the “source of check-in” are defined in this attachment, and the values for the “Baggage tag licence plate number” are in the BSM specifications, RP1745. This is also where the sizes of the variable length fields are defined.

Recommendation

The following fields define a unique BCBP, without storing personal data:

- Date of flight (Julian date)
- Operating carrier code
- Flight number
- Check-in Sequence number
- From city / airport code

Sequence number should be unique for a given flight. However an airline may use a blank sequence number for an infant. The seat (usually INF) number helps to differentiate the infant from the adult.

If a duplicate BCBP is detected at security check:

- It may be that a passenger went airside, came back landside, and returned airside.
- Otherwise the airline and other agents are alerted that there is a duplicate.

Notes on mandatory items (Please refer to Glossary of terms of RESO792)

Note on item 11 – Passenger name

Certain passenger names have specific characters which are sometimes not correctly translated because of host system limitations. Please refer Glossary of terms of RESO792 and to section 2.6 Name Element in AIRIMP to see how to best handle these specific cases.

Note on item 253 – Electronic Ticket Indicator

Field 253 distinguishes passengers traveling on an electronic ticket versus a ticketless product.

Note on item 71 – Compartment Code

This field uses the code of the compartment (call Cabin Type) and not the booking fare class. Please refer to Resolution 728 for the list of codes

Notes on calculations of fields 6, 10 and 17

Note on calculations of fields 6, 10 and 17 (please refer to examples 1 to 6 in Resolution 792)

Item 10 (Field size of following structured message – unique) Size of data used within the subsequent fields (item 15 to 32), in ASCII-printed hexadecimal Item 17 (Field size of following structured message – repeated). Size of data used within the subsequent conditional and airline individual fields. (Item 142 to 254) in ASCII-printed hexadecimal
Item 6. Size of data used within the subsequent conditional and airline individual fields (item 8 to 254, plus item 4) in ASCII-printed hexadecimal

Notes on conditional items

Note on item 12 – Source of check-in

This field reflects the check-in channel where the customer initiated the check-in (e.g. set values of attachment C Reso 792)

Note on item 14 – Source of boarding pass issuance

This field not necessarily needs to be the same as item 12. For example, customer may check-in online but retrieve the boarding pass at the airport.

Note on item 22 – Date of issue of boarding pass (Julian Date)

The Julian date is formed of the last digit of the year the boarding pass was issued and the number of elapsed days since the beginning of that particular year. If the number of elapsed days is less than 10, add two "0" after the year. If the number of elapsed days is less than 100, add one "0" after the year.

Example: 1st of January 2016 shall read as: 6001.
Another example: 31st of December 2016 (leap year) shall read as: 6366.

Note on item 23 – Baggage tag licence plate number (s)

This field allows carriers to populate baggage tag numbers and the number of consecutive bags.
It contains 13 characters corresponding to the 10 digit bag tag number, as per BCM specifications, Reso 740 and 3 digits identifying the number of consecutive tags:

- 1: leading digit – 0 for interline tag, 1 for fall-back tag, 2 for interline rush tag
- 2-4: carrier numeric code
- 5-10: carrier initial tag number (leading zeros)
- 11-13: number of consecutive tags (allows for up to 999 tags)

Example: If the passenger checks in two bags with consecutive numbers (e.g. tag numbers 0016111111 & 0016111112), field no. 23 shall read as: 0016111111002.
Another example: If the passenger checks in one bag (e.g. 0016111111), field no.23 shall read as: 0016111111001.
First consecutive series of bag tag license plate number(s). The last 3 digits of the Baggage tag License Plate Number(s) (field 23) designates the number of bags in that series: 001= 1 bag, 002= 2 bags, 007= 7 bags, etc. If additional tag numbers exist that are not consecutive with the first series, populate field 31 for the next series and field 32 for a third series. A maximum of 3 instances of consecutive bag series per passenger are able to be encoded in the Boarding pass Barcode, using fields 23, 31, and 32 as necessary.

Note on items 31 and 32 – 1st and 2nd Non-Consecutive Baggage Tag License Plate Number

Airlines have the possibility to use fields 31 and 32 when they handle non-consecutive bags. Both fields contain 13 characters corresponding to the 10digit bag tag number, as per BCM specifications, Reso 740 and 3 digits identifying the number of non-consecutive tags.
When fields 31 and 32 are not used, they are not included in the calculation of field 10.

If additional tag numbers exist that are not consecutive with the first series (field 23), populate field 31. The last 3 digits of the Baggage tag License Plate Number(s) (field 31) designates the number of bags in that series: 001= 1 bag, 002= 2 bags, 007= 7 bags, etc. A maximum of 3 instances of consecutive bag series per passenger are able to be encoded in the Boarding pass Barcode, using fields 23, 31, and 32 as necessary.

If additional tag numbers exist that are not consecutive with the second series (field 31), populate field 32. The last 3 digits of the Baggage tag License Plate Number(s) (field 32) designates the number of bags in that series: 001= 1 bag, 002= 2 bags, 007= 7 bags, etc. A maximum of 3 instances of consecutive bag series per passenger are able to be encoded in the Boarding pass Barcode, using fields 23, 31, and 32 as necessary.

Note on item 18 – Selectee indicator

This field is used by some agencies for additional screening and it assists airlines to classify customers that require additional inspection at airports in certain countries.

Best practice
Although field 18 is a conditional field, airlines are required to populate this item if they have the information in their system. If the item is not used by the airline system, the item should be populated with blanks.

Please note the changes made to field 18 in Resolution 792 – since version 6
Although field 18 is a conditional item, airlines travelling in and out of the US need to populate this field as it is a ***mandatory field when United States travel is involved****.*

Example
When the passenger itinerary involves United States travel, this field should be populated with the appropriate value ("0", "1", or "3") which provides the vetting status of the passenger to determine the type of screening the passenger will receive at U.S. airports. Note: The vetting status value definitions are maintained by the U.S. Transportation Security Administration (TSA)

Examples for illustration purposes:

Passenger itinerary #1:
1. Frankfurt (FRA) to London Heathrow (LHR) operated by Lufthansa: No change from Reso 792 - Version 5
2.London Heathrow (LHR) to Dallas Ft. Worth (DFW) operated by United Airlines: No change from Reso 792 - Version 5
3.Dallas Ft. Worth (DFW) to Los Angeles (LAS) operated by United Airlines: Field 18 must be populated

Passenger itinerary #2:
1. New York (LGA) to Chicago (ORD) operated by American Airlines: Field 18 must be populated
2. Chicago (ORD) to Las Vegas (LAS) operated by American Airlines: Field 18 must be populated

Passenger itinerary #3:
1. Denver (DEN) to Los Angeles (LAX) operated by Southwest Airlines: Field 18 must be populated
2. Los Angeles (LAX) to Honolulu (HNL) operated by United Airlines: Field 18 must be populated
3. Honolulu (HNL) to Sydney (SYD) operated by Qantas: Field 18 must be populated
4. Sydney (SYD) to Auckland (AKL) operated by Qantas: No change from Reso 792 - Version 5

Note on item 108 – International documentation verification

This field assists carriers to identify passengers requiring their travel documentation to be verified (e.g. valid travel document).

Note on item 254 – Fast Track

This field reflects if the passenger is entitled to use a priority security or immigration lane.

A fast track is a service offered to selected passengers to bypass the queue at a security checkpoint. An agent controlling the passenger's boarding pass decides whether to grant the access to the fast track. The BCBP enables to automate the control, and consequently to make it self-service.

Notes on airline only use item

Note on item 4 – For individual airline use

Airlines can populate this field with different entries such as but not limited to: frequent flyer tier, passenger preferences, etc.

Notes on security items

Note on item 30 – Security data

The security field is a separate field that enables a third party to verify that the bar code data was not tampered with.

The security field is optional and to be used only when required by the local security administration. Typically, this field may contain a digital signature of variable length, the length of the field and a type of security data (that defines the algorithm used). IATA is only providing the structure for the signature to be stored in the bar code.

The bar code data (mandatory, optional and individual airline use fields) remain unchanged and can be read regardless of the digital signature.

2.2.2. Encoding one flight leg

Please refer to Resolution 792 available at the IATA store

2.2.3. Version management

Resolution 792 was initially published in 2005. In the initial version two formats existed: M and S.
In 2007 the S format was removed from the standard.
In 2008, the standard was extended to mobile phones and some conditional items were added or modified, setting the version number to 2.
In 2009, the version 3 of the BCBP standard includes a new optional security field, to be used where a digital signature is required.
In 2011, the version 4 or the BCBP standard includes NFC format in addition to fields 31 and 32 for non-consecutive bag tags.
In 2013, the version 5 of the BCBP standard includes a fast track field.
In 2016, the version 6 of the BCBP standard includes new values for fields 253, 12 and 18, a glossary of terms and a new example 6 for non-consecutive bag tags.
In 2018, the version 7 of the BCBP standard includes:

- Bar Code on Printed Boarding Pass the default Bar Code presented on printed boarding pass is a 2-dimensional Bar Code in PDF417 standard containing a structure data message (SDM), On the request from the Airlines we will extend the standards to allow Aztec, Datamatrix or QR code formats on printed boarding pass those formats are currently used on Electronic (Mobile) Boarding Pass only.

- Field 23 (Baggage Tag License Plate Number (s)): Last 3 digits have been changed to follow RESO 740/RP1745 where 001= 1 bag, 002= 2 bags, 007= 7 on the version 6th of RESO 792, 000= 1 bag.

- Field 6 (Field Size of variable size field): There was a change in the Implementation Guide where the previous version stated: Items 8 to 118, Plus Item 4, and now Size of data used within the subsequent conditional and airline individual fields (items 8 to 254, plus item 4) in ASCII-printed hexadecimal. If not used, enter “00.”

- Field 10 (Field Size of following structured message - unique): There was a change in the Implementation Guide where the previous version stated: Items 15 to 23 the updated version: Size of data used within the subsequent fields (items 15 to 32), in ASCII-printed hexadecimal. If not used, enter “00.” Should only count for the length of the conditional data identified as unique. In other words, it is the sum of the length of items 15, 12, 14, 22, 16, 21, 23, 31 and 32."

Recommendation

The BCBP group recommends that:

- The effective date of any standard is the date of publication (June), unless mentioned otherwise.
- Airlines should support the latest version and the previous version - currently 5 and 6 - to allow for stakeholders to implement the new version.
- The best practice should be for airlines to support a new version no later than 1 year after it becomes effective.

2.2.4. E-Ticket Itinerary receipt

The BCBP standard allows including a 2D bar code on the ET Itinerary Receipt. The mandatory data should all be populated except seat number and sequence number, which are available only at time of check-in. However airlines offering seat pre-assignment are able to populate the seat number. In the conditional data, only the item 16 'Document type' must be populated, to indicate that the document is an Itinerary Receipt, not a Boarding Pass. All the other fields are optional.
Resolution 722f – Electronic Ticket Airline (6.2.1.7) and Resolution 722g – Electronic Ticket Neutral (6.2.3.8) confirm this possibility from a ticketing perspective.

