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EMERGENCY WARNING SATELLITE SERVICE

COMMON ALERT MESSAGE FORMAT SPECIFICATION

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#EUSpace

Forewords

The development of disaster risk reduction technologies is a global trend that follows the **United Nations' objective under the Sendai Framework for Disaster Risk Reduction**, to "*substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to people by 2030*". The "Early Warnings for all Executive plan 2023-2027" unveiled at COP27 in November 2022, identifies actions and calls for investments to meet this target.

Since 2018, Japan and the European Union have initiated the development of satellite dissemination capacity for alert message, as a complementary service to the corpus of existing early warning systems. Such services are named "***Emergency Warning Satellite Services (EWSS)***", and exploit the advantages offered by satellite navigation systems.

With the objective to make EWSS a capacity that is useful to the greatest number of people, and that can be implemented in any satellite navigation system, EU and Japan joined efforts to create a common message format. Such common format is easily re-usable by other providers willing to introduce EWSS capacity in their system, thereby allowing service interoperability and harmonisation of implementation.

The proposed structure for the alert message will initially be implemented in the European global navigation satellite system 'Galileo' and the Japanese regional navigation satellite system 'QZSS'. Other nations and satellite navigation providers are free to adopt the proposed common format and contribute with their experience to the evolution of EWSS.

Of universal scope, EWSS are to be used to warn population threatened by a looming disaster, contributing therefore to protecting people and properties from disasters. It is expected therefore that the development of such services in other satellite navigation systems, their use for the benefit of other nations, the good practices for user adoption and the return of experience from the civil protection community, will be discussed amongst interested parties worldwide.

Acknowledgements

The Common Alert Message Format was jointly developed by the European Commission[1], the Cabinet Office[2] and the Advanced Institute for Industrial Technology[3]. It has been agreed in December 2022, and successfully tested in field demonstrations in 2023, both on QZSS and Galileo.

[1] https://defence-industry-space.ec.europa.eu/eu-space-policy/eu-space-programme_en
[2] https://www.cao.go.jp/index-e.html
[3] https://aiit.ac.jp/english/

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1. Introduction

1.1. Scope of the Document

This document provides the full specification of the common message format that can be implemented in any satellite navigation systems to code and broadcast alert messages encapsulated in the satellite navigation signals.

The document is intended for use by satellite navigation providers, satellite operators, civil protection authorities and receiver manufacturers.

The format specification is described independently of any specific implementation or characteristic of satellite navigation systems (e.g. design, architecture, signal encapsulation, frequencies, repetition rates, etc). Similarly, the document does not describe the implementation of the format on the side of national civil protection systems.

As a complement to this document, receiver guidelines for the user segment implementation of EWSS should be provided separately by satellite navigation providers, describing the steps to be followed by receivers and user terminals to ensure coherent interpretation of the common alert format and exploit its full potential.

1.2. Structure of the Document

The document is structured as follows:

- Section 1 is the introduction, providing the scope of the document, an overview of the Emergency Warning Satellite Services and explaining the rationale for developing a common alert message format;
- Section 2 describes high-level structure of the common alert message;
- Section 3 describes each individual field of the message format;
- Annex A provides the list of reference documents;
- Annex B provides the acronyms and notations;
- Annex C provides the full content of the CAMF fields.

1.3. Overview of the Emergency Warning Satellite Service

The use of satellite navigation capacity for disseminating alert to population is a novel approach with the following features:

- It offers to civil protection entities an additional distribution channel;
- It allows people to receive the alert messages directly on their navigation devices or mobile phones (typical navigation devices include smartphones, smartwatches, car navigator and maritime receivers). In addition, widespread public warning systems (e.g. public signage, displays in buildings and sirens) could be adapted in the future to also relay the alert messages;
- The alert service is independent of the mobile communication infrastructure, and remains operational even when existing systems have been destroyed or are not available (e.g. network saturation, or poor mobile network coverage on land or in open sea areas).

1.3.1. Service Description

An overview of the Emergency Warning Satellite Services is provided in ***Figure 1***. The service concept includes the following top-level functions:

1. **Generate alert:** The authorised civil protection authority generates a standard alert message using the Common Alerting Protocol (CAP) format, indicating at least country, issuing civil protection authority, event type and affected area. Other information can be coded to precise the situation (day and time of the onset of the emergency, expected duration, severity, etc).
2. **Request satellite broadcast:** The authorised civil protection authority sends the message in CAP format for approval to the national or international Emergency Centre who operates the interface of the satellite navigation provider and requests a satellite broadcast of an alert over the affected geographical area.
3. **Coding of the alert information:** the satellite navigation system encodes the request from the authority into a satellite message (the Emergency Warning Message, or EWM), using the CAMF as format. The geometry of the affected area is converted into a target area in the form of an ellipse.

The CAMF is the format that allows to code the alert in a satellite message (EWM). It is the interface between the satellite navigation system and the user terminal. It shall allow to code the information defined by the civil protection authority using the CAP protocol. In other words, the CAMF translates the CAP message in a format suitable for satellite navigation systems.

4. **Uplink and broadcast:** The EWM is then embedded in the navigation message of the signals, uplinked to the navigation satellites and broadcast to the end users.
5. **Display alert:** The user receives the EWM via EWSS-compatible equipment capable to decode and interpret the CAMF. The receiver reads, decodes, and displays the message provided by the civil protection authority. The message is only shown to users located within the target area (geo-fencing principle, see section 2.3.1).

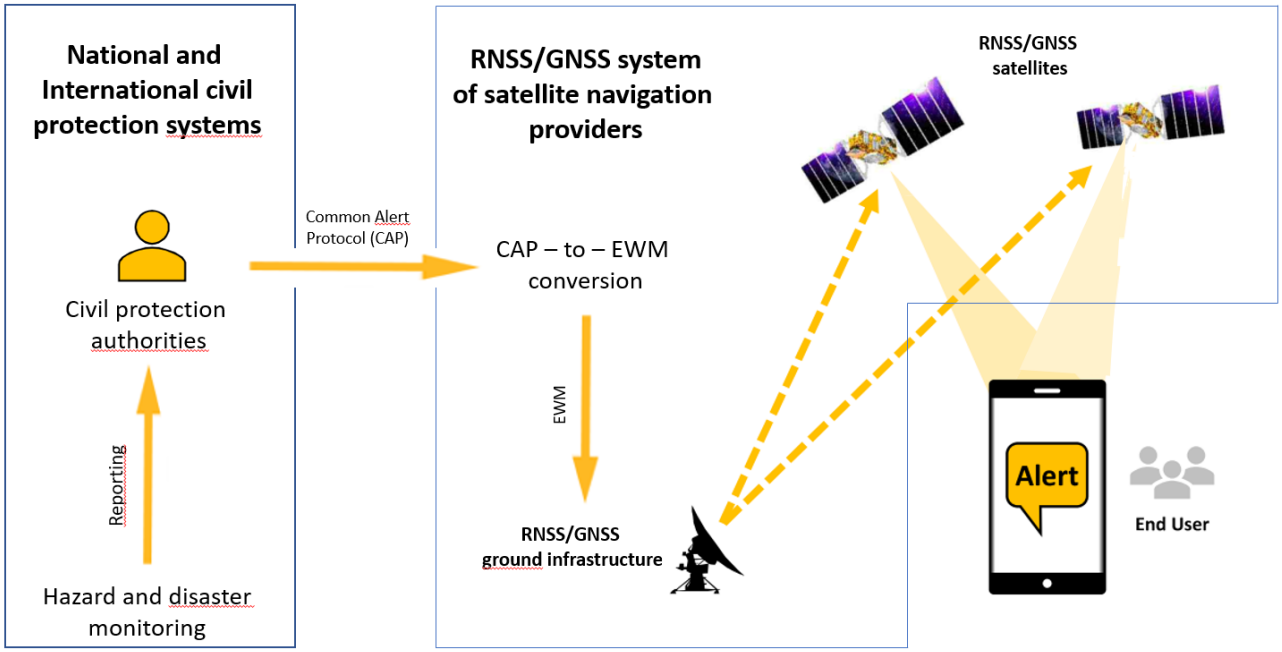


Figure 1: EWSS Overview

1.3.2. Service Interoperability

Satellite navigation systems include global systems such as Galileo, GPS, GLONASS and Beidou, and regional systems include QZSS, NAVIC, EGNOS, etc. All these systems have the potential to introduce EWSS in their portfolio of services, by using the downlink signals as the vehicle containing the alert messages.

Given the number of satellite navigation providers worldwide, it is key to ensure interoperability at service and user equipment levels to facilitate the adoption by market actors and end users, independently of the system that is broadcasting the alert message. The search of a standard approach for developing EWSS led to adopting two principles:

- The content of the alert message encoded in the EWM shall follow as much as possible the structure of the Common Alert Protocol (CAP) standard. CAP is a simple but general format for exchanging all-hazard emergency alerts and public warnings over all kinds of networks. CAP allows a consistent warning message to be disseminated simultaneously over many different warning systems, thus increasing warning effectiveness while simplifying the alert generation task. CAP provides a template for effective warning messages based on best practices identified in academic research and real-world experience. Therefore, CAP allows ease of integration of EWSS into existing early warning services. This is the upstream interoperability.

- The EWM that is broadcast by satellite navigation constellations must be read, decoded, and displayed by most people and alert systems on Earth. It is therefore essential to harmonise as much as possible the alert message format and avoid multiplication of formats that would impede its adoption in market segments. This leads to developing a Common Alert Message Format (CAMF), as the minimum common structure that allows broadcasting alert messages from different satellite navigation service providers. This is the downstream interoperability.

