MACHINE READABLE TRAVEL DOCUMENTS

(Logo)

TECHNICAL REPORT

DEVELOPMENT
OF A
LOGICAL DATA STRUCTURE - LDS
For
OPTIONAL CAPACITY EXPANSION TECHNOLOGIES

FIRST EDITION - 2003

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FOREWORD

The International Civil Aviation Organization published the first edition of Doc 9303 in 1980. Titled *A Passport with Machine Reading Capability*, this document contained specifications and guidance material solely for machine readable passports and was the basis for ISO Standard 7501 (1985).

During the 1990s, Doc 9303 was expanded to cover a family of machine readable travel documents and is now issued in separate parts. Part 1, *Machine Readable Passports*, contains the basic specifications of the 1980 edition, integrated with ISO Standard 7501 (1985) and updated in the light of technological developments and experience by the ICAO consultative body now known as the Technical Advisory Group on Machine Readable Travel Documents (TAG/MRTD). The technical specifications sections of the previous editions of Part 1, Part 2 (*Machine Readable Visas*), and Part 3 (*Size 1 and Size 2 Machine Readable Official Travel Documents*) have been endorsed by the International Organization for Standardization as ISO/IEC Standards 7501-1, 7501-2, and 7501-3, respectively. Part 4 (*Machine Readable Crew Member Certificate*) was not submitted for ISO endorsement since its specifications are technically a subset of Part 3.

As developmental work on Parts 2, 3 and 4 proceeded, the design concepts evolved, and it was believed that some of the new concepts incorporated in the more recently completed parts could also be applied to those issued earlier; for example, the flexibility of layout in the visual inspection zone that has been permitted in the specifications for visas and official travel documents could well be extended to the specifications for passports. Moreover, there are many features that are common to every document in the family, and the contents of the various parts have many similarities. Therefore, the fourth edition of Doc 9303, Part 1, is the result of a comprehensive review of the four parts, with the objective of harmonizing them to the maximum extent.

In addition to expanded and enhanced specifications and guidance material on matters such as naming conventions, transliteration of national characters in the machine readable zone and the calculation of check digits, a number of new concepts have been introduced to reflect the most recent work of the TAG/MRTD in the light of technological progress. With the introduction of a specification for placement of a bar code on the data page, States now have the option of expanding the machine readable passport's storage capacity for machine readable data, which may be used in machine-assisted identity confirmation and machine-assisted verification of document security. Further, the specifications for a "passport card", previously presented as a Size-3 document, have been replaced with a provision for issuing the passport as a wallet-size card in accordance with the specifications for the Size-1 machine readable official travel document as set forth in Doc 9303, Part 3.

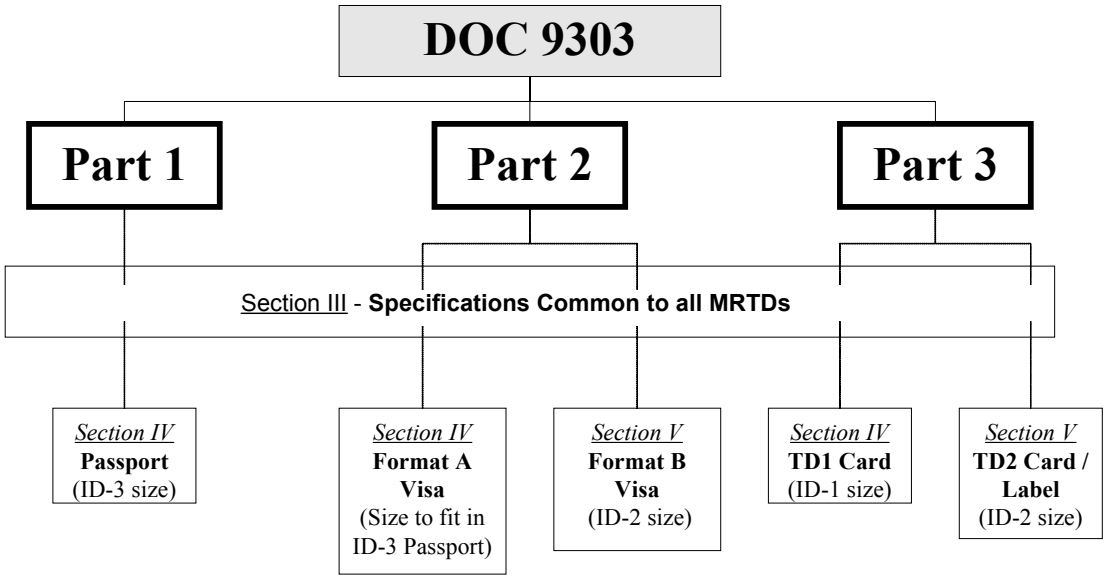
A concept which is highlighted in the fourth edition is that of "global interoperability". In this context, the term is understood as the capability of inspection systems (either manual or automated) in different States throughout the world to exchange data, to process data received from systems in other States, and to utilize that data in inspection operations in their respective States. Global interoperability is a major objective of the standardized specifications for placement of both eye-readable and machine readable data in all MRTDs.

I. INTRODUCTION

ICAO's work on machine readable travel documents began in 1968 with the establishment, by the Air Transport Committee of the Council, of a Panel on Passport Cards. This Panel was charged with developing recommendations for a standardized passport book or card that would be machine readable, in the interest of accelerating the clearance of passengers through passport controls. The Panel produced a number of recommendations, including the adoption of optical character reading (OCR) as the machine reading technology of choice due to its maturity, cost-effectiveness and reliability. In 1980, the specifications and guidance material developed by the Panel were published as the first edition of Doc 9303, titled *A Passport with Machine Readable Capability*, which became the basis for the initial issuance of machine readable passports by Australia, Canada and the United States.

In 1984, ICAO established what is now known as the Technical Advisory Group on Machine Readable Travel Documents (TAG/MRTD), comprised of government officials who specialize in the issuance of passports and other travel documents, in order to update and enhance the specifications which had been prepared by the Panel. Subsequently, this group's terms of reference were expanded to include, first, the development of specifications for a machine readable visa and, later, specifications for machine readable cards that may be used as official travel documents. Doc 9303 is now published in separate parts, one for each type of document.

In 1997 the TAG/MRTD commenced a comprehensive revision of Doc 9303, Parts 1, 2 and 3. In this revision process the structure and organization of the three parts have been harmonized in order to ease implementation by issuing States and Organizations. Each part of Doc 9303 contain a section which outlines the specifications which are common to all types of machine readable travel documents, followed by one or more sections detailing the specifications unique to the type of travel document addressed in the particular part. This familial relationship among the three parts of Doc 9303 is demonstrated in the following diagram.



During the revision of Doc 9303 TAG/MRTD determined that a State or organization might wish to expand the machine readable data capacity of the MRTD beyond that defined for global interchange (optical character reading of the MRZ), for such purposes as providing machine readable access to breeder document information (e.g. birth certificate details), stored personal identity confirmation and/or document authenticity verification details. Since *co-existence* of an optional machine readable data storage technology with the *mandatory OCR technology* is critical to ensure global interoperability of the MRTD, specifications where developed governing the location of the capacity expansion technologies (i.e. magnetic stripe, IC(s) with contacts, contactless IC(s), optical memory and bar code(s)) on a MRTD. These specifications have been included in the new editions of each Part of Doc 9303.

To ensure global interoperability for machine reading of stored details, TAG/MRTD initiated the development of a standardized organization of data ("Logical Data Structure" or 'LDS' as referred to herein) for the recording of details in a capacity expansion technology. As part of this work, unique 'mappings' – *ways of storing the Logical Data Structure* - were developed to ensure optimal recording for each capacity expansion technology, as well as compliance with published International Standards specific to that technology.

Given the lengthy time required to develop the LDS and the various technology specific mappings; the importance ICAO places on proactively supporting the needs of Member States and their solution providers by sharing information on planned developments in advance of publication of specifications in Doc 9303; and the need to establish a sense of order, which is important for achieving and maintaining global interoperability during this period of development, ICAO has decided to publish a Technical Report in advance of publication of formal specifications for the LDS in future Editions of Doc 9303 as follows:

- Technical Report: Development of a Logical Data Structure (LDS) For Optional Capacity Expansion Technologies

GENERAL CONSIDERATIONS

ICAO's leadership role

ICAO's initiative to develop standard specifications for passports and other travel documents followed the tradition established by the League of Nations Passport Conferences of the 1920s and the work of the League's successor, the United Nations Organization. ICAO's mandate to continue in its leadership role stems from the Chicago Convention, which covers the full range of requirements for efficient and orderly civil aviation operations, including provisions for clearance of persons through border controls, i.e.

a) the requirement for persons traveling by air and aircraft crews to comply with immigration, customs and passport regulations (Article 13);

b) the requirement for States to facilitate border clearance formalities and prevent unnecessary delays (Article 22); and

c) the requirement for States to develop and adopt internationally standard procedures for immigration and customs clearance (Article 37 (j)).

Under this mandate, ICAO develops and maintains international standards in Annex 9 to the Convention *(Facilitation)* for implementation by Contracting States. In the development of such standards, it is a fundamental precept that if public authorities are to offer facilitation benefits to the vast majority of air travelers, those authorities must have a satisfactory level of confidence in the reliability of travel

documents and in the effectiveness of inspection procedures. The production of standardized specifications for travel documents is aimed at building that confidence.

For these reasons, the Council of ICAO has affirmed that work on specifications for travel documents is an appropriate part of the work programme for the Organization. Nevertheless, ICAO is prepared to cooperate with any other international organization that might wish to promote the use of MRTDs. In addition to the International Organization for Standardization (ISO), consultants to the TAG/MRTD include the International Air Transport Association (IATA), the Airports Council International (ACI), and the International Criminal Police Organization (INTERPOL).

Relative costs and benefits of machine readable travel documents

Experience with the issuance of machine readable passports, in conformity with the specifications set forth in Doc9303, Part 1, indicates that the cost of producing MRTDs may be no greater than that of producing conventional documents. As traffic volumes grow and more States focus on how they can rationalize their clearance processes with the employment of computerized databases and electronic data interchange, the MRTD plays a pivotal part in modern, enhanced compliance systems. Equipment to read the documents and access the databases may entail a substantial investment, but this can be expected to be returned by the improvements in security, clearance speed and accuracy of verification that such systems provide. Use of MRTDs in automated clearance systems may also make it possible for States to eliminate both the requirement for paper documents, such as passenger manifests and embarkation/disembarkation cards, and the administrative costs associated with the related manual procedures.

Operations

The machine readable travel document, with its OCR medium, is designed for both visual and mechanical reading. This feature is essential, since the conversion of travel documents to machine readable format can only be made gradually as current travel documents expire and are renewed or reissued, and the introduction of machine readability at border-crossing points is only being introduced gradually according to traffic volumes. As additional machine reading technologies are introduced on an optional basis in various travel documents, the OCR will be retained as the basic technology, considered mandatory to ensure international interoperability.

It has been discovered that the benefits of adopting the machine readable formats for passports and other travel documents extend beyond the obvious advantages for States that have the machine readers and databases for use in automated clearance systems. Many developing countries have elected to invest resources in the introduction of machine readable travel documents because the physical characteristics and data security features of the documents themselves offer strong defence against alteration, forgery or counterfeit. Moreover, adoption of the standardized format for the visual zone of an MRTD facilitates inspection by airline and government officials, with the result that clearance of low-risk traffic is expedited, problem cases are more readily identified, and enforcement is improved.

Endorsement of Doc 9303 by ISO

The technical specifications sections of Doc 9303, Part 1 (third edition), Part 2 (second edition) and Part 3 (first edition) have received the endorsement of the International Organization for Standardization as ISO Standards 7501-1, 7501-2, and 7501-3, respectively. Such endorsement is made possible by means of a liaison mechanism through which designers and manufacturers of travel documents and readers provide technical and engineering advice to the TAG/MRTD under the auspices of ISO, thus coordinating the development of Doc 9303 with the relevant ISO standards. Through this working relationship, the ICAO specifications have achieved the status of worldwide standards by means of a simplified procedure within ISO.

The liaison mechanism with ISO has been successfully applied not only to the endorsement of new specifications for travel documents as ISO standards but also to the approval of amendments to the specifications. Subsequent revisions to Doc 9303, Parts 1, 2 and 3, will therefore be processed for ISO endorsement in the same manner as previously.

II. DEVELOPMENT OF A LOGICAL DATA STRUCTURE FOR OPTIONAL CAPACITY EXPANSION TECNOLOGIES

Scope

1. *Technical Report: Development of a Logical Data Structure (LDS) For Optional Capacity Expansion Technologies* defines the current state of development of specifications[1] for the standardized organization of data ('Logical Data Structure - LDS') recorded to a capacity expansion technology of a MRTD at the discretion of an issuing State or organization.

Normative references

2. Certain provisions of the following International Standards, referenced in this text, constitute provisions of this Technical Report. Where differences exist between the emerging specifications[1] contained in this Technical Report and the referenced Standards, to accommodate specific construction requirements for machine readable travel documents including machine readable passports, the specifications[1] contained herein shall prevail. Note, individual mapping annexes list additional normative references specific to the technologies associated with that mapping methodology.

ISO 1073-II : 1976	Alphanumeric character sets for optical character recognition - Part II: Character set OCR-B - Shapes and dimensions of the printed image
ISO 1831 : 1980	Printing specifications for optical character recognition
ISO 3166 : 1997	Codes for representation of names of countries
ISO/IEC 7810 : 1995	Identification cards - Physical characteristics
ISO/IEC 8601: 1988	Data elements and interchange formats - Information interchange - Representation of dates and times
ISO/IEC 8825: xxxx,	Information technology – Open Systems Interconnections – Specification of Basic Encoding Rules for Abstract Syntex Notation One (ASN.1)

Definitions

3. For the purpose of this Technical Report, the following definitions shall apply.

- ASN.1: Abstract Syntex Notation One
- *CBEFF:* Common Biometric Exchange File Format, NISTIR 6529-A, a common file format that facilitates exchane and interoperability of biometric data. This document is currently being promted by ISO/IEC JTC1/SC37 as an draft international standard.

[1] *Specifications* as envisaged based on work completed to date. Specifications will only be considered final when they have been published in Doc 9303.

- *Machine readable travel document (MRTD):* Official document issued by a State or Organization which is used by the holder for international travel (e.g. passport, visa, official document of identity) and which contains mandatory visual (eye readable) data and a separate mandatory data summary, intended for global use, reflecting essential data elements capable of being machine read.

- *Machine readable passport (MRP):* Passport conforming with the specifications contained herein, formulated to improve facilitation and enhance security. Contains mandatory visual (eye readable) data and a separate mandatory data summary, intended for global use, reflecting essential data elements capable of being machine read. Presentation of optional data is permitted in accordance with the specifications defined herein. Normally constructed as an ID-3 size book containing pages with information on the holder and the issuing State or Organization and pages for visas and other endorsements. Machine readable information is contained in two lines of OCR-B text, each with 44 characters. May also be a free-standing card of ID-1 size with three lines of machine readable OCR-B text, each with 30 characters.

- *MRP Data Page:* Fixed dimensional page within the MRP containing a standardized presentation of visual and machine readable data. When constructed to form an end leaf of the MRP, the presentation of details is restricted to the front of the MRP Data Page, with the back securely bonded to the cover stock of the MRP.

- *Machine readable visa (MRV):* A visa or, where appropriate, an entry clearance (hereinafter collectively referred to as visas) conforming with the specifications contained herein, formulated to improve facilitation and enhance security for the visa holder. Contains mandatory visual (eye readable) data and a separate mandatory data summary capable of being machine read. The MRV is normally a label which is attached to a visa page in a passport.

- *Full size (Format-A) machine readable visa (MRV-A):* An MRV conforming with the dimensional specifications contained in Doc 9303, Part 2, for use by States who wish to ensure they have sufficient space available to accommodate their data requirements (including the use of two 44-character machine readable lines of data) and who do not need to maintain a clear area on the passport visa page adjacent to the visa.

- *Small size (Format-B) machine readable visa (MRV-B):* An MRV conforming with the dimensional specifications (ID-2 size) contained in Doc 9303, Part 2, and enabling States to maintain a clear area on the passport visa page adjacent to the visa to allow, for example, a seal to be placed on the visa and the passport page on which it is affixed. Consistent with its smaller size, the MRV-B contains two 36-character machine readable lines of data.

- *Machine readable official travel document:* An official document issued by a State or Organization which may, at the discretion of States, be accepted in lieu of a passport or visa for international travel, and suitable for machine reading.

- *Size 1 machine readable official travel document (TD1):* A card with nominal dimensions guided by those specified for the ID-1 type card (ISO 7810) (excluding thickness).

- *Size 2 machine readable official travel document (TD2):* A card or label conforming with the dimensions defined for the ID-2 type card (ISO 7810) (excluding thickness).

- *Machine readable zone (MRZ):* Fixed dimensional area located on the front of the MRTD or MRP Data Page or, in the case of the TD1, the back of the MRTD, containing mandatory and optional

data for machine reading using OCR methods.

- *Effective reading zone (ERZ):* Fixed dimensional area, common to all MRTDs, in which the mandatory machine readable data can be read by document readers.

- *Visual inspection zone (VIZ):* Those portions of the MRTD (data page in the case of MRP), i.e. front and back (where applicable), not defined as the MRZ.

- *Issuing State:* The Country issuing the MRTD.

- *Receiving State:* The Country to which the MRTD holder is applying for entry.

- *Issuing Organization:* Organization authorized to issue an official travel document (e.g. the United Nations Organization, issuer of the Laissez-passer).

- *Authorized Receiving Organization:* Organization authorized to process an official travel document (e.g. an air carrier) and as such, allowed to record details in the optional capacity expansion technology.

- *Zone:* An area containing a logical grouping of data elements on the MRTD. Seven (7) zones are defined for MRTDs.

- *Field:* Specified space for an individual data element within a zone.

- *Caption:* Printed field name used to identify a field. Several captions are mandatory on the MRTD.

- *Portrait:* A visual representation of the facial image of the holder of the document.

- *Logical Data Structure (LDS):* The collection of groupings of Data Elements stored in the optional capacity expansion technology.

- *Data Group:* A series of related Data Elements grouped together within the Logical Data Structure.

- *Issuer Data Block:* A series of Data Groups that are written to the optional capacity expansion technology by the issuing State or organization.

- *Receiver Data Block:* A series of Data Groups that are written to the optional capacity expansion technology by a receiving State or authorized receiving organization.

- *Authenticity:* The ability to confirm that the Logical Data Structure and its components were created by the issuing State or organization.

- *Integrity:* The ability to confirm that the Logical Data Structure and its components have not been altered from that created by the issuing State or organization.

Development of a Logical Data Structure for Optional Capacity Expansion Technologies

4. Details on the LDS [Version 1.0] as developed to date are presented in eight sections as follows:

Section III – Background;

Section IV – Requirements;
Section V – Organization of Mandatory and Optional Data Elements;
Section VI – Security Principles;
Section VII – Mapping Principles Common to All Optional Capacity Expansion Technologies;
Section VIII - Mapping Annexes (*Normative*);
Section IX - Supporting Annexes (*Normative*); and
Section X - Supporting Annexes (*Informative*).

III. BACKGROUND

A standardized Logical Data Structure (LDS) is required to enable global interoperability for machine reading of recorded details stored in an optional capacity expansion technology that has been added to a MRTD at the discretion of an issuing State or Organization.

In developing the LDS, ICAO established as a preeminent requirement the need for a single LDS for all MRTDs, one that governs the recording of details when using any of the optional capacity expansion technologies currently defined for MRTDs; *i.e. IC(s) with contacts*, *contactless IC(s)*, *optical memory* and *bar code(s)*. Addressing this requirement is complicated since each of the capacity expansion technologies operates differently and while a sequential recording of data can be implemented with all (i.e. data is organized as a single continuous entity, written from beginning to end in a predefined, standardized organization (order)), this would not afford optimal use (performance) of certain technologies; *for example,* IC(s) with contacts and contactless IC(s) have the inherent ability to have details recorded out of order and still provide them to a machine reader in the predefined, fixed logical order required. IC(s) with contacts and contactless IC(s) also have the ability to provide individual details (Data Elements) when requested by a machine reader.

ICAO has conceived a LDS that allows both options to coexist: *i.e. (1)* a *sequential recording of data in a predefined, standardized organization and (2)* a *random ordering when using accommodating technologies (e.g. IC(s) with contacts, contactless IC(s), and optical memory)*. This has been accomplished by developing 'mapping specifications' for each optional capacity expansion technology; i.e. specifications that define how the LDS should be written to a specific optional capacity technology to enable optimal use of an optional capacity expansion technology and to ensure compliance with technology related International Standards, while ensuring a predefined, standardized organization is provided to achieve global interoperability when machine reading.

The LDS continues to evolve, as more is confirmed about the capacity expansion needs of ICAO Member States and other organizations that will use the LDS. The evolution of data security requirements, in particular, may impact the LDS as more is known about the needs for data integrity and privacy.

IV. REQUIREMENTS

1. ICAO has determined that the predefined, standardized Logical Data Structure - LDS must meet a number of *mandatory* requirements:

- Ensure efficient and optimum facilitation of the rightful holder;
- Ensure protection of details recorded in the optional capacity expansion technology;
- Allow global interchange of capacity expanded data based on the use of a single LDS common to all MRTDs;
- Be compatible with the complete range of optional machine readable data capacity expansion technologies currently defined for the MRTD; i.e. *IC(s) with contacts*, *contactless IC(s)*, *optical memory* and *bar code(s)*. *Note bar code(s) are restricted to 2-dimensional (2-D) bar codes to meet the recording needs dictated by the LDS*;
- Accommodate sequential recording of data in a predefined, standardized organization as well as a random ordering when using accommodating technologies;
- Allow fully compliant implementation within a small storage capacity technology (e.g. 2-dimensional bar code(s)), as well as, a technology offering significant capacity expansion (e.g. optical memory and integrated circuits);
- Ensure that issuing States and organizations need only purchase the optional storage capacity required to address their specific needs (an important consideration for those wishing to use IC(s) with contacts or contactless IC(s));
- Ensure that print-based capacity expansion technologies [e.g. bar code(s)] utilize only that portion of the Visual Inspection Zone (VIZ) required to store the capacity of optional machine readable data;
- Address the diverse optional capacity expansion needs of issuing States and organizations;
- Support multiple, co-existent capacity expansion technology implementations;
- Provide expansion capacity as user needs and available technology evolve;
- Support a variety of data protection options;
- Support the updating of details by a issuing State or organization;
- Support the addition of details by a receiving State or approved receiving organization while maintaining the authenticity[2] and integrity[3] of data created by the issuing state or organization; and

[2] *Authenticity* - ability to confirm the LDS and its components were created by the issuing State or organization.

[3] *Integrity* – ability to confirm the LDS and its components have not been altered from that created by the issuing State or organization.

- Utilize existing International Standards to the maximum extent possible (*For example*, stored binary representations of *displayed portrait*, *displayed signature or usual mark* and *displayed single-digit fingerprint* must conform to internationally recognized encoding/decoding and compression standards to ensure global interoperability).

2. ICAO has determined that the predefined, standardized Logical Data Structure - LDS should be arranged, where ever possible, to:

- Allow two (2) fundamental data ordering approaches to coexist – *i.e. (1) sequential ordering of data in a predefined, standardized organization and (2) random ordering of data when using accommodating technologies*.

- Allow three (3) data recording (mapping) approaches to coexist – *i.e. (1) sequential representation of the LDS when using optional 2-D Bar Codes ; (2) random access representation of the LDS when using optional Optical Memory*; and (3) *random access representation of the LDS when using optional IC(s) with Contacts or Contactless IC(s)*.

- Use a common method to protect the authenticity and integrity of the data contained in the LDS. This method is described in Section VI, Security Principles.

V. ORGANIZATION OF MANDATORY AND OPTIONAL DATA ELEMENTS

Scope

1. This Section defines the pinnacle level of data organization defined for the Logical Data Structure – LDS; that being, the identification of all mandatory and optional data elements and any prescriptive ordering and/or grouping of data elements that must be followed to achieve global interoperability for reading of details (Data Elements) recorded in a capacity expansion technology optionally included on a MRTD. Details on the writing (mapping) of the LDS common to all the different types of optional capacity expansion technologies are presented in Section VII, while comprehensive details specific to a technology are included in the normative Mapping Annexes contained in Section VIII.

