input paper: [[1]](#footnote-1) VTS51-10.2.3

Input paper for the following Committee(s): check as appropriate Purpose of paper:

**□**ARM **□**ENG **□**PAP **X** Input

**□**ENAV **X**VTS **□** Information

Agenda item [[2]](#footnote-2) 10.2

Technical Domain / Task Number 2.2.3

Author(s) / Submitter(s) China Maritime Safety Administration

**Proposal on the revised Guideline《Draft G1111-3 Producing Requirements for RADAR Functions, Performance And radar specific Acceptance》（ VTS50-13.3.2.5）**

# 1. BACKGROUND

At present, there are many nearly 50 brands of VTS radars used in the world, such as ATLAS, KNC, HITT and TRANSAS. VTS radars have various models. Among them, the data output format of different brands of radars is not consistent, and the data convergence of different radars is not matched. It imposes costs and labour burdens on radar equipment maintenance and renewal on radar users, such as VTS authorities. Therefore, it is necessary to establish a unified VTS radar data format specification as part of the IALA Guidelines 1111-3, which is under revision, in order to solve the problem of data mismatch between different radars for the convenience of VTS radar users and managers.

# PURPOSE

The purpose of this document is to present a statement and specification based on the revised IALA guideline G1111-3, which aims to resolve the issue of inconsistent output data standards for VTS Radars.

# proposal

In order to solve the problem of inconsistency of radar data for VTS applications of different brands, and taking the opportunity of revising the G1111-3, the following proposals are made:

## 3.1 The addition of the specification of the radar data output format in part 6 of the draft guide.

* + Formulate develop the standard format of digital video data output by VTS radar equipment, including video elements such as video azimuth and signal amplitude;
  + Formulate the standard format of radar target track data output by VTS radar equipment, including position, course, speed and other elements;
  + Formulate the standard format of control signaling for VTS radar equipment, including Transmitter switching, range switching, switch transmitting, silent zone setting and other elements.

## 3.2 Add an appendix to the current draft guideline (see appendix).

# ACTION REQUIRED BY THE COMMITTEE

The Committee is requested to consider the above proposals.

# appendix

Radar data format requirements

* 1. References

[1] EUROCONTROL Specification for Surveillance Data Exchange ASTERIX Category 240 Radar Video Transmission.

[2] EUROCONTROL Specification for Surveillance Data Exchange ASTERIX Category 010 Radar track Transmission.

[3] EUROCONTROL Specification for Surveillance Data Exchange ASTERIX Category 253 Radar status/control Transmission.

* 1. Layout of Radar Data

Radar data includes three categories: radar status/control data, radar target track data and radar video data. The data will have the following layout：



Where:

− Data Category (CAT) is a one-octet field indicating that the Data Block contains remote control data.

253 = radar status/control data

010 = radar target track data

240 = radar video data

− Length Indicator (LEN) is a two octet field indicating the total length in octets of the Data Block, including the CAT en LEN fields.

− FSPEC is the Field Specification.

− Record is the Data.

* 1. Radar data definition
     1. Radar status/control data definition
        1. User Application Profile

The following UAP shall be used for the transmission of status/control data:

Table 1 User Application Profile for Status/Control Data

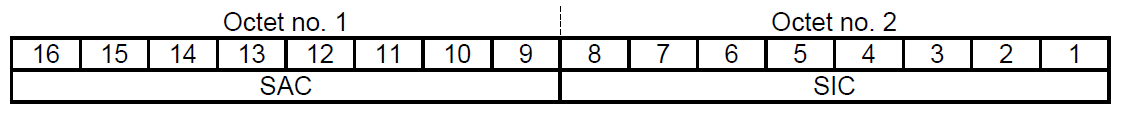
|  |  |  |  |
| --- | --- | --- | --- |
| FRN | Data Item | Information | Length in Octets |
| 1 | I253/010 | Data Source Identifier | 2 |
| 2 | I253/015 | Local Data Source Identifier | 1 |
| 3 | I253/025 | Data Destination and Local Identifier | 1+3×n |
| 4 | I253/040 | Message Type | 1 |
| 5 | I253/050 | Message Sequence ID | 1+2×n |
| 6 | I253/060 | Blocking Information | 2 |
| 7 | I253/070 | Time of Day | 3 |
| FX | N.A. | Field Extension Indicator | N.A. |
| 8 | I253/080 | Application Data Structure | 4+ |
| 9 | I253/090 | Application Data | 1+16×n |
| 10 | I253/100 | Transparent Application Data 1 | N |
| 11 | I253/110 | Transparent Application Data 2 | N |
| 12 | I253/120 | Extended Transparent Application Data – total length | 2 |
| 13 | I253/130 | Extended Transparent Application Data | 1+256×n |
| 14 | I253/SP | Special Purpose | 1+ |
| FX | N.A. | Field Extension Indicator | N.A. |

* + - 1. Description of the Data Items
         1. Data Item I253/010, Data Source Identifier

**Definition**: Identification of the system from which the data are received.

**Format**: Two octets fixed length Data Item.

**Structure**:



bits-16/9 (SAC) = System Area Code

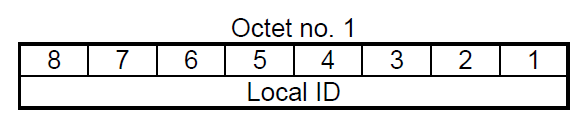
bits-8/1 (SIC) = System Identification Code

* + - * 1. Data Item I253/015, Local Data Source Identifier

**Definition**: Identification of the local system from which the data are received.

**Format**: One octet fixed length Data Item.

**Structure**:



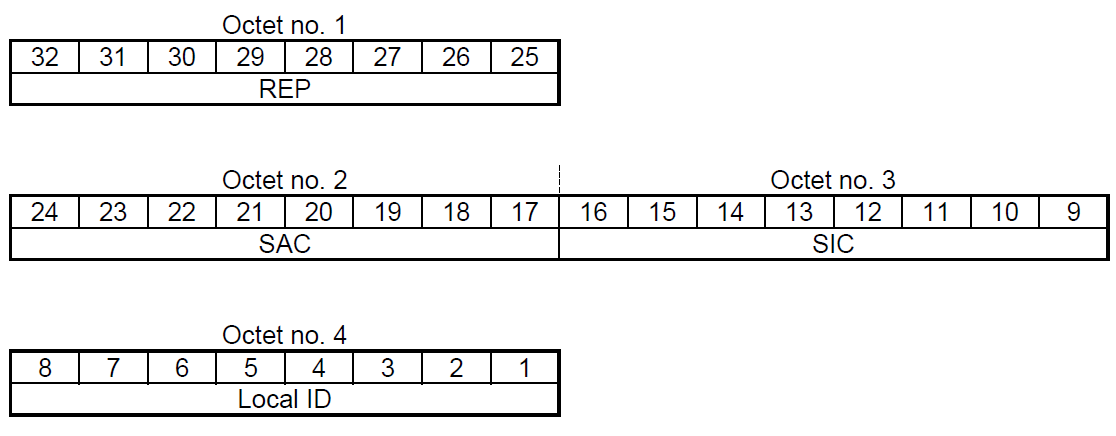
bits-8/1 (Local ID) = Local Identifier per SAC/SIC

* + - * 1. Data Item I253/025, Data Destination and Local Identifier

**Definition**: Identification of the system to which the data must be sent.

**Format**: Repetitive Data Item, starting with a one-octet Field Repetition Indicator (REP) followed by at least one Data Destination and Local ID Identifier of three-octet length.

**Structure**:



bits-32/25 (REP) = Number of destination identifiers

bits-24/17 (SAC) = System Area Code

bits-16/9 (SIC) = System Identification Code

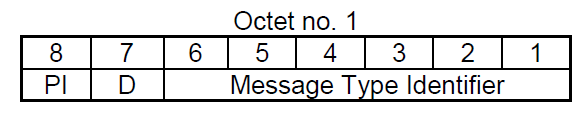
bits-8/1 (Local ID) = Local identifier per SAC/SIC

* + - * 1. Data Item I253/040, Message Type Identifier

**Definition**: The Message Type Identifier defines what kind of CAT 253 message was sent and identifies some basic properties of the message.

**Format**: One octet fixed length Data Item.

**Structure**:



bit 8 (PI) = Priority Identifier

0 = low priority

1 = high priority

bit 7 (D) = Delivery bit

0 = no explicit acknowledgement compulsory

1 = explicit acknowledgement compulsory

bits 6/1 (MIT) = Message Type Identifier

1 = Time and Day

2 = Connect Request

3 = Connect Response

4 = Connect Release

5 = Command Token Request

6 = Command Token Release

7 = Command Token Assign

8 = Command Message

9 = Complete Status Transfer Message

10 = Delta Status Transfer Message

11 = Complete Status Transfer Request Message

12 = Centre Exchange Message

13 = Centre Status Message

14 = Centre Transparent Message

15 = Centre Resynchronisation Request Message

16 = Radar Monitoring Start Message

17 = Radar Monitoring Stop Message

18 = Acknowledgement

19 = Error

20 = Alarm

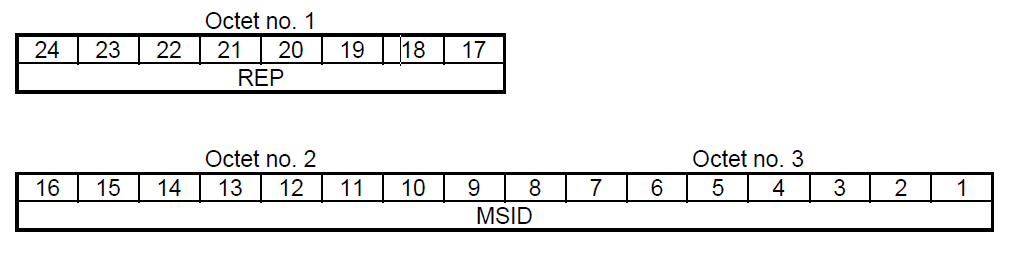
21 = Alive Message

* + - * 1. Data Item I253/050, Message Sequence Identifier

**Definition**: The Item Message Sequence Identifier contains consecutively incremented message counters for each receiving application. The ID counters shall be incremented by the originator application.

**Format**: Repetitive Data Item, starting with a one-octet Field Repetition Indicator (REP) followed by at least one Message Sequence Identifier of two octet length.

**Structure**:



bits-24/17 (REP) = Number of MSIDs

bits-16/1 (MSID) = Message Sequence Identifiers

**Notes**

The Message Sequence Identifier can be used by an application to associate acknowledgments or responses to the corresponding request. This may be important in case the issuing of requests is not synchronous, i.e. if an application has multiple outstanding requests at a time.

