# EUROCONTROL Specification for Surveillance Data Exchange ASTERIX

## Part 4 Category 048 Monoradar Target Reports

Edition: 1.31
Edition date: 03-10-2022
Classification: White
Reference nr: EUROCONTROL-SPEC-0149-4

SUPPORTING EUROPEAN AVIATION

# EUROCONTROL
# Specification for Surveillance Data Exchange
# ASTERIX Part 4 Category 048
# Monoradar Target Reports

DOCUMENT IDENTIFIER : EUROCONTROL-SPEC-0149-4

|  |  |  |
|---|---|---|
| **Edition Number** | **:** | **1.31** |
| **Edition Date** | **:** | **03/10/2022** |
| **Status** | **:** | **Released Edition** |
| **Intended for** | **:** | **General Public** |
| **Category** | **:** | **EUROCONTROL Specification** |

# DOCUMENT CHARACTERISTICS

| | | |
|---|---|---|
| **TITLE** | | |
| **EUROCONTROL Specification for Surveillance Data Exchange – ASTERIX Part 4<br>Category 048: Monoradar Target Reports** | | |
| | **Publications Reference:** | SPEC-0149-4 |
| | **ISBN Number:** | 978-2-87497-028-3 |
| **Document Identifier** | **Edition Number:** | 1.31 |
| EUROCONTROL-SPEC-0149-4 | **Edition Date:** | 03/10/2022 |

**Abstract**

This document specifies the contents of ASTERIX Category 048 messages used for the transmission of Monoradar Target Reports.

**Keywords**

| | | | |
|---|---|---|---|
| Data Exchange | Messages | SAC | SIC |
| Data Category | Data Field | Data Block | Data Item |
| ASTERIX | UAP | Monoradar | |

| Contact Person(s) | Tel | Unit |
|---|---|---|
| Alexander Engel | +32-2-729 3355 | EGSD/PCS/SCS/STAN |

**STATUS, AUDIENCE AND ACCESSIBILITY**

| Status | | Intended for | | Accessible via | |
|---|---|---|---|---|---|
| Working Draft | ☐ | General Public | ☑ | Intranet | ☐ |
| Draft | ☐ | EUROCONTROL | ☐ | Extranet | ☐ |
| Proposed Issue | ☐ | Restricted | ☐ | Internet (www.eurocontrol.int) | ☑ |
| Released Issue | ☑ | | | | |

# DOCUMENT APPROVAL

This document has been approved by the ASTERIX Maintenance Group (AMG).

For management approval of the complete set of ASTERIX documentation refer to Part 1.

# DOCUMENT CHANGE RECORD

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

| EDITION | DATE | REASON FOR CHANGE | SECTIONS PAGES AFFECTED |
|---|---|---|---|
| 0.7 | March 1998 | New format and the ex-part 4 split to align with the migration strategy as follows:<br>Category 048 - Part 4<br>Category 017 - Part 5<br>Category 018 - Part 6 | ALL |
| 0.8 | May 1998 | Standard Deviations removed from item 130 | See I048/130 |
| 0.9 | June 1998 | The title of the document amended by replacing Radar with Surveillance.<br>Document renamed to apply to PSR, SSR, MSSR as well as Mode S radars.<br>Minor modifications in items 030, 070, 090, 100, 130, 140, 200, 240, 250 | ALL<br>1.2 Scope Updated<br>See respective Data Items |
| 0.9a | October 1998 | Introduction updated to keep in line with Part1<br>I048/120 Doppler Speed redesigned<br>I048/170 Track Status :<br>• Vertical Manoeuvre renamed Climbing/Descending Mode and expanded to 2 bits<br>• bits reshuffled in Octet 1<br>I048/230 modified | 1.<br>See I048/120<br>See I048/170<br>See I048/230 |
| 0.9b | January 1999 | • Item 260 modified.<br>• Minor modifications in the encoding rules and notes of items 030, 100, 230, 240, 250.<br>• Reserved Expansion Indicator added in UAP.<br>• 1.1.3 and 1.2 suppressed | See respective items<br>5.3 |
| 1.11 | March 1999 | • editorial corrections | ALL |
| 1.12 | September 1999 | • encoding rules and notes modifications in items 070, 100, 230<br>• editorial modifications | ALL |
| 1.14 | November 2000 | • editorial corrections | ALL |

| | | | |
|---|---|---|---|
| 1.15 | April 2007 | • Document ID & Signature Page updated | |
| 1.16 | March 2009 | • Reference Document 2 updated<br>• SI/II Indication added to I048/230 | 2.2<br>5.2.23 |
| 1.17 | June 2010 | • Data item I048/030 amended (codes 19, 20) | 5.2.3 |
| 1.18 | November 2010 | • Data item I048/030 amended (codes 21, 22) | 5.2.3 |
| 1.19 | March 2011 | • Data item I048/030 amended (code 23)<br>• Signature Page updated | |
| 1.20 | June 2011 | • Signature Page updated<br>• Abbreviations list updated<br>• Note added to I048/020 1st extension (FOE/FRI) | iii<br>6<br>5.2.2 |
| 1.21 | July 2012 | • Signature Page updated<br>• X-Pulse indication added to I048/020 1st ext.<br>• Correction of annotation in the UAP of FRNs 23 – 26 from I048/YY to I048/YYY | iii<br>5.2.2<br>5.3.1 |
| 1.22 | October 2016 | • Migration to new layout<br>• Definition of CDM in I048/170 updated | All<br>5.2.19 |
| 1.23 | July 2017 | • Reference to Reserved Expansion Field added to data items I048/020 and I048/040<br>• Bit 1 of I048/120 changed to FX-bit in line with Part 1 of ASTERIX<br>• Value 7 defined for STAT in I048/230 | 5.2.2 & 5.2.4<br>5.2.15<br>5.2.23 |
| 1.24 | March 2019 | • Value 24 defined in I048/030; data item renamed<br>• Note added to data item I048/055 | 5.2.3<br>5.2.7 |
| 1.25 | August 2019 | • Values 25 and 26 added to I048/030<br>• Editorial correction in I048/260 | 5.2.3<br>5.2.26 |
| 1.26 | February 2020 | • Numerous editorial corrections<br>• Values 27 to 30 added to I048/030 | various<br>5.2.3 |
| 1.27 | May 2020 | • Note 3 in I048/020 modified<br>• Value 31 added to I048/030<br>• Correction of maximum value in I048/040<br>• Editorial correction of LSB in I048/140 | 5.2.2<br>5.2.3<br>5.2.4<br>5.2.17 |

| | | | |
|---|---|---|---|
| 1.28 | February 2021 | • List of Reference Documents updated<br>• Values 32 - 34 added to I048/030, Code 15 updated | 2.2<br>5.2.3 |
| 1.29 | August 2021 | • List of Reference Documents updated<br>• Data Item renamed and Note added to Data Item I048/250<br>• Note added to Data Item I048/260 | 2.2<br>5.2.25<br>5.2.26 |
| 1.30 | November 2021 | • Encoding Rule of Data Item I048/220 updated for “Track End Messages” (also check the respective Note in Data Item I048/220)<br>• Encoding Rule of Data Item I048/230 updated for “Track End Messages” (also check the respective Note in Data Item I048/230)<br>• Encoding Rule of Data Item I048/240 updated for “Track End Messages” (also check the respective Note in Data Item I048/240)<br>• Encoding Rule of Data Item I048/250 updated for “Track End Messages” (also check the respective Note in Data Item I048/250) | 5.2.22<br>5.2.23<br>5.2.24<br>5.2.25 |
| 1.31 | October 2022 | • List of Reference Documents updated<br>• Acronyms and Abbreviations updated<br>• Resolution of I048/120 corrected<br>• Second Extension added to I048/020<br>• Values 35 & 36 added to I048/030 (Check NOTE on Code = 36); Note 3 deleted<br>• Note added to I048/120 | 2.2<br>3.2<br>5.1<br>5.2.2<br>5.2.3<br>5.2.15 |

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

## TABLE OF CONTENTS

This page is intentionally left blank

# 1. INTRODUCTION

## 1.1 Scope

1.1.1 This document describes the message structure for the transmission of monoradar target reports from a radar station (conventional Secondary Surveillance Radar (SSR), monopulse, Mode S, conventional primary radar or primary radar using Moving Target Detection (MTD) processing), to one or more Surveillance Data Processing (SDP) Systems.

1.1.2 Radar target reports are data out of Data Category 048.

This page is intentionally left blank

# 2. REFERENCES

## 2.1 General

The following Documents and Standards contain provisions which, through references in this text, constitute provisions of this EUROCONTROL Standard Document.

At the time of publication of this EUROCONTROL Standard Document, the editions indicated for the referenced documents and standards were valid.

Any revision of the referenced ICAO Documents shall be immediately taken into account to revise this EUROCONTROL Standard Document.