Mandatory and Optional Data Elements

2. A series of mandatory and optional **Data Elements** has been defined for the LDS to meet the global requirements of processing persons presenting MRTDs as illustrated in Figure V-1.

Ordering and Grouping of Data Elements

3. A logical order[4] supported by ordered groupings of related Data Elements has been established for the series of mandatory and optional Data Elements as illustrated in Figure V-1.

4. The ordered groupings of Data Elements are further grouped depending on whether they have been recorded by (1) an issuing State or organization or (2) a receiving State or approved receiving organization.

5. The only Data Elements that must be present (mandatory) if a LDS is recorded to an optional capacity expansion technology are those that define the contents of the Machine Readable Zone (MRZ) of the MRTD. All other Data Elements defined for recording by an issuing State or organization are *optional*.

6. Groupings of Data Elements added by receiving States or approved receiving organizations may or may not be present in a LDS. More than one recording of grouped Data Elements added by receiving States or approved receiving organizations can be present in the LDS as illustrated in Figure V-2. *Note: The ability for a receiving State or approved receiving organization to add data to the LDS is not supported in LDS [Version 1.0].*

7. The LDS is considered to be a single cohesive entity containing the number of groupings of Data Elements recorded in the optional capacity expansion technology at the time of machine reading.

[4] The logical order for Data Elements defined in Section V has been standardized to meet the global requirements established for enhanced facilitation and improved security when processing persons presenting MRTDs. The actual order of recording of the grouped Data Elements is defined by specifications established to ensure efficient performance of each capacity expansion technology. These specifications are defined in the individual normative Mapping Annexes contained in Section VIII.

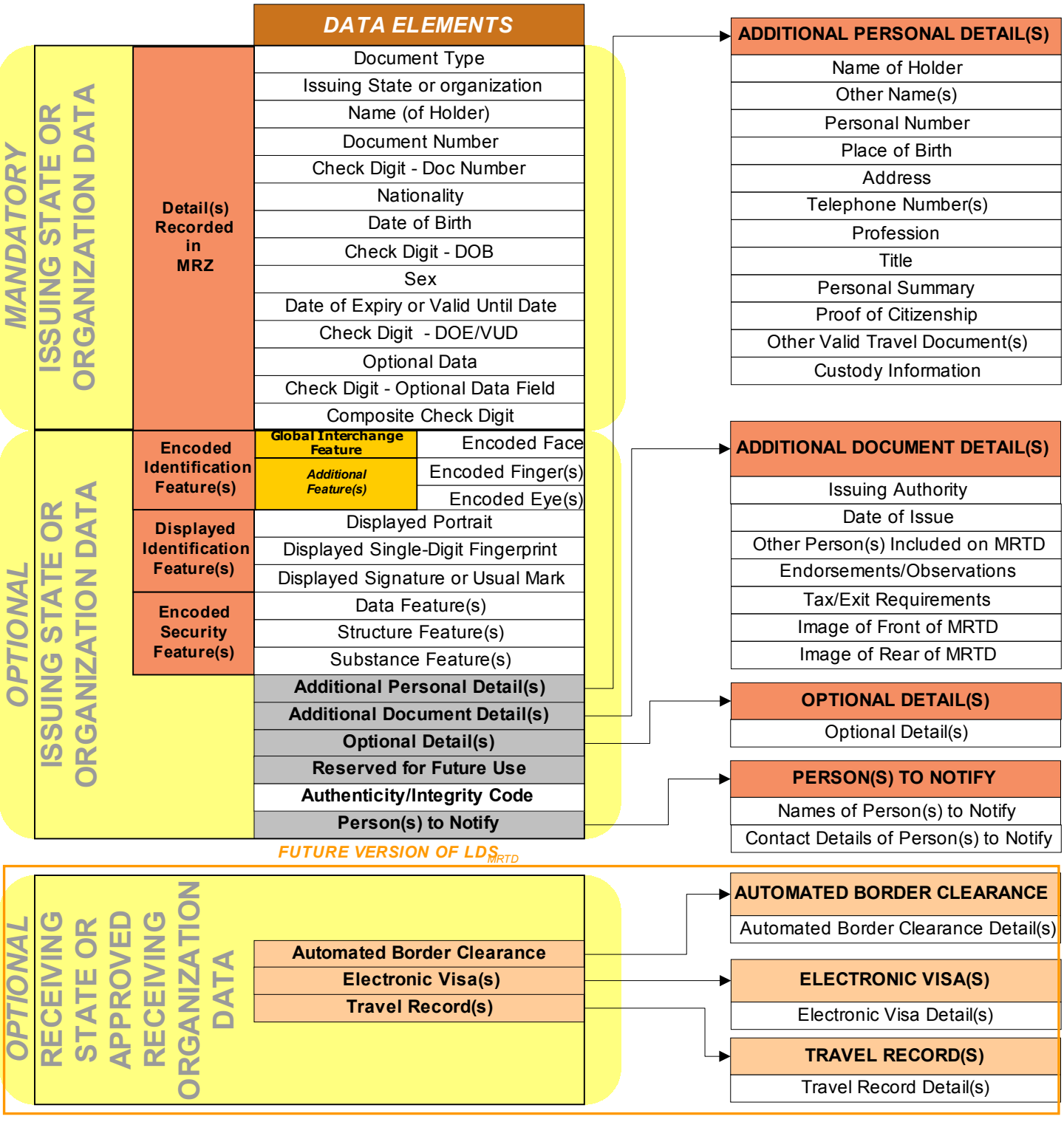


FIGURE V-1. MANDATORY AND OPTIONAL DATA ELEMENTS DEFINED FOR LDS [Version 1.0]

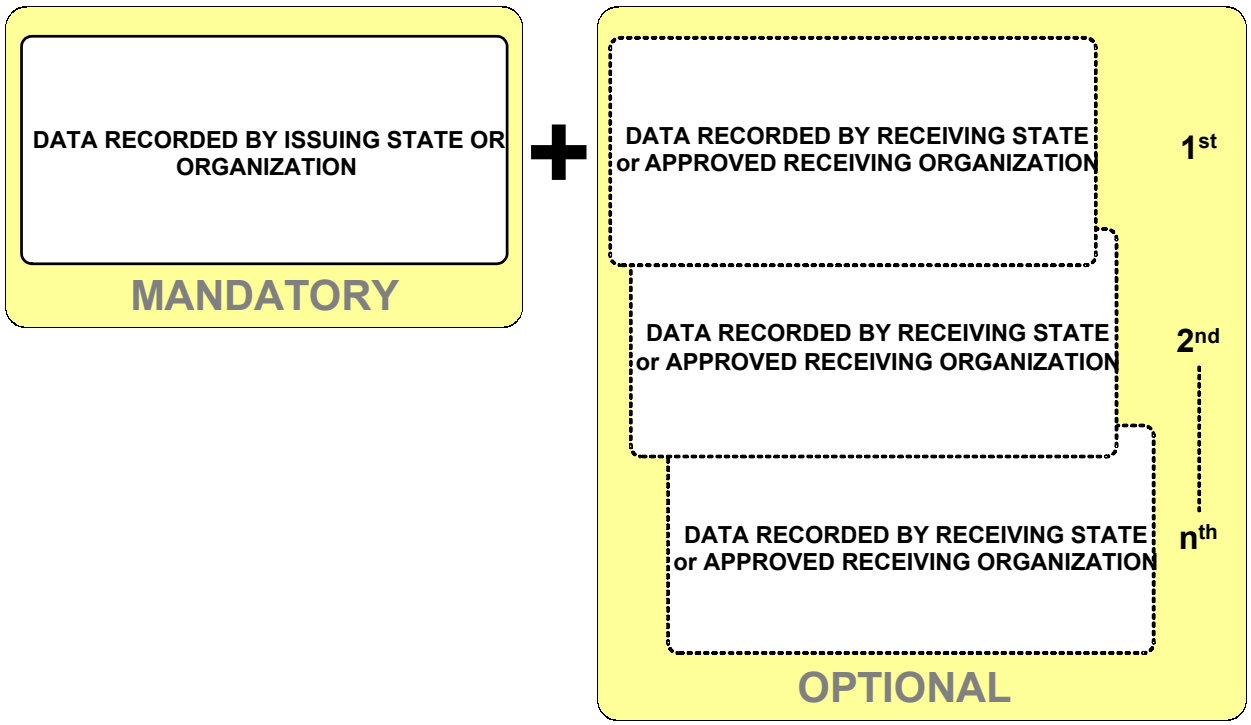


FIGURE V-2. DATA RECORDINGS WITHIN LDS [VERSION 1.0]

8. Within the LDS, logical groupings of related Data Elements have been established. These logical groupings are referred to as **Data Groups**.

9. Each Data Group is assigned a reference number. Figure V-3 identifies the reference number assigned to each Data Group**]**. *For Example,* "DG2" identifies Data Group # 2, Encoded Identification Feature(s) for the face of the rightful holder of the MRTD (*i.e.* facial biometric details). *Note: Receiving State Data Groups (Data Groups 17-19) are not supported in LDS [Version 1.0].*

Data Groups Coded to Allow Confirmation of Authenticity and Integrity of Data

10. To allow confirmation of the authenticity and integrity of recorded details, Authenticity/Integrity Code(s) are implemented two ways. If the LDS is recorded as one sequential structure, one Authenticity/Integrity Code (Data Group 15) is used to protect the mandatory MRZ (Data Group 1) and any optional Data Groups included at the discretion of the issuing State or organization. If the LDS has been implemented to allow random access of individual Data Groups, each Data Group may, at the discretion of the issuing State or organization, be protected by its own Authenticity/Integrity Code. Data Group 15 is not used when a random access structure is used. Due to the CBEFF structure utilized for Encoded Identification Feature Data Groups 2-4, identity confirmation details (e.g. biometric templates) may be individually protected at the discretion of the issuing State or organization. Identity confirmation details such as biometric templates may also be enciphered to restrict their use to specific agreements established by the issuing State or organization. Information on the preparation and use of the Authenticity/Integrity Code is presented in Section VI, Security Principles.

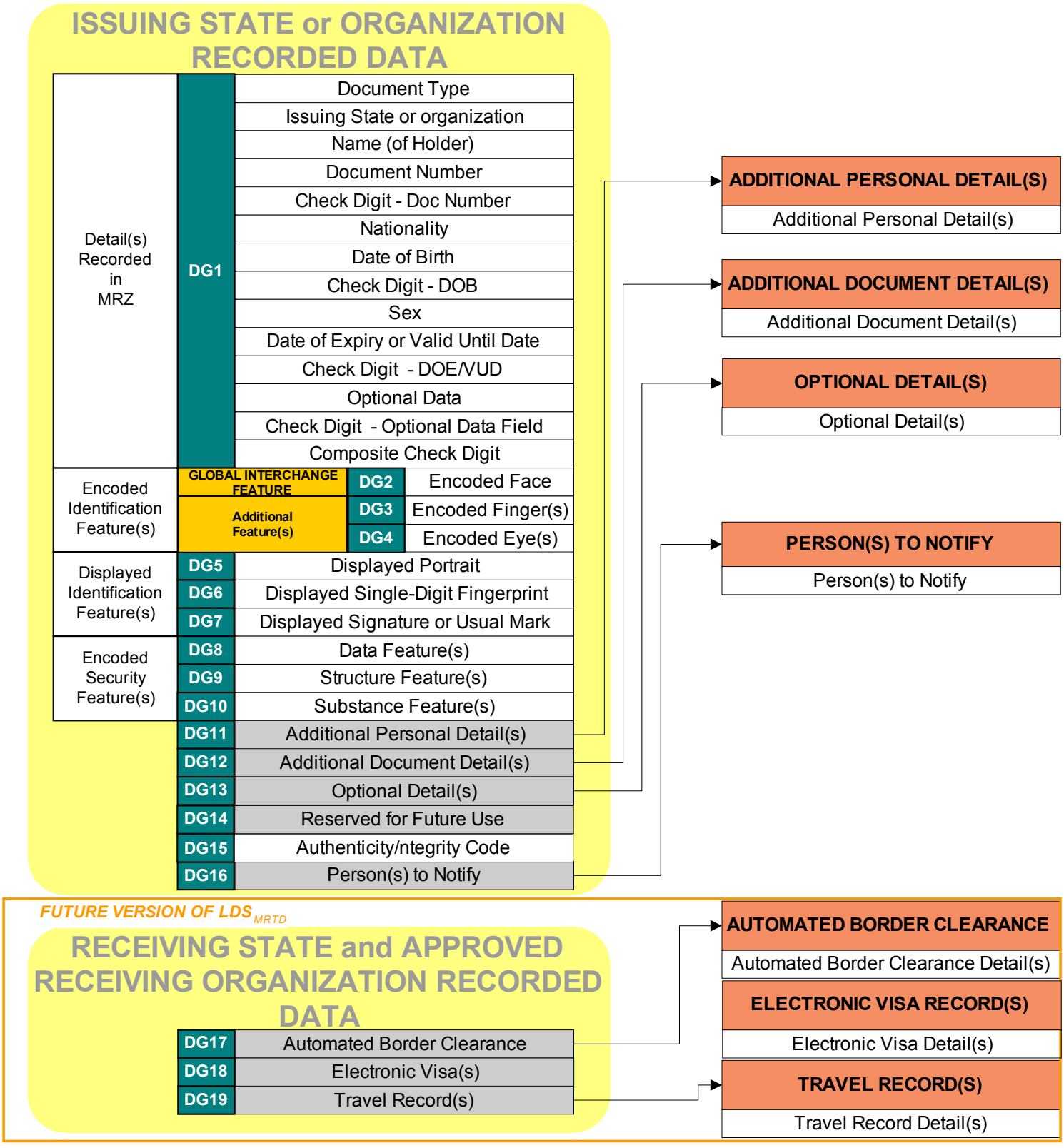


FIGURE V-3. DATA GROUP REFERENCE NUMBERS ASSIGNED TO LDS [VERSION 1.0]

DATA GROUPS RECORDED BY THE ISSUING STATE OR ORGANIZATION

11. The following Table defines the *mandatory* and *optional* Data Groups that combine to form that portion of the LDS [Version 1.0] recorded by the Issuing State or Organization.

DATA GROUP	MANDATORY (M) / OPTIONAL (O)	DATA ITEM	
Detail(s) Recorded in MRZ of the MRTD			
1	M	Machine Readable Zone (MRZ) Data *[See 13.1]*	
Machine Assisted Identity Confirmation Detail(s) – Encoded Identification Feature(s)			
2	O	**GLOBAL INTERCHANGE FEATURE**	Encoded Face *[See 13.2]*
3	O	Additional Feature	Encoded Finger(s) *[See 13.2]*
4	O	Additional Feature	Encoded Iris(s) *[See 13.2]*
Machine Assisted Identity Confirmation Detail(s) – Displayed Identification Feature(s)			
5	O	Displayed Portrait *[See 13.3]*	
6	O	Displayed Single-Digit Fingerprint *[See 13.3]*	
7	O	Displayed Signature or Usual Mark *[See 13.3]*	
Machine Assisted Security Feature Verification – Encoded Security Feature(s)			
8	O	Data Feature(s) *[See 13.4]*	
9	O	Structure Feature(s) *[See 13.4]*	
10	O	Substance Feature(s) *[See 13.4]*	
Additional Personal Detail(s)			
11	O	Additional Personal Data Elements *[See 13.5]*	
Additional Document Detail(s)			
12	O	Additional Document Data Elements *[See 13.6]*	
Optional Detail(s)			
13	O	Discretionary Data Element(s) defined by issuing State or organization *[See 13.7]*	
Reserved for Future Use			
14	O	Reserved for future use	
Authenticity/Integrity Code			
15	M for sequential ordering of data, Not used for random ordering of data	Recorded Details Authenticity/Integrity Code *[See 13.8]*	
Person(s) to Notify			
16	O	Person(s) to Notify Data Element(s) *[See 13.9]*	

Data Elements Forming Data Groups 1 Through 16

12. Data Groups 1 (DG1) through 16 (DG16) individually consist of a number of *mandatory* and *optional* Data Elements. The order of Data Elements within the Data Group is standardized[5].

13. The following Tables define the *mandatory* and *optional* Data Elements that combine to form the structure of Data Groups 1 (DG1) through 16 (DG16).

13.1 *Detail(s) Recorded in MRZ of the MRTD.* Data Elements assigned to Data Group 1 (DG1) are as follows,

Data Group	Data Element	Fixed/ Variable	Mandatory / Optional	Data Item
DG1			**M**	**MRZ (Summary of details as recorded on MRTD)**
	01	F	M	Document Type
	02	F	M	Issuing State or organization
	03	V	M	Name (*of Holder*)
	04	F	M	Document Number (*9 most significant characters*) *[see 13.1.1]*
	05	F	M	Check digit - Document Number or filler character (<) indicating Document Number exceeds 9 characters. *[see 13.1.1]*
	06	F	M	Nationality
	07	F	M	Date of Birth
	08	F	M	Check digit - Date of Birth
	09	F	M	Sex
	10	F	M	Date of Expiry *(For MRP, TD-1 and TD-2)*
		F	M	Valid Until Date *(For MRV-A and MRV-B)*
	11	F	M	Check digit - Date of Expiry or Valid Until Date
	12	V	O	Optional Data and/or *in the case of a TD-1* Least Significant Characters of Document Number + Document Number Check digit + filler character (<) *[when Document Number > 9 characters] [see 13.1.1 and 13.1.2]*
	13	F	M	Check digit – Optional Data Field
	14	F	M	Composite Check Digit

13.1.1 *Document Number on a TD-1 has more than 9 characters.* The nine (9) principal (most significant) characters shall be recorded in Data Element 04. Data Element 05 shall be coded with the filler character (<). The remaining characters of the document number shall be recorded at the beginning of Data Element 12 (Optional Data) followed by the Document Number Check digit and a filler character (<).

13.1.2 *Data Element 12 on a TD-1 contains least significant characters for Document Number exceeding 9 characters.* The remaining characters of the document number shall be recorded at the beginning of Data Element 12 followed by the Document Number Check digit and a filler character (<). Optional Data, if present, shall be located in the remaining character positions of Data Element 12.

[5] The order of Data Elements within a Data Group is standardized in a logical sense. The final ordering can be effected by the mapping requirements of the individual capacity expansion technologies, as set out in Section VII.

13.2 *Machine Assisted Identity Confirmation Detail(s) – Encoded Identification Feature(s).* Data Elements assigned to Data Groups 2 (DG2) through 4 (DG4) are as follows,

Data Group	Data Element	Mandatory / Optional	Data Item
DG2		**O**	**GLOBAL INTERCHANGE IDENTIFICATION FEATURE – FACE** *[see 13.2.1]*
	01	M *(If encoded face feature recorded)*	Number of Face Biometric Encodings Recorded
	02[6]	M *(If encoded face feature recorded)*	Header *[see 13.2.3]*
	03[6]	M *(If encoded face feature recorded)*	Face Biometric Data Encoding(s) *[see 13.2.3]*
	04[6]	O	Face Biometric Data Integrity Code(s) *(see 13.2.4)*
	05	M *(If random ordering of data)*	Data Group Authenticity/Integrity Code *[see 13.2.5]*
ADDITIONAL IDENTIFICATION FEATURE(s) *[see 13.2.2]*			
DG3		**O**	**ADDITIONAL IDENTIFICATION FEATURE – FINGER(S)** *[see 13.2.2]*
	01	M *(If encoded finger(s) feature recorded)*	Number of Finger(s) Biometric Encodings Recorded
	02[6]	M *(If encoded finger(s) feature recorded)*	Header *[see 13.2.3]*
	03[6]	M *(If encoded finger(s) feature recorded)*	Finger Biometric Data Encoding(s) *[see 13.2.3]*
	04[6]	O	Finger Biometric Data Integrity Code(s) *(see 13.2.4)*
	05	M *(If random ordering of data)*	Data Group Authenticity/Integrity Code *[see 13.2.5]*
DG4		**O**	**ADDITIONAL IDENTIFICATION FEATURE – IRIS(S)** ***Usage Subject to resolution if intellrctual property issues*** *[see 13.2.2]*
	01	M *(If encoded eye(s) feature recorded)*	Number of Iris(s) Biometric Encodings Recorded
	02[6]	M *(If encoded eye(s) feature recorded)*	Header *[see 13.2.3]*
	03[6]	M *(If encoded eye(s) feature recorded)*	Iris Biometric Data Encoding(s) *[see 13.2.3]*
	04[6]	O	Iris Biometric Data Integrity Code(s) *(see 13.2.4)*
	05	M *(If random ordering of data)*	Data Group Authenticity/Integrity Code *[see 13.2.5]*

[6] Data Element will repeat within the Data Group when more than one recording of the biometric feature is present; *i.e.* as defined through Data Element 01. Refer to technology mapping annexes for specific implementations.

13.2.1 Data Group 2 (DG2) when present represents the globally interoperable biometric for machine assisted identity confirmation with machine readable travel documents, which shall be face recognition. If there is more than one recording, the most recent internationally interoperable encoding shall be be the first entry.

13.2.2 ICAO recognizes that Member States may elect to use fingerprint and/or iris recognition as additional biometric technologies in support of machine assisted identity confirmation, which shall be encoded as Data Group 3 (DG3) and Data Group 4 (DG4) respectively.

13.2.3 Data Elements 02 and 03 shall be encoded as defined in *Normative Supporting Annex A to Section IX.*

13.2.4 Optional Biometric Data Integrity Code can be included for each individual biometric sample. The presence of this code is defined in the Header contained within DG2, DG3 and/or DG4.

13.2.5 Data Group Authenticity/Integrity Code; i.e. Data Element 05 shall be encoded as defined in *Normative Supporting Annex A to Section IX.*

13.3 *Machine Assisted Identity Confirmation Detail(s) – Displayed Identification Feature(s).* Data Elements Assigned to Data Groups 5 (DG5) through 7 (DG7) are as follows,

Data Group	Data Element	Mandatory / Optional	Data Item
DG5		**O**	**DISPLAYED PORTRAIT**
	01	M *(If displayed portrait recorded)*	Number of Displayed Portraits Recorded
	02[7]	M *(If displayed portrait recorded)*	Displayed Portrait Representation(s) *[see 13.3.1]*
	03	M *(If random ordering of data)*	Data Group Authenticity/Integrity Code *[see 13.3.3]*
DG6		**O**	**DISPLAYED SINGLE-DIGIT FINGERPRINT**
	01	M *(If displayed single-digit fingerprint recorded)*	Number of Single-Digit Fingerprints Recorded
	02[7]	M *(If displayed single-digit fingerprint recorded)*	Displayed Single-Digit Fingerprint Representation *[see 13.3.2]*
	03	M *(If random ordering of data)*	Data Group Authenticity/Integrity Code *[see 13.3.3]*
DG7		**O**	**DISPLAYED SIGNATURE OR USUAL MARK**
	01	M *(If displayed signature or usual mark recorded)*	Number of Displayed Signature or Usual Marks

[7] Data Element will repeat within the Data Group when more than one recording of the displayed feature is present; *i.e.* as defined through Data Element 01.

Data Group	Data Element	Mandatory / Optional	Data Item
	02[7]	M *(If displayed signature or usual mark recorded)*	Displayed Signature or Usual Mark Representation *[see 13.3.1]*
	03	M *(If random ordering of data)*	Data Group Authenticity/Integrity Code *[see 13.3.3]*

13.3.1 Data Element 02 of Data Groups 5 (DG5) and 7 (DG7) shall be encoded as defined in *ISO 10918-1 using the JFIF option*.

13.3.2 Data Element 02 of Data Group 6 (DG6) shall be encoded as defined in *ANSI/NIST-CSL 1-1993* and *Addendum to ANSI/NIST-CSL 1-1993: ANSI/NIST-ITL 1a-1997*.

13.3.3 The Authenticity/Integrity Code; i.e. Data Element 03 shall be encoded as defined in *Normative Supporting Annex A to Section IX.*

13.4 *Machine Assisted Security Feature Verification – Encoded Detail(s).* Data Elements combining to form Data Groups 8 (DG8) through 10 (DG10) are as follows,

Data Group	Data Element	Mandatory /Optional	Data Item
DG8		**O**	**DATA FEATURE(S)**
	01	M *(If this Encoded feature is used)*	Number of Data Feature(s)
	02[8]	M *(If this Encoded feature is used)*	Header *(to be defined)*
	03[8]	M *(If this Encoded feature is used)*	Data Feature(s) Data
	04	M *(If random ordering of data)*	Data Group Authenticity/Integrity Code
DG9		**O**	**STRUCTURE FEATURE(S)**
	01	M *(If this Encoded feature is used)*	Number of Structure Feature(s)
	02[8]	M *(If this Encoded feature is used)*	Header *(to be defined)*
	03[8]	M *(If this Encoded feature is used)*	Structure Feature(s) Data
	04	M *(If random ordering of data)*	Data Group Authenticity/Integrity Code
DG10		**O**	**SUBSTANCE FEATURE(S)**
	01	M *(If this Encoded feature is used)*	Number of Substance Feature(s) Recorded

[8] Data Element will repeat within the Data Group when more than one recording of the encoded security feature is present; *i.e.* as defined through Data Element 01.