2.2.5. Digital signature

The security field is optional and to be used only when required by the local security administration. Typically, this field may contain a digital signature of variable length, the length of the field and a type of security data (that defines the algorithm used).

When it is used, the digital signature is part of a public key infrastructure (PKI): the airlines own their private key, used to generate the digital signatures, and distribute their public keys to third parties who need to verify the signatures.
Each signature is unique to an airline and a boarding pass: if the bar code data are modified, they won't match the signature any more. Moreover a signature cannot be generated without the private key. Consequently only an airline can generate a boarding pass with a digital signature and the bar code cannot be tampered with.

2.2.6. BCBP XML

The BCBP Working Group owns the business requirement document that defines the exchange of BCBP data between an airline system and a third party, e.g. an airport security checkpoints. The BCBP standard notes that IATA AIDM message standards shall be used for the exchange of BCBP data. AIDM is defined under Resolution 783 – Passenger and Airport Data Interchange Standards.

The message sent by the authority scanning the BCBP contains a header and the bar code data, as outlined below. Some items are mandatory because they enable to identify the originator of the message.

Field Name	M / O	Description	Example	Format	Subtype	Note
TRANSACTION_DATE_TIME	M	Message creation date/time (includes seconds and sub-seconds)		xsd:dateTime		Expressed in UTC time or local time.
AIRPORT_CODE	M	Airport 3 letter code where the BCBP is scanned	LHR	string		
TERMINAL_CODE	O	Local code identifying an airport terminal	T3	string		Terminal identification where multiple terminals exist under one airport code
ORIGINATOR_TYPE	M	Type of entity that scanned the BCBP and is sending the message	Security	string	IATA codeset	Airport, Security, Ground Handler, Lounge, Parking, Hotel…
ORIGINATOR LOCATION	O	Location of entity performing the scan functions	Point A	1-70an		e.g., Lufthansa Senator Lounge
DELIVERING_SYSTEM	O	Identifier of the delivering system of the data if different from the originator (e.g. same system provided to two carriers on different contracts, need to identify which participant is sending the message)	TBD	TBD		Inverted form of the domain name. ex: gov.ca.sfo or com.united
TRANSACTION IDENTIFIER	M	A unique identifier to relate all messages within a transaction	Integer > 0	String 32		Used by sender to uniquely identify each message sent
AGENT ID	O	Agent sign id				This would be the agent signed in using the system doing the scanning ,when available
BARCODE_DATA	M	Data contained in the barcode		Base64binary		Some non printable data

The airline system receives a message and sends back a reply, as outlined below.

Field Name	M / O	Description	Example	Format	Subtype	Note
Reply	M	Yes or No		Boolean		
Reason code	M*	Code for the reason of a 'no' reply		Integer		
Free text	O	Free text provided by the airline		String		

Notes

- The scope of the BCBP XML business requirements document is to define the format of messages exchanged between an airport security checkpoint and an airline system when a BCBP is scanned.
- The scope is not to define how security agents decide which passenger can go through the checkpoints and how to communicate their decisions with the passengers. The BCBP XML messages do not interfere with the existing security processes.

For more information on the IATA Airline Industry Data Model

Recommendations

- The BCBP XML schema is published to ensure that the airlines and third parties who wish to exchange BCBP data always do it in a consistent manner, to avoid unnecessary duplication of efforts, potential misinterpretations and associated costs.
- However the development of data exchange should be based on a multilateral local agreement. The BCBP XML schema is not encouraging such agreements, but wherever those agreements take place it recommends the most efficient implementation.
- The message sent back by the airline system validates the authenticity of the bar code and the readiness of the passenger to fly. However the decision to let the passenger go through the airport security checkpoint remains an airport security's decision. It is also the airport security's decision to provide the passenger with explanation in case of refusal.

2.3. Boarding pass

2.3.1. Check-in data

When the boarding pass is issued at check-in, the IATA standard requires the input of some specific data. Here is a typical flow of data introducing the PNR code (see fig. 11).

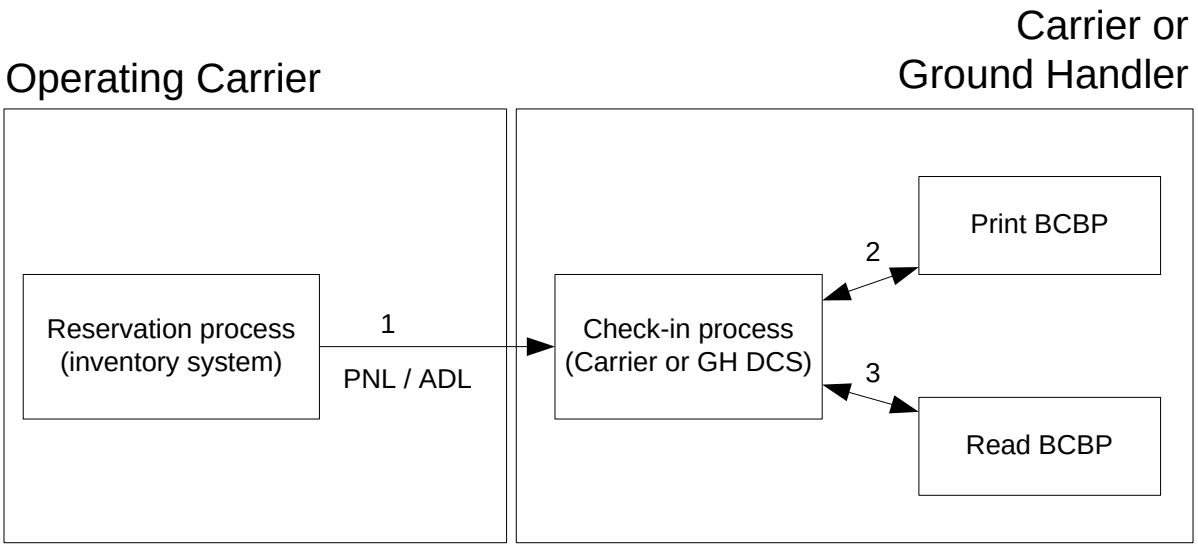


Figure 6 - Data flow of passenger information at check-in

1. The reservation process of the operating carrier sends the Passenger Name Records (PNR) to the check-in process
2. The check-in process enables the printing of the BCBP, either at check-in desk, kiosk or on the web. Once the passenger is checked-in, a message is sent back to the check-in process
3. The BCBP are read at the gate, messages are sent back as flown

The content of the Passenger Name List (PNL) and the Additions and Deletions List (ADL) are described in the Recommended Practice 1708.

2.3.2. Layout of the boarding pass

Unlike Resolution 722c for ATB, Resolution 792 for BCBP does not define a standard layout of the boarding pass. However the BCBP layout does have some constraints in order to guarantee readability. As layouts may vary from one airline to another, staffs need to be trained to read and accept the new documents.

The sections below provide recommendations to facilitate the implementation and interoperability of BCBP.

2.3.3. Mandatory text

Recommended Practice 1706d, attachment A defines mandatory fields to be printed on a boarding pass as this could have an influence on the size and positioning of the bar code.

It is recommended to use a bigger font for:

- Key passenger information such as boarding time and seat number
- The ET logo so that the ground handlers do not look for the coupon

2.3.4. Size of the boarding pass

Two sizes are currently used by IATA member airlines: the A4 or letter size and the identification card size.

Size	Description	Dimensions
A4 / Letter	- The international standard is ISO 216, which defines A4, amongst other - In the US, Letter is the most commonly used size	A4: 21 x 29.7 cm Letter: 8 1/2 x 11 inch
Identification card	Defined in ISO 7810. ID-1 is commonly used for banking cards, driving licenses, loyalty cards and business cards	8,56 x 5.40 cm 3.37 x 2.12 inch

There are several advantages to this smaller size and one potential drawback. Passengers will find it easier to store a credit card in their wallet (no need to fold) than folding an A4 page twice. It also saves paper at the kiosk by 75% or increases the paper capacity of the kiosk by 300%. The limit to this size is the quantity of information to be printed and the space available of the bar code.

2.3.5. Boarding pass for infants

Airlines have different procedures regarding boarding passes and infants. When an adult travels with an infant, some airlines deliver one boarding pass for both the adult and the infant, whereas some airlines deliver two boarding passes, one for the adult and one for the infant.
In the first case, item 15 (Passenger description) should be set to the value 6 (adult with infant), and in the second case, the value would be 0 for the adult boarding pass and 4 for the infant boarding pass.
This item may be useful in particular for security checkpoints and self-boarding gates. Security checkpoints that require scanning one boarding pass for every individual, adult or infant, and are looking for duplicates, are likely to reject the infant on the ground that the same name / seat / flight was already scanned (from the adult boarding pass). Item 15 may prevent this issue. At a self-boarding gate, the item 15 set to 6 may allow a passenger carrying an infant to use the gate, rather than scanning two boarding passes.

Recommendation

It is recommended that:

- Airlines issuing a separate boarding pass for infants enter INF in the seat number
- Airlines issuing a unique boarding pass for the adult travelling with an infant enter the value 6 in the item 15 of the bar code

2.4. Mobile and Web BCBP

When you check in online (web check in), it reflects the status of the passengers and a lot of the fields will be unknown or reflect the condition at that particular moment. If the Boarding pass is

not re-issued / refreshed, fields would not be updated (e.g. passenger status, baggage tag license plate number).

Web page examples can be found under Appendix B – BCBP Sample.

2.5. Mobile BCBP

2.5.1. Selecting a symbology

New symbologies, known as matrix codes, were needed because PDF417 is not adapted to being displayed on a screen. There are dozens of matrix codes available in the market. IATA has selected 3 symbologies because they are all ISO standard available in the public domain, widely used around the world, however IATA has no preference for one of the 3 symbologies.

The arguments for each symbology are:

- Aztec: no need for a quiet zone, finding pattern in the middle, both should make it easier to read on mobile
- Datamatrix: well supported and used in various industries
- QR (quick response): quick to read, widely used in Asian countries

Airlines may choose any of them according to their preferences. The data encoded in the bar code will be the same, independently of the bar code selected. The scanners should be able read any of them, and they are equally supported by handsets.

2.5.2. Sending a 2D bar code to a mobile device

Sending a 2D bar code to a mobile device depends on:

- The mobile network
- The handset
- The transmission (e.g. SMS / email/ application / MMS)

The tables below evaluate the pros and cons of the 4 potential transmission channels, not including price and penetration, which depend on each country.