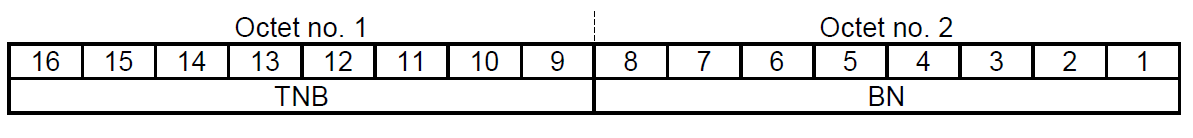
The Message Sequence Identifier is additionally used for applications that use an underlying network that potentially re-orders messages on the way to the receiver. For messages with multiple destinations (multicast transmissions) the sending application can specify a sequence number for each of the receiving instances. The order of the number of the sequence numbers must correspond to the order and number of SAC/SICs in I253/025.

* + - * 1. Data Item I253/060, Blocking Information

**Definition**: The Blocking Information contains the total number of blocks (TNB) which have been generated out of one larger message and the block number (BN) of the current block in this sequence.

**Format**: Two octets fixed length Data Item .

**Structure**:



bits-16/9 (TNB) = Total Number of Blocks

bits-8/1 (BN) = Block Number of current block in sequence

**NOTES**

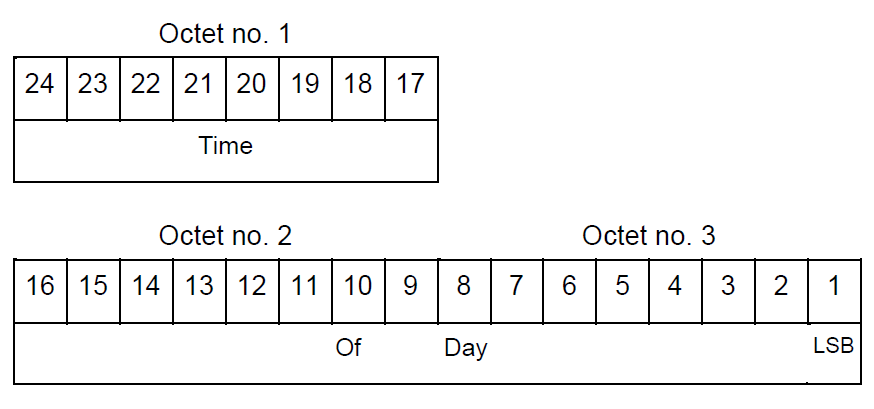
The Blocking Information is used for applications that use an underlying network which does not allow arbitrary length CAT 253 messages to be transmitted. It supports an application-driven segmentation and de-segmentation of messages into smaller parts.

* + - * 1. Data Item I253/070, Time of Day

**Definition**: Absolute time stamping expressed as UTC time.

**Format**: Three-octet fixed length Data Item.

**Structure**:



bit-1 (LSB) 1/128 s

**NOTES**

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

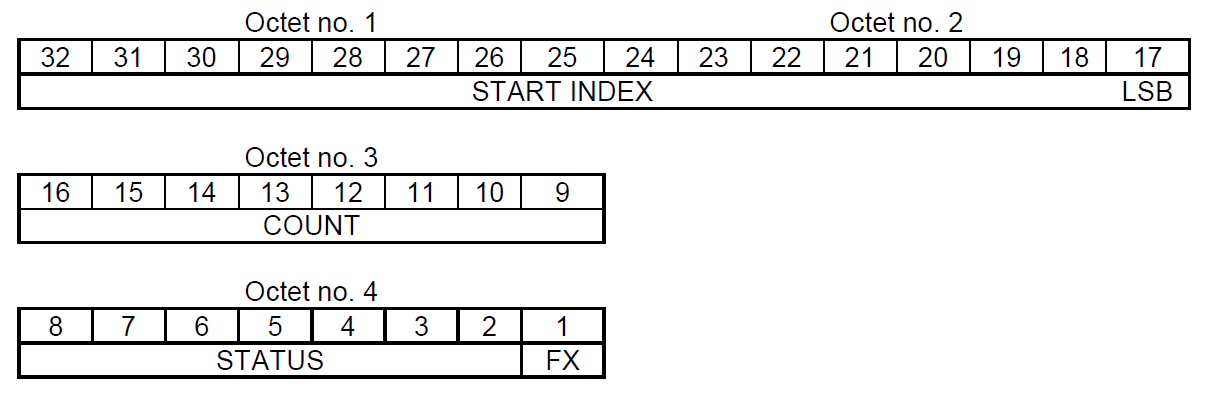
The time of day value is reset to Zero each day at midnight and shall contain the originator’s time stamp.

* + - * 1. Data Item I253/080, Application Data Structure

**Definition**: Absolute time stamping expressed as UTC time.

**Format**: Three-octet fixed length Data Item.

**Structure**:



bits-32/31 (START INDEX)= Provides identity of first object value to be transferred as part of the application data item. Index refers to an ordered list of objects previously agreed between client and server.

bits-16/9 (COUNT) = Indicates the number of object values with the same status to be transferred as part of the data field, starting with “Start Index” and using the consecutive numbers following this index. Thus, objects with the same status are bundled.

bits-8/1 (STATUS) = Provides common status information for all objects in the data field:

bit 8 = 0 non-stale data

= 1 stale data

bit 7 = 0 real data

= 1 simulated data

bit 6 = 0 monitored object under remote control

= 1 monitored object under local control

bit 5 = 0 no data included

= 1 data included

bit 4-2 = 0 reserved for application specific data

= 1 stale data

bit 1 = 0 End of item

= 1 Extension into another status segment

**NOTES**

1) Stale data is data that may not be up-to-date, e.g. because the acquisition processor has failed.

2) Simulated data may be data that an operator “manually” sets for various purposes.

3) The “Data\_included” bit determines whether there exists a corresponding data field in I253/090 of this record.

4) Monitored objects under local control indicates that the object is not in an operational mode but in a maintenance mode.

5) This item transfers an FX-concatenated list of status segments that describe the identity, ordering and monitoring status of the monitoring data itself in I253/090. Each status segment represents a number of monitoring objects (specified in the count field) starting with the index given in the start index field. The indices are based on an agreed ordered list between client and server.

The list of items present for the two message types is defined in the following table. M stands for mandatory, O for optional, X for never present：

Table 2 Items per Message Types

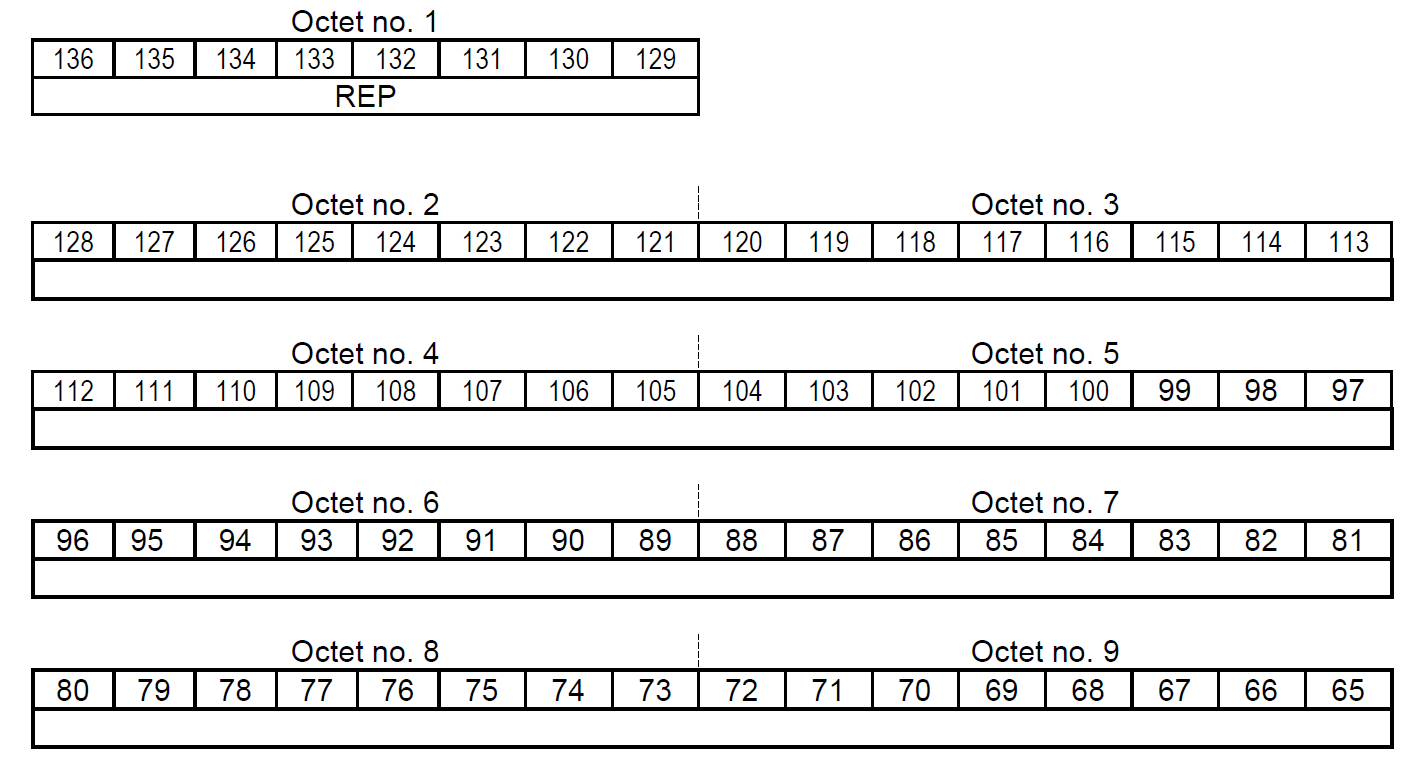
|  |  |  |  |
| --- | --- | --- | --- |
| Start Index | Item | Control Message | Status Response Message |
| 1001 | Heartbeat Message | X | O |
| 2001 | Mask Area | O | X |
| 2002 | Set Main Transmitter | O | X |
| 2003 | Set Transmission Status | O | X |
| 2004 | Set Range | O | X |
| 2005 | Set PRF | O | X |
| 2006 | Set Main Power Status | O | X |
| 2007 | Request Radar Status | O | X |
| 3001 | Mask Area Updated | X | O |
| 3002 | Main Transmitter Updated | X | O |
| 3003 | Transmission Status Updated | X | O |
| 3004 | Range Updated | X | O |
| 3005 | PRF Updated | X | O |