Data Group	Data Element	Mandatory /Optional	Data Item
	02[8]	M *(If this Encoded feature is used)*	Header *(to be defined)*
	03[8]	M *(If this Encoded feature is used)*	Substance Feature(s) Data
	04	M *(If random ordering of data)*	Data Group Authenticity/Integrity Code

13.5 *Additional Personal Detail(s).* Data Elements combining to form Data Group 11 (DG11) are as follows,

Data Group	Data Element	Mandatory /Optional	Date Item
DG11		**O**	**ADDITIONAL PERSONAL DETAIL(S)**
	01	O	Name of Holder (Primary and Secondary Identifiers, in full)
	02	O	Other Name(s)
	03	O	Personal Number
	04	O	Place of Birth
	05	O	Date of Birth (in full)
	06	O	Address
	07	O	Telephone Number(s)
	08	O	Profession
	09	O	Title
	10	O	Personal Summary
	11	O	Proof of Citizenship *[see 13.5.1]*
	12	M* ** If DE 13 recorded.*	Number of Other Valid Travel Documents
	13	O	Other Travel Document Numbers
	14	O	Custody Information
	15	O	Data Group Authenticity/Integrity Code

13.5.1 Data Element 11 shall be encoded as defined in *ISO 10918-1*.

13.6 *Additional Document Detail(s).* Data Elements combining to form Data Group 12 (DG12) are as follows,

Data Group	Data Element	Mandatory /Optional	Data Item
DG12			**ADDITIONAL DOCUMENT DETAILS**
	01	O	Issuing Authority *(for the MRTD)*
	02	O	Date of Issue *(of MRTD)*
	03	M* ** If Other Person(s) Included on MRTD*	Number of Other Person(s) on MRTD *(MRV only)*
	04	O	Other Person(s) Included on MRTD *(MRV only)*
	05	O	Endorsements / Observations *(related to MRTD)*
	06	O	Tax / Exit Requirements
	07	O	Image of Front of MRTD *[see 13.6.1]*
	08	O	Image of Rear MRTD *[see 13.6.1]*
	09	O	Time MRTD Personalized
	10	O	Machine Used to Personalize MRTD
	11	O	Data Group Authenticity/Integrity Code

13.6.1 Data Elements 07 and 08 shall be encoded as defined in *ISO 10918-1*.

13.7 *Optional Detail(s).* Data Elements combining to form Data Group 13 (DG13) are as follows,

Data Group	Data Element	Mandatory /Optional	Data Item
DG13		**O**	**OPTIONAL DETAIL(S)**
	01	M *(If Data Group13 Recorded)*	Details as Determined by the issuing State or organization
	02	O	Data Group Authenticity/Integrity Code

13.8 *Unassigned Data Group*. Reserved for future use.

Data Group	Data Element	Mandatory /Optional	Data Item
DG14		**O**	**Reserved for future use**

13.9 *Authenticity/Integrity Code.* Data Elements combining to form Data Group 14 (DG14) are as follows,

Data Group	Data Element	Mandatory /Optional	Data Item
DG15		**Mandatory for sequential implementations**	**AUTHENTICITY/INTEGRITY CODE**
	01	M* **If Data Group 15 is used*	Algorithm
	02	M* **If Data Group 15 is used*	Key reference
	03	M* **If Data Group 15 is used*	Digital Signature

13.10 *Person(s) to Notify.* Data Elements combining to form Data Group 16 (DG16) are as follows,

Data Group	Data Element	Mandatory /Optional	Data Item
DG16		**O**	**PERSON(S) TO NOTIFY**
	01	M *(If Data Group16 Recorded)*	Number of Persons Identified
	02	M *(If Data Group16 Recorded)*	Date details Recorded
	03	M *(If Data Group16 Recorded)*	Name of Person to Notify
	04	M *(If Data Group16 Recorded)*	Telephone Number of Person to Notify
	05	O	Address of Person to Notify

DATA GROUPS RECORDED BY A RECEIVING STATE OR APPROVED RECEIVING ORGANIZATION

14. The following Table defines the optional Data Groups that combine to form that portion of the LDS available for recording data by the Receiving State or approved receiving organization. *Note: A Receiving State or approved receiving organization is not allowed to record data under LDS [Version 1.0]. Therefore, Data Groups 17 through 19 are not valid, nor are they supported in LDS [Version 1.0].*

DATA GROUP	MANDATORY (M) / OPTIONAL (O)	DATA ITEM
Automated Border Clearance Detail(s)		
DG17	O	Automated Border Clearance
Electronic Visas		
DG18	O	Electronic Visa(s)
Travel Record Detail(s)		
DG19	O	Travel Record(s)

Format of Data Elements

15. *Data Element Directory*.

This section describes the Data Elements that may be present in each Data Group.

Note: variable length Data Elements are always defined as a length and a value (Length|Value). Lengths are specified two ways – (1) Sequential mapping and random mapping using IC(s) will utilize ASN.1 notation. (Refer to Appendix 1 to Normative Annex A.); and (2) Random mapping with optical memory will utilize decimal notation. Please refer to the specific technology mapping annexes for details. If the length of a variable field equals zero, no data is stored.

15.1 Issuing State or approved issuing organization Data Elements

Data Groups 1 (DG1) through 16 (DG16): Data Elements and their format within each Data Group area as follows,

A = Alpha character, N = Numeric character, S = Special character, B= 8-bit Binary data, F = fixed-length field, Var = variable-length field

Data Element	Optional or Mandatory	Name of Data Element	Number of Bytes	Fixed or Variable	Type of Coding	Coding Requirements
DATA GROUP 1: Data Recorded in MRZ						
01	M	Document Type	2	F	A,N,S	Document Type (as per MRZ)
02	M	Issuing State or organization	3	F	A,S	Issuing State or organization (as per MRZ)
03	M	Name of Holder				
	M	*Primary and Secondary Identifiers*	39 Max	Var	A,S,B	Single and Double Filler characters (<) inserted as per MRZ. Note: The number of characters recorded shall be one (1) character longer than

Data Element	Optional or Mandatory	Name of Data Element	Number of Bytes	Fixed or Variable	Type of Coding	Coding Requirements
						the actual number of characters used to construct the name in the MRZ except where the name consumes the maximum number of characters available for the name in the MRZ, in which case, the recorded number of characters shall equal the maximum number of characters available for the name in the MRZ.
04	M	Document Number	9	F	A,N,S	Document Number (as per MRZ) Note: Consistent with specifications defined in Part 3 of ICAO Doc 9303 for the TD-1, if the Document Number exceeds 9 characters in length a filler character (<) shall be inserted in the Document Check Digit position (DE 05) and the remaining characters making up the Document Number shall be recorded at the beginning of DE 12 followed by the Document Number Check digit and a filler character (<).
05	M	Check digit - *Document Number*	1	F	N	Check digit for Data Element 04 (as per MRZ).
06	M	Nationality	3	F	A,S	Alpha-3 Code (as per MRZ).
07	M	Date of Birth	6	F	N,S	Format = YYMMDD as per MRZ.
08	M	Check digit - *Date of Birth*	1	F	N	Check digit for Data Element 07 (as per MRZ).
09	M	Sex	1	F	A,S	As per MRZ.
10	M if MRP, TD-1, TD-2	Date of Expiry	6	F	N	Format = YYMMDD as per MRZ.
	M if MRV-A, MRV-B	Valid Until Date	6	F	N	Format = YYMMDD as per MRZ.
11	M	Check digit - *Date of expiry or Valid Until Date*	1	F	N	Check digit for Data Element 10 (as per MRZ).
12	M *if Optional Data in MRZ*	Optional Data				
	M *if Optional Data in MRZ*	*Optional Data*	15 Max	Var	A,N,S	As per MRZ. Note: If the Document Number in the MRZ is exceeds 9 characters in length (TD-1 only), the remaining characters of the Document Number shall be presented at the beginning of Data Element 12 followed by the Document Number Check digit, a filler character (<) and any optional data to be recorded. If Optional Data is not stored, the length of this field is '00'
13	M	Check digit – *Optional Data Field*	1	F	N	Check digit for Data element 12 (as per MRZ).

Data Element	Optional or Mandatory	Name of Data Element	Number of Bytes	Fixed or Variable	Type of Coding	Coding Requirements
14	M	Check digit - *Composite Check digit*	1	F	N	As per MRZ.
DATA GROUP 2: Encoded Identification Features – FACE						
01	M *if Encoded Face Feature included*	Number of Face Biometric Encodings Recorded	1	F	N	1 to 9 identifying number of unique encodings of data on the Face.
02	M *if Encoded Face Feature included*	Header		F		See *Normative Supporting Annex A to Section IX* for details on encoding. Data Element may recur as defined by DE 01.
03	M *if Encoded Face Feature included*	Face Biometric Data Encoding(s)	99999 Max	Var	A,N,S, B	See *Normative Supporting Annex A to Section IX* for details on encoding. Data Element may recur as defined by DE 01.
04	O	Face Biometric Encoding Authenticity/Integrity Code		Var	B,N	Data Element may recur as defined by DE 01.
	M if Biometric Encoding Authenticity /Integrity Code included	*Algorithm Identifier*	1	F	N	1 to 9, identifying type of algorithm used to create Biometric Encoding Authenticity/Integrity Code.[9]
	M if Biometric Encoding Authenticity /Integrity Code included	*Key Reference*	3	F	N	001 to 999, identifying key reference used to create Biometric Encoding Authenticity/Integrity Code.
	M if Biometric Encoding Authenticity /Integrity Code included	*Biometric Encoding Authenticity/Integrity Code*	40 or 128	F	B	LDS [Version 1.0] Biometric Encoding Authenticity/Integrity Code shall be created, when included, as aDigital Signature
05	*M for random implementations*	Data Group Authenticity/Integrity Code		Var	B,N	
	M if DG Authenticity /Integrity Code included	*Algorithm Identifier*	1	F	N	1 to 9, identifying type of algorithm used to create DG Authenticity/Integrity Code.[9]
	M if DG Authenticity /Integrity Code included	*Key Reference*	3	F	N	001 to 999, identifying key reference used to create DG Authenticity/Integrity Code.
	M if DG Authenticity /Integrity Code included	*DG Authenticity/Integrity Code*	40 or 128	F	B	LDS [Version 1.0] DG Authenticity/Integrity Code shall be created, when included, as a Digital Signature.

[9] Current options: 1 = Digital Signature Algorithm (FIPS 186-2) – 40 bytes
2 = Secure Hashing Algorithm 1 (SHA-1) with RSA 1024 bit (ANSI X9.31) – 40 bytes
3 =Elliptical Curve Digital Signature Algorithm SHA-1 / Elliptical Curve (ANSI X9.62) - 40 bytes
4 = Reserved for SHA-2 (256 bit hash) with RSA 2048 bit

Data Element	Optional or Mandatory	Name of Data Element	Number of Bytes	Fixed or Variable	Type of Coding	Coding Requirements
DATA GROUP 3: Encoded Identification Features – FINGER(s)						
01	M *if Encoded Finger(s) Feature included*	Number of Finger Biometric Encodings Recorded	1	F	N	1 to 9 identifying number of unique encodings of data on the Finger(s).
02	M *if Encoded Finger(s) Feature included*	Header		F		See *Normative Annex A to Section IX* for details on encoding. Data Element may recur as defined by DE 01.
03	M *if Encoded Finger(s) Feature included*	Finger Biometric Data Encoding(s)	99999 Max	Var	A,N,S, B	See *Normative Annex A to Section IX* for details on encoding. Data Element may recur as defined by DE 01.
04	O	Biometric Encoding Authenticity/Integrity Code		Var		Data Element may recur as defined by DE 01.
	M *if Biometric Encoding Authenticity /Integrity Code included*	*Algorithm Identifier*	1	F	N	1 to 9, identifying type of algorithm used to create Biometric Encoding Authenticity/Integrity Code.
	M *if Biometric Encoding Authenticity /Integrity Code included*	*Key Reference*	3	F	N	001 to 999, identifying key reference used to create Biometric Encoding Authenticity/Integrity Code.
	M *if Biometric Encoding Authenticity /Integrity Code included*	*Biometric Encoding Authenticity/Integrity Code*	40 or 128	F	B	LDS [Version 1.0] Biometric Encoding Authenticity/Integrity Code shall be created, when included, as a Digital Signature.
05	M *for random implementations*	Data Group Authenticity/Integrity Code		Var		Data Element may recur as defined by DE 01.
	M *if DG Authenticity /Integrity Code included*	*Algorithm Identifier*	1	F	N	1 to 9, identifying type of algorithm used to create DG Authenticity/Integrity Code.
	M *if DG Authenticity /Integrity Code included*	*Key Reference*	3	F	N	001 to 999, identifying key reference used to create DG Authenticity/Integrity Code.
	M *if DG Authenticity /Integrity Code included*	*DG Authenticity/Integrity Code*	40 or 128	F	B	LDS [Version 1.0] DG Authenticity/Integrity Code shall be created, when included, as a Digital Signature.
DATA GROUP 4: Encoded Identification Features – IRIS(s)						
01	M *if Encoded Eye(s) Feature included*	Number of Eye Biometric Encodings Recorded	1	F	N	1 to 9 identifying number of unique encodings of data on the Eye(s).
02	M *if Encoded Eye(s) Feature included*	Header		F		See *Normative Annex A to Section IX* for details on encoding. Data Element may recur as defined by DE 01.

Data Element	Optional or Mandatory	Name of Data Element	Number of Bytes	Fixed or Variable	Type of Coding	Coding Requirements
03	M *if Encoded Eye(s) Feature included*	Eye Biometric Data Encoding(s)	99999 Max	Var	A,N,S, B	See *Normative Annex A to Section IX* for details on encoding. Data Element may recur as defined by DE 01.
04	O	Biometric Encoding Authenticity/Integrity Code		Var		Data Element may recur as defined by DE 01.
	M *if Biometric Encoding Authenticity /Integrity Code included*	*Algorithm Identifier*	1	F	N	1 to 9, identifying type of algorithm used to create Biometric Encoding Authenticity/Integrity Code.
	M *if Biometric Encoding Authenticity /Integrity Code included*	*Key Reference*	3	F	N	01 to 99, identifying key reference used to create Biometric Encoding Authenticity/Integrity Code.
	M *if Biometric Encoding Authenticity /Integrity Code included*	*Biometric Encoding Authenticity/Integrity Code*	40 or 128	F	B	LDS [Version 1.0] Biometric Encoding Authenticity/Integrity Code shall be created, when included, as a Digital Signature.
05	*M* *for random implementations*	Data Group Authenticity/Integrity Code		Var		Data Element may recur as defined by DE 01.
	M *if DG Authenticity /Integrity Code included*	*Algorithm Identifier*	1	F	N	1 to 9, identifying type of algorithm used to create DG Authenticity/Integrity Code.
	M *if DG Authenticity /Integrity Code included*	*Key Reference*	3	F	N	001 to 999, identifying key reference used to create DG Authenticity/Integrity Code.
	M *if DG Authenticity /Integrity Code included*	*DG Authenticity/Integrity Code*	40 or 128	F	B	LDS [Version 1.0] DG Authenticity/Integrity Code shall be created, when included, as a Digital Signature.
DATA GROUP 5: Displayed Identification Features – PORTRAIT						
01	M *if Displayed Portrait included*	Number of entries: Displayed Portrait	1	F	N	1 to 9 identifying number of unique recordings of Displayed Portrait.
02	M *if Displayed Portrait included*	Displayed Portrait Data		F		Data Element may recur as defined by DE 01.
	M *if Displayed Portrait included*	*Number of bytes in representation of Displayed Portrait*	5	F	N	00001 to 99999, identifying number of bytes in representation of Displayed Portrait immediately following.
	M *if Displayed Portrait included*	*Representation of Displayed Portrait*	99999 Max	Var	A,N,S, B	Formatted as per ISO 10918-1.
03	*M for random implementations*	Displayed Portrait Authenticity/Integrity Code		Var		Data Element may recur as defined by DE 01.

Data Element	Optional or Mandatory	Name of Data Element	Number of Bytes	Fixed or Variable	Type of Coding	Coding Requirements
	M if Displayed Portrait Authenticity /Integrity Code included	*Algorithm Identifier*	1	F	N	1 to 9, identifying type of algorithm used to create Displayed Portrait Authenticity/Integrity Code.
	M if Displayed Portrait Authenticity /Integrity Code included	*Key Reference*	3	F	N	001 to 999, identifying key reference used to create Displayed Portrait Authenticity/Integrity Code.
	M if Displayed Portrait Authenticity /Integrity Code included	*Displayed Portrait Authenticity/Integrity Code*	40 or 128 bytes	F	A,N,B	LDS [Version 1.0] Displayed Portrait Authenticity/Integrity Code shall be created, when included, as a Digital Signature.
DATA GROUP 6: Displayed Identification Features – SINGLE-DIGIT FINGERPRINT						
01	M *if Displayed Single-Digit Fingerprint included*	Number of entries: Displayed Single-Digit Fingerprint	1	F	N	1 to 9 identifying number of unique recordings of Displayed Single-Digit Fingerprint.
02	M *if Displayed Single-Digit Fingerprint included*	Displayed Single-Digit Fingerprint Data		Var.		Data Element may recur as defined by DE 01.
	M if Displayed Single-Digit Fingerprint included	*Number of bytes in representation of Displayed Single-Digit Fingerprint*	*	*	*	Number of bytes in representation of Displayed Single-Digit Fingerprint immediately following.
	M if Displayed Single-Digit Fingerprint included	*Representation of Displayed Single-Digit Fingerprint*	99999 Max	Var	A,N,S, B	Formatted as per ISO 10918-1.
03	*M for random implementations*	Displayed Single-Digit Fingerprint Authenticity/Integrity Code		Var		Data Element may recur as defined by DE 01.
	M if Displayed SD Fingerprint Authenticity /Integrity Code included	*Algorithm Identifier*	1	F	N	1 to 9, identifying type of algorithm used to create Displayed SD Fingerprint Authenticity/Integrity Code.
	M if Displayed SD Fingerprint Authenticity /Integrity Code included	*Key Reference*	3	F	N	001 to 999, identifying key reference used to create Displayed SD Fingerprint Authenticity/Integrity Code.
	M if Displayed SD Fingerprint Authenticity /Integrity Code included	*Displayed SD Fingerprint Authenticity/Integrity Code*	40 or 128 bytes	Var	A,N,B	LDS [Version 1.0] Displayed SD Fingerprint Authenticity/Integrity Code shall be created, when included, as a Digital Signature.

Data Element	Optional or Mandatory	Name of Data Element	Number of Bytes	Fixed or Variable	Type of Coding	Coding Requirements
DATA GROUP 7: Displayed Identification Features – SIGNATURE or USUAL MARK						
01	M *if Displayed Signature or Usual Mark included*	Number of entries: Displayed Signature or Usual Mark	1	F	N	1 to 9 identifying number of unique recordings of Displayed Signature or Usual Mark.
02	M *if Displayed Signature or Usual Mark included*	Displayed Signature or Usual Mark Data		V		Data Element may recur as defined by DE 01.
	M if Displayed Signature or Usual Mark included	*Representation of Displayed Signature or Usual Mark*	99999 Max	Var	A,N,S, B	Formatted as per ISO 10918-1.
03	*M for random implementations*	DE Authenticity/Integrity Code		Var		
	M if Signature or Usual Mark Authenticity /Integrity Code included	*Algorithm Identifier*	1	F	N	1 to 9, identifying type of algorithm used to create Signature or Usual Mark Authenticity/Integrity Code.
	M if Signature or Usual Mark Authenticity /Integrity Code included	*Key Reference*	3	F	N	001 to 999, identifying key reference used to create Signature or Usual Mark Authenticity/Integrity Code.
	M if Signature or Usual Mark Authenticity /Integrity Code included	*Signature or Usual Mark Authenticity/Integrity Code*	40 or 128 bytes	Var	A,N,B	LDS [Version 1.0] Signature or Usual Mark Authenticity/Integrity Code shall be created, when included, as a Digital Signature.
DATA GROUP 8: Encoded Security Features – DATA FEATURE(s)						
01	M *if encoded Data Feature included*	Number of Data Features	1	F	N	1 to 9, identifying number of unique encodings of Data Feature(s) (embraces DE 02 through DE 04).
02	M *if encoded Data Feature included*	Header Information	1	TBD		Header details to be defined.
03	M *if encoded Data Feature included*	Data Feature Data		Var		
	M if encoded Data Feature included	*Encoded Data Feature*	999 Max	Var	B	Format defined at the discretion of issuing State or organization.
04	*M for random implementations*	DG Authenticity/Integrity Code		Var		
	M if Data Feature(s) Authenticity /Integrity Code included	*Algorithm Identifier*	1	F	N	1 to 9, identifying type of algorithm used to create Data Feature(s) Authenticity/Integrity Code.