2. The Common Alert Message Format

2.1. Message Structure

The Common Alert Message Format (CAMF) is based on 122 bits, to be encapsulated in the signals of the satellite navigation systems. This size is driven by design constraints applying to some satellite constellations, where only a limited number of bits is available for messaging. The CAMF has been developed with these constraints. However, if satellite navigation providers have more space in their signals (i.e. spare bits), it is still possible to use these extra bits for extending the information contained in the EWM (e.g. for adding more severity levels, or more instructions).

Most of the CAMF fields correspond one-to-one to the CAP fields, allowing a direct transfer between the incoming information and the EWM coding. In the case of the alert area however, CAP offers to code it using a polygon, a circle, or an administrative code. In EWSS, the shape of the alert area has been chosen to be an ellipse, for efficiency: to code an ellipse in geographical coordinates, only its centre's latitude and longitude, the length of its two axes, and an azimuth to the North are required.

CAMF codes the following information:

- **Message identifier**
  1. Message type (A1)
  2. Country / Region ID (A2)
  3. Provider identifier (A3)
- **Hazard**
  4. Hazard category & type (A4)
  5. Severity (A5)
- **Hazard chronology**
  6. Hazard onset: week number (A6)
  7. Hazard onset: time of the week (A7)
  8. Hazard duration (A8)
- **Guidance to react**
  9. Guidance library selection (A9)
  10. Guidance library version (A10)
  11. Guidance instructions (A11)
- **Target area**
  12. Ellipse centre latitude (A12)
  13. Ellipse centre longitude (A13)
  14. Ellipse semi-major axis length (A14)
  15. Ellipse semi-minor axis length (A15)
  16. Ellipse azimuth angle (A16)
- **Additional parameters**
  17. Main subject (A17)
  18. Specific settings (A18)

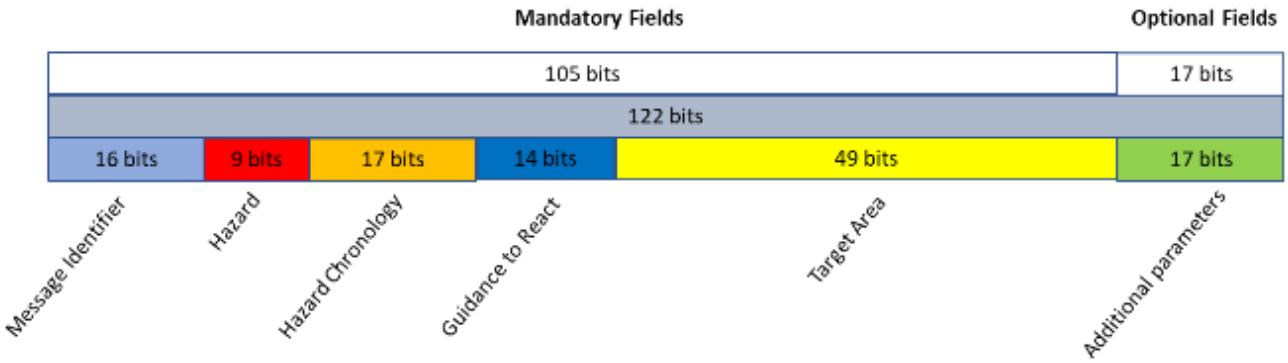


Figure 2: High Level Structure of CAMF

2.2. Requirements from the Civil Protection Community

The alert message contains several important fields, as per recommendations of early warning operators and civil protection community:

- **Alert messages sent to population shall contain the origin of the sender**, i.e. at least the national entity that created the alert and decided to inform the population with this alert. Such national entities can be the weather services, a fire brigade, a prefecture, the governor's office, etc. Their identification depends on the organisation and governance of the civil protection services. In the case of EWSS, the country of origin of the alert message, i.e. the country that wants to alert its population, is also provided. Specific bodies of international organisations (FAO, WMO, European Commission, etc) are also included as potential alert providers acting on behalf of a requesting party (see section 2.4).

- **Alert messages sent to population should contain instruction(s) to react**, so that people know what to do, and/or are guided towards the safest place via an evacuation route. In the case of EWSS, only generic instructions can be provided, via libraries pre-installed in receivers. The full list of instructions is provided in Annex C, section 11.

- **Alert messages sent to population should be sent only to relevant people**, i.e. to those who are considered by the civil protection authority to be affected by the disaster. This translates in the alert to be notified only to the people located within a specific geographical area, defined by the civil protection entity at the origin of the alert. This filtering is realised by applying the principle of geo-fencing at the level of the end user, using two masks: the country / region code, and the ellipse parameters. The application of the geo-fencing principle to EWSS is described in section 2.3.

2.3. Contribution of the User Segment

2.3.1. Geo-Fencing

To notify an alert only to people threatened or affected by a situation, the EWSS concept applies the geo-fencing principle. By comparing its own geographical position with both the country / region code and the geographical coordinates of the ellipse encoded in the received EWM, the receiver is able to determine whether to notify the alert to the user or not. In other words, the receiver notifies the alert if the following condition is true:

$$Receiver\ position\ \in (\ Country \cap Ellipse\ )$$

This double condition allows the receiver to resolve the issue of cross-border alerts, when the ellipse coded for the alert area crosses the border with a neighbouring country. To avoid notifying people located across the border with an alert that does not originate from their own country, the receiver reads the country code in the CAMF: if the user is located within the ellipse but not in the country that

has emitted the alert (i.e. the user is located in the parts of the ellipse that has crossed the border), the receiver discards the EWM and the user is not notified.

2.3.2. EWM Libraries

In order to interpret the data received in the satellite navigation signals, the receiver shall access pre-stored libraries. Each binary code of the CAMF refers to a given value of a given field of the EWM library. When reading the bit chain corresponding to a given field of the CAMF, the receiver simply picks the corresponding value in the library.

In CAMF, one field (field A10) is used to identify the library version that has been used to encode the alert. To ensure correct interpretation when decoding the data received, the receiver shall make sure it is using the same version of the library as that used by the operator to encode the alert. For more details, see section 3.5.2 - Version of library.

Example: The list of possible hazards contains 113 entries. The bit sequence corresponding to 'Tsunami' is '0101100', which is the code looked up by the receiver in the EWM library to retrieve the value 'Tsunami'. The same applies for all fields of the CAMF.

2.3.3. Language Versions

The alert message can be displayed in the language setting of the receiver, as long as the full library content is available in that language version. Otherwise, the receiver selects by default the English version of the library.

For example, in the case of Galileo, the library is available in 25 language versions[4].

2.4. International Usage

The CAMF has been designed to allow the broadcast of an alert that has been generated by an authorised organisation of the United Nations or of the European Union, on behalf of a requesting party. In such case, the same geo-fencing principle applies, where the country / region code is used to select the area for which there is an alert (field A2), and the name of the authorised international organisation acting on behalf of that country is used to identify the originator of the alert (field A3).

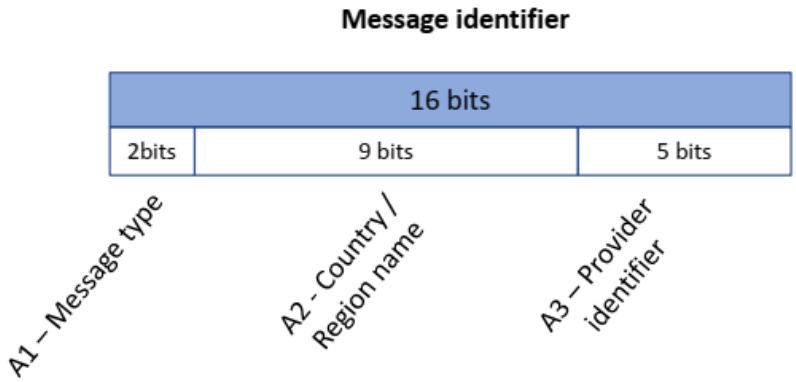
Countries and regions interested to benefit from EWSS capacity are invited to contact the satellite navigation provider of their choice to understand the modalities of this international usage.

[4] Bulgarian, Croatian, Czech, Danish, Dutch, English, Estonian, Finnish, French, German, Greek, Hungarian, Irish, Italian, Latvian, Lithuanian, Maltese, Norwegian, Polish, Portuguese, Romanian, Slovak, Slovene, Spanish, Swedish.

3. CAMF Individual Fields

3.1. Message Identifier

The Message Identifier is split into 3 message fields, covering the message type and the issuing authority (Provider identifier) within a country or region. The content of each message field is specified in the subsections below.



3.1.1. Message Type (A1)

This field allows to identify, for a given alert, whether the message received is an alert message, an update of the initial alert message, a test message, or if the alert is terminated.

A1 - Message Type	
Code [2 bits]	**Message Type**
00	Test
01	Alert
10	Update
11	All Clear

3.1.2. Country/Region Name (A2)

This field allows to identify the country / region from which the alert is issued. It corresponds to the country that is using the satellite infrastructure to broadcast an alert message over its territory. It is encoded by 9 bits allowing 512 possible entries.

The whole list of United Nation's countries is provided in a database (e.g. Afghanistan, Argentina, Italy, etc), based on the ISO 3166 standard. The list is further completed with names of relevant regions (e.g. French Polynesia, Curaçao, New Caledonia, etc). This field has two main functions at user level: it strengthens the legitimacy and the relevance of the information for the people receiving it, and it is used by the receiver as one of the two geographical masks (see section 2.3.1).

A conversion table is necessary in the user terminal to interpret this field and convert the binary code into an intelligible country, region or international organisation.

