

**EUROCONTROL  
Specification for Surveillance  
Data Exchange - Part 1  
All Purpose Structured  
EUROCONTROL Surveillance  
Information Exchange  
(ASTERIX)**

**DOCUMENT IDENTIFIER : EUROCONTROL-SPEC-0149**

<b>Edition Number</b>	:	<b>2.2</b>
<b>Edition Date</b>	:	<b>17/10/2014</b>
<b>Status</b>	:	<b>Released Issue</b>
<b>Intended for</b>	:	<b>General Public</b>
<b>Category</b>	:	<b>EUROCONTROL Specification</b>



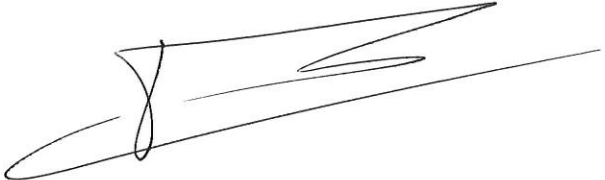

## DOCUMENT CHARACTERISTICS

TITLE		
<b>EUROCONTROL Specification for Surveillance Data Exchange - Part 1 All Purpose Structured EUROCONTROL Surveillance Information Exchange (ASTERIX)</b>		
<b>Publications Reference:</b>		SPEC-0149
<b>ISBN Number:</b>		978-2-87497-028-3
<b>Document Identifier</b>	<b>Edition Number:</b>	2.2
EUROCONTROL-SPEC-0149	<b>Edition Date:</b>	17/10/2014
Abstract		
This document presents the general structure of the ASTERIX format.		
Keywords		
Data Exchange	Messages	SAC
Data Category	Data Field	Data Block
ASTERIX	UAP	SIC
		Data Item
<b>Contact Person(s)</b>	<b>Tel</b>	<b>Unit</b>
Alexander Engel	+32-2-729 3355	DPS/STAN

STATUS, AUDIENCE AND ACCESSIBILITY					
Status		Intended for		Accessible via	
Working Draft	<input type="checkbox"/>	General Public	<input checked="" type="checkbox"/>	Intranet	<input type="checkbox"/>
Draft	<input type="checkbox"/>	EUROCONTROL	<input type="checkbox"/>	Extranet	<input type="checkbox"/>
Proposed Issue	<input type="checkbox"/>	Restricted	<input type="checkbox"/>	Internet (www.eurocontrol.int)	<input checked="" type="checkbox"/>
Released Issue	<input checked="" type="checkbox"/>				

## DOCUMENT APPROVAL

The following table identifies all management authorities who have successively approved the present issue of this document.

AUTHORITY	NAME AND SIGNATURE	DATE
DPS/STAN Editor	 Mr. Alexander ENGEL	21/10/2014
DPS/STAN Head of Unit	 Mr. Peter GREEN	27/10/2014
Director Pan-European Single Sky (DPS)	 Mr. Luc TYTGAT	10/11/2014
Director General EUROCONTROL	 Mr. Frank BRENNER	17/11/14



## DOCUMENT CHANGE RECORD

The following table records the complete history of the successive editions of the present document.

EDITION NUMBER	EDITION DATE	REASON FOR CHANGE	PAGES AFFECTED
Released Ed 1.0	November 1997	Adoption by the EUROCONTROL Permanent Commission	
Working Draft Ed 1.1	August 1998	Suppress RFS, units, add migration policy and compound data item structure.	

EDITION NUMBER	EDITION DATE	REASON FOR CHANGE	PAGES AFFECTED
Draft Ed 1.2	October 1998	<ul style="list-style-type: none"> <li>• Where applicable the term Radar replaced by Surveillance</li> <li>• Introduction amended (1)</li> <li>• X.121 reference suppressed. (2)</li> <li>• Documents referenced in paragraph 2.2 updated (2.2)</li> <li>• Definitions, acronyms and abbreviations updated.(3)</li> <li>• Characteristics of the data suppressed.(4)</li> <li>• Data item symbolic reference changed.(4)</li> <li>• UAP unique per Category as a rule.(4)</li> <li>• Source Identification must be present in every record.(4)</li> <li>• Explicit Length data fields suppressed.(4)</li> <li>• Conventions updated to be more general.(5)</li> <li>• Annex A redesigned and changed to informative. (A)</li> <li>• Annex B replaced by list of SACs affected to USA, Canada &amp; Mexico. (B)</li> <li>• Annex C suppressed. (C)</li> </ul>	ALL
Draft Ed 1.21	January 1999	<ul style="list-style-type: none"> <li>• 1.1 reworded</li> <li>• Explicit Length data fields re-introduced. (4)</li> <li>• Reserved Expansion field added. (4)</li> <li>• Migration Policy reworded. (7)</li> </ul>	ALL
Draft Ed 1.22	March 1999	<ul style="list-style-type: none"> <li>• Editorial corrections</li> </ul>	ALL

EDITION NUMBER	EDITION DATE	REASON FOR CHANGE	PAGES AFFECTED
Proposed Ed 1.24	September 1999	<ul style="list-style-type: none"> <li>• Editorial corrections</li> </ul>	ALL
Proposed Ed 1.26	November 2000	<ul style="list-style-type: none"> <li>• SAC added for UK and for Ukraine</li> <li>• Annex A updated</li> </ul>	6.4 A
Working Draft Ed 1.27	November 2001	<ul style="list-style-type: none"> <li>• Editorial correction</li> <li>• List of SAC removed</li> <li>• Annex A updated</li> <li>• Annex B removed</li> </ul>	4.1.1.5 6.4.1 A B
Working Draft Ed 1.28	December 2001	<ul style="list-style-type: none"> <li>• Editorial corrections</li> <li>• Annex A removed</li> </ul>	A
Working Draft Ed 1.29	February 2002	<ul style="list-style-type: none"> <li>• Note on Reserved Expansion field added</li> <li>• Editorial corrections</li> </ul>	4.2.6.4 4.2.7.4
Released Issue Ed 1.30	November 2007	<ul style="list-style-type: none"> <li>• Document ID-sheet updated</li> <li>• Signature Page updated</li> <li>• Status: Released Issue</li> </ul>	
Draft Specification Ed 2.00	October 2012	<ul style="list-style-type: none"> <li>• Transposition into an EUROCONTROL Specification. Successor of EUROCONTROL Standard SUR.ET1.ST05.2000-STD-01-01</li> <li>• Introduction of the traceability to the relevant provisions of the Commission Implementing Regulation (EU) No 1207/2011</li> </ul>	All  Annex A
Ed 2.1	April 2013	<ul style="list-style-type: none"> <li>• Chapter 7.2.3 updated</li> </ul>	7.2.3

EDITION NUMBER	EDITION DATE	REASON FOR CHANGE	PAGES AFFECTED
Ed 2.2	October 2014	<ul style="list-style-type: none"><li>• New Record Structure</li></ul>	3.1.2 4.2.1.5 4.3.2 4.3.3 4.3.6 7.2.3.2 Annex B

**Publications**

EUROCONTROL Headquarters  
96 Rue de la Fusée  
B-1130 BRUSSELS

Tel: +32 (0)2 729 4715  
Fax: +32 (0)2 729 5149  
E-mail: [publications@eurocontrol.int](mailto:publications@eurocontrol.int)

