

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



Edition	:	1.6
Edition Date	:	November 2012
Status	:	Released Issue
Class	:	General Public

DOCUMENT IDENTIFICATION SHEET

DOCUMENT DESCRIPTION

Document Title

Coding rules for "Reserved Expansion Field"

EWP DELIVERABLE REFERENCE NUMBER

PROGRAMME REFERENCE INDEX

EDITION : 1.6

EDITION DATE : November 2012

Abstract

Keywords

CONTACT PERSON :

A. Engel

TEL : +32-2-729 3355

DIVISION :

DSS/REG/SES

DOCUMENT STATUS AND TYPE

STATUS		CATEGORY		CLASSIFICATION	
Working Draft	<input type="checkbox"/>	Executive Task	<input type="checkbox"/>	General Public	<input checked="" type="checkbox"/>
Draft	<input type="checkbox"/>	Specialist Task	<input type="checkbox"/>	EATCHIP	<input type="checkbox"/>
Proposed Issue	<input type="checkbox"/>	Lower Layer Task	<input checked="" type="checkbox"/>	Restricted	<input type="checkbox"/>
Released Issue	<input checked="" type="checkbox"/>				

ELECTRONIC BACKUP

INTERNAL REFERENCE NAME :

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.

AUTHORITY	NAME AND SIGNATURE	DATE
ASTERIX Manager	D. Doukas	
SES Unit Manager	P. Green	
DSS Director	L. Tytgat	
On behalf of the Director General by special delegation Principal Director ATM	B. Redeborn	

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
1.0	January 2003	Creation	All
0.11	March 2003	Modification of the release numbering Modification of the size of the "length field" Correction of item MD5	
1.1	June 2005	Status of document: "Released Issue" Document ID Sheet Updated Document Approval Sheet updated Editorial "Cleanup"	ii iii All
1.2	July 2005	Category added on title page	i
1.3	April 2007	Document ID-Sheet updated Signature Page updated Editorial "clean-up"	
1.4	June 2011	Signature Page updated Mode 5-New added Extended encoding of Mode 4 information added	iii 2.4 2.5
1.5	July 2012	Signature Page updated X-Pulse definition updated Subfield #8 (FOM) added to M5N	iii 2.3 2.4 2.4
1.6	November 2012	V, G, L bits added to MD5, SF#5 Mode 1 Code V, G, L bits added to M5N, SF#5 Mode 1 Code	2.3 2.4

TABLE OF CONTENTS

DOCUMENT IDENTIFICATION SHEET.....	ii
DOCUMENT APPROVAL.....	iii
DOCUMENT CHANGE RECORD	iv
TABLE OF CONTENTS.....	v
EXECUTIVE SUMMARY.....	1
1. INTRODUCTION	2
1.1 Scope	2
2. DESCRIPTION OF THE CONTENT OF RESERVED EXPANSION FIELD	3
2.1 Length Indicator	3
2.2 Items indicator	4
2.3 MD5.....	5
2.4 M5N.....	15
2.5 M4E.....	27

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.

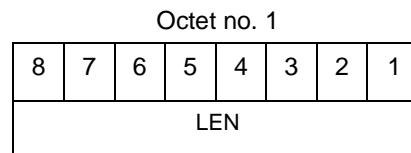
2. DESCRIPTION OF THE CONTENT OF RESERVED EXPANSION FIELD

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:



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	M5N	M4E	0	0	0	0	0

bit 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

bit 7 (M5N) = 0 New Encoding for Mode 5 Data/Reports, Extended Mode 1 Code and X Pulse is not present in the REF

= 1 New Encoding for Mode 5 Data/Reports, Extended Mode 1 Code and X Pulse is present in the REF

bit 6 (M4E) = 0 Extended Encoding for Mode 4 is not present in the REF

= 1 Extended Encoding for Mode 4 is present in the REF

bits 5/1 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

Note: In 2011 NATO has modified the format of the National Origin information available in subfield 2 of the Mode 5 data item in this Reserved Expansion Field. The information for National Origin and Mission Code were combined into a 11-bit long field. In order to maintain backwards compatibility and to ease the use of the new layout, the original Mode 5 data item was copied and the layout of subfield #2 adapted. The new layout is reflected in the data item M5N and shall be used by equipment prepared for the new National Origin system. Equipment certified to the previous encoding shall continue to use the data item MD5 corresponding to the 5-bit National Origin / 6-bit Mission Code.