A2 - Country / Region name	
Code [9 bits]	**Name**
000000000	Afghanistan
000000001	Albania
000000010	Antarctica
…	…
011111000	Zambia
011111001	*Reserved*
…	…
111111111	*Reserved*

3.1.3. Provider Identifier (A3)

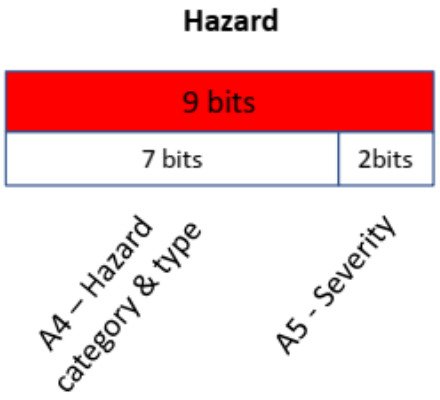
The Provider Identifier is a unique ID that specifies the issuing authority of the alert message in a given country, such as a governor's office, the national weather forecast service, a fire brigade, etc.

The list of issuing authorities (Provider Identifier) shall be provided for each Country/Region, as well as for international organisations (United Nations, European Union, African Union, etc). In CAMF, up to 32 individual alert providers can be identified per Country/Region.

A3 - Provider identifier	
Code [5 bits]	**Provider name**
00000	
00001	
00010	
00011	
…	…
11110	
11111	

3.2. Hazard

The hazard is specified by the hazard category and type and by its severity.



3.2.1. Hazard Category and Type (A4)

This field identifies the type of the hazard, for which the alert is issued. There are 12 categories as per the CAP format[5], to which 113 types of hazards are associated.

A4 – Hazard category and type	
Code [7 bits]	**Name**
0000000	*not used*
0000001	CBRNE-Air strike
0000010	CBRNE-Attack on IT systems
…	…
0010010	ENVIRONMENT – Marine pollution
…	…
0011011	FIRE – Forest fire
…	…
0101100	GEO – Tsunami
…	…
0110011	HEALTH - Pandemic
…	…
1001101	MET – Storm or thunderstorm
…	…
1110000	TRANSPORT – Tunnel accident
1110001	OTHER – Test alert
1110010	*reserved*
…	…
1111111	*reserved*

3.2.2. Severity (A5)

This field defines the severity of the hazard. There are 4 possible values, used to specify the possible or actual threat to life and property in the alert area:

A5 – Severity	
Code [2 bits]	**Severity**
00	Unknown
01	Moderate – possible threat to life or property
10	Severe – Significant threat to life or property
11	Extreme – Extraordinary threat to life or property

The severity information can be used to adapt the display of the information in the end user device or smartphone, for example the colour code (e.g. flashing red for extreme, red for severe and orange for

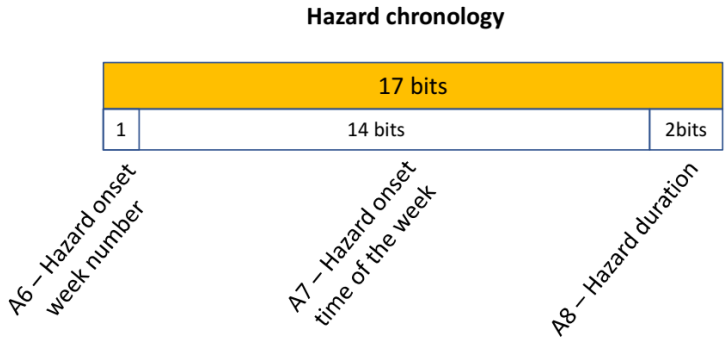
[5] meteorological, environment, geological, fire, CBRNE, health, infrastructure, rescue, safety, security, transport, other

moderate). The visualisation of the warning or alert message is subject of the manufacturer implementation.

Note: While it is a possible value in CAP format, it is not possible in CAMF to assign the severity level "minor" to any hazard: such type of minor events is deemed not relevant for using satellite capacity. Other means exist to alert population in case of a minor event. In the case the operator still wants to encode a "minor" alert, he shall choose "Unknown".

3.3. Hazard Chronology

The hazard chronology is defined through 2 fields: the onset of the hazard and the expected duration of the hazard.



3.3.1. Hazard Onset: Week Number (A6) and Time of the Week (A7)

The hazard onset is the known, or expected, time of the beginning of the hazard. It is expressed in UTC. It is encoded by 15 bits, has a 1-minute resolution, and allows to identify the start of a foreseeable hazard up to 2 weeks in advance.

The first bit of the field is used to identify the week[6] when the hazard is expected to occur: the current week, or the week after. The next 14 bits are used to code the time within the chosen week, at 1-minute resolution.

Example: the code ***100000000000011*** indicates that the hazard is expected to occur Monday next week, 2 minutes after midnight. (00:02 am).

A6 – Hazard onset – week number	
Code [1 bit]	**Week**
0	Current week
1	Next week

A7 – Hazard onset – time of the week	
Code [14 bits]	**Day/Hour/Minute**
00000000000000	*not used*
00000000000001	MONDAY – 00:00 am
00000000000010	MONDAY – 00:01 am
00000000000011	MONDAY – 00:02 am

[6] A week starts on Monday, 0:00am and ends on Sunday, 11:59 pm.

A7 – Hazard onset – time of the week	
…	…
100000000000011	MONDAY (next week) – 00:02 am
…	…
10011101011111	SUNDAY – 11:58 pm
10011101100000	SUNDAY – 11:59 pm
10011101100001	*not used*
…	…
11111111111111	*not used*

Note: The hazard onset is an optional field in the CAP format. However, it shall be a mandatory field in EWM to be able to define the "Alert ID" (see section 3.4). In case there is no onset value provided by the operator, this field in EWM shall be filled in automatically by using the value provided in the "Sent Date/Time" field of the CAP message, which is a mandatory field to be provided in CAP. In this case, the field simply indicates the time when the alert was generated.

3.3.2. Hazard Duration (A8)

The hazard duration corresponds to the expected validity of the alert in hours. It is encoded by 2 bits which offers 4 possible entries:

A8 – Hazard duration	
Code [2 bits]	**Duration**
00	Unknown
01	Duration < 6 hours
10	6 hours < duration < 12 hours
11	12 hours < duration < 24 hours

This field can be used by the receiver to clear an alert which duration has elapsed. In other words, even if no "all clear" message is sent, the receiver can interpret this field and compare it with the current time for deciding whether the alert shall be considered still active or not.

Note: The entry 'Unknown' can be used for events which duration are unknown at the time of the alert, or that could exceed 24 hours. In the case this value is selected, an "all clear" message shall be sent mandatorily at the end of the event to "clear it" and avoid keeping it active endlessly in the receiver memory.

3.4. Alert Identifier

Considering that simultaneous alerts can occur and affect the same group of population, each alert that is broadcast by satellite shall be clearly identified with a unique ID. This allows traceability, as well as consistent processing and display of the message on the user terminal.

This unique "alert ID" is constructed by combining in a key, the values of the main fields that are used to characterise uniquely the alert. These are: Country/Region ID (A2), Provider identifier (A3), Hazard category & type (A4), and Hazard onset (A6 and A7).

This key allows proper update management by civil protection operator, and correct interpretation at user terminal level. By using this key, the end-user terminal can manage and process without

ambiguity the initial alert and its associated updates/all-clear messages, as well as other simultaneous alerts occurring in the same area.

Note: Since the fields A4 (hazard category & type) and A6 and A7 (hazard onset, week number and time of the week) are part of this key, they shall not be modified anymore in the update process, so that the update of an alert uses the correct key. When creating an update of this alert, the operational concept should prevent the operator from modifying this information, (e.g. a mechanism at HMI level to prevent changing these fields when creating an update). Similarly, to avoid creating different alerts with the same key, the operational concept shall prevent the operator from a given provider (A3) in a given country/region (A2) to create 2 different alerts with the same hazard category & type (A4) and onset (A6 and A7).

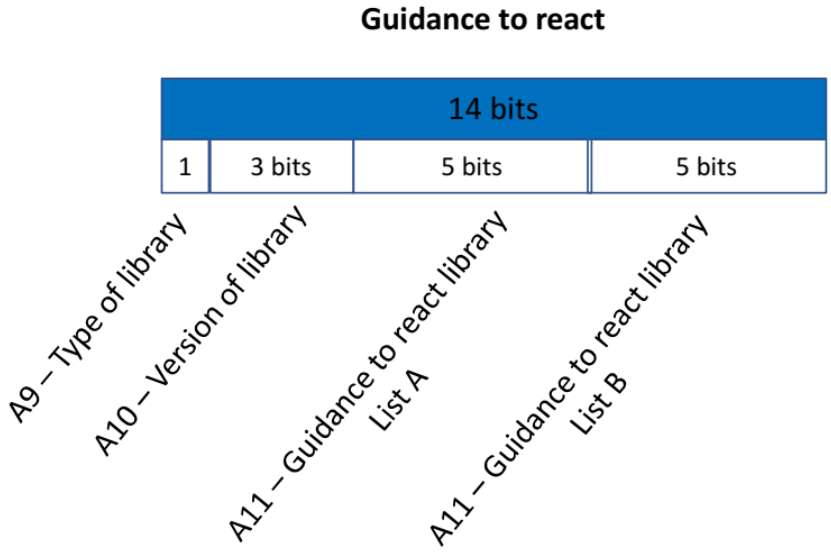
If the hazard onset has to be changed for a given alert (e.g. the time of arrival of a hurricane has changed), the system shall create a new alert. This will generate a new "Alert ID".

3.5. Guidance to react

For the population to react adequately to an alert, clear and unambiguous instructions shall be provided as part of the message. Since it is not possible to broadcast free text in the GNSS signals, the CAMF uses a library of generic instructions, so that the operator creating an alert picks the most adequate instruction for the given situation.

The guidance library is encoded by 3 fields:

- Type of Library (1 bit): it is the source of the library to use, either national or international library.
- Version ID of the library (3 bits): it allows identifying unambiguously the actual version of the library to be used, to avoid confusion in case the end user is using an obsolete version.
- Instruction (10 bits): it is the detailed recommended action to the end user.



3.5.1. Selection of Library (A9)

The CAMF allows the use of two different types of libraries for the instructions: an international library, or a national library. National civil protection operators, when using EWSS, can decide which type of library to use. The international library has been created by the European Commission, based on inputs from EU Member States.

