BAR CODED BOARDING PASS (BCBP)

IMPLEMENTATION GUIDE

Effective Date: 1st June, 2016

Fifth 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.

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 at bcbpexperts@iata.org.

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 as the unique symbology to be used to encode the data on paper boarding passes. PDF417 is an ISO standard bar code 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.

1.2.2. The rationale for BCBP

Boarding passes are delivered through 4 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 via the Internet,
- 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
- Or 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
Fallback 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 instead of one page per	1D bar code documents can also handle only one segment.

		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.
- Equipment installed base: some laser scanners can read only 1D bar codes, some others can read 2D bar codes including the IATA 2D standard and a third category can be upgraded so that it reads 2D bar codes.
- 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. STAKEHOLDER MANAGEMENT

The major stakeholders involved in the implementation of a BCBP project are as follows:

- Airlines
- Airports
- Ground handlers
- Governments (Security, Immigrations, Customs)
- Industry suppliers (DCS, printers, scanners)

3. IMPLEMENTING A BCBP PROJECT

This section provides our recommendations for managing a BCBP implementation project should an airline or airport wish to implement it for the first time. One key issue is to have a team in place with a proper organisation. It is especially true for a BCBP project as it involves multiple disciplines in the company and multiple external stakeholders, all with different motivations. Everyone must understand one's roles and responsibilities.

3.1. The project team

A BCBP project requires various skills and expertise. One needs to make sure that those resources are available for the project and that the roles and the responsibilities of each participant are clearly defined. Typical reasons for slow and uncoordinated projects include:

- Lack of structure
- Lack of definition of the project
- Missing roles and responsibilities
- Missing executive level sponsorship

3.1.1. Participants

The project team will consist of participants coming mainly from 7 departments within the company (see fig. 3). Those persons should dedicate fully or partly to the project and an executive level officer should sponsor the project.

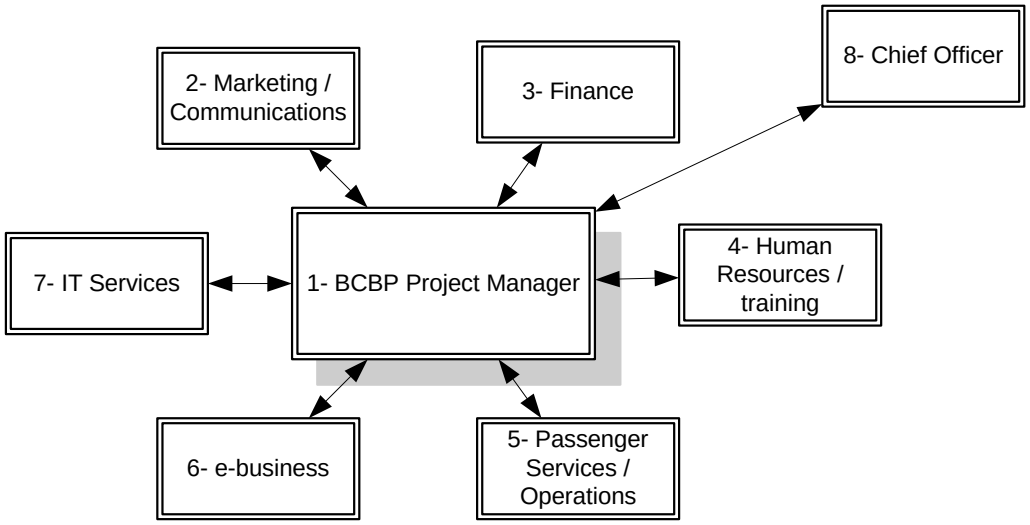


Figure 3 - Organisation of the project team

3.1.2. Roles

The role of the participants should cover the main project tasks. Most roles are straightforward to assign as they relate to participants jobs or activities.

Function	Roles
1- Project management	Business case, planning, budget, coordination, monitoring progress
2- Marketing / Communications	Boarding pass layout, internal and external communication, advertising, launch
3- Finance	Financial evaluations of cost model and requests for proposals
4- Human Resources	Training staff
5- Passenger Services / Operations	Handle the new boarding passes in airports
6- e-business	Upgrade web site
7- IT services	Upgrade information systems such as DCS
* Chief Officer	Sponsoring, stakeholder management

3.1.3. Responsibilities

The project manager needs to define a responsible participant for each task or deliverable. The sponsor of the project may be asked to facilitate this definition.

Function	Responsibilities
1- Project management	Deliver the project within time and budget
2- Marketing	Leverage opportunities of the new boarding pass type
3- Finance	Leverage potential cost savings
4- Human Resources	Facilitate resources to drive the adoption of the new boarding pass
5- Passenger Services / Operations	Support customers and staff in the use of the boarding pass type
6- e-business	Deliver user-friendly and reliable web interface
7- IT services	Deliver a global and compatible infrastructure
* Chief Officer	Set targets, remove roadblocks

3.2. Critical IT infrastructure elements

Boarding passes can either be issued via an airline's web site or at the airport. In the latter case, the check-in is processed either through the Departure Control System or through the systems of ground handlers. Moreover, when interlining with partner airlines, a boarding pass for each segment must be issued.

3.2.1. Risk assessment

A risk that is clearly identified is easier to deal with and to mitigate. Here are some risks related to the project that may occur:

- Airport infrastructures are not ready or not compatible
- Third parties not aligned or not able to support BCBP

- Legal department not aligned
- Customers are not informed correctly and do not use the system properly
- Airline management not on board
- Staff are not aware of the project or procedures

3.3. Roll out

The implementation of a BCBP project involves prototyping and testing of applications, integration with airport environment and other hardware equipment. It is highly recommended to first conduct pilot phases and then proceed to a step-by-step rollout phase, in order to tackle problems and fix them as they occur. Here are examples of steps in each implementation phase.

3.3.1. Pilot phase

The pilot phase should focus on a simple case, for example:

- Enabling 2 stations, i.e. 1 route, with 2D scanners at the gates
- Enabling web check-in on that route
- Limiting the pilot to passengers with carry-on bags only

Enabling a station for web check-in means ensuring home-printed BCBP are accepted at security and immigration, 2D bar code readers are available at the gates and the DCS can handle BCBP data. Depending on web check-in usage, the passengers in this pilot would account for maybe 10% of boarding passes on every flight. The passenger on the flight can easily be checked-in manually in case of a technical problem.

Once an airline has had the BCBP development completed for them by their DCS supplier or in-house DCS team, the implementation at airports around the world becomes a relatively straight forward operation. It depends on the way the DCS application works: it could be as simple as updating the database for the airports to change settings and then ensure they have the correct pectab downloaded for the site, or just changing the data stream at the site. If the development has been completed in the airline host DCS then there is nothing technical required other than the CUPPS administrators or airline DCS team updating the settings.

3.3.2. Roll out phase

The roll out phase will broaden the scope of the implementation step by step:

- Add more stations
- Add desks and kiosks printing BCBP
- BCBP accepted for passengers checking bags
- Add interline through check-in partners

If no agreement exists between interline partners, an ATB2 boarding pass will be issued for checked-through passengers.

3.4. Checklist

The checklist contains 6 steps: Evaluate – Plan – Decide – Develop & Deploy – Train – Communicate. The purpose of this checklist is to help the airlines drive their BCBP project and not overlook any critical elements.

3.4.1. Evaluate

The first phase of the checklist consists of understanding the various requirements of the project and evaluating the status of equipment and resources with respect to those requirements.

