

**European Mode S Station
Surveillance Output
Interface Control
Document**

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

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EXECUTIVE SUMMARY

1. INTRODUCTION

The present document provides additional requirements for a coherent implementation of the ASTERIX Category 34 and 48 in Mode S radar stations based on the European Mode S Station Functional Specification.

This document supplements but is not part of the EUROCONTROL standard documents for Radar Data Exchange.

2. REFERENCES

2.1 General

The following Documents and Standards contain requirements which, through references in this text, constitute requirements of this document.

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

2.2 Documents

- [1] Eurocontrol Mode S Station Functional Specifications; SUR/MODES/EMS/SPE-01 (form. SUR.ET2.ST03.3114-SPC-01-00), Edition 3.08, 19 April 2001
- [2] Eurocontrol Standard Document for Surveillance Data Exchange, Part 1: All Purpose Structured Eurocontrol Surveillance Information Exchange (ASTERIX); SUR.ET1.ST05.2000-STD-01-01, Edition 1.26, Proposed Standard, November 2000
- [3] Eurocontrol Standard Document for Surveillance Data Exchange, Part 2b: Transmission of Monoradar Service Messages; SUR.ET1.ST05.2000-STD-02b-01, Edition 1.26, Proposed Standard, November 2000
- [4] Eurocontrol Standard Document for Surveillance Data Exchange, Part 4: Transmission of Monoradar Target Reports; SUR.ET1.ST05.2000-STD-02b-01, Edition 1.14, Proposed Standard, November 2000

3. TRANSMISSION OF MONORADAR TARGET REPORT

3.1 General

The European Mode S Station shall output monoradar target reports in the ASTERIX Category 48 format, in conformance with [4].

All data items described in [4], except item I048/210, shall be implemented. Implementation of data item I048/210, Track Quality, is subject to local requirements.

An Site Dependent Parameter (SDP) shall allow the enabling/disabling of the output of each optional item separately, within the limits of the encoding rules defined in [4].

It is the responsibility of each user to output these optional items or not.

4. TRANSMISSION OF MONORADAR SERVICE MESSAGES

4.1 General

The European Mode S Station shall output monoradar service messages in the ASTERIX Category 34 format, in conformance with [3].

All data items described in [3], apart from items I034/070 to I034/110, shall be implemented. The implementation of items I034/070 to I034/110 will be subject to local requirements.

An Site Dependent Parameter (SDP) shall allow the enabling/disabling of the output of each optional item separately, within the limits of the encoding rules defined in [3]. The operator shall be able to perform this separately for each type of messages.

The implementation of Sector Crossing messages in European Mode S Stations is mandatory, although their output is optional as indicated in [3].

4.2 Output of Sector Crossing Messages

Depending on the European Mode S Station implementation and/or the setting of an SDP, the transmission sequence of Sector Crossing (if enabled) and plot messages may be different.

In the first case, Sector Crossing messages will be generated as soon as the formatter is notified of azimuth crossing and the message will be sent to the communications layer.

In the second case, Sector Crossing messages will follow all plots processed and formatted within the sector to which it relates.

In the third case, Sector Crossing message will be just in front of all plots processed and formatted within the sector to which it relates.

In all cases, the Sector Crossing message time-stamp (i.e., the I034/030 Time of Day item) shall reflect the exact time of the azimuth crossing (beginning of the sector), as required in [3].

4.3 Encoding Rules for Items I034/050 and I034/060

This section deals with the rules to apply for encoding information contained in the I034/050 and I034/060 in the Sector Crossing and North Marker messages.

As specified in [3], both items are optional in the North Marker and Sector Crossing messages. When selected, the items will be sent in all North Marker, respectively Sector Crossing, messages.

The actual encoding of subfields depends on their relevance and/or the availability of their content.

In the context of European Mode S Stations:

- **COM** subfields are relevant and encoded;
- **PSR** subfields can only be present when a communications link is assigned and configured to receive PSR data and corresponding status message are being received.
- **SSR** subfields are irrelevant and never encoded;
- **MDS** subfields are relevant and encoded.

The following type of fields can be recognised in the data-items I034/050 (System Configuration and Status) and I034/060 (System Processing Mode).

- **States**, which are likely to remain unchanged for a long period of time. Stable periods typically span on several hours or days. An example is the RDPC field in the COM sub-field.
- **Dynamic conditions**, which will normally be only valid for a short period of time. The order of magnitude of the period of these changes lies between a few hundreds milliseconds and a few scans. Examples are all OVL bits.
- **Events**, which have no duration. The only event field is the RDPR bit.

The timing of the sector messages (delayed or real time sending) has no influence on the definition of the bits and encoding rules.

4.3.1 States

4.3.1.1 *In Sector Crossing messages*

The state has been read at a time corresponding approximately to the Azimuth crossing.

4.3.1.2 *In North Marking messages*

The state has been read at a time corresponding approximately to the North crossing.