# CONTENTS

<b>DOCUMENT CHARACTERISTICS</b> .....	<b>2</b>
<b>DOCUMENT APPROVAL</b> .....	<b>3</b>
<b>DOCUMENT CHANGE RECORD</b> .....	<b>4</b>
<b>CONTENTS</b> .....	<b>8</b>
<b>LIST OF FIGURES</b> .....	<b>10</b>
<b>LIST OF TABLES</b> .....	<b>11</b>
<b>EXECUTIVE SUMMARY</b> .....	<b>12</b>
<b>1. INTRODUCTION</b> .....	<b>13</b>
1.1 General.....	13
1.2 Scope .....	14
<b>2. REFERENCES</b> .....	<b>15</b>
<b>3. DEFINITIONS, ACRONYMS AND ABBREVIATIONS</b> .....	<b>16</b>
3.1 Definitions.....	16
3.2 Acronyms and Abbreviations.....	17
<b>4. DESCRIPTION AND PRINCIPLES OF ASTERIX</b> .....	<b>18</b>
4.1 ASTERIX Management Procedures.....	18
4.1.1 Maintenance of ASTERIX Documentation.....	18
4.1.2 Endorsement of ASTERIX Documents.....	18
4.1.3 Publication of ASTERIX Documents .....	18
4.2 Organisation of the Data.....	19
4.2.1 Data Categories .....	19
4.2.2 Data Items and Catalogue of Data Items.....	21
4.2.3 Data Fields .....	21
4.2.4 User Application Profile .....	21
4.3 The General Message Structure.....	22
4.3.1 General.....	22
4.3.2 The Data Block.....	22
4.3.3 The Record.....	25
4.3.4 Standard Data Field Formats .....	25
4.3.5 Non-Standard Data Fields .....	28
4.3.6 Reserved Expansion Data Field.....	28
4.3.7 Field Organisation .....	29



<b>5. CONVENTIONS</b> .....	<b>32</b>
5.1 Bit Numbering.....	32
5.2 Binary Values.....	32
5.3 Time Management .....	32
<b>6. ASTERIX ADDRESSING SCHEME</b> .....	<b>33</b>
6.1 General.....	33
6.2 Syntax .....	33
6.3 Formats.....	33
6.3.1 System Area Code (SAC) .....	33
6.3.2 System Identification Code (SIC).....	33
6.4 Assignment of the Systems Identifiers.....	34
6.4.1 System Area Codes .....	34
6.4.2 System Identification Codes.....	34
<b>7. ASTERIX MIGRATION POLICY</b> .....	<b>35</b>
7.1 General.....	35
7.2 Description .....	35
7.2.1 Application Domain.....	35
7.2.2 Version Management.....	35
7.2.3 Modifications .....	37
<b>ANNEX A – Traceability between ASTERIX Specifications and Commission Implementing Regulation (EU) No 1207/2011 of 22/11/2011</b> .....	<b>38</b>
A.1 General.....	38
A.2 Compliance Matrix .....	39
<b>ANNEX B – ASTERIX Categories managed by the AMG</b> .....	<b>40</b>
<b>ANNEX C – ASTERIX Categories coordinated with the AMG</b> .....	<b>42</b>

## LIST OF FIGURES

<b>Figure 1 - Organisation of the Data.....</b>	<b>20</b>
<b>Figure 2 - Data Block Structure until Edition 2.1 .....</b>	<b>23</b>
<b>Figure 3 - ASTERIX Record Structure as of Edition 2.2 .....</b>	<b>24</b>
<b>Figure 4 - Standard Data Fields Types (except compound).....</b>	<b>26</b>
<b>Figure 5 - Compound Data Field Type.....</b>	<b>27</b>
<b>Figure 6 - Field Sequencing Organisation.....</b>	<b>30</b>
<b>Figure 7 - Overall Record Structure.....</b>	<b>31</b>

## LIST OF TABLES

<b>Table 1 - Compliance matrix.....</b>	<b>39</b>
<b>Table 2 - ASTERIX Categories managed by the AMG.....</b>	<b>41</b>
<b>Table 3 - ASTERIX Categories coordinated with the AMG.....</b>	<b>42</b>

## EXECUTIVE SUMMARY

This EUROCONTROL specification describes the basic rules and procedures to be applied when implementing the ASTERIX data format for the transmission of surveillance related information.

It provides information on the way ASTERIX data is organised, defines the structure of ASTERIX messages and specifies the format conventions to be respected when composing ASTERIX records.

Finally the ASTERIX addressing scheme is defined as well as the procedure to be followed in the evolution of ASTERIX Category definitions.

This EUROCONTROL specification is the successor of the EUROCONTROL Standard SUR.ET1.ST05.2000-STD-01-01.

# 1. INTRODUCTION

## 1.1 General

This EUROCONTROL Specification describes the message structure, known by the acronym **ASTERIX**, originally standing for “**All Purpose STructured EUROCONTROL Radar Information Exchange**”, devised by the Study Group on the exchange of surveillance related data between processors of ATC systems. This group was a subgroup of the former Radar Systems Specialist Panel (RSSP), whose responsibilities have been taken over by the Surveillance Team (SURT) as from April 1994. ASTERIX was approved by the former RSSP at their 15th Meeting held on 1/4 July 1986. The ASTERIX Specification is now under the responsibility of the ASTERIX Maintenance Group (AMG), a working arrangement under the EUROCONTROL SUR SG. The expansion of the application domains of ASTERIX beyond radar led to a modification of the significance of the acronym ASTERIX, now standing for “**All Purpose STructured EUROCONTROL SuRveillance Information Exchange**”.

Throughout this document the following conventions apply:

- Requirements using the operative verb "**shall**" must be implemented to achieve the minimum objectives of this specification.
- Requirements using the operative verb "**should**" are *recommended* to achieve the best possible implementation of this specification.
- Requirements using the operative verb "**may**" indicate *options*

## 1.2 Scope

- 1.2.1** ASTERIX is an application/presentation protocol responsible for data definition and data assembly developed to support the transmission and exchange of surveillance related data.
- Its purpose is to allow a meaningful transfer of information between two application entities using a mutually agreed representation of the data to be exchanged.
- 1.2.2** The ASTERIX Specification (consisting of this Part 1 as well as the category definitions) refers to the Presentation and Application layers (layers six and seven) as defined by the Open Systems Interconnection (OSI) Reference Model (International Standards Organization (ISO) Standard 7498) [[Ref. 1](#)].
- 1.2.3** The definition of the lower telecommunication support layers (layers one to five) is out of the scope of the ASTERIX Specification. Transmission of ASTERIX coded surveillance information can make use of any available communication medium, for instance a packet switched Wide Area Network (WAN) as well as a Local Area Network (LAN).
- 1.2.4** The lower telecommunication protocol levels will be agreed between the partners of the data exchange.
- 1.2.5** The ASTERIX Specification, as a Presentation protocol, defines the structure of the data to be exchanged over the communication medium, from the encoding of every bit of information up to the organisation of the data within an ASTERIX Record.
- 1.2.6** Considering that there is information common to all systems (for instance position, Mode-A Code and Mode-C Code information), ASTERIX specifies minimum requirements at the Application level, so as to ease the data exchange between heterogeneous applications. The communication between two different systems is thus made possible, based on a core of commonly used surveillance related data, transferred in the same way by the ASTERIX Presentation layer.
- 1.2.7** In order to achieve the intended level of interoperability the implementation of the individual ASTERIX categories **shall** be performed exactly like specified in the latest editions of the respective definitions as published on the EUROCONTROL ASTERIX website ([www.eurocontrol.int/asterix](http://www.eurocontrol.int/asterix)).
- 1.2.8** If two users need to exchange specific information beyond the contents of the latest available definition of a category, this information **shall** be encoded exclusively in the "Special Purpose Field" as defined in 4.2.5 below.
- 1.2.9** This edition of Part 1 does not apply to Categories 001, 002 and 008. The implementation of these categories **shall** follow the rules as described in the corresponding specifications.