SMS link

In this scenario, a link is sent by SMS. The passenger clicks on the link, which opens a connection to download a page on the phone, containing the 2D bar code.

Pros	Cons
Robust enough to incorporate airline branding No content limitation (within screen display and device memory) Easy storage to mobile device wallet (e.g. Apple Wallet)	Need mobile data access to download

Email

In this scenario, the email contains all the flight related information, as well as the 2D bar code as attachment.

Pros	Cons
Robust enough to incorporate airline branding No content limitation (within screen display and device memory) Easy storage to mobile device wallet (e.g. Apple Wallet)	Needs bar code optimisation for screen Low control over how the barcode is displayed Limited support on mobile devices

Application
In this scenario the passenger has installed an application on the phone. The application has to update the flight details and generate the 2D bar code.

Pros	Cons
2D bar code generated by the application, adapted to the size of the screen Robust enough to incorporate airline branding No content limitation (within screen display and device memory) Easy storage to mobile device wallet (e.g. Apple Wallet)	Requires upfront installation by the user Limited support on mobile devices

MMS (Multimedia Messaging Service)
In this scenario the 2D bar code is embedded as an image in the MMS.

Pros	Cons
Actual image could be sent in the message	Regional differences in coverage Some countries may require special permissions to deliver MMS

2.5.3. Size of the 2D bar code displayed

The number of cells of the bar code depends on the number of characters encoded:

- Number of chars * symbology = number of cells

The number of pixels used depends on the number of pixels available on the handset.

- Number of pixels per cell * number of cells = number of pixels

The physical size of the bar code displayed on the handset depends on the resolution of the handset, i.e. the size of each pixel

- Size of pixel * number of pixels = physical size of bar code

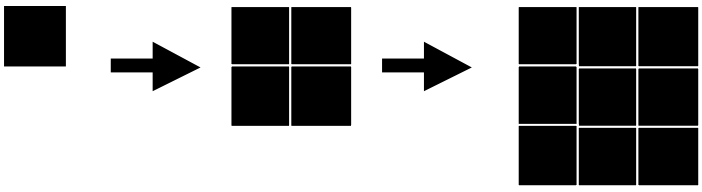


Figure 7 - One bar code cell displayed in 1, 2 or 3 pixel width

It is possible to optimize the size of bar code by increasing the number of pixels per cell (see fig. 12). Reading a bigger bar code should be easier for a scanner, although tests performed by

IATA Strategic Partners did not validate it. If the bar code is smaller due to the high resolution of a particular device, then it may not scan.

2.5.4. Reading the 2D bar code from the handset

There are several parameters to consider:

- The size of the screen: must be large enough to fit the 2D bar code
- The features enabled: SMS/MMS/email

It is recommended to test handsets and allow only customers handsets that are supported. Other recommendations include:

- The backlight on the handset is required.
- The passenger should hold the phone.

All scanners are not equal for reading 2D bar codes from mobile phones. There are flat-bed scanners and mounted scanners:

2D BC scanner	Flat bed	Mounted	Comments
Fix length focus	YES	NO	Higher reading speed
Line of sight of BC	NO	YES	Faster detection of BC

When scanning the bar code, the resolution of the 2D bar code matters, e.g. a module read by IER must be at least 0.25mm.

2.5.5. Processing mobile BCBP at the gate

Some airlines have chosen to print a receipt at the gate. This may be done during the transition, but it is not really paperless.
Several reasons have been advanced for issuing a receipt:

- In case of seat change*
- Passenger convenience, who likes to keep a receipt
- Crew convenience, who prefers to see the receipt than read from a phone
- Airline policy, which requires to switch off mobile phones when boarding

Whichever the reason, the goal of mobile BCBP is to go paperless.

**If there has been a seat change (due to aircraft change, standby acceptance or other reason) the system or the agent will adjust seat numbers without passengers being present. All affected passengers are now holding a boarding pass, which has invalid seat assignments. In order to avoid manually reissuing boarding passes at the gate for each passenger (many airports do not even have a boarding pass printer at the gate), the receipt printers issue receipts with the new seat during boarding, following the AEA standard. The receipt printer might be cascaded behind a boarding gate reader or integrated in a self-boarding gate.*

2.5.6. Paper specifications

Paper specifications for kiosks are described in Recommended Practice 1706e including:

- Paper Grammage[1]
- Thickness
- Brightness
- Thermal image optical density
- Thermal image stability
- Plasticizer resistance
- Bar Code scanning

[1] Paper grammage is a metric measure of paper weight based on the same square meter sheet of paper, regardless of paper grade.

- Print head residue

2.5.7. Bar code print quality

The coding of the PDF417 requires several parameters. It is recommended to test the quality of printing with several test flights, on several readers and papers, before using the bar code in production. Here is some guidance on the main parameters:

- Narrow bar (element) size: from 0.25 mm (0.010 in; 10 mil).
- Height: minimum of 6.35 mm (0.254 in).
- Ratio: Wide element to narrow element — not less than 3:1.
- Quiet zone — as measured on the face material:
  - Minimum: 7 times narrow bar (element): 1.778 mm (0.070 in).
  - Preferred 10 times narrow bar (element): 2.54 mm (0.100 in).
- Print Contrast Signal: not less than 80% at a wavelength of 633 nm.

During the test phase, it is recommended to analyze the bar code print quality. ISO/IEC 15415 standard defines the “bar code print quality test specification – Two-dimensional symbols”. The test provides quality grades on various parameters, using scales with grades from 0 to 4 (see fig. 13).

Codeword Yield	Grade
≥ 71%	4
≥ 64%	3
≥ 57%	2
≥ 50%	1
< 50%	0

Figure 8 - Example of grading scale for measuring print quality of a PDF417 bar code

The kind of parameters to be analysed are: codeword yield, symbol contrast, modulation, axial non-uniformity, grid non-uniformity, unused error correction.

2.6. Departure Control System

The Departure Control System (DCS) is an airline's central system for check-in and boarding.

The features offered by a DCS typically include:

- Flight scheduling
- Self-service kiosk and web check-in: displays traveler itineraries, provides interactive seat maps, verifies flight status and generates boarding passes
- Boarding control: Gate reader verifies passenger information before boarding approval, ensures accuracy of flight data, identifies boarding anomalies such as duplicate seats
- Aircraft Load Control

The benefits are:

- Self-service kiosk and web check-in: improve customer service, reduce airport queues
- Boarding control: faster, more accurate closeout of flights

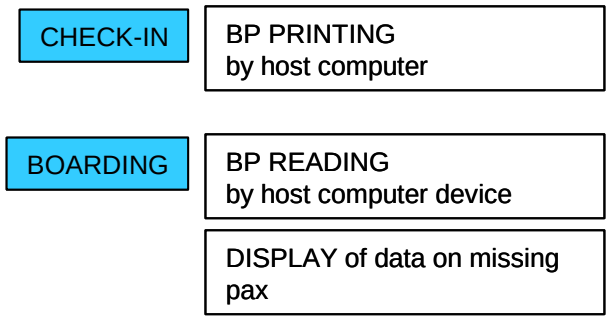
To become BCBP capable an airline has to upgrade its DCS so that it supports the IATA 2D bar code as the default boarding pass solution.

2.6.1. Automated Boarding Control

The Automated Boarding Control (ABC) Recommended Practice 1789 was published by IATA in 1987 and sets the basis for improvement of the:

- Security measures;
- Quality of passenger services functions;
- Accuracy of down-line messages, statistics and revenue accounting;
- Efficiency of airline operations.

Automated Boarding Control (RP1789)



In the Automated Boarding Control process (Recommended Practice 1789), as the host computer prints the boarding pass at check-in and reads it at boarding, it can display the list of missing passengers. Or, if the reader is stand-alone, it can display a list of sequence numbers boarded to identify missing passengers, and the agent can then use the DCS interface to obtain data on missing passengers.

2.6.2. Common Use Systems

CUPPS is a generic airline industry term defined in Recommended Practice 1797 for a facility that allows individual users, through a transparent mode to access their host DCS (see fig. 14),

to make the same entries and to get the same responses as they would through their own terminal equipment, i.e. boarding pass printers and boarding gate readers.

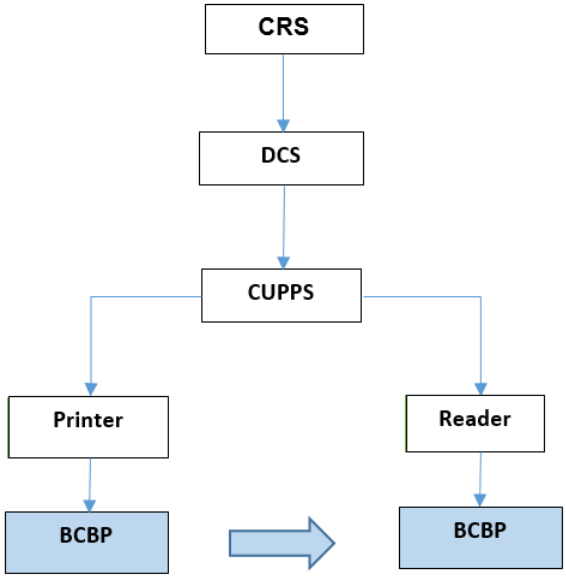


Figure 9 - Data flow in a CUPPS environment

The CRS is the reservation system providing the list of passengers booked for a flight.
The DCS is an application running either on a server that is hosted by the airline in a central location or on a local airport server.

CUPPS is installed in the airport. CUPPS provides a connection to the DCS and to devices such as printers and readers.

The bar code printed on the BCBP contains data coming from the CRS through the DCS and CUPPS. The data, e.g. passenger name, are captured by the reader at the gate and sent back to the CRS.

2.6.3. Fraud Prevention

Ill-intentioned persons may falsify their BCBP by changing the flight number or class of service. They may also simply print two copies of the BCBP and pass one to a friend, or even create a counterfeit BCBP. Technical solutions exist, e.g. algorithms, called certificates, which can for example secure the bar code if necessary.

Risk	Description	Mitigation
Duplicate	2 copies of the same valid boarding pass	Reject second copy of a boarding pass; stop the second person and verify their identity.
Modified	A feature of a valid boarding pass has been modified	- Check that the passenger is on the PNL - Add a certificate to the bar code that proves that the bar code has been modified
Forged	A forged bar code has been created	- Check that the passenger is on the PNL - Add a certificate to the bar code that proves that the bar code is not the original

Of course, a forged BCBP will not entitle the person carrying it with any right to travel, nor will it create any confusion with the system. The official information is stored in the airline's system.

It is recommended that a disclaimer state on the BCBP that the document itself has no value and is being issued for ease of processing only.

At certain airports, there is a link between the security checkpoint and the DCS to validate the BCBP among other things.