Revisions of the other referenced documents shall not form part of the provisions of this EUROCONTROL Standard Document until they are formally reviewed and incorporated into this EUROCONTROL Standard Document.

In the case of a conflict between the requirements of this EUROCONTROL Standard Document and the contents of the other referenced documents, this EUROCONTROL Standard Document shall take precedence.

## 2.2 Reference Documents

1. EUROCONTROL Specification SUR.ET1.ST05.2000-STD-01-01. All Purpose Structured EUROCONTROL Surveillance Information Exchange - ASTERIX. Edition 3.1, Released Issue, 28 October 2021.
2. EUROCAE ED-73F/DO181F “MOPS for Secondary Surveillance Radar Mode S Transponders”.
3. EUROCAE ED-275/RTCA DO-386 “MOPS for Airborne Collision Avoidance System $X_u$ (ACAS $X_u$)”.
4. “EUROCONTROL Specification for European Mode S Station (EMS)” Edition 4.0 including Corrigendum 1 (EUROCONTROL-SPEC-189)
5. EUROCONTROL Specification for Surveillance Data Exchange - ASTERIX Part 2b: Category 034 Monoradar Service Messages (EUROCONTROL-SPEC-0149-2b) Edition 1.30.

This page is intentionally left blank

# 3. DEFINITIONS, ACRONYMS AND ABBREVIATIONS

## 3.1 Definitions

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

| | | |
|---|---|---|
| 3.1.1 | Catalogue of Data Items: | 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 | Data Block: | 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. |
| 3.1.3 | Data Category: | Classification of the data in order to permit inter alia an easy identification. |
| 3.1.4 | Data Field: | 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 | Data Item: | The smallest unit of information in each Data Category. |
| 3.1.6 | Measured Item: | A piece of information (e.g. the position of a target) directly derived from the radar information and transmitted without any intermediate processing. |
| 3.1.7 | Mode S: | An enhanced mode of SSR which permits the interrogation of all SSR equipped aircraft and the addressed interrogation of suitably equipped aircraft and two-way exchange of digital data between such aircraft and the interrogator. |
| 3.1.8 | Record: | 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 |
| 3.1.9 | User Application Profile: | 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 Standard Document the following shall apply:

| | |
|---|---|
| **ACAS** | **Airborne Collision Avoidance System** |
| **AMG** | **ASTERIX Maintenance Group** |
| **ASTERIX** | **All Purpose STructured EUROCONTROL suRveillance Information EXchange** |
| **BDS** | **Binary Data Source** |
| **CAT** | **Data Category** |
| **dBm** | **The dBm is the unit of absolute power related to 1 milliwatt.** |
| **Dg** | **Degrees** |
| **EATM** | **European Air Traffic Management** |
| **ELM** | **Extended Length Message** |
| **FL** | **Flight Level, unit of altitude (expressed in 100's of feet)** |
| **FRN** | **Field Reference Number** |
| **FSPEC** | **Field Specification** |
| **FX** | **Field Extension Indicator** |
| **GICB** | **Ground Initiated Comm-B** |
| **IC** | **Interrogator Code** |
| **ICAO** | **International Civil Aviation Organization** |
| **IFF** | **Identification Friend/Foe** |
| **kt** | **knot = NM/hour, unit of speed** |
| **LEN** | **Length Indicator** |
| **LSB** | **Least Significant Bit** |
| **MB** | **Message, Comm B** |
| **MSB** | **Most Significant Bit** |
| **MSSR** | **Monopulse Secondary Surveillance Radar** |
| **MTD** | **Moving Target Detection** |
| **NM** | **Nautical Mile, unit of distance (1852 metres)** |
| **PSR** | **Primary Surveillance Radar** |
| **RA** | **Resolution Advisory** |
| **RDP** | **Radar Data Processing** |
| **REP** | **Field Repetition Indicator** |
| **REF** | **Reserved Expansion Field** |

| | |
|---|---|
| **s** | **second, unit of time** |
| **SAC** | **System Area Code** |
| **SARPs** | **Standards and Recommended Practices (ICAO)** |
| **SCN** | **Surveillance Cluster Network** |
| **SDP** | **Surveillance Data Processing (system)** |
| **SIC** | **System Identification Code** |
| **SP** | **Special Purpose Indicator** |
| **SPI** | **Special Position Identification** |
| **SSR** | **Secondary Surveillance Radar** |
| **UAP** | **User Application Profile (see Definitions )** |
| **UTC** | **Co-ordinated Universal Time** |

This page is intentionally left blank

# 4. GENERAL PRINCIPLES

## 4.1 General

The transmission of monoradar information shall require the transmission of two types of messages:

- data messages of radar target reports;
- radar service messages used to signal status information of the radar station to the user systems (not covered by this document).

## 4.2 Time Management

### 4.2.1 Definition

The target time stamp shall be consistent with the reported plot position.

### 4.2.2 Requirements for Time Stamping

The timestamping shall comply with the following requirements:

- every individual target report shall have its own individual timestamp;
- co-ordinated Universal Time (UTC) as specified in ICAO Annex 5 shall be used to time stamp radar data.

## 4.3 Projection Systems and Geographical Co-ordinates

### 4.3.1 Measured Position

The measured position, as contained in plots or tracks, shall be provided by Data Item I048/040 as slant polar co-ordinates, with the radar site location serving as the origin of the polar co-ordinate system. The reference for the azimuth shall be local geographical north.

### 4.3.2 Calculated Position

Two different types of co-ordinate reference systems are supported for local tracking purposes.

#### 4.3.2.1 *Co-ordinates Expressed in the Radar Plane*

When no stereographical projection is performed, the 3D to 2D co-ordinate transformation process is defined by the following simple equations:

X = RHO * SIN(THETA);
Y = RHO * COS(THETA);
Whereby:
RHO = measured slant range
THETA = measured azimuth

The reference for the azimuth shall be local geographical north.

#### 4.3.2.2 *Co-ordinates Expressed in the Local 2D Co-ordinate Reference System:*

The exported calculated position is expressed in a 2D Cartesian co-ordinate system, which is a plane tangential to the WGS-84 Ellipsoid at the location of the radar head. The origin of the Cartesian co-ordinate system coincides with the radar head position. The Y-axis points to the geographical north at that position. The X-axis is perpendicular to the Y-axis and points to the east. The X, Y co-ordinates are calculated using either the measured height or an assumed target height and apply a suitable projection technique for the final 3D to 2D conversion (e.g. a stereographical projection).

The type of co-ordinate reference system in use is signalled by a flag within the Track Status Data Item I048/170.

All tracker derived information elements, shall be a consistent set of values, expressed in the same co-ordinate reference system (state vector components and the corresponding elements of the track quality vector).

## 4.4 Unused Bits in Data Items.

Decoders of ASTERIX data shall never assume and rely on specific settings of spare or unused bits. However in order to improve the readability of binary dumps of ASTERIX records, it is recommended to set all spare bits to zero.

## 4.5 Definitions and Addressing Concepts

In order to address radar sources in an unambiguous way, a simple abstract model for concepts like sensors or radar systems has been designed.

### 4.5.1 Radar Sensor

In the framework of category 048 a Radar Sensor is a detection/measurement device, either of the Primary (PSR), Secondary Surveillance Radar (SSR, MSSR) or Mode S type, which uses a single rotating antenna assembly.

### 4.5.2 Radar System

In the framework of category 048 a Radar System is a construction, consisting of either one single sensor or a combination of two sensors of different types. In the case of combined sensors it is assumed that the respective antenna subsystems are configured such that:

- a coincidence in target detection is guaranteed;
- a single co-ordinate reference point is used.

### 4.5.3 Combination of Target Reports

The Radar Data Combiner is a function which combines (merges) the digitized target reports (plots) from two sensors constituting one Radar System.

### 4.5.4 Addressing Concepts: Assigning SAC/SIC Codes

By convention a dedicated and unambiguous SAC/SIC code shall be assigned to every Radar System.

EXAMPLES

1. A back-to-back configuration of two PSRs with an on-mounted SSR antenna each, is considered as two Radar Systems, being addressed via two SAC/SIC codes.
2. A main tower carrying a combined PSR/SSR radar station, supplemented with a standby tower at several hundreds of meters from the main tower and supporting a single back-up SSR station, shall be considered as two independent Radar Systems. It is irrelevant whether both radar systems are synchronised or not, and in addition whether only one Radar System at a time transmits its data or both Radar Systems simultaneously.
3. Two distinct radar heads, located at close distance, whose data is processed in a time-exclusive way by the same plot processor equipment may be considered as a single Radar System, using a single SAC/SIC address, provided that:
    - the same geographical reference point is used, irrespective of whether the data of head#1 or head#2 is selected;
    - the access lines to the site carry only the data of one head at a time.

    Where the above conditions are not simultaneously met, it is imperative to assign two SAC/SIC codes.

## 4.6 Radar Target Reports

### 4.6.1 Types of Radar Target Reports

Radar target reports shall be transmitted either in the form of plots or tracks. A track is a superset of a plot, containing additional data generated by a local tracking system at the radar site.