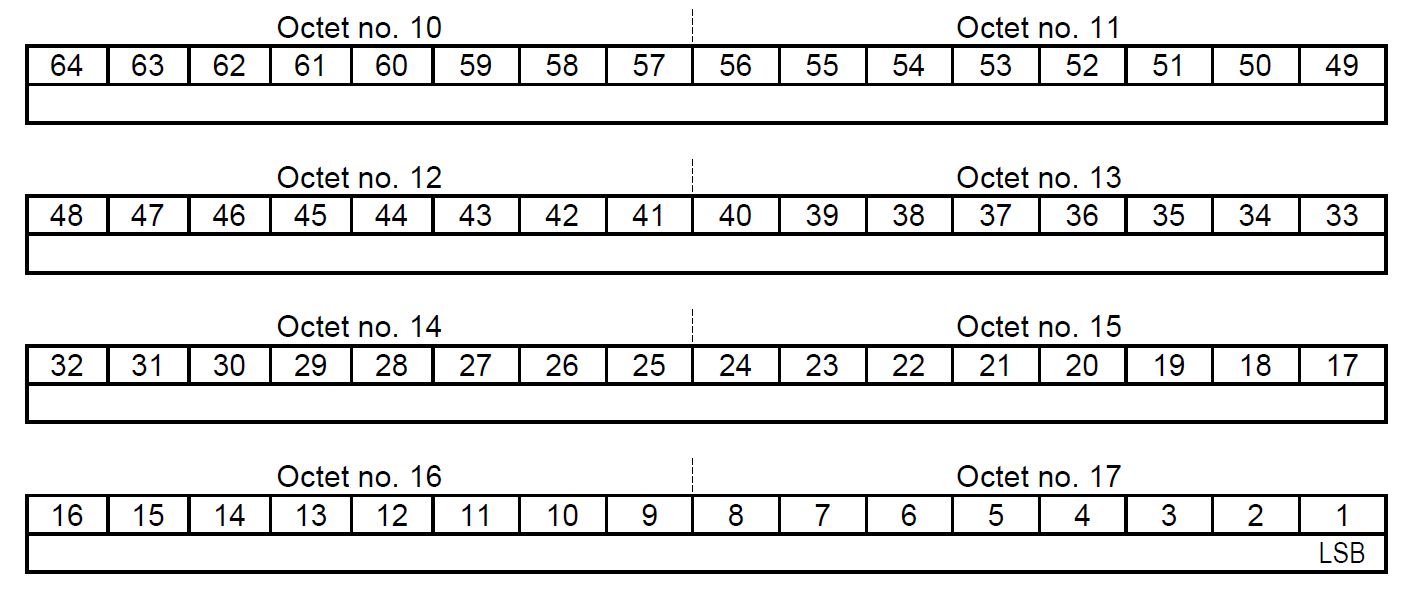
* + - * 1. Data Item I253/090, Application Data Item

**Definition**: Data item I253/090 contains the monitoring data that is to be transmitted from server to client as a sequence of octets. The contents of this octet sequence are defined with the item I253/080

**Format**: Repetitive Data Item, starting with a one-octet Field Repetition Indicator (REP) followed by at least one Application Data block of sixteen octet length.

**Structure**:





bits-136/129 (REP) = Number of Application Data blocks

bits-128/1 (LSB) = block of 128 bits containing the application data to be transferred. The identity and the structure of this application data is specified in I253/080

1. Heartbeat information

This message is used by the radar to send system validity information to the gateway.

This message does not need to apply a data structure.

1. Mask Area

1) This message is used to set or delete the mask area;

2) Each mask area is defined by polygons with up to 40 vertices;

3) If the radar successfully executes the mask area command, it will reply with the updated mask area message;

4) Unsuccessful execution will result in negative radar response confirmation;

If the radar receives a new mask area and its ID is consistent with the existing area, the radar will replace the existing area with the latest one.

Table 3 Data structure of mask area

|  |  |  |  |
| --- | --- | --- | --- |
| Item | Describe | Size (bytes) | Notes |
| REP | | | |
| REP | Number of Application Data Blocks | 1 | 0～255 |
| Application Data Block | | | |
| Mask Area Data Header | | | |
| Data Length | Length of Mask Area | 4 |  |
| Type | Type of Mask Area | 1 | 0～255 |
| Identification | Identification of Mask Area | 1 | 0～255 |
| Action | Action of Mask Area | 1 | 0 : Add/Update; 1: Delete |
| Vertex Number | Number of Vertex | 1 | ≤40 |
| Separator | Separator | 8 | Zeros |
| Area Label (Not Required for Delete Operation) | | | |
| Area Label | Label of Mask Area | 16 | ASCII Code, Empty bytes fill with“@” |
| Vertex of Mask Area, Repeat for m Times (Not Required for Delete Operation) | | | |
| LAT | Latitude | 4 | WGS-84 Coordinates |
| Separator | Separator | 4 | Zeros |
| LONG | longitude | 4 | WGS-84 Coordinates |
| Separator | Separator | 4 | Zeros |

1. Set Main Transmitter

1) This message is sent to select a valid radar unit in the dual radar system;

2) If the the command is successfully executed, it will reply with message of transceiver status has been updated;

1. Unsuccessful execution will result in a negative radar response.

Table 4 Data structure of Set Main Transmitter

|  |  |  |  |
| --- | --- | --- | --- |
| Item | Describe | Size (bytes) | Notes |
| REP | | | |
| REP | Number of Application Data Blocks | 1 | 0～255 |
| Application Data Block | | | |
| Main Transmitter | Select Main Transmitter | 2 | 0 : Transmitter1; 1: Transmitter2 |
| Separator | Separator | 4 | Zeros |

1. Set Transmission Status：

1) This message shall be sent to request the radar transmitter to turn on/off;

2) If the the command is successfully executed, it will reply with message of transmission status has been updated;

3) Unsuccessful execution will result in a negative radar response.

Table 5 Data structure of Set Main Transmitter

|  |  |  |  |
| --- | --- | --- | --- |
| Item | Describe | Size (bytes) | Notes |
| REP | | | |
| REP | Number of Application Data Blocks | 1 | 0～255 |
| Application Data Block | | | |
| Transmission Status | Set Transmission Status | 2 | 0 : Off; 1: On |
| Separator | Separator | 4 | Zeros |

1. Set Range

1) This message is used to set the range of radar;

2) If the radar successfully executes the command, it will reply with message of range has been updated;

3) Unsuccessful execution will result in a negative radar response.

Table 6 Data structure of Set Range

|  |  |  |  |
| --- | --- | --- | --- |
| Item | Describe | Size (bytes) | Notes |
| REP | | | |
| REP | Number of Application Data Blocks | 1 | 0～255 |
| Application Data Block | | | |
| Range | Set Range | 2 | 0.01 NM |
| Separator | Separator | 4 | Zeros |

1. Set PRF

1) This message is used to set PRF;

2) If the radar successfully executes the command, it will reply with message of PRF has been updated;

3) Unsuccessful execution will result in a negative radar response.

Table 7 Data structure of Set PRF

|  |  |  |  |
| --- | --- | --- | --- |
| Item | Describe | Size (bytes) | Notes |
| REP | | | |
| REP | Number of Application Data Blocks | 1 | 0～255 |
| Application Data Block | | | |
| PRF | Set PRF | 2 | 0: Extremely Short; 1: Short; 2: Medium;  3: Long; 4: Extremely Long |
| Separator | Separator | 4 | Zeros |

1. Request Radar Status：

1) This message requests radar status;

2) The radar replies with the following message:

Mask Area has been Updated

Transceiver status has been updated;

Transmission status has been updated;

Range has been updated;

PRF has been updated;

Other status information agreed by the equipment manufacturers.

This message does not need to apply a data structure.

1. Mask Area Updated

This message is used to send the updated Mask Area Information. If the Radar Mask Area has been set or deleted, The radar replies with message of Mask Area has been Updated.

Table 8 Data structure of Mask Area Updated

|  |  |  |  |
| --- | --- | --- | --- |
| Item | Describe | Size (bytes) | Notes |
| REP | | | |
| REP | Number of Application Data Blocks | 1 | 0～255 |
| Application Data Block | | | |
| Mask Area Data Header | | | |
| Data Length | Length of Mask Area | 4 |  |
| Type | Type of Mask Area | 1 | 0～255 |
| Identification | Identification of Mask Area | 1 | 0～255 |
| Action | Action of Mask Area | 1 | 0 : Add/Update 1: Delete |
| Vertex Number | Number of Vertex | 1 | ≤40 |
| Separator | Separator | 8 | Zeros |
| Area Label (Not Required for Delete Operation) | | | |
| Area Label | Label of Mask Area | 16 | ASCII Code, Empty bytes fill with“@” |
| Vertex of Mask Area, Repeat for m Times (Not Required for Delete Operation) | | | |
| LAT | Latitude | 4 | WGS-84 Coordinates |
| LONG | longitude | 4 | WGS-84 Coordinates |
| Initiator | Command initiator | 2 | SAC and SIC |
| Separator | Separator | 4 | Zeros |

1. Main Transmitter Updated

This message is used to send the updated Main Transmitter Information. If the Main Transmitter has been set or deleted, The radar replies with message of Main Transmitter has been Updated.

Table 9 Data structure of Main Transmitter Updated

|  |  |  |  |
| --- | --- | --- | --- |
| Item | Describe | Size (bytes) | Notes |
| REP | | | |
| REP | Number of Application Data Blocks | 1 | 0～255 |
| Application Data Block | | | |
| Main Transmitter | Select Main Transmitter | 2 | 0 : Transmitter1; 1: Transmitter2 |
| Initiator | Command initiator | 2 | SAC and SIC |
| Separator | Separator | 4 | Zeros |

1. Transmission Status Updated

This message is used to send the updated Transmission Status Information. If the Transmission Status has been set or deleted, The radar replies with message of Transmission Status has been Updated.

Table 10 Data structure of Transmission Status Updated

|  |  |  |  |
| --- | --- | --- | --- |
| Item | Describe | Size (bytes) | Notes |
| REP | | | |
| REP | Number of Application Data Blocks | 1 | 0～255 |
| Application Data Block | | | |
| Transmission Status | Set Transmission Status | 2 | 0 : Off; 1: On |
| Initiator | Command initiator | 2 | SAC and SIC |
| Separator | Separator | 4 | Zeros |

1. Range Updated

This message is used to send the updated Range Information. If the Range has been set or deleted, The radar replies with message of Range has been Updated.

Table 11 Data structure of Range Updated

|  |  |  |  |
| --- | --- | --- | --- |
| Item | Describe | Size (bytes) | Notes |
| REP | | | |
| REP | Number of Application Data Blocks | 1 | 0～255 |
| Application Data Block | | | |
| Range | Set Range | 2 | 0.01 NM |
| Initiator | Command initiator | 2 | SAC and SIC |
| Separator | Separator | 4 | Zeros |

1. PRF Updated

This message is used to send the updated PRF Information. If the PRF has been set or deleted, The radar replies with message of PRF has been Updated.

Table 12 Data structure of PRF Updated

|  |  |  |  |
| --- | --- | --- | --- |
| Item | Describe | Size (bytes) | Notes |
| REP | | | |
| REP | Number of Application Data Blocks | 1 | 0～255 |
| Application Data Block | | | |
| PRF | Set PRF | 2 | 0: Extremely Short; 1: Short; 2: Medium;  3: Long; 4: Extremely Long |
| Initiator | Command initiator | 2 | SAC and SIC |
| Separator | Separator | 4 | Zeros |

* + - * 1. Data Item I253/100, Transparent Application Data 1

**Definition**: The Transparent Application Data item contains application data not further standardised by this Guideline .