## 2. REFERENCES

1. ISO/IEC 7498-1: 1994 [ITU-Rec.X.200 (1994)]  
Information Processing Systems - OSI Reference Model - The Basic Model
2. Commission Implementing Regulation (EU) No 1207/2011 of 22/11/2011 laying  
down requirements for the Performance and the Interoperability of Surveillance  
for the Single European Sky

## 3. DEFINITIONS, ACRONYMS AND ABBREVIATIONS

### 3.1 Definitions

For the purposes of this EUROCONTROL Specification, the following definitions shall apply:

- |       |                                  |   |
|-------|----------------------------------|---|
| 3.1.1 | <b>Catalogue of Data Items:</b>  | List of all the possible Data Items of each Data Category describing the Data Items by their reference, structure, size and units (where applicable).   |
| 3.1.2 | <b>Data Block:</b>               | Unit of information seen by the application as a discrete entity by its contents. A Data Block contains one or more Record(s) containing data of the same Category. This principle is used until and including edition 2.1 of Part 1. |
| 3.1.3 | <b>Data Category:</b>            | Classification of the data in order to permit inter-alia an easy identification.  |
| 3.1.4 | <b>Data Field:</b>               | Physical implementation for the purpose of communication of a Data Item, it is associated with a unique Field Reference Number and is the smallest unit of transmitted information.   |
| 3.1.5 | <b>Data Item:</b>                | The smallest unit of information in each Data Category.   |
| 3.1.6 | <b>Record:</b>                   | A collection of transmitted Data Fields of the same Category preceded by a Field Specification field, signalling the presence/absence of the various Data Fields  |
| 3.1.7 | <b>User Application Profile:</b> | The mechanism for assigning Data Items to Data Fields, and containing all necessary information which needs to be standardised for the successful encoding and decoding of the messages.  |



## 3.2 Acronyms and Abbreviations

For the purposes of this EUROCONTROL Specification the following shall apply:

<b>ASTERIX</b>	All Purpose STructured EUROCONTROL suRveillance Information EXchange
<b>AMG</b>	ASTERIX Maintenance Group
<b>ATC</b>	Air Traffic Control
<b>CAT</b>	Data Category
<b>CNS</b>	Communication, Navigation, Surveillance
<b>DCE</b>	Data Circuit-Terminating Equipment
<b>DTE</b>	Data Terminal Equipment
<b>FRN</b>	Field Reference Number
<b>FSPEC</b>	Field Specification
<b>FX</b>	Field Extension Indicator
<b>ICAO</b>	International Civil Aviation Organization
<b>ISO</b>	International Standards Organization
<b>LAN</b>	Local Area Network
<b>LEN</b>	Length Indicator
<b>LSB</b>	Least Significant Bit
<b>OSI</b>	Open Systems Interconnection
<b>RDE-TF</b>	Surveillance Data Exchange Task Force
<b>RE</b>	Reserved Expansion Indicator
<b>REP</b>	Field Repetition Indicator
<b>RSSP</b>	Radar Systems Specialist Panel
<b>SAC</b>	System Area Code
<b>SIC</b>	System Identification Code
<b>SP</b>	Special Purpose Indicator
<b>SUR SG</b>	Surveillance Steering-Group
<b>SURT</b>	Surveillance Team
<b>UAP</b>	User Application Profile (see Definitions)
<b>UTC</b>	Co-ordinated Universal Time
<b>WAN</b>	Wide Area Network

## 4. DESCRIPTION AND PRINCIPLES OF ASTERIX

### 4.1 ASTERIX Management Procedures

#### 4.1.1 Maintenance of ASTERIX Documentation

Maintenance of the existing ASTERIX documents is performed by the EUROCONTROL ASTERIX team in coordination with the ASTERIX Maintenance Group (AMG).

Maintenance requests (corrective or enhanceive) **shall** be submitted to EUROCONTROL's ASTERIX Manager ([asterix@eurocontrol.int](mailto:asterix@eurocontrol.int)).

The maintenance task will be performed using collaborative tools (e.g. OneSky Team, Webex, emails). As far as possible, AMG members will be asked to review and agree proposed modifications by correspondence.

Stakeholders wishing to participate in the AMG should send a request by email to EUROCONTROL's ASTERIX Manager ([asterix@eurocontrol.int](mailto:asterix@eurocontrol.int)). Initially the members of the AMG were/are the members of the former surveillance Data Exchange Task Force (RDE-TF).

#### 4.1.2 Endorsement of ASTERIX Documents

The endorsement of ASTERIX documentation is the responsibility of the AMG.

Proposed editions of ASTERIX documents **shall** be submitted by the EUROCONTROL ASTERIX Manager to the members of the AMG for review.

Following the review period the proposed edition of an ASTERIX document **shall** be updated by the ASTERIX Manager or the drafting group and the members of the AMG will be notified about the update.

#### 4.1.3 Publication of ASTERIX Documents

Once the ASTERIX document has been approved by the members of the AMG following the procedure outlined in 4.1.2 above, the new edition of the document **shall** be published on the EUROCONTROL ASTERIX website ([www.eurocontrol.int/asterix](http://www.eurocontrol.int/asterix)) for official use.

## 4.2 Organisation of the Data

The surveillance related data exchanged between the users **shall** be organised as shown in Figure 1.

### 4.2.1 Data Categories

**4.2.1.1** The data exchanged over the communication medium between the different users **shall** be classified into Data Categories.

**4.2.1.2** Those categories which define the type of data exchanged **shall** be standardised and be the same for all users of ASTERIX.

**4.2.1.3** The purpose of such a classification **shall** be to:

- allow easy identification and subsequent processing of the data;
- facilitate the dispatching of the data to the appropriate application task in the receiving unit;

**4.2.1.4** Up to 256 Data Categories can be defined and their usage **shall** be as follows:

- Data Categories 000 to 127 for standard civil and military applications;
- Data Categories 128 to 240 reserved for special civil and military applications;
- Data Categories 241 to 255 used for both civil and military non-standard applications.

**NOTE** - The up-to-date list of ASTERIX Data Categories (except for special military applications) is published on the EUROCONTROL Web Site (<http://www.eurocontrol.int/asterix>).

**4.2.1.5** Allocation of ASTERIX Categories

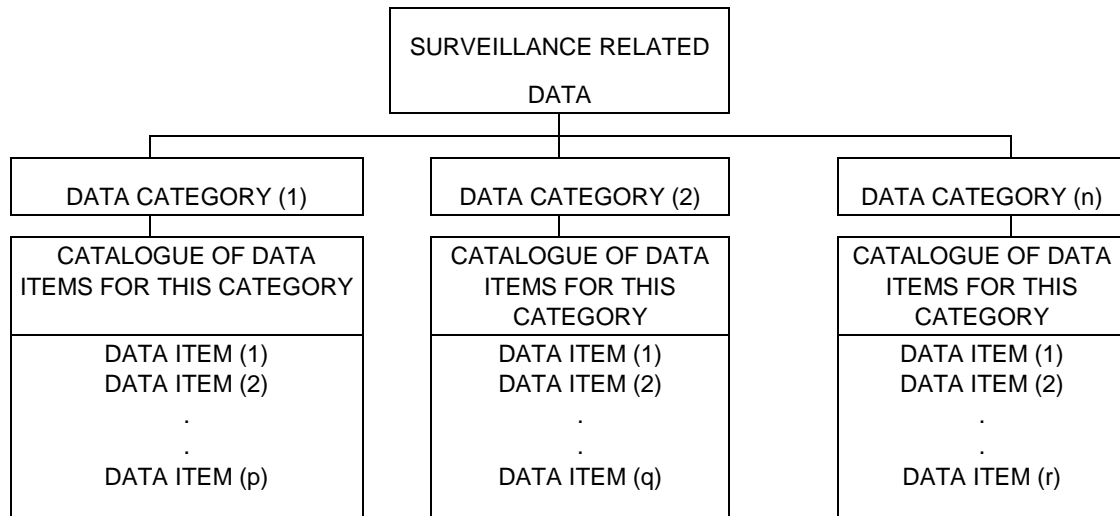
- For Data Categories 000 to 127, the allocation of category numbers is the responsibility of the AMG.

ANNEX B – contains a list of all ASTERIX categories assigned by the AMG at the date of publication of this specification.

- For all other categories coordination of the category number with the AMG is recommended in order to ensure as far as possible a unique identification of the categories. To request the allocation of a category number for a specific application, the ASTERIX Manager **shall** be consulted at [asterix@eurocontrol.int](mailto:asterix@eurocontrol.int). Further coordination will then be initiated. The detailed contents of these categories **may** be defined by the requesting authority following the basic principles laid down in this EUROCONTROL specification.