### 4.6.2 User Application Profile and Data Blocks

A single User Application Profile (UAP) is defined and shall be used whether plot or track information is provided by the radar.

Data Blocks containing radar target reports shall have the following layout.

| | | | | | | |
|---|---|---|---|---|---|---|
| CAT = 048 | LEN | FSPEC | Items of the first record | | FSPEC | Items of the last record |

where:

- Data Category (CAT) = 048, is a one-octet field indicating that the Data Block contains radar target reports;
- Length Indicator (LEN) is a two-octet field indicating the total length in octets of the Data Block, including the CAT and LEN fields;
- FSPEC is the Field Specification.

## 4.7 Composition of Messages

Messages shall be composed of Data Items assembled in the order defined by the Field Reference Number (FRN) in the associated UAP.
Transmitted items shall always be in a Record with the corresponding FSPEC bits set to one.

# 5. LAYOUT OF TARGET REPORT MESSAGES

## 5.1 Standard Data Items

The standardised Data Items which shall be used for the transmission of monoradar target reports from a Mode S station are defined in Table 1 and described in the following pages.

Table 1 - Standard Data Items of Category 048

| Data Item Ref. No. | Description | System Units |
|---|---|---|
| I048/010 | Data Source Identifier | N.A. |
| I048/020 | Target Report Descriptor | N.A. |
| I048/030 | Warning/Error Conditions/Target Classification | N.A. |
| I048/040 | Measured Position in Slant Polar Co-ordinates | RHO: 1/256 NM<br>THETA: 360°/($2^{16}$) |
| I048/042 | Calculated Position in Cartesian Co-ordinates | X, Y: 1/128 NM |
| I048/050 | Mode-2 Code in Octal Representation | N.A. |
| I048/055 | Mode-1 Code in Octal Representation | N.A. |
| I048/060 | Mode-2 Code Confidence Indicator | N.A. |
| I048/065 | Mode-1 Code Confidence Indicator | N.A. |
| I048/070 | Mode-3/A Code in Octal Representation | N.A. |
| I048/080 | Mode-3/A Code Confidence Indicator | N.A. |
| I048/090 | Flight Level in Binary Representation | 1/4 FL |
| I048/100 | Mode-C Code and Confidence Indicator | N.A. |
| I048/110 | Height Measured by a 3D Radar | 25 ft |
| I048/120 | Radial Doppler Speed | N.A. |
| I048/130 | Radar Plot Characteristics | N.A. |
| I048/140 | Time of Day | 1/128 s |
| I048/161 | Track/Plot Number | N.A. |
| I048/170 | Track Status | N.A. |
| I048/200 | Calculated Track Velocity in Polar Representation | Speed: (2-14) NM/s<br>Heading:360°/($2^{16}$) |
| I048/210 | Track Quality | N.A. |
| I048/220 | Aircraft Address | N.A. |
| I048/230 | Communications / ACAS Capability and Flight Status | N.A. |
| I048/240 | Aircraft Identification | N.A. |
| I048/250 | Mode S MB Data | N.A. |
| I048/260 | ACAS Resolution Advisory Report | N.A. |

## 5.2 Description of Standard Data Items

### 5.2.1 Data Item I048/010, Data Source Identifier

Definition: Identification of the radar station from which the data is received.

Format: Two-octet fixed length Data Item.

Structure:

| Octet no. 1 | | | | | | | | Octet no. 2 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| SAC | | | | | | | | SIC | | | | | | | |

| | | |
|---|---|---|
| bits-16/9 | (SAC) | System Area Code |
| bits-8/1 | (SIC) | System Identification Code |

**Encoding Rule:**

This Item shall be present in every ASTERIX record.

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

### 5.2.2 Data Item I048/020, Target Report Descriptor

| | |
|---|---|
| Definition: | Type and properties of the target report. |
| Format: | Variable length Data Item comprising a first part of one-octet, followed by one-octet extents as necessary. |

Structure of First Part:

Octet no. 1

| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|---|
| TYP | | | SIM | RDP | SPI | RAB | FX |

| | | | |
|---|---|---|---|
| bits-8/6 | (TYP) | = 000 | No detection |
| | | = 001 | Single PSR detection |
| | | = 010 | Single SSR detection |
| | | = 011 | SSR + PSR detection |
| | | = 100 | Single ModeS All-Call |
| | | = 101 | Single ModeS Roll-Call |
| | | = 110 | ModeS All-Call + PSR |
| | | = 111 | ModeS Roll-Call +PSR |
| bit-5 | (SIM) | = 0 | Actual target report |
| | | = 1 | Simulated target report |
| bit-4 | (RDP) | = 0 | Report from RDP Chain 1 |
| | | = 1 | Report from RDP Chain 2 |
| bit-3 | (SPI) | = 0 | Absence of SPI |
| | | = 1 | Special Position Identification |
| bit-2 | (RAB) | = 0 | Report from aircraft transponder |
| | | = 1 | Report from field monitor (fixed transponder) |
| bit-1 | (FX) | = 0 | End of Data Item |
| | | = 1 | Extension into first extent |

**NOTE -** For Mode S aircraft, the SPI information is also contained in I048/230.

Structure
of First Extension:

Octet no. 1

| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|---|
| TST | ERR | XPP | ME | MI | FOE/FRI | | FX |

| | | | |
|---|---|---|---|
| bit-8 | (TST) | = 0 | Real target report |
| | | = 1 | Test target report |
| bit-7 | (ERR) | = 0 | No Extended Range |
| | | = 1 | Extended Range present |
| bit-6 | (XPP) | = 0 | No X-Pulse present |
| | | = 1 | X-Pulse present |
| bit-5 | (ME) | = 0 | No military emergency |
| | | = 1 | Military emergency |
| bit-4 | (MI) | = 0 | No military identification |
| | | = 1 | Military identification |
| bits-3/2 | (FOE/FRI) | = 00 | No Mode 4 interrogation |
| | | = 01 | Friendly target |
| | | = 10 | Unknown target |
| | | = 11 | No reply |
| bit-1 | (FX) | = 0 | End of Data Item |
| | | = 1 | Extension into next extent |

**NOTE -** To bits 3/2 of extension 1 (FOE/FRI): IFF interrogators supporting a three level classification of the processing of the Mode 4 interrogation result shall encode the detailed response information in data item M4E of the Reserved Expansion Field of category 048. In this case the value for FOE/FRI in I048/020 shall be set to “00”.
However, even those interrogators shall use I048/020 to encode the information “No reply”.

**NOTE -** To bit 6 of extension 1 (XPP): This bit shall always be set when the X-pulse has been extracted, independent from the Mode it was extracted with.

**NOTE -** To bit 7 of extension 1 (ERR): This bit set to “1” indicates that the range of the target is beyond the maximum range in data item I048/040.In this case – and this case only - the ERR Data Item in the Reserved Expansion Field shall provide the range value of the Measured Position in Polar Coordinates.

Structure
of Second Extension (Presence of external data for a target):

Octet no. 1

| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|---|
| ADSB | | SCN | | PAI | | 0 | FX |

| | | |
|---|---|---|
| bits-8/7 | (ADSB) | On-Site ADS-B Information |
| bit-8 | (ADSB#EP) | ADSB Element Populated Bit |
| | | = 0 ADSB not populated |
| | | = 1 ADSB populated |
| bit-7 | (ADSB#VAL) | On-Site ADS-B Information |
| | | = 0 not available |
| | | = 1 available |
| bits-6/5 | (SCN) | Surveillance Cluster Network Information |
| bit-6 | (SCN#EP) | SCN Element Populated Bit |
| | | = 0 SCN not populated |
| | | = 1 SCN populated |
| bit-5 | (SCN#VAL) | Surveillance Cluster Network Information |
| | | = 0 not available |
| | | = 1 available |
| bits-4/3 | (PAI) | Passive Acquisition Interface Information |
| bit-4 | (PAI#EP) | PAI Element Populated Bit |
| | | = 0 PAI not populated |
| | | = 1 PAI populated |
| bit-3 | (PAI#VAL) | Passive Acquisition Interface Information |
| | | = 0 not available |
| | | = 1 available |
| bit-2 | (SPARE) | Spare Bit, set to 0 |
| bit-1 | (FX) | = 0 End of Data Item |
| | | = 1 Extension into next extent |

**NOTE -** To Extension 2: The EUROCONTROL Specification for European Mode S Stations Edition 4.0 (EMS 4.0) [Ref. 4] defines new functionalities that can use external data inputs. The possibilities described in EMS 4.0 cover the presence of target information acquired via the on-site ADS-B, the Surveillance Cluster Network or the Passive Acquisition Interface. The second extension provides information – per target – on whether such information is available supporting performance improvements, e.g. Passive Acquisition, and new features, e.g. detection of a potential IC Conflict.

**Encoding Rule:**

This Data Item shall be present in every target record.