If the operator has selected 'national library', the receiver will automatically use the library corresponding to the country code filled in A2. If no such library exists, the receiver can still display the rest of the alert message but shall not display any instruction. It will also inform the end user (e.g. through a pop-up message) of a compatibility issue.

A9 – Selection of library	
Code [1 bit]	**Library**
0	International library
1	Country/region guidance library.

Note: The CAMF describes the international library only. Nations willing to use a different library are free to do it and are responsible for developing and maintaining their own list of national instructions.

3.5.2. Version of Library (A10)

The concept of library relies on the obligation to use the same version of it on both ends of the service: by the operator encoding the alert, and by the end user terminal that is interpreting the code received in the EWM.

The use of a "library ID" as a unique key ensures the strict alignment between libraries and prevents inconsistencies when interpreting the code. In the same fashion as for the "Alert ID", the "library ID" allows the user terminal to check if its own library, i.e. the one it is about to use for interpreting the data, and notably for picking the instructions, is identical to the one used by the operator. If the check returns "false", the receiver shall notify the user that an alert is on-going nearby, but the warning message cannot be displayed as the library version is not aligned with that used by the operator to create the alert. Instead, the user is informed that he should install the latest version of the library in its receiver, to avoid misinterpretation and misguidance.

There are 8 versions of library identifiable. This allows to modify up to 8 times the full library of data, before roll-over and start again to version #1. This means that by process, the update rate shall not be too often, so as to avoid situations where the end-user terminal would still apply an old version #1 of the library while 8 successive versions of the libraries have been deployed (roll-over). Indicatively, an update of the library every year (resp. every 2 years) would allow a maximum of 8 (resp. 16) years of operations without the risk of the roll-over.

Past the 8th version, the library version numbering starts again at #1, with the reasonable assumption that by that time no receiver terminal will exist with the original version #1 of the library still in use. A warning mechanism (e.g. a pop-up message advising the user to download the latest version of the library immediately) or an automatic download could be foreseen at every change of library version.

Note: This field "library version number" applies to all the libraries that are used to code and interpret the EWM. Any single change applied to the format and the values in each field shall be endorsed formally by the stakeholders, to keep end-to-end consistency and avoid proliferation of uncoordinated libraries. It requires an increment of the version number.

Example: An alert message using the international library in its version 7 would be coded as ***0110.***

A10 – Version of library	
Code [3 bits]	**Library version**
000	#1
001	#2
…	…
110	#7
111	#8

3.5.3. Guidance to react library (A11)

The international guidance library is made of 2 distinct lists of 32 instructions each (list A and list B), allowing an operator to choose one instruction from list A and one instruction from list B, and to combine them into a unique instruction to the population.

List A covers the instructions of first priority, such as shelter, prepare, evacuate or execute.

List B covers the instructions of secondary priority, such as monitor, assess or avoid.

Note: Empty values are provided for each list (bit sequence 'null' in each list), meaning that it is still possible to broadcast an alert message without any instruction. The null value can also be selected in case if compatibility issue detected by the receiver.

Example: An "evacuate" instruction from List A could be combined with a "monitor" instruction from List B, to build the following instruction: "*Prepare for evacuation*" (from list A), "*stay aware, keep listening to official instructions broadcast on the radio, television, websites and social networks pages*" (from List B).

A11 – Guidance to react – International library (list A)	
Code [5 bits]	**Instructions**
00000	[*empty*]
00001	You are in the danger zone, leave the area immediately. Listen to radio or media for directions and information.
00010	You are in the danger zone, leave the area immediately and reach the evacuation point indicated by the area plotted in yellow. Listen to radio or media for directions and information.
00011	Seek shelter in a building immediately. Stay under cover and stay informed.
…	…
11111	Conditions have improved and are no longer expected to meet alert criteria.

A11 – Guidance to react – International library (list B)	
Code [5 bits]	**Instructions**
00000	[*empty*]
00001	Check with the weather services and local authorities for additional information
00010	Find out the location of the information points set up by the authorities on official channels (radio, internet, TV, social networks…)
00011	Sensitive or vulnerable people should not go out unless they must.
…	…
11111	This replaces the warning previously in effect for this area.

Note: Other libraries can be constructed for national use, and based on a different allocation of the 10 bits (e.g. 2 bits/8 bits). In this case, the structure of the library of instruction shall be made available to the receiver (e.g. through metadata in the field A2) so that the reading/decoding is consistent.

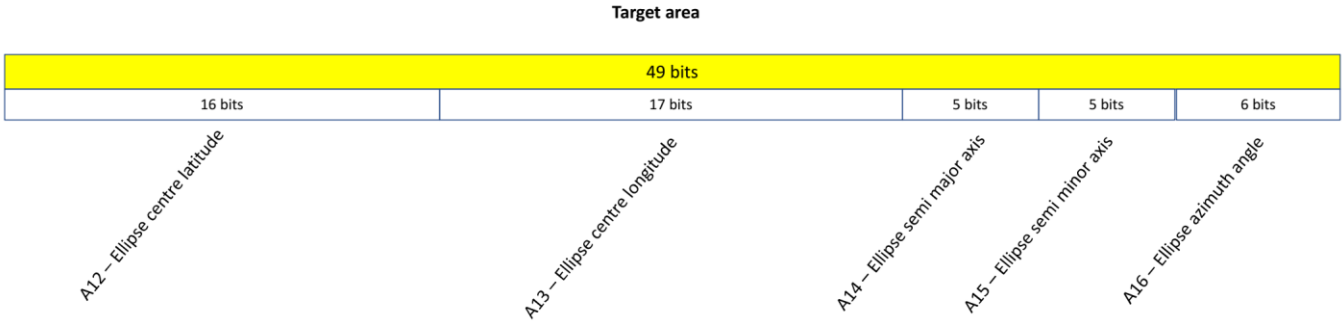
3.6. Target Area

The definition of the target area is an essential aspect of EWSS, as it defines the area where the warning message and in particular the associated instruction applies.

The area of dissemination of the alert (called alert area) is defined as an ellipse (see ***Figure 3*** below) with 5 parameters:

- Ellipse centre latitude (A12);
- Ellipse centre longitude (A13);
- Ellipse semi-major axis length (A14);
- Ellipse semi-minor axis length (A15);
- Ellipse azimuth angle (A16).

The geographic coordinates for constructing the ellipse are defined in the World Geodetic System WGS84. This ensures compatibility with the user segment, WGS84 being mostly used in geolocated applications.



These parameters are shown in ***Figure 3***, where C_0 is the centre of the ellipse which geographical coordinates are defined in A12 and A13, L_M (resp. L_m) is the length of the semi-major axis defined in A14 (resp. of the semi-minor axis defined in A15), and λ is the azimuth to the North defined in A16.

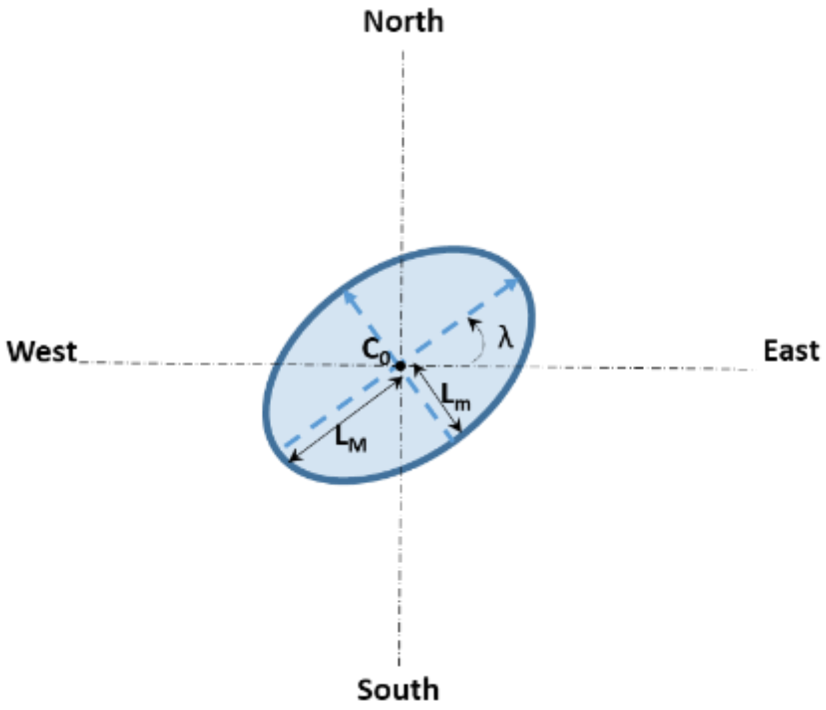


Figure 3: The alert area as an ellipse, and its parameters {C_0, L_M, L_m, λ}.

The ellipse parameters shall be computed by the system based on the information contained in the CAP message. In the most general case, when a polygon is provided in CAP as the target area, the system shall compute the ellipse parameters such that the resulting ellipse fits best the polygon. This best fit ellipse is the ellipse that contains the entire polygon area and that has the smallest area (**Figure 4**).

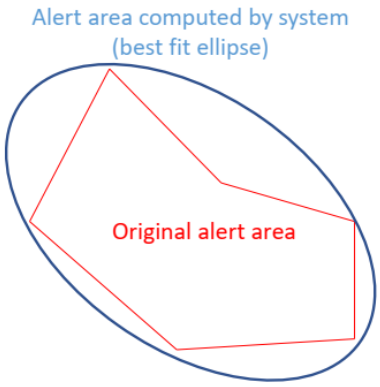


Figure 4: Ellipse area versus original target area

3.6.1. Ellipse Centre Latitude (A12)

The ellipse centre C_0 is positioned on a Mercator grid of fixed resolution. The grid uses 16 bits to code a range of latitudes between -90° and 90°.