3. MEDIA USED AS BOARDING PASSES

The airline industry has decided to use the BCBP standard for 100% of the boarding passes. The BCBP standard is about boarding data: it enables other technologies to leverage on the data. Airlines may decide to use other media as boarding passes.

Passenger Media	Technology	Media Maturity	Technology Maturity
Mobile phone	NFC	Medium	Medium
Iris or fingerprint or Facial	Biometrics	Medium	Medium
E-passport	RFID	Medium	Medium

Notes on maturity:

- *Low: Trial stage*
- *Medium: Used by early adopters*
- *High: Mainstream*

3.1. Mobile phones (NFC)

The concept of mobile Radio Frequency (RF) boarding pass is similar to BCBP, except that the data is stored in a chip. RF is a mature technology, for example for personal access control. Initiatives such as the Near Field Communication (NFC) technology aim at developing contactless identification into mobile phones.

The IATA Resolution 791 'Specifications for airline industry integrated circuit card (ICC) – version 03' defines the use of ICC or smart cards. The purpose of Resolution 791 is to support interline ET. The data contains an element called 'Boarding data' of length 60, which is not sufficient to include the BCBP data. The current ICC standard cannot support the BCBP standard (see fig. 12).

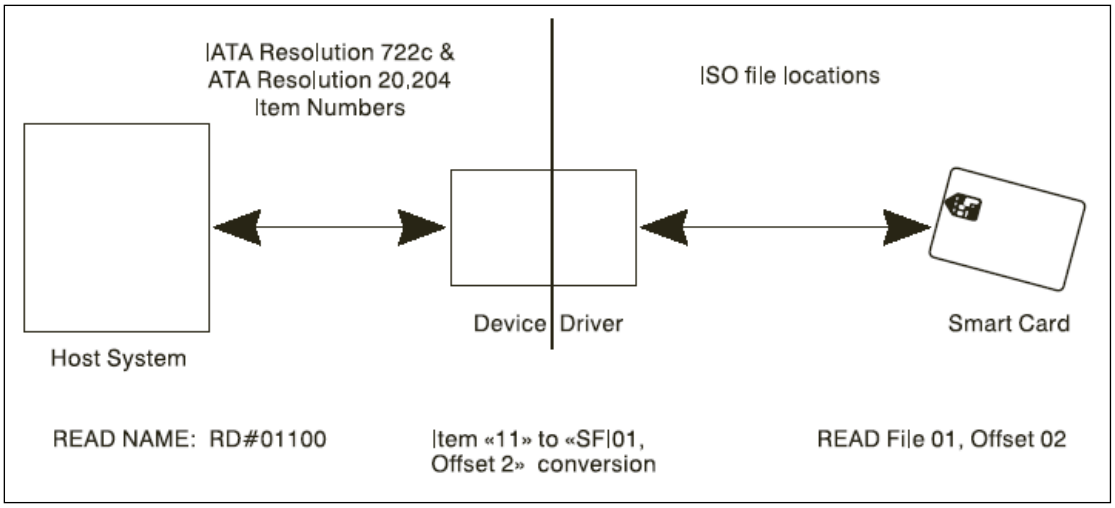


Figure 10 - ICC standard defined in IATA Resolution 791

3.2. Biometrics

In this concept the boarding pass actually becomes a virtual one. By identifying the passenger and matching its biometrics to the database, the boarding system will let him/her get on board or not.

APPENDIX A - RESOURCES

The BCBP standard depends on the work of various groups within IATA, airlines and other organisations and relies on a series of documentation coming from IATA conferences or other bodies for standardisation.

A.1 Glossary of Terms

CARRIER

- Validating Carrier: the airline that sold the ticket and whose numeric code is the ticket number of the flight coupons
- Marketing Carrier: the airline recorded as the transporting carrier on the flight coupons
- Operating Carrier: the airline actually providing the transportation (this may be different from the Marketing carrier in certain bilateral agreements such as code-share situations)

COMMON USE PASSENGER PROCESSING SYSTEMS (CUPPS) describes the range of services, specifications, and standards enacted to enable multiple airlines, service providers, or other users to share physical locations such as check-in desks, bag drops, and gate podium positions either simultaneously or consecutively.

COMPUTER RESERVATIONS SYSTEM (CRS) / SYSTEM PROVIDER means a computerized system containing information about schedules, availability, fares and related services, and through which reservations can be made and/or tickets issued.

DEPARTURE CONTROL SYSTEM (DCS) is an automated method of performing check-in, capacity and load control and dispatch of flights.

DOCUMENT NUMBER is the unique identification number of a traffic document as outlined in Recommended Practice 1720a. The document number comprises the airline code, form code, serial number and a check digit.

ELECTRONIC TICKET (ET) means the Itinerary Receipt issued by or on behalf of the Carrier, the Electronic Coupons and, if applicable, a boarding document.

ITINERARY RECEIPT means a document or documents forming part of the Electronic Ticket, which contains the information and notices required in accordance with Resolutions 722f and 722g.

PASSENGER NAME RECORD (PNR) means a record of each passenger's travel requirements, which contains all information necessary to enable reservations to be processed and controlled by the booking and participating airlines.

PECTAB Parametric Table – a pectab defines the locations on a Boarding Pass where data appears, also for reading.

TICKET means either the document entitled "Passenger Ticket and Baggage Check" or the Electronic Ticket, in each case issued by or on behalf of Carrier, and including Conditions of Contract, notices and the Coupons contained in it.

A.2 Industry Groups

Bar Coded Boarding Pass is a highly multi-disciplinary issue and as such has an impact on many industry functions, practices and standards. The following summarises the main industry groups involved with BCBP:

A.2.1 Joint A4A/IATA Passenger Services Conference (JPSC)

Responsible for the adoption of Resolutions and Recommended Practices specifying standards and procedures on Passenger Services related issues, including the Bar Coded Boarding Pass Resolution.

A.2.2 Passenger Experience Management Group (PEMG)

PEMG reports to JPSC and enables the industry to focus its efforts on standards and solutions aligned to the end-to-end passenger process. It comprises a range of projects to improve the travel experience and help reduce unnecessary operational costs to the industry.

The individual Working Groups within PEMG are:

- Fast Travel
- Common Use
- Passenger Facilitation
- Biometrics

A.2.3 BCBP group of experts

The BCBP group of experts is a sub-group of the Common Use Working Group.

A.2.4 Association of European Airlines (AEA)

Defines standards such as AEA 99 for bar code pectab printing and AEA 2016 SSD for switching pectabs.

A.2.5 International Organization for Standardization (ISO)

ISO and IEC (the International Electrotechnical Commission) form the specialised system for worldwide standardisation. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organisation to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organisations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

A.3 Reference Documents

This document refers to IATA documents as well as other standards. For further information on those documents, it is recommended to contact the publisher directly.

A.3.1 The BCBP Resolution

The IATA standard is published in the Passenger Services Conference Resolutions Manual as Resolution 792 'Bar Coded Boarding Pass'. A copy of the Resolution is provided on the IATA PEMG Extranet which is available to IATA and A4A members, ACI members in addition to IATA Strategic Partners involved in the area of Common Use.

A.3.2 Other Resolutions

Other standards related to our document are published in the Passenger Services Conference Resolutions Manual:

722c	Automated Ticket/Boarding Pass – Version 2 (ATB2)
722e	Automated Ticket/Boarding Pass (ATB) and Multiple Purpose Document (MPD) – Coupon-by-coupon technical specification
728	Code designators for passenger ticket and baggage check
761	Flight numbers
762	Airline Designators
767	Assignment of airline accounting codes and airline prefixes
791	Specifications for airline industry integrated circuit card (ICC) – version 03

A.3.3 Recommended Practices

Also in the Passenger Services Conference Resolutions Manual, we refer to Recommended Practices:

1008	Glossary of commonly used air passenger terms
1706d	Non-ATB document specifications for Common Use Self-Service (CUSS) Kiosks
1706e	Paper specifications – Documents to be printed by a General Purpose Printer (GPP) in a Common Use Self-Service (CUSS) kiosk
1708	Passenger Name List (PNL) and Additions and Deletions List (ADL)
1789	Automated Boarding Control
1797	Common Use Passenger Processing Systems (CUPPS)

A.3.4 IATA Manuals

IATA provides guidance in several manuals available on the IATA online store:

	Airport Development Reference Manual
	Airport Handling Manual

A.3.5 The AEA specifications

Most of the ATB printers follow the specifications from the AEA:

	ATB Technical Specifications (Edition 2016)

A.3.6 The ISO/IEC standards

We refer to the ISO/IEC for standards such PDF417 or the size of paper:

216	Writing paper and certain classes of printed matter -- Trimmed sizes -- A and B series
15415	Information technology — Automatic identification and data capture techniques — Bar code print quality test specification — Two-dimensional symbols
15438	Information technology — Automatic identification and data capture techniques — Bar code symbology specifications — PDF417
16022	Information technology — Automatic identification and data capture techniques — Data Matrix bar code symbology specification
18004	Information technology — Automatic identification and data capture techniques — QR Code 2005 bar code symbology specification
24778	Information technology — Automatic identification and data capture techniques — Aztec Code bar code symbology specification

APPENDIX B - BCBP SAMPLES

The following pages present samples of BCBP either:

- Printed at home: the BCBP printed at home usually fit on a full page, which is larger than the ATB stock
- Printed at a kiosk: the BCBP printed at a kiosk are usually provided on plain paper and in the dimensions of the ATB stock
- Shown on a mobile (e.g. smartphone or iPhone wallet)

We also present alternative bar code and boarding pass formats, for information. There are several 2D bar code standards on the market, such as Datamatrix, QR Code or Aztec. PDF417 is only one of the 2D bar code symbologies, mainly used for access control, whereas 2D matrix codes mentioned above are mainly used in the industry, for small parts marking, for example.

B.1 BCBP printed at home

B.1.1 LH Home Printed Boarding Pass

Nonstop you
Lufthansa
A STAR ALLIANCE MEMBER

Buchungscode:**8OQ6FU**

Boarding Pass

Name	**TEST / HIDDEN MR**		
Flug	**LH4010 / 12.Jan 16** Frankfurt - Rostock/Laage		
Abfluggate	....		
Boardingzeit	**20:30**	Boarding Nummer	**0001**
Abflugzeit	21:00	Fluggesellschaft	LUFTHANSA
Sitznummer	4D	etix	220 2364224106
Klasse	Business	Passagier Status	
Gepäckabgabe	**Gepäckautomat**	Gepäck	

Allgemeine Informationen

1. Dieses Dokument ist Ihre Bordkarte, die Sie für den Zutritt in den Gatebereich und zum Einsteigen benötigen.
2. Bitte führen Sie zusätzlich zu diesem Ausdruck Ihren Lichtbildausweis zur Identitätskontrolle während der Reise mit.
3. Wenn Sie mit Gepäck reisen, geben Sie dieses bitte frühzeitig, bis spätestens 30 Minuten vor Abflug an den oben unter "Gepäckannahme" angegebenen Lufthansa Gepäckannahmeschaltern auf.
4. Bitte seien Sie zur angegebenen Boardingzeit am Abflugsgate, da Ihr Sitzplatz andernfalls erneut vergeben werden kann.