Data Element	Optional or Mandatory	Name of Data Element	Number of Bytes	Fixed or Variable	Type of Coding	Coding Requirements
	M if Data Feature(s) Authenticity /Integrity Code included	*Key Reference*	3	F	N	001 to 999, identifying key reference used to create Data Feature(s) Authenticity/Integrity Code.
	M if Data Feature(s) Authenticity /Integrity Code included	*Data Feature(s) Authenticity/Integrity Code*	40 or 128 bytes	Var	A,N,B	LDS [Version 1.0] Data Feature(s) Authenticity/Integrity Code shall be created, when included, as a Digital Signature.
DATA GROUP9: Encoded Security Features – STRUCTURE FEATURE(s)						
01	M *if encoded Structure Feature included*	Number of Structure Features	1	F	N	1 to 9, identifying number of unique encodings of Structure Feature(s) (embraces DE 02 through DE 04).
02	M *if encoded Structure Feature included*	Header information	TBD	TBD	N	Header details to be defined
03	M *if encoded Structure Feature included*	Structure Feature Data		Var		
	M if encoded Structure Feature included	*Encoded Structure Feature*	999 Max	Var	B	Format defined at the discretion of issuing State or organization.
04	*M for random implementations*	DG Authenticity/Integrity		Var		
	M if Structure Feature(s) Authenticity /Integrity Code included	*Algorithm Identifier*	1	F	N	1 to 9, identifying type of algorithm used to create Structure Feature(s) Authenticity/Integrity Code.
	M if Structure Feature(s) Authenticity /Integrity Code included	*Key Reference*	3	F	N	001 to 999, identifying key reference used to create Structure Feature(s) Authenticity/Integrity Code.
	M if Structure Feature(s) Authenticity /Integrity Code included	*Structure Feature(s) Authenticity/Integrity Code*	40 or 128 bytes	Var	A,N,B	LDS [Version 1.0] Structure Feature(s) Authenticity/Integrity Code shall be created, when included, as a Digital Signature.
DATA GROUP10: Encoded Security Features – SUBSTANCE FEATURE(s)						
01	M *if encoded Substance Feature included*	Number of Substance Features	1	F	N	1 to 9, identifying number of unique encodings of Substance Feature(s) (embraces DE 02 through DE 04).
02	M *if encoded Substance Feature included*	Header information	TBD	TBD	N	Details to be defined

Data Element	Optional or Mandatory	Name of Data Element	Number of Bytes	Fixed or Variable	Type of Coding	Coding Requirements
03	M *if encoded Substance Feature included*	Substance Feature Data		Var		
	M *if encoded Substance Feature included*	*Encoded Substance Feature*	999 Max	Var	B	Format defined at the discretion of issuing State or organization.
04	*M for random implementations*	DG Authenticity/Integrity		Var		
	M *if Substance Feature(s) Authenticity /Integrity Code included*	*Algorithm Identifier*	1	F	N	1 to 9, identifying type of algorithm used to create Substance Feature(s) Authenticity/Integrity Code.
	M *if Substance Feature(s) Authenticity /Integrity Code included*	*Key Reference*	3	F	N	001 to 999, identifying key reference used to create Substance Feature(s) Authenticity/Integrity Code.
	M *if Substance Feature(s) Authenticity /Integrity Code included*	*Substance Feature(s) Authenticity/Integrity Code*	40 or 128 bytes	Var	A,N,B	LDS [Version 1.0] Substance Feature(s) Authenticity/Integrity Code shall be created, when included, as a Digital Signature.
DATA GROUP 11: Additional Personal Detail(s)						
See Data Element Directory - Additional Personal Detail(s) [see 15.1.1]						
DATA GROUP 12: Additional Document Detail(s)						
See Data Element Directory - Additional Document Detail(s) [see 15.1.2]						
DATA GROUP 13: Optional Detail(s)						
See Data Element Directory - Optional Detail(s) [see 15.1.3]						
DATA GROUP 14: Reserved for Future Use						
Reserved						
DATA GROUP 15: Issuing Authority Authenticity/Integrity Code						
01	*M* *for sequential implementations*	Issuing Authority Authenticity/Integrity Code		Var		
	M *if DG 14 included*	*Algorithm Identifier*	1	F	N	Refer to Footnote 9
	M *if DG 14 included*	*Key Reference*	3	F	N	ID to verification key
	M *if DG 14 included*	*Issuing Authority Authenticity/Integrity Code*	40 or 128 bytes	Var	B	Authenticity/Integrity Code

Data Element	Optional or Mandatory	Name of Data Element	Number of Bytes	Fixed or Variable	Type of Coding	Coding Requirements
DATA GROUP 16: Person(s) to Notify						
See Data Element Directory – Details on Person(s) to Notify [see 15.1.4]						

15.1.1 *Data Group 11 (DG11)*: Data Elements and their format within **DG11 – Additional Personal Detail(s)** are as follows,

A = Alpha character, N = Numeric character, S = Special character, B= 8-bit Binary data, F = fixed-length field, Var = variable-length field

DATA GROUP 11: Additional Personal Detail(s)						
Data Element	Optional or Mandatory	Name of Data Element	Number of Bytes	Fixed or Variable	Type of Coding	Coding Requirements
01	O	Name of Holder (in full)				
	M if DE 01 included	*Primary and Secondary Identifiers*	99 Max	Var	A,S	Filler characters (<) inserted as per MRZ. No fillers inserted at end of line. Truncation not permitted.
02	O	Other Name(s)				
		Primary and Secondary Identifiers	99 Max	Var	A,S	Filler characters (<) inserted as per MRZ. No fillers inserted at end of line. Truncation not permitted.
03	O	Personal Number				
		Personal Number	99 Max	Var	A,N,S	Free-Form Text.
04	O	Place of Birth				
		Place of Birth	99 Max	Var	A,N,S	Free-Form Text
05	O	Address				
		Address	99 Max	Var	A,N,S	Free-Form Text
06	O	Full Date of Birth				
		Date of Birth	8	F	N	CCYYMMDD
07	O	Telephone				
	M if DE 06 included	*Telephone*	99 Max	Var	N,S	Free-Form Text
08	O	Profession				
	M if DE 07 included	*Profession*	99 Max	Var	A,N,S	Free-Form Text
09	O	Title				
	M if DE 08 included	*Title*	99 Max	Var	A,N,S	Free-Form Text
10	O	Personal Summary				

	M if DE 09 included	*Personal Summary*	99 Max	Var	A,N,S	Free-Form Text
11	O	Proof of Citizenship		Var		
	M if DE 10 included	*Citizenship Detail*	9999999 Max	Var	B	Image of Citizenship Document formatted as per ISO 10918-1.
12	M *if DE 12 included*	Number of Other Valid Travel Document(s)	1	F	N	1-9, identifying number of Other Valid Travel Documents detailed
13	O	Other Valid Travel Document(s)		Var		
	M if DE 12 included	*Travel Document Number*	99 Max		A,N,S	Free-Form Text
14	O	Custody Information		Var		
	M if DE 13 included	*Custody Information*	999 Max	Var	A,N,S	Free-Form Text
15	*M for random implementations*	Additional Personal Detail(s) Authenticity/Integrity Code		Var		
	M if Additional Personal Detail(s) Authenticity /Integrity Code included	*Algorithm Identifier*	1	F	N	1 to 9, identifying type of algorithm used to create Additional Personal Details(s) Authenticity/Integrity Code.
	M if Additional Personal Detail(s) Authenticity /Integrity Code included	*Key Reference*	2	F	N	001 to 999, identifying key reference used to create Additional Personal Details(s) Authenticity/Integrity Code.
	M if Additional Personal Detail(s) Authenticity /Integrity Code included	*Additional Personal Detail(s) Authenticity/Integrity Code*	40 or 128 bytes	Var	A,N,B	LDS [Version 1.0] Additional Personal Details(s) Authenticity/Integrity Code shall be created, when included, as a Digital Signature.

15.1.2 *Data Group 12 (DG12)*: Data Elements and their format within **DG12 – Additional Document Detail(s)** are as follows,

A = Alpha character, N = Numeric character, S = Special character, B= 8-bit Binary data, F = fixed-length field, Var = variable-length field

DATA GROUP 12: Additional Document Detail(s)						
Data Element	**Optional or Mandatory**	**Name of Data Element**	**Number of Bytes**	**Fixed or Variable**	**Type of Coding**	**Coding Requirements**
01	O	Issuing Authority				
		Issuing Authority	99 Max	Var	A,N,S	Free-Form Text
02	O	Date of Issue	8	F	N	Date of Issue of Document; i.e. YYYYMMDD
03	O	Other Person(s) Included				** Only valid with MRV **

		Other Person Detail(s)	99 Max	Var	A,N,S	Free-Form Text
04	O	Endorsement(s) / Observation(s)				
		Endorsement(s) / Observation(s)	99 Max	Var	A,N,S	Free-Form Text
05	O	Tax / Exit Requirements				
		Tax / Exit Requirements	99 Max	Var	A,N,S	Free-Form Text
06	O	Image of Front of MRTD				
		Image of MRTD (front)	9999999 Max	Var	B	Formatted as per ISO 10918-1.
07	O	Image of Rear of MRTD				
		Image of MRTD (rear)	9999999 Max	Var	B	Formatted as per ISO 10918-1.
08	O	Personalization time				
		Time document was personalized		F	F 14N	ccyymmddhhmmss
09	O	Personalization serial number				
		Serial number of personalization device		V	V 99ANS	Free format
10		Additional Document Detail(s) Authenticity/Integrity Code		Var		
	M if Additional Document Detail(s) Authenticity /Integrity Code included	*Algorithm Identifier*	1	F	N	1 to 9, identifying type of algorithm used to create Additional Document Details(s) Authenticity/Integrity Code.
	M if Additional Document Detail(s) Authenticity /Integrity Code included	*Key Reference*	2	F	N	001 to 999, identifying key reference used to create Additional Document Details(s) Authenticity/Integrity Code.
	M if Additional Document Detail(s) Authenticity /Integrity Code included	*Additional document Detail(s) Authenticity/Integrity Code*	40 or 128 bytes	Var	A,N,B	LDS [Version 1.0] Additional Document Details(s) Authenticity/Integrity Code shall be created, when included, as a Digital Signature.

15.1.3 *Data Group 13 (DG13)*: Data Elements and their format within **DG13 – Optional Detail(s)** are as follows,

A = Alpha character, N = Numeric character, S = Special character, B= 8-bit Binary data, F = fixed-length field, Var = variable-length field

DATA GROUP 13: Optional Detail(s)						
Data Element	**Optional or Mandatory**	**Name of Data Element**	**Number of Bytes**	**Fixed or Variable**	**Type of Coding**	**Coding Requirements**
TBD	O	Optional Details		Var		At the Discretion of Issuing State or organization

15.1.4 *Data Group 16 (DG16)*: Data Elements and their format within **DG16 – Person(s) to Notify** are as follows,

A = Alpha character, N = Numeric character, S = Special character, B= 8-bit Binary data, F = fixed-length field, Var = variable-length field

DATA GROUP 16: Person(s) to Notify						
Data Element	**Optional or Mandatory**	**Name of Data Element**	**Number of Bytes**	**Fixed or Variable**	**Type of Coding**	**Coding Requirements**
01	M *if DG 15 included*	Number of Persons Identified	2	F	N	Identifies number of persons included in the Data Group.
02	M *if DG 15 included*	Date Details Recorded	8	F	N	Date notification date recorded; Format = CCYYMMDD
03	M *if DG 15 included*	Name of Person to Notify *Primary and Secondary Identifiers*		Var	A,S	Filler characters (<) inserted as per MRZ. Truncation not permitted.
04	M *if DE 03 included*	Telephone Number of Person to Notify		Var	N,S	Telephone number in international form (country code and local number)
05	M	Address of Person to Notify		Var	A,N,S	Free-Form Text

VI. Security Principles

Scope

1. This Section defines the security principles used to protect the recorded Logical Data Structure – LDS and ensure receiving States and approved receiving organizations can confirm the authenticity and integrity of data read from the optional capacity expansion technology.

Security Requirements

2. A MRTD can be read by any receiving State or approved receiving organization for both the visible and machine readable data. No information that is externally visible is confidential and the machine-readable version of this information is not confidential. The information cannot be deleted, amended or altered by anyone other than the issuing state or organization.

2.1 The security techniques must be implemented within the framework of the bi-lateral relationships between states established by ICAO. Specifically, certain security keys have to be distributed in order to verify the authenticity and integrity of the MRTD data. The keys will be distributed according to these agreements.

2.2 The security techniques must be well-known and globally accepted.

2.3 A receiving State or approved receiving organization must be able to verify that the machine readable information has not been modified. This establishes the integrity of the data.

2.4 A receiving State or approved receiving organization must be able to establish that the machine readable information was received from a legitimate issuing state or organization. This establishes the authenticity of the data.

2.5 The issuing State or organization must include the data needed to verify the authenticity and integrity of the data when the MRTD is created.

2.6 The additional data required to prove the authenticity and integrity of the data must be small.

2.7 The same technique shall be used for all expansion technology options in the MRTD.

2.8 The use of some biometric or display data may be restricted by the issuer to certain receiving states. This data may be enciphered to prevent access by other states.

Numbering messed up in this section

Key Exchange Considerations

ICAO does not have a Certification Authority, nor is it envisioned that one will be established in the near future. NTWG has recommended that ICAO serve as a secure key depository. If such a depository is established member states could post their public keys and associated certificates for retrieval by other member countries wishing to authenticate documents.

Until a secure depository is established member countries will have to use bi-lateral agreements for exchange of authentication keys. The specification currently allows for 999 such keys for

each country.

Chosen Technology[9]

3. The technique chosen for the MRTD is the use of a digital signature with public key security techniques. This code is also called an Authenticity/Integrity Code.

A secure hash code provides the means to verify the integrity of the data; that is, nothing in the data (not a single binary bit) has been changed. The algorithm chosen for this version of the MRTD is The Secure Hash Algorithm (SHA-1) as defined by *ANSI X9.30:2-1993. It is anticipated that future versions of this specification will recommend the use of SHA-2.*

SHA-1 will be used in conjunction with one of the following digital signature algorithms

- DSA, or Digital Signature Algorithm, as specified in the US *Federal Information Processing Standard (FIPS) 186-2, Digital Signature Standard (DSS).* This standard was developed for US Government digital standard use, and produces a digital signature of 320 bits (40 bytes).
- RSA, or Rivest Shamir Adleman slgorithm, as specified in PKCS#1, v2.0, *Public Key Cryptography Standard # 1 – RSA Cryptography Standard (ANSI X9.31-1998)* This algorithm creates a digital signature 1024 bits (128 bytes) long.
- ECC/ECDSA, or Elliptical Curve Digital Signature Algorithm, as specified by ANSI X9.62-1998 *Public Key Cryptography for the Financial Services Industry; ECDSA.* This algorithm creates a digital signature 320 bits (40 bytes) long.

ECC/ECDSA shall be the default algorithm due to its short key length and signature length.

.

3.1 Issuing states may have one or more pairs of keys. Each pair of keys shall have a unique reference number. The issuing state will retain the private keys in a secure facility. The public keys and the associated reference numbers will be distributed to the receiving states.

3.2 Each instance of an authenticity/integrity code shall be accompanied by two data elements that define 1) the algorithm (SHA-1 or SHA-2) and the type of public key technology (RSA or EC), and 2) the reference to which key pair to use.

Verification Method

4. The method to verify the authenticity and integrity of MRTD data is specified below.

4.1 The data to be verified is selected. This may be the entire MRTD, a Data Group or an individual biometric.

4.2 The associated Authenticity/Integrity data contains the algorithm, the key reference, and the

[9] With acceptance of high capacity contatless microprocessor integrated circuits as the recommended storage media, use of digital certificates has become practical. Use of such certificates will greatly simplify key exchange requirements. Certificates will be addressed in Version 1.1 of this report.

enciphered hash code.

4.3 The specified algorithm is used to compute a secure hash code for the data to be verified.

4.4 The key reference is used to determine the public key to be used. This key is retrieved for the list of keys supplied by the issuing country and is used with the specified digital signature algorithm to confirm data authenticity and integrity.

VII. MAPPING PRINCIPLES COMMON TO ALL OPTIONAL CAPACITY EXPANSION TECHNOLOGIES

Scope

1. This Section defines the mapping principles common to all optional capacity expansion technologies that must be followed when recording the Logical Data Structure – LDS. Details on those mapping principles that are unique to an optional capacity expansion technology are included in the normative Mapping Annexes contained in Section VIII.

Sequential or Random Ordering of LDS

2. Three types of sequencing (data arrangement) schemes are available for mapping the LDS to a capacity expansion technology as follows,

2.1 *Sequential Ordering Scheme*: The Sequential Ordering Scheme requires that Data Groups and Data Elements be recorded following the logical order defined in Section V. Those Data Groups and Data Elements that are not required, determined at the discretion of the State or organization recording the data, are omitted, with no space left as a placeholder. Variable length data elements are encoded as *Length|Value* and lengths are specified in ASN.1 notation.

This scheme is valid for recording to *2-D Bar Codes*.

2.2 *Random Ordering Scheme:* The Random Ordering Scheme allows Data Groups and Data Elements to be recorded following a random ordering which is consistent with the ability of the optional capacity expansion technology to allow direct retrieval of specific Data Elements even if they are recorded out of order. Random Order Recording can only be used with accommodating technologies such as IC(s) with contacts and contactless IC(s), both of which support such retrieval. Details on the random ordering scheme(s) possible are presented in those applicable normative Mapping Annexes contained in Section VIII. Variable length data elements are encoded as *Length|Value* and lengths are specified in ASN.1 notation.

This scheme is valid for recording to *IC(s) with Contacts* and *Contactless IC(s)*.

2.3 *Optical Memory Scheme:* Optical Cards utilize a Random Ordering Scheme specifically designed to take advantage of optical stripe capabilities. Variable length data elements are encoded as *Length|Value* and lengths are specified in decimal notation.

Header and Data Group Presence Information

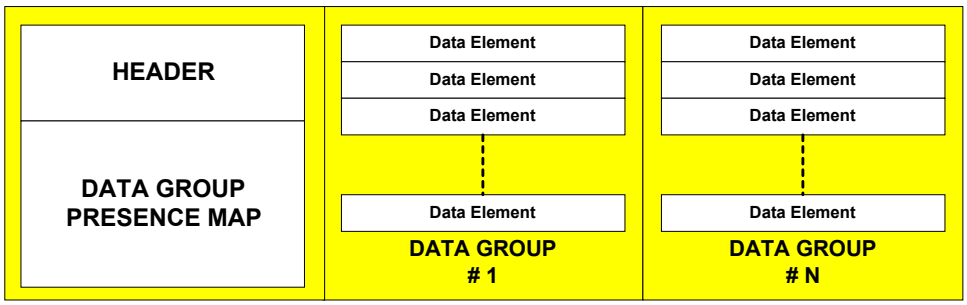


FIGURE VII-1. MANDATORY HEADER AND DATA GROUP PRESENCE INFORMATION

2.4 A *mandatory* **Header** and **Data Group Presence Map** are located at the start of each recording made by an issuing State or organization as illustrated in Figure VII-1.

2.5 *Header.* The Header contains the following information, which enables a receiving State or approved receiving organization locate and decode the various Data Groups and Data Elements contained within the block of data recorded by the issuing State or organization.

APPLICATION IDENTIFIER (AID)
LDS VERSION NUMBER
UNICODE VERSION NUMBER

2.5.1 *LDS Version Number.* The LDS Version Number defines the format version of the LDS[10]. The standardized format for an LDS Version Number is "Vab", where,

"a" = number (01 –99) identifying the Version of the LDS (i.e., Significant additions to the LDS)

"b" = number (01-99) identifying the Update of the LDS

2.5.2 *Unicode Version Number*[11]. The Unicode Version Number identifies the coding method used when recording alpha, numeric and special characters, including national characters. The standardized format for a Unicode Version Number is “Ua.b.c”, where,

“a” = number identifying the **Major version** of the Unicode Standard (i.e. Significant additions to the standard, published as a book);

“b” = number identifying the **Minor version** of the Unicode Standard (i.e. Character additions or more significant normative changes, published as a Technical Report); and

[10] Future upgrades to the standardized organization of the LDS have been anticipated and will be addressed through publication of Amendments to the specifications by ICAO. A Version Number will be assigned to each upgrade to ensure that receiving States and approved receiving organizations will be able to accurately decode all versions of the LDS.

[11] *Unicode* is based on ISO/IEC 10646. Details on *Unicode* can be found on the Internet at www.unicode.org.

"c" = number identifying the **Update version** of the Unicode Standard (i.e. Any other changes to normative or important informative portions of the Standard that could change program behavior. These changes are reflected in new Unicode Character Database files and an update page).

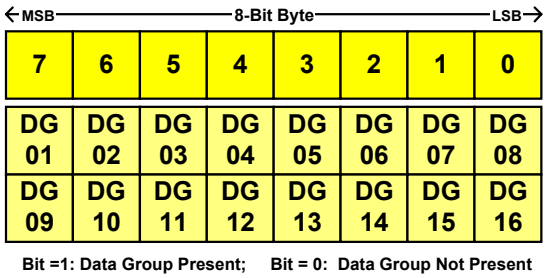
Note: For historical reasons, the numbering within each of the fields (i.e. a, b, c) is not necessarily consecutive.

2.6 *Data Group Presence Map*. The Data Group Presence Map (DGPM) contains information, which enables a receiving State or approved receiving organization determine which Data Groups are present in the block of data recorded by the issuing State or organization.

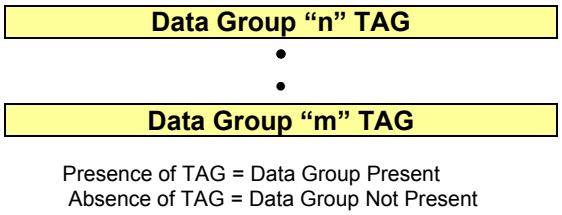
2.6.1 DGPMs can take two (2) forms as follows,

2.6.1.1 *Form 1 DGPM*. Form 1 DGPM consists of a series of bytes in which each bit identifies the presence or non-presence of a specific Data Group in the block of data recorded by the issuing State or organization.

Note: the number of the bytes allocated for the DGPM is defined in each of the normative Mapping Annexes contained in Section VIII.



2.6.1.2 *Form 2 DGPM*. Form 2 DGPM consists of a list of "TAGs", consistent with the convention for identifying Data Elements recorded in IC(s) with contacts and contactless IC(s) in which each TAG identifies if a specific Data Group is recorded in the block of data recorded by the issuing State or organization.



Note: the number of the bytes allocated for the DGPM is defined in each of the normative Mapping Annexes contained in Section VIII.

3. A similar concept of presence maps is used with a number of Data Groups that contain a series of subordinate Data Elements, which may be included at the discretion of the State or organization making the recording. These presence maps, called **Data Element Presence Map**s are located at the start of those specific Data Groups that allow optional expansion as illustrated in Figure VII-2.

Data Groups requiring the use of a Data Element Presence Map are specified in each of the normative Mapping Annexes contained in Section VII.

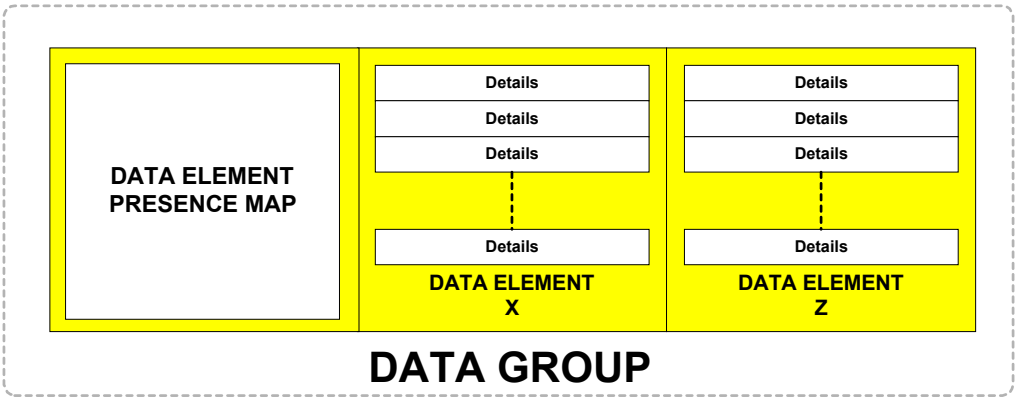


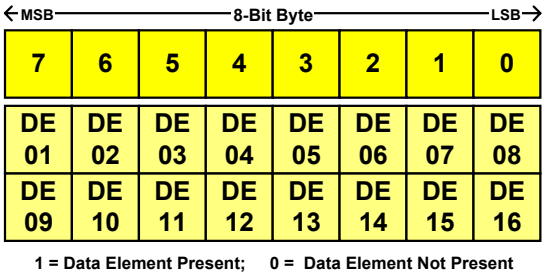
FIGURE VII-2. DATA ELEMENT PRESENCE MAP

3.1 *Data Element Presence Map*. A Data Element Presence Map (DEPM) contains information to enable a receiving State or approved receiving organization to determine which Data Elements are present in the Data Group.

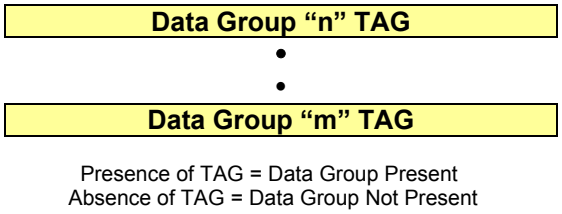
3.1.1 DEPMs can take two (2) forms as follows,

3.1.1.1 *Form 1 DEPM*. Form 1 DEPM consists of a series of bytes in which each bit identifies the presence or non-presence of a specific Data Element within the Data Group; and

Note: the number of the bytes allocated for the DEPM is defined in each of the normative Mapping Annexes contained in Section VIII.



3.1.1.2 *Form 2 DEPM*. Form 2 DEPM consists of a list of "TAGs", consistent with the convention for identifying Data Elements recorded in IC(s) with contacts and contactless IC(s) in which each TAG identifies if a specific Data Element is recorded in the Data Group.



Note: the number of the bytes allocated for the DEPM is defined in each of the normative Mapping Annexes contained in Section VIII.

VIII. MAPPING ANNEXES

Scope

1. This Section defines the principles that shall be followed when mapping the Logical Data Structure – LDS [Version 1.0] to any of the optional capacity expansion technologies specified for use with MRTDS.

2. Principles are presented in normative Mapping Annexes specific to each technology as follows,

ANNEX A: Mapping of LDS [Version 1.0] Using Sequential File Representation to *Optional 2-D Bar Codes*;

ANNEX B: Mapping of LDS [Version 1.0] Using Random Access File Representation to *Optional Optical Memory*; and

ANNEX C: Mapping of LDS [Version 1.0] Using Random Access File Representation to *Optional Integrated Circuits (IC(s))*

ANNEX A (NORMATIVE) to Section VIII

MAPPING OF LDS [VERSION 1.0] USING SEQUENTIAL FILE REPRESENTATION
WITH OPTIONAL
2-D BAR CODE(S)

A.1 Scope – Annex A defines the current state specifications[12] governing mapping of the Logical Data Structure – LDS [Version 1.0] using a *sequential file representation*[13] to 2-D bar code(s) on an MRTD to allow expansion of the machine readable data capacity at the discretion of the issuing State or organization.