A copy of the respective specification **shall** be made available to the ASTERIX Manager.

ANNEX C – shows a list of categories coordinated with the AMG at the date of publication of this specification.



	USER APPLICATION PROFILE							
	DATA FIELD	DATA FIELD	DATA FIELD	DATA FIELD	DATA FIELD	DATA FIELD	DATA FIELD	DATA FIELD
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
DATA ITEM (1)		x						
DATA ITEM (2)						x		
DATA ITEM (3)	x							
DATA ITEM (4)				x				
DATA ITEM (5)								
...								
DATA ITEM (x)			x					
DATA ITEM (x + 1)								x
...								
DATA ITEM (q)					x			

Figure 1 - Organisation of the Data

## 4.2.2 Data Items and Catalogue of Data Items

- 4.2.2.1** A Data Item is the smallest unit of information defined and standardised. For each Data Category, a Catalogue of Data Items **shall** be standardised.
- 4.2.2.2** Applications involving the exchange of information out of a given Data Category, **shall** exclusively make use of the Data Items standardised in such Catalogue(s) of Data Items.
- 4.2.2.3** Each Data Item **shall** be given a unique reference which unambiguously identifies this item in the relevant catalogue.
- 4.2.2.4** The Data Item symbolic reference **shall** consist of an eight-character reference of the form **Innn/AAA**, where:
- **I** indicates that this represents a Data Item;
  - **nnn** is a three digit decimal number which indicates the Data Category to which this Data Item belongs (000 to 255);
  - **AAA** is a three digit decimal number which indicates the data item.
- 4.2.2.5** Where applicable, the system units **shall** also be standardised.

## 4.2.3 Data Fields

- 4.2.3.1** For the purpose of communication, the various Data Items **shall** be assigned to Data Fields, each having a length of an integral number of octets and referenced by a Field Reference Number (FRN).
- 4.2.3.2** The correspondence between Data Items and Data Fields **shall** be standardised for each relevant application by the User Application Profile (UAP) concerning this application.

## 4.2.4 User Application Profile

- 4.2.4.1** The UAP is the mechanism whereby the correspondence between Data Items and Data Fields **shall** be standardised for each application making use of the ASTERIX message structure.
- 4.2.4.2** The UAP **shall** be considered as a control table attached to the message assembly/disassembly programs resident in the relevant processing systems. It essentially defines which of the catalogued Data Items will be used, their length (where applicable), their assignment to the Data Fields and any specific requirements which need to be standardised for the successful transmission and interpretation of the messages.
- NOTE** - With this mechanism, it is easy to optimise the transmission efficiency without program modification by taking into account the frequency of occurrence of specific Data Items. Furthermore, it enables a choice to be made between various representations of the same logical piece of information.
- 4.2.4.3** Spare bits in the UAP **shall** be set to zero.
- 4.2.4.4** The UAP **should** be unique per Category.
- Note: The UAP forms an integral part of a category and is defined within the respective definition.

## 4.3 The General Message Structure

### 4.3.1 General

The application data to be transmitted over the communication medium **shall** consist of either one or a concatenation of consecutive Data Blocks.

### 4.3.2 The Data Block

**4.3.2.1** Until and including edition 2.1 of Part 1 of the ASTERIX documentation, a blocking mechanism **may** be used to combine ASTERIX record in a data block before transmission. All categories existing before the release of edition 2.2 of Part 1 (September 2014) **shall** continue to use the blocking principle as far as deemed appropriate.

The list of categories following this procedure is available in Annexes B and C.

**4.3.2.2** A Data Block **shall** consist of:

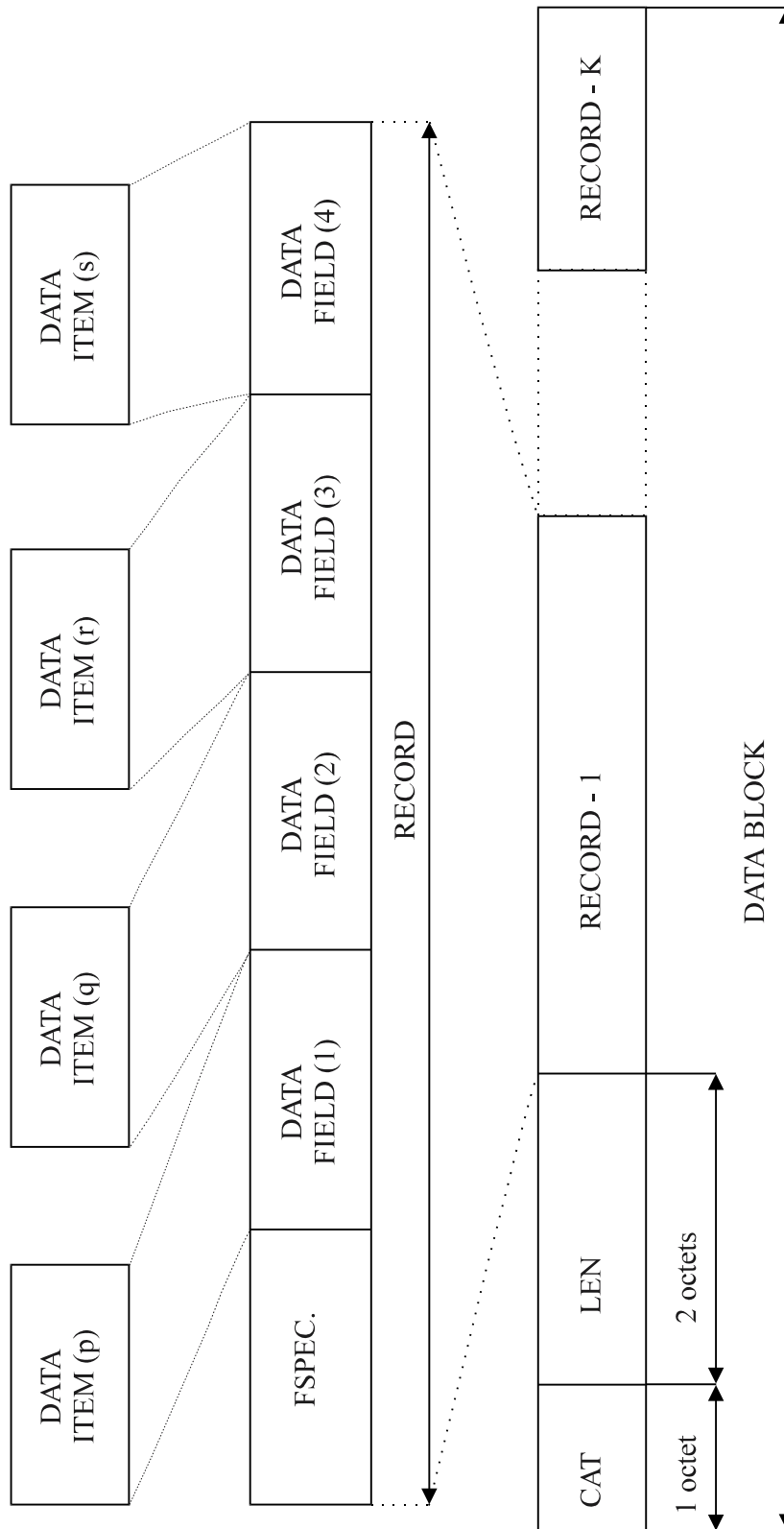
- a one-octet field Data Category (CAT) indicating to which Category the data transmitted belongs;
- a two-octet field Length Indicator (LEN) indicating the total length (in octets) of the Data Block, including the CAT and LEN fields;
- one or more Record(s) containing data of the same Category.

**NOTE** - The Data Block structure is depicted in Figure 2.

**4.3.2.3** Each Record is of variable length but aligned on an octet boundary. The length of a Data Block is thus variable but **shall** always be a multiple of an octet.