***Bitte beachten Sie mögliche Gate-Wechsel.**

Wichtiger Hinweis:

Eine Reise mit diesem Flugschein kann dem Montrealer Übereinkommen oder dem Warschauer Abkommen unterliegen, die die Haftung des Luftfrachtführers für Verlust oder Beschädigung von Gepäck und für Verspätungen beschränken. Für Tod oder Körperverletzung gelten nach dem Montrealer Übereinkommen und für die Luftfahrtunternehmen der Europäischen Gemeinschaft keine Haftungsgrenzen und entfällt für Schäden bis zu einem 113,100 SZR entsprechenden Betrag der Einwand fehlenden Verschuldens.

Beförderung mit der Deutschen Lufthansa AG unterliegt deren Beförderungs-, Tarif- und sonstigen Bedingungen.

Gefährliche Güter im Passagiergepäck
Aus Sicherheitsgründen darf das Reisegepäck folgende Artikel oder Stoffe nicht enthalten:

Explosivstoffe, Munition, Feuerwerke und Leuchtraketen Gase (entzündliche, nicht entzündliche, tiefgekühlte und giftige), wie z.B. Camping Gas und Aerosol, Kohlendioxyd-Kartuschen, Entflammbare flüssige Stoffe wie Feuerzeugfüllungen, Farben und Verdünner, Entflammbare feste Stoffe (wie Streichhölzer) und andere leicht entflammbare Materialien, Stoffe, die zur Selbstentzündung neigen, Stoffe, welche in Berührung mit Wasser brennbare Gase entwickeln, Oxydierende Stoffe wie Bleichpulver und Peroxyde, Giftige (toxische) Stoffe und Krankheitserreger, Radioaktive Materialien, Ätzendes wie Quecksilber, was in Thermometern enthalten sein kann, Säuren, Alkali und Batterien, nass, gefüllt mit Batterieflüssigkeit, Magnetisierende Stoffe und verschiedene gefährliche Güter, welche in den IATA Gefahrgut-Vorschriften aufgeführt sind. Streichhölzer und Gasfeuerzeuge dürfen nur am
Körper mitgeführt werden.

Figure 11 - Sample of LH Home Printed Boarding Pass

B.1.2 KL – Home Printed Boarding Pass

KLM Royal Dutch Airlines

Boarding pass

NAME PETER TEST

TICKET NUMBER 074 2497067621

Sec.nr.: KL 1733: 001

SCHIPHOL (AMS) AMSTERDAM → BRUSSELS (BRU) BRUSSELS KL 1733

DATE	BOARDING	DEPARTURE	GATE	SEAT	TRAVEL CLASS
19 JAN 16	20:50	21:20	C05	08A	ECONOMY

OPERATED BY KLM ROYAL DUTCH AIRLINES

Baggage drop-off

View the baggage drop-off location on the airport information screens

If you have any check-in baggage please take it to the baggage drop-off point.

1. The check-in desk and baggage drop-off points open from Friday through Monday at 4:30 hours (AM). On Tuesday through Thursday, they open at 5:00 hours (AM).
2. Each piece of check-in baggage may weigh max. 23 kg in Economy Class, and max 32 kg in Business Class (up to 23 kg if you bought an upgrade to Business Class). Extra pieces or excess weight (up to max. 32 kg per piece) you can bring at a fee. Read more about baggage on KLM.com
3. KLM Business Class passengers and Flying Blue Elite - and SkyTeam Elite Plus members are welcome to check in and drop off their baggage with priority, and to use the priority lanes for passport and security checks.

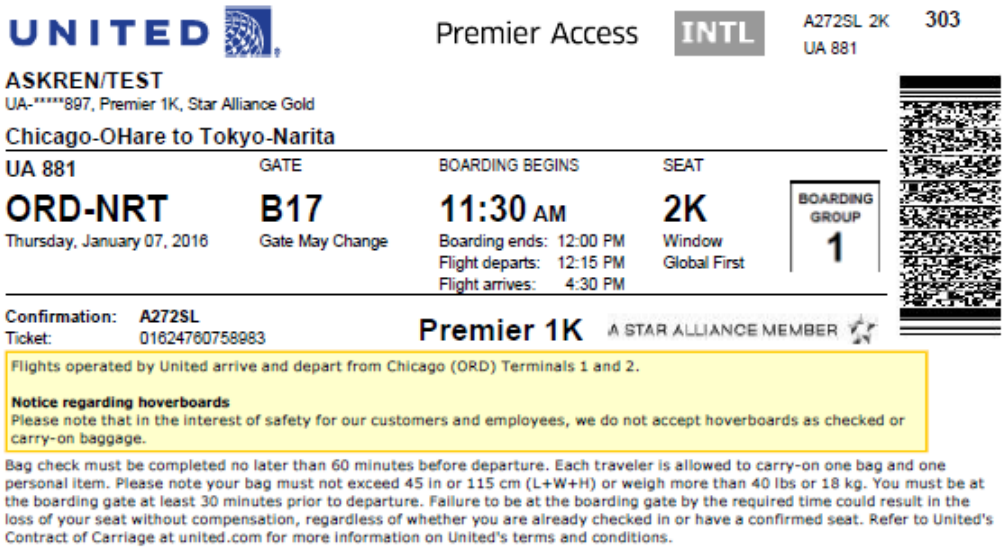
Gate closes 15 min before departure

Check the gate closing time

Please note that after the gate closing time you can no longer board the aircraft. Any check-in baggage will be offloaded.

Figure 12 - Sample of KL Home Printed Boarding Pass

B.1.3 UA – Home Printed Boarding Pass


UNITED

Premier Access INTL A272SL 2K 303
UA 881

ASKREN/TEST
UA-*****897, Premier 1K, Star Alliance Gold

Chicago-OHare to Tokyo-Narita

UA 881	GATE	BOARDING BEGINS	SEAT	BOARDING GROUP
ORD-NRT	B17	11:30 AM	2K	1
Thursday, January 07, 2016	Gate May Change	Boarding ends: 12:00 PM Flight departs: 12:15 PM Flight arrives: 4:30 PM	Window Global First	

Confirmation: A272SL
Ticket: 01624760758983

Premier 1K A STAR ALLIANCE MEMBER

Flights operated by United arrive and depart from Chicago (ORD) Terminals 1 and 2.

Notice regarding hoverboards
Please note that in the interest of safety for our customers and employees, we do not accept hoverboards as checked or carry-on baggage.

Bag check must be completed no later than 60 minutes before departure. Each traveler is allowed to carry-on one bag and one personal item. Please note your bag must not exceed 45 in or 115 cm (L+W+H) or weigh more than 40 lbs or 18 kg. You must be at the boarding gate at least 30 minutes prior to departure. Failure to be at the boarding gate by the required time could result in the loss of your seat without compensation, regardless of whether you are already checked in or have a confirmed seat. Refer to United's Contract of Carriage at united.com for more information on United's terms and conditions.

