EUROPEAN ORGANISATION FOR THE SAFETY OF
AIR NAVIGATION

EUROCONTROL

EUROCONTROL STANDARD DOCUMENT

FOR

SURVEILLANCE DATA EXCHANGE

Part 4 : Category 048

Transmission of Monoradar Target Reports

SUR.ET1.ST05.2000-STD-04-01

Edition	:	1.19
Edition Date	:	March 2011
Status	:	Released Issue
Class	:	General Public

EUROPEAN AIR TRAFFIC MANAGEMENT

DOCUMENT IDENTIFICATION SHEET

DOCUMENT DESCRIPTION

Document Title

Surveillance Data Exchange - Part 4

Transmission of Monoradar Target Reports

EWP DELIVERABLE REFERENCE NUMBER

PROGRAMME REFERENCE INDEX	**EDITION :**	1.19
SUR.ET1.ST05.2000-STD-04-01	**EDITION DATE :**	March 2011

Abstract

This document describes the application of ASTERIX to the transmission of Monoradar target reports from a PSR, SSR, MSSR or Mode S station. It is based on an amalgamation of Part 2a edition 1.0 and of a Working Draft of Part 4.

Keywords

Monoradar Data, ASTERIX, UAP, Target Reports, Data Item, Category 48

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DOCUMENT STATUS AND TYPE

STATUS		CATEGORY		CLASSIFICATION	
Working Draft	☐	Executive Task	☐	General Public	☑
Draft	☐	Specialist Task	☐	EATMP	☐
Proposed Issue	☐	Lower Layer Task	☑	Restricted	☐
Released Issue	☑				

ELECTRONIC BACKUP

INTERNAL REFERENCE NAME : Asterix - Part 4

HOST SYSTEM	MEDIA	SOFTWARE(S)
Microsoft Windows	Type : Hard disk	
	Media Identification :	

DOCUMENT APPROVAL

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

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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: Category 048 - Part 4 Category 017 - Part 5 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. Document renamed to apply to PSR, SSR, MSSR as well as Mode S radars. Minor modifications in items 030, 070, 090, 100, 130, 140, 200, 240, 250	ALL 1.2 Scope Updated See respective Data Items
0.9a	October 1998	Introduction updated to keep in line with Part1 I048/120 Doppler Speed redesigned I048/170 Track Status : • Vertical Manoeuvre renamed Climbing/Descending Mode and expanded to 2 bits • bits reshuffled in Octet 1 I048/230 modified	1. See I048/120 See I048/170 See I048/230
0.9b	January 1999	• Item 260 modified. • Minor modifications in the encoding rules and notes of items 030, 100, 230, 240, 250. • Reserved Expansion Indicator added in UAP. • 1.1.3 and 1.2 suppressed	See respective items 5.3
1.11	March 1999	• editorial corrections	ALL
1.12	September 1999	• encoding rules and notes modifications in items 070, 100, 230 • 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 • SI/II Indication added to I048/230	2.2 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) • Signature Page updated	

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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.

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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 Standard 000-1-92. Directives for the Uniform Drafting and Presentation of Eurocontrol Standard Documents. 1992.
2. Eurocontrol Standard SUR.ET1.ST05.2000-STD-01-01. All Purpose Structured Eurocontrol Surveillance Information Exchange - ASTERIX. Edition 1.30, Released Issue, November 2007.

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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
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
ICAO	International Civil Aviation Organization
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
RDE-TF	suRveillance Data Exchange Task Force
RDP	Radar Data Processing
REP	Field Repetition Indicator
RSSP	Radar Systems Specialist Panel

s	second, unit of time
SAC	System Area Code
SARPs	Standards and Recommended Practices (ICAO)
SDP	Surveillance Data Processing (system)
SIC	System Identification Code
SP	Special Purpose Indicator
SPI	Special Position Identification
SSR	Secondary Surveillance Radar
STFRDE	Surveillance Task Force on Radar Data Exchange
SURT	Surveillance Team (EATMP)
TCAS	Traffic Alert and Collision-Avoidance System
UAP	User Application Profile (see Definitions)
UTC	Co-ordinated Universal Time
W/E	Warning/Error Condition

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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

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

4.6.2.2 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

4.7.1 Messages shall be composed of Data Items assembled in the order defined by the Field Reference Number (FRN) in the associated UAP.

4.7.2 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	N.A.
I048/040	Measured Position in Slant Polar Co-ordinates	RHO: 1/256 NM THETA: $360^\circ/(2^{16})$
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	(2^{-14}) NM/s
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 Heading: $360^\circ/(2^{16})$
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 are received.