A.2 Normative references – The following International Standards contain provisions that, through reference herein, constitute provisions of Annex A to Section VIII of this Technical Report. Where differences exist between the specifications contained in this Technical Report and the referenced Standards to accommodate the use of bar code(s), the specifications contained herein shall prevail.

ISO/IEC 7501 (ICAO Doc 9303), Parts 1 through 3

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CBEFF, Common Biometric Exchange File Format, NISTAR 6529-A

ISO/IEC 8824-1:1998 | ITU-T Recommendation X.680 (1997), *Information technology – Abstract Syntax Notation One (ASN.1): Specification of basic notation*

ISO/IEC 8824-2:1998 | ITU-T Recommendation X.681 (1997), *Information technology – Abstract Syntax Notation One (ASN.1): Information object specification*

ISO/IEC 8824-3:1998 | ITU-T Recommendation X.682 (1997), *Information technology – Abstract Syntax Notation One (ASN.1): Constraint specification*

ISO/IEC 8824-4:1998 | ITU-T Recommendation X.683 (1997), *Information technology – Abstract Syntax Notation One (ASN.1): Parameterization of ASN.1 specifications*

ISO/IEC 8825-1:1998 | ITU-T Recommendation X.690 (1997), *Information technology – ASN.1 encoding rules: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER)*

ISO/IEC 10918-1: Information Technology – Digital compression and coding of continuous-tone still images: Requirements and Guidelines

ISO/IEC 10918-1: Information Technology – Digital compression and coding of continuous-tone still images: Extensions

A.3 Sequential File Representation – The *sequential file representation* has been defined with the following considerations and assumptions:

- A single standardized sequential file representation must support use of 2-D barcode(s),

[12] *Specifications* as envisaged based on work completed to date. Specifications will only be considered final when they have been published in Doc 9303.

[13] Sequential file representations are often referred to as BLOBs (Binary Large Objects).

- A single standardized sequential file representation must accommodate an LDS containing limited data – i.e. typically less than 8K byes.

A.3.1 To minimize memory utilization a number of storage saving techniques are used.

As the entire LDS is read at one time, only one overall Authenticity/Integrity Code (DG15) is used. Data Presence Maps (DPMs) are used to indicate which of the optional Data Groups and Data Elements are present for a specific implementation. In the *sequential file representation* DPMs are simply strings of binary bits that, by their position, indicate if a specific Data Group is or is not present.

- A limited form of ASN.1 Tag-Length-Value (TLV) notation is used for each Data Group. The Data Group tags (T) are listed in Appendix C[14] to Normative Annex A. The length (L) of the Data Group immediately follows the Tag. Within a Data Group, the Data Elements are recorded sequentially (in order) as a value (V). The LDS defines the sequence of Data Elements and whether they are fixed length or variable length. Hence, position within the Data Group defines the identity of the Data Element and tags are not used to identify individual Data Elements.

- Some Data Groups permit one or more embedded templates, e.g., multiple occurrences of a specific type of biometric. In such cases, the tag Ax is used, where x = the occurrence count. The tag, Ax, designates the presence of the template within the Data Group. The length of this template immediately follows the tag. Template data elements follow and constitute the value of the template.

- A biometric data group may have an individual authenticity/integrity code. (The integrity options data element within the header defines whether one is or is not present.) If an authenticity/integrity code is being used, the data element immediately follows the biometric data.

- Variable length Data Elements are preceded by a length definition using ASN.1 encoding rules. Fixed length Data Elements do not use a length definition as their length is known.

A.3.2 To minimize memory utilization a number of storage saving techniques are used.
Within Data Group 1 (DG1 – details recorded in the MRZ of the MRTD), a length of "0" indicates that a variable length Data Element is not present.

.For example,

- The fixed length Data Element "Date" with the value 'September 15, 1999' would be encoded as 19990915 if the format is CCYYMMDD or 990915 if the format is YYMMDD

- The variable length Data Element "Name of holder" with the value 'John Q Document Holder' would be encoded as 16DOCUMENTHOLDER<<JOHN<Q.
Note: 16_{16} (hexadecimal) = 22_{10} (base 10)

[14] ISO/IEC 7816-4 coexistent tag convention has been used.

UTF-8 encoding is used. Most of the Data Elements used in the LDS are Basic Latin (ASCII) characters or binary. A small number of Data Elements such as "Name in National Characters," "Place of Birth" cannot always be encoded with the Basic Latin code set. Therefore, characters will be encoded using the Unicode Standard: UTF-8. It is a variable length encoding that preserves ASCII transparency. UTF-8 is fully compliant with Unicode Standard and ISO/IEC 10646. UTF-8 uses one byte to encode standard ASCII characters (code values 0 ….. 127). Many non-ideographic scripts are represented with two bytes. The remaining characters are represented with three or four bytes. Using UTF-8 allows for easy incorporation of non-ASCII characters without the overhead of two, three or four byte representation for all characters.

Note – use of Unicode means character counts do not always equal the number of storage bytes. As an example, the name François has 9 characters but requires 10 bytes storage because "ç" requires two bytes.

A.4 Security Requirements

Data integrity and authenticity are needed for trusted international interchange. A single, mandatory cryptographic checksum (enciphered hash) will be used within the LDS incorporating all implemented Data Groups except for Data Group 16 ["Person(s) to Notify]. In addition, the structure of Data Groups 2-4 allows for protection of biometric templates on an individual or group basis, if such protection is desired.
Write protection of the Data Elements is required. However, specific write protection schemes are outside the scope of this Technical Report. Details of such schemes are not needed for interchange as only the issuer may write to the capacity expansion technology.

A.5 Structure of Sequential File – Each implementation will be unique, reflecting the specific needs of an issuer. The overall structure, however, is the following:

[Header][DGPM][DG1][Optional DG2] …. [Optional DG13][DG15][Optional DG16]

Where,

Header	= Mandatory header information
DGPM	= Mandatory Data Group Presence Map
DG1	= Mandatory MRZ Data
Optional DG*n*	= Optional presence of Data Groups 2 through 14 inclusive
DG15	= Mandatory Authenticity/Integrity Code
DG16	= Optional presence of Person(s) to Notify – placed after the mandatory Authenticity/Integrity Code to permit updating of the Code without the need to re-compute and record the Authenticity/Integrity Code.

The structure above expands as follows.

[Header] = {AID}{LDS Version Level}{Unicode Version Level}{Total LDS length. (*i.e.* less header and total length)},

where,

{AID} = ISO Application Identifier (registered identifier and pix)

[DGPM] = Two byte binary map that specified which data groups are present

[DG1 MRZ Data] = {Data Group tag}{Length}{Constructed MRZ data element} [15],

[Optional DGn] = {Data Group tag[16]}{Length}{Data Element Presence Map}[17]
{Data Element$_1$}{Data Element$_2$}…{Data Element$_n$}[18]

A.6 Header Information – The Header data is used by the read/decode system to correctly interpret recorded LDS data. The Header is a single, 12-byte Data Element with the following format.

AIDVijUabcL

Where,

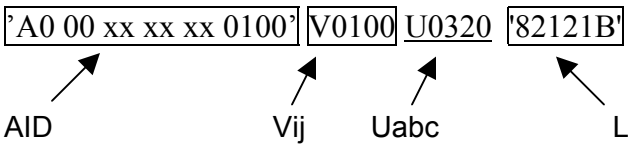
AID = Application Identifier in format 'A0 00 xx xx xx 0100'[19]
Vij = LDS Version Number, xxyy, where i defines the Major revision level (01-99) and j. defines the Minor revision level (01-99). Thus, Version 1.0 of the LDS would be expressed as V0100
Uabc = Unicode version level where a = the Major revision level (0-99), b = the Minor revision level (0-9) and c = the Update Version. The current version of Unicode is 03.2.0 (March 2002) or U0320.

L = Total length of LDS, exclusive of Header. Note: Length shall be encoded according to ASN.1 notation (*See Appendix A to Normative Annex A for details).*

Example: Assume a MRTD is encoded in LDS [Version 1.0] format using Unicode Level 3.2

Total length = 4635_{10} bytes (' 82121B' using ASN.1 notation as defined in Appendix A to this Normative Annex A)

Then the Header for the LDS would be encoded as



Note: Quotation marks (' and ') used above are not encoded within the LDS. They are shown to visually delineate hexadecimal characters.

A.7 Data Group Presence Map – A two (2) byte Data Group Presence Map (i.e. Form 1 DGPM as defined in Section VII of this Technical Report) will immediately follow the "Header".

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[15] One Authenticity/Integrity Code will be included. It shall precede Data Group 16 (DG 16) in the LDS. Biometric templates may be individually signed if so indicated in the CBEFF header.

[16] Refer to Appendix B to Normative Annex A for a list of Data Element Tags

[17] For Data Groups 12, 13, 15 only

[18] If the Data Element is variable length, the length, encoded in hexadecimal shall precede the value.

[19] The AID has the format 'AnnnnnnnnnPIX,' The 'Annnnnnnnn' characters are a registered identifier and identify the application(s) as an ICAO LDS. The PIX is an application specific suffix. The PIX is used to designate a specific application within the LDS, i.e., PIX = '0100'for the issuer data elements in a sequential representation.

As defined in Figure A-1 the DGPM indicates which of the 15 Data Groups defined for LDS [Version 1.0] are present for any specific encoding as determined at the discretion of the issuing State or organization. *Note:* the MRZ (Data Group 1) is mandatory and therefore, always present.

Figure A-1

	b7	*B6*	*b5*	*b4*	*b3*	*B2*	*b1*	*b0*	*Bit*
Data Group	1	2	3	4	5	6	7	8	*Byte 1 of DGPM*
Data Group	9	10	11	12	13	14	15	16-	*Byte 2 of DGPM*

For example, assuming the following Data Groups have been encoded in the LDS:

DG1 - MRZ
DG2 - Encoded face
DG5 - Displayed Portrait
DG11 - Additional Personal Detail(s)
DG15 - Authenticity/Integrity Code

The DGPM would be as follows:

Byte 1 = 11001000 (binary) or ‘C4’ (hex)

Byte 2 = 00100010 (binary) or ‘22’ (hex)

A.8 Data Element Presence Map(s) – A Data Element Presence Map (i.e. Form 1 DEPM as defined in Section VII of this Technical Report) will immediately follow the first data recorded in the following Data Groups if included in the LDS at the discretion of the issuing State or organization. The DEPM will be one or two bytes in length as noted.

DG11 – Additional Personal Detail(s);` Two bytes
DG12 – Additional Document Detail(s); Two bytes
DG16 – Person(s) to Notify; One byte

As defined in Figure A-2 the DEPM indicates which of the Data Elements, in this case sixteen (16) defined for the Data Group are have been encoded at the discretion of the issuing State or organization.

Figure A-2

	b7	*b6*	*B5*	*b4*	*B3*	*b2*	*b1*	*b0*	*Bit*
Data Element	1	2	3	4	5	6	7	8	*Byte 1 of DEPM*
Data Element	9	10	11	12	13	14	15	16	*Byte 2 of DEPM*

For example, assuming the following Data Elements have been encoded in the DG11 – additional Personal Detail(s) of the LDS:

DE1 - Name of Holder (Primary and Secondary Identifiers, in full)
DE3 - Personal Number
DE8 - Profession
DE9 - Title
DE15 - Data Group Authenticity/Integrity Code

The DEPM would be as follows:

Byte 1 = 10100001 (binary) or ‘A1’ (hex)

Byte 2 = 10000010 (binary) or ‘82’ (hex)

A.9 Structure for DG16 – Person(s) to Notify – The LDS allows for multiple recordings of one or more persons to notify. Since the Data Elements used for each recording are optional, a *one-byte* data presence map and length is needed for each individual recording included in the LDS. The resulting structure is as follows:

{Tag}{Overall length of Data Group 15}{Number of recordings included}{Length of first recording}{DEPM for first recording}{Data Elements for first recording}{Length of second recording}{DEPM for second recording}{Data Elements for second recording}{repeated structure for other recordings}

A.10 Structure for DG1 – MRZ Data – All machine readable OCR-B data contained within the MRZ is integrated sequentially and encoded as a single Data Element within the LDS. To minimize storage requirements the use of the filler characteristic (<) has been minimized. All fixed length data elements contained in the MRZ have known lengths and therefore their length is assumed and not defined separately within the integrated Data Element. Name and Optional Data are variable and are therefore preceded by their length.

For example, if the following MRZ data elements from an MRP are assumed:

Doc Type	= P<
Issuing State	= UTO
Name	= ERIKSSON<<ANNA<MARIA
Document #	= L898902C<
Document # Check Digit	= 3
Nationality	= UTO
Date of Birth	= 6 August 1969
Date of Birth Check Digit	= 1
Sex	= F
Date of Expiry	= 23 June 1994
Date of Expiry Check Digit	= 6
Optional Data	= ZE184226B
Optional Data Check Digit	= 1
Composite Check Digit	= 4

The integrated Data Element representation would be as follows:

'61"42'P<UTO'14'ERIKSSON<<ANNA<MARIAL898902C<3UTO
6908061F9406236'09'ZE184226B14

Where,

'61"42' are the Tag and length (in hexadecimal) of this group

The first underlined number (i.e. 14) defines the length of the name field (in hexadecimal); and

The second underlined number (i.e. 09) defines the length of the optional data field, in hexadecimal.

A.11 Example of Sequential Encoding of LDS

Assuming the MRZ from an MRP as defined in paragraph A.10 above, the following:

AID = A0 00 xx xx xx 0100

LDS Version: 1.0
Unicode: 3.2

MRZ re above — Data Group 1

Facial biometric — Tag = 75 — Data Group 2
One entry — Data Element 1
With the following characteristics (header information) — Data Element 2

Authenticity/Integrity option = Digital signature = '2002'

ICAO patron template = version 1.0 = '01 00'

Biometric type = face = '000002'

Biometric feature = Not applicable (no information) = '00'

Captured on 15 March 2002, at 2:45:00 PM, in
Mexico City, Mexico = 200203151445006

Valid from 1 April 2002 through 31 March 2007
= 2002040120070331

Captured using a device with a PID (Product Identifier) of '0001'
Template format owner'000A'

Format type '0004'

Data block length of 4568 bytes ('11D8')
= '82 11 D8' — Data Element 3

Optional Integrity code — Data Element 4
Digital signature
using algorithm type 1 (SHA-1 / ECDSA)
key reference 003

Displayed portrait – Using ISO 10918, length = 2132_{10} bytes
Data Group 6
Number of entries = 1 — Data Element 1
Encoded portrait — Data Element 2

Additional personal information - — Data Group 12
Place of Birth: Nürnberg, Germany - — Data Element 4
Address: 23 Maple Rd, Pleasantville ZZ Z59065 Utopia — Data Element 5
Phone Number:–99 800 555 1212 Data Element 6
One overall Authenticity/Integrity Code - — Data Group 15

Person to Notify - — Data Group 16

Number: 01		Data Element 1
Date data recorded:	January 15, 2001 -	Data Element 2
Name:	François de Pélève	Data Element 3
Telephone:	99-800-555-1212	Data Element 4
Address:	23 Maple Rd, Pleasantville, ZZ, Z59065, Utopia	Data Element 5

Overall length of data = 5431_{10} bytes or 1537_{16}, encoded as '821537' per ASN.1 rules

Then the data stored within the IC would be (Note, Tag, Length, Value notation is not used within data groups.),

'A0 00 xx xx xx 0100' V0100U0320'821537"C413'

'61"42'P<UTO'14'ERIKSSON<<ANNA<MARIAL898902C<3UTO6908061F940623609ZE184226B14

'75"82122C7'1
'A1"821212'
'20"02"0100"000002"00'*200203051445000620020401200733 1*'0001"000A"0004'
'8211D8"[4568 bytes of binary]
'B5"2C'3003[40 bytes of binary]

'65''8207D4''1''8207D0''….2000 byte Portrait per ISO 10918…'

'
6C''54'16''00'
'11'Nünberg, Germany
'2E'23 Maple Rd, Pleasantville, ZZ, Z59065, Utopia
'0F'99 800 555 1212

'
'B5"2C'3003[40 bytes binary]

'70''55'01''53'F0'
20010115 (Note, fixed length field, no length defined)
'15'François de Pélève
''0F'99 800 555 1212
'
'30'23 Maple Rd, Pleasantville, ZZ, Z59065, Utopia

Where,

'A0 00 xx xx xx '0100' =	AID and PIX extension
V0100	= Version level 1.0
U0320	= Unicode Version 3.2.0
'821537'	= Overall length of LDS ($1537_{16} = 5431_{10}$)
'C413'	= Data Group Presence Map (1100 0100 0001 0011)
'61'	= Tag for MRZ data element template (Data Group 1)
'42'	= Length of MRZ (66_{10})
P<……6B14	= MRZ per pervious example
'75'	= Tag for facial biometric template
'821217'	= Overall length of template(s)
1	= One template
'A1'	= Start of first occurrence (in this case only occurrence)
'821212'	= Length of this occurrence

‘2002’	= Integrity option – (MACed)
‘0100’	= ICAO Patron template version 1.0
‘00’	= Biometric feature, not applicable
‘2002031513300006’	= Captured 15 March 2002, at 1:30 PM, 00 sec (UTC + 6)
‘2002040120070331’ =	= Valid from 1 April 2002 through 31 March 2007
‘0001’	= Product identifier
‘000A’	= Format owner
‘0004’	= Format type
’8211D8’	= Length of biometric data block (4568 bytes)
‘B5’	= Tag for integrity code (for this template)
‘2C’	= Length of enciphered hash , algorithm identifier, and key identifier
3	= Algorithm reference 1 (SHA-1 / ECDSA)
003	= Key identifier 03
‘..40 bytes…’	= Digital signature
‘66’	= Tag for facial portrait (Data Group 6)
‘8207D4’	= Length of portrait data group
1	= Number of portraits
‘8207D0’	= Length of portrait
‘6C’	= Tag for Additional Personal Information (Data Group 12)
‘53’	= Overall length of Data Group 12 (84_{10} bytes)
‘1600’	= Data element presence map for Data Group 12
‘11’N…ny	= Length and value of Place of birth (Data element 4)
‘2E’…Utopia	= Length and value of address (Data element 5)
‘0F’99…..1212	= Length and value of phone number (data element 6)
‘B5”	= Tag for Authenticity/Integrity code (Data Group 15)
‘2C’	= Length
3	= Algorithm identifier
003	= Key ID
‘40 bytes binary’	= Digital signature
’70’	= Tag for Person(s) to Notify (Data Group 16)
‘61’	= Overall length of Data Group 16 (97_{10} bytes)
01	= Value of Number of entries (Data element 1) Note, fixed length, two character data element, no length designator used
‘5E’	= Length of first entry, including presence map
‘F0’	= Data element presence map for first instance of Data Group 16
20010115	= Value of Date Recorded (Data element 2)
‘15’Fran….ve	= Length and value of Name (Data element 3)
‘0F'99..1212	= Length and value of phone number (Data element 4)
‘2E’23…Utopia	= Length and value of address (Data element 5)

APPENDIX 1 TO NORMATIVE ANNEX A

ASN.1 LENGTH ENCODING RULES

Range	# of bytes	1st byte	2nd byte	3rd byte
0 to 127	1	binary value	none	none
0 to 255	2	'81'	binary value	none
0 to 65,535	3	'82'	binary value MS byte LS byte	
MS = most significant byte; LS = least significant byte				

Note: Quotation marks (') are used to visually separate hexadecimal characters. They are not encoded in the LDS.

Based on the above defined rules,

Example 1: a Length of thirty nine (39) would be encoded as '27' in hexadecimal representation.

Example 2: a Length of ninety nine (99) would be encoded as '8163' in hexadecimal representation.

Example 3: a Length of one thousand (1000) would be encoded as '8203E8' in hexadecimal representation.

APPENDIX 2 TO NORMATIVE ANNEX A

BIOMETRIC ENCODING

Note, on-going discussions may result in minor changes to this structure

ICAO Patron version of the Common Biometric Exchange File Format (CBEFF), NISTR 6529a.

Table 1 ICAO CBEFF Header data elements

CBEFF data element	Format	Value
Security Options[20]	F 2B	'0000' = plain biometric '2002'= with Integrity '
ICAO Header Version	F 2B	'01 00' (Version 1.0)
Biometric Type	F 3B	'000002'= Facial '000008' = Finger '000010' = Iris
Biometric sub-feature	F 1B	Refer to Table X
Creation date and time	F 7B	YYYY:MM:DD:HH:MM:SS: Note 1
Validity period (from - to)	F 8B	Y YYYY:MM:DDYYYY:MM:DD Note 2
Biometric product identifier	F 2B	Refer to CBEFF
Format owner	F 2B	Refer to CBEFF
Format type	F 2B	Refer to CBEFF
Biometric reference data block	V	Length and template data
Optional authenticity/integrity code	Per 'B5' definition	Contains Algorithm identifier, Key reference, enciphered hash

B = Binary, F = Fixed length, V = variable length

Note 1: Colons are not encoded. Each character is expressed in 4 bit BCD (Binary Code Decimal). Example 15 December 2000, 5:35:30 AM would be encoded as 20001215053530. If hour, minute or second information is not available, 00 shall be encoded.

Note 2: From YYYY:MM::DD to YYYY:MM:DD, characters encoded in BCD

Note *3:* Suggest we delete this as an entire infrastructure and registration system will be needed.

[20] Version 1.0 only supports Plain Biometric or Integrity using a Digital signature. The applicable Security Option + Integrity Option combinations are '00''00' and '20''02' respectively.

APPENDIX 3 TO NORMATIVE ANNEX A

TAG ASSIGNMENTS – *SEQUENTIAL FILE REPRESENTATION*

Appendix 3 to Normative Annex A defines the Data Group Tag assignments valid for LDS [Version 1.0].

Tags are only used to identify Data Groups in LDS [Version 1.0].

General Assumptions:

Tags are to be interpreted as a *Coexistent tag allocation scheme*.

Effort has been made to avoid use of existing tags in the 5Fxx range. However, a number of tags identified in ISO 7816-6 have been redefined, specifically in the 5F4x range.

DATA GROUP		TAG
Data Group Number	**ITEM**	
Issuing State Recorded Data		
DG1	Machine Readable Zone (MRZ)	**61**
DG2	Encoded Identification Feature(s) – Face	**75**
DG3	Encoded Identification Feature(s) - Finger(s)	**63**
DG4	Encoded Identification Feature(s) – Eye(s)	**76**
DG5	Displayed Identification Feature(s) – Portrait	**65**
DG6	Displayed Identification Feature(s) – Single Digit Fingerprint	**66**
DG7	Displayed Identification Feature(s) – Signature of Usual Mark	**67**
DG8	Encoded Security Feature(s) – Data Feature(s)	**68**
DG9	Encoded Security Feature(s) – Structure Feature(s)	**69**
DG10	Encoded Security Feature(s) – Substance Feature(s)	**6A**
DG11	Additional Personal Detail(s)	**6B**
DG12	Additional Document Detail(s)	**6C**
DG13	Optional Detail(s)	**6D**
DG14	*Reserved for future use*	**6E**
DG15	Authenticity/Integrity Code (for sequential implementations)	**B5**
DG16	Person(s) to Notify	**70**
Receiving State Recorded Data		
DG17	Automated Border Clearance Details	**Not Used in LDS [Version 1.0]**
DG18	Electronic Visa(s)	**Not Used in LDS [Version 1.0]**
DG19	Travel Record(s)	**Not Used in LDS [Version 1.0]**

Abbreviations: A = Alpha, B = Binary, F = Fixed, M = Mandatory, N = Numeric, O = Optional, S = Special, V = Variable

ISSUING STATE or ORGANIZATION DATA GROUPS

Data Group	Data Element	Description	Tag	Optional or Mandatory	Format	Example
Header						
		Application identifier		M	Ax 00 xx xx xx yyyy	'A0 00 12 34 56 0100'
		ICAO LDS Version level		M	Vxxyy	V0100
		Unicode Version Level		M	Uxxyz	U0320
		Total length of LDS including presence map		M	ASN.1	'82 12 1B'
		Presence map		M	F 2B	'A4 12'

DG1		**Machine Readable Zone**	61	M		
	01	Document type		M	F 2AS	I<
	02	Issuing state or organization		M	F 3A	ATA
	03	Name of holder		M	V 39 ANS	SMITH<<JOHN<T
	04	Document Number (primary numbers)		M	F 9ANS	12345678<
	05	Check digit, document number		M	F 1N	1
	06	Nationality		M	F 3A	CND
	07	Date of Birth (truncated)		M	F 6N	740602 (yymmdd)
	08	Check Digit, DOB		M	F 1N	2
	09	Sex		M	F 1A	F, M or U
	10	Date of Expiry or Valid Until Date		M	F 6N	060531 (yymmdd)
	11	Check digit, date of expiry		M	F 1N	3
	12	Optional Data		O	Passports = V 14NS ID-1 = 26ANS[21] ID-2 = 7ANS	123456
	13	Check digit, optional data (ID-3 only)		M if ID-3	F 1N	0
	14	Check digit, Composite		M	F 1N	4

Correct per updated CBEFF

DG2			**Facial Biometric Data**	75	O		
	01		Total length of facial data		M	ASN.1	'82 03 07'
	01		Number of templates (entries)		M	F 1N	2
	02		Biometric Header Template – ICAO patron format	Ax[22]	M	F 1B	'A1'
		01	Length of this entry		M	ASN.1	'82 03 05'
		02	Security Options		M	F 1B	'0000'= Plain biometric '2002' = with Integrity
		03	ICAO Header Version		M	F 2B	'01"00'
		04	Biometric type		M	F 3B	'000002'= Facial '000008'= Finger '000010'= Iris
		05	Biometric Feature		M	F 1B	Refer to Table x
		06	Capture (record) date		M	F 8B	Yyyy:mm;dd;hh;mm;ss[23]
		07	Validity period (From date, to date)		M	F 8B	Yyyy:mm:dd:yyyy:mm:dd[24]
		08	Biometric product identifier		M	F 4B	Refer to NISTIR 6529-A

[21] For ID-1 documents the first 15 characters are printed in positions 16-20 of line 1 and the remaining 11 characters are printed in positions 19-29 of line 2.