Figure 13 - Sample of UA BCBP Home Printed Boarding Pass

B.1.4 BA - British Airways Web

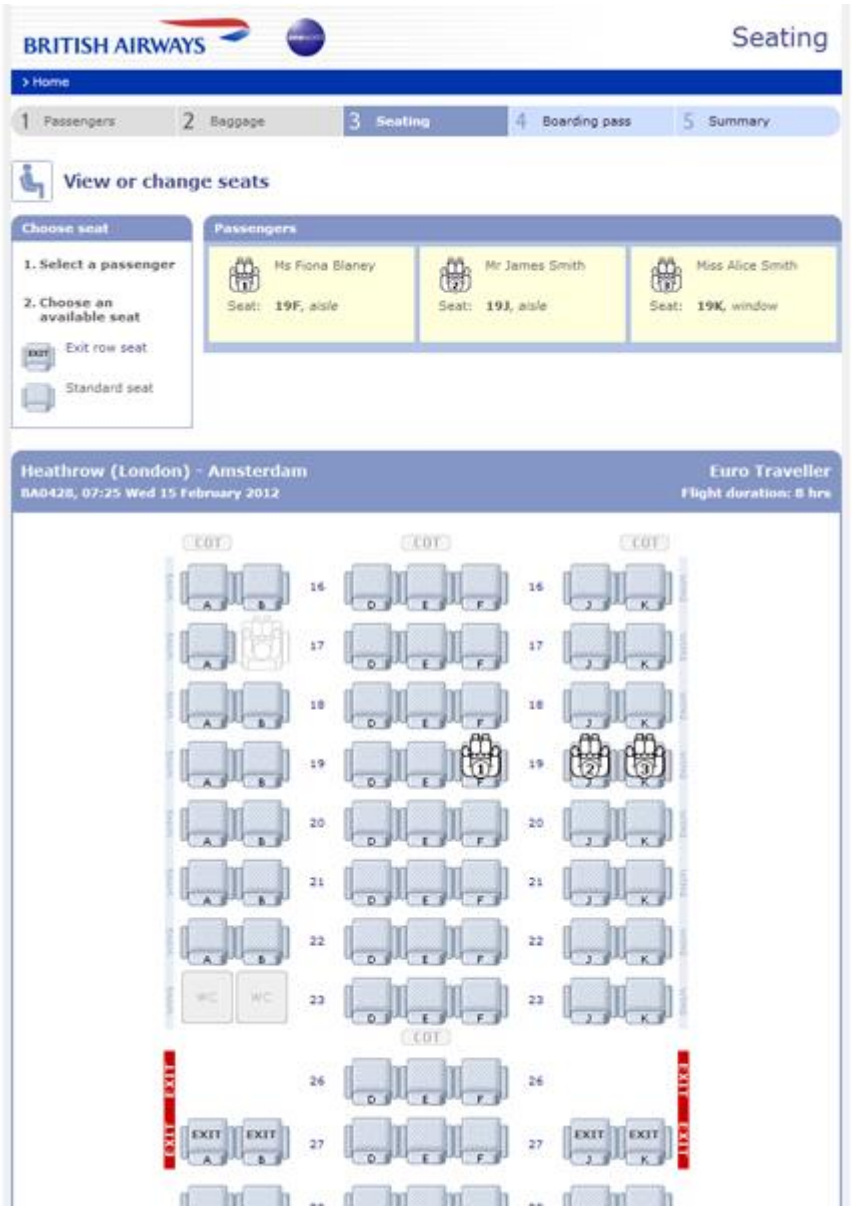


Figure 14 - Example of web check-in seat selection courtesy of British Airways

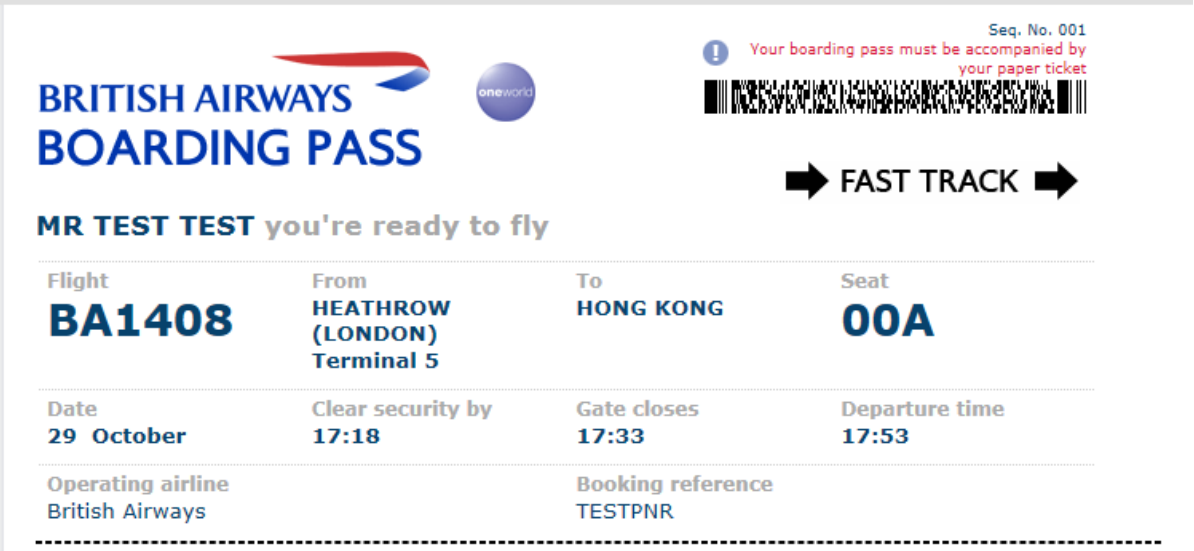


Figure 15 - Sample of BCBP printed from the British Airways web site

B.2 BCBP printed at a kiosk

B.2.1 UA - UA kiosk

Figure 16 - Sample of BCBP printed from the UA kiosk

B.3 Mobile BCBP

B.3.1 LH - Lufthansa mobile BCBP

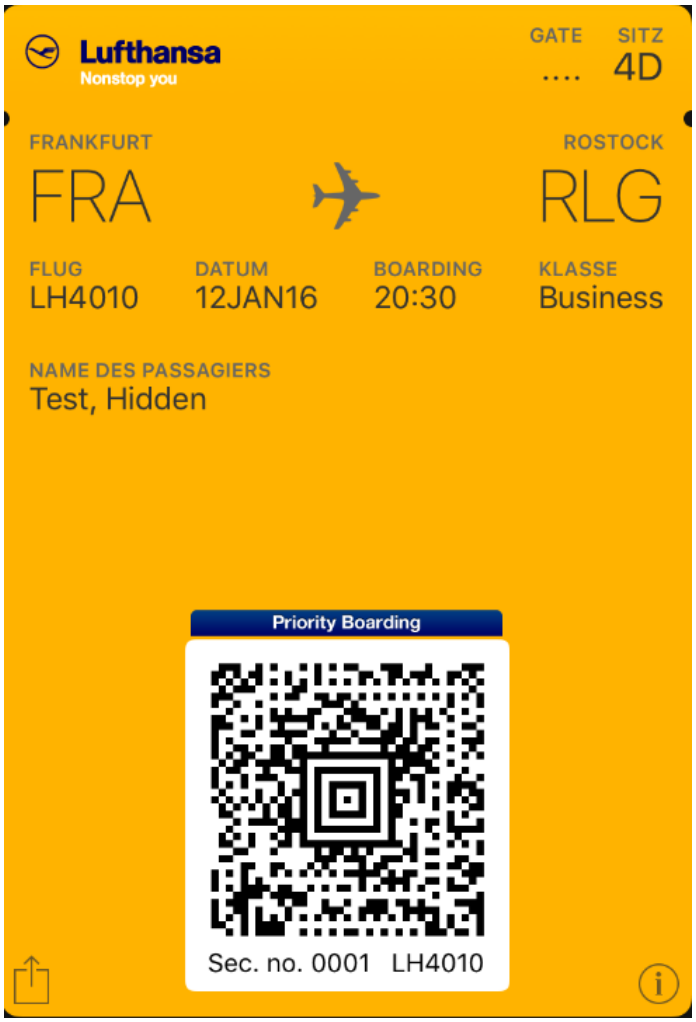


Figure 17 - Sample BCBP iPhone Wallet courtesy of Lufthansa

B.3.2 UA – UA mobile BCBP

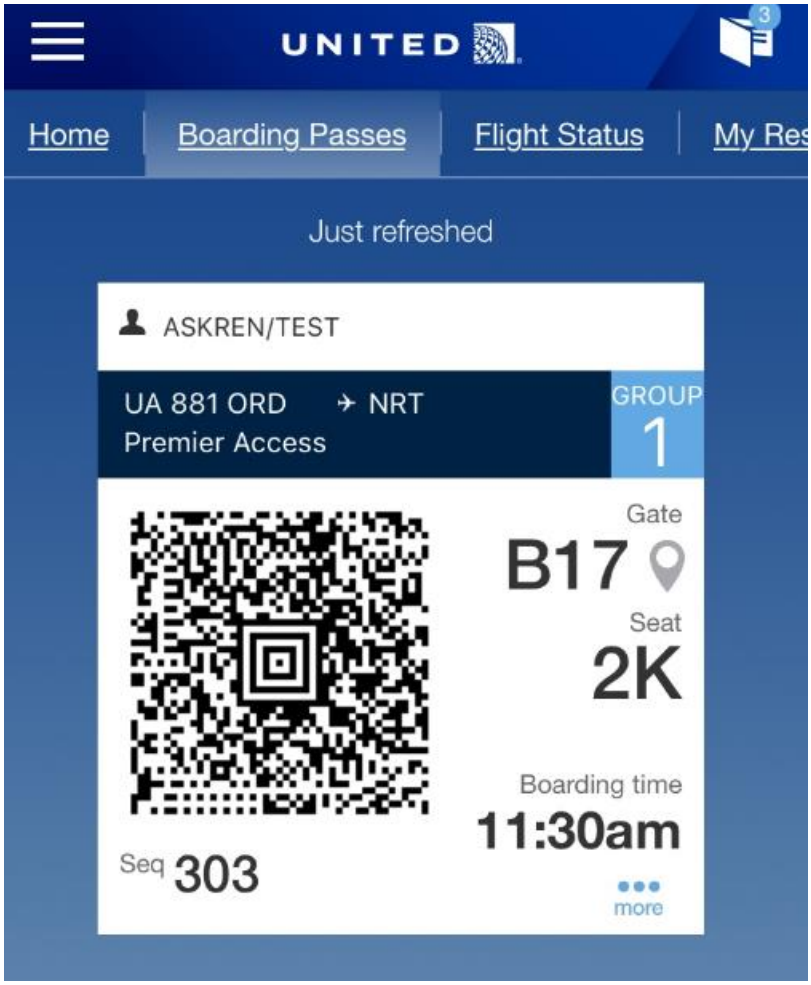


Figure 18 - Sample of mobile BCBP courtesy of UA

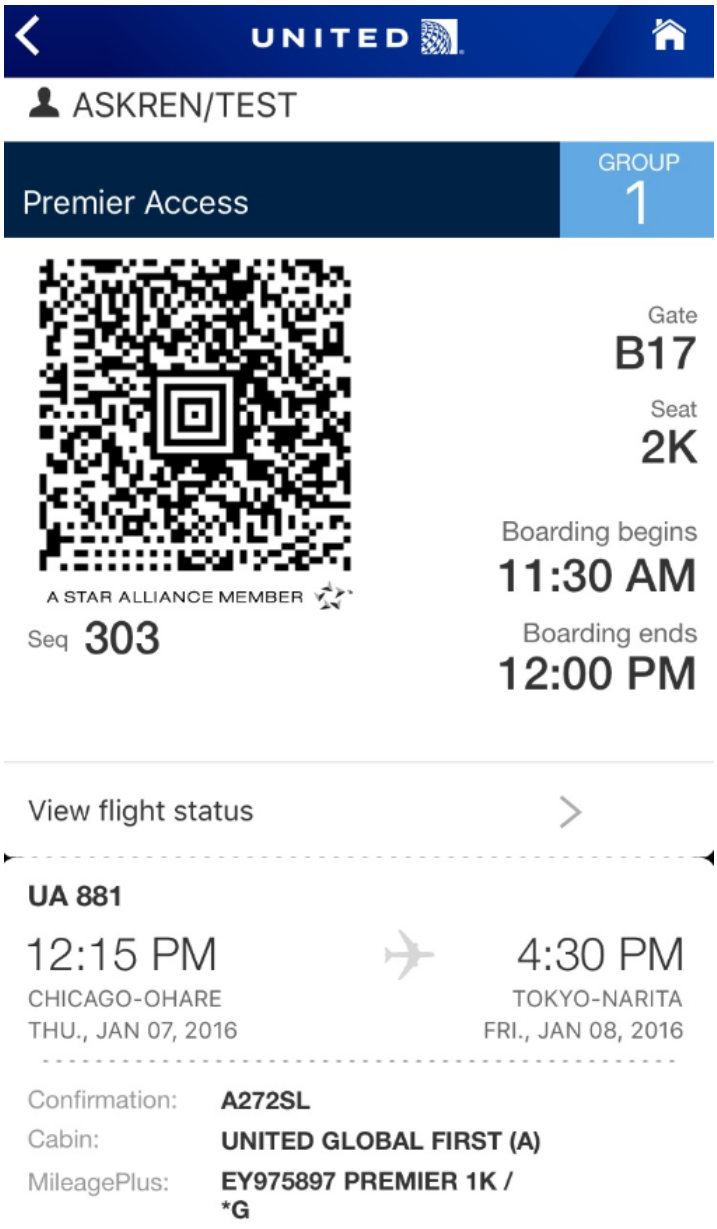


Figure 19 - Sample of UA smartphone full mobile boarding pass

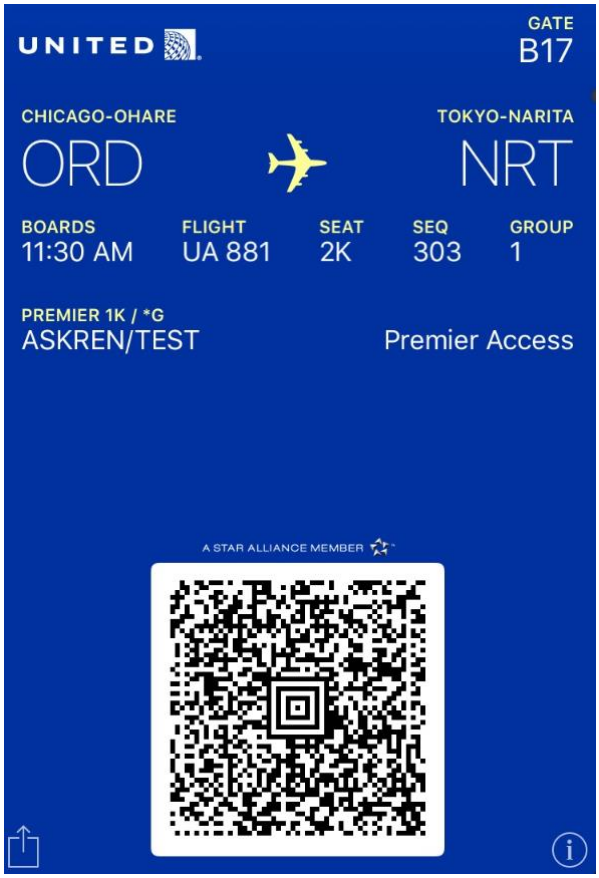


Figure 20 - Sample of UA iPhone Wallet boarding pass

APPENDIX C - PDF417

PDF417 is a standard of the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC), defined in the document ISO/IEC 15438:2001. According to this standard, the PDF417 symbology is “entirely in the public domain and free of all user restrictions, licences and fees”. The specifications of the PDF417 provide all the parameters used to create such a bar code (see fig. 27).

Structure of the PDF417 symbol

Parameter	Definition
Quiet zone	A quiet zone is a blank margin that prevents the reader from picking up information that does not pertain to the bar code that is being scanned. The blank zone will not send any signal, hence the name “quiet”. The symbol shall include a quiet zone on all four sides with a minimum size of 2X (see X definition below)
Start / stop pattern	A special pattern that provides the reader with start / stop instructions as well as scanning directions.
Left / right row indicator	A character that contains information about the structure of the symbol (number of rows and columns, error correction level)
Data codeword	Codewords containing the data. Pad codewords, error correction codewords and function codewords are also generated.

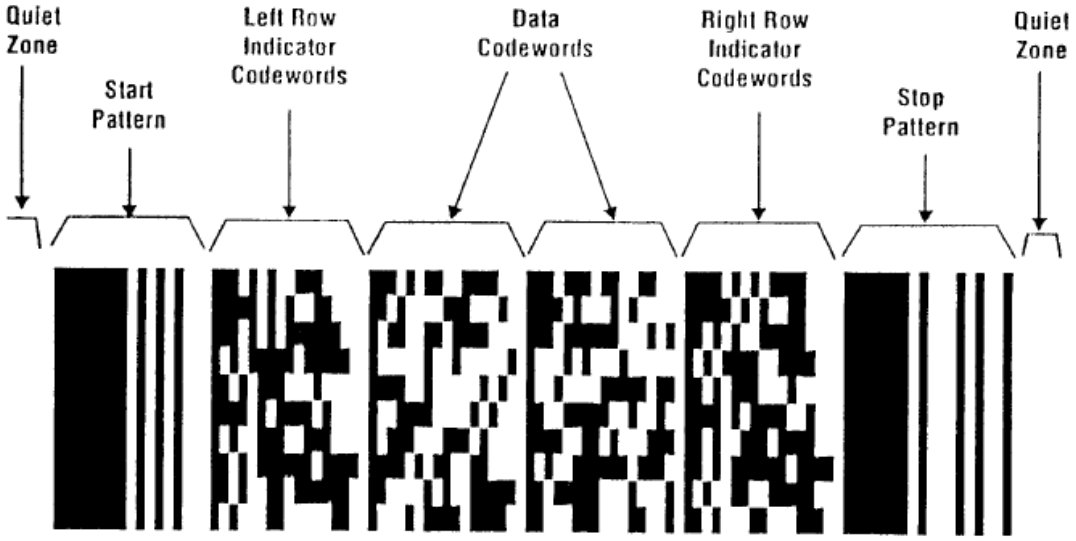


Figure 21 - Structure of the PDF417 symbol as defined in the ISO/IEC 15438

The name of this symbology derives from the structure of the symbol. The codewords are made of blocks containing 17 positions or “modules”. The codewords consist of 4 bars and 4 spaces, each of which can be one to six modules wide (see fig. 28). A codeword is defined by the width of each element, bar or space.

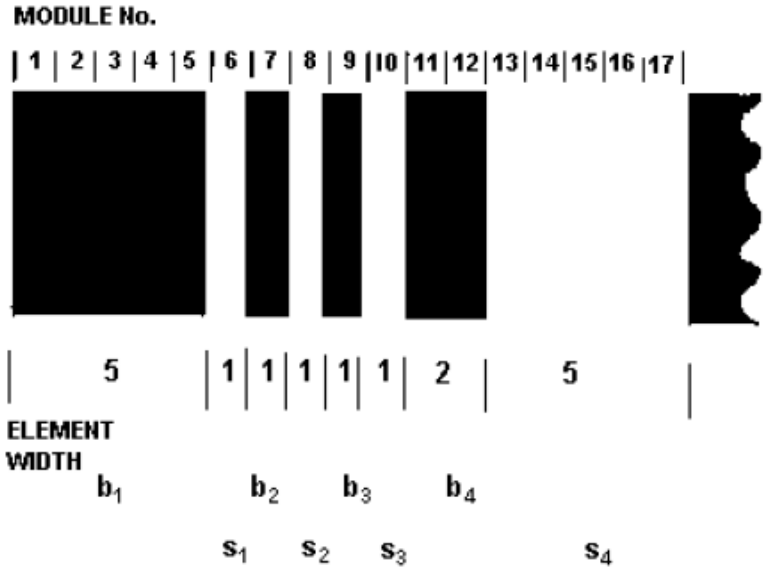