The latitude of any given grid point is given by the equation:

$$Latitude(i) = -90 + i \times \frac{180}{(2^{16}-1)} \; [degrees]$$

The angular interval between two consecutive A12 values on the WGS84 geoid is:

$$Interval\_Latitude(degrees) = \frac{180}{(2^{16}-1)} = 0{,}00274662394140536$$

The geographic distance between two consecutive A12 values on the WGS84 geoid is:

$$Resolution\_Latitude(meters) = R_E \times \frac{\pi}{(2^{16}-1)} = 305{,}752778557858$$

R_E is the Earth Radius. In WGS84 reference system, R_E=6 378 137 meters.

A12 – Ellipse centre latitude	
Code [16 bits]	**Angle (°)**
0000000000000000	-90
0000000000000001	-89.9972533760586
0000000000000010	-89.9945067521172
…	…
1111111111111111	90

3.6.2. Ellipse Centre Longitude (A13)

The ellipse centre C_0 is positioned on a Mercator grid of fixed resolution. The grid uses 17 bits to code a range of longitudes between -180° and 180°.

The longitude of any given grid point is given by the equation:

$$Longitude(i) = -180 + i \times \frac{360}{(2^{17}-1)} \; [degrees]$$

The angular interval between two consecutive A13 values on the WGS84 geoid is:

$$Interval\_Longitude(degrees) = \frac{360}{(2^{17}-1)} = 0{,}0027466029861678$$

The geographic distance between two consecutive A13 values on the WGS84 geoid is:

$$Resolution\_Longitude = R_E \times \frac{2\pi}{(2^{17}-1)} \times cosine(Latitude)$$

with R_E the Earth Radius. In WGS84 reference system, R_E =6378137 meters.

A13 – Ellipse centre longitude	
Code [17 bits]	**Angle (°)**
00000000000000000	-180
00000000000000001	-179.9972533970140
00000000000000010	-179.994506794028
…	…

A13 – Ellipse centre longitude	
Code [17 bits]	**Angle (°)**
11111111111111111	180

3.6.3. Ellipse Semi-Major Axis (A14)

The semi-major axis of the ellipse is coded on 5 bits with the following formula:

$$Length_n = 10^{log10(L_m^0)+\frac{n}{N-1}\cdot(log10(L_M^0)-log10(L_m^0))}$$

Where *N* is the number of intermediate steps[7] (i.e. the resolution), and L_m^0 (resp. L_M^0) the minimum (resp. maximum) length of the semi-axis.

A14 – Ellipse semi-major axis	
Code [5 bits]	**Length (km)**
00000	0.216
00001	0.292
…	…
11110	1848.727
11111	2500

Note: The minimum length of the semi-minor axis shall be compatible with the resolution of the grid (305.75 x 305.75 metres at the Equator, worst case). This means that the smallest possible ellipse shall still be capable to encompass all the geographical points within the resolution grid. The minimum length is therefore dependent on the resolution of the grid, and is computed according to the following formula:

$$L_m^0 = \min L_m = \sqrt{\frac{1}{2}\cdot resolution^2} = 216.2\ metres$$

The maximum length of the semi-major axis allows to generate an ellipse that can cover the whole continental Europe, or the whole territory of Japan including the islands, from North to South and from East to West.

$$L_M^0 = \max L_M = 2\,500\,000\ metres$$

[7] With 5 bits, there are 32 intermediate values possible.

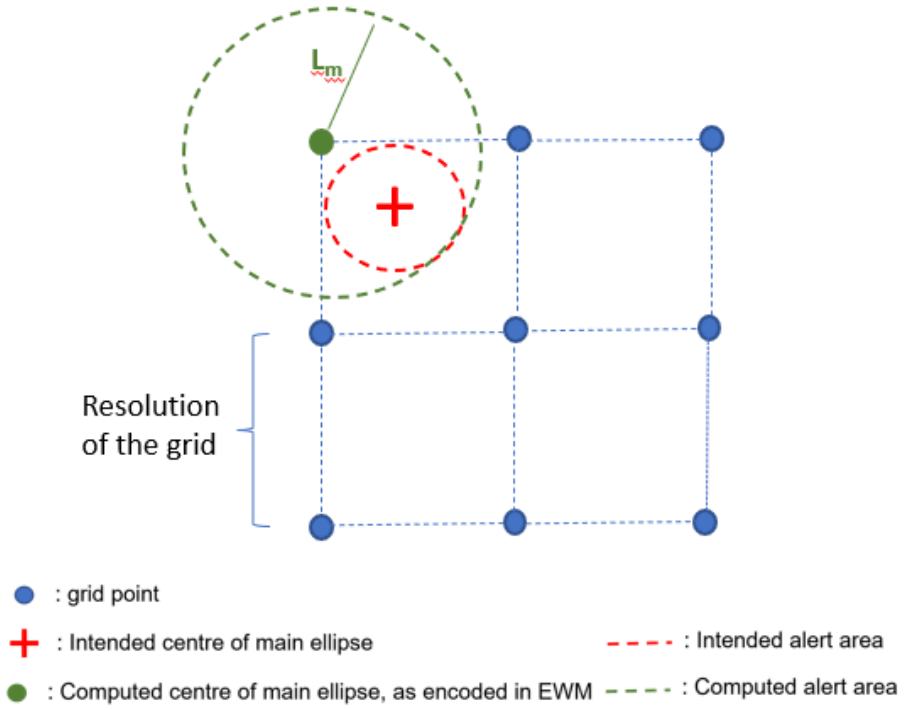


Figure 5: Relation between resolution of the grid and minimum length of ellipse axis

3.6.4. Ellipse Semi-Minor Axis (A15)

Similarly, the semi-minor axis of the ellipse is coded on 5 bits. The same formula as for A14 is used to define the intermediate values.

A15 – Ellipse semi-minor axis	
Code [5 bits]	**Length (km)**
00000	0.216
00001	0.292
…	…
11110	1848.727
11111	2500

3.6.5. Ellipse Azimuth (A16)

6 bits are used to encode the azimuth of the semi-major axis to the North. This offers 64 possible rotation angles for the ellipse, i.e. an azimuth resolution of 2.81° between each possible ellipse.

By convention, azimuth angles are counted positive from East to North.

$$Azimuth\ angle\ (i) = -90 + i \cdot \frac{180}{2^6}$$

A16 – Ellipse azimuth angle	
Code [6 bits]	**Angle (°)**
000000	-90

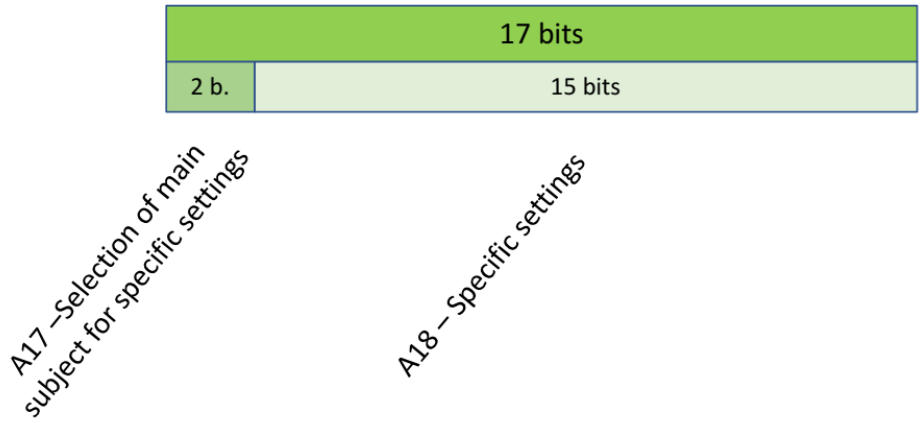
A16 – Ellipse azimuth angle	
Code [6 bits]	**Angle (°)**
000001	-87.19
…	…
111110	84.38
111111	87.19

3.7. Main Subject for Specific Settings (A17)

The specific setting field is used to encode additional information in relation to the hazard. The category of extra information is first to be selected in A17 amongst 4 possibilities:

- B1: Improved resolution of main ellipse
- B2: Position of centre of the hazard
- B3: Secondary ellipse definition
- B4: Quantitative and detailed information about the hazard

A17 and A18 – Main subject selection and specific settings



Note: Each of these categories will then make use of the next 15 bits available in A18. In consequence, these categories are mutually exclusive: a single EWM may only contain one of these categories.

A17 – Main subjects for specific settings	
Code [2 bits]	**Category**
00	B1 – Improved resolution of main ellipse
01	B2 – Position of centre of hazard
10	B3 – Secondary ellipse definition
11	B4 – Quantitative and detailed information related to hazard

Note 1: The field B1 should be used *by default* to improve the resolution of the main ellipse parameters, when the operator decides not to use any of the specific settings B2, B3 or B4. In this situation, the full extent of the CAMF is used at the benefit of the precision of the alert. As soon as the operator decides to use B2, B3 or B4 categories, the resolution of the main ellipse reverts to the coarse resolution values as defined in A12 through A16.

Note 2: The fields B2 to B4 are optional, and may not be filled in.

3.7.1. Improved Resolution of Main Ellipse (B1)

This category uses 12 bits to refine the resolution of the centre C_0 and axes of the main ellipse. The 12 bits are divided in 4 sub-fields, each one being used to refine the resolution of the associated ellipse parameter, as follows: the first 3 bits in this field are dedicated to improving the latitude of the main ellipse's centre C_0, the next 3 bits are dedicated to improving the longitude of the main ellipse's centre C_0, and the next 6 bits are dedicated to improving the resolution of the length of the semi-axes.