[22] X denotes which template in data group, e.g., A2 = second template

[23] Colons are not encoded. Each character is expressed in 4 bit BCD (Binary Code Decimal). Example 15 December 2000, 5:35:30 AM would be encoded as 20001215053530

[24] From YYYY:MM::DD to YYYY:MM:DD, characters encoded in BCD

		09	Format owner		M	F 2B	Refer to NISTIR 6529-A
		10	Format type		M	F 2B	Refer to NISTIR 6529-A
	03		Biometric data block		M	V	Binary data block (Includes length)
	04		Authenticity/Integrity Code	B5	M (if protected)	ASN.1	Length of integrity code
		01	Algorithm identifier		M (if signed)	F 1N	3
		02	Key reference		M (if signed)	F 3N	016
		03	Digital signature		M (if signed)	V	Binary data

DG3	**Finger Biometric Data**	**63**	**O**		**Same structure as DG2**

DG4	**Iris Biometric Data**	**76**	**O**		**Same structure as DG2**

DG5		**Displayed Portrait(s)**	**65**	**O**		
	01	Number of images		M	F 1N	1
	02	Digitized facial image(s)		M	V	Variable length template up to 99,999 bytes. Encoded ISO/IEC 10918

DG6		**Displayed Finger(s)**	**66**	**O**		
	01	Number of images		M	F 1N	1
	02	Digitized finger image(s)		M	V	Variable length template up to 99,999 bytes. Encoded per ANSI/NIST-ITL 1-2000

DG7		**Displayed Signature or Mark**	**67**	**O**		
	01	Number of images		M	F 1N	1
	02	Digitized Signature or Mark(s)		M	V	Variable length template up to 9999 bytes. Encoded per Encoded ISO/IEC 10918)

DG8	**Machine assisted Security Features - Encoded Data. Details to be defined**	**68**			

DG9	**Machine assisted Security Features - Structure. Details to be defined**	**69**			

DG10	**Machine assisted Security Features - Substance. . Details to be defined**	**6A**			

DG11			**Additional Personal Details Template**	**6B**	O		
			Presence map		M	F 1B	
	01		Full Name of Doc Holder in National Characters		O	99ANS	Free form
	02		Other names		O		
		01	Number of entries		M if 'Other names present'	F 2N	2

		02	Name entry		M if 'Other names present'	V 999ANS	'Free format
	03		Personal Number		O	V 99NAS	Free format
	04		Place of Birth		O	V 999 ANS	Free format
	05		Full DOB		O	F 8N	CCYYMMDD
	06		Address		O	V 999ANS	Free format
	07		Telephone Number		O	V 99ANS	Free format
	08		Profession		O	V 99ANS	Free format
	09		Title		O	V 99ANS	Free format
	10		Personal summary		O	V 999NS	Free format
	11		Proof of citizenship		O	V	Compressed image per ISO/IEC 10918
	12		Other valid ID numbers		O	V 99ANS	Free format
	13		Custody information		O	V 999ANS	Free format

DG12			**Additional Document Details Template**	**6C**	O		
			Presence map		M	F 1B	
	01		Issuing Authority		O	99ANS	Free form
	02		Date of issue		O	F 8N	CCYYMMDD
	03		Other people listed on document				
		01	Number of entries		M if 'Other people listed present'	F 2N	2
		02	Name entry		M if 'Other people listed present'	V 999ANS	'Free format
	04		Endorsements / Observations		O	V 999NAS	Free format
	05		Tax / Exit Requirements		O	V 999 ANS	Free format
	06		Image of front of document		O	V	Compressed image per ISO/IEC 10918
	07		Image of rear of document		O	V	Compressed image per ISO/IEC 10918
	08		Personalization time		O	F 14N	Ccyymmddhhmmss
	09		Personalization s/n		O	V 99ANS	Free format

DG13	**Optional Detail(s)**	**6D**	O		

DG14	**Reserved for future use**	**6E**	O		

DG15		**Authenticity/Integrity Code**	**B5**	M	ASN.1	
	01	Algorithm identifier		M	F 1N	2
	02	Key identifier		M	F 3N	013
	03	Authenticity/Integrity		M	40/128 B	

DG16			**Person to Notify**	**70**	O	ASN.1	
	01		Number of entries		M	F 1N	2
		01	Length of this entry		M	ASN.1	'82 03 05'
		02	Presence map for this entry		M	F 1B	
		03	Date data recorded		O	F 8N	Yyymmdd
		04	Name of person		O	V 999ANS	Free format
		05	Telephone		O	V 99ANS	Free format
		06	Address		O	V 999ANS	Free format

A.12

b8	b7	b6	b5	b4	b3	b2	b1	Biometric Feature
0	0	0	0	0	0	0	0	No information given
		0						Indication of mask
1								Right e.g., right iris
	1							Left
			0	0	0	0	1	Right Thumb
			0	0	0	1	0	Right Index
			0	0	0	1	1	Right Middle
			0	0	1	0	0	Right Ring
			0	0	1	0	1	Right Little
			0	0	1	1	0	Left Thumb
			0	0	1	1	1	Left Index
			0	1	0	0	0	Left Middle
			0	1	0	0	1	Left Ring
			0	1	0	1	0	Left Little

ANNEX B (NORMATIVE) to Section VIII

MAPPING OF LDS [VERSION 1.0]

TO OPTIONAL
OPTICAL MEMORY

B.1 Scope - Annex B defines the current state of development of specifications[25] governing mapping of the Logical Data Structure – LDS [Version 1.0] using *random access* to optical memory on TD-1 size cards to allow expansion of the machine readable data capacity at the discretion of the issuing State or organization.

B.2 Normative references - The following International Standards contain provisions which, through reference herein, constitute provisions of Annex B to Section VIII of this Technical Report. Where differences exist between the specifications contained in this Technical Report and the referenced Standards to accommodate the use of bar code(s), the specifications contained herein shall prevail.

ISO/IEC 11693:2000	Identification cards - Optical memory cards - General characteristics.
ISO/IEC 11694-1:2000	Identification cards - Optical memory cards - Linear recording method - Part 1: Physical characteristics.
ISO/IEC 11694-2:2000	Identification cards - Optical memory cards - Linear recording method - Part 2: Dimensions and location of the accessible optical area.
ISO/IEC 11694-3:2001	Identification cards - Optical memory cards - Linear recording method - Part 3: Optical properties and characteristics.
ISO/IEC 11694-4:2001	Identification cards - Optical memory cards - Linear recording method - Part4: Logical data structures.
NISTIR 6529-A	Common Biometric Exchange File Format (CBEFF)

B.3 Definitions – The following definitions shall apply,

Application: Since the optical memory on a TD-1 contains digital storage, this data is accessed by a computer application that reads the data and makes use of the information it contains. Applications change just like data formats, and so application versions as well as data format versions must be a consideration.

Data item: A well defined data element or set of data. A data item requires no other data in order to be useful. It is read in its entirety from one or more sectors. A data item may contain sub-elements, but should contain no optional sub-elements that cannot fit into the sector with the required sub-elements.

Sector: The smallest area on a random access media that can be accessed. A fraction of a sector cannot be written to or read from. The entire sector must be read or written to.

[25] *Specifications* as envisaged based on work completed to date. Specifications will only be considered final when they have been published in Doc 9303.

Data sector: A sector that contains all or part of a TLV data stream.

Directory: A structure used to keep track of the presence and/or location of data on a random access media.

Directory sector: A sector on a random access media that contains directory information.

MRTD Tag: A unique unsigned 16-bit number used to identify a data item stored on the document. A single set of tags applies to any and all data stored on any random access optical memory resident on a TD-1 that conforms to the specifications defined herein.

Tag, Length, Value (TLV) data stream: A storage structure that involves placing data in serial fashion on a storage medium and keeping track of it through a tag, which identifies the meaning of the data, followed by the length of the data in bytes, followed by the value, which is the data itself. The last byte of the 'value' part is then optionally followed by another TLV structure. The stream is terminated by a tag of zero. Although such a data stream is a serial entity, a random access technology can contain any number of such streams, and parts of a TLV stream can be read independently if desired.

Track: A data area on an optical memory resident on a TD-1 that can contain one or more sectors

Unique stamp: A unique 12-byte value that is created based on the time of writing and the unique serial number of the optical memory card writer. This is used to identify two separate sectors as containing parts of the same logical data stream.

Note: All numbers are in decimal unless otherwise specified.
Note: All multi-byte numbers are stored in little-Endian format (least significant byte first) unless otherwise specified.

B.4 General Structure – While access to serial devices is relatively simple, random access storage has associated with it the idea of 'geography'. The issuer of the document can and must define where on the document a given item of data is to be written. In the case of optical memory cards, this is defined by track and sector numbers and by the choice of sector format for a given track.

For serial storage technologies, all of the data must be read if any is read. For random access technologies, a part of the data set can be read without having to read other parts. To take advantage of this capability, a directory structure is required on the media. This structure allows the reader to read a desired subset of the data by telling the reader which data items (specified by a unique MRTD tag) are present on the media, and where to find each.

This standard does not define the exact location of any piece of data on the media. It defines only a starting point for the directory of the media. The starting point tells the reader where the directory for the media starts. The location of the remainder of the directory and of the data itself is contained in the directory itself. The reading application can make use of the standard and the directory to find the rest of the directory and the data no matter where the writing application has chosen to write it.

So the starting point and the directory structure allow the reader to determine the presence and location of any desired data item on the media. This leaves only the definition of the data item itself to be resolved. This is done through tags and the tag document

B.5 The TLV Structure and TAG - An MRTD tag is a unique number that is used to identify a type of data item. The standard will define some of the tags and their associated data items. Other tags will be issued and defined as needed by the document issuer. The tags will be kept unique and their meaning

published by the tag issuing body, (LaserCard Systems Corporation will volunteer to act as the tag issuing body if desired). Groups of numerically adjacent tags will be issued to a document issuer by the tag issuing body as required for the document being issued. It is the responsibility of the document issuer to return to the tag issuing body a description of the data item associated with each tag it intends to use when issuing its document. Each tag or set of tags will be described by a 'tag document' which will completely describe the use and format of the data to be associated with the tag. These new tags and definitions will then be added to the standard so that other document issuers or receiving organizations can use them. A tag that is issued to a given document issuer that is not then described to the tag issuing body is considered 'issued and proprietary" and documents created using such tags still fall within the standard. A standard reading system will ignore the data associated with such tags. Tags that are not proprietary will be published by the tag issuing body as soon as they are accepted.

Each tag is a 16-bit unsigned number. This allows for 65535 tags, which will be adequate for all implementations. Within a TLV (tag, length, value) data stream, which contains one or more TLV items, the L or length part of the stream will be a 32-bit unsigned number, which allows a single piece of data to be up to 4 Gb in length. This is adequate because the highest capacity technology included in the standard has a maximum user data capacity of approximately 3 Mb.

What tags do:

- Tell the reader of the document (by lookup) the intended meaning of the associated data. This can be considered 'the type of data'.

- Tell the reader of the document (by lookup) the layout or format of the associated data

What tags do not do:

- Tell the reader the date or time that the data was obtained or recorded

- Tell the reader who recorded the data

- Tell the reader how many data items of this type exist on the document or indeed anything about any other piece of data of this type or any other type.

- Authenticate the source of the data

The functionality of this latter list is left to the data item itself. The data item will contain any information that is defined in the tag document for the associated tag, so the tag document can define the data item as having date and time stamps, who recorded the data, etc.

A tag may be associated with a single well defined piece of text, such as a person's name, but often will be associated with a standard fixed format data set. An example of such a set is a standard JPEG file. The data inside a JPEG file conforms to a standard, and many software applications and components know how to read and display such a file. The file itself contains information about the image contained in the file, such as width, height, etc. A tag may call out a standard JPEG file, or may call out a specific type of JPEG file. For example, the tag for a 'Document holder portrait' may call out a standard JPEG file that is of a specified minimum width and height that contains an image of the person's head and neck, and shows at least one ear. The data set associated with this tag is not limited to just holding a JPEG file: it may contain any other information which the card issuer wants to include with the image. For example, the date and time the picture was taken, the date and time the picture was written to the document, etc.

Another example of a standard data set that may be associated with a single tag is the machine readable zone (MRZ) data set that is currently printed as OCR characters on passports. Since the format of this set of fields is standardized, the tag document need only describe the standard that is used.

B.6 Guidelines for Assigning Data to Data Elements –

Because the standard allows different data elements to be placed within a single data item, or split up into different data items, a card issuer must decide how to break up their data into items. Here are a few guidelines:

- If two data elements are useless without each other, they should be in the same data item
- If a data element is optional, it should be in its own data item
- If several data elements are always written and read together, they should be in the same data item
- If several data elements are small enough to fit in a single sector together, they should be in the same data item.

If a data element will be updated independently of other data elements, that element should not be in the same data item.

B.7 Biometric data –

It is expected that most MRTD's will contain at least one biometric identifier. In order to facilitate interoperability of MRTD's with other systems that make use of biometric data, the standard format for biometric data items in MRTD's will be the Common Biometric Exchange File Format (CBEFF) as defined in NISTIR 6529-A. CBEFF is not yet a standard, but is being promoted as a standard for the exchange of biometric data elements. A document issuer can issue documents that meet this standard (MRTD), but which do not meet CBEFF requirements - but such data elements will be considered as proprietary data items and the associated tag documents will be published by the MRTD tag issuing authority as "proprietary" with no details of the format included in the accepted tag document. In other words, any 'standard' biometric must meet the CBEFF requirements.

B.8 The Tag Document –

This standard requires the creation of a standard tag document that contains a unique tag or a unique consecutive set of tags, and a description of the data that is associated with that tag or set of tags.

The tag document is a kind of a mini-standard that describes a single type of data. The document may itself completely describe the data in question or may refer to other standards or documents.

A tag document must contain the following minimum set of information:

1.) The tag or consecutive set of tags to be defined
2.) The title of the tag or tag set
3.) The name and contact information of the requesting organization
4.) The date the tag document was submitted to the tag issuing body
5.) The date the tag document was accepted by the tag issuing body (if accepted)
6.) The status of the tag document (submitted, accepted, etc.)
7.) Any standards that apply to the format of the data
8.) A complete description of the format and content of the data to be associated with the tag.
9.) If multiple tags are defined, a complete listing of the difference in meaning from one tag to another.

The description part can contain references to other documents, which together with the tag document completely define the associated data.

Here is an example of a tag document:

Tag(s):	2010 - 2019
Title:	Government of Potsylvania fingerprint biometric version 1
Requested by:	Government of Potsylvania, Passport division 123 Main Street Potsylvania Administrator: Joe Smith (jsmith@potsylvania.gov) Phone: 99 123-456-7890
Date submitted:	2001.10.03
Date accepted:	2001.12.04
Status:	Accepted. In use.
Applicable Standards:	NISTIR 6529-A Draft Version 2 (02/11/01) Common Biometric Exchange File Format

Description:

This data item contains a CBEFF compliant file containing a fingerprint biometric template created by the FingerId corporation FP-101 fingerprint biometric identifier system version 4.5 or later compatible. The following required and optional CBEFF fields are included in this file:

Format owner:	C12B (hex)	Finger ID corporation
Format type:	0003 (hex)	FP-101 and compatibles
SBH Security Options	30 (hex)	Privacy and Integrity
Integrity	02 (hex)	Signed
Biometric Type	08 (hex)	Fingerprint
Biometric Feature	001fffhh (binary)	Finger as defined in CBEFF (f = finger, h = hand)
Format document:	CBEFF.C12B.0003	Document fully describing the BDB format

The SBH Security Options value will never change, but the reader of passports must be prepared for the Integrity option to switch from 0x02 (signed) to 0x01 (MACed), which is planned for the future.

The BDB of this file contains the following fields:

Offset (bytes)	Length (bytes)	Example	Meaning
0	10	“2001.12.01”	Date the fingerprint template was created
10	8	“12345678”	ID number of biometric device
18	500	---	Standard Finger Id template version 4.5 or greater

The tag set applies as follows:

Tag	Finger
3010	Right hand thumb
3011	Left hand thumb
3012	Right hand index finger
3013	Left hand index finger
3014	Right hand middle finger
3015	Left hand middle finger
3016	Right hand ring finger
3017	Left hand ring finger
3018	Right hand little finger
3019	Left hand little finger

In addition to the particular finger being encoded into the tag to allow the reader to determine the finger from reading only the directory, the reader can determine the finger from the optional 'Biometric Feature' field of the CBEFF file.

The government of Potsylvania had a choice to encode the finger within the data item or to use different tags. It was decided to request one tag for each finger so that receiving states could determine more quickly from the directory which fingers were present on the media without having to read the data.

B.9 MRTD TAG Ranges Defined by the Standard –

Tag (decimal)	Data Group	Mandatory/ Optional	Data Item
0	-	-	Reserved for end of TLV stream. Finding a tag value of zero tells the reader to stop reading because the TLV stream has ended.
1000	1	M	Machine Readable Zone (MRZ) data
2000	2	O	Encoded Face
3000	3	O	Encoded Finger
4000	4	O	Encoded Eye
5000	5	O	Encoded Hand
6000	6	O	Displayed Portrait
7000	7	O	Displayed Single-Digit Fingerprint
8000	8	O	Displayed Signature or Usual Mark
9000	9	O	Data Features
10000	10	O	Structure Features
11000	11	O	Substance Features
12000	12	O	Additional Personal Data Elements
13000	13	O	Additional Document Data Elements
14000	14	O	Discretionary Data Elements
15000	15	O	Data Authentication Code
16000	16	O	Person(s) to Notify Data Elements

Each data group as defined by WD-002-2001-05-01 uses one tag in the preceding list. Each of these should have a corresponding tag document that contains the required data elements as specified in that document. Note that this table contains only 16 tags out of the possible 65535 tags. The rest will be

defined as card issuers submit tag documents to the tag issuing body.

B.10 Mapping to TD-1 with Optical Memory

This section contains details of how the standard is mapped onto the optical memory card. This implementation allows for making the best use of the random access nature of the optical memory card.

This document uses references to ISO/IEC 11694 Part 4 Annex B. There is nothing in this document that prevents the standard from working with cards that conform to Annex A of ISO/IEC 11694 Part 4.

B.10.1 OMC Track Locations (Annex B of ISO/IEC 11694 Part 4):

Track	Meaning
0	Format Description Track (reserved by 11694 Part 4) describes card type
5	Application Description Track. This track will be written in the 1112 byte sector format. The mandatory MRZ data set will be contained in a standard TLV stream in this sector at offset 320 (from 0) of the sector. The MRTD tag is 1000 and the length is 90 bytes. This data set is coded using the ASCII character set.
6	First directory track. This track will be written with the 1112 byte sector format on all issued documents.
7	Recommended second directory track
….	
2577	Maximum data/directory track

B.10.2 Sector Signature

Sector signatures have two purposes: to act as a signature so that a reader will be sure of only interpreting data that meets this standard, and to differentiate the different types of standard sectors on the card (i.e. data sectors vs. directory sectors).

Sector signatures defined by the standard:

Signature (hex)	Meaning
AB 4D 52 54 44 5F	Directory sector containing both tags and data addresses
AA 4C 43 46 53 5F	Data sector containing part of a TLV stream
BA EA	Alternative data sector containing multiple instances of the same type of data.

B.10.3 Layout of Directory Sectors

Directory sectors always start with the following header:

Offset (bytes)	Length (bytes)	Example	Meaning
0	6	AB 4D 52 54 44 5F (hex)	Sector signature for directory sector
2	3	7	Track address of next logical directory sector

5	1	4	Sector format of next logical directory sector

The rest of the directory sector contains multiple copies of the following structure:

Offset (bytes)	Length (bytes)	Example	Meaning
0	2	1000	Tag representing a data item on the media
2	3	200	Track address of track containing data associated with this tag
5	1	4	Sector format of track containing data associated with this tag
6	2	20	Number of tagged items in the described TLV stream

When an application that writes data to the document has written all its data, it knows which tracks it used and which track is the first available for subsequent applications to write. It points the next application to the first remaining free track by ending its list of the above structures with a final entry containing a tag of zero and containing the track address of the first free track on the media. All other fields of the structure will be set to zero. The reader application also uses this zero tag entry as a signal that no more valid tags exist in the current directory sector. Any unused part of a directory sector will be filled with zeroes.

If the number of tagged items in the described TLV stream is 1, then we already have the tag for the data from the directory entry, and we will have the length in the data sector header (described below). In this case, the data portion of the sector will not contain the tag and length, but will contain only the single data item itself.

B.10.4 Layout Data Sectors

Most TLV stream data sectors will start out with the following header:

Offset (bytes)	Length (bytes)	Example	Meaning
0	6	AA 4C 43 46 53 5F (hex)	Sector signature for a sector containing a TLV data stream
6	2	0	Reserved for future use
8	4	3214	Length of this TLV data stream in bytes
12	4	0	Reserved for future use
16	12	-	Unique stamp for this TLV data stream
28	2	0	Offset of this sector within TLV data stream
30	2	4	Number of sectors in this TLV data stream
32	2	0	Reserved for future use
34	2	234	Byte offset of first tag within this sector

The first sector of a given TLV stream is specified in the directory. If the TLV stream consists of more than one sector, succeeding sectors of the stream will be written to and read from succeeding sectors on the same track. If the TLV stream is larger than one track, succeeding sectors of the stream will be written/read from succeeding physical tracks on the media.

For example, if a TLV stream is 3000 bytes in length and is written using a sector format with a length of 1112 bytes, the data portion of the stream will be 1112 – 36 bytes = 1076 bytes in length, so the stream will be written to 3000 / 1076 = 3 sectors (rounding up). Since the 1112 byte sector format is one sector per track, the stream will be written to and read from 3 consecutive physical tracks. If, for example, the

track location for this stream in the directory was specified as track 20, then the stream will occupy tracks 20, 21, and 22 on the media. The remaining (3 * 1076) – 3000 = 228 bytes of track 22 will be written with zeroes and ignored by the application that reads the stream back.

Following the header, the data sector consists of either a partial or complete TLV stream. A TLV stream consists of one or more copies of the following structure:

Offset (bytes)	Length (bytes)	Example	Meaning
0	2	1005	Tag representing the data item to follow, e.g. First name (T field)
2	4	3	Length of the data item in bytes (L field)
6	Var	"Joe"	The data item itself. Its length is the number in the L field (V field)

Any unused part of the sector will be filled with zeroes. The reader uses the first tag value of zero it encounters to signal the end of the TLV stream.