**Format**: Explicit length Data Item.

**Structure**:



bits-8/1 (LEN) = Total Length of the Data Item including itself.

(TAD) = Sequence of bytes containing transparent application data for various purposes.

* + - * 1. Data Item I253/100, Transparent Application Data 2

**Definition**: The Transparent Application Data item contains application data not further standardised by this Guideline .

**Format**: Explicit length Data Item.

**Structure**:



bits-8/1 (LEN) = Total Length of the Data Item including itself.

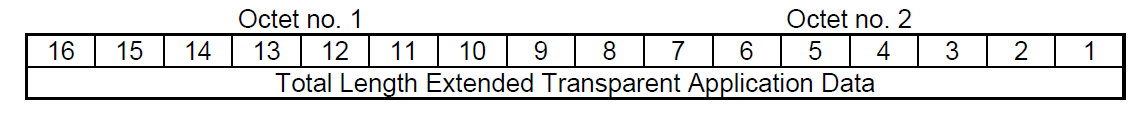
(TAD) = Sequence of bytes containing transparent application data for various purposes.

* + - * 1. Data Item I253/120, Extended Transparent Application Data – Total Length

**Definition**: Total Length of the extended transparent application data

**Format**: Two octet fixed length Data Item.

**Structure**:



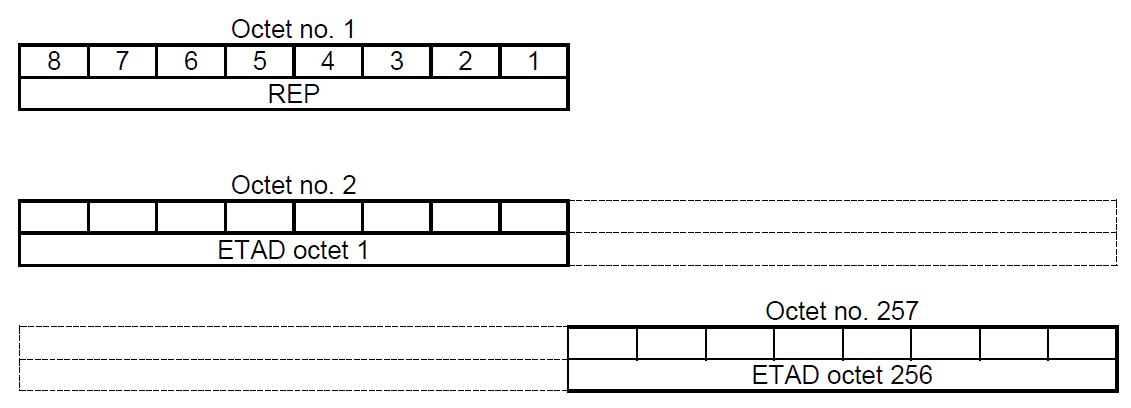
bits-16/1 (TLTAD) = Total length in octets of the extended transparent application data (ETAD) contained in data item I253/130, Maximum value = 65.280 octets.

* + - * 1. Data Item I253/130, Extended Transparent Application Data

**Definition**:Extended transparent application data

**Format**: Repetitive Data item starting with a one-octet Field Repetition Indicator (REP) followed by at least one Extended Transparent Application Data block of 256 octets.

**Structure**:



bits-8/1 (REP) = Repetition Factor = number of ETAD blocks following.

(ETAD) = Extended transparent application data

**NOTE**

If required, data item will be filled with padding bits set to “0” to achieve the 256 octet length.

* + 1. Radar target track data definition
       1. User Application Profile

The following UAP shall be used for the transmission of target track data:

Table 13 User Application Profile for Target Track Data

|  |  |  |  |
| --- | --- | --- | --- |
| FRN | Data Item | Information | Length in Octets |
| 1 | I010/000 | Message Type | 1 |
| 2 | I010/010 | Data Source Identifier | 2 |
| 3 | I010/040 | Measured Position in Polar Co-ordinates | 4 |
| 4 | I010/041 | Position in WGS-84 | 8 |
| 5 | I010/042 | Position in Cartesian Co-ordinates | 4 |
| 6 | I010/131 | Amplitude of Primary Plot | 1 |
| 7 | I010/140 | Time of Day | 3 |
| FX | - | Field Extension Indicator | N.A. |
| 8 | I010/161 | Track Number | 2 |
| 9 | I010/170 | Track Status | 1+ |
| 10 | I010/200 | Calculated Track Velocity in Polar Co-ordinates | 4 |
| 11 | I010/202 | Calculated Track Velocity in Cartesian Coord | 4 |
| 12 | I010/210 | Calculated Acceleration | 2 |
| 13 | I010/220 | Track Number | 3 |
| 14 | I010/270 | Target Size & Orientation | 1+ |
| FX | - | Field Extension Indicator | N.A. |
| 15 | I010/280 | Presence | 1+2×n |
| 16 | I010/SP | Special Purpose | 1+ |
| 17 | I010/RE | Reserved | 1+ |
| FX | - | Field Extension Indicator | N.A. |

* + - 1. Description of the Data Items
         1. Data Item I010/000, Message Type

**Definition**: This Data Item allows for a more convenient handling of the messages at the receiver side by further defining the type of transaction.

**Format**: One-octet fixed length Data Item.

**Structure**:



bits-8/1 = Message Type

**Encoding rule**: This data item shall be present in every ASTERIX record.

**NOTES**

1. In application where transactions of various types are exchanged, the Message Type Data Item facilitates the proper message handling at the receiver side.

2. All Message Type values are reserved for common standard use.

3. The following set of Message Types are standardised for category 010 records:

• 001 Target Report

• 002 Start of Update Cycle

• 003 Periodic Status Message

• 004 Event-triggered Status Message

4. The list of items present for the four message types is defined in the following table. M stands for mandatory, O for optional, X for never present.

Table 14 Items per Message Types

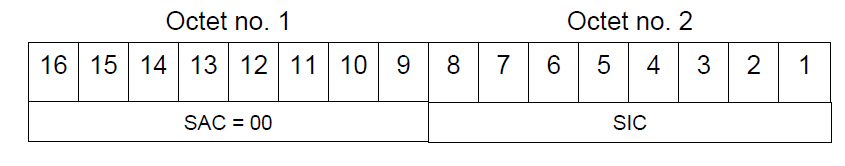
|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Item | Type | 001 Target Report | 002 Start of Update Cycle | 003 Periodic Status Message | 004 Event Status Message |
| I010/000 | Message Type | M | M | M | M |
| I010/010 | Data Source Identifier | M | M | M | M |
| I010/040 | Measured Position in Polar Co-ordinates | O | X | X | X |
| I010/041 | Position in WGS-84 | O | X | X | X |
| I010/042 | Position in Cartesian Co-ordinates | O | X | X | X |
| I010/131 | Amplitude of Primary Plot | O | X | X | X |
| I010/140 | Time of Day | M | M | M | M |
| I010/161 | Track Number | O | X | X | X |
| I010/170 | Track Status | O | X | X | X |
| I010/200 | Calculated Track Velocity in Polar Co-ordinates | O | X | X | X |
| I010/202 | Calculated Track Velocity in Cartesian Coord | O | X | X | X |
| I010/210 | Calculated Acceleration | O | X | X | X |
| I010/220 | Track Number | O | X | X | X |
| I010/270 | Target Size & Orientation | O | X | X | X |
| I010/280 | Presence | O | X | X | X |

* + - * 1. Data Item I010/010,Data Source Identifier

**Definition**: Identification of the system from which the data are received.

**Format**: Two-octet fixed length Data Item.

**Structure**:



bits-16/9 (SAC) = System Area Code fixed to zero

bits-8/1 (SIC) = System Identification Code

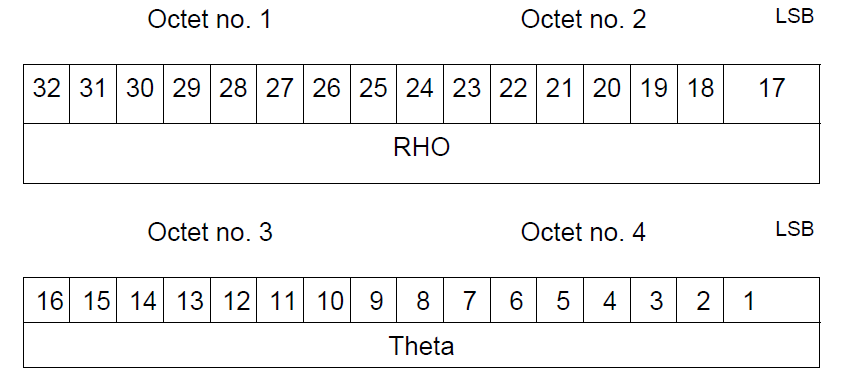
**NOTE**: The SAC is fixed to zero to indicate a data flow local to the airport.

* + - * 1. Data Item I010/040,Measured Position in Polar Co-ordinates

**Definition**: Measured position of a target in local polar co-ordinates.

**Format**: Four-octet fixed length Data Item.

**Structure**:



bit-17 (LSB) = 1m, max.range = 65536m, approx. 35.4NM

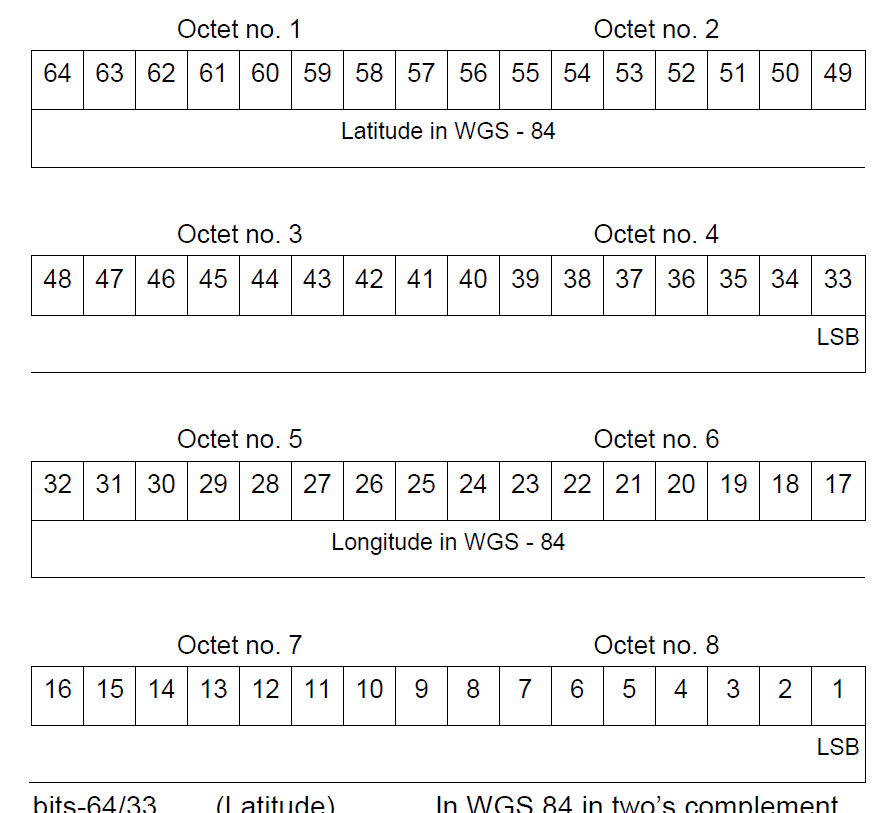
bit-1 (LSB) = 360°/(216), approx. 0.0055°

* + - * 1. Data Item I010/041, Position in WGS-84 Co-ordinates

**Definition** : Position of a target in WGS-84 Co-ordinates.

**Format** : Eight-octet fixed length Data Item

**Structure**:



bits-64/33 (Latitude) = In WGS.84 in two’s complement. Range -90 <= latitude <= 90 deg.