### 5.2.3 Data Item I048/030, Warning/Error Conditions and Target Classification

Definition: Warning/error conditions detected by a radar station for the target report involved. Target Classification information for the target involved.

Format: Variable length Data Item comprising a first part of one-octet, followed by one-octet extents as necessary.

Structure:

Octet no. 1

| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|---|
| Code | | | | | | | FX |

bits-8/2 (Code) Code describing the information

bit-1 (FX) = 0 End of Data Item
= 1 Extension into first extent (next W/E condition value)

| Code | Description |
|---|---|
| 0 | Not defined; never used. |
| 1 | Multipath Reply (Reflection) |
| 2 | Reply due to sidelobe interrogation/reception |
| 3 | Split plot |
| 4 | Second time around reply |
| 5 | Angel |
| 6 | Slow moving target correlated with road infrastructure (terrestrial vehicle) |
| 7 | Fixed PSR plot |
| 8 | Slow PSR target |
| 9 | Low quality PSR plot |
| 10 | Phantom SSR plot |
| 11 | Non-Matching Mode-3/A Code |
| 12 | Mode C code / Mode S altitude code abnormal value compared to the track |
| 13 | Target in Clutter Area |
| 14 | Maximum Doppler Response in Zero Filter |
| 15 | Transponder anomaly detected – see Note 4 below |
| 16 | Duplicated or Illegal Mode S Aircraft Address |
| 17 | Mode S error correction applied |
| 18 | Undecodable Mode C code / Mode S altitude code |
| 19 | Birds |
| 20 | Flock of Birds |
| 21 | Mode-1 was present in original reply |
| 22 | Mode-2 was present in original reply |
| 23 | Plot potentially caused by Wind Turbine |
| 24 | Helicopter |
| 25 | Maximum number of re-interrogations reached (surveillance information) |
| 26 | Maximum number of re-interrogations reached (BDS Extractions) |

| | |
|---|---|
| 27 | BDS Overlay Incoherence |
| 28 | Potential BDS Swap Detected |
| 29 | Track Update in the Zenithal Gap |
| 30 | Mode S Track re-acquired |
| 31 | Duplicated Mode 5 Pair NO/PIN detected |
| 32 | Wrong DF reply format detected |
| 33 | Transponder anomaly (MS XPD replies with Mode A/C to Mode A/C-only all-call) – see Note 5 below |
| 34 | Transponder anomaly (SI capability report wrong) – see Note 5 below |
| 35 | Potential IC Conflict |
| 36 | IC Conflict detection possible – no conflict currently detected |

**Encoding Rule:**

This Data Item is optional. When used, it shall be transmitted only if different from zero. The zero value for this field means no warning neither error conditions and that the target classification is unknown.

If Codes 33 or 34 are sent, also Code 15 **shall** be sent – see Notes below.

Values 0-63 are allocated by the AMG, values 64 to 127 are available for allocation by manufacturers and shall be described in the corresponding ICD.

**NOTES**

1. It has to be stressed that a series of one or more codes can be reported per target report.
2. Data conveyed in this item are of secondary importance, and can generally also be derived from the processing of mandatory items.
3. Note outdated and deleted.
4. As of Edition 1.28 of this specification it is possible to indicate specific Transponder Anomalies by means of dedicated Codes (such as Codes 33 and 34). Code 15 is kept for backwards compatibility. It needs to be understood that ASTERIX Encoders implementing Category 048 in line with Edition 1.27 or earlier of this specification cannot indicate specific Transponder Anomalies.
5. Values 25 to 30 and 32 to 36 have been defined to comply with the Edition 4.0 of the EUROCONTROL Specification for European Mode S Station (EMS) [Ref. 4] and to provide the possibility to report the following information:
   - Code 25: the maximum number of permitted re-interrogations to acquire the surveillance information has been reached;
   - Code 26: the maximum number of permitted re-interrogations to extract BDS Registers has been reached;
   - Code 27: inconsistency detected between the contents of the message and the BDS register overlayed;
   - Code 28: a BDS swap has been detected and the respective information has been discarded;
   - Code 29: the track has been updated while being in the zenithal gap (also referred to as “Cone of Silence”);

- Code 30: the radar had lost track of an aircraft and subsequently re-acquired it.
- Code 32: the transponder has used a wrong Downlink Format
- Codes 33 & 34: reporting specific Transponder Anomalies.
- Code 35 indicates that a plot has been obtained despite a high probability of an IC Conflict with another interrogator.
- Code 36 indicates that a plot is in a configuration that it would be possible to detect an IC Conflict with another interrogator. Currently no potential IC Conflict has been detected.

  **NOTE:** Although implementation dependent, the use of this code should be limited to the target acquisition phase.

6. Together with Codes 35 and 36 the possibility to communicate the area within which the detection of an IC Conflict is possible was implemented in the Category 034 Specification Ref. [5] by means of Message Type 008.
7. The use of this Data Item is implementation specific and **shall** be described in the ICD of the system generating the Category 048 target reports.

### 5.2.4 Data Item I048/040, Measured Position in Polar Co-ordinates

Definition: Measured position of an aircraft in local polar co-ordinates.

Format: Four-octet fixed length Data Item.

Structure:

Octet no. 1 Octet no. 2

| 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RHO | | | | | | | | | | | | | | | LSB |

Octet no. 3 Octet no. 4

| 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| THETA | | | | | | | | | | | | | | | LSB |

bit-17 (LSB) = 1/256 NM.
Max. range = 256-(1/256) NM

bit-1 (LSB) = 360°/ $2^{16}$ = approx. 0.0055°

**Encoding Rule:**

This item shall be sent when there is a detection.

**NOTES**

1. In case of no detection, the extrapolated position expressed in slant polar co-ordinates may be sent, except for a track cancellation message. No detection is signalled by the TYP field set to zero in I048/020 Target Report Descriptor.
2. This item represents the measured target position of the plot, even if associated with a track, for the present antenna scan. It is expressed in polar co-ordinates in the local reference system, centred on the radar station.
3. In case of combined detection by a PSR and an SSR, then the SSR position is sent.
4. For targets having a range beyond the maximum range the data item “Extended Range Report” has been added to the Reserved Expansion Field of category 048. The presence of this data item is indicated by the ERR bit set to one in data item I048/020, first extension.
   The ERR data item shall only be sent if the value of RHO is equal to or greater than 256NM.
   Please note that if this data item is used, the Encoding Rule to data item I048/040 still applies, meaning that the extra item in the Reserved Expansion Field shall be transmitted in addition to data item I048/040.
   If the Extended Range Report item in the Reserved Expansion Field is used, it is recommended to set the value of RHO in data item I048/040 to its maximum, meaning bits 32/17 all set to 1.

### 5.2.5 Data Item I048/042, Calculated Position in Cartesian Co-ordinates

Definition: Calculated position of an aircraft in Cartesian co-ordinates.

Format: Four-octet fixed length Data Item in Two’s Complement.

Structure:

| Octet no. 1 | | | | | | | | Octet no. 2 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 |
| X-Component | | | | | | | | | | | | | | | LSB |

| Octet no. 3 | | | | | | | | Octet no. 4 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Y-Component | | | | | | | | | | | | | | | LSB |

bit-17 (LSB) = 1/128 NM
Max. range = ±256 NM

bit-1 (LSB) = 1/128 NM
Max. range =±256 NM

**Encoding Rule:**

This item is optional.

### 5.2.6 Data Item I048/050, Mode-2 Code in Octal Representation

Definition : Reply to Mode-2 interrogation.

Format: Two-octet fixed length Data Item.

Structure:

| Octet no. 1 | | | | | | | | Octet no. 2 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| V | G | L | 0 | A4 | A2 | A1 | B4 | B2 | B1 | C4 | C2 | C1 | D4 | D2 | D1 |

| | | | |
|---|---|---|---|
| bit-16 | (V) | = | 0 Code validated |
| | | = | 1 Code not validated |
| bit-15 | (G) | = | 0 Default |
| | | = | 1 Garbled code |
| bit-14 | (L) | = | 0 Mode-2 code as derived from the reply of the transponder |
| | | = | 1 Smoothed Mode-2 code as provided by a local tracker |
| bit-13 | | | Spare bit set to 0 |
| bits-12/1 | | | Mode-2 code in octal representation |

**Encoding Rule:**

This item is optional. When used, it shall be sent when :

- Mode-2 is present. Then, it represents the Mode-2 code for the plot, even if associated with a track.
- Mode-2 is absent and local tracking is performed. It shall then be sent with the bit-14 (L) set to one.

**NOTE -** Bit 15 has no meaning in the case of a smoothed Mode-2 and is set to 0 for a calculated track.

### 5.2.7 Data Item I048/055, Mode-1 Code in Octal Representation

Definition: Reply to Mode-1 interrogation

Format: One octet fixed length data item.