Figure 22 - PDF417 is composed of 4 elements whose widths add up to 17 modules

Parameter	Definition	Recommendation
X	Width of a module. The X Dimension should be constant throughout a symbol	A minimum X dimension is recommended in the IATA standard (see Appendix C)
Y	Row height.	The PDF417 standard recommends that Y ≥ 3X.

Algorithms then relate codewords and ASCII characters. Data compaction schemes are used to achieve high levels encoding. The text compaction mode encodes up to 2 characters per codeword. It includes all printable ASCII characters plus three control characters: tab, line feed and carriage return. In byte compaction mode, the algorithm converts six data bytes to five PDF417 data codewords. In numeric compaction mode, the algorithm converts 44 consecutive numeric digits to 15 or fewer PDF417 data codewords. Numeric compaction is used to encode long strings of consecutive numeric digits.

Although PDF417 is a 2D bar code, it is in reality a stack of 1D bar codes. The decode algorithm uses scan lines which enables laser scanners that read 1D bar codes to also read PDF417 (see fig. 29), whereas the laser scanners would not read 2D matrix codes.

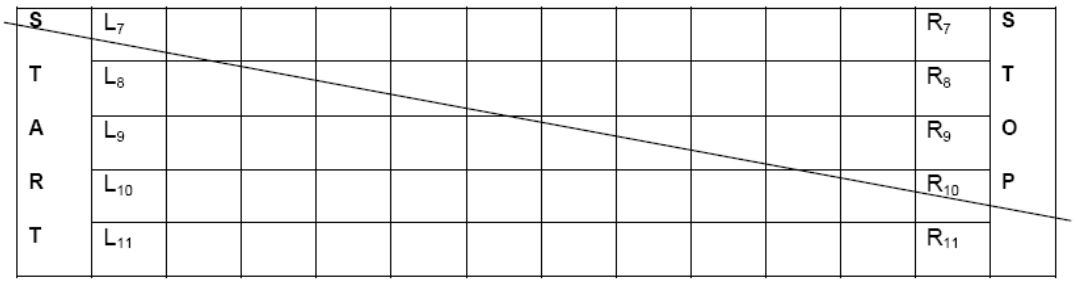


Figure 23 - Schematic showing a scan line crossing rows of the PDF417 symbol

The main reason for selecting 2D bar codes instead of 1D bar codes is that they can store more data in a given space. Airlines can play with the settings to fit as much data as possible on the boarding pass.

Here are some examples of how the size of the bar code varies depending on the number of characters. The settings used for the following examples are:

EC level	3
X dim	0.03cm
X to Y ratio	3
Number of columns	adapted to the number of characters

Example 1:

- Content: 36 characters
- String: QWERTYUIOPASDFGHJKLZXCVBNM1234567890
- Width: 5 Columns
- Size: 4.5 x 1.0 cm
- Bar code:

Example 2:

- Content: 108 characters
- String: QWERTYUIOPASDFGHJKLZXCVBNM1234567890QWERTYUIOPASDFGHJKLZXCVBNM1234567890 QWERTYUIOPASDFGHJKLZXCVBNM1234567890
- Width: 5 Columns
- Size: 4.5cm x 1.5cm
- Bar code:

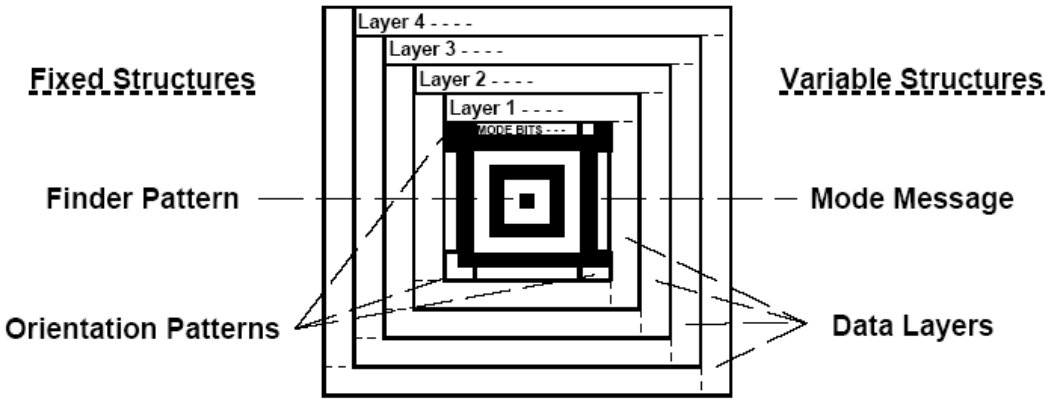
Example 3:

- Content: 324 characters
- String: QWERTYUIOPASDFGHJKLZXCVBNM1234567890QWERTYUIOPASDFGHJKLZXCVBNM1234567890QWERTYUIOPASDFGHJKLZXCVBNM1234567890QWERTYUIOPASDFGHJKLZXCVBNM1234567890QWERTYUIOPASDFGHJKLZXCVBNM1234567890QWERTYUIOPASDFGHJKLZXCVBNM1234567890QWERTYUIOPASDFGHJKLZXCVBNM1234567890
- Width: 9 Columns
- Size: 6.3 x 2.0 cm
- Bar code:

APPENDIX D - AZTEC

Aztec is defined in ISO/IEC 24778.

