Functional Specification

ET1240 – Barcode Generation Logic

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Table of Contents

1 PURPOSE 2
2 SCOPE 2
3 FUNCTIONAL OVERVIEW 2
4 FUNCTIONAL REQUIREMENTS 3
4.1 Barcode Composition and Format 3
4.2 Office/Branch Codes 4
4.3 Application Type Codes 7
4.4 Priority Codes 8
4.5 Check Digit Calculation Logic 8
4.5.1 Functional Description 8
4.5.2 Example Calculation 8
4.5.3 Validation Rules 9
4.5.4 Integration Notes 9
4.5.5 Complete Barcode Example 9
4.6 Printing & Display Rules 9
4.7 Security & Validation 10
5 TESTING & QA REQUIREMENTS 10
6 DOCUMENT SIGN-OFF 11

1 Purpose

The purpose of this document is to define the functional requirements and generation logic for the barcode that uniquely identifies each application within the ePass system.

This barcode will be printed on the application from and used for tracking, verification and validation across issuing offices.

2 Scope

This functional specification applies to all application types where a barcode is required. The barcode is generated automatically by the system upon application generation.

3 Functional Overview

The barcode serves as a unique identifier that encodes key application attributes and can be used for:

- Tracking the origin, type and priority of the application.
- Ensure uniqueness and integrity through a check digit mechanism.
- Identifying where the application originated from, whether the ICS Central office, Portal or a branch.

4 Functional Requirements

4.1 Barcode Composition and Format

Component	Length	Description	Source Field / Logic
Office/Branch Code	2 Characters	Code assigned to the processing office or branch where the application was created.	Derived from the office configuration table. See below.
Application Type	2 Characters	Defines the type of application.	Mapped from the application type code. See below.
Priority	1 Digit	Priority level of application.	Derived from the Service Type priority selected on start of the application. See below.
Gregorian Year (YY)	2 Digits	Last two digits of the current Gregorian year.	System date at time of barcode generation.
Hexadecimal Sequence	6 Characters	A sequential counter in hexadecimal format ensuring uniqueness.	Generated automatically by system for each new barcode per year.
Check Digit	1 Digit	Calculated checksum to validate data integrity of the barcode string.	See below
Origin Indicator	1 Character (Suffix)	Indicates application origin: O = Office P = Portal B = Branch In V2.0 “O” will be replaced by “W”.	Derived from application source.

4.2 Office/Branch Codes

Office/Branch	Country	Code
MESOB	MS	Ethiopia
ARBAMINCH	ARB	Ethiopia
ICS Diplomatic Mobile Kit	AA	Ethiopia
Bole Airport	BA	Ethiopia
Adama ICS	AD	Ethiopia
Immigration and Citizenship Service	AA	Ethiopia
Bahir Dar ICS	BD	Ethiopia
Dessie ICS	DS	Ethiopia
Dire Dawa ICS	DR	Ethiopia
Gambella ICS	GM	Ethiopia
Hawassa ICS	HW	Ethiopia
Jigjiga ICS	JG	Ethiopia
Jimma ICS	JM	Ethiopia
Mekelle ICS	MK	Ethiopia
Samara ICS	SM	Ethiopia
Hosaena ICS	HO	Ethiopia
Asosa	AS	Ethiopia
Embassy of Ethiopia – Bahrain	BH	Bahrain
Embassy of Ethiopia – Washington	WT	United States of America
Consulate of Ethiopia – New York	NY	United States of America
Consulate of Ethiopia – Los Angeles	USL	United States of America
Consulate of Ethiopia – Minnesota	MI	United States of America
Embassy of Ethiopia – London	LD	United Kingdom
Consulate of Ethiopia – Geneva	GN	Switzerland
Consulate of Ethiopia - The Hague	HG	Netherlands
Embassy of Ethiopia - Ottawa	OT	Canada
Embassy of Ethiopia – Tokyo	JP	Japan

Embassy of Ethiopia – New Delhi	IN	India
Embassy of Ethiopia – Berlin	BR	Germany
Embassy of Ethiopia – Frankfurt	FK	Germany
Embassy of Ethiopia – Rome	RO	Italy
Embassy of Ethiopia - Paris	PA	France
Embassy of Ethiopia – Moscow	MO	Russian Federation
Consulate of Ethiopia – Shanghai	SH	China
Consulate of Ethiopia – Chongqing	CH	China
Consulate of Ethiopia – Guangzhou	GU	China
Consulate of Ethiopia – Hong Kong	HK	Hong Kong
Embassy of Ethiopia – Stockholm	ST	Sweden
Embassy of Ethiopia – Tel Aviv	IS	Israel
Embassy of Ethiopia - Brussels	BS	Belgium
Embassy of Ethiopia - Anchara	TU	Turkey
Consulate of Ethiopia - Athens	AT	Greece
Embassy of Ethiopia – Juba	JU	South Sudan
Embassy of Ethiopia – Kampala	KP	Uganda
Embassy of Ethiopia – Harare	HA	Zimbabwe
Embassy of Ethiopia – Pretoria	PT	South Africa
Embassy of Ethiopia - Riyadh	RY	Saudi Arabia
Embassy of Ethiopia – Jeddah	JD	Saudi Arabia
Embassy of Ethiopia – Morocco	MC	Morocco
Embassy of Ethiopia - Doha	DO	Qatar
Embassy of Ethiopia – Muscat	MU	Oman
Embassy of Ethiopia – Abuja	AD	Nigeria
Embassy of Ethiopia – Mogadishu	MG	Somalia
Consulate of Ethiopia – Beirut	BT	Lebanon
Embassy of Ethiopia – Kuwait City	KW	Kuwait
Embassy of Ethiopia – Kigali	KG	Rwanda