**4.3.2.4** The maximum size of a Data Block **shall** be mutually agreed between data sources and users.

**4.3.2.5** As of edition 2.2 of Part 1 of the ASTERIX documentation the principle of blocking of records **shall** no longer be applied. Instead each ASTERIX record **shall** be constructed as displayed in Figure 3. All ASTERIX categories that are created as of edition 2.2 of Part 1 of the ASTERIX documentation (October 2014) **shall** follow this rule when assembling the ASTERIX messages.



**Figure 2 - Data Block Structure until Edition 2.1**

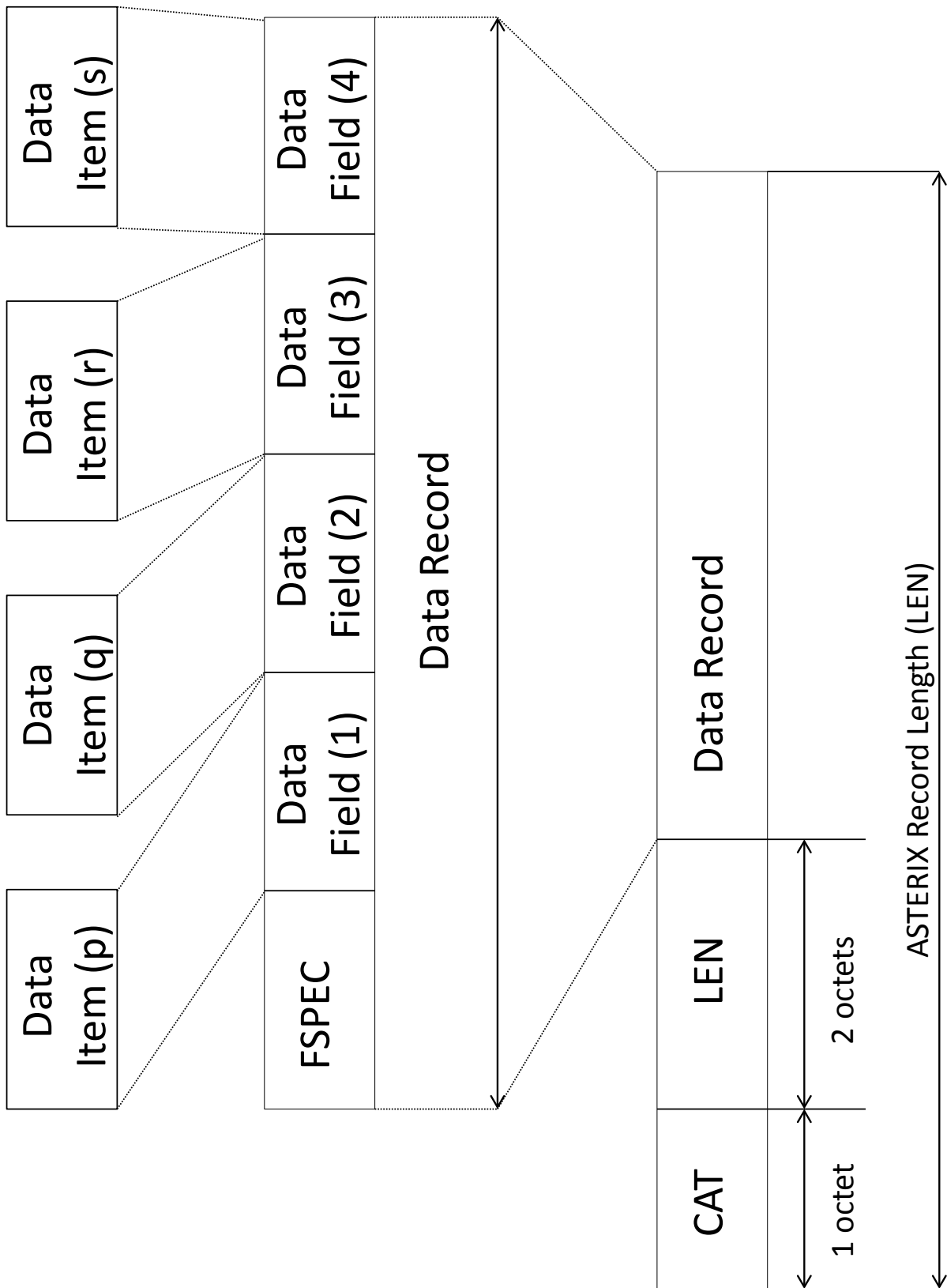


Figure 3 - ASTERIX Record Structure as of Edition 2.2



### 4.3.3 The Record

**4.3.3.1** A Record **shall** contain the information of the same Data Category needed by a given application and **shall** consist of:

- a one-octet field Data Category (CAT) indicating to which Category the data transmitted belongs;
- a two-octet field ASTERIX Record Length Indicator (LEN) indicating the total length (in octets) of the ASTERIX Record, including the CAT and LEN fields
- a Data Record of variable length consisting of:
  - a Field Specification (FSPEC) field of variable length, considered as a table of contents, in the form of a bit sequence, where every individual bit signals the presence (bit set to one) or absence (bit set to zero) of a well defined Data Field assigned to it;
  - a variable number of Data Fields. Each Data Field is associated with one and only one Data Item, as defined by the UAP.

**4.3.3.2** Encoding Rules

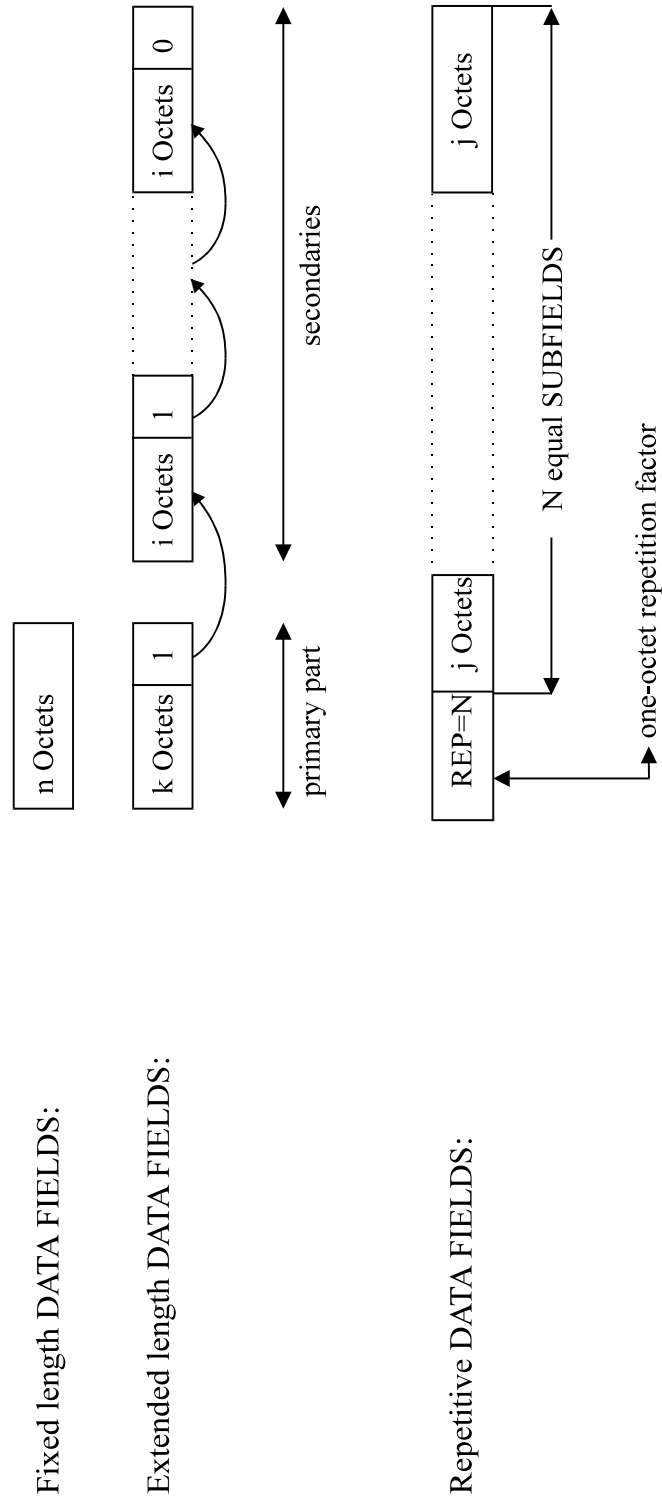
For each data item the specification **shall** contain an Encoding Rule indicating whether a data item is mandatory or optional and the conditions under which it **shall** be included in the ASTERIX record.