Structure of Primary Subfield of Compound Data Item:

Octet no. 1							
8	7	6	5	4	3	2	1
SUM	PMN	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							
8	7	6	5	4	3	2	1
M5	ID	DA	M1	M2	M3	MC	0

bit-8	(M5)	= 0 No Mode 5 interrogation = 1 Mode 5 interrogation
bit-7	(ID)	= 0 No authenticated Mode 5 ID reply/report = 1 Authenticated Mode 5 ID reply/report
bit-6	(DA)	= 0 No authenticated Mode 5 Data reply/report = 1 Authenticated Mode 5 Data reply/report (i.e any valid Mode 5 reply type other than ID)
bit-5	(M1)	= 0 Mode 1 code not present or not from Mode 5 reply/report = 1 Mode 1 code from Mode 5 reply/report.
bit-4	(M2)	= 0 Mode 2 code not present or not from Mode 5 reply/report = 1 Mode 2 code from Mode 5 reply/report.
bit-3	(M3)	= 0 Mode 3 code not present or not from Mode 5 reply/report = 1 Mode 3 code from Mode 5 reply/report.
bit-2	(MC)	= 0 Mode C altitude not present or not from Mode 5 reply/report = 1 Mode C altitude from Mode 5 reply/report
bit-1	Spare bit set 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/report 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/report 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 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)													

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	NAT (LSB)				0	0	MIS (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**

Octet no. 1								Octet no. 2							
48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33
Latitude in WGS 84															

Octet no. 3								Octet no. 4							
32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
(LSB)								Longitude in WGS 84							

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

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 $-90^{\circ} \leq \text{latitude} \leq 90^{\circ}$. 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 $-180^{\circ} \leq \text{longitude} < 180^{\circ}$. 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	GA (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
V	G	L	0	Extended Mode 1 Code											
				A4	A2	A1	B4	B2	B1	C4	C2	C1	D4	D2	D1

bit-16 (V) = 0 Code not validated (see note 2)
= 1 Code validated (see note 2)

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) spare bit, set to "0"

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

Note 1: If Subfield #1 is present, the M1 bit in Subfield #1 indicates whether the 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.

Note 2: For reasons of backwards compatibility the logic for the setting of the V-bit was inverted compared to other similar data items.

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

Octet no. 1							
8	7	6	5	4	3	2	1
TOS (LSB)							

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 (I048/140) 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	XP	X5	XC	X3	X2	X1

bits-8/7 spare bits set to zero

bit-6	(XP)	X-pulse from Mode 5 PIN reply/report = 0 X-Pulse not present. = 1 X-pulse present.
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 in a Mode 5 reply/report.

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.

NOTE to Subfield #7 (X Pulse Presence):

Within Mode 5 replies/reports, the X-Pulse can be set for the following cases:

1. In a combined Mode 1 and Mode 2 reply/report: in this case the X5 bit and the X2 bit shall be set;
2. In a combined Mode 3 and Mode C reply/report: in this case the X5 bit and the X3 bit shall be set;
3. In a Mode 5 PIN data reply/report: in this case the X5 bit and the XP bit shall be set.

The X1 bit and the XC bit are meaningless as in Mode 1 and Mode C replies/reports the X Pulse is not defined. They are kept for compatibility reasons.

2.4

M5N

Definition: Mode 5 Data/Reports, Extended Mode 1 Code and X pulse following the updated NATO format for the National Origin code

Format: Compound data item comprising of a primary subfield of up to two octets, followed by the indicated subfields.

Note: In 2011 NATO has modified the format of the National Origin information available in subfield 2 of the Mode 5 data item in this Reserved Expansion Field. The information for National Origin and Mission Code were combined into a 11-bit long field. In order to maintain backwards compatibility and to ease the use of the new layout, the original Mode 5 data item was copied and the layout of subfield #2 adapted. The new layout is reflected in the data item M5N and shall be used by equipment prepared for the new National Origin system. Equipment certified to the previous encoding shall continue to use the data item MD5 corresponding to the 5-bit National Origin / 6-bit Mission Code.

Structure of Primary Subfield of Compound Data Item:

Octet no. 1

16	15	14	13	12	11	10	9
SUM	PMN	POS	GA	EM1	TOS	XP	FX

Octet no. 2

8	7	6	5	4	3	2	1
FOM	0	0	0	0	0	0	FX

- bit-16, octet 1 (SUM) Subfield #1: Mode 5 Summary
 =0 Absence of Subfield #1
 =1 Presence of Subfield #1
- bit-15, octet 1 (PMN) Subfield #2: Mode 5 PIN/ National Origin
 =0 Absence of Subfield #2
 =1 Presence of Subfield #2
- bit-14, octet 1 (POS) Subfield #3: Mode 5 Reported Position
 =0 Absence of Subfield #3
 =1 Presence of Subfield #3
- bit-13, octet 1 (GA) Subfield #4: Mode 5 GNSS-derived Altitude
 =0 Absence of Subfield #4
 =1 Presence of Subfield #4
- bit-12, octet 1 (EM1) Subfield #5: Extended Mode 1 Code in Octal Representation
 =0 Absence of Subfield #5
 =1 Presence of Subfield #5
- bit-11, octet 1 (TOS) Subfield #6: Time Offset for POS and GA.
 =0 Absence of Subfield #6
 =1 Presence of Subfield #6
- bit-10, octet 1 (XP) Subfield #7: X Pulse Presence
 =0 Absence of Subfield #7
 =1 Presence of Subfield #7

bit-9, octet 1 (FX) = 0 End of Primary Subfield
 = 1 Extension of Primary
 Subfield into next octet

bit-8, octet 2 (FOM) Subfield #8: Figure of Merit
 =0 Absence of Subfield #8
 =1 Presence of Subfield #8

bits-7/2, octet 2 (spare) Spare bits, set to 0

bit-1, octet 2 (FX) = 0 End of Primary Subfield
 = 1 Extension of Primary
 Subfield into next octet