The following items are of interest:

Action	Status
Evaluate bar coding equipment (printers, readers): installed base, ownership of equipment, migration plans, selected vendors	
Evaluate IT infrastructure (DCS, web site): capabilities of current versions regarding BCBP, selected vendors	
Evaluate processes and staff (check-in, boarding): training organisation, internal procedures, expertise and resources available	
Assess readiness of external stakeholders (vendors, airports, ground handlers): list of stations, Common Use systems, readiness	
Calculate cost-benefit: market and usage growth assumptions, quotations from vendors or internal department	

3.4.2. Plan

The second phase consists of translating the evaluation into an action plan. The key elements of the action plan are:

Action	Status
Define the objectives the airline wants to achieve in order of priority. It could be cost reduction or improved passenger service for example.	
Define the timing the airline is targeting. Time constraints may come from airport infrastructure, decisions from alliance partners or implementation of e-ticket.	
Assess the benefits expected from the project. It could be facilitation of through check-in or traffic growth at space-constrained airports.	
Assess the costs related to the project. The upgrade of the departure and control system is a potential source of cost if not included in a larger migration process.	
Assess the risks caused by the project. For example, throughput may be slow at the gate if the print quality is not adequate	
Consider the consequences of the airline not following the mandate: compatibility issues in airports, through check-in problems and poor customer service are likely to occur.	
Define the type of team required for the project. Involve IT and web resources, as well as coordinators with airports, ground handlers and governments.	

3.4.3. Decide

The third phase consists of making decisions and signing contracts. The implementation phase is really launched at this stage.

Action	Status
Select BCBP in kiosks: cost reduction comes from the replacement of ATB equipment by GPP and bar code readers, but it is recommended to secure the transition phase with dual mode equipment	
Choose BCBP readers at gates: how many readers per gate, hand held or integrated to the BGR, decode capabilities beyond the IATA standard	
Define web check-in: tutorial, login options, features available, communication and promotion plan	
Define BCBP Layout: 1 or 2 bar codes, fields mentioned, fonts used, branding, display advertising or not	
Contract with vendors: timing, pricing, quality assurance, expertise, dedicated resources	

3.4.4. Develop and deploy

The fourth phase is the heart of implementation. It includes the upgrade of hardware and software as well as the deployment in stations. The complexity of this phase highly depends on the breadth of the network covered by the airline.

Action	Status
Upgrade the web site check-in features	
Upgrade the application: unless there is an alternative solution with Common Use systems or third parties	
Upgrade the Departure Control System: unless there is an alternative solution with Common Use systems or third parties	
Create test flights: the airline creates flights in the DCS from which sample BCBPs can be printed and tested	
Run trials: in each station the equipment may vary, a trial should be conducted before going into production	

3.4.5. Train

The fifth phase guarantees smooth operations. As processes are changed, operations are affected and stakeholders must be trained. Various training methods may prove to be effective: room training (an instructor in front of colleagues in a room) or peer training (one colleague teaching his/her colleague at workplace).

Action	Status
Train agents at the gate: they need to become familiar with scanning a bar code	
Train agents at the desk: BCBP allows multiple segments on the same documents, agents will have to explain it to customers	
Train security staff: they may need to scan bar codes as well if requested by the local security agency	
Ground handlers: they will have to handle the new type of boarding pass	

3.4.6. Communicate

The sixth and last phase focuses on the passenger and guarantees the success of the project. Cost savings will come from the increased usage of BCBP. At the end of the project it is recommended that airlines conduct an analysis of both the financial and operational success.

Action	Status
Inform governments: one airline using BCBP in one country does not necessarily mean that other airlines can simply do it as well, it is recommended to contact the government anyway	
Inform airports: passengers will circulate in the airport with a new airline document, the layout may vary from other airline documents, the airport needs to receive a sample BCBP	
Educate passengers: tutorial for online check-in, raise awareness on the multiple segment document	
Advertise: mainly on the airline's properties such as mailings, web site, displays in the terminal, bus carrying passengers to the aircraft	
Issue a press release: list of stations available, features of online check-in, level of through check-in	

3.5. Project map

The steps of the project can be mapped onto a passenger travel chart, from home to the aircraft (see fig. 4). The Departure Control System (DCS) is involved in every check-in mode and in the boarding stage.

A BCBP project can start with any of the channels:

- At the airport
- On the web
- On the kiosks
- Or even on mobile phones

Although several channels can be initiated simultaneously, airlines tend to start with one of them, and generally choose the web check-in first.
Once the BCBP is available online and printed at home, the project manager has to inform the airports of the introduction of the new type of boarding pass. Using the IATA standard will facilitate this step as airports can easily check the content of the bar code.

Then the BCBP needs to be read at the gate: it is both a hardware and a software issue as we have seen. At the same time the agent at the gate needs to be trained, in order to accept the BCBP and handle the bar code reader properly.

Once the boarding process is automated with the new standard, additional bar codes can be introduced. Upgrading the kiosk involves ensuring that the print quality of the General Purpose Printer (GPP) is adequate and upgrading the airline application so that it handles bar codes and GPP. The same happens at the desk, although the owner of the equipment may be different.
The following section provides a timeframe for the project.

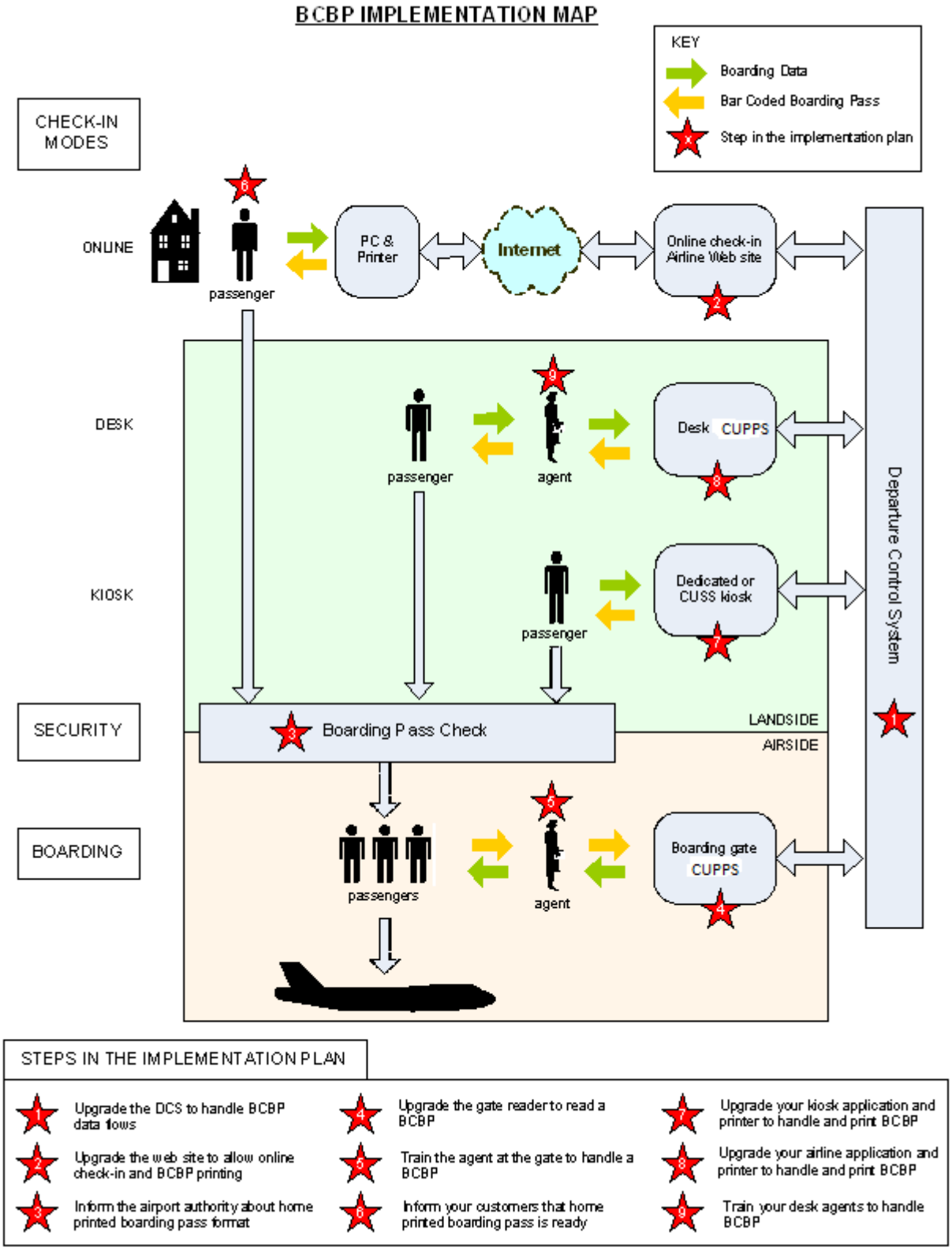


Figure 4 - BCBP implementation map

3.6. Timeframe

We provide the following timeframe as guidance only (see fig. 5). The objective of this time chart is to help BCBP project managers get a vision of the timeframes of the project in order to book resources in advance.