Structure:

Octet no. 1

| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|---|
| V | G | L | A4 | A2 | A1 | B2 | B1 |

| | | | |
|---|---|---|---|
| bit-8 | (V) | = 0 | Code validated |
| | | = 1 | Code not validated |
| bit-7 | (G) | = 0 | Default |
| | | = 1 | Garbled Code |
| bit-6 | (L) | = 0 | Mode-1 code as derived from the reply of the transponder. |
| | | = 1 | Smoothed Mode-1 code as provided by a local tracker. |
| bits-5/1 | | | Mode-1 code |

**Encoding Rule:**

This item is optional. When used, it shall be sent when:

- Mode-1 is present. Then, it represents the Mode-1 code for the plot, even if associated with a track.
- Mode-1 is absent and local tracking is performed. It shall then be sent with the bit-6 (L) set to one.

**NOTE -** Bit 7 has no meaning in the case of a smoothed Mode-1 and is set to 0 for a calculated track.

**NOTE -** The values of the bits for V, G, L, A4, A2, A1, B2 and B1 shall be identical to the values of the corresponding bits in subfield #5 of data item “MD5 – Mode 5 Reports” and in subfield #5 of data item “MD5 – Mode 5 Reports, New Format” in the Reserved Expansion Field.

### 5.2.8 Data Item I048/060, Mode-2 Code Confidence Indicator

Definition: Confidence level for each bit of a Mode-2 reply as provided by a monopulse SSR station.

Format: Two-octet fixed length Data Item.

Structure:

Octet no. 1 Octet no. 2

| 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | QA 4 | QA 2 | QA 1 | QB 4 | QB 2 | QB 1 | QC 4 | QC 2 | QC 1 | QD 4 | QD 2 | QD 1 |

bits-16/13 Spare bits set to 0

bits-12/1 (QXi) = 0 High quality pulse Xi
= 1 Low quality pulse Xi

**Encoding Rule:**

This data item is optional.

When used, it shall be transmitted only when at least one pulse is of low quality. It represents the confidence level for each reply bit of the Mode-2 code of the plot.

### 5.2.9 Data Item I048/065, Mode-1 Code Confidence Indicator

Definition: Confidence level for each bit of a Mode-1 reply as provided by a monopulse SSR station.

Format: One-octet fixed length Data Item.

Structure:

Octet no. 1

| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | QA 4 | QA 2 | QA 1 | QB 2 | QB 1 |

bits-8/6 Spare bits set to zero

bits-5/1 (QXi) = 0 High quality pulse Xi
= 1 Low quality pulse Xi

**Encoding Rule:**

This data item is optional.

When used, it shall be transmitted only when at least one pulse is of low quality. It represents the confidence level for each reply bit of the Mode-1 code of the plot.

### 5.2.10 Data Item I048/070, Mode-3/A Code in Octal Representation

Definition: Mode-3/A code converted into octal representation.

Format: Two-octet fixed length Data Item.

Structure:

| Octet no. 1 | | | | | | | | Octet no. 2 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| V | G | L | 0 | A4 | A2 | A1 | B4 | B2 | B1 | C4 | C2 | C1 | D4 | D2 | D1 |

| | | | |
|---|---|---|---|
| bit-16 | (V) | = 0 | Code validated |
| | | = 1 | Code not validated |
| bit-15 | (G) | = 0 | Default |
| | | = 1 | Garbled code |
| bit-14 | (L) | = 0 | Mode-3/A code derived from the reply of the transponder |
| | | = 1 | Mode-3/A code not extracted during the last scan |
| bit-13 | | Spare bit set to 0 | |
| bits-12/1 | | Mode-3/A reply in octal representation | |

**Encoding Rule:**

- When Mode-3/A code is present, this item shall be sent. Then, it represents the Mode-3/A code for the plot, even if associated with a track.
- When Mode-3/A code is absent and local tracking is performed, it shall be sent with the bit-14 (L) set to one.
- For Mode S, once a Mode-3/A code is seen, that code shall be sent every scan, provided the radar is receiving replies for that aircraft.

**NOTES**

1. Bit 15 has no meaning in the case of a smoothed Mode-3/A code and is set to 0 for a calculated track. For Mode S, it is set to one when an error correction has been attempted.
2. For Mode S, bit 16 is normally set to zero, but can exceptionally be set to one to indicate a non-validated Mode-3/A code (e.g. alert condition detected, but new Mode-3/A code not successfully extracted).

### 5.2.11 Data Item I048/080, Mode-3/A Code Confidence Indicator

Definition: Confidence level for each bit of a Mode-3/A reply as provided by a monopulse SSR station.

Format: Two-octet fixed length Data Item.

Structure:

| Octet no. 1 | | | | | | | | Octet no. 2 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 0 | 0 | 0 | 0 | QA 4 | QA 2 | QA 1 | QB 4 | QB 2 | QB 1 | QC 4 | QC 2 | QC 1 | QD 4 | QD 2 | QD 1 |

bits-16/13 Spare bits set to 0

bits-12/1 (QXi) = 0 High quality pulse Xi
= 1 Low quality pulse Xi

**Encoding Rule:**

This data item is optional.

When used, it shall be transmitted only when at least one pulse is of low quality. It represents the confidence level for each reply bit of the Mode-3/A code of the plot.

### 5.2.12 Data Item I048/090, Flight Level in Binary Representation

Definition: Flight Level converted into binary representation.

Format: Two-octet fixed length Data Item.

Structure:

Octet no. 1 Octet no. 2

| 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| V | G | Flight Level | | | | | | | | | | | | | LSB |

| | | | |
|---|---|---|---|
| bit-16 | (V) | = 0 | Code validated |
| | | = 1 | Code not validated |
| bit-15 | (G) | = 0 | Default |
| | | = 1 | Garbled code |
| bits-14/1 | (Flight Level) | | LSB= 1/4 FL |

**Encoding Rule:**

This data item shall be sent when Mode C code or Mode S altitude code is present and decodable. It represents the flight level of the plot, even if associated with a track.

**NOTES**

1. When Mode C code / Mode S altitude code is present but not decodable, the “Undecodable Mode C code / Mode S altitude code” Warning/Error should be sent in I048/030.
2. When local tracking is applied and the received Mode C code / Mode S altitude code corresponds to an abnormal value (the variation with the previous plot is estimated too important by the tracker), the “Mode C code / Mode S altitude code abnormal value compared to the track“ Warning/Error should be sent in I048/030.
3. The value shall be within the range described by ICAO Annex 10
4. For Mode S, bit 15 (G) is set to one when an error correction has been attempted.

### 5.2.13 Data Item I048/100, Mode-C Code and Code Confidence Indicator

Definition: Mode-C height in Gray notation as received from the transponder together with the confidence level for each reply bit as provided by a MSSR/Mode S station.

Format: Four-octet fixed length Data Item.

Structure:

| Octet no. 1 | | | | | | | | Octet no. 2 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 |
| V | G | 0 | 0 | C1 | A1 | C2 | A2 | C4 | A4 | B1 | D1 | B2 | D2 | B4 | D4 |

| Octet no. 3 | | | | | | | | Octet no. 4 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 0 | 0 | 0 | 0 | QC 1 | QA 1 | QC 2 | QA 2 | QC 4 | QA 4 | QB 1 | QD 1 | QB 2 | QD 2 | QB 4 | QD 4 |

| | | | |
|---|---|---|---|
| bit-32 | (V) | = 0 | Code validated |
| | | = 1 | Code not validated |
| bit-31 | (G) | = 0 | Default |
| | | = 1 | Garbled code |
| bits-30/29 | | | Spare bits set to 0 |
| bits-28/17 | | | Mode-C reply in Gray notation |
| bits-16/13 | | | Spare bits set to 0 |
| bits-12/1 | (QXi) | = 0 | High quality pulse Xi |
| | | = 1 | Low quality pulse Xi |

**Encoding Rule:**

This data item is optional.

When used, it shall only be sent when a not validated or undecodable Mode C code has been received. For Mode A/C, it represents the confidence level for each reply bit of the Mode C code of the plot. For Mode S, if this item is sent because of an undecodable Mode-C code received in a Mode S altitude reply, all pulse quality bits will be set to high (zero).

**NOTES**

1. For Mode S, D1 is also designated as Q, and is used to denote either 25ft or 100ft reporting.
2. For Mode S, bit-31 (G) is set when an error correction has been attempted.

### 5.2.14 Data Item I048/110, Height Measured by a 3D Radar

Definition: Height of a target as measured by a 3D radar. The height shall use mean sea level as the zero reference level.

Format: Two-octet fixed length Data Item.

Structure:

| Octet no.1 | | | | | | | | Octet no.2 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 0 | 0 | 3D-Height | | | | | | | | | | | | | LSB |

| | | |
|---|---|---|
| bits-16/15 | | Spare bits set to zero |
| bits-14/1 | (3D-Height) | 3D height, in binary notation. Negative values are expressed in two's complement<br>LSB = 25 ft |

**Encoding Rule:**

This data item is optional.