**4.3.3.3** The length of a Record is implicit from its structure and **shall** always be a multiple of an octet.

### 4.3.4 Standard Data Field Formats

The length of Standard Data Fields **shall** be either fixed or variable, as defined below:

- Fixed length Data Fields, depicted in Figure 3, **shall** comprise a fixed number of octets.
- Extended length Data Fields, depicted in Figure 3, being of a variable length, **shall** contain a primary part of predetermined length, immediately followed by a number of secondary parts, each of predetermined length. The presence of the next following secondary part **shall** be indicated by the setting to one of the Least Significant Bit (LSB) of the last octet of the preceding part (either the primary part or a secondary part). This bit which is reserved for that purpose is called the Field Extension Indicator (FX).
- Explicit length Data Fields **shall** start with a one-octet length indicator giving the total field length in octets including the length indicator itself.
- Repetitive Data Fields, depicted in Figure 3, being of a variable length, **shall** comprise a one-octet Field Repetition Indicator (REP) signalling the presence of N consecutive sub-fields each of the same pre-determined length.
- Compound Data Fields, depicted in Figure 4, being of a variable length, **shall** comprise a primary subfield, followed by data subfields. The primary subfield determines the presence or absence of the subsequent data subfields. It comprises a first part of one octet extendible using the Field Extension (FX) mechanism. The definition, structure and format of the data subfields are part of the description of the relevant Compound Data Item. Data subfields **shall** be either fixed length, extended length, explicit length or repetitive, but not compound.



**Figure 4 - Standard Data Fields Types (except compound)**

**Primary Subfield**

Octet No.1							
8	7	6	5	4	3	2	1
SF1	SF2	SF3	SF4	SF5	SF6	SF7	FX

bits-8/2 (SF n) = 0 Absence of Subfield n  
 = 1 Presence of Subfield n

bit-1 (FX) = 0 End of Primary Subfield  
 = 1 Extension of Primary Subfield into next octet

**Data Subfield No 1**

Octet No.1								Octet No.2							
16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Item of Information 1															

.

.

.

.

.

**Data Subfield No 7**

Octet No.1							
8	7	6	5	4	3	2	1
Item of Information 7							

**Figure 5 - Compound Data Field Type**

### 4.3.5 Non-Standard Data Fields

- 4.3.5.1** There is a special feature, called Special Purpose field, allowing a user subgroup to exchange a variable length field which **shall** be transparent to non-interested users. It completes the ASTERIX Record assembly mechanism and is intended to provide an escape mechanism for the exceptional exchange of non-standard information. When this feature is used, a Special Purpose Indicator, (the SP-bit) **shall** be reserved in the FSPEC field.
- 4.3.5.2** The first octet **shall** contain the explicit length of the field expressed in octets and including the length indicator itself. The following Data Field **may** contain information such as a Data Item not defined, a text string for operator communication, test data, etc.
- 4.3.5.3** The contents of such a Data Field **shall** be agreed between the users concerned, while those not concerned may skip the data.

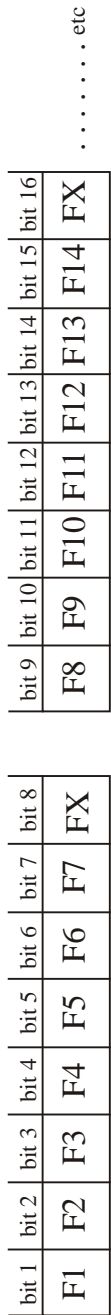
### 4.3.6 Reserved Expansion Data Field

- 4.3.6.1** The Reserved Expansion Field is used only until and including Edition 2.1 of Part 1 of the ASTERIX documentation.
- 4.3.6.1** The Reserved Expansion Data field is intended to provide a mechanism to introduce intermediate changes to a given category, as explained in 7.2.3. In a way similar to the Special Purpose mechanism, users which are not able to decode the information contained in this data field may skip the data. This feature **shall** be implemented in all categories referring to this edition of Part 1: at least one Reserved Expansion Indicator (RE-bit) **shall** be allocated in the FSPEC field.
- 4.3.6.2** The first octet **shall** contain the explicit length of the field expressed in octets, including the length indicator itself.
- 4.3.6.3** The contents of such a Data Field **shall** be agreed by the AMG.
- 4.3.6.4** When necessary, the use of the Reserved Expansion Data field, for a given category, will be described in a separate document from the ASTERIX Category definition document.
- This document will be available on the EUROCONTROL Web Site (<http://www.eurocontrol.int/asterix>) and a reference to it will be present near the appropriate ASTERIX Category definition document.
- 4.3.6.5** As of Edition 2.2 of Part 1 of the ASTERIX documentation the Reserved Expansion Field **shall** no longer be used. Because of the presence of the length of each individual ASTERIX record, it is possible to add new data items at the end of the UAP in order to further evolve the specification of an ASTERIX category. This makes the use of the mechanism of the Reserved Expansion Field no longer necessary.

### 4.3.7 Field Organisation

- 4.3.7.1** In a Record, Data Fields **shall** be sent in the order of increasing FRNs.
- 4.3.7.2** The minimum length of the FSPEC field **shall** be one octet, which allows the composition of Records consisting of any combination of Data Fields with FRNs from one up to and including seven.
- 4.3.7.3** When Data Fields with FRNs greater than seven have to be transmitted the FSPEC extension mechanism **shall** be used. This is achieved by assigning a special meaning to the LSB of any FSPEC octet. The LSB, when set to one, signals the continuation of the FSPEC field with at least one further octet, until finally an octet is encountered with the LSB set to zero. The LSB in the FSPEC field is called the Field Extension Indicator (FX).
- NOTE -** For illustrative purposes two examples of Record Structures are shown in Figure 5. The first example contains a Record with a single-octet FSPEC, whereas the second one highlights a case with a multi-octet FSPEC.
- 4.3.7.4** In order to illustrate all elements of ASTERIX Record composition an example is depicted in Figure 6 where FSPEC bit-14 is dedicated to the SP feature.

STRUCTURE OF THE FIELD SPECIFICATION (FSPEC)



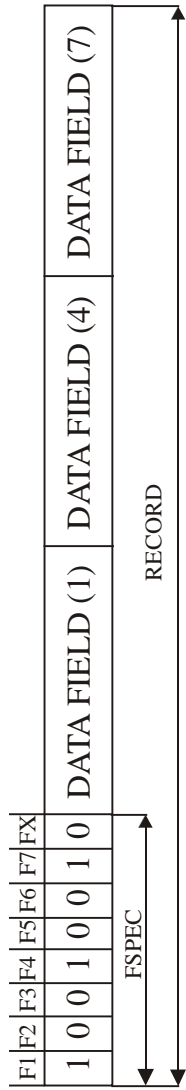
F1 to F7: FIELD PRESENCE INDICATOR

|= 0 Data Field not present  
|= 1 Data Field present

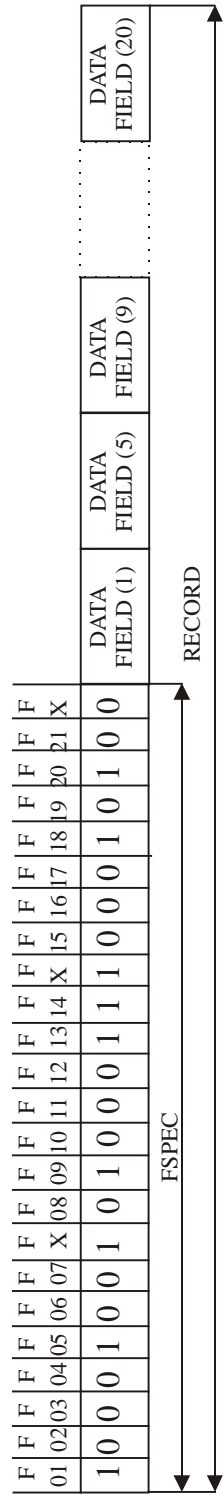
FX : FIELD EXTENSION INDICATOR

|= 0 No Field Specification extension  
|= 1 Following octet contains a Field Specification extension