(LSB) = 180/231 degrees

bits-32/1 (Longitude) = In WGS.84 in two’s complement. Range -180 <= longitude < 180 deg.

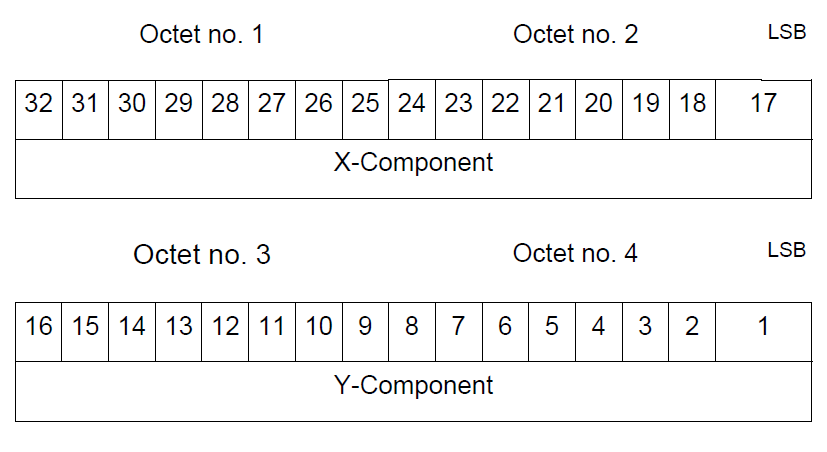
(LSB) = 180/231 degrees

* + - * 1. Data Item I010/042, Position in Cartesian Co-ordinates

**Definition**: Position of a target in Cartesian co-ordinates, in two’s complement form.

**Format**: Four-octet fixed length Data Item .

**Structure**:



bit-17 (LSB) = 1m, max.range = ±32768m, approx.±17.7NM

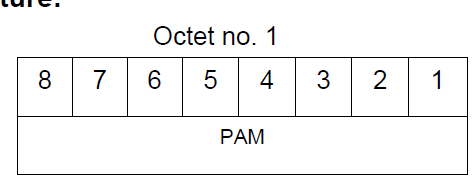
bit-1 (LSB) = 1m, max.range = ±32768m, approx.±17.7NM

* + - * 1. Data Item I010/131, Amplitude of Primary Plot

**Definition**: Amplitude of Primary Plot.

**Format**: One-Octet fixed length Data Item.

**Structure**:



bits-8/1 (PAM) = Range 0～255

**NOTE**: The value is radar-dependent, 0 being the minimum detectable level for that radar.

* + - * 1. Data Item I010/140, Time of Day

**Definition**: Absolute time stamping expressed as UTC.

**Format**: Three-octet fixed length Data Item.

**Structure**:



bit-1 (LSB) = (2-7)s = 1/128 s

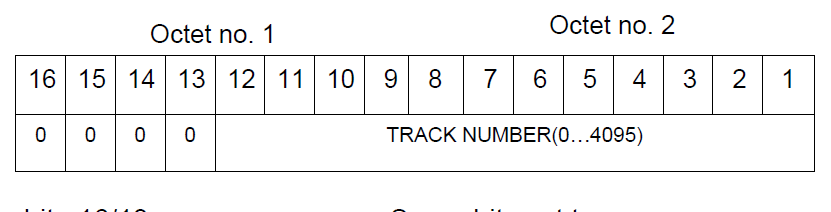
**NOTE**: The time of day value is reset to zero each day at midnight.

* + - * 1. Data Item I010/161, 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**:



bits-16/13 = Spare bits set to zero.

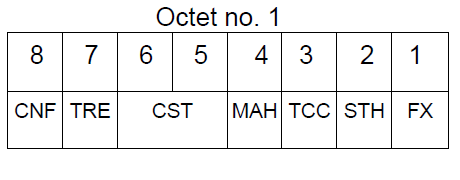
bits-12/1 = Track number.

* + - * 1. Data Item I010/170, Track Status

**Definition**: Status of track.

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

**Structure of First Part**:



bit-8 (CNF) = 0 Confirmed track

= 1 Track in initialisation phase

bit-7 (TRE) = 0 Default

= 1 Last report for a track

bits-6/5 (CST) = 00 No extrapolation

= 01 Predictable extrapolation due to sensor refresh period (see NOTE)

= 10 Predictable extrapolation in masked area

= 11 Extrapolation due to unpredictable absence of detection

bit-4 (MAH) = 0 Default

= 1 Horizontal manoeuvre

bit-3 (TCC) = 0 Tracking performed in 'Sensor Plane', i.e. neither slant range correction nor 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 Sensor Site co-ordinates.

bit-2 (STH) = 0 Measured position

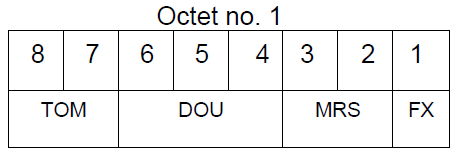
= 1 Smoothed position

bit-1 (FX) = 0 End of Data Item

= 1 Extension into first extent

**NOTE**: Some sensors are not be able to scan the whole coverage in one refresh period. Therefore, track extrapolation is performed in un-scanned sectors. CST is then set to 01.

**Structure of First Extent**:



bits-8/7 (TOM) = 00 Unknown type of movement

= 01 Taking-off

= 10 Landing

= 11 Other types of movement

bits-6/4 (DOU) = 000 No doubt

= 001 Doubtful correlation (undetermined reason)

= 010 Doubtful correlation in clutter

= 011 Loss of accuracy

= 100 Loss of accuracy in clutter

= 101 Unstable track

= 110 Previously coasted

bits-3/2 (MRS) = 00 Merge or split indication undetermined

= 01 Track merged by association to plot

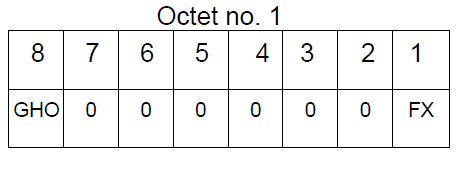
= 10 Track merged by non-association to plot

= 11 Split track

bit-1 (FX) = 0 End of Data Item

= 1 Extension into next extent

**Structure of Second Extent**:



bit-8 (GHO) = 0 Default

= 1 Ghost track

bits-7/2 = Spare bits set to zero

bit-1 (FX) = 0 End of Data Item

= 1 Extension into next extent

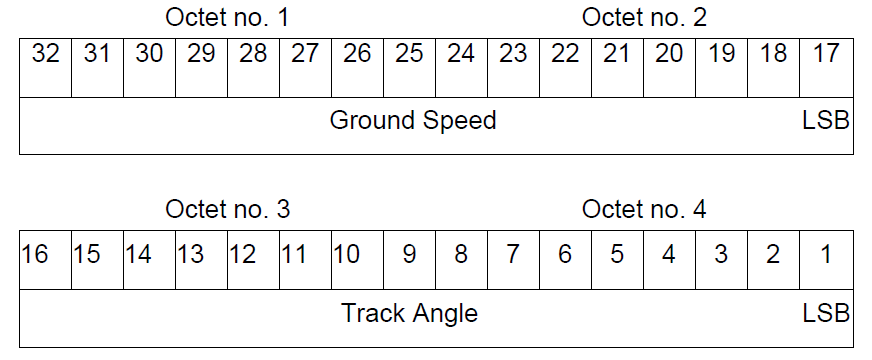
**NOTES**: Bit-8 (GHO) is used to signal that the track is suspected to have been generated by a fake target.

* + - * 1. Data Item I010/200, Calculated Track Velocity in Polar Co-ordinates

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

**Format**: Four-octet fixed length Data Item.

**Structure**:



bits 32-17 = Ground Speed

(LSB) = 2-14 NM/s ≅0.22 kt Max. val. = 2 NM/s = 7200kt

bit 16-1 = Track Angle

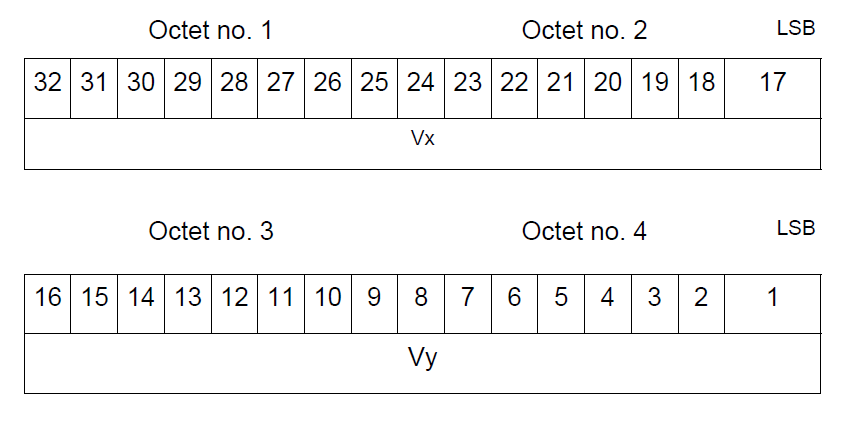
(LSB) = 360°/ 216 = 0.0055°

* + - * 1. Data Item I010/202, Calculated Track Velocity in Cartesian Co-ordinates

**Definition**: Calculated track velocity expressed in Cartesian co-ordinates, in two’s complement representation.

**Format**: Four-octet fixed length Data Item.

**Structure**:



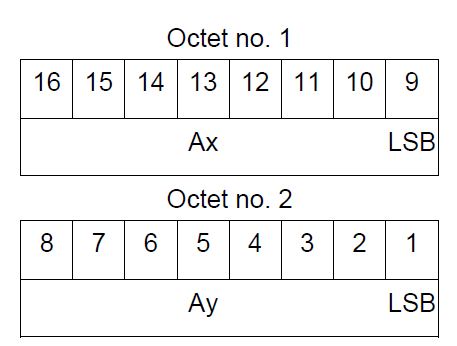
bit-17 & 1 (LSB) = 0.25 m/s, Max.range = ±8192m/s