### 5.2.15 Data Item I048/120, Radial Doppler Speed

Definition: Information on the Doppler Speed of the target report.

Format: Compound Data Item, comprising a primary subfield of one octet, followed by one of the two defined subfields.

Structure of
Primary Subfield:

Octet no.1

| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|---|
| CAL | RDS | 0 | 0 | 0 | 0 | 0 | FX |

| | | | |
|---|---|---|---|
| bit-8 | (CAL) | | Subfield #1: Calculated Doppler Speed |
| | | = 0 | Absence of Subfield #1 |
| | | = 1 | Presence of Subfield #1 |
| bit-7 | (RDS) | | Subfield #2: Raw Doppler Speed |
| | | = 0 | Absence of Subfield #2 |
| | | = 1 | Presence of Subfield #2 |
| bits-6/2 | (Spare) | | Subfields #3/7: Spare |
| | | = 0 | Absence of Subfield |
| | | = 1 | Presence of Subfield |
| bit-1 | (FX) | = 0 | End of Data Item |
| | | = 1 | Extension into first extension |

Structure of Subfield # 1:

Calculated Doppler Speed

| Octet no.1 | | | | | | | | Octet no. 2 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| D | 0 | 0 | 0 | 0 | 0 | CAL | | | | | | | | | LSB |

| | | | |
|---|---|---|---|
| bit-16 | (D) | = 0 | Doppler speed is valid |
| | | = 1 | Doppler speed is doubtful |
| bits-15/11 | (Spare) | | Fixed to zero |
| bits-10/1 | (CAL) | | Calculated Doppler Speed, coded in two’s complement<br>LSB= 1 m/sec |

**NOTE -** Although the meaning of a positive or negative value is implementation dependent and **shall** be described in the ICD of the system generating the ASTERIX record, it is recommended to transmit a positive value for targets moving away from the radar.

Structure of Subfield # 2:
Raw Doppler Speed

Octet no.1

| 56 | 55 | 54 | 53 | 52 | 51 | 50 | 49 |
|---|---|---|---|---|---|---|---|
| REP | | | | | | | |

Octet no.2 Octet no.3

| 48 | 47 | 46 | 45 | 44 | 43 | 42 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DOP | | | | | | | | | | | | | | | LSB |

Octet no.4 Octet no. 5

| 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AMB | | | | | | | | | | | | | | | LSB |

Octet no.6 Octet no. 7

| 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FRQ | | | | | | | | | | | | | | | LSB |

| | | |
|---|---|---|
| bits-56/49 | (REP) | Repetition Factor |
| bit-48/33 | (DOP) | Doppler Speed<br>LSB= 1 m/sec |
| bits-32/17 | (AMB) | Ambiguity Range<br>LSB= 1 m/sec |
| bits-16/1 | (FRQ) | Transmitter Frequency<br>LSB= 1 Mhz |

**Encoding Rule:**

This data item is optional. When used, only one secondary subfield shall be present.

### 5.2.16 Data Item I048/130, Radar Plot Characteristics

Definition: Additional information on the quality of the target report.

Format: Compound Data Item.

Structure of Primary Subfield:

Octet no.1

| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|---|
| SRL | SRR | SAM | PRL | PAM | RPD | APD | FX |

| | | | |
|---|---|---|---|
| bit-8 | (SRL) | | Subfield #1: SSR plot runlength |
| | | = 0 | Absence of Subfield #1 |
| | | = 1 | Presence of Subfield #1 |
| bit-7 | (SRR) | | Subfield #2: Number of received replies for M(SSR) |
| | | = 0 | Absence of Subfield #2 |
| | | = 1 | Presence of Subfield #2 |
| bit-6 | (SAM) | | Subfield #3: Amplitude of received replies for M(SSR) |
| | | = 0 | Absence of Subfield #3 |
| | | = 1 | Presence of Subfield #3 |
| bit-5 | (PRL) | | Subfield #4: PSR plot runlength |
| | | = 0 | Absence of Subfield #4 |
| | | = 1 | Presence of Subfield #4 |
| bit-4 | (PAM) | | Subfield #5: PSR amplitude |
| | | = 0 | Absence of Subfield #5 |
| | | = 1 | Presence of Subfield #5 |
| bit-3 | (RPD) | | Subfield #6: Difference in Range between PSR and SSR plot |
| | | = 0 | Absence of Subfield #6 |
| | | = 1 | Presence of Subfield #6 |
| bit-2 | (APD) | | Subfield #7: Difference in Azimuth between PSR and SSR plot |
| | | = 0 | Absence of Subfield #7 |
| | | = 1 | Presence of Subfield #7 |
| bit-1 | (FX) | = 0 | End of Primary Subfield |
| | | = 1 | Extension of Primary Subfield into next octet |

Structure of Subfield # 1:
SSR Plot Runlength

Octet no.1

| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|---|
| SRL | | | | | | | LSB |

bits-8/1 (SRL) SSR plot runlength, expressed as a positive binary value.

LSB=360/$2^{13}$ dg (0.044 dg)

**NOTE -** The total range covered is therefore from 0 to 11.21 dg.

Structure of Subfield # 2:
Number of Received Replies for (M)SSR

Octet no.1

| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|---|
| SRR | | | | | | | LSB |

bits-8/1 (SRR) Number of received replies for (M)SSR

LSB= 1

Structure of Subfield # 3:
Amplitude of (M)SSR Reply

Octet no.1

| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|---|
| SAM | | | | | | | LSB |

bits-8/1 (SAM) Amplitude of (M)SSR reply

LSB= 1 dBm

**NOTE -** Negative values are coded in two’s complement form.

Structure of Subfield # 4:

Primary Plot Runlength

Octet no.1

| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|---|
| PRL | | | | | | | LSB |

bits-8/1 (PRL) Primary Plot Runlength, expressed as positive binary value

LSB= $360/2^{13}$ dg (0.044 dg)

**NOTE -** The total range covered is therefore from 0 to 11.21 dg.

Structure of Subfield # 5:

Amplitude of Primary Plot

Octet no.1

| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|---|
| PAM | | | | | | | LSB |

bits-8/1 (PAM) Amplitude of Primary Plot

LSB= 1 dBm

**NOTE -** Negative values are coded in two’s complement form.

Structure of Subfield # 6:

Difference in Range between PSR and SSR plot

Octet no.1

| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|---|
| RPD | | | | | | | LSB |

bits-8/1 (RPD) Range (PSR-SSR)

LSB= 1/256 NM

**NOTES**

1. Negative values are coded in two's complement form.
2. The covered range difference is +/- 0.5 NM.
3. Sending the maximum value means that the difference in range is equal or greater than the maximum value.

Structure of Subfield # 7:

Difference in Azimuth between PSR and SSR plot

Octet no.1

| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|---|
| APD | | | | | | | LSB |

bits-8/1 (APD) Azimuth (PSR-SSR)

LSB= $360/2^{14}$ dg

**NOTES**

1. Negative values are coded in two's complement form.
2. The covered azimuth difference is $+/-360/2^7 = +/- 2.8125$ dg.
3. Sending the maximum value means that the difference in range is equal or greater than the maximum value.

**Encoding Rule:**

This data item is optional.
When used, all secondary subfields are optional.

Recommendation: For a combined target report, subfields RPD and APD of primary subfield should be present.

### 5.2.17 Data Item I048/140, Time of Day

Definition: Absolute time stamping expressed as Co-ordinated Universal Time (UTC).

Format: Three-octet fixed length Data Item.

Structure:

| Octet no. 1 | | | | | | | | Octet no. 2 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 |
| Time-of-Day | | | | | | | | | | | | | | | |

| Octet no. 3 | | | | | | | |
|---|---|---|---|---|---|---|---|
| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| | | | | | | | LSB |

| | | |
|---|---|---|
| bits-24/1 | (Time-of-Day) | Acceptable Range of values:<br>0<= Time-of-Day<=24 hrs |
| bit-1 | (LSB) | = $2^{-7}$ seconds = 1/128 seconds |

**Encoding Rule:**

This data item shall be present in every ASTERIX record, except in case of failure of all sources of time-stamping.

The time information, coded in three octets, shall reflect the exact time of an event, expressed as a number of 1/128 s elapsed since last midnight.

**NOTES**

1. The time of day value is reset to 0 each day at midnight.
2. Every radar station using ASTERIX should be equipped with at least one synchronised time source

### 5.2.18 Data Item I048/161, Track Number

Definition: An integer value representing a unique reference to a track record within a particular track file.

Format: Two-octet fixed length Data Item.

Structure:

| Octet no. 1 | | | | | | | | Octet no. 2 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| 0 | 0 | 0 | 0 | TRACK NUMBER (0..4095) | | | | | | | | | | | |

**Encoding Rule:**

This data item shall be sent when the radar station outputs tracks.

### 5.2.19 Data Item I048/170, Track Status

Definition: Status of monoradar track (PSR and/or SSR updated).