Format: Two-octet fixed length Data Item.

Structure:

<table>
<tr><th colspan="8">Octet no. 1</th><th colspan="8">Octet no. 2</th></tr>
<tr><td>16</td><td>15</td><td>14</td><td>13</td><td>12</td><td>11</td><td>10</td><td>9</td><td>8</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td></tr>
<tr><td colspan="8">SAC</td><td colspan="8">SIC</td></tr>
</table>

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.

NOTES

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 Extent:

Octet no. 1

8	7	6	5	4	3	2	1
TST	0	0	ME	MI	FOE/FRI		FX

bit-8	(TST)	= 0	Real target report
		= 1	Test target report
bits-7/6	(spare)		spare bits set to zero
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

Encoding Rule:

This Data Item shall be present in every target record.

5.2.3 Data Item I048/030, Warning/Error Conditions

Definition: Warning/error conditions detected by a radar station for the target report 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
W/E Value							FX

bits-8/2 (W/E Value) Warning/error condition value

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

Warning/Error 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
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

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.

NOTES

1. It has to be stressed that a series of one or more W/E conditions 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. Definitions can be found in SUR.ET1.ST03.1000-STD-01-01 Radar Sensor Performance Analysis.

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 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.

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 .

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.

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	QA4	QA2	QA1	QB4	QB2	QB1	QC4	QC2	QC1	QD4	QD2	QD1

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	QA4	QA2	QA1	QB2	QB1

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	QA4	QA2	QA1	QB4	QB2	QB1	QC4	QC2	QC1	QD4	QD2	QD1

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	QC1	QA1	QC2	QA2	QC4	QA4	QB1	QD1	QB2	QD2	QB4	QD4

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 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	0

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-6/1	(Spare)		Subfields #3/7: Spare
		= 0	Absence of Subfield
		= 1	Presence of Subfield

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					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 LSB= 1 m/sec

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 LSB= 1 m/sec
bits-32/17	(AMB)	Ambiguity Range LSB= 1 m/sec
bits-16/1	(FRQ)	Transmitter Frequency 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, octet1	(SRL)		Subfield #1: SSR plot runlength
		= 0	Absence of Subfield #1
		= 1	Presence of Subfield #1
bit-7, octet1	(SRR)		Subfield #2: Number of received replies for M(SSR)
		= 0	Absence of Subfield #2
		= 1	Presence of Subfield #2
bit-6, octet1	(SAM)		Subfield #3: Amplitude of received replies for M(SSR)
		= 0	Absence of Subfield #3
		= 1	Presence of Subfield #3
bit-5, octet1	(PRL)		Subfield #4: PSR plot runlength
		= 0	Absence of Subfield #4
		= 1	Presence of Subfield #4
bit-4, octet1	(PAM)		Subfield #5: PSR amplitude
		= 0	Absence of Subfield #5
		= 1	Presence of Subfield #5
bit-3, octet1	(RPD)		Subfield #6: Difference in Range between PSR and SSR plot
		= 0	Absence of Subfield #6
		= 1	Presence of Subfield #6
bit-2, octet1	(APD)		Subfield #7: Difference in Azimuth between PSR and SSR plot
		= 0	Absence of Subfield #7
		= 1	Presence of Subfield #7
bit-1, octet1	(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: 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	Invalid
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.

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 - 7 Not assigned
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. If the datalink capability has not been extracted yet, bits 16/14 shall be set to zero.

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. 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.

5.2.25 Data Item I048/250, Mode S MB Data

Definition: Mode S Comm B 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 report comprising one seven octet BDS register and one octet BDS 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									MB						

Octet no. 4 Octet no. 5

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

Octet no. 6 Octet no. 7

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

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	(MB Data)	56-bit message conveying Mode S Comm B message data
bits-8/5	(BDS1)	Comm B Data Buffer Store 1 Address
bits-4/1	(BDS2)	Comm B Data Buffer Store 2 Address

Encoding Rule:

This item shall be present in every ASTERIX record conveying data related to a Mode S target, provided BDS data has been extracted in the last scan.

NOTES

1. For the transmission of BDS20, item 240 is used.
2. For the transmission of BDS30, item 260 is used.
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.

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
MB DATA															

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	(MB Data)	56-bit message conveying Mode S Comm B message data of BDS Register 3,0.

Encoding Rule:

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

NOTES

1. Refer to ICAO Draft SARPs for ACAS for detailed explanations.

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	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	I048/55	Mode-1 Code in Octal Representation	1
24	I048/50	Mode-2 Code in Octal Representation	2
25	I048/65	Mode-1 Code Confidence Indicator	1
26	I048/60	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.