4.3.2 Dynamic conditions

4.3.2.1 *In Sector Crossing messages*

If the condition has been true during any part the sector, it will be considered true for the sector.

If the condition has never been true anywhere in the sector, the condition will be considered false.

If the field is not just binary, but may take different values (e.g. the reduction levels), the highest value reached during the sector will be reported.

4.3.2.2 In North Marking messages

If the condition is still true at North Crossing, it will be considered true for the scan. If the field is not just binary, but may take different values (e.g. the reduction levels), the highest value reached during the scan will be reported.

4.3.3 Events

The event bit will only be set if the event has occurred in the sector or the scan.

4.3.4 Classification

S = state, D = dynamic condition, E = event

Data Item	Subfield	Bitfield	S	D	E
1034/050	COM	NOGO	✓		
		RDPC	✓		
		RDPR			✓
		OVL RDP		✓	
		OVL XMT		✓	
		MSC	✓		
		TSV	✓		
	PSR, SSR & MDS	ANT	✓		
		CH-A/B	✓		
		OVL		✓	
		MSC	✓		
	MDS	SCF	✓		
		DLF	✓		
		OVL SCF		✓	
OVL DLF			✓		
1034/060	COM	RED-RDP		✓	
		RED-XMT		✓	
	PSR	POL	✓		
		STC	✓		
	PSR, SSR, MDS	RED-RAD		✓	
	MDS	CLU	✓		

Table 1 - Fields classification

4.4 Data Rate Control (DRC)

4.4.1 Background

A priority scheme has been defined in section 4.2.7.3 of [1], from the highest priority information (1) to the lowest (5):

Priority	Data
1	Any RTQC messages, Status, Sector messages, Military and SSR emergencies (7500, 7600 and 7700), Mode S alert flags, Military Identity.
2	[Combined] Mode S/SSR plots in the Area of Prime Interest

Priority	Data
	(API).
3	[Combined] Mode S/SSR plots not in the API.
4	Primary only data.
5	Enhanced Surveillance transactions only (including ACAS broadcast).

Table 2 - Surveillance data priority scheme

If overload occurs due to output limitations, then reduction shall be applied according to the above priority scheme. DRC will discard data of lowest priority first.

Note that DRC could be initiated preventively, when overload *conditions* are detected. There is no need for actual overload to happen before DRC measures are taken.

If overload (conditions) persist, further steps will be taken by discarding data of the next higher priority. This leads to the following reduction levels:

DRC Level	Action
1	Discard data of lowest priority level, 5.
2	Discard data of priority levels 5 and 4.
3	Discard data of priority levels 5, 4 and 3.
4	Discard data of priority levels 5, 4, 3 and 2.

Table 3 - Surveillance data reduction levels

NOTE: In DRC level 3, Primary and Enhanced Surveillance only data are suppressed, wherever they are located (API or not API), while Mode S/SSR data are only suppressed if they are out of the API.

Consequently, all European Mode S Stations shall implement the DRC in such a way that there are 4 clearly defined reduction levels, which corresponds to the above data. This derives from the Functional Specifications and is independent from the actual implementations.

4.4.2 Notification

The system shall notify surveillance data users of DRC, provided the corresponding items have been selected, in the following manner:

Use of the **OVL XMT** flag of the **COM** subfield of I034/050 to indicate that surveillance data has been lost in a *non controlled way* at the output buffer level. Consequently, this flag should be set independently of DRC.

Use the **RED XMT** field of the **COM** subfield of I034/060 to indicate the level of DRC performed. In the context of European Mode S Stations, the valid range is [000,100], "000" meaning that no DRC is performed.

The option of using of the Geographical Filtering message for more precise DRC notification (both in time and in extent) is left open. In the context of European Mode S Stations, the encoding of RED XMT remains mandatory.

The encoding rules described in the previous chapter apply to these two **XMT** fields as well. That means that DRC will be reported both in Sector Crossing and in North Marking messages.

The **XMT** fields in Sector Crossing messages relate to conditions met between the time of the previous sector crossing and the current one.

If they wish, the European Mode S Stations suppliers may additionally implement a more precise DRC notification using Geographical Filtering messages. In order to insure interoperability, the messages shall strictly conform to the format and encoding rules described in [3]. The item I034/110 contains all the data types needed in order to signal the 4 different reduction level performed in European Mode S Stations. The following table lists the matching between DRC levels and the content of the TYP field.

DRC Level	I034/110 TYP
1	6 (Enhanced Surveillance data)
2	7 (Enhanced Surveillance data + PSR)
3	8 (Enhanced Surveillance data + PSR + SSR/Mode S not in API)
4	9 (Enhanced Surveillance data + PSR + all SSR/Mode S)

Table 4 - Equivalence table between DRC and I034/110

If need be, DRC maps could be programmed at the ATCC level in order to improve geographical information accuracy, although this is not recommended, for the sake of interoperability. The information contained in ASTERIX messages should be self-contained.