B1 – Improved resolution of main ellipse	
Code [15 bits]	**Parameter to be improved**
Bits 0-2	C1: Latitude of centre of main ellipse
Bits 3-5	C2: Longitude of centre of main ellipse
Bits 6-8	C3: Semi-major axis
Bits 9-11	C4: Semi-minor axis
Bits 12-14	*reserved*

3.7.1.1. Refined Latitude of Centre of Main Ellipse (C1)

The values are defined as the interval in latitude between two successive points of the main grid, divided by 8 intermediate steps. This field allows to attain 7 additional latitude points within the main resolution grid.

C1 – Refined latitude of centre of main ellipse	
Code [3 bits]	**Delta angle (°)**
000	0
001	0.000343
010	0.000687
…	…
110	0.002060
111	0.002403

3.7.1.2. Refined Longitude of Centre of Main Ellipse (C2)

The values are defined as the interval in longitude between two successive points of the main grid, divided by 8 intermediate steps. This field allows to attain 7 additional longitude points within the main resolution grid.

C2 – Refined longitude of centre of main ellipse	
Code [3 bits]	**Delta angle (°)**
000	0
001	0.000343325
010	0.000686651
…	…
110	0.002059952
111	0.002403278

3.7.1.3. Refined Length of Semi-Major Axis (C3)

The values are defined in such a way that intermediate values between two consecutive lengths of the semi-major axis can be used. This field gives access to 7 additional possible lengths for coding the main ellipse's semi-major axis.

The formula used to access the refined length of semi-major axis is:

$$refined\ length\ semi\ major\ axis = A14_i - \mathrm{C3}.\Delta_i$$

$$with\ \Delta_i = A14_i - A14_{i-1}\ if\ i > 0, and\ \Delta_0 = A14_0$$

C3 – Refined semi-major axis length	
Code [3 bits]	**Factor**
000	0
001	0.125
010	0.250
…	…
110	0.750
111	0.875

3.7.1.4. Refined Length of Semi-Minor Axis (C4)

The values are defined in such a way that intermediate values between two consecutive lengths of the semi-minor axis can be used. This field gives access to 7 additional possible lengths for coding the main ellipse's semi-minor axis.

The formula used to access the refined length of semi-minor axis is:

$$refined\ length\ semi\ minor\ axis = A15_i - \mathrm{C4}.\Delta_i$$

$$with\ \Delta_i = A15_i - A15_{i-1}\ if\ i > 0, and\ \Delta_0 = A15_0$$

C4 – Refined semi-minor axis length	
Code [3 bits]	**Factor**
000	0
001	0.125
010	0.250
…	…
110	0.750
111	0.875

3.7.2. Position of the Centre of the Hazard (B2)

This category uses 14 bits to code the latitude and longitude values of the centre of the hazard. This can be useful to inform population as to the whereabouts of the hazard (earthquake epicentre, volcano position, forest fire, etc.). The centre of the hazard is expressed as an offset in geographical coordinates from the centre C_0 of the main ellipse.

B2 – Position of centre of hazard	
Code [15 bits]	**Parameter to be improved**
Bits 0-6	C5: Delta latitude from main ellipse centre
Bits 7-13	C6: Delta longitude from main ellipse centre
Bit 14	*reserved*

3.7.2.1. Delta-Latitude from Main Ellipse Centre (C5)

The field allows to position the centre of the hazard C_H at a distance of up to 10° of latitude from the centre C_0 of the main ellipse, north- or southward. This corresponds on Earth to a maximum distance from the centre C_0 of the main ellipse of 1113 km.

The formula used to access the latitude of the centre of the hazard is:

$$latitude\ C_H = latitude\ C_0 + \Delta_i$$

$$with\ \Delta_i = -10° + i \cdot \frac{20}{128}\ if\ i \leq 63$$

$$with\ \Delta_i = -10° + (i+1) \cdot \frac{20}{128}\ if\ i > 63$$

C5 – Delta latitude from main ellipse centre	
Code [7 bits]	**Delta latitude (°)**
0000000	-10
0000001	-9.84375
0000010	-9.6875
…	…
0111110	-0.15625
0111111	0.15625
1000000	0.3125
1000001	0.46875
1000010	0.625
…	…
1111101	9.6875
1111110	9.84375
1111111	10

3.7.2.2. Delta-Longitude from Main Ellipse Centre (C6)

The field allows to position the centre of the hazard C_H at a distance of up to 10° of longitude from the centre C_0 of the main ellipse, east- or westward. This corresponds on Earth (at the Equator) to a maximum distance from the centre C_0 of the main ellipse of 1113 km.

The formula used to access the longitude of the centre of the hazard is:

$$Longitude\ C_H = longitude\ C_0 + \Delta_i$$

$$with\ \Delta_i = -10° + i \cdot \frac{20}{128}\ if\ i \leq 63$$

$$with\ \Delta_i = -10° + (i+1) \cdot \frac{20}{128}\ if\ i > 63$$

C6 – Delta longitude from main ellipse centre	
Code [7 bits]	**Delta longitude (°)**
0000000	-10
0000001	-9.84375
0000010	-9.6875
…	…
0111110	-0.15625
0111111	0.15625
1000000	0.3125
1000001	0.46875
1000010	0.625
…	…
1111101	9.6875
1111110	9.84375
1111111	10

3.7.3. Secondary Ellipse Definition (B3)

With this field, an operator has the possibility to code a secondary ellipse, for providing additional information to the population located within the boundaries of this ellipse. The secondary ellipse can be used either:

- To provide a different type of instruction to the people located within its boundaries, in order to raise awareness on the proximity of a hazard and recommend a course of action. This use case corresponds to the 'vigilance' configuration of the secondary ellipse.
- Or to indicate a place on a map that is safe, or recommended to reach, or where help and supplies can be found (shelter). This use case corresponds to the 'evacuation' configuration of the secondary ellipse.

B3 – Secondary ellipse definition	
Code [15 bits]	**Parameter to be improved**
Bits 0-1	C7: Shift of second ellipse centre
Bits 2-4	C8: Homothetic factor of second ellipse
Bits 5-9	C9: Bearing angle of second ellipse
Bits 10-14	C10: Guidance library for second Ellipse

The secondary ellipse is a transformation of the main ellipse. It is constructed by applying geometrical transform functions[8] to the parameters defining the main ellipse, in order to position its centre C_S on the grid and set the lengths of its semi-axes L_M^S and L_m^S.

Several cases are represented in the ***Figure 6*** to ***Figure 9***, to illustrate the potential of the secondary ellipse for informing/guiding people, and its construction using CAMF.

[8] Translation, homothety, rotation

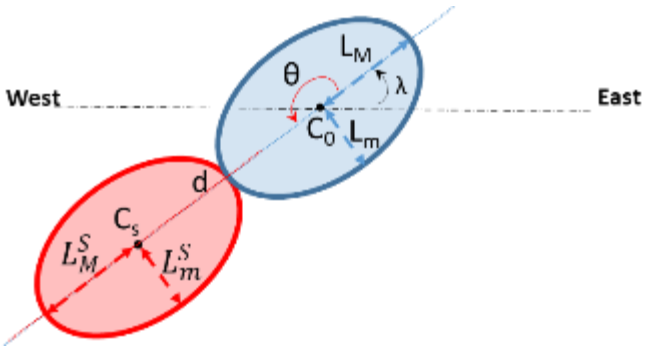


Figure 6: Example of the coding of a secondary ellipse.

Figure 6 shows a secondary ellipse constructed from the parameters of the main ellipse, where:

- The centre C_s of the secondary is positioned at a distance $d = 2 \cdot L_M$ from C_0
- The length of the semi-major axis (resp. of the semi-minor axis) of the secondary ellipse is $L_M^S = 1 \cdot L_M$, (resp. $L_m^S = 1 \cdot L_m$)
- The line of the semi-major axis of the secondary ellipse is rotated by θ = 180° from the azimuth of the main ellipse.

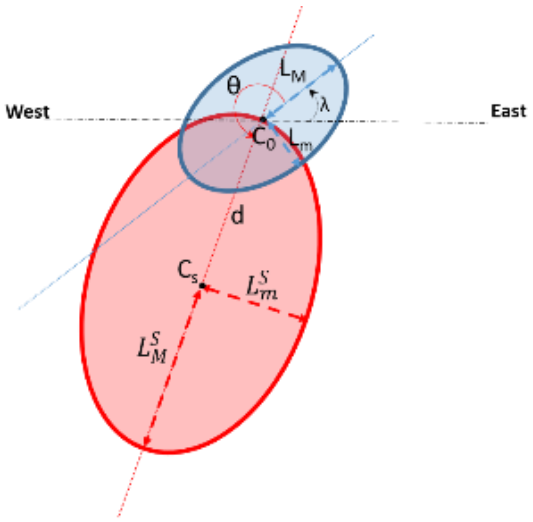


Figure 7: Example of the coding of a secondary ellipse in 'Vigilance' configuration.

Figure 7 shows a secondary ellipse constructed from the parameters defining the main ellipse, where:

- The centre C_s of the secondary is positioned at a distance $d = 2 \cdot L_M$ from C_0
- The length of the semi-major axis (resp. of the semi-minor axis) of the secondary ellipse is $L_M^S = 2 \cdot L_M$, (resp. $L_m^S = 2 \cdot L_m$)
- The line of the semi-major axis of the secondary ellipse is rotated by θ = 230° from the azimuth of the main ellipse.

Note: In ***Figure 7*** the second ellipse overlaps parts of the main ellipse. In this situation, for the people located within both the main ellipse and the secondary ellipse (intersection area), the user terminal shall decode and display the information related to the main ellipse only. Therefore, dedicated filter functions shall be implemented in the user terminal to manage the intersection case, such that the information related to the main ellipse always prevails over that of the secondary ellipse.