Phase	Time	Tasks / steps / achievements	Estimated average length
	Start T=0	Start reading, planning, building team	1 month
Evaluate	T+1 months	Project team ready	
		Start evaluations	2 months
Plan	T+3 months	Evaluations ready	
		Start cost-benefits analysis	2 months
Decide	T+5 months	Plan ready	
		Decision making process	1 month
Develop & Deploy	T+6 months	Decision made – project launched	
		Start upgrading infrastructure	
		Development and testing of application	3 months
		Certification of the application	2 weeks
		Deployment of the application	1 week per site 1 year for 50 sites
Train		Training staff	2 days per site

Figure 5 - Example of timeframe for a BCBP project

4. 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.

4.1. 2D bar codes

4.1.1. 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 6 shows an actual PDF417 bar code from a British Airways Bar Coded Boarding Pass containing the following data:

M1LEOPOLD/EMR EZQ7O92 GVALHRBA 00723319C002F00009100

Figure 6 - Example of a PDF417 bar code courtesy of British Airways

The BCBP standard enables the encoding up to 4 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 4 leg segments with all conditional elements filled-in.

Note that the 3 below symbologies cannot be used for printed BP because it is not part of the current standard and there is an issue in quality.

4.1.2. Aztec

Aztec is one of the three symbologies selected in the BCBP standard for mobile 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 7 - 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).
- Scanners used to read mobile boarding passes should support all of the three symbologies.

4.1.3. Datamatrix

Datamatrix is one of the three symbologies selected in the BCBP standard for mobile 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.

4.1.4. QR code

QR code is one of the three symbologies selected in the BCBP standard for mobile 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).

4.1.5. 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 8 - 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.

4.2. BCBP Standard (Resolution 792)

4.2.1. 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

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 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 and not the booking fare class.

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) 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 and 23.
Item 17 (Field size of following structured message – repeated) should only be the length of the conditional repeated items 142, 143, 18, 108, 19, 20, 236, 89, 118 and 254.
Item 6 (Field size of following variable size field) is the sum of values of item 10, item 17, plus the length of items 8, 9, 10 and 17, plus the length of item 4.

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: 0016111111001.
Another example: If the passenger checks in one bag (e.g. 0016111111), field no.23 shall read as: 0016111111000.

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 10 digit 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.

1st Non-Consecutive Baggage Tag License Plate
Example: If the passenger checks in two non-consecutive bags (e.g. 0016111111 & 0016222222), field no. 23 shall read as: 0016111111000 and field no. 31 shall read as: 0016222222000.

2nd Non-Consecutive Baggage Tag License Plate
Example: If the passenger checks in three non-consecutive bags (e.g. 0016111111, 0016222222 & 0016333333), field no. 23 shall read as: 0016111111000, field no. 31 shall read as: 0016222222000, field no. 32 shall read as: 0016333333000.

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 – 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 US travel is involved****.*

Example
When the passenger itinerary involves United States travel, this field should be populated with a 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.

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.

4.2.2. Encoding one flight leg

The M format is used for single leg or multiple legs. Encoding one leg will set the value of 'number of legs encoded' to '1'. The example below (see fig. 9) uses a fixed-length field with 60 positions, according to the BCBP standard.

	New item number	Element Description	Field Size	Unique / repeated	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Notes
Mandatory Items	1	Format Code	1	U	M																				
	5	Number of Legs Encoded	1	U	1																				
	11	Passenger Name	20	U	D	E	S	M	A	R	A	I	S	/	L	U	C								
	253	Electronic Ticket Indicator	1	U	E																				
	7	Operating carrier PNR Code	7	R	A	B	C	1	2	3															
	26	From City Airport Code	3	R	Y	U	L																		
	38	To City Airport Code	3	R	F	R	A																		
	42	Operating carrier Designator	3	R	A	C																			
	43	Flight Number	5	R	0	8	3	4																	
	46	Date of Flight (Julian Date)	3	R	2	2	6																		August 14th
	71	Compartment Code	1	R	F																				
	104	Seat Number	4	R	0	0	1	A																	
	107	Check-in Sequence Number	5	R	0	0	2	5																	
	113	Passenger Status	1	R	1																				
	6	Field Size of variable size field (Conditional + Airline item 4)	2	R	0	0																			0 in Decimal = 00 in Hexadecimal
Conditional items - Flight segment # 1	8	Beginning of version number	1	U																					
	9	Version Number	1	U																					
	10	Field Size of following structured message - unique	2	U																					
	15	Passenger Description	1	U																					
	12	Source of check-in	1	U																					
	14	Source of Boarding Pass Issuance	1	U																					
	22	Date of Issue of Boarding Pass (Julian Date)	4	U																					
	16	Document Type	1	U																					
	21	Airline Designator of boarding pass issuer	3	U																					
	23	Baggage Tag Licence Plate Number (s)	13	U																					
	31	1st Non-Consecutive Baggage Tag Licensce Plate Number	13	U																					
	32	2nd Non-Consecutive Baggage Tag Licensce Plate Number	13	U																					
	17	Field Size of following structured message - repeated	2	R																					
	142	Airline Numeric Code	3	R																					
	143	Document Form/Serial Number	10	R																					
	18	Selectee indicator	1	R																					
	108	International Documentation Verification	1	R																					
	19	Marketing carrier designator	3	R																					
	20	Frequent Flyer Airline Designator	3	R																					
	236	Frequent Flyer Number	16	R																					
	89	ID/AD Indicator	1	R																					
	118	Free Baggage Allowance	3	R																					
	254	Fast Track	1	R																					
	4	For individual airline use	Var	R																					
Security	25	Beginning of Security Data	1	U	^																				
	28	Type of Security Data	1	U	1																				
	29	Length of Security Data	2	U	6	4																			100 in Decimal = 64 in Hexadecimal
	30	Security Data	100	U	G	I	W	V	C	5	E	H	7	J	N	T	6	8	4	F	V	N	J	9	
					1	W	2	Q	A	4	D	V	N	5	J	8	K	4	F	0	L	0	G	E	continued from previous row
					Q	3	D	F	5	T	G	B	N	8	7	0	9	H	K	T	5	D	3	D	continued from previous row
					W	3	G	B	H	F	C	V	H	M	Y	7	J	5	T	6	H	F	R	4	continued from previous row
					1	W	2	Q	A	4	D	V	N	5	J	8	K	4	F	0	L	0	G	E	continued from previous row

Figure 9 - Format M example one flight leg

4.2.3. Encoding multiple flight legs

In the example below 2 flight legs are encoded, setting the value of 'number of legs encoded' to '2' (see fig. 10).