Structure of Subfield #1:
Mode 5 Summary:

Octet no. 1							
8	7	6	5	4	3	2	1
M5	ID	DA	M1	M2	M3	MC	0

bit-8	(M5)	= 0 No Mode 5 interrogation = 1 Mode 5 interrogation
bit-7	(ID)	= 0 No authenticated Mode 5 ID reply/report = 1 Authenticated Mode 5 ID reply/report
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	(M1)	= 0 Mode 1 code not present or not from Mode 5 reply/report = 1 Mode 1 code from Mode 5 reply/report.
bit-4	(M2)	= 0 Mode 2 code not present or not from Mode 5 reply/report = 1 Mode 2 code from Mode 5 reply/report.
bit-3	(M3)	= 0 Mode 3 code not present or not from Mode 5 reply/report = 1 Mode 3 code from Mode 5 reply/report.
bit-2	(MC)	= 0 Mode C altitude not present or not from Mode 5 reply/report = 1 Mode C altitude from Mode 5 reply/report
bit-1	Spare bit set to 0	

Notes:

4. 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).
5. If an authenticated Mode 5 reply/report is received with the Emergency bit set, then the Military Emergency bit (ME) in Data Item I048/020, Target Report Descriptor, shall be set.
6. If an authenticated Mode 5 reply/report 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**

Octet 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)

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	0	NO										

bits-32/31 (spare) spare bits set to 0

bits-30/17 (PIN) PIN Code

bits-16/12 (spare) spare bits set to 0

bits-11/1 (NO) National Origin Code

Structure of Subfield #3:
Mode 5 Reported Position

Octet no. 1								Octet no. 2							
48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33
Latitude in WGS 84															

Octet no. 3								Octet no. 4							
32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
(LSB)								Longitude in WGS 84							

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

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 $-90^{\circ} \leq \text{latitude} \leq 90^{\circ}$. 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 $-180^{\circ} \leq \text{longitude} < 180^{\circ}$. 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	GA (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
V	G	L	0	Extended Mode 1 Code											
				A4	A2	A1	B4	B2	B1	C4	C2	C1	D4	D2	D1

bit-16 (V) = 0 Code not validated (see Note 2)
= 1 Code validated (see Note 2)

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) spare bit, set to "0"

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

Note 1: If Subfield #1 is present, the M1 bit in Subfield #1 indicates whether the 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.

Note 2: For reasons of backwards compatibility the logic for the setting of the V-bit was inverted compared to other similar data items.

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

Octet no. 1							
8	7	6	5	4	3	2	1
TOS							(LSB)

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 (I048/140) 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	XP	X5	XC	X3	X2	X1

bits-8/7 spare bits set to zero

bit-6	(XP)	X-pulse from Mode 5 PIN reply/report = 0 X-Pulse not present. = 1 X-pulse present.
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)

NOTE to Subfield #7 (X Pulse Presence):

Within Mode 5 replies/reports, the X-Pulse can be set for the following cases:

1. In a combined Mode 1 and Mode 2 reply/report: in this case the X5 bit and the X2 bit shall be set;
2. In a combined Mode 3 and Mode C reply/report: in this case the X5 bit and the X3 bit shall be set;
3. In a Mode 5 PIN data reply/report: in this case the X5 bit and the XP bit shall be set.

The X1 bit and the XC bit are meaningless as in Mode 1 and Mode C replies/reports the X Pulse is not defined. They are kept for compatibility reasons.

**Structure of Subfield #8 of Compound Data Item:
Figure of Merit**

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

bits-8/6	(spare)	spare bits set to zero
bits-5/1	(FOM)	Figure of Merit Position Accuracy as extracted and provided by a Mode 5 transponder

Encoding Rule:

The Reserved Expansion Field is optional. When used to transmit M5N, 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 in a Mode 5 reply/report.

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.

M4E

Definition: Extended encoding of the Mode 4 interrogation result

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
0	0	0	0	0	FOE/FRI		FX

Bits 8/4 (spare) spare bits, set to 0

Bits 3/2	(FOE/FRI)	Indication Foe/Friend (Mode4)
		= 00 No Mode 4 identification
		= 01 possibly friendly target
		= 10 probably friendly target
		= 11 friendly target

Bit-1	(FX)	= 0	End of Data Item
		= 1	Extension into first extent

Encoding Rule :

This item is optional and shall be used if the IFF interrogator is capable to encode the extended Mode 4 interpretation.

IFF interrogators not capable of using the extended Mode 4 encoding shall instead use data item I048/020, 1st extension.