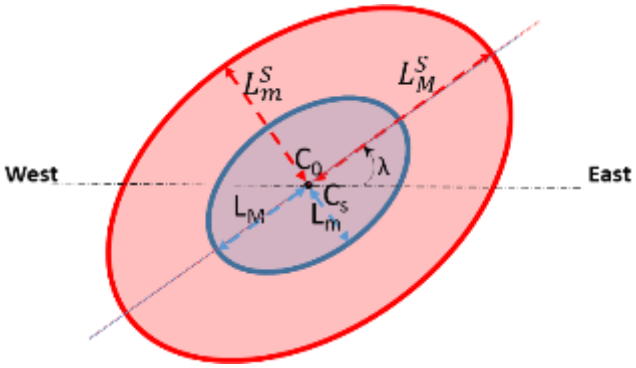


Figure 8: Example of the coding of a secondary ellipse in 'Vigilance' configuration.

Figure 8 shows a secondary ellipse constructed from the parameters defining the main ellipse, where:

- The centre C_s of the secondary is positioned at a distance d = 0 from C_0, i.e. C_s=C_0
- The length of the semi-major axis (resp. of the semi-minor axis) of the secondary ellipse is $L_M^S = 2 \cdot L_M$, (resp. $L_m^S = 2 \cdot L_m$)
- The line of the semi-major axis of the secondary ellipse is rotated by θ = 0° from the azimuth of the main ellipse.

Note: In ***Figure 8*** the second ellipse overlaps completely the main ellipse. Here again, the user terminal shall manage the intersection area in such way that people in it receive only the information related to the main ellipse. People located outside the main ellipse but within the secondary ellipse, are simply informed of a hazard occurring in their vicinity.

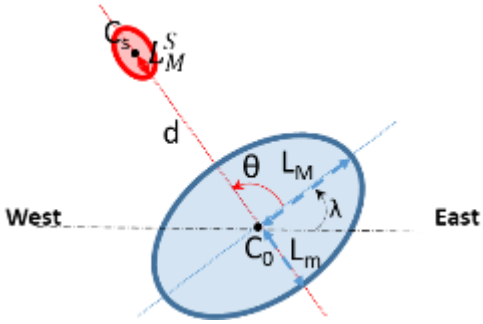


Figure 9: Example of the coding of a secondary ellipse in 'Evacuation' configuration.

Figure 9 shows a secondary ellipse constructed from the parameters defining the main ellipse, where:

- The centre C_s of the secondary is positioned at a distance $d = 2 \cdot L_M$ from C_0

- The length of the semi-major axis (resp. of the semi-minor axis) of the secondary ellipse is $L_M^S = \frac{1}{4} \cdot L_M$, (resp. $L_m^S = \frac{1}{4} \cdot L_m$)
- The line of the semi-major axis of the secondary ellipse is rotated by θ = 90° from the azimuth of the main ellipse.

Note: ***Figure 9*** shows the use of the secondary ellipse to indicate on the map a safe destination to reach.

3.7.3.1. Shift of Second Ellipse Centre (C7)

The centre C_s of the secondary ellipse is obtained by translating the centre C_0 of the main ellipse by a factor of the length of the semi-major axis of the main ellipse, along this semi-major axis. This means that the distance *d* between C_0 and C_S is a multiple of the length of the semi-major axis of the main ellipse, as follows:

$$d_{C_0-C_S}(i) = L_M \cdot i \cdot \frac{4}{2^2}$$

C7 – Shift of second ellipse centre	
Code [2 bits]	**Shift factor**
00	0
01	1
10	2
11	3

3.7.3.2. Homothetic Factor of Second Ellipse (C8)

The lengths of the semi-axes of the secondary ellipse are obtained by multiplying the lengths of the respective axis of the main ellipse by a factor between 0.25 and 2, as follows:

$$L_M^S(i) = L_M \cdot (i+1) \cdot \frac{2}{2^3}$$

$$L_m^S(i) = L_m \cdot (i+1) \cdot \frac{2}{2^3}$$

C8 – Homothetic factor of second ellipse	
Code [3 bits]	**Homothetic factor**
000	0.25
001	0.5
010	0.75
…	…
110	1.75
111	2

3.7.3.3. Bearing Angle of Second Ellipse (C9)

To define the orientation of the secondary ellipse, the semi-major axis of the main ellipse is used as reference and rotated around C_0. This allows coding the value of the angle θ between the main lines

of the main and secondary ellipses. By convention, the semi-major axis of the ellipse is positive to the East, and θ is positive from East to North.

The rotation angle of the main axis of the secondary ellipse is given by the following formula:

$$\theta_i = i \cdot \frac{360}{2^5}$$

Note: In navigation terminology, θ is also known as the "bearing angle".

C9 – Bearing angle of second ellipse	
Code [5 bits]	**Bearing angle**
00000	0
00001	11.25
00010	22.5
…	…
11110	337.5
11111	348.75

3.7.3.4. Guidance Library for Second Ellipse (C10)

When using the option of the secondary ellipse, a dedicated instruction shall be provided to the population located in the area defined by the secondary ellipse. 5 bits are used to code 32 possible instructions. The list of instructions for the secondary ellipse is the list C.

Note: The code ***00000*** corresponds to the empty field, i.e. no instruction is provided from this list. However, this code shall only be used when the secondary ellipse is used in its 'evacuation' configuration. In this case, instruction IC-A-03 from list A[9] is used by default, since the information for locating the safe destination is key for the people in the main ellipse.

C10 – Guidance library for second ellipse		
Code [5 bits]	**Instruction code**	**Instructions**
00000	IC-C-01	[*empty*]
00001	IC-C-02	Prepare for evacuation. Take only the essentials with you, especially ID cards, passport, credit cards and cash. Evacuate only after the instruction of the emergency authorities.
00010	IC-C-03	Prepare emergency food and relief material: Check and restock your equipment and supplies of water, food, medicine, cash and batteries.
…	…	…
00110	IC-C-07	Avoid using lifts
00111	IC-C-08	Avoid the danger area
01000	IC-C-09	Avoid driving
…	…	…
01101	IC-C-14	Protect the most vulnerable and hear from your loved ones. Be aware of their special needs and support, as required. If you notice distressed or vulnerable persons, contact the emergency services. Provide first aid if necessary but do not put yourself in any danger.
…	…	…

[9] "You are in the danger zone, leave the area immediately and reach the evacuation point indicated by the area plotted in yellow. Listen to radio or media for directions and information."

10001	IC-C-18	*reserved*
…	…	…
11110	IC-C-31	This is only a test. You do not have to take any action or adopt any particular sheltering behaviour.
11111	IC-C-32	Conditions have improved and are no longer expected to meet alert criteria.

3.7.4. Quantitative and detailed information about the Hazard (B4)

This category uses the 15 bits of the A18 field to code additional information related to the hazard, such as the magnitude of an earthquake on the Richter scale, the wind speed or the amount of rainfall in case of a storm or cyclone, the wave height, the forecast temperature in case of heat or cold wave, the noise level in decibels, the type of infectious disease, etc.

A set of 36 additional hazard characteristics are provided in B4, allowing an operator to precise the type and magnitude of the hazard.

Note: Not all hazards defined in field A4 are given additional characteristics in B4. Only a subset of those hazards can be further characterised through meaningful quantitative or qualitative information. Yet, hazard characteristics (beyond the current D fields) could be updated or added in future.

B4 – Quantitative or detailed information for Earthquake	
Code [15 bits]	**Lower level fields**
0-3	D1 – Magnitude on Richter scale
4-6	D2 – Seismic coefficient
7-10	D3 – Azimuth from centre of main ellipse to epicentre
11-14	D4 – Vector length between centre of main ellipse and epicentre

B4 – Quantitative or detailed information for Tsunami / tidal wave	
Code [15 bits]	**Lower level fields**
0-2	D5 – Wave height
3-14	*reserved*

B4 – Quantitative or detailed information for Cold wave / heat wave	
Code [15 bits]	**Lower level fields**
0-3	D6 – Temperature range
4-14	*reserved*

B4 – Quantitative or detailed information for Tropical cyclone (hurricane)	
Code Bits Code [15 bits]to 16	**Lower level fields**
0-2	D7 – Hurricane categories
3-6	D8 – Wind speed
7-9	D9 – Rainfall amounts
10-14	*reserved*

B4 – Quantitative or detailed information for Tropical cyclone (typhoon)	
Code [15 bits]	**Lower level fields**
0-2	D36 – Typhoon categories
3-6	D8 – Wind speed

B4 – Quantitative or detailed information for Tropical cyclone (typhoon)	
Code [15 bits]	**Lower level fields**
7-9	D9 – Rainfall amounts
10-14	*reserved*

B4 – Quantitative or detailed information for Tornado	
Code [15 bits]	**Lower level fields**
0-3	D8 – Wind speed
4-6	D9 – Rainfall amounts
7-9	D11 – Tornado probability
10-14	*reserved*

B4 – Quantitative or detailed information for Storm or thunderstorm	
Code [15 bits]	**Lower level fields**
0-3	D8 – Wind speed
4-6	D9 – Rainfall amounts
7-9	D10 – Damage category
10-12	D16 – Lightning intensity
13-14	*reserved*

B4 – Quantitative or detailed information for Hail	
Code [15 bits]	**Lower level fields**
0-3	D12 – Hail scale
4-14	*reserved*

B4 – Quantitative or detailed information for Rainfall	
Code [15 bits]	**Lower level fields**
0-2	D9 – Rainfall amounts
3-6	D13 – Visibility
7-14	*reserved*

B4 – Quantitative or detailed information for Snowfall	
Code [15 bits]	**Lower level fields**
0-4	D14 – Snow depth
5-8	D13 – Visibility
9-14	*reserved*

B4 – Quantitative or detailed information for Flood	
Code [15 bits]	**Lower level fields**
0-1	D15 – Flood severity
2-14	*reserved*

B4 – Quantitative or detailed information for Lightning	
Code [15 bits]	**Lower level fields**
0-2	D16 – Lightning intensity
3-14	*reserved*