	New item number	Element Description	Field Size	Unique / repeated	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Notes
Mandatory Items	1	Format Code	1	U	M																				
	5	Number of Legs Encoded	1	U	2																				
	11	Passenger Name	20	U	D	E	S	M	A	R	A	I	S	/	L	U	C								
	253	Electronic Ticket Indicator	1	U	E																				
	7	Operating carrier PNR Code	7	R	A	B	C	1	2	3															
	26	From City Airport Code	3	R	Y	U	L																		
	38	To City Airport Code	3	R	F	R	A																		
	42	Operating carrier Designator	3	R	A	C																			
	43	Flight Number	5	R	0	8	3	4																	
	46	Date of Flight (Julian Date)	3	R	2	2	6																		226 = August 14th
	71	Compartment Code	1	R	F																				
	104	Seat Number	4	R	0	0	1	A																	
	107	Check-in Sequence Number	5	R	0	0	2	5																	
	113	Passenger Status	1	R	1																				
	6	Field Size of variable size field (Conditional + Airline item 4)	2	R	4	D																			77 in Decimal = 4D in Hexadecimal
Conditional items - Flight segment # 1	8	Beginning of version number	1	U	>																				
	9	Version Number	1	U	6																				
	10	Field Size of following structured message - unique	2	U	1	8																			24 in Decimal = 18 in Hexadecimal
	15	Passenger Description	1	U	1																				
	12	Source of check-in	1	U	W																				
	14	Source of Boarding Pass Issuance	1	U	W																				
	22	Date of Issue of Boarding Pass (Julian Date)	4	U	6	2	2	5																	6 = 2006, 225 = August 13th
	16	Document Type	1	U	B																				
	21	Airline Designator of boarding pass issuer	3	U	A	C																			
	23	Baggage Tag Licence Plate Number (s)	13	U	0	0	1	4	1	2	3	4	5	6	0	0	3								
	31	1st Non-Consecutive Baggage Tag Licence Plate Number	13	U																					
	32	2nd Non-Consecutive Baggage Tag Licence Plate Number	13	U																					
	17	Field Size of following structured message - repeated	2	R	2	A																			42 in Decimal = 2A in Hexadecimal
	142	Airline Numeric Code	3	R	0	1	4																		
	143	Document Form/Serial Number	10	R	1	2	3	4	5	6	7	8	9	0											
	18	Selectee indicator	1	R																					Not applicable to that flight
	108	International Documentation Verification	1	R	1																				
	19	Marketing carrier designator	3	R	A	C																			
	20	Frequent Flyer Airline Designator	3	R	A	C																			
	236	Frequent Flyer Number	16	R	1	2	3	4	5	6	7	8	9	0	1	2	3								
	89	ID/AD Indicator	1	R																					
	118	Free Baggage Allowance	3	R	2	0	K																		
	254	Fast Track	1	R	Y																				Fast Track eligible
	4	For individual airline use	Var	R	L	X	5	8	Z																

Mandatory Items - Flight segment # 2	7	Operating carrier PNR Code	7	R	D	E	F	4	5	6																
	26	From City Airport Code	3	R	F	R	A																			
	38	To City Airport Code	3	R	G	V	A																			
	42	Operating carrier Designator	3	R	L	H																				
	43	Flight Number	5	R	3	6	6	4																		
	46	Date of Flight (Julian Date)	3	R	2	2	7																			
	71	Compartment Code	1	R	C																					
	104	Seat Number	4	R	0	1	2	C																		
	107	Check-in Sequence Number	5	R	0	0	0	2																		
	113	Passenger Status	1	R	1																					
	6	Field Size of variable size field (Conditional + Airline item 4)	2	R	2	E																				46 in Decimal = 2E in Hexadecimal
Conditional items - Flight segment # 2	17	Field Size of following structured message - repeated	2	R	2	A																				42 in Decimal = 2A in Hexasecimal
	142	Airline Numeric Code	3	R	0	1	4																			
	143	Document Form/Serial Number	10	R	0	9	8	7	6	5	4	3	2	1												
	18	Selectee indicator	1	R																						
	108	International Documentation Verification	1	R	1																					
	19	Marketing carrier designator	3	R	A	C																				
	20	Frequent Flyer Airline Designator	3	R	A	C																				
	236	Frequent Flyer Number	16	R	1	2	3	4	5	6	7	8	9	0	1	2	3									
	89	ID/AD Indicator	1	R																						
	118	Free Baggage Allowance	3	R	2	P	C																			
	254	Fast Track	1	R	N																					Fast Track Not eligible for this segement
	4	For individual airline use	Var	R	W	Q																				
Security	25	Beginning of Security Data	1	U	^																					
	28	Type of Security Data	1	U	1																					
	29	Length of Security Data	2	U	6	4																				100 in Decimal = 64 in Hexadecimal
	30	Security Data	100	U	G	I	W	V	C	5	E	H	7	J	N	T	6	8	4	F	V	N	J	9		
					1	W	2	Q	A	4	D	V	N	5	J	8	K	4	F	0	L	0	G	E	continued from previous row	
					Q	3	D	F	5	T	G	B	N	8	7	0	9	H	K	T	5	D	3	D	continued from previous row	
					W	3	G	B	H	F	C	V	H	M	Y	7	J	5	T	6	H	F	R	4	continued from previous row	
					1	W	2	Q	A	4	D	V	N	5	J	8	K	4	F	0	L	0	G	E	continued from previous row	

Figure 10 - Format M example two flight legs

4.2.4. 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.

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.

4.2.5. 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.

4.2.6. 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.

4.2.7. 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 PADIS XML message standards shall be used for the exchange of BCBP data. PADIS 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.

The BCBP XML schema is on the IATA PADIS extranet:
https://extranet2.iata.org/sites/padis/Pages/XMLStandards.aspx

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.

4.3. Boarding pass

4.3.1. 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).

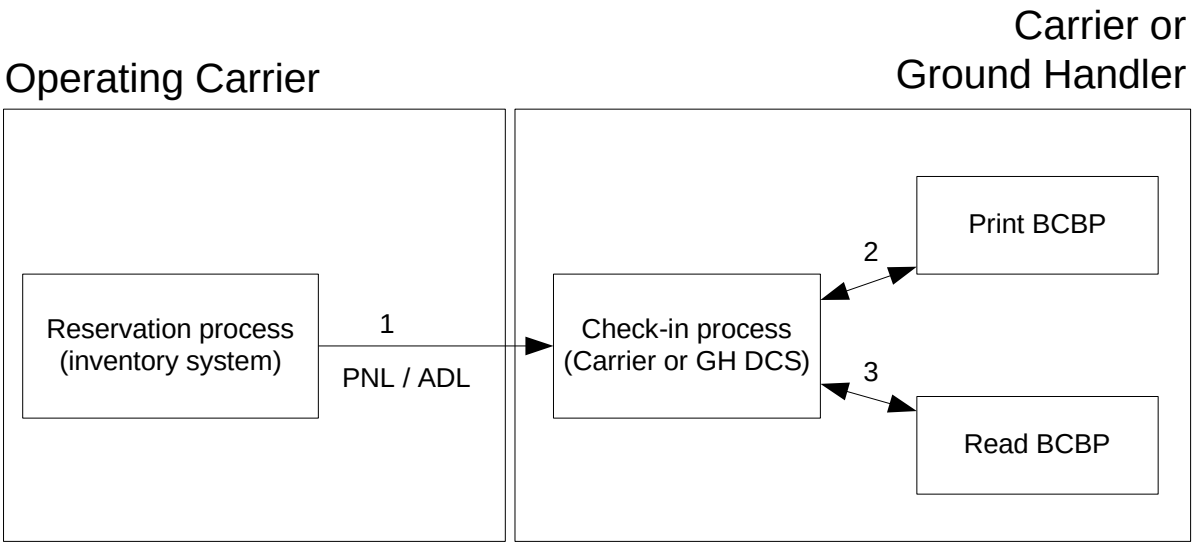


Figure 11 - Data flow of passenger information at check-in

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.

4.3.2. 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.

4.3.3. 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

4.3.4. 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.

4.3.5. 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

4.4. 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.

4.5. Mobile BCBP

4.5.1. 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.

4.5.2. 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

4.5.3. 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

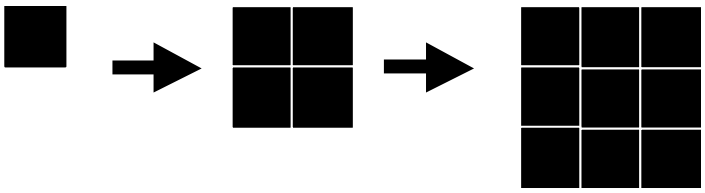


Figure 12 - One bar code cell displayed in 1, 2 or 3 pixel width

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.