Embassy of Ethiopia – Nairobi	NR	Kenya
Embassy of Ethiopia – Dublin	IR	Ireland
Embassy of Ethiopia – Jakarta	IJ	Indonesia
Ethiopian Consulate General – Hargeisa	HR	Somalia
Embassy of Ethiopia – Cairo	CA	Egypt
Consulate of Ethiopia – Dubai	DB	United Arab Emirates
Embassy of Ethiopia - Djibouti	DJ	Djibouti
Embassy of Ethiopia – Dar es salaam	TZ	United Republic Of Tanzania
Embassy of Ethiopia – Dakar	SN	Senegal
Embassy of Ethiopia – Havana	CU	Cuba
Embassy of Ethiopia – Abidjan	AB	Côte Divoire
Embassy of Ethiopia – Asmara	AM	Eritrea
Embassy of Ethiopia – Algese	AG	Algeria
Embassy of Ethiopia – Accra	AC	Ghana
Embassy of Ethiopia – Abu Dhabi	AD	United Arab Emirates
Embassy of Ethiopia – Khartoum	KT	Sudan

4.3 Application Type Codes

Code	Application
PP	Ordinary Passport
PO	Service Passport
PD	Diplomatic Passport
PT	Alien Passport
PL	Liassez-Passer
PE	Emergency Travel Document
IP	Permanent Residence Card
IT	Temporary Residence Card
IO	Origin ID
IE	Granted Ethiopian ID
VM	Government Work Visa
VN	NGO Visa
VK	Medical Treatment Visa
VQ	Religious Visa
VT	Tourism & Family Visit
VI	Investment Visa
VM	Private Work Visa
VR	Business and Related Studies
VE	Entertainment Industry
VU	Residence Visa
VX	Exit Visa for Refugee
VL	Exit Visa
VC	Workshop Visa
VJ	Media and Journalism
VY	Sports Competition and Training Visa
VA	Neighbouring Country Visa
VP	Transit Visa
VF	Student Visa
VD	Diplomatic Visa
VS	Service Visa

4.4 Priority Codes

Service Type Priority	Value
Immediate (Visa On Arrival) Service	0
4 Hour Service	1
1 Day Service	2
2 Day Service	3
5 Day Service	4
Normal Service	5
15 Day Service	6
Special Service	7

4.5 Check Digit Calculation Logic

The check digit ensures the validity and integrity of the barcode.
It is calculated based on the barcode string (excluding the check digit and origin indicator) and the hexadecimal sequence value.

4.5.1 Functional Description

The system will calculate a 1-digit checksum as follows:

1. Convert the hexadecimal sequence value to its decimal equivalent.
2. Calculate the sum of the ASCII values of each character in the barcode string (excluding the check digit and origin indicator).
3. Add the decimal value of the hexadecimal sequence to this sum.
4. Divide the resulting sum by 10.
5. The remainder of this division is used as the check digit.
6. If the calculation fails (e.g., invalid input), the system will return an error indicator value “E”.

4.5.2 Example Calculation

Step	Description	Value
1	Barcode String	AAPP325087534
2	Hexadecimal Value	087534
3	Hexadecimal to Decimal	554292
4	Sum of ASCII values for	759
5	Total Sum	759 + 554292 = 555051
6	Modulus 10	555051 % 10 = 1
Check Digit		1
Final Barcode		**AAPP3250875341P**

4.5.3 Validation Rules

Rule ID	Condition	System Behaviour
CD-001	Hexadecimal value invalid	Return "E"
CD-002	ASCII sum calculation fails	Return "E"
CD-003	Valid calculation	Return 1-digit numeric check digit (0-9)
CD-004	Final barcode must include check digit before the origin suffix	Append calculated digit to the barcode string

4.5.4 Integration Notes

- This logic must execute **after** the hexadecimal sequence has been generated but **before** appending the origin suffix.
- The resulting check digit becomes part of the final barcode string as shown:
  Final format: [Office][Type][Priority][YY][Hex][CheckDigit][Origin]
  Example: AAPP3250875341P

4.5.5 Complete Barcode Example

Component	Example Value	Explanation
Office/Branch Code	AA	Immigration and Citizenship Service
Application Type	PP	Ordinary Passport
Priority (Service Type)	3	2 Day Service
Year	25	2025
Hex Sequence	087534	Auto-generated
Check Digit	7	Calculated Checksum
Origin Indicator	P	Portal
Final Barcode String	AAPP3250875341P	Full formatted value

4.6 Printing & Display Rules

- Barcode must appear top-right on the application form.
- The barcode format (QR or PDF417) is configurable via system settings.
- Textual value of the barcode must appear beneath the barcode image for manual reference.
- The barcode must maintain a minimum resolution of 300 DPI for print clarity.

4.7 Security & Validation

- The hexadecimal sequence is generated via a system-controlled sequence table to prevent reuse.
- The hexadecimal sequence is restarted on a yearly bases.
- The barcode must be validated upon scan using checksum verification.

5 Testing & QA Requirements

Test ID	Test Scenario	Expected Result
TST-BR-01	Generate barcode for new application.	Barcode string follows defined pattern.
TST-BR-02	Attempt duplicate generation.	System rejects duplicate.
TST-BR-03	Verify barcode checksum.	Check digit validation passes.
TST-BR-04	Scan barcode with handheld reader	Barcode decodes to correct data
TST-BR-05	Generate origin suffix	Suffix based on origin code (e.g., “P” for Portal)

6 Document Sign-off

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