B4 – Quantitative or detailed information for Wind chill/frost	
Code [15 bits]	**Lower level fields**
0-3	D8 – Wind speed
4-7	D6 – Temperature range
8-14	*reserved*

B4 – Quantitative or detailed information for Derecho	
Code [15 bits]	**Lower level fields**
0-3	D8 – Wind speed
4-6	D9 – Rainfall amounts
7-9	D16 – Lightning intensity
10-12	D11 – Tornado probability
13-14	*reserved*

B4 – Quantitative or detailed information for Fog	
Code [15 bits]	**Lower level fields**
0-2	D17 – Fog level
3-6	D13 – Visibility
7-14	*reserved*

B4 – Quantitative or detailed information for Snow storm / blizzard	
Code [15 bits]	**Lower level fields**
0-3	D13 – Visibility
4-7	D8 – Wind speed
8-14	*reserved*

B4 – Quantitative or detailed information for Drought	
Code [15 bits]	**Lower level fields**
0-1	D18 – Drought level
2-14	*reserved*

B4 – Quantitative or detailed information for Avalanche risk	
Code [15 bits]	**Lower level fields**
0-2	D19 – Avalanche warning level
3-14	*reserved*

B4 – Quantitative or detailed information for Ash fall	
Code [15 bits]	**Lower level fields**
0-2	D20 – Ash fall amount and impact
3-14	*reserved*

B4 – Quantitative or detailed information for Wind/wave/storm surge	
Code [15 bits]	**Lower level fields**
0-3	D8 – Wind speed
4-6	D5 – Wave height
7-14	*reserved*

B4 – Quantitative or detailed information for Geomagnetic or solar storm	
Code [15 bits]	**Lower level fields**
0-2	D21 – Geomagnetic scale
3-14	*reserved*

B4 – Quantitative or detailed information for Terrorism	
Code [15 bits]	**Lower level fields**
0-2	D22 – Terrorism threat level
3-14	*reserved*

B4 – Quantitative or detailed information for Forest fire / risk of fire	
Code [15 bits]	**Lower level fields**
0-2	D23 – Fire risk level
3-14	*reserved*

B4 – Quantitative or detailed information for Contaminated drinking water/marine pollution	
Code [15 bits]	**Lower level fields**
0-2	D24 – Water quality
3-14	*reserved*

B4 – Quantitative or detailed information for UV radiation	
Code [15 bits]	**Lower level fields**
0-3	D25 – UV index
4-14	*reserved*

B4 – Quantitative or detailed information for Risk of infection / pandemic	
Code [15 bits]	**Lower level fields**
0-4	D26 – Number of cases per 100 000 inhabitants
5-10	D35 – Infection type
11-14	*reserved*

B4 – Quantitative or detailed information for Noise pollution	
Code [15 bits]	**Lower level fields**
0-3	D27 – Noise range
4-14	*reserved*

B4 – Quantitative or detailed information for Air pollution	
Code [15 bits]	**Lower level fields**
0-2	D28 – Air quality index
3-14	*reserved*

B4 – Quantitative or detailed information for Marine pollution / river pollution	
Code [15 bits]	**Lower level fields**
0-2	D24 – Water quality
3-14	*reserved*

B4 – Quantitative or detailed information for Outage of Gas supply/IT systems/Power systems/ Emergency number/Telephone line	
Code [15 bits]	**Lower level fields**
0-4	D29– Outage estimation duration
5-14	*reserved*

B4 – Quantitative or detailed information for Radiological hazard, nuclear hazard and nuclear power station accident	
Code [15 bits]	**Lower level fields**
0-3	D30– Nuclear event scale
4-14	*reserved*

B4 – Quantitative or detailed information for Chemical hazard	
Code [15 bits]	**Lower level fields**
0-3	D31– Chemical hazard type
4-14	*reserved*

B4 – Quantitative or detailed information for Biological hazard	
Code [15 bits]	**Lower level fields**
0-1	D32– Biohazard level
2-3	D33 – Biohazard type
4-14	*reserved*

B4 – Quantitative or detailed information for Explosive hazard	
Code [15 bits]	**Lower level fields**
0-1	D34– Explosive hazard type
2-14	*reserved*

Annex A. Reference Documents

[RD1]	Sendai Framework for Disaster Risk Reduction (United Nations)
[RD2]	Early Warnings for all, Executive Plan 2023-2027 (United Nations)
[RD3]	OASIS Standard, Common Alerting Protocol (CAP)
[RD4]	Peril Classification and Hazard Glossary, Data Project Report No. 1, March 2014
[RD5]	QZSS SIS ICD
[RD6]	Galileo OS SIS ICD

Annex B. Acronyms and Notations

∈	is an element of a set
∩	intersection of
λ	Azimuth of semi-major axis of main ellipse
θ	Bearing of the semi-major axis of the secondary ellipse
C_0	Centre of main ellipse
C_H	Centre of hazard location
C_s	Centre of secondary ellipse
CAP	Common Alert Protocol
CAMF	Common Alert Message Format
CBRNE	Chemical, Biological, Radiological, Nuclear and enhanced Explosives
COP	Conference of the Parties of the convention on climate change
CPA	Civil Protection Authorities
d	Distance between C_0 and C_S
deg°	Angle value in degrees
EC	European Commission
EGNOS	European Geostationary Navigation Overlay System
EU	European Union
EWM	Emergency Warning Message
EWSS	Emergency Warning Satellite Service

FAO	Food and Agricultural Organisation (of the United Nations)
GLONASS	GLObal NAvigation Satellite System
GNSS	Global Navigation Satellite systems
GPS	Global navigation system (US)
HMI	Human Machine Interface
ICD	Interface Control Document
ID	Identifier
IRDR	Integrated Research on Disaster Risk
IRNSS	Indian Regional Navigation Satellite System
ISO	International Standard Organisation
IT	Information Technology
Km	Kilometre
L_M	Length of semi-major axis of main ellipse
L_m	Length of semi-minor axis of main ellipse
L_M^S	Length of semi-major axis of secondary ellipse
L_m^S	Length of semi-minor axis of secondary ellipse
MEO	Medium-Earth Orbit
MET	Meteorology
NavIC	Message service using IRNSS
QZSS	Quasi Zenith Satellite System
R_E	Radius of the Earth in the WGS84 reference system
RNSS	Regional Navigation Satellite System
SBAS	Satellite based augmentation system
UN	United Nation
UTC	Universal Time Coordinate
WMO	World Meteorological Organisation (of the United Nations)

Annex C. CAMF Detailed Field Information

1. A1 – Message Type

A1 - Message type	
Code [2 bits]	**Message Type**
00	Test
01	Alert
10	Update
11	All Clear

2. A2 – Country / Region Name Field

A2 - Country / Region name		
Code [9 bits]	***corresponding decimal code***	**Country / Region Name**
000000000	*0*	Afghanistan
000000001	*1*	Albania
000000010	*2*	Antarctica
000000011	*3*	Algeria
000000100	*4*	American Samoa
000000101	*5*	Andorra
000000110	*6*	Angola
000000111	*7*	Antigua and Barbuda
000001000	*8*	Azerbaijan
000001001	*9*	Argentina
000001010	*10*	Australia
000001011	*11*	Austria
000001100	*12*	Bahamas (the)
000001101	*13*	Bahrain
000001110	*14*	Bangladesh
000001111	*15*	Armenia
000010000	*16*	Barbados
000010001	*17*	Belgium
000010010	*18*	Bermuda
000010011	*19*	Bhutan
000010100	*20*	Bolivia (Plurinational State of)
000010101	*21*	Bosnia and Herzegovina
000010110	*22*	Botswana
000010111	*23*	Bouvet Island
000011000	*24*	Brazil
000011001	*25*	Belize
000011010	*26*	British Indian Ocean Territory (the)
000011011	*27*	Solomon Islands
000011100	*28*	Virgin Islands (British)
000011101	*29*	Brunei Darussalam
000011110	*30*	Bulgaria
000011111	*31*	Myanmar
000100000	*32*	Burundi
000100001	*33*	Belarus
000100010	*34*	Cambodia
000100011	*35*	Cameroon
000100100	*36*	Canada
000100101	*37*	Cabo Verde
000100110	*38*	Cayman Islands (the)
000100111	*39*	Central African Republic (the)
000101000	*40*	Sri Lanka
000101001	*41*	Chad
000101010	*42*	Chile
000101011	*43*	China

A2 - Country / Region name		
Code [9 bits]	***corresponding decimal code***	**Country / Region Name**
000101100	*44*	Taiwan (Province of China)
000101101	*45*	Christmas Island
000101110	*46*	Cocos (Keeling) Islands (the)
000101111	*47*	Colombia
000110000	*48*	Comoros (the)
000110001	*49*	Mayotte
000110010	*50*	Congo (the)
000110011	*51*	Congo (the Democratic Republic of the)
000110100	*52*	Cook Islands (the)
000110101	*53*	Costa Rica
000110110	*54*	Croatia
000110111	*55*	Cuba
000111000	*56*	Cyprus
000111001	*57*	Czechia
000111010	*58*	Benin
000111011	*59*	Denmark
000111100	*60*	Dominica
000111101	*61*	Dominican Republic (the)
000111110	*62*	Ecuador
000111111	*63*	El Salvador
001000000	*64*	Equatorial Guinea
001000001	*65*	Ethiopia
001000010	*66*	Eritrea
001000011	*67*	Estonia
001000100	*68*	Faroe Islands (the)
001000101	*69*	Falkland Islands (the) [Malvinas]
001000110	*70*	South Georgia and the South Sandwich Islands
001000111	*71*	Fiji
001001000	*72*	Finland
001001001	*73*	Åland Islands
001001010	*74*	France
001001011	*75*	French Guiana
001001100	*76*	French Polynesia
001001101	*77*	French Southern Territories (the)
001001110