B10.4.1 Alternate Layout

Sometimes it is desired to store a lot of relatively small updates of data that has essentially the same meaning. For example, the MRV data corresponding to stamps or labels that are applied to a current passport. For such cases, the header above is inappropriate, so the following alternative header may be used:

Offset (bytes)	Length (bytes)	Example	Meaning
0	2	BAEA (hex)	Signature for sector containing a single type of TLV entry
2	2	9031	Tag representing the data to follow
4	1	40	Length of data to follow
5	Var	"Entered Australia 2001.03.01"	Data associated with this tag

The above types of TLV entries are expected to occupy succeeding sectors in an area of the media that has its starting track and format specified by a single entry in the directory that is associated with the specified tag.

B.10.5 Track Addresses

The directory sector header contains a pointer to (address of) the next logical sector of the directory. This consists of the second and third fields in the header. This next logical sector contains the continuation of the directory.

The address of the next logical sector contains a track number and a sector format. This tells the reader how to read the track containing the next logical sector. The sector number is not included in the header because the directory will always be continued on the first sector of the indicated track. If there are multiple sectors on a track, all sectors except the last one on the track will contain the track number of the current track. The reader will look for the continuation of the directory in the following sectors on that track. The last sector on the track will contain the track number of another track where the directory continues.

At some point, the system which is initializing or updating the document will have written all of its directory sectors. At this point, the last sectors in the directory will contain a pointer to a blank track on the media where the next directory update will begin.

B.10.6 Unique Stamp

The 12 byte unique stamp referenced in the data sector header contains the following:

Offset (bytes)	Length (bytes)	Example	Meaning
0	3	123456h	Written with document writer serial number 123456
3	2	2002 = the year 2002	Year
5	1	3 = March	Month (1 = January)
6	1	31 = 31st day	Day (from 1 to 31)
7	1	14 = 2 pm	Hour (from 0 = midnight to 23 = 11 pm)
8	1	59	Minute (from 0 to 59)
9	1	59	Second (from 0 to 59)
10	2	999	Millisecond (from 0 to 999)

APPENDIX 1 TO NORMATIVE ANNEX B

TAG DOCUMENTS

Tag(s): 1000
Title: Data contained in the Machine Readable Zone of a MRTD
Requested by: MRTD working group
[Contact Info required]

Date submitted: 2002.04.15
Date accepted: -
Status: Part of the initial standard. Will be accepted with it.

Description:

This data item consists of a set of fixed length fields. It is a copy of the data that is printed on the machine readable zone of a machine readable travel document. This is the minimum data set that is required on a machine readable travel document. As printed OCR text, this data is not digitally encoded – it exists as a set of characters which all belong to the ASCII character set. As such, this data written digitally will be encoded using the ASCII character set.

The set of text fields in this item is defined in the document: WD-002-2001-05-01

Tag(s): 9001
Title: Standard serial data format
Requested by: MRTD working group
[Contact Info required]

Date submitted: 2002.04.15
Date accepted: -
Status: Part of the initial standard. Will be accepted with it.

Description:

This data item contains the set of data defined as the standard serial implementation by the appropriate part of this standard. This allows the random access media to be used to store the exact same data stream used by serial-only technologies if desired.

Tag(s): 9002
Title: Default biometric identifier
Requested by: MRTD working group

[Contact Info required]

Date submitted: 2002.04.15
Date accepted: -
Status: Part of the initial standard. Will be accepted with it.

Description:

This data item contains the default CBEFF format biometric identifier for the cardholder. In addition to a tag issued to the card issuer that describes the exact content of the data item, the card issuer can include this tag on the document to reference the data item containing the primary biometric that was placed on the card at the time the card was issued. Note that because a tag is just a descriptor of data, two tags can reference the same data without having to write the data twice. Readers that do not recognize the card issuer's tag, but which have access to multiple biometric verification or identification devices - can use this tag to find the biometric data file. They can then use the CBEFF format to parse the file and determine if they can make use of the biometric template contained in the file.

ANNEX C (NORMATIVE) to Section VIII

MAPPING OF LDS [VERSION 1.0] USING RANDOM ACCESS REPRESENTATION TO OPTIONAL INTEGRATED CIRCUITS (IC(S))

C.1 Scope - Annex C defines the current specifications[26] governing mapping of the Logical Data Structure – LDS [Version 1.0] using a *random access representation* to integrated circuits (IC(s)) on an MRTD to allow expansion of the machine readable data capacity at the discretion of the issuing State or organization.

Note: The specifications presented in Annex C apply only to a LDS supporting "off-card" biometric authentication, i.e., where the MRTD provides the LDS to machine-assisted identity confirmation that requires the MRTD to act only as the carrier of data..

C.2 Normative references - The following International Standards contain provisions which, through reference herein, constitute provisions of Annex C to Section VIII of this Technical Report. Where differences exist between the specifications contained in this Technical Report and the referenced Standards to accommodate the use of IC(s) with contacts and Contactless IC(s), the specifications contained herein shall prevail.

ISO/IEC 7810 : 1995	*Identification cards - Physical characteristics*
ISO/IEC 7816-1 : 1998	*Identification cards - Integrated circuit(s) cards with contacts - Part 1: Physical characteristics*
ISO/IEC 7816-2 : 1998	*Identification cards - Integrated circuit(s) cards with contacts - Part 2: Dimensions and location of the contacts*
ISO/IEC 7816-3 : 1997	*Identification cards - Integrated circuit(s) cards with contacts - Part 3: Electronic signals and transmission protocols*
ISO/IEC 7816-4 : 1994	*Identification cards - Integrated circuit(s) cards with contacts - Part 4: Interindustry commands for interchange*
Amendment Report	*ISO/IEC 7816-4/AM1*
ISO/IEC 7816-5 : 1994	*Identification cards - Integrated circuit(s) cards with contacts - Part 5: Registration system for applications in IC Cards.*
ISO/IEC 7816-5/AM : 1996	*Identification cards - Integrated circuit(s) cards with contacts - Part 5: Registration system for applications in IC Cards - AM1: Proposal for a set of Registered Application provider identifiers (RIDs)*
ISO/IEC 7816-6 : 1998	*Identification cards - Integrated circuit(s) cards with contacts - Part 6: Inter-Industry Data Elements*
Defect Report	*ISO/IEC 7816-6/DAM1*
ISO/IEC 7816-7 : 1998	*Identification cards - Integrated circuit(s) cards with contacts - Part 7: Interindustry commands for Structured Card Query Language (SCQL)*

[26] *Specifications* as envisaged based on work completed to date. Specifications will only be considered final when they have been published in Doc 9303.

ISO/IEC 7816-8 : 1999	*Identification cards - Integrated circuit(s) cards with contacts - Part 8: Security architecture and related interindustry commands*
ISO/IEC 7816-9 : 1999	*Identification cards - Integrated circuit(s) cards with contacts - Part 9: Additional interindustry enhanced commands*
ISO/IEC 7816-10 : 1999	*Identification cards - Integrated circuit(s) cards with contacts - Part 10: Operating procedure and answer to reset for synchronous cards*
(ISO/IEC 7816-11:	*Identification cards – Integrated circuit(s) cards with contacts – Part 11: Personal verification through biometric methods (Currently Committee Draft))*
ISO/IEC 8824-2:1998	*ITU-T Recommendation X.681 (1997), Information technology – Abstract Syntax Notation One (ASN.1): Information object specification*
ISO/IEC 8824-3:1998	*ITU-T Recommendation X.682 (1997), Information technology – ISO/IEC 8824-1:1998*
ITU-T Recommendation X.680 (1997), Information technology – Abstract Syntax Notation One (ASN.1): Constraint specification	
ISO/IEC 8824-4:1998	*ITU-T Recommendation X.683 (1997), Information technology – Abstract Syntax Notation One (ASN.1): Parameterization of ASN.1 specifications*
ISO/IEC 8825-1:1998	*ITU-T Recommendation X.690 (1997), Information technology – ASN.1 encoding rules: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER)*
ISO/IEC 10918	*Information technology – Digital compression and coding of continuous-tone still images*
ISO/IEC 14443-1	*Identification cards - Contactless integrated circuit(s) cards - Proximity cards – Part 1: Physical Characteristics*
ISO/IEC 14443-2	*Identification cards - Contactless integrated circuit(s) cards - Proximity cards – Part 2: Radio frequency power and signal interface*
ISO/IEC 14443-3	*Identification cards - Contactless integrated circuit(s) cards - Proximity cards – Part 3: Initialization and anticollision*
ISO/IEC 14443-4	*Identification cards - Contactless integrated circuit(s) cards - Proximity cards – Part 4: Transmission protocol*
ISO/IEC 15444	*Information technology -- JPEG 2000 image coding system -- Part 1: Core coding system: Information Technology – JPEG 2000 image coding system*
ANSI/NIST ITL 1- 2000	*Data Formatting for the Interchange of Fingerprint, Facial, and Scar Mark & Tattoo (SMT) Information*
NISTIR 6529	*CBEFF (Common Biometric Exchange File Format)*

C.3 Random Access File Representation – The *random access file representation* has been defined with the following considerations and assumptions.

- Support a wide variety of implementations – The LDS includes a wide variety of optional data elements. These data elements are included to facilitate MRTD authentication, rightful holder authentication, and expedite processing at document/person points.
- The data structure must support

- Limited or extensive set of data elements
- Multiple occurrences of specific data elements
- Continuing evolution of specific implementations

♦ Support at least two (2) application data sets
- Issuer defined and controlled Data Elements that are
  - Write protected
  - Digitally signed, using an enciphered hash, so the receiving State or approved receiving organization can be confident as to the authenticity and integrity of data contained in the LDS
- User controlled Data Elements (Not supported in Version 1.0)
  - Written in a write once area
  - Digitally signed

♦ Allow for other national specific applications

♦ Support data authentication within an evolving key management environment

♦ Support rapid access of selected Data Elements to facilitate rapid document holder processing
- Immediate access to necessary data elements
- Direct access to data templates, biometric data in particular

C.3.1 To provide interoperability Annex C defines:

♦ Physical characteristics of an IC card, in addition to those characteristics specified in ISO/IEC 7810.

♦ Location and dimensions of the contacts or coupling areas

♦ Electrical signals to support communications between the IC card and the Interface Device (IFD);

♦ Transmission protocols and answer to reset;

♦ Command set;

♦ The use of commands including security references

♦ The file structure for the ICAO MRTD LDS application; and

♦ The Data Element mappings to the files.

♦ Character set[27]

[27] UTF-8 encoding is used. Most of the data elements used in the LDS are Basic Latin (ASCII) characters or binary. A small number of data elements such as "Name in National Characters," "Place of Birth" etc cannot always be encoded with the Basic Latin code set. Therefore, characters will be encoded using the Unicode Standard: UTF-8. It is a variable length encoding that preserves ASCII transparency. UTF-8 is fully compliant with Unicode Standard and ISO/IEC 10646. UTF-8 uses one byte to encode standard ASCII characters (code values 0…127). Many non-ideographic scripts are represented with two bytes. The remaining characters are represented with three or four bytes. Using UTF-8 allows for easy incorporation of non-ASCII characters without the overhead of two, three or four byte representation for all characters.

C.4 Security Requirements - Security Requirements - Data integrity and authenticity are needed for trusted international interchange. Specifications defined herein limit the means to provide data integrity and authenticity to static signatures. Future revisions may address use of dynamic signatures.

C.5 Compatibility with Existing International Standards - Compatibility with existing standards is critical to facilitate implementation and insure interoperability. Therefore, the Tag structure must,

- Adhere to existing standards for IC(s) [with contacts and contactless];
- Maximize compatibility with other ISO specified travel related documents, i.e., International Driver Licenses
- Maximize compatibility with interoperable biometric representations used for machine-assisted identity confirmation.

C.6 Definitions - [to be specified]

C.7 Physical Characteristics - The physical characteristics of the IC card shall adhere to the physical characteristics specified in the Standard for the respective type of card

C.8 Location and Dimensions of Coupling Areas - The location and dimension of the contact or coupling areas of the IC shall adhere to the location and dimension specified in the Standard for the respective type of card.

C.9 Electronic Signals - The electronic signals and reset procedures are given in the Standard for the respective type of card.

C.10 Transmission Protocols and Answer to Reset

C.10.1 **Transmission protocols -** The MRTD may support a variety of protocols in accordance with the Standard for the respective type of card. For contact cards, both the interface device (IFD) and the IC card shall support at least the protocol T = 0 (see ISO/IEC 7816-3). Other protocols that may be used are defined in the respective standards.

C.10.2 **Answer to Reset (Contact ICs) -** The answer to reset shall adhere to the answer to reset specified in the standard for the respective type of card. A contact IC shall not use the programming voltage, contact (Vpp). The use of historical bytes in the answer to reset is a vendor option, but shall be in compliance with the respective standard.

C.10.3 **Request for Command (Contactless ICs) –** The IC shall respond to Request for Command - Type A (REQA) or Request for Command – Type B (REQB) with Answer to Request – Type A (ATRA) or Answer to Request – Type B (ATAB) as appropriate with the settings defined in Normative Appendix 3 to Annex C

C.10.4 **Application Selection –** IC cards shall support at least two Machine Readable Travel Document (MRTD) applications, as follows:

- One application shall consist of data recorded by the issuing State or organization [Data Groups 1-16]; and

- The second application consists of data added by receiving States or approved receiving organizations. [Data Groups 17-19].

In addition, issuing States or organizations may wish to add other applications. The file structure shall accommodate such additional applications, but the specifics of such applications are outside the scope of this normative Annex.

The MRTD applications shall be selected by use of the Application Identification (AID) as a reserved DF name. The AID shall consist of the Registered Application Identifier (RID) assigned by ISO according to ISO/IEC 7816-5 and a Proprietary Application Identifier Extension (PIX).

The RID is 'A0 00 xx xx xx'. The issuer application shall use PIX = '0101'. The user data application shall be PIX = '0201'.

C.10.5 **Security**

Data Groups 1 – 15 inclusive shall be write protected. Each Data Group shall be protected using a staticDigital Signature to insure data integrity and source authenticity. Future versions of this specification may accommodate dynamic signatures.

Only the issuing State or organization shall have write access to these Data Elements. Therefore, there are no interchange requirements and the means used to achieve write protection are not part of this specification..

Data Group 16 inclusive shall be write protected. Only the issuing State or organization shall have write access to the Data Elements in this Data Group.

Data Groups 17, 18 and 19 in this application shall be declared as "write once, read many." These Data Groups are for use by the receiving state or approved receiving organization. The structure and use of these Data Groups will be defined in a future version of this document.

C.11 File Structure - Information on an IC card is stored in a file system defined in ISO/IEC 7816-4. The card file system is organized hierarchically into dedicated files (DFs) and elementary files (EFs). Dedicated files (DFs) contain elementary files or other dedicated files. A master file (MF) is the root of the file system.

One DF as defined by this specification contains issuer data elements. This DF has the name 'A0 00 xx xx xx 0101' for the application (the registered RID and PIX) and is selected by this name. It can be placed anywhere in the DF tree attached to the MF of the card. The second application, if present, contains data crated by receiving states. This DF has the name "A0 00 xx xx xx 0201.' It can be placed anywhere in the DF tree attached to the MF.

Within each application there may be a number of "Data Groups." The issuing State or organization application may have up to 16 Data Groups. Data Group 1 [DG1], the Machine Readable Zone (MRZ), is mandatory. All other Data Groups are optional. The receiving State or approved receiving organization application may have three Data Groups. All three Data Groups are optional. All Data Groups are in the form of data templates and have individual ASN.1 Tags.

Each DF has one file (name EF.COM) that contains the common information for the application. The short file identifier for this file is 30. This file will contain a LDS version information, Unicode version information and a list of the Data Groups that are present for the application. Each Data Group shall be stored in one EF with a short file ID as shown in Table CT-1. The names for the files shall be EF.DG*n*, where *n* is the Data Group number. (e.g., EF.DG1, EF.DG2, EF.DG16). See Figure C-1 for a graphical

representation of the file structure.

Table CT-1 – Assignment of Short File Identifiers and Data Group Tags

ISSUING STATE OR ORGANIZATION APPLICATION			RECEIVING STATE OR APPROVED RECEIVING ORGANIZATION APPLICATION		
Data Group	Short EF identifier	Tag	Data Group	Short EF identifier	Tag
DG1	1	61	DG16	1	71
DG2	2	75	DG17	2	72
DG3	3	63	DG18	3	73
DG4	4	76			
DG5	5	65			
DG6	6	66			
DG7	7	67			
DG8	8	68			
DG9	9	69			
DG10	10	6A			
DG11	11	6B			
DG12	12	6C			
DG13	13	6D			
DG14	14	*6E*			
DG15	15	B5			
DG16	16	70			

Each Data Group consists of a series of data objects within a template. Each Data Group shall be stored in a separate Elementary File (EF). Individual data objects from the Data Group can be retrieved directly.

The files contain the Data Elements as data objects within specific records. The structure and coding of data objects are defined in ISO/IEC 7816-4 and 7816-6. Each data object has an identification Tag that is specified in hexadecimal coding (for example, '5A'). The tags defined in this Annex use the coexistent coding option. Each data object has a unique Tag, a length and a value. The data objects that may be present in a file are identified as mandatory (M) or optional (O). The definitions contain the specific reference to the Data Element number defined in section 13. Whenever possible inter-industry Tags are used. Note that the specific definition and format of some Tags have been changed to make them relevant for the MRTD application. As examples,

Tag 5A is defined as Document Number rather than Primary Account Number and has the format F9N rather than V19N.

Tag 5F20, Cardholder name, has been redefined as "Name of holder" with length of up to 39 characters, encoded per ICAO 9303 format.

Tag 66 is defined as the Displayed Finger(s) template rather than Card Data template.

As needed additional Tags have been defined within the 5F01 through 5F8F range.

C.12 Command Set [28]- The minimum set of commands to be supported by the MRTD are as follows:

[28] This section defines the absolute minimum command set needed for interoperability. In practice issuers will also

- SELECT FILE by DF name (full name) to select the application

- READ RECORD by short EF identifier with a specified record number or with a specified record identifier

In addition, if the IC(s) is capable, the GET DATA command may be used to retrieve a specific data object Tag.

These commands, formats, and their return codes are defined in ISO/IEC 7816-4. Please refer to normative appendix 1 to this Annex for examples of use of these commands.

C.13 Issuer application**, AID = 'A0 00 xx xx xx 01 01' -** The issuer application consists of two mandatory Data Groups and fourteen optional Data Groups. The information common to the Data Groups is stored in the application template '61'. This template is stored in the first record of file EF.COM.

EF.COM – common data elements (short file ID = 30)

Application Template Tag '60' – application level information

Note: this template currently only contains the tag list '5C.' The template structure has been defined to support future developments, such as dynamic signatures and Biometric Information Templates(BITs) .

Tag	L	Value
'5F01'	04	LDS Version number with format aabb, where aa defines the revison level and bb defines the release level
'5F36'	'06	Unicode Version number with format aabbcc, where aa defiens the Major version, bb defines the Minor version and cc defines the release level
'5C'	X	Tag list. List of all Data Groups present.

The following example indicates that an implementation of LDS Version 1.0 using Unicode Version 3.2.0 having Data Groups 1 (tag '61'), 2 (tag '75'), 4 (tag '76'), and 12 (tag '6C') present.

For this and all other examples, the Tags are printed in RED, the Lengths printed in blue, and the Values are printed in black. Hexadecimal tags, lengths and values are in quote marks ('xx').

'60''06'
'5F01''04'0100
'5F36''06'030200
'5C' '04''6175766C'

C.13.1 **EF.DG1 Machine Readable Zone Information Tag = '61'**
This EF contains the mandatory Machine Readable Zone (MRZ) information for the document in template '61.' The template contains two data objects, the MRZ in data object '5F1F' and a digital signature in data object 'B5.' The MRZ data object is a composite data element, essentially identical to the OCR-B MRZ information printed on the document. The only differences are

- The use of variable length fields for 'Name" and 'Optional Data.'

need to select integrated circuits that support the commands listed in ISO 7816-4, Table 11 - Sectuion 5.4.2.

- Lengths are only used for two data elements – 'Name of holder' and 'Optional data.' A length of '0' preceding "Optional data' indicates the data element it not present. All other fields are fixed length, '<' filled. Refer to ICAO 9303 for additional details.
- A digital signature in appended as a separate data element

Machine Readable Zone template Tag '61'

Tag	L	Value		
'5F1F'	X	The MRZ data object as a composite data element. (Mandatory) (The data element contains all 13 primitive fields from Document Type through Composite – check digit.)		
'B5'	X	Authenticity/Integrity Code for the MRZ data object value. (Optional)		
		Tag	**L**	**Value**
		'80'	01	Algorithm Identifier
		'83'	03	Key identifier
		'90'	X	Enciphered Hash of value field of data object '5F1F'

The MRZ data element is structured as follows: Note, tags are not used within this composite data element. They are included for reference only. They can be used once the data object has been parsed into individual data elements.

Field	Content	Mandatory /Optional	Format	Example	Tag (Information only)
1	Document type	M	F 2A	I<	5F03
2	Issuing State or Organization	M	F 3A	ATA	5F28
3	Name of holder[29]	M	V 39ANS	Smith<<John<T	5F20
4	Document number	M	F 9N[30]	123456789	5A
5	Check digit –document number	M	F 1NS	1 or <	5F04
6	Nationality	M	F 3A	HMD	5F2C
7	Date of birth	M	F 6N	740622 (yymmdd)	5F82
8	Check digit – Date of birth	M	F 1N	2	5F05
9	Sex	M	F 1A	F, M, or U	5F35
10	Date of Expiry or valid Until Date	M	F 6N	101231 (yymmdd)	59
11	Check digit – Date of Expiry	M	F 1N	3	5F06

[29] Refer to ICAO 9303 for truncation rules for names longer than 39 characters

[30] If the document number length exceed 9 characters, a '<' character is placed in the following check digit field (Field 5) and the remaining document number digits are placed in the optional data field, immediately followed by the document number check digit. In the above example the total document number length is 12 (value = 123456789012) with check digit = 1.

12	Optional data	O	V nn[31]ANS	0121	53
13	Check digit – Optional data (ID-3 documents only)	M	F 1N	5	5F02
14	Check digit – Composite	M	F 1N	4	5F07

An example of the MRZ template using this information is shown below. The length of the MRZ data element is 53 bytes (‘35’).

’61’ ’74’ ’5F1F’ ’35’ 1<ATA’0D’SMITH<<JOHN<T123456789<HMD7406222M1012313‘04’01214
’B5’ ’32’ ’80’ ’01’3 ’83’ ’03’ 003 ’90’ ’28’ ‘bbbbb..40bytes..bbb’

EF.DG2 - EF.DG5 (one EF for each DG) Biometric Templates Tags = ‘’75’’63’’76’

The biometric template is based on the Common Biometric Exchange File Format (CBEFF), NISTR 6529a. The biometric sub-header defines the type of biometric that is present and the specific biometric feature.

Each template has the following structure. Note, all data elements, except the Authenticity/Integrity code ‘B5’ are mandatory.