4.5.4. 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.

4.5.5. 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:

- Passenger convenience, who likes to keep a receipt
- Crew convenience, who prefers to see the receipt than read from a phone
- Airline policy, that requires to switch off mobile phone when boarding

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

4.5.6. 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
- Print head residue

4.5.7. 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 13 - 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.

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

4.6. 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 traveller 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

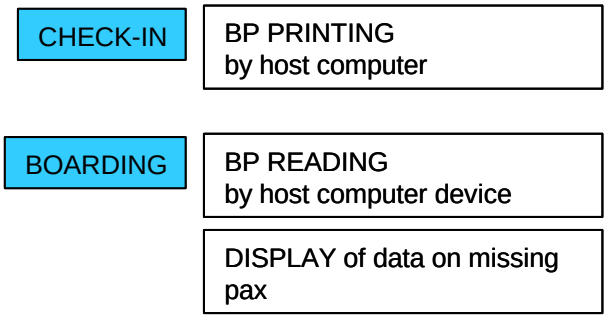
To become BCBP capable an airline has to upgrade its DCS so that it supports the IATA 2D bar code as the default boarding pass solution.

4.6.1. 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 operation.

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.

4.6.2. 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.

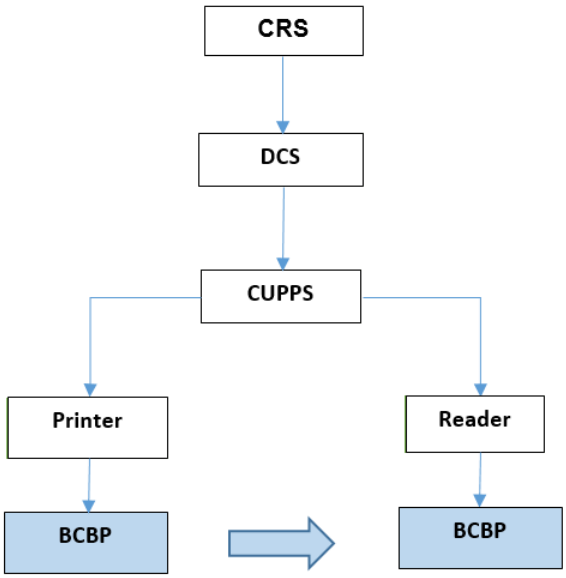


Figure 14 - Data flow in a CUPPS environment

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.

The CUPPS is installed in the airport. The 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 the CUPPS. The data, e.g. passenger name, are captured by the reader at the gate and sent back to the CRS.

4.6.3. 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.

5. 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	Biometrics	Medium	Medium
E-passport	RFID	Medium	Medium

Notes on maturity:

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

5.1. 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 contact-less 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. 15).

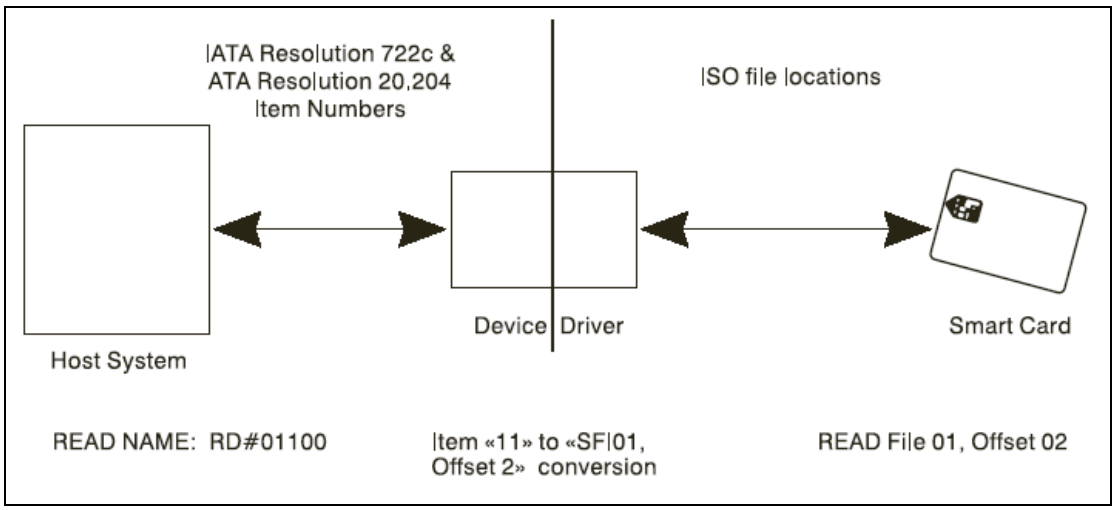


Figure 15 - ICC standard defined in IATA Resolution 791

5.2. 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.

5.3. E-Passport

Phasing boarding passes out in favour of a paperless process is a fascinating idea. It would simplify the business, as no boarding pass would be required at the airport any more. The e-passport could serve as a unique identifier. However, in the absence of a detailed implementation plan and arguments to overcome regulatory hurdles to paperless travel, the e-BP is still a dream.

Figure 16 - e-passport architecture courtesy of Bundes Druckerei

As a matter of fact, allowing passengers through the security check point would require the security guards to connect to all the airlines' DCS and all travellers would have to use biometrics for identification.

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 whether 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 2001 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 (Amended August 2002)
	ATB Technical Specifications (Amended December 2006)

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 erfolgt 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, Kohlendioxid-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 17 - 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.

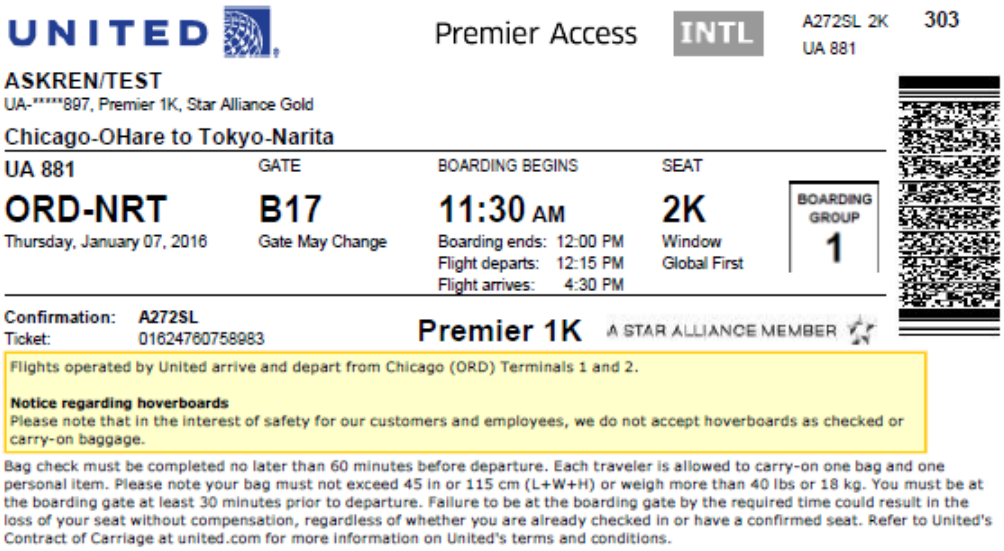
Gate closes 15 min before departure

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 18 - 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 19 - Sample of UA BCBP Home Printed Boarding Pass