* + - * 1. Data Item I010/210, Calculated Acceleration

**Definition**: Calculated Acceleration of the target, in two’s complement form.

**Format**: Two-octet fixed length Data Item.

**Structure**:



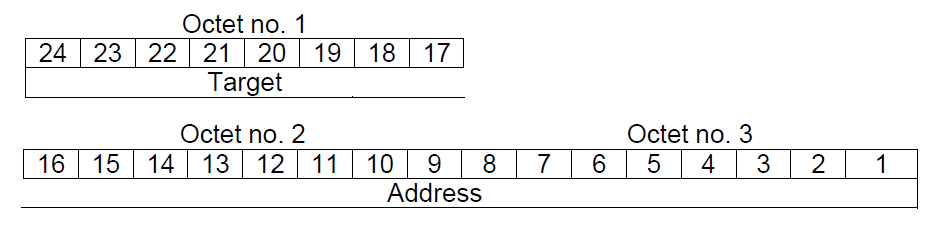
bits 9 & 1 (LSB) = 0.25 m/s2, Max. range ± 31 m/s2

* + - * 1. Data Item I010/220, Target Address

**Definition**: Target address (24-bits address) assigned uniquely to each Target.

**Format**: Three-octet fixed length Data Item.

**Structure**:



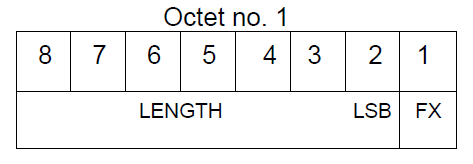
bits-24/1 = 24-bits Target Address, A23 to A0

* + - * 1. Data Item I010/270, Target Size & Orientation

**Definition**: Target size defined as length and width of the detected target, and orientation.

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

**Structure of First Part**:

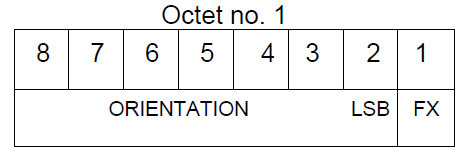


bit-2 (LSB) = 1 m

bit-1 (FX) = 0 End of Data Item

= 1 Extension into first extent

**Structure of First Extent**:

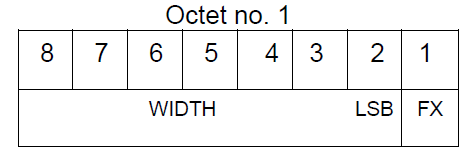


bit-2 (LSB) = 360° / 128 = approx. 2.81°

bit-1 (FX) = 0 End of Data Item

= 1 Extension into next extent

**Structure of Second Extent**:



bit-2 (LSB) = 1 m

bit-1 (FX) = 0 End of Data Item

= 1 Extension into next extent

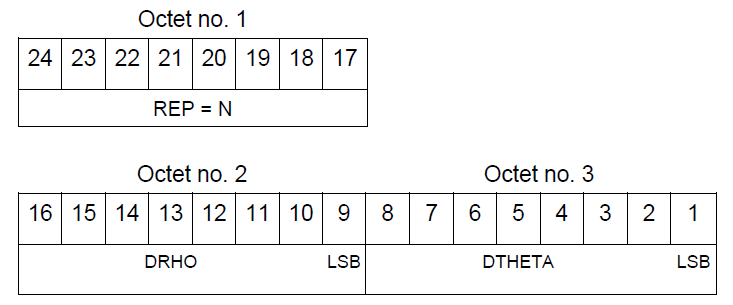
**NOTE**: The orientation gives the direction which the aircraft nose is pointing, relative to the Geographical North.

* + - * 1. Data Item I010/280, Presence

**Definition**: Positions of all elementary presences constituting a plot.

**Format**: Repetitive Data Item, starting with a one octet Field Repetition Indicator (REP) indicating the number of presences associated to the plot, followed by series of two octets (co-ordinates differences) as necessary.

**Structure**:



bits-24/17 (REP) Number of presences associated to the plot

bits-16/9 (DRHO) Difference between the radial distance of the plot centre and that of the presence.

(LSB) = 1 m, Max. Range = ± 127 m

bits-8/1 (DTHETA) Difference between the azimuth of the plot centre and that of the presence.

(LSB) = 0.15°, Max. Range = ± 19.05°

* + 1. Radar video data definition
       1. User Application Profile

The following UAP shall be used for the transmission of video data:

Table 15 User Application Profile for Video Data

|  |  |  |  |
| --- | --- | --- | --- |
| FRN | Data Item | Information | Length in Octets |
| 1 | I240/000 | Message Type | 1 |
| 2 | I240/010 | Data Source Identifier | 2 |
| 3 | I240/020 | Video Record Header | 4 |
| 4 | I240/030 | Video Summary | 1+n |
| 5 | I240/040 | Video Header Nano | 12 |
| 6 | I240/041 | Video Header Femto | 12 |
| 7 | I240/048 | Video Cells Resolution & Data Compression Indicator | 2 |
| FX | - | Field Extension Indicator | N.A. |
| 8 | I240/049 | Video Octets & Video Cells Counters | 5 |
| 9 | I240/050 | Video Block Low Data Volume | 1+4×n |
| 10 | I240/051 | Video Block Medium Data Volume | 1+64×n |
| 11 | I240/052 | Video Block High Data Volume | 1+256×n |
| 12 | I240/140 | Time of Day | 3 |
| 13 | I240/150 | Location of Radar Antenna | 12 |
| 14 | I240/SP | Special Purpose | 1+ |
| FX | - | Field Extension Indicator | N.A. |
| 15 | I240/RE | Reserved | 1+ |
| FX | - | Field Extension Indicator | N.A. |

* + - 1. Description of the Data Items
         1. Data Item I240/000, Message Type

**Definition**: This Data Item allows for a more convenient handling of the messages at the receiver side by further defining the type of transaction.

**Format**: One-octet fixed length Data Item.

**Structure**:



bits-8/1 = Message Type

**Encoding rule**: This data item shall be present in every ASTERIX record.

**NOTES**

1. In application where transactions of various types are exchanged, the Message Type Data Item facilitates the proper message handling at the receiver side.

2. All Message Type values are reserved for common standard use.

3. The following set of Message Types are standardised for category 240 records:

• 001 Video Summary message

• 002 Video message

4. The list of items present for the four message types is defined in the following table. M stands for mandatory, O for optional, X for never present. 001.

Table 16 Items per Message Types

|  |  |  |  |
| --- | --- | --- | --- |
| Item | Type | 001 Video Summary Message | 002 Video Message |
| I240/000 | Message Type | M | M |
| I240/010 | Data Source Identifier | M | M |
| I240/020 | Video Record Header | X | M |
| I240/030 | Video Summary | M | X |
| I240/040 | Video Header Nano | X | O1 |
| I240/041 | Video Header Femto | X | O1 |
| I240/048 | Video Cells Resolution & Data Compression Indicator | X | M |
| I240/049 | Video Octets & Video Cells Counters | X | M |
| I240/050 | Video Block Low Data Volume | X | O2 |
| I240/051 | Video Block Medium Data Volume | X | O2 |
| I240/052 | Video Block High Data Volume | X | O2 |
| I240/140 | Time of Day | O | O |
| I240/150 | Location of Radar Antenna | O | O |

· 1 Either Item I240/040 or I240/041 shall be present in each Video Message.

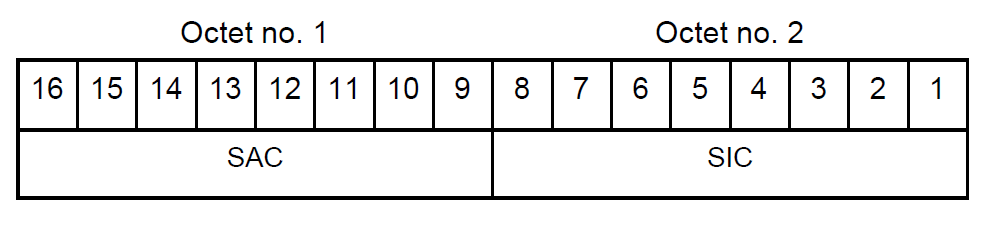
· 2 Either Item I240/050 or I240/051 or I240/052 shall be present in each Video Message.

* + - * 1. Data Item I240/010, Data Source Identifier

**Definition**: Identification of the system from which the data are received.

**Format**: Two-octet fixed length Data Item.

**Structure**:



bits-16/9 (SAC) = System Area Code

bits-8/1 (SIC) = System Identification Code

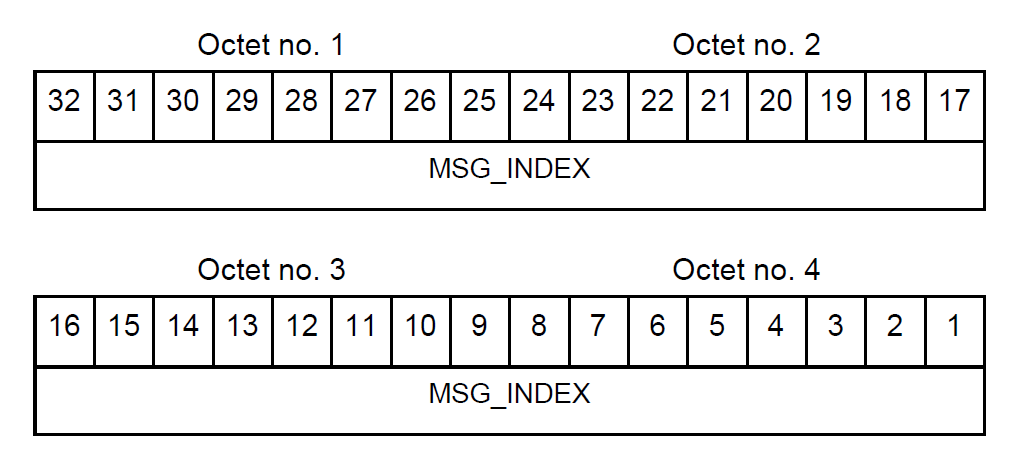
**Encoding Rule** : This item shall be present in each ASTERIX message

* + - * 1. Data Item I240/020, Video Record Header

**Definition**: Contains a message sequence identifier.

**Format**: Four-octet fixed length Data Item.

**Structure**:



Bits 32/1 (MSG\_INDEX) = Message Sequence Identifier (video record cyclic counter)

**Encoding Rule** : This item shall be present in each ASTERIX message.

**NOTE**: The Message Sequence Identifier is used by the receiving application to detect lost messages.

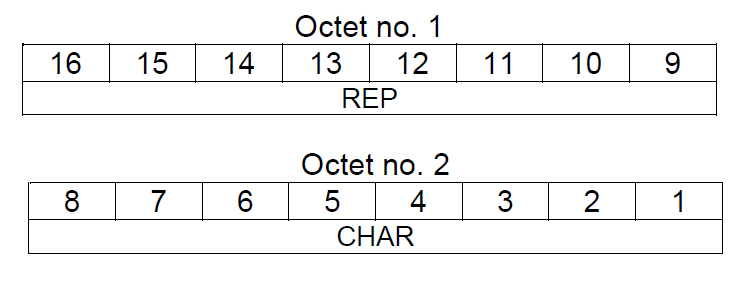
MSG\_INDEX have a length of 32 bits to ease real time encoding.