Structure of code:



Size and capacity:

# of Data Layers	Symbol Size (in x)	Codeword Count x Size	Symbol Bit Capacity	Symbol Data Capacities		
				Digits	Text	Bytes
1*	15 x 15	17 x 6	102	13	12	6
1	19 x 19	21 x 6	126	18	15	8
2*	19 x 19	40 x 6	240	40	33	19
2	23 x 23	48 x 6	288	49	40	24
3*	23 x 23	51 x 8	408	70	57	33
3	27 x 27	60 x 8	480	84	68	40
4*	27 x 27	76 x 8	608	110	89	53
4	31 x 31	88 x 8	704	128	104	62
5	37 x 37	120 x 8	960	178	144	87
6	41 x 41	156 x 8	1248	232	187	114
7	45 x 45	196 x 8	1568	294	236	145
8	49 x 49	240 x 8	1920	362	291	179
9	53 x 53	230 x 10	2300	433	348	214
10	57 x 57	272 x 10	2720	516	414	256
11	61 x 61	316 x 10	3160	601	482	298
12	67 x 67	364 x 10	3640	691	554	343
13	71 x 71	416 x 10	4160	793	636	394
14	75 x 75	470 x 10	4700	896	718	446
15	79 x 79	528 x 10	5280	1008	808	502
16	83 x 83	588 x 10	5880	1123	900	559

APPENDIX E - DATAMATRIX

Datamatrix is defined in ISO 16022.

There are two types: ECC 200, using Reed-Solomon error correction, which is recommended, and ECC 000 to 140, using levels of convolutional error correction.

Size and capacity:

Table 7 — ECC 200 symbol attributes

Symbol size[a]		Data region		Mapping matrix size	Total codewords		Reed-Solomon block		Inter-leaved blocks	Maximum data capacity			% of codewords used for error correction	Max. correctable codewords
Row	Col	Size	No.		Data	Error	Data	Error		Num.	Alphanum.[d]	Byte		Error/ erasure[b]
10	10	8 x 8	1	8 x 8	3	5	3	5	1	6	3	1	62,5	2/0
12	12	10 x 10	1	10 x 10	5	7	5	7	1	10	6	3	58,3	3/0
14	14	12 x 12	1	12 x 12	8	10	8	10	1	16	10	6	55,6	5/7
16	16	14 x 14	1	14 x 14	12	12	12	12	1	24	16	10	50	6/9
18	18	16 x 16	1	16 x 16	18	14	18	14	1	36	25	16	43,8	7/11
20	20	18 x 18	1	18 x 18	22	18	22	18	1	44	31	20	45	9/15
22	22	20 x 20	1	20 x 20	30	20	30	20	1	60	43	28	40	10/17
24	24	22 x 22	1	22 x 22	36	24	36	24	1	72	52	34	40	12/21
26	26	24 x 24	1	24 x 24	44	28	44	28	1	88	64	42	38,9	14/25
32	32	14 x 14	4	28 x 28	62	36	62	36	1	124	91	60	36,7	18/33
36	36	16 x 16	4	32 x 32	86	42	86	42	1	172	127	84	32,8	21/39
40	40	18 x 18	4	36 x 36	114	48	114	48	1	228	169	112	29,6	24/45
44	44	20 x 20	4	40 x 40	144	56	144	56	1	288	214	142	28	28/53
48	48	22 x 22	4	44 x 44	174	68	174	68	1	348	259	172	28,1	34/65
52	52	24 x 24	4	48 x 48	204	84	102	42	2	408	304	202	29,2	42/78
64	64	14 x 14	16	56 x 56	280	112	140	56	2	560	418	277	28,6	56/106
72	72	16 x 16	16	64 x 64	368	144	92	36	4	736	550	365	28,1	72/132
80	80	18 x 18	16	72 x 72	456	192	114	48	4	912	682	453	29,6	96/180
88	88	20 x 20	16	80 x 80	576	224	144	56	4	1 152	862	573	28	112/212
96	96	22 x 22	16	88 x 88	696	272	174	68	4	1 392	1 042	693	28,1	136/260
104	104	24 x 24	16	96 x 96	816	336	136	56	6	1 632	1 222	813	29,2	168/318
120	120	18 x 18	36	108 x 108	1 050	408	175	68	6	2 100	1 573	1 047	28	204/390
132	132	20 x 20	36	120 x 120	1 304	496	163	62	8	2 608	1 954	1 301	27,6	248/472
144	144	22 x 22	36	132 x 132	1 558	620	156	62	8[c]	3 116	2 335	1 555	28,5	310/590
							155	62	2[c]					

APPENDIX F - QR CODE

QR code is defined in ISO 18004.

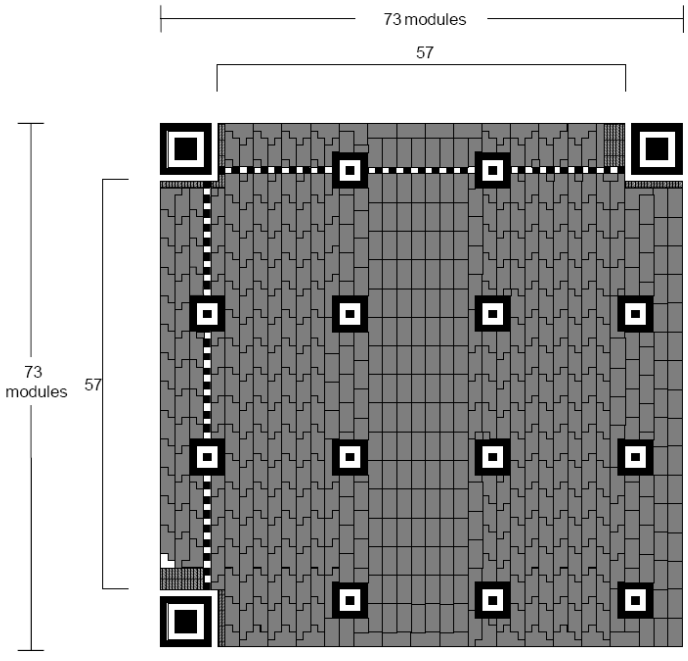
QR code has 4 levels of error correction (Reed-Salomon), allowing recovery of a percentage of codewords

Error Correction Level	Recovery Capacity % (approx.)
L	7
M	15
Q	25
H	30

Encoding Kanji characters

Input character	“点”
(Shift JIS value):	**935F**
1. Subtract 8140 or C140	**935F - 8140 = 121F**
2. Multiply m.s.b. by C0	**12 × C0 = D80**
3. Add l.s.b.	**D80 + 1F = D9F**
4. Convert to 13-bit binary	**0D9F →0 1101 1001 1111**

The size of the code is called a version. Version 14 of QR code has 73 modules:



Version 14

Capacity in codewords :

Table 1 — Codeword capacity of all versions of QR Code 2005

Version	No. of Modules/ side (A)	Function pattern modules (B)	Format and version information modules (C)	Data modules except (C) ($D=A^2-B-C$)	Data capacity [codewords][a] (E)	Remainder Bits
M1	11	70	15	36	5	0
M2	13	74	15	80	10	0
M3	15	78	15	132	17	0
M4	17	82	15	192	24	0
1	21	202	31	208	26	0
2	25	235	31	359	44	7
3	29	243	31	567	70	7
4	33	251	31	807	100	7
5	37	259	31	1 079	134	7
6	41	267	31	1 383	172	7
7	45	390	67	1 568	196	0
8	49	398	67	1 936	242	0
9	53	406	67	2 336	292	0
10	57	414	67	2 768	346	0
11	61	422	67	3 232	404	0
12	65	430	67	3 728	466	0
13	69	438	67	4 256	532	0
14	73	611	67	4 651	581	3
15	77	619	67	5 243	655	3
16	81	627	67	5 867	733	3
17	85	635	67	6 523	815	3
18	89	643	67	7 211	901	3
19	93	651	67	7 931	991	3
20	97	659	67	8 683	1 085	3

Capacity in alphanumeric characters

Version	Error correction level	Number of data codewords	Number of data bits	Data capacity			
				Numeric	Alphanumeric	Byte	Kanji
6	L	136	1 088	322	195	134	82
	M	108	864	255	154	106	65
	Q	76	608	178	108	74	45
	H	60	480	139	84	58	36
7	L	156	1 248	370	224	154	95
	M	124	992	293	178	122	75
	Q	88	704	207	125	86	53
	H	66	528	154	93	64	39
8	L	194	1 552	461	279	192	118
	M	154	1 232	365	221	152	93
	Q	110	880	259	157	108	66
	H	86	688	202	122	84	52
9	L	232	1 856	552	335	230	141
	M	182	1 456	432	262	180	111
	Q	132	1 056	312	189	130	80
	H	100	800	235	143	98	60
10	L	274	2 192	652	395	271	167
	M	216	1 728	513	311	213	131
	Q	154	1 232	364	221	151	93
	H	122	976	288	174	119	74
11	L	324	2 592	772	468	321	198
	M	254	2 032	604	366	251	155
	Q	180	1 440	427	259	177	109
	H	140	1 120	331	200	137	85
12	L	370	2 960	883	535	367	226
	M	290	2 320	691	419	287	177
	Q	206	1 648	489	296	203	125
	H	158	1 264	374	227	155	96
13	L	428	3 424	1 022	619	425	262
	M	334	2 672	796	483	331	204
	Q	244	1 952	580	352	241	149
	H	180	1 440	427	259	177	109
14	L	461	3 688	1 101	667	458	282
	M	365	2 920	871	528	362	223
	Q	261	2 088	621	376	258	159
	H	197	1 576	468	283	194	120
15	L	523	4 184	1 250	758	520	320
	M	415	3 320	991	600	412	254
	Q	295	2 360	703	426	292	180
	H	223	1 784	530	321	220	136
16	L	589	4 712	1 408	854	586	361
	M	453	3 624	1 082	656	450	277
	Q	325	2 600	775	470	322	198
	H	253	2 024	602	365	250	154
17	L	647	5 176	1 548	938	644	397
	M	507	4 056	1 212	734	504	310
	Q	367	2 936	876	531	364	224
	H	283	2 264	674	408	280	173