B.1.4 BA - British Airways Web

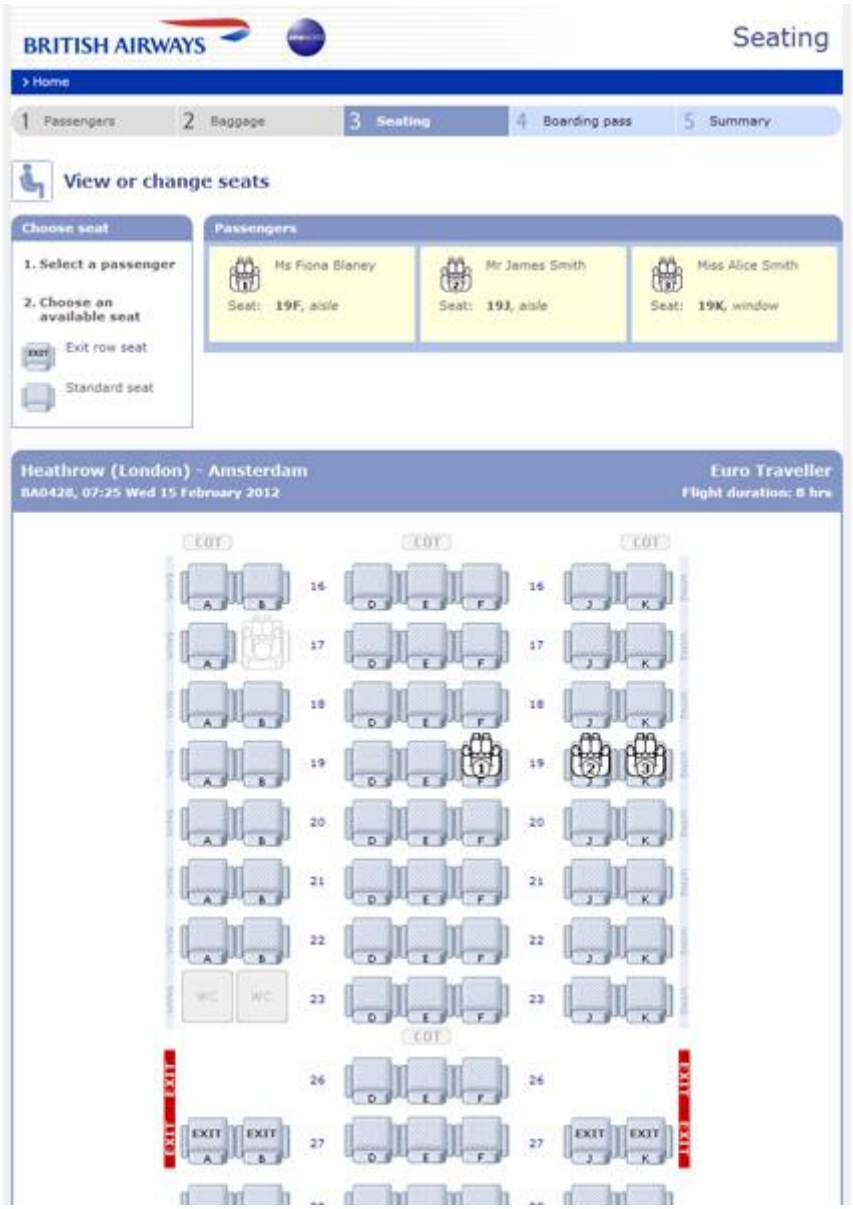


Figure 20 - Example of web check-in seat selection courtesy of British Airways

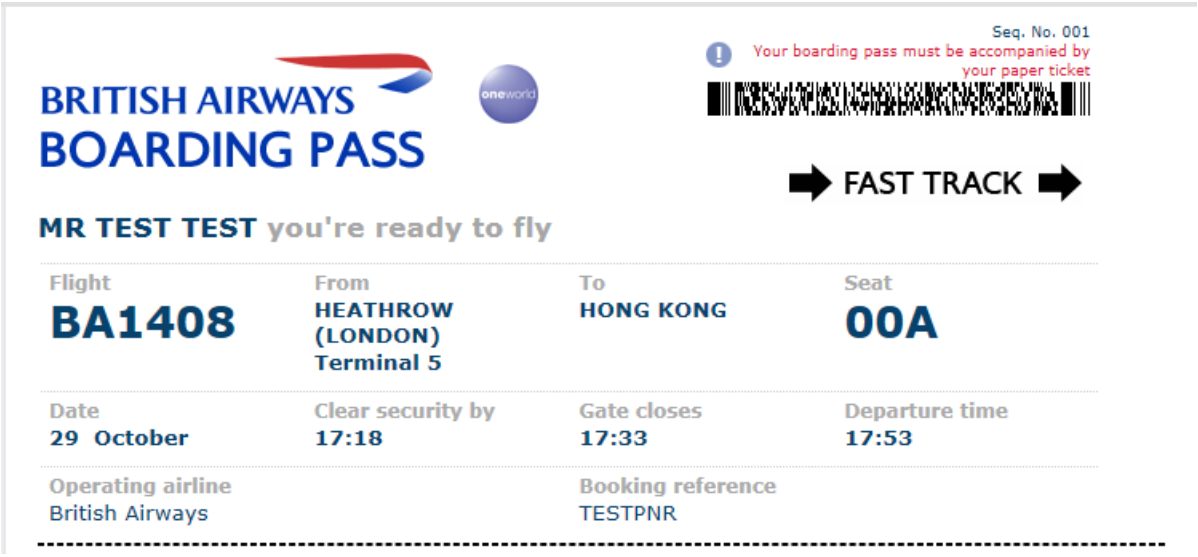


Figure 21 - Sample of BCBP printed from the British Airways web site

B.2 BCBP printed at a kiosk

B.2.1 UA - UA kiosk

Figure 22 - Sample of BCBP printed from the UA kiosk

B.3 Mobile BCBP

B.3.1 LH - Lufthansa mobile BCBP

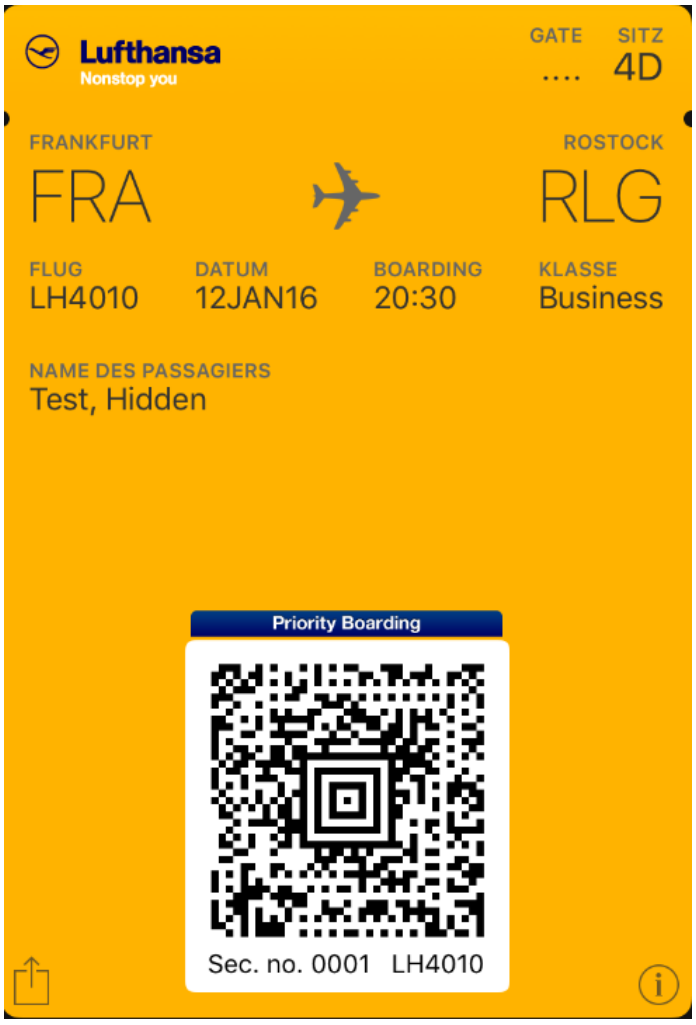