* + - * 1. Data Item I240/030, Video Summary

**Definition**: Contains an ASCII string (free text to define stream meta data).

**Format**: Repetitive Data Item, starting with a one-octet Field Repetition Indicator (REP) followed by at least one sub-field of one octet (ASCII character).

**Structure**:



bit-16/9 (REP) = Number of characters following

bit-8/1 (CHAR) = Character in ASCII representation

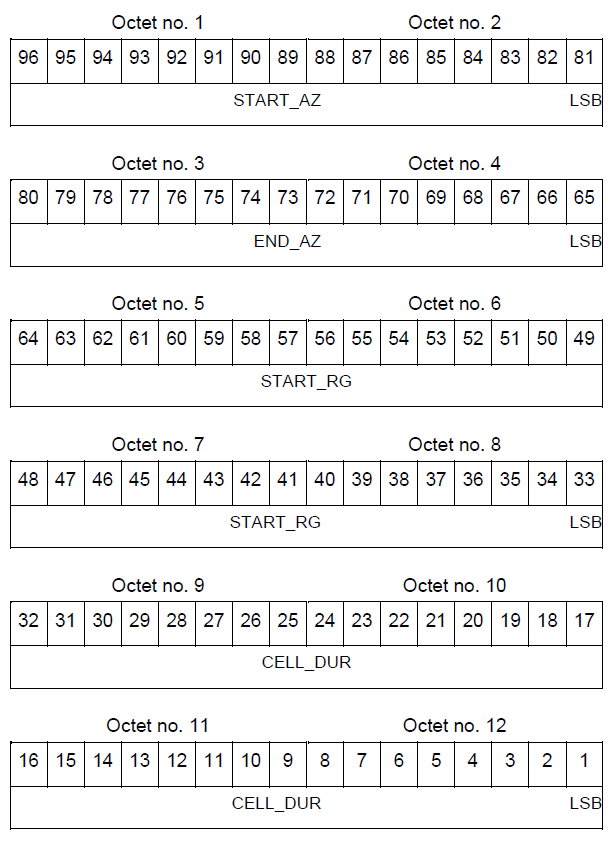
**Encoding Rule** : This item shall be present in each Video Summary Message.

* + - * 1. Data Item I240/040, Video Header Nano

**Definition**: Defines a group of video cells corresponding to a video radial: all cells have the same size in azimuth and range and are consecutive in range.

**Format**: Twelve-Octets fixed length data item.

**Structure**:



Bits 96/81 (START\_AZ) = Start azimuth of the cells group

(LSB) = 360/216, Range 0<= Start azimuth <= 360 deg.

Bits 80/65 (END\_AZ) = End azimuth of the cells group

(LSB) = 360/216, Range 0<= End azimuth <= 360 deg.

Bits 64/33 (START\_RG) = Starting range of the cells group, expressed in number of cells. 0 is the radar location without any bias.

Bits 32/1 (CELL\_DUR) = Video cell duration in nano-seconds.

(LSB) = 10-9 s

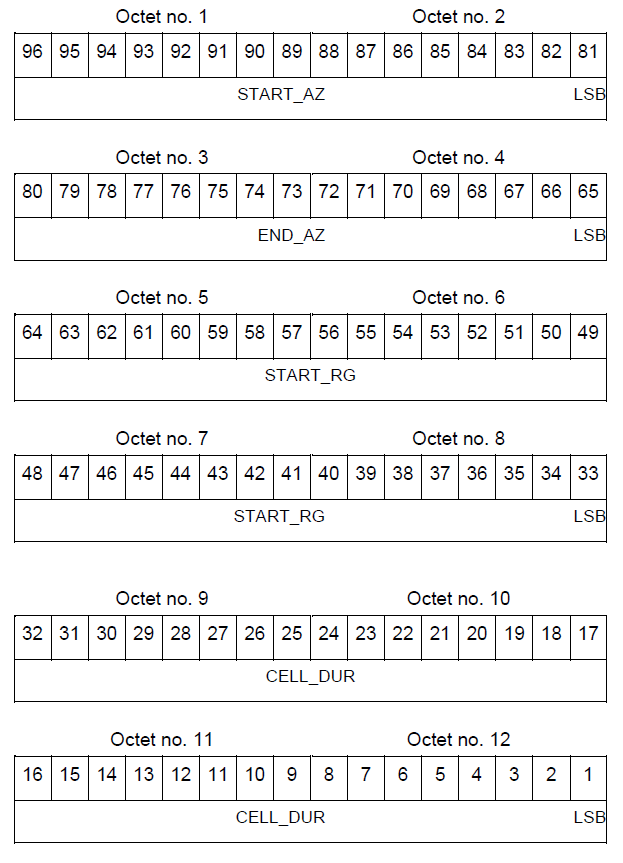
**Encoding Rule** : Either item I240/040 or I240/041 shall be present in each Video Message.

* + - * 1. Data Item I240/041, Video Header Femto

**Definition**: Defines a group of video cells corresponding to a video radial: all cells have the same size in azimuth and range and are consecutive in range.

**Format**: Twelve-Octets fixed length data item.

**Structure**:



Bits 96/81 (START\_AZ) Start azimuth of the cells group

(LSB) = 360/216, Range 0<= Start azimuth <= 360 deg.

Bits 80/65 (END\_AZ) End azimuth of the cells group

(LSB) = 360/216, Range 0<= End azimuth <= 360 deg.

Bits 64/33 (START\_RG) Starting range of the cells group, expressed in number of cells. 0 is the radar location without any bias.

Bits 32/1 (CELL\_DUR) Video cell duration in femto-seconds.

(LSB)= 10-15 s

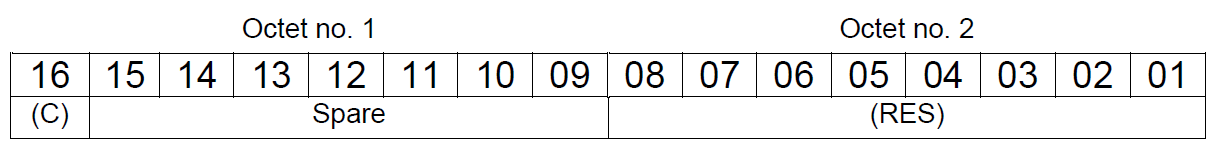
**Encoding Rule** : Either item I240/040 or I240/041 shall be present in each Video Message.

* + - * 1. Data Item I240/048, Video Cells Resolution & Data Compression Indicator

**Definition**: This Data Item defines the bit resolution used in the coding of the video signal amplitude in all cells of the video group as well as an indicator whether data compression has been applied.

**Format**: Two-Octets fixed length data item.

**Structure**:



Bit 16 (C) = Data Compression Indicator

0 = No compression applied

1 = Compression applied

Bits 15/9 = Spare Spare Bits set to 0

Bits 8/1 (RES) = Bit resolution used for the coding of the amplitude of the video signal in every cell of a video group.

|  |  |  |
| --- | --- | --- |
| RES | Resolution Coding | Length in bits |
| 1 | Monobit Resolution | 1 |
| 2 | Low Resolution | 2 |
| 3 | Medium Resolution | 4 |
| 4 | High Resolution | 8 |
| 5 | Very High Resolution | 16 |
| 6 | Ultra High Resolution | 32 |

**Encoding Rule** : This data item shall be present in every Video Message.

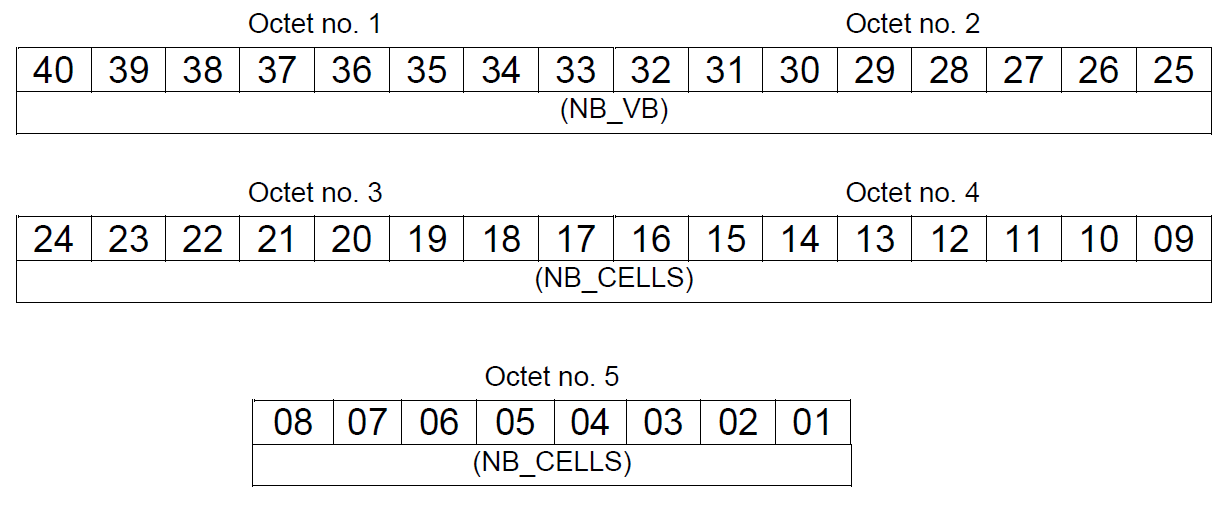
**NOTE**: When the Data Compression Indicator (C) is set, shows that a data compression technique has been applied. The actual algorithm used and the related parameters have to be specified in a relevant ICD (Interface Control Document).

* + - * 1. Data Item I240/049, Video Octets & Video Cells Counters

**Definition**: This Data Item contains the number of “valid” octets (i.e. nonempty octets) used in the coding of the video signal amplitude and the number of “valid” cells in the video group.