EXAMPLE OF ONE-OCTET FSPEC



EXAMPLE OF A MULTI-OCTET FSPEC



**Figure 6 - Field Sequencing Organisation**

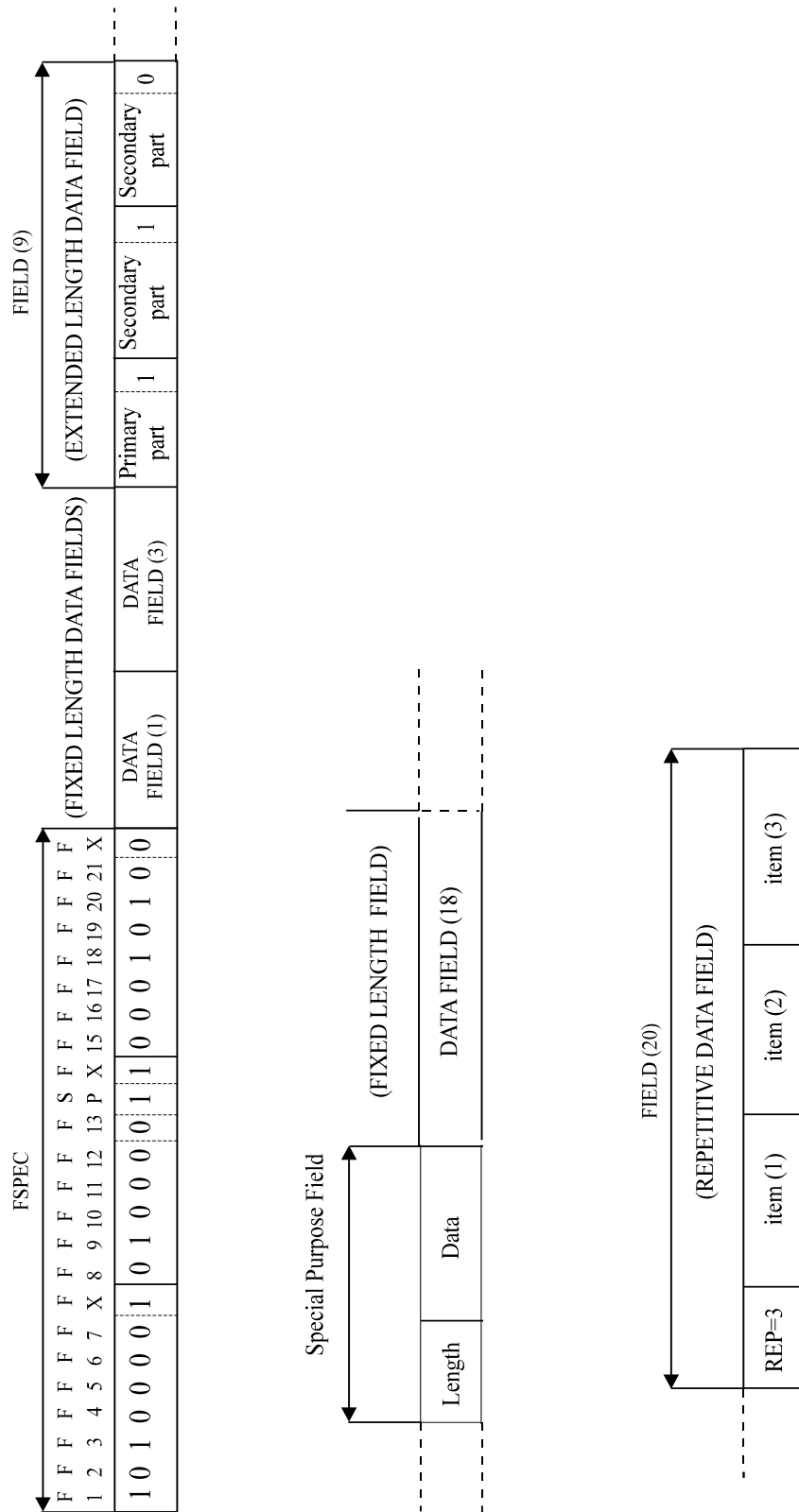


Figure 7 - Overall Record Structure

## 5. CONVENTIONS

### 5.1 Bit Numbering

- 5.1.1 All bit positions within a one octet field **shall** be numbered right to left from one to eight.
- 5.1.2 For a field consisting of n octets (with  $n > 1$ ):
- the octets **shall** be numbered left to right from one to n;
  - the bit positions **shall** be numbered right to left from one to  $n \times 8$ .
- 5.1.3 With an FSPEC field the following exceptions for bit positions **shall** apply:
- in a one-octet FSPEC the bits will be numbered left to right from one to eight;
  - in a FSPEC consisting of p octets (with  $p > 1$ ) the bits will be numbered left to right from one to  $p \times 8$ .
- 5.1.4 Data **shall** be presented to the application at the receiving end in the same order as generated at the transmitting end.

### 5.2 Binary Values

Negative values **shall** be represented in two's complement form.

### 5.3 Time Management

Time stamping **shall** be expressed as Co-ordinated Universal Time (UTC).



## 6. ASTERIX ADDRESSING SCHEME

### 6.1 General

In order to avoid ambiguity, every system **shall** have a unique identification in an area where ASTERIX is used for the exchange of data.

### 6.2 Syntax

The ASTERIX System Identifier format **shall** be composed of two subfields as illustrated below:



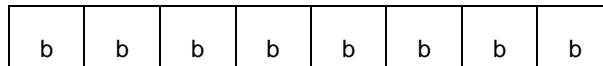
	Field Name	Element Type	Field Size
SAC	System Area Code	Binary	One octet
SIC	System Identification Code	Binary	One octet

### 6.3 Formats

#### 6.3.1 System Area Code (SAC)

**6.3.1.1** The SAC field **shall** consist of an eight-bit number assigned to a geographical area or a country.

**6.3.1.3** The SAC field format **shall** be as illustrated below:

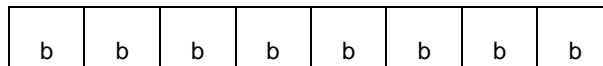


where b represents a binary digit.

#### 6.3.2 System Identification Code (SIC)

**6.3.2.1** The SIC **shall** consist of an eight-bit number assigned to every system (surveillance station, processing system, server, etc.) located in the geographical area or country defined by the SAC.

**6.3.2.2** The SIC field format **shall** be as illustrated below:



where b represents a binary digit.

## 6.4 Assignment of the Systems Identifiers

### 6.4.1 System Area Codes

6.4.1.1 One SAC **should** be assigned to each country.

**NOTE** - *When needed, more than one SAC **may** be assigned to a single country, for example to differentiate between civil and military applications.*

6.4.1.3 Assignment of SACs **shall** be co-ordinated by the AMG.

**NOTE** - The up-to-date list of SACs is published on the EUROCONTROL Web Site (<http://www.eurocontrol.int/asterix>).

### 6.4.2 System Identification Codes

6.4.2.1 The individual SICs **shall** be assigned by the State concerned within the area identified by the SAC applying national arrangements.

6.4.2.2 Within one geographical area or country identified by a SAC, up to 256 individual codes (SICs) can be assigned.

## 7. ASTERIX MIGRATION POLICY

### 7.1 General

The ASTERIX migration policy allows the co-existence and support of two or even more consecutive versions of a particular part of the EUROCONTROL Specification for Surveillance Data Exchange. It **shall** be applicable to standard categories, within the range 000-127.