Figure 23 - Sample BCBP iPhone Wallet courtesy of Lufthansa

B.3.2 UA – UA mobile BCBP

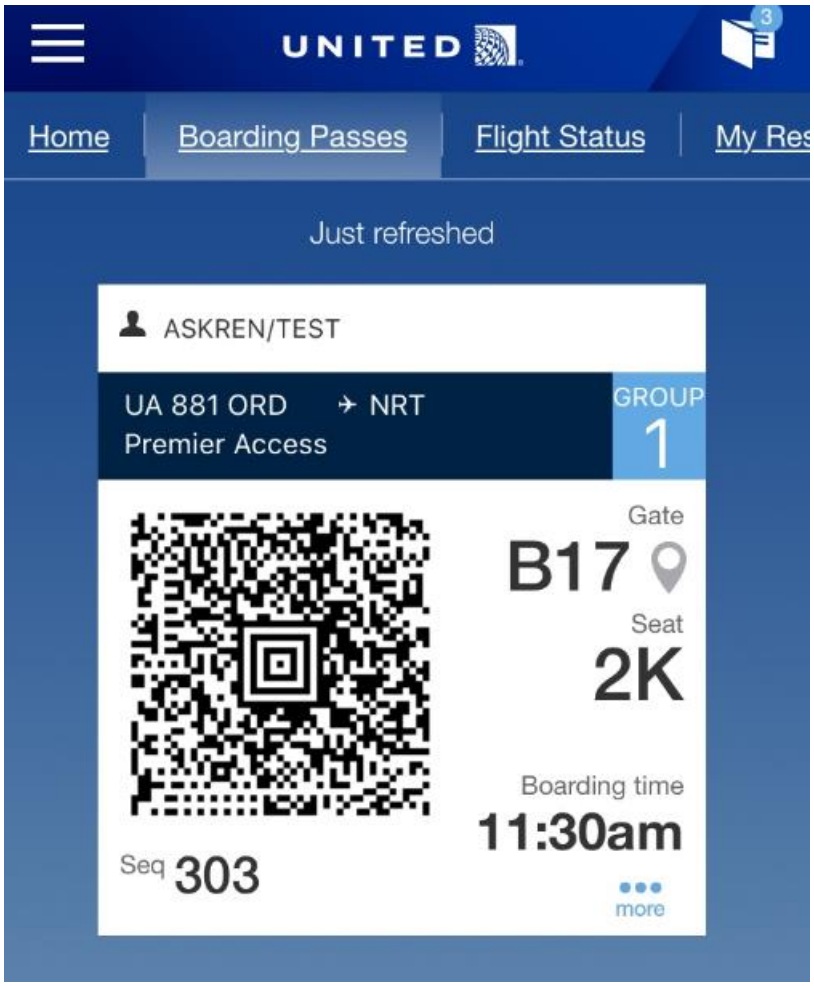


Figure 24 - Sample of mobile BCBP courtesy of UA

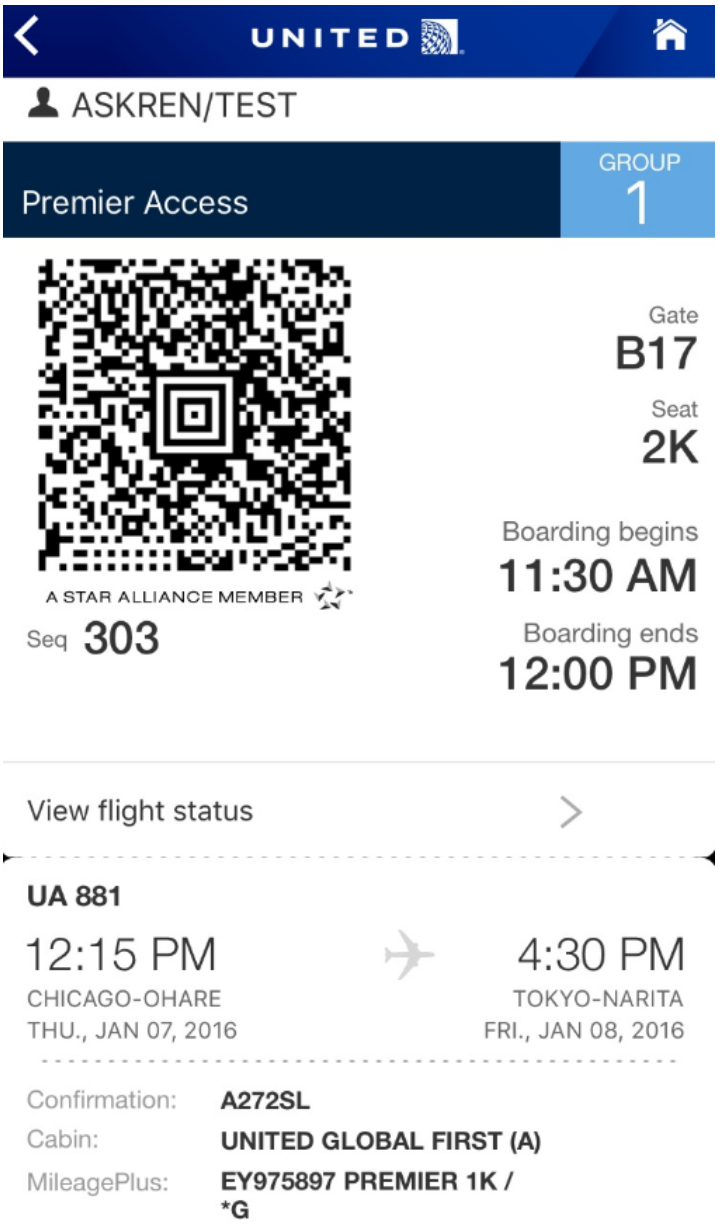


Figure 25 - Sample of UA smartphone full mobile boarding pass

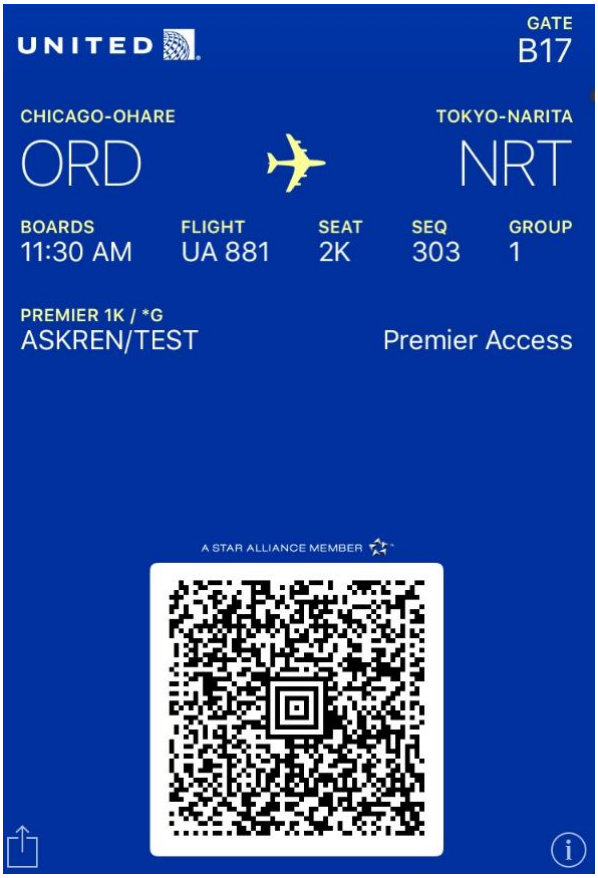


Figure 26 - Sample of UA iPhone Wallet boarding pass

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.