**Format**: Five-octets fixed length Data Item.

**Structure**:



Bits 40/25 (NB\_VB) = Number of “valid” octets in the Video Block Data Volume Item; i.e. one of I240/050 or I240/051 or I240/052 whichever is present

Bits 24/01 (NB\_CELLS) = Number of “valid” cells in the Video Block Data Volume Item; i.e. one of I240/050 or I240/051 or I240/052 whichever is present

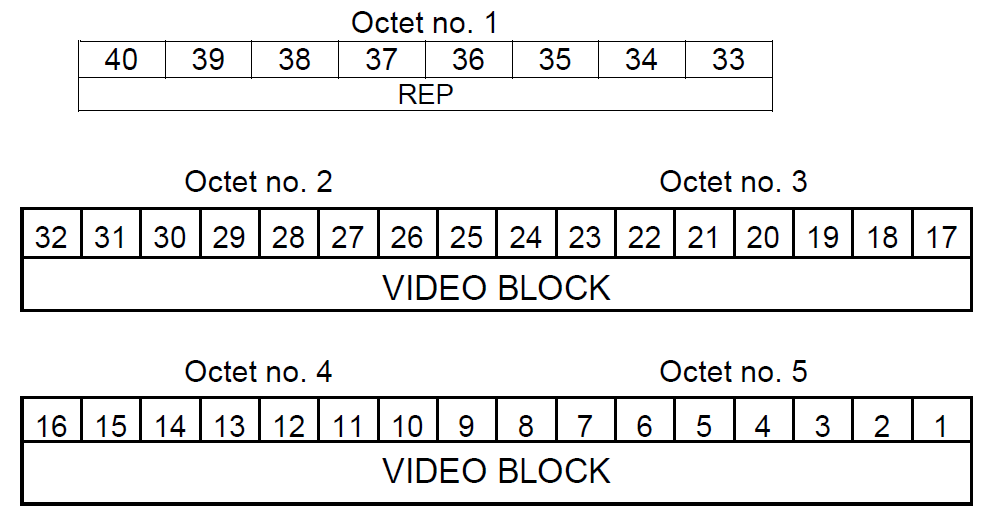
**Encoding Rule** : This item shall be present in each Video Message.

* + - * 1. Data Item I240/050, Video Block Low Data Volume

**Definition**: Contains a group of video cells corresponding to a video radial; all cells have the same size in azimuth and range and are consecutive in range. This item shall be used in cases where a low data volume, up to 1020 bytes, will be transmitted.

**Format**: Repetitive Data Item starting with a one-octet Field Repetition Indicator (REP) followed by at least one video block of four-octets.

**Structure**:



Bits 40/33 (REP) = Repetition factor, indicating the number of video blocks following

Bits 32/1 (VIDEO BLOCK) = Video signal amplitude of the cells in the group, coded according to the resolution defined in Item I240/048

**Encoding Rule** : One of the Items I240/050, I240/051 or I240/052 shall be present in each Video Message.

**NOTES**

1. The first cell in the block is always the closest to the sensor and the following cells are in increasing range order.

2. To get the range in meters of the cell at position “NU\_CELL” in the data stream, the following formula shall be used:



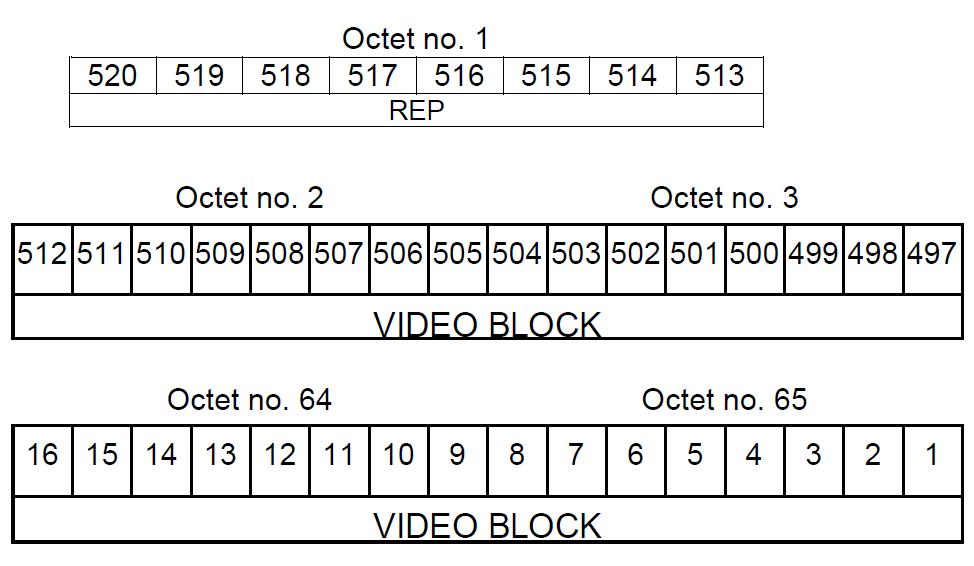
where c = 299 792 458 m/s: light celerity.

* + - * 1. Data Item I240/050, Video Block Medium Data Volume

**Definition**: Contains a group of video cells corresponding to a video radial; all cells have the same size in azimuth and range and are consecutive in range. This item shall be used in cases where a medium data volume, up to 16320 bytes, will be transmitted.

**Format**: Repetitive Data Item starting with a one-octet Field Repetition Indicator (REP) followed by at least one video block of sixty four-octets.

**Structure**:



Bits 520/513 (REP) = Repetition factor, indicating the number of video blocks following

Bits 512/1 (VIDEO BLOCK) = Video signal amplitude of the cells in the group, coded according to the resolution defined in Item I240/048

**Encoding Rule** : One of the Items I240/050, I240/051 or I240/052 shall be present in each Video Message.

**NOTES**

1. The first cell in the block is always the closest to the sensor and the following cells are in increasing range order.

2. To get the range in meters of the cell at position “NU\_CELL” in the data stream, the following formula shall be used:



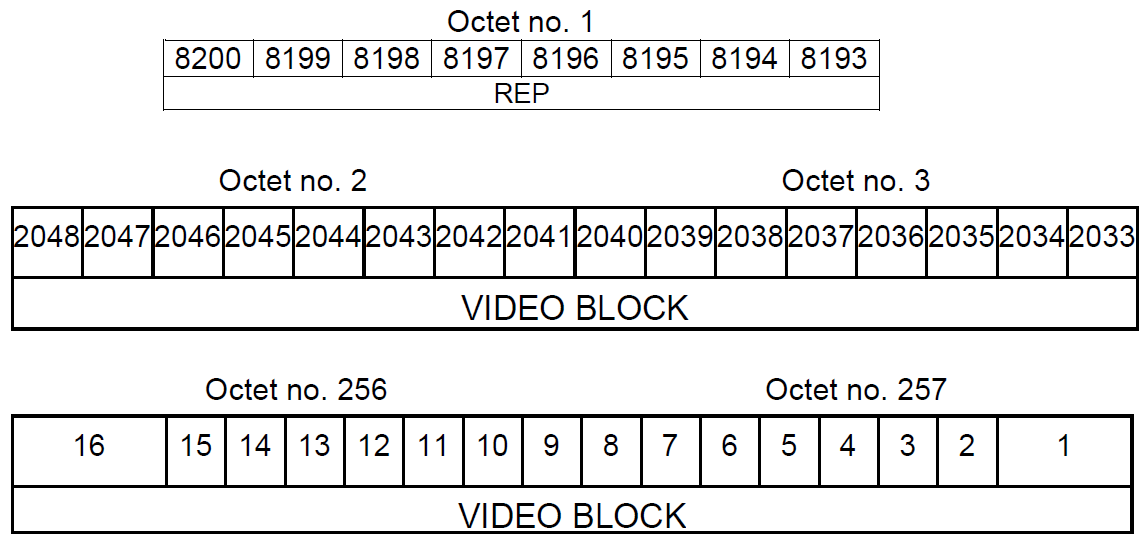
where c = 299 792 458 m/s: light celerity.

* + - * 1. Data Item I240/052, Video Block High Data Volume

**Definition**: Contains a group of video cells corresponding to a video radial; all cells have the same size in azimuth and range and are consecutive in range. This item shall be used in cases where a high data volume, up to 65024 bytes, will be transmitted.

**Format**: Repetitive Data Item starting with a one-octet Field Repetition Indicator (REP) followed by at least one video block of two hundred fifty six-octets.

**Structure**:



Bits 8200/8193 (REP) = Repetition factor, indicating the number of video blocks following (Max. value 254)

Bits 8192/1 (VIDEO BLOCK) = Video signal amplitude of the cells in the group, coded according to the resolution defined in Item I240/048

**Encoding Rule** : One of the Items I240/050, I240/051 or I240/052 shall be present in each Video Message.

**NOTES**

1. The first cell in the block is always the closest to the sensor and the following cells are in increasing range order.

2. To get the range in meters of the cell at position “NU\_CELL” in the data stream, the following formula shall be used:



where c = 299 792 458 m/s: light celerity.

* + - * 1. Data Item I240/140, Time of Day

**Definition**: Absolute time stamping expressed as UTC.

**Format**: Three-octet fixed length Data Item.

**Structure**:



bit-1 (LSB) = (2-7)s = 1/128 s

**Encoding Rule** :This data item is optional.

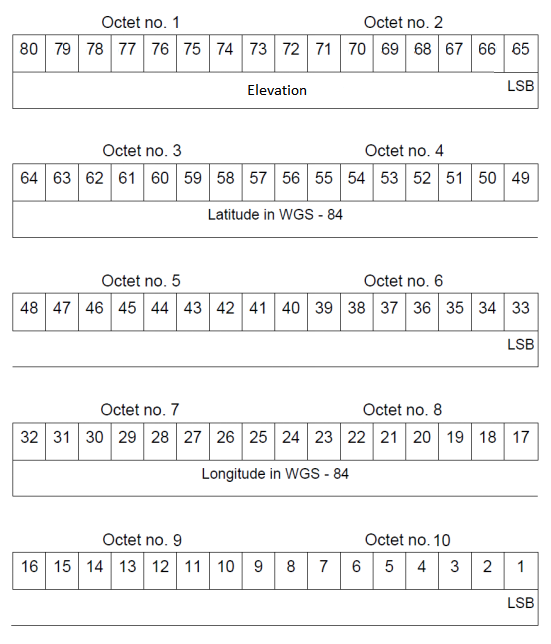
**NOTE**:

1. The time of day value is reset to zero each day at midnight.
2. The time information, shall reflect the exact time of an event, expressed as a number of 1/128 s elapsed since last midnight.
   * + - 1. Data Item I240/150,Location of Radar Antenna

**Definition** : Elevation and Latitude/Longitude in WGS-84 Co-ordinates of radar antenna.

**Format** : Ten-octet fixed length Data Item

**Structure**:



bits-80/65 (Elevation) = Range 0 <= Elevation <= 10000 m.

(LSB) = 1m

bits-64/33 (Latitude) = In WGS.84 in two’s complement. Range -90 <= latitude <= 90 deg.

(LSB) = 180/231 degrees

bits-32/1 (Longitude) = In WGS.84 in two’s complement. Range -180 <= longitude < 180 deg.

(LSB) = 180/231 degrees

1. Input document number, to be assigned by the Committee Secretary [↑](#footnote-ref-1)
2. Leave open if uncertain [↑](#footnote-ref-2)