### 7.2 Description

#### 7.2.1 Application Domain

**7.2.1.1** The ASTERIX format can be used to convey various information related to surveillance. An application domain is a particular application of ASTERIX, such as the transmission of mono-surveillance target reports or the transmission of mono-surveillance service messages.

**7.2.1.2** The ASTERIX migration policy allows the definition of 32 application domains that **shall** be identified by an initial Category number between 0 and 31. Each application domain **shall** be described in one and only one part of the ASTERIX Specification.

#### 7.2.2 Version Management

**7.2.2.1** For a given application domain, the version of the corresponding Category definition **shall** be identified by its reference number and its edition date. In order to avoid any mis-interpretation of data, any new version of a part **shall** be allocated a Category number different from the previous one, according to the rule below:

$$\text{Cat}(N+1) = (\text{Cat}(N) + 32) \text{ Mod } 128$$

**NOTE** - This approach allows the coexistence of up to four versions of a same part.

**7.2.2.2 Recommendation** *In order to limit the number of simultaneous versions of a same part, the publication of a subsequent version **should** not be within a time-lapse of typically five to ten years.*

### **7.2.2.3 Example of Monoradar Service Messages**

This application domain covers sector crossing and other messages used to provide information on the status of a Primary, Secondary or Mode S radar station. It is described in detail in Part 2b. The initial Category number allocated to this application domain is 002.

The next version of this Category will be Category 034, followed by versions 066, 098 and then returning again to 002. On the basic premise that a version is applicable for ten years, this will provide half a century for the old Category 002 to disappear before a new version with the same Category number is created.

### **7.2.2.4 Exceptions**

#### **7.2.2.4.1 Categories 000 and 032**

There will not be any subsequent versions of Category 000.

Therefore, Category 032 is not the next version of Category 000, but is related to a different application domain. The next versions of Category 032 will be 064, 096 and then again 000.

#### **7.2.2.4.2 Monoradar Target Reports: Categories 001, 016 and 048**

This application domain covers the messages carrying plots and tracks issued by Primary, Secondary and Mode S radar stations.

The initial Category number allocated to this application domain was 001. As primary and non-Mode S secondary stations were already operational while Mode S was still under development, it was decided to split this application domain into two separate categories: 001 for primary and non-Mode S secondary surveillance, and 016 for Mode S surveillance.

As Mode S is now a mature technology, the decision was taken to combine all monoradar target reports into a single category, category 048, which is the next version of both categories 001 and 016. The next versions of category 048 will be 080, 112, 016 and then again 048.

## 7.2.3 Modifications

**7.2.3.1** Modifications to existing categories shall be performed in a way that interoperability is maintained (“backwards compatibility”). This rule shall be respected to the maximum extent possible, but can only be guaranteed to specifications which have reached the status “Released Issue”.

For documents in status “Working Draft” or “Draft” backwards compatibility cannot be guaranteed as they are still under development and may need to be modified substantially during this process. Implementing ASTERIX categories that are not yet released is at the risk of the implementer.

**7.2.3.1** Modifications, which would result in non-interoperable implementations, **shall** be withheld and collected during a five to ten years period for implementation in the next version, which then re-uses the eldest Category number from the cyclic pool.

**7.2.3.2** **Recommendation** *Minor modifications, not leading to interoperability problems, **should** be implemented at intermediate points in time (in the last version, thus not creating a new version).*

**NOTE** - In ASTERIX categories defined before edition 2.2 of Part 1 of the ASTERIX specification, the Reserved Expansion Field feature provides an escape mechanism to introduce modifications at an early stage, before proceeding to a new version.

# **ANNEX A – Traceability between ASTERIX Specifications and Commission Implementing Regulation (EU) No 1207/2011 of 22/11/2011**

## **A.1 General**

Commission Implementing Regulation (EU) No 1207/2011 of 22/11/2011 lays down requirements for the performance and interoperability of surveillance for the Single European Sky.

ASTERIX as data format for the exchange of surveillance related data is fully consistent with the relevant requirements of the Regulation therefore it may be used by the stakeholders in the implementation of these requirements. In order to facilitate the implementation as well as the demonstration of compliance, Annex A.2 provides the traceability between the relevant regulatory requirements and content of the ASTERIX Specification.

To be considered compliant with the interoperability requirements of the regulation the basic principles as laid down in Part 1 of ASTERIX have to be respected and the ASTERIX categories have to be implemented as described in the respective definitions.

To be compliant with the interoperability requirements of the regulation it is assumed that the appropriate surveillance infrastructure has been implemented.

## A.2 Compliance Matrix

Commission Implementing Regulation (EU) No 1207/2011 Regulatory Requirements	ASTERIX Requirements
Generic interoperability requirements	As attachments to this EUROCONTROL specification, the ASTERIX category definitions (containing the detailed format descriptions of the various ASTERIX categories) are considered as Means of Compliance to Commission Regulation No 1207/2011 only as long as they are implemented following the version as published on the ASTERIX website.  <a href="http://www.eurocontrol.int/asterix">www.eurocontrol.int/asterix</a> .
Annex III: Surveillance data exchange requirements referred to in Article 5(1): Identification of data source	Data source identifier (SAC/SIC) present in all ASTERIX categories.
Annex III: Surveillance data exchange requirements referred to in Article 5(1): Identification of the type of data	Category indication present in all ASTERIX blocks.
Annex III: Surveillance data exchange requirements referred to in Article 5(1): Time stamping requirements	Time of Day (expressed in UTC) present in all ASTERIX categories.

**Table 1 - Compliance matrix**

## ANNEX B – ASTERIX Categories managed by the AMG

The following table contains a list of ASTERIX categories in the standard range (0 ... 127) and the purpose for which they are assigned. This list reflects the status at the date of publication of this specification. For the latest available information please refer to EUROCONTROL's ASTERIX website at [www.eurocontrol.int/asterix](http://www.eurocontrol.int/asterix).

The categories contained in this Annex are implemented following the blocking mechanism as described in chapter 4.3.2.1.

Category	Application
000	Time Synchronisation Messages
001	Monoradar Target Reports
002	Monoradar Service Messages
003	Air Traffic Situation Picture
004	Safety Net Messages
007	Directed Interrogation Messages
008	Monoradar Weather Data
009	Composite Weather Reports
010	Monoradar Surface Movement Data
011	SMGCS Data
017	Mode S Surveillance Coordination Function Messages
018	Mode S Data Link Function Messages
019	Multilateration System Status Messages
020	Multilateration Target Reports
021	ADS-B Reports
022	TIS-B Management Messages



Category	Application
023	CNS/ATM Ground Station Service Messages
024	ADS-C Messages
034	Monoradar Service Messages (Successor of category 002)
048	Monoradar Target Reports (Successor of category 001)
061	SDPS Session and Service Control Messages
062	System Track Data
063	Sensor Status Messages
065	SDPS Service Status Messages

***Table 2 - ASTERIX Categories managed by the AMG***

## ANNEX C – ASTERIX Categories coordinated with the AMG

The following ASTERIX categories, outside the standard range of categories, have been coordinated with the AMG and their evolution will be agreed with the AMG. This list reflects the status at the date of publication of this specification. For the latest available information please refer to EUROCONTROL's ASTERIX website at [www.eurocontrol.int/asterix](http://www.eurocontrol.int/asterix).

Category	Application
128	C <sup>3</sup> I Messages
150	Flight Data Messages
151	Association Messages
152	Time Stamp Messages
153	Special Purpose Messages
204	Recognised Air Picture
239	Foreign Object Debris Detection System (reserved)
240	Radar Video Transmission
247	Version Number Exchange
251	Supplemental Data (Birdtam)
252	Session and Service Control Messages
253	Remote Station Monitoring and Control Information

**Table 3 - ASTERIX Categories coordinated with the AMG**