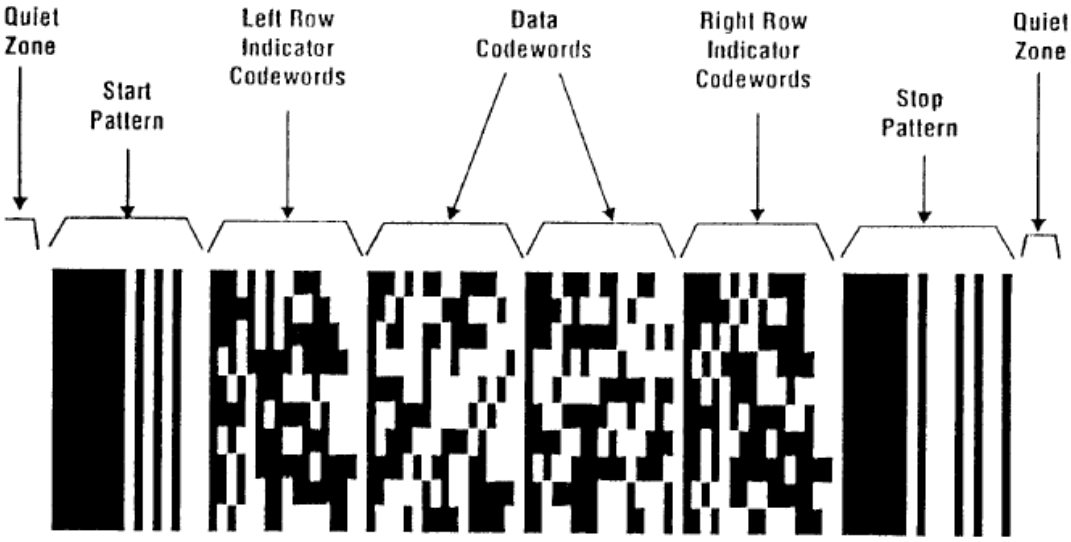


Figure 27 - Structure of the PDF417 symbol as defined in the ISO/IEC 15438

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.

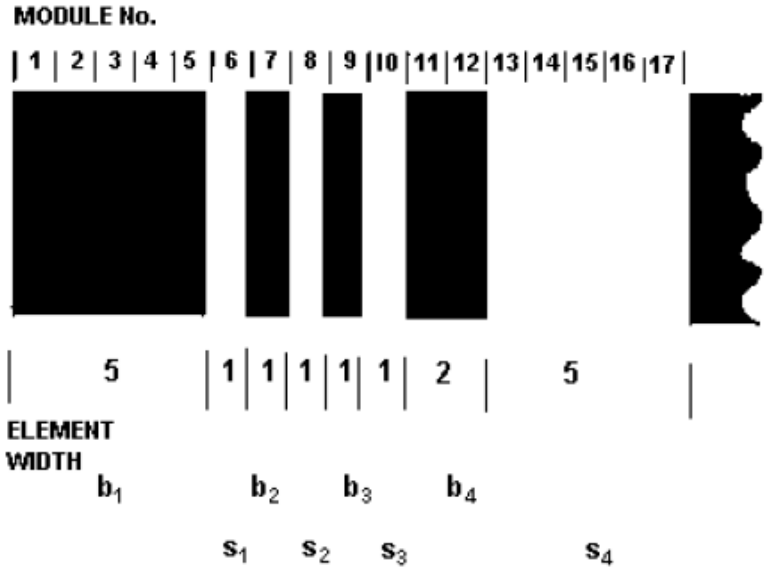


Figure 28 - PDF417 is composed of 4 elements whose widths add up to 17 modules

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 level 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.

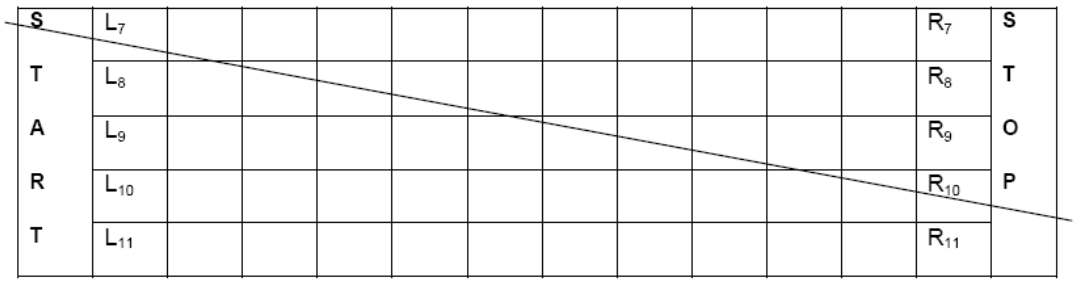


Figure 29 - Schematic showing a scan line crossing rows of the PDF417 symbol

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:

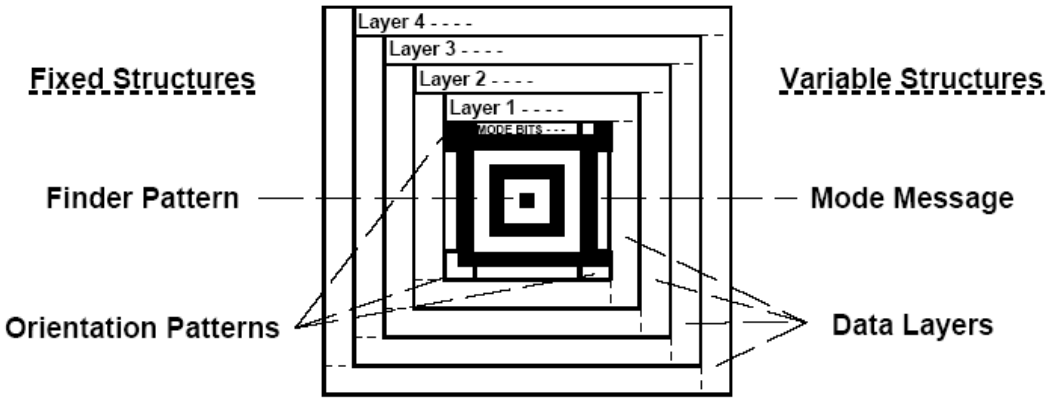
Example 3:

- Content: 324 characters
- String: QWERTYUIOPASDFGHJKLZXCVBNM1234567890QWERTYUIOPASDFGHJKLZXCVBNM1234567890QWERTYUIOPASDFGHJKLZXCVBNM1234567890QWERTYUIOPASDFGHJKLZXCVBNM1234567890QWERTYUIOPASDFGHJKLZXCVBNM1234567890QWERTYUIOPASDFGHJKLZXCVBNM1234567890QWERTYUIOPASDFGHJKLZXCVBNM1234567890QWERTYUIOPASDFGHJKLZXCVBNM1234567890
- 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.

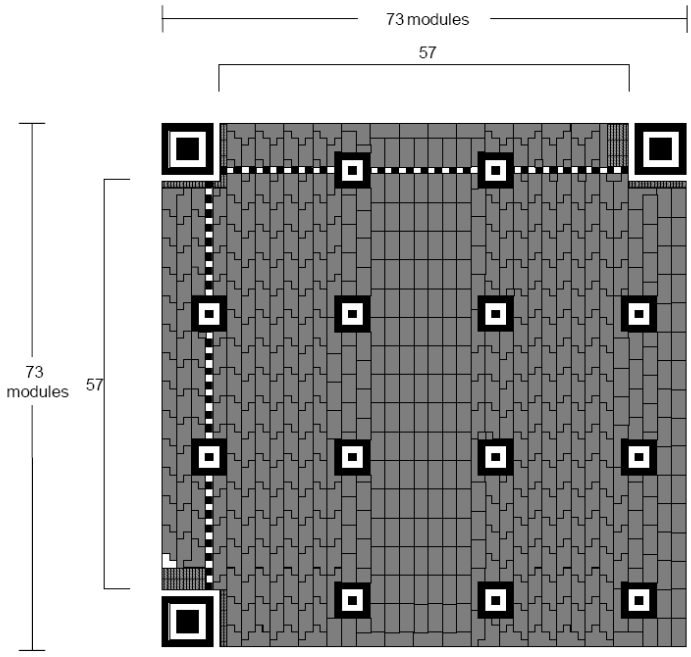
QR code has 4 levels of error correction (Reed-Salomon), allowing recovery of a percentage of codewords

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