Format: Variable length Data Item comprising a first part of one-octet, followed by one-octet extents as necessary.

Structure of First Part:

Octet no.1

| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|---|
| CNF | RAD | | DOU | MAH | CDM | | FX |

| | | | |
|---|---|---|---|
| bit-8 | (CNF) | | Confirmed vs. Tentative Track |
| | | = 0 | Confirmed Track |
| | | = 1 | Tentative Track |
| bits-7/6 | (RAD) | | Type of Sensor(s) maintaining Track |
| | | = 00 | Combined Track |
| | | = 01 | PSR Track |
| | | = 10 | SSR/Mode S Track |
| | | = 11 | Invalid |
| bit-5 | (DOU) | | Signals level of confidence in plot to track association process |
| | | = 0 | Normal confidence |
| | | = 1 | Low confidence in plot to track association. |
| bit-4 | (MAH) | | Manoeuvre detection in Horizontal Sense |
| | | = 0 | No horizontal man.sensed |
| | | = 1 | Horizontal man. sensed |
| bits-3/2 | (CDM) | | Climbing / Descending Mode |
| | | = 00 | Maintaining |
| | | = 01 | Climbing |
| | | = 10 | Descending |
| | | = 11 | Unknown |
| bit-1 | (FX) | = 0 | End of Data Item |
| | | = 1 | Extension into first extent |

**NOTE -** RAD can change after a number of non-matching with TYP in item 020.

Structure
of First Extent:

Octet no.2

| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|---|
| TRE | GHO | SUP | TCC | 0 | 0 | 0 | FX |

| | | | |
|---|---|---|---|
| bit-8 | (TRE) | | Signal for End_of_Track |
| | | = 0 | Track still alive |
| | | = 1 | End of track lifetime(last report for this track) |
| bit-7 | (GHO) | | Ghost vs. true target |
| | | = 0 | True target track. |
| | | = 1 | Ghost target track. |
| bit-6 | (SUP) | | Track maintained with track information from neighbouring Node B on the cluster, or network |
| | | = 0 | no |
| | | = 1 | yes |
| bit-5 | (TCC) | | Type of plot coordinate transformation mechanism: |
| | | = 0 | Tracking performed in so-called 'Radar Plane', i.e. neither slant range correction nor stereographical projection was applied. |
| | | = 1 | Slant range correction and a suitable projection technique are used to track in a 2D.reference plane, tangential to the earth model at the Radar Site co-ordinates. |
| bits-4/2 | (spare) | | Spare bits, set to 0 |
| bit-1 | (FX) | = 0 | End of Data Item |
| | | = 1 | Extension into second extent |

**Encoding Rule:**

This data item shall be sent when the radar station outputs tracks.

### 5.2.20 Data Item I048/200, Calculated Track Velocity in Polar Co-ordinates

Definition: Calculated track velocity expressed in polar co-ordinates.

Format: Four-octet fixed length Data Item.

Structure:

| Octet no. 1 | | | | | | | | Octet no. 2 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 |
| CALCULATED GROUNDSPEED (max. 2 NM/s) | | | | | | | | | | | | | | | LSB |

| Octet no. 3 | | | | | | | | Octet no. 4 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| CALCULATED HEADING | | | | | | | | | | | | | | | LSB |

bit-17 (LSB) = $(2^{-14})$ NM/s = approx. 0.22 kt

bit-1 (LSB) = $360° / 2^{16}$ = approx. 0.0055°

**Encoding Rule:**

This data item shall be sent when the radar station outputs tracks, except for a track cancellation message.

**NOTE -** The calculated heading is related to the geographical North at the aircraft position.

### 5.2.21 Data Item I048/210, Track Quality

Definition: Track quality in the form of a vector of standard deviations.

Format: Four-octet fixed length Data Item.

Structure:

Octet no.1

| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|---|
| Sigma (X) | | | | | | | LSB |

| | | |
|---|---|---|
| bits-8/1 | (Sigma (X)) | Standard Deviation on the horizontal axis of the local grid system |
| bit-1 | (LSB) | = 1/128 NM |

**NOTE -** The standard deviation is per definition a positive value, hence the range covered is : 0<= Sigma(X)<2 NM

Octet no.2

| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|---|
| Sigma (Y) | | | | | | | LSB |

| | | |
|---|---|---|
| bits-8/1 | (Sigma (Y)) | Standard Deviation on the vertical axis of the local grid system |
| bit-1 | (LSB) | = 1/128 NM |

**NOTE -** The standard deviation is per definition a positive value, hence the range covered is: 0<= Sigma (Y)<2 NM

Octet no.3

| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|---|
| Sigma (V) | | | | | | | LSB |

| | | |
|---|---|---|
| bits-8/1 | (Sigma (V)) | Standard Deviation on the groundspeed within the local grid system |
| bit-1 | (LSB) | = ($2^{-14}$) NM/s = 0.22 Kt |

**NOTE -** The standard deviation is per definition a positive value, hence the range covered is: 0<=Sigma (V)<56.25 Kt

Octet no.4

| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|---|
| Sigma (H) | | | | | | | LSB |

| | | |
|---|---|---|
| bits-8/1 | (Sigma (H)) | Standard Deviation on the heading within the local grid system |
| bit-1 | (LSB) | = 360/($2^{12}$) degrees = 0.08789 degrees |

**NOTE -** The standard deviation is per definition a positive value; hence the range covered is: 0 <= sigma (H) < 22.5 degrees.

**Encoding Rule:**

This item is optional.

### 5.2.22 Data Item I048/220, Aircraft Address

Definition: Aircraft address (24-bits Mode S address) assigned uniquely to each aircraft.

Format: Three-octet fixed length Data Item.

Structure:

Octet no. 1

| 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 |
|---|---|---|---|---|---|---|---|
| AIRCRAFT | | | | | | | |

Octet no. 2 Octet no. 3

| 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ADDRESS | | | | | | | | | | | | | | | |

| | |
|---|---|
| bits-24/1 | 24-bits Mode S address, A23 to A0 |

**Encoding Rule:**

This item shall be present in every ASTERIX record conveying data related to a Mode S target, except for an "End of Track Message" (i.e. I048/170, First Extension, Bit 8 is set to "1") in which this Data Item is optional.

**NOTE -** The Encoding Rule for Data Item I048/220 has been relaxed in Edition 1.30 for the "End of Track Message". In order to prevent interoperability problems it is recommended that systems sending I048/220 in an "End of Track Message" continue to do so.

### 5.2.23 Data Item I048/230, Communications/ACAS Capability and Flight Status

Definition: Communications capability of the transponder, capability of the on-board ACAS equipment and flight status.

Format: Two-octet fixed length Data Item.

Structure:

Octet no. 1 Octet no. 2

| 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COM | | | STAT | | | SI | 0 | MSSC | ARC | AIC | B1A | B1B | | | |

| | | | |
|---|---|---|---|
| bits-16/14 | (COM) | | Communications capability of the transponder |
| | | = 0 | No communications capability (surveillance only) |
| | | = 1 | Comm. A and Comm. B capability |
| | | = 2 | Comm. A, Comm. B and Uplink ELM |
| | | = 3 | Comm. A, Comm. B, Uplink ELM and Downlink ELM |
| | | = 4 | Level 5 Transponder capability |
| | | 5 to 7 | Not assigned |
| bits-13/11 | (STAT) | | Flight Status |
| | | = 0 | No alert, no SPI, aircraft airborne |
| | | = 1 | No alert, no SPI, aircraft on ground |
| | | = 2 | Alert, no SPI, aircraft airborne |
| | | = 3 | Alert, no SPI, aircraft on ground |
| | | = 4 | Alert, SPI, aircraft airborne or on ground |
| | | = 5 | No alert, SPI, aircraft airborne or on ground |
| | | = 6 | Not assigned |
| | | = 7 | Unknown |
| bit-10 | (SI) | | SI/II Transponder Capability |
| | | = 0 | SI-Code Capable |
| | | = 1 | II-Code Capable |
| bit-9 | (spare) | | spare bit set to zero |
| bit-8 | (MSSC) | | Mode-S Specific Service Capability |
| | | = 0 | No |
| | | = 1 | Yes |
| bit-7 | (ARC) | | Altitude reporting capability |
| | | = 0 | 100 ft resolution |
| | | = 1 | 25 ft resolution |
| bit-6 | (AIC) | | Aircraft identification capability |
| | | = 0 | No |
| | | = 1 | Yes |
| bit-5 | (B1A) | | BDS 1,0 bit 16 |
| bits 4/1 | (B1B) | | BDS 1,0 bits 37/40 |

**Encoding Rule:**

This item shall be present in every ASTERIX record conveying data related to a Mode S target, except for an “End of Track Message” (i.e. I048/170, First Extension, Bit 8 is set to “1”) in which this Data Item is optional. If the datalink capability has not been extracted yet, bits 16/14 shall be set to zero.