Tag	**L**	**Value**		
‘02’	1	Integer - Number of instances of this type of biometric (Mandatory in first template. Not used in succeeding templates.)		
’Ax’	X	Biometric Header Template (BHT) - as specified in this standard and NISTIR 6529-A. The ‘x’ within the Ax tag is indexed for each occurrence from ‘A0’ through tag ‘BF’ allowing for 32 occurrences of the same type of biometric data.		
		Tag	**L**	**Value**
		‘8A’	’02’	Security and Integrity options. ’00 00’ = not protected, ’20 01’ = signed.
		‘80’	‘02’	ICAO header version ’01 00’ (Version 1.0)
		‘81’	‘01’	Biometric type
		‘82’	’01’	Biometric feature
		‘83’	’07’	Creation date and time
		‘84’	‘08’	Validity period (from through)
		‘86’	‘02’	Creator of the biometric reference data (PID)
		‘87’	‘02’	Format owner
		‘88’	‘02’	Format type
‘5F2E’ or ‘7F2E’	x	Biometric data (encoded according to Format Owner) also called the biometric data block (BDB). Note: this data is normally stored in the clear in ‘5F2E’, but it may be enciphered and stored in template ‘7F2E’ The format of template ‘7F2E’ is shown in Appendix 2 of this Annex.		
‘B5’	X	Authenticity/Integrity code for biometric header and data		
		Tag	**L**	**Value**
		'80'	01	Algorithm Identifier
		'83'	03	Key identifier
		‘90’	X	Digital signature of value fields of ‘Ax’ and either ‘5F2E’ or ‘7F2E’

Example,

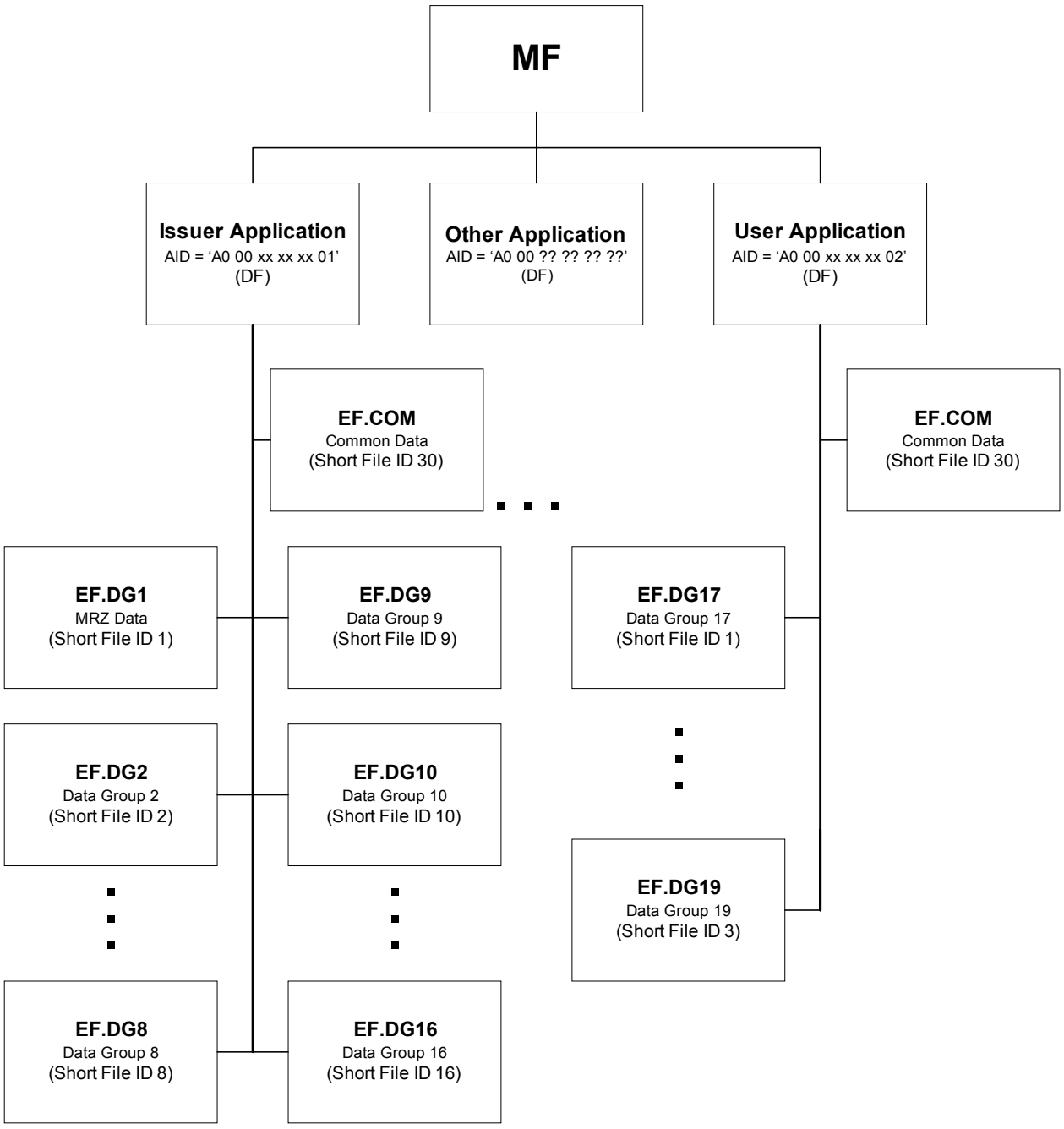
[31] For ID-1 documents nn = 26, for ID-2 documents nn= 7, for passports (ID-3) nn = 14

One signed, right index finger template with the biometric data length of 568 bytes (‘0234’ bytes), encoded using a device with a PID of ’00 01’, using format type ’00 04’ owned by template provider ’00 0A’ was captured on 15 March 2002 (no UTC offset) and is valid from 1 April 2002 through 31 March 2007. ICAO patron template Version 1.0 is being used..

The total length of the template is 678 bytes (‘02A6’). The template is stored in the first record of EF.DG3 (SFID 03).

‘63’’8202A6’
‘02’’01’1
‘A1’30’
‘8A’’02’’2001’
‘80’02’’0100’
‘81’’03’’000008’
‘82’’01’’02’
‘83’’08’’2002031513300000’
‘84’’08’’2002040120070331’
‘86’’02’’0101’
‘87’’02’’000A’
‘88’’02’’0004’
‘5F2E’’820238’’… 568 bytes of biometric data …’
‘B5’’32’
‘80’’01’’03’
‘81’’03’’003’
‘90’’28’’…40 bytes of digital signature….’

Figure X1 – IC Card File Structure



11.2 EF.DG6 - EF.DG8 (one EF for each DG) Displayed Image Template Tags = ’65’ Displayed Portraits
‘66’ Displayed Finger image(s)
‘67’ Displayed Signature or Usual Mark

Tag	L	Value		
‘02’	1	Integer – Number of instances of this type of displayed image (Mandatory in first template. Not used in succeeding templates.)		
‘5F40’ ’5F09’ or ‘5F43’	x	Displayed portrait Displayed finger(s) Displayed signature or mark		
‘B5’	X	Authenticity/Integrity code for displayed image data		
		Tag	**L**	**Value**
		'80'	01	Algorithm Identifier
		'83'	03	Key identifier
		‘90’	X	Digital signature of value field of displayed data

Example, image template with the displayed image data length of 2000 bytes. The length of the template is 2160 bytes (‘080C’).

‘66’’82080C’
’02’’01’1
’5F40’ ’8207D0’ ‘….2000 bytes of image data …’
‘B5’ ’ 32’
’80’ ’01’ 1
’83’ ’03’ 003
’90’ ’28’ ’… 40 bytes for the digital signature …’

The following Format Owners are recognized for the specified type of displayed image.

Displayed Image	Format Owner
Displayed Facial Image	ISO 10918, JFIF option
Displayed Finger	ANSI/NIST-ITL 1-2000
Displayed Signature/ usual mark	ISO 10918, JFIF option

11.3 EF.DG9-EF.DG11 Machine Assisted Security Features, Tags ’68’’69’’6A’

These three data groups remain to be defined. Until then, they are available for temporary proprietary usage. These data elements could use a structure similar to that for biometric templates.

Tag	L	Value
‘02’	1	Integer - Number of instances of this type of template (Mandatory in first template. Not used in succeeding templates.)
	x	Header Template. Details to be defined.

11.4 EF. DG12 Additional Personal Details, Tag = 6B

This data group is used for additional details about the document holder. Since all of the data elements within this group are optional, a Tag list is used to define those present. Note, this template may contain non-Latin characters.

Tag	L	Value
‘5C’	X	Tag list with list of data elements in the template.
‘5F0E’	X	Full name of document holder in national characters. Encoded per ICAO 9303 rules
’A0’	‘01’	Content specific constructed data object of names
‘02’	01	Number of other names
‘5F0F’	X	Other name formatted per ICAO 9303. The data object repeats as many times as specified in the ’02’ element.
‘5F10’	X	Personal number
‘5F2B’	08	Full date of birth yyyymmdd
‘5F11’	X	Place of Birth. Fields separated by ‘<’
‘5F42’	X	Permanent Address. Fields separated by ‘<’
‘5F12’	X	Telephone
‘5F13’	X	Profession
‘5F14’	X	Title
‘5F15’	X	Personal summary
‘5F16’	X	Proof of citizenship. Compressed image per ISO/IEC 10918
‘5F17’	X	Other valid TD numbers. Separated by ‘<’
‘5F18’	X	Custody information
‘B5’	X	Authenticity/Integrity Code for the data

		Tag	L	Value
		'80'	01	Algorithm Identifier
		'83'	03	Key identifier
		‘90’	X	Digital signature of value fields present in the template

The following example shows the following personal details: Full name (John J Smith), Personal Number (8), Place of Birth (Anytown, MN), Permanent Address (123 Maple Rd, Anytown, MN) and Profession (Travel Agent). The length of the template is 140 bytes (‘8C’).

‘6C’ ’818C’
‘5C’ ’0B’ ’5F0E’ 5F10’ ’5F11’ ’5F42’ ’5F13’ ’B5’

‘5F0E’ ‘0C’ SMITH<<JOHN<J
’5F10’ ’02’ 08
’5F11’ ’0A’ ANYTOWN<MN
’5F42’ ’17’ 123 MAPLE RD<ANYTOWN<MN
’5F13’ ’0C’ TRAVEL<AGENT
‘B5’ ’32’
’80’ ’01’ ’01’
’83’ ’03’ ’003’
’90’ ’28’ ’… 40 bytes for the digital signature …’

11.5 EF.DG13 Additional Document Details, Tag = 6C

This data group is used for additional information about the document. All data elements within this group are optional.

Tag	L	Value
'5C'	X	Tag list with list of data elements in the template.
'5F19'	X	Issuing Authority
'5F26'	X	Date of Issue. Yyyymmdd
'A0'	'01'	Context specific constructed data object of other people
'02'	'01'	Number of other people
'5F1A'	X	Name of other person formatted per ICAO 9303 rules
'5F1B'	X	Endorsements, Observations
'5F1C'	X	Tax / Exit Requirements
'5F1D'	X	Image of front of document. Image per ISO/IEC 10918
'5F1E'	X	Image of rear of document. Image per ISO/IEC 10918
'5F85'	X	Date and time of document personalization yyyymmddhhmmss
'5F86'	X	Serial number of personalization system
'B5'	X	Authenticity/Integrity Code for the data

		Tag	L	Value
		'80'	01	Algorithm Identifier
		'83'	03	Key identifier
		'90'	X	Digital signature of value fields present in the template

The following example contains the Issuing Authority (United States of America), the Data of Issue (May 31, 2002), one other person included on the document (Brenda P Smith), and an Authenticity/Integrity Code. The length of the template is 115 bytes ('73').

'6D' '73'
'5C' '07' '5F19' '5F26' '5F1A' 'B5'
'5F19' '18' UNITED STATES OF AMERICA
'5F26' '08' 20020531
'5F1A' '0F' SMITH<<BRENDA<P
'B5' '32'
'80' '01' 1
'83' '03' 003
'90' '28' '… 40 bytes for the digital signature …

11.6 EF.DG16 Person(s) to Notify, Tag '70'

This data group lists emergency notification information. It is encoded as a series of templates using the tag ‘Ax’ designation. The data is not signed, allowing for updating by the document holder.

Tag	L	Value
‘02’	01	Number of templates (occurs only in first template)
‘Ax’	X	Start of template, where x increments for each occurrence
‘5F50’	X	Date data recorded
‘5F51’	X	Name of person
‘5F52’	X	Telephone
‘5F53’	X	Address

Example with two entries: Charles R Smith of Anytown, MN and Mary J Brown of Ocean Breeze, CA. The length of the template is 162 bytes (‘A2’).

‘70’ ’81A2’

‘02’ ’01’ 2
‘A1”4C’
’5F50’ ’08’ 20020101
’5F51’ ’10’ SMITH<<CHARLES<R
’5F52’ ’0B’ 19525551212
’5F53’ ’1D’ 123 MAPLE RD<ANYTOWN<MN<55100
‘A2’’4F’
’5F50’ ’08’ 20020315
’5F51’ ’0D’ BROWN<<MARY<J
’5F52’ ’0B’ 14155551212
’5F53’ ’23’ 49 REDWOOD LN<OCEAN BREEZE<CA<94000

12. Receiving state application, AID = ‘A0 00 xx xx xx 0201’

The common data will be stored in a template in EF.COM. The record will contain at a minimum the tag list (‘5C’) of the tags for the Data Groups that are present.

.

The format and contents of the templates are to be defined.

Name	Mandatory/ Optional	Description	Tag
Tag List	M	List of the types of data objects present	5C
Border Crossing	O	Information about automated border crossing programs	71
Electronic Visa	O	Information about electronic visas	72
Travel Records	O	Travel record details	73

12.1 Electronic Visas

The format and contents of the templates are to be defined.

12.2 Border Clearance

The format and contents of the templates are to be defined.

12.3 Travel Records

The format and contents of the templates are to be defined.

The following is a suggested listing of the contents of the template with tag ‘73.’

Tag	L	Value
‘74’	X	Travel record template
‘5F84’	X	Record number
‘5F4B’	X	Entry (0) / Exit (1) indicator
‘5F44’	X	Country of entry/exit
‘5F45’	X	Date of entry/exit
‘5F46’	X	Port of entry/exit
‘5F47’	X	Entry or Exit
‘5F48’	X	Length of stay

‘5F49’	X	Category
‘5F4A’	X	Inspector
‘5F4x’	X	Others?
‘B5’	X	Authenticity/Integrity code

Intended usage: The Travel Record Data Group will be declared as “Write Once.” It can be accessed using Tag ‘73’ of SF 03 of the User Application. The first record and then subsequent records can be read to review contents, or the last record can be read and then preceding records read. To add a record, the record number of the last record is used to create the record number for the new record by incrementing the record number by one. The new record would be added with the incremented record number.

13. Tags used

13.1 Normative tags used in the LDS

Tag	Definition	Where Used
02	Integer	Biometric and display templates
5C	Tag list	EF.COM and Numerous other
5F01	LDS Version Number	EF.COM
5F09	Compressed image (ANSI/NIST-ITL 1-2000)	Displayed Finger
5F0A	Security features – Encoded Data	Security features (details TBD)
5F0B	Security features – Structure	Security features (details TBD)
5F0C	Security features	Security features (details TBD)
5F0E	Full name, in national characters	Additional personal details
5F0F	Other names	Additional personal details
5F10	Personal Number	Additional personal details
5F11	Place of birth	Additional personal details
5F12	Telephone	Additional personal details
5F13	Profession	Additional personal details
5F14	Title	Additional personal details
5F15	Personal Summary	Additional personal details
5F16	Proof of citizenship (10918 image)	Additional personal details
5F17	Other valid TD Numbers	Additional personal details
5F18	Custody information	Additional personal details
5F19	Issuing Authority	Additional document details
5F1A	Other people on document	Additional document details
5F1B	Endorsements/Observations	Additional document details
5F1C	Tax/Exit requirements	Additional document details
5F1D	Image of document front	Additional document details
5F1E	Image of document rear	Additional document details
5F1F	MRZ data elements	MRZ data objects
5F26	Date of Issue	Additional document details
5F2E	Biometric data block	Biometric data
5F36	Unicode Version Level	EF.COM
5F40	Compressed image template	Displayed portrait
5F42	Address	Additional personal details
5F43	Compressed image template	Displayed Signature or Mark
5F50	Date data recorded	Person to Notify
5F51	Name of person	Name of Person to
5F52	Telephone	Telephone number of Person to Notify 5F53 Address Address of Person to Notify
5F82	Date of birth (Truncated)	MRZ

5F84	Record number of Travel Record Entry	Travel Records
5F85	Time and Date document personalized	Other document details
5F86	Serial Number of personalization system	Other document details
60	Common data elements	EF.COM
61	Template for MRZ data group	
63	Template for Finger biometric data group	
65	Template for digitized facial image	
66	Template for digitized finger image(s)	
67	Template for digitized Signature or usual mark	
68	Template for Machine Assisted Security – Encoded Data	
69	Template for Machine Assisted Security - Structure	
6A	Template for Machine Assisted Security – Substance	
6B	Template for Additional Personal Details	
6C	Template for Additional Document Details	
6D	Optional details	
6E	Reserved for future use	
70	Person to Notify	
71		
75	Template for Facial biometric data group	
76	Template for Iris (eye) biometric template	
8x	Context specific tags	CBEFF, Authenticity/Integrity code
90	Enciphered hash code	Authenticity/Integrity code
A0	Context specific constructed data objects	Additional personal details Additional document details
Ax	Repeating template, where x defines occurrence	Biometric header,
B5	Authenticity/Integrity Code Numerous	

13.2 Tags useful for intermediate processing (informative)

Tag	Definition	Where Used
53	Optional Data	Part of MRZ
59	Date of expiry or valid Until Date	Part of MRZ
5A	Document Number	Part of MRZ
5F02	Check digit – Optional data (ID-3 only)	Part of MRZ
5F03	Document Type	Part of MRZ
5F04	Check digit – Doc Number	Part of MRZ
5F05	Check digit - DOB	Part of MRZ
5F06	Check digit – Expiry date	Part of MRZ
5F07	Check digit – Composite	Part of MRZ

5F20	Name of document holder	Part of MRZ
5F28	Issuing State or Organization	Part of MRZ
5F2B	Date of birth	Part of MRZ
5F2C	Nationality	Part of MRZ
5F35	Sex	Part of MRZ

13.3 Tags reserved for future use (normative)

Tag	Definition	Where Used
5F44	Country of entry/exit	Travel records
5F45	Date of entry/exit	Travel records
5F46	Port of entry/exit	Travel records
5F47	Entry/Exit indicator	Travel records
5F48	Length of stay	Travel records
5F49	Category (classification)	Travel records
5F4A	Inspector reference	Travel records
5F4B	Entry / Exit indicator	Travel records
71	Template for Electronic Visas	
72	Template for Border Crossing Schemes	
73	Template for Travel Record Data Group	

Appendix 1 of Annex C (Normative)

The use of the record number is to obtain a specific data record, usually the first record that contains the common data. The use of the record identifier is to obtain an instance of a multiply occurring data object. The data object tag is used as the record identifier. Each instance of the data object has the same tag, but the record pointer (defined in ISO/IEC 7816-4) is different for each instance.

The normal sequence of processing is:

1. Select the issuer application

2. Read the common data for the application using short file ID 30

3. Determine which Data Groups are present

4. Access the MRZ data

a. Read record number one from Short file ID 1, or

b. Select EF.DG1 and use GET DATA to for MRZ data object

5. Access other Data Group as needed

a. Select the EF based on short file ID

b. Read record number one for the Data Group or Get Data for the common data template (e.g., number of templates)

c. Determine any other data objects needed from the EF

d. Read record using the record identifier to obtain the repeating data object or use GET DATA to obtain the data object

*e. Read the next record with the identifier (until there are no more records)or use GET DATA to obtain the next data object_*

6. Access another Data Group as needed

Example of application selection for the issuer application

The issuer application shall be selected by use of the following parameters for the APDU.

CLA	*'00'*
INS	*'A4'*
P1	*'04' – (select by DF name – the AID)*
P2	*'00'*
L_c	*'06' – (length of AID)*
Data field	*'A0 00 xx xx xx 01' – (the issuer AID)*
L_e	*'00' – return the application label if present*

The response data field contains the application label. The label shall be 'MRTD''

Example of reading a record from a file using a record number

The READ command can be used to access a specific record number. This example reads record number one from the issuer file that is known by the short file identifier '01.' The APDU parameters for this action are shown below.

CLA	*'00'*
INS	*'B2'*
P1	*'01' - specifies record number one*
P2	*'0C' - read by record number from SFI '01'*

L_c	*Empty*
Data field	*Empty*
L_e	*0 - specifies to read the entire record*

The response data field contains the record.

Example of reading a record from a file using a record identifier

The READ command can be used to access a record using a record identifier. This example reads the next record from the issuer file that is known by the short file identifier '01.' The record identifier is the template tag '61' in the first byte of the record. The APDU parameters for this action are shown below.

CLA	*'00'*
INS	*'B2'*
P1	*'61' - specifies the record identifier*
P2	*'0A' - read by record number from SFI '01'*
L_c	*Empty*
Data field	*Empty*
L_e	*0 - specifies to read the entire record*

The response data field contains the record.

Example of a reading an individual data object using "Get Data" command

The GETDATA command can be used to access a specific data object. This example gets the data object with tag '5C' from the current DF. (This data object contains the list of data groups present in the application.) The APDU parameters for this action are shown below.

CLA	*'00'*
INS	*'CA'*
P1	*'00' - indicates a simple-BER-TLV tag*
P2	*'5C' - data object tag'*
L_c	*Empty*
Data field	*Empty*
L_e	*0 - specifies to read the entire data object*

The response data field contains the data object

Appendix 2 of Annex C (Normative)

The use of encrypted biometric data is rare, but may be needed for special circumstances where the issuing state does not wish to allow every receiving state to use the data. For example, an uncovered facial image of a religious sect may not be allowed to be read by anyone, but some receiving states may be able to use the data. In this event the enciphered biometric data block (BDB) is stored in template '7F2E' together with the information required to decrypt the BDB.

The structure of the template is shown below. The BDB is enciphered using the algorithm and the key reference specified in the template. The algorithm is usually a public key algorithm such as RSA or ECC. The key reference identifies which one of possibly several keys provided by the issuer is to be used. Using the specified key, the BDB is decrypted before it is used.

The encrypted data is then used to verify the person's identity.

Tag	**L**	**Value**		
'7F2E'	X	Encrypted biometric data		
		Tag	**L**	**Value**
		'80'	01	Algorithm Identifier
		'83'	01	Key identifier
		'5F2E'	X	Enciphered BDB

Appendix 3 to Annex C (Normative)

This appendix defines the minimum requirements for interoperability of proximity[32] (ISO/IEC 14443) contactless IC based MRTDs.

- ISO/IEC 14443 Parts 1-4 and ISO/IEC 10373-6 compliant also considering amendments to both standard series.
- Type A or Type B signal interface[33]
- Support for a file structure as defined by ISO/IEC 7816-4 for variable length records
- Support for one or more applications and appropriate commands as defined by ISO/IEC 7816-4,5.

[32] The use of vicinity cards, ISO/IEC 15693, may be considered in the future
[33] Note, this implies that readers (Proximity Coupling Devices) shall be capable of reading Type A and B.

Appendix 3 to Annex C (Informative)

Example of sequence of operation

- Document enters operating field of Proximity Coupling Device (PCD)
- IC responds to Request for Command-Type A (REQA) or Request for Command-Type B (REQB) with Answer to Request-Type A (ATQA) or Answer to Request-Type B (ATQB) as appropriate.
- The PCD shall detect and resolve any collision that may occur if multiple documents are within the operating field.
  - ICAO AFI = *tbd*
- Compliance with 7816 commands shall be indicated by
  - Type A: SAK (Select Acknowledge) bit 6 = 1, bit 3 = 0
  - Type B: Protocol_Type = "0001"
- The ICAO MRTD Application shall be selected using the following sequence

  Example of application selection for the issuer application
  The issuer application shall be selected by use of the following parameters for the APDU.

CLA	*'00'*
INS	*'A4'*
P1	*'04' – (select by DF name – the AID)*
P2	*'00'*
L_c	*'06' – (length of AID)*
Data field	*'A0 00 xx xx xx 01' – (the issuer AID)*
L_e	*'00' – return the application label if present*

  The response data field contains the application label. The label shall be 'MRTD''
- The common data file EF.COM (Short File ID = 30) containing Application Identifier, Version levels and tag list will be read using the Read Record command

CLA	'00'
INS	'B2'
P1	'1E' - specifies record number thirty
P2	'0C' - read by record number from SFI '1E'
L_c	Empty
Data field	Empty
L_e	0 - specifies to read the entire record

- The tag list in EF.COM will list the Data Groups (Elementary Files) encoded within this document.

- The Machine Readable Zone (MRZ) is read using the Short File designator, '01' or record identifier '61.'

Example using short file designator

CLA	'00'
INS	'B2'
P1	'01' - specifies record number one
P2	'0C' - read by record number from SFI '01'
L_c	Empty
Data field	Empty
L_e	0 - specifies to read the entire record

Example using record identifier

CLA	'00'
INS	'B2'
P1	'61' - specifies the record identifier
P2	'0A' - read next record by record identifier from SFI '01'
L_c	Empty
Data field	Empty
L_e	0 - specifies to read the entire record

- Other Data Groups are read as needed

- If the IC supports "Get Data," this command can be used to retrieve a specific data object.

  This example gets the data object with tag '5C' from the current DF. (This data object contains the list of data groups present in the application.) The APDU parameters for this action are shown below.

CLA	'00'
INS	'CA'
P1	'00' - indicates a simple-BER-TLV tag
P2	'5C' - data object tag'
L_c	Empty
Data field	Empty
L_e	0 - specifies to read the entire data object

The response data field contains the data object