EUROPEAN ORGANISATION FOR THE SAFETY OF AIR NAVIGATION



ASTERIX Part 4 Category 048 Appendix A Coding rules for "Reserved Expansion Field"

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DOCUMENT APPROVAL

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DOCUMENT CHANGE RECORD

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0.11	March 2003	Modification of the release numbering Modification of the size of the "length field" Correction of item MD5	
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EXECUTIVE SUMMARY

1. INTRODUCTION

1.1 Scope

This document describes the way to encode information in the Reserved Expansion Field of Monoradar Target Report from ASTERIX Cat 048.

2. DESCRIPTION OF THE CONTENT OF RESERVED EXPANSION FIELD

2.1 Length Indicator

Definition: This field indicates the total length in octets of the Reserved

Expansion Field (including the REF length itself)

Format: One-octet fixed length Data Item

Structure:

	Octet no. 1									
8	7 6 5 4 3 2 1									
	LEN									

bits 8-1 (LEN)

Length of REF in octets, including the Length Indicator itself.

Encoding Rule:

This item shall be present in every REF

2.2 Items indicator

Definition: This field indicates what are the items encoded in the REF

Format: One-octet fixed length Data Item

Structure:

Octet no. 1									
8	7	6	5	4	3	2	1		
MD5	0	0	0	0	0	0	0		

bits 8 (MD5) = 0 Mode 5 Data/Reports,

Extended Mode 1 Code and X Pulse are not present in the

REF

= 1 Mode 5 Data/Reports and Extended Mode 1 Code and X

Pulse are present in the REF

bits 7/1 Spare bits set to 0

Encoding Rule:

This item shall be present in every REF

2.3 MD5

Definition: Mode 5 Data/Reports, Extended Mode 1 Code and X pulse

Format: Compound data item comprising one primary subfield of one

octet, followed by up to 7 subfields

Structure of Primary Subfield of Compound Data Item:

Octet	no.	1
-------	-----	---

8	7	6	5	4	3	2	1
SU	м РМ	N POS	GA	EM1	TOS	XP	FX

bit-8, octet 1 (SUM) Subfield #1: Mode 5 Summary

=0 Absence of Subfield #1=1 Presence of Subfield #1

bit-7, octet 1 (PMN) Subfield #2: Mode 5 PIN/ National

Origin/Mission Code =0 Absence of Subfield #2 =1 Presence of Subfield #2

bit-6, octet 1 (POS) Subfield #3: Mode 5 Reported

Position

=0 Absence of Subfield #3

=1 Presence of Subfield #3

bit-5, octet 1 (GA) Subfield #4: Mode 5 GNSS-

derived Altitude

=0 Absence of Subfield #4

=1 Presence of Subfield #4

bit-4, octet 1 (EM1) Subfield #5: Extended Mode 1

Code in Octal Representation

=0 Absence of Subfield #5

=1 Presence of Subfield #5

bit-3, octet 1 (TOS) Subfield #6: Time Offset for POS

and GA.

=0 Absence of Subfield #6

=1 Presence of Subfield #6

bit-2, octet 1 (XP) Subfield #7: X Pulse Presence

=0 Absence of Subfield #7

=1 Presence of Subfield #7

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

Structure of Subfield #1: Mode 5 Summary:

Octet no. 1

		(Octet	no. 1								
8	7	6	5	4	3	2	1					
M5	ID	DA	M1	M2	М3	МС	0					
bit-8		(N	15)					lode 5 interrogation e 5 interrogation				
bit-7		(11)	D)					uthenticated Mode 5 ID reply enticated Mode 5 ID reply				
bit-6 (DA)						 = 0 No authenticated Mode 5 Data reply or Report = 1 Authenticated Mode 5 Data reply or Report (i.e any valid Mode 5 reply type other than ID) 						
bit-5		(N	11)				from	e 1 code not present or not Mode 5 reply e 1 code from Mode 5 reply.				
bit-4		(N	12)				from	e 2 code not present or not Mode 5 reply e 2 code from Mode 5 reply.				
bit-3		(N	13)				from	e 3 code not present or not Mode 5 reply e 3 code from Mode 5 reply.				
bit-2		(N	(C)			fr	om I	C altitude not present or not Mode 5 reply C altitude from Mode 5 reply				
bit-1		Sı	oare	bit s	et to	0						

Notes:

- 1. The flags M2, M3, MC refer to the contents of data items I048/050, I048/070 and I048/090 respectively. The flag M1 refers to the contents of data item I048/055, Mode 1 Code in Octal Representation, and to the contents of the Subfield #5 (Extended Mode 1 Code in Octal Representation).
- 2. If an authenticated Mode 5 reply is received with the Emergency bit set, then the Military Emergency bit (ME) in Data Item I048/020, Target Report Descriptor, shall be set.
- 3. If an authenticated Mode 5 reply is received with the Identification of Position bit set, then the Special Position Identification bit (SPI) in Data Item I048/020, Target Report Descriptor, shall be set.

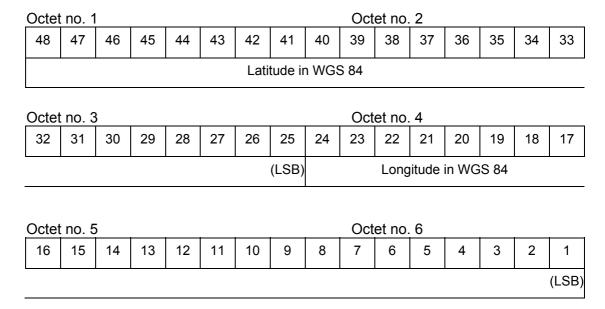
Structure of Subfield #2: Mode 5 PIN /National Origin/ Mission Code

Octet	t no. 1							Octet no. 2							
32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
0	0		PIN						(LSB)						
Octob	Octet no. 3								Oct	ot no	1				

Octet	no. c	5							Oct	et no.	. 4				
16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
0	0	0			NAT		(LSB)	0	0			N	IIS		(LSB)

bits-32/31	(spare)	spare bits set to 0
bits-30/17	(PIN)	PIN Code
bits-16/14	(spare)	spare bits set to 0
bits-13/9	(NAT)	National Origin
bits-8/7	(spare)	spare bits set to 0
bits-6/1	(MIS)	Mission Code

Structure of Subfield #3: Mode 5 Reported Position



bits-48/25 (LAT) Latitude in WGS 84

bits-24/1 (LON) Longitude in WGS 84

Notes: Latitude in WGS 84 is expressed as a 24-bit two's complement number. Range $-90^{\circ} \le \text{latitude} \le 90^{\circ}$. Sign convention: North is positive.

LSB = $180/2^{23}$ degrees = $2.145767*10^{-05}$ degrees

Longitude in WGS 84 is expressed as a 24-bit two's complement number. Range -180° ≤ longitude < 180°. Sign convention: East is positive.

LSB = $180/2^{23}$ degrees = $2.145767*10^{-05}$ degrees

The resolution implied by the LSB is better than the resolution with which Mode 5 position reports are transmitted from aircraft transponders using currently defined formats.

Structure of Subfield #4: Mode 5 GNSS-derived Altitude

Octet no. 1						Octet no. 2									
16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
0	RES							(βA						(LSB)

bit-16	(spare)	spare bit set to 0
bit-15	(RES)	Resolution with which the GNSS- derived Altitude (GA) is reported. =0 GA reported in 100 ft increments, =1 GA reported in 25 ft increments.
bits-14/1	(GA)	GNSS-derived Altitude of target, expressed as height above WGS 84 ellipsoid. GA is coded as a 14-bit two's complement binary number with an LSB of 25 ft. irrespective of the setting of RES. The minimum value of GA that can be reported is -1000 ft.

Structure of Subfield #5: **Extended Mode 1 Code in Octal Representation**

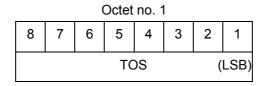
Octet 1							Octet 2								
16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
0	0	0	0		Extended Mode 1 Code										
				A4	A2	A1	B4	B2	B1	C4	C2	C1	D4	D2	D1

bit 16/13 Spare bits set to 0

bits-12/1 (EM1) Extended Mode 1 Code in octal representation

If Subfield #1 is present, the M1 bit in Subfield #1 indicates whether the Note: Extended Mode 1 Code is from a Mode 5 reply or a Mode 1 reply. If Subfield #1 is not present, the Extended Mode 1 Code is from a Mode 1 reply.

Structure of Subfield #6 of Compound Data Item: Time Offset for POS and GA



bits-8/1 (TOS)

Time Offset coded as a twos complement number with an LSB of 1/128 s. The time at which the Mode 5 Reported Position (Subfield #3) and Mode 5 GNSS-derived Altitude (Subfield #4) are valid is given by Time of Day (1048/140) plus Time Offset.

Note:

TOS shall be assumed to be zero if Subfield #6 is not present.

Structure of Subfield #7 of Compound Data Item: X Pulse Presence

Octet no. 1								
8	7	6	5	4	3	2	1	
0	0	0	X5	XC	X3	X2	X1	

bits-8/6 spare bits set to zero

bit-5 (X5) X-pulse from Mode 5 Data reply or Report.

= 0 X-pulse set to zero or no authenticated Data reply or

Report received.

= 1 X-pulse set to one (present).

bit-4 (XC) X-pulse from Mode C reply

= 0 X-pulse set to zero or no Mode C reply

= 1 X-pulse set to one (present)

bit-3	(X3)	X-pulse from Mode 3/A reply
		= 0 X-pulse set to zero or no Mode 3/A reply
		= 1 X-pulse set to one (present)
bit-2	(X2)	X-pulse from Mode 2 reply
	(-)	= 0 X-pulse set to zero or no Mode 2 reply
		= 1 X-pulse set to one (present)
bit-1	(X1)	X-pulse from Mode 1 reply
		= 0 X-pulse set to zero or no Mode 1 reply
		= 1 X-pulse set to one (present)

Encoding Rule:

The Reserved Expansion Field is optional. When used to transmit MD5, it shall be sent when at least one of the following conditions is satisfied:

- 1. The target represented by the Monoradar Target Report has been interrogated in Mode 5.
- 2. A non-zero Extended Mode 1 Code is received.
- 3. An X-pulse is present.

If condition 1 is satisfied, then Subfield #1 (Mode 5 Summary) shall be present. If condition 2 is satisfied then Subfield #5 (Extended Mode 1 Code in Octal Representation) shall be present.

If condition 3 is satisfied, then Subfield #7 (X Pulse Presence) shall be present.