**NOTE -** The Encoding Rule for Data Item I048/230 has been relaxed in Edition 1.30 for the “End of Track Message”. In order to prevent interoperability problems it is recommended that systems sending I048/230 in an “End of Track Message” continue to do so.

### 5.2.24 Data Item I048/240, Aircraft Identification

| | |
|---|---|
| Definition: | Aircraft identification (in 8 characters) obtained from an aircraft equipped with a Mode S transponder. |
| Format: | Six-octet fixed length Data Item. |
| Structure: | |

| Octet no. 1 | | | | | | | | Octet no. 2 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 48 | 47 | 46 | 45 | 44 | 43 | 42 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 |
| MSB Character 1 | | | | | | Character 2 | | | | | | Character 3 | | | |

| Octet no. 3 | | | | | | | | Octet no. 4 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 |
| | | Character 4 | | | | | | Character 5 | | | | | | | |

| Octet no. 5 | | | | | | | | Octet no. 6 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| Character 6 | | | | Character 7 | | | | | | Character 8 | | | | | LSB |

| | |
|---|---|
| bits-48/1 | Characters 1-8 (coded on 6 bits each) defining aircraft identification when flight plan is available or the registration marking when no flight plan is available. |

**Encoding Rule:**

After the first extraction of aircraft identification, this item shall be present in every ASTERIX record conveying data related to a Mode S target, except for an “End of Track Message” (i.e. I048/170, First Extension, Bit 8 is set to “1”) in which this Data Item is optional. Bit-48 is the MSB of character 1. Bit-1 is the LSB of character 8.

**NOTE -** This data item contains the flight identification as available in the respective Mode S transponder registers.

**NOTE -** The Encoding Rule for Data Item I048/240 has been relaxed in Edition 1.30 for the “End of Track Message”. In order to prevent interoperability problems it is recommended that systems sending I048/240 in an “End of Track Message” continue to do so.

### 5.2.25 Data Item I048/250, BDS Register Data

Definition: BDS Register Data as extracted from the aircraft transponder.

Format: Repetitive Data Item starting with a one-octet Field Repetition Indicator (REP) followed by at least one BDS Register comprising one seven octet BDS Register Data and one octet BDS Register code.

Structure:

Octet no. 1

| 72 | 71 | 70 | 69 | 68 | 67 | 66 | 65 |
|---|---|---|---|---|---|---|---|
| REP | | | | | | | |

Octet no. 2 Octet no. 3

| 64 | 63 | 62 | 61 | 60 | 59 | 58 | 57 | 56 | 55 | 54 | 53 | 52 | 51 | 50 | 49 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MSB | | | | | | | | | BDS | | | | | | |

Octet no. 4 Octet no. 5

| 48 | 47 | 46 | 45 | 44 | 43 | 42 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

Octet no. 6 Octet no. 7

| 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | DATA | | | | | | | |

Octet no. 8 Octet no. 9

| 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | LSB | BDS1 | | | | BDS2 | | | |

| | | |
|---|---|---|
| bits-72/65 | (REP) | Repetition factor |
| bits-64/9 | (BDSDATA) | 56-bit message conveying BDS Register Data |
| bits-8/5 | (BDS1) | BDS Register Address 1 |
| bits-4/1 | (BDS2) | BDS Register Address 2 |

**Encoding Rule:**

This item shall be present in every ASTERIX record conveying data related to a Mode S target, provided BDS Register Data has been extracted in the last scan. In an “End of Track Message” (i.e.

I048/170, First Extension, Bit 8 is set to “1”) this Data Item is optional.

**NOTES**

1. For the transmission of BDS Register 2,0, Data Item I048/240 is used.
2. For the transmission of BDS Register 3,0, Data Item I048/260 is used. In case of ACAS $X_u$ (as defined in [3]), the Resolution Advisory consists of two parts (BDS Register 3,0 and BDS Register 3,1). BDS Register 3,1 will be transmitted using Data Item I048/250. For the detailed definition of BDS Register 3,0 and 3,1please refer to [2] Tables B-3-48a and B-3-49.
3. In case of data extracted via Comm-B broadcast, all bits of fields BDS1 and BDS2 are set to 0; in case of data extracted via GICB requests, the fields BDS1 and BDS2 correspond to the GICB register number.
4. The Encoding Rule for Data Item I048/250 has been relaxed in Edition 1.30 for the “End of Track Message”. In order to prevent interoperability problems it is recommended that systems sending I048/250 in an “End of Track Message” continue to do so.

### 5.2.26 Data Item I048/260, ACAS Resolution Advisory Report

Definition: Currently active Resolution Advisory (RA), if any, generated by the ACAS associated with the transponder transmitting the report and threat identity data.

Format: Seven-octet fixed length Data Item.

Structure:

| Octet no. 1 | | | | | | | | Octet no. 2 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 56 | 55 | 54 | 53 | 52 | 51 | 50 | 49 | 48 | 47 | 46 | 45 | 44 | 43 | 42 | 41 |
| | | | | | | | | | | | | | | | |

| Octet no. 3 | | | | | | | | Octet no. 4 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 |
| ACASRA | | | | | | | | | | | | | | | |

| Octet no. 5 | | | | | | | | Octet no. 6 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 |
| | | | | | | | | | | | | | | | |

| Octet 7 | | | | | | | |
|---|---|---|---|---|---|---|---|
| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| | | | | | | | |

| | | |
|---|---|---|
| bits-56/1 | (ACASRA) | Currently active ACAS Resolution Advisory (RA) |

**Encoding Rule:**

This item shall be present when a Resolution Advisory (RA) has been generated in the last scan.

**NOTES**

1. Refer to ICAO Draft SARPs for ACAS for detailed explanations.
2. In case of ACAS $X_u$, the Resolution Advisory consists of two parts (BDS30 and BDS31). BDS31 will be transmitted using item 250.

## 5.3 Transmission of Surveillance Information

### 5.3.1 Standard User Application Profile

The following standard UAP shown in Table 2 shall be used for the transmission of surveillance data from primary, SSR/ModeS or combined primary-SSR/Mode S radars:

Table 2 - Standard UAP

| FRN | Data Item | Data Item Description | Length in Octets |
|---|---|---|---|
| 1 | I048/010 | Data Source Identifier | 2 |
| 2 | I048/140 | Time-of-Day | 3 |
| 3 | I048/020 | Target Report Descriptor | 1+ |
| 4 | I048/040 | Measured Position in Slant Polar Coordinates | 4 |
| 5 | I048/070 | Mode-3/A Code in Octal Representation | 2 |
| 6 | I048/090 | Flight Level in Binary Representation | 2 |
| 7 | I048/130 | Radar Plot Characteristics | 1+1+ |
| FX | n.a. | Field Extension Indicator | n.a. |
| 8 | I048/220 | Aircraft Address | 3 |
| 9 | I048/240 | Aircraft Identification | 6 |
| 10 | I048/250 | Mode S MB Data | 1+8*n |
| 11 | I048/161 | Track Number | 2 |
| 12 | I048/042 | Calculated Position in Cartesian Coordinates | 4 |
| 13 | I048/200 | Calculated Track Velocity in Polar Representation | 4 |
| 14 | I048/170 | Track Status | 1+ |
| FX | n.a. | Field Extension Indicator | n.a. |
| 15 | I048/210 | Track Quality | 4 |
| 16 | I048/030 | Warning/Error Conditions/Target Classification | 1+ |
| 17 | I048/080 | Mode-3/A Code Confidence Indicator | 2 |
| 18 | I048/100 | Mode-C Code and Confidence Indicator | 4 |
| 19 | I048/110 | Height Measured by 3D Radar | 2 |
| 20 | I048/120 | Radial Doppler Speed | 1+ |
| 21 | I048/230 | Communications / ACAS Capability and Flight Status | 2 |
| FX | n.a. | Field Extension Indicator | n.a. |
| 22 | I048/260 | ACAS Resolution Advisory Report | 7 |
| 23 | I048/055 | Mode-1 Code in Octal Representation | 1 |
| 24 | I048/050 | Mode-2 Code in Octal Representation | 2 |
| 25 | I048/065 | Mode-1 Code Confidence Indicator | 1 |
| 26 | I048/060 | Mode-2 Code Confidence Indicator | 2 |
| 27 | SP-Data Item | Special Purpose Field | 1+1+ |
| 28 | RE-Data Item | Reserved Expansion Field | 1+1+ |
| FX | n.a. | Field Extension Indicator | n.a. |

In the above table

- the first column indicates the Field Reference Number (FRN) associated to each Data Item used in the UAP;
- the fourth column gives the format and the length of each item, a stand-alone figure indicates the octet-count of a fixed-length Data Item, 1+

indicates a variable-length Data Item comprising a first part of 1 octet followed by n-octets extents as necessary.

EUROCONTROL

**SUPPORTING EUROPEAN AVIATION**

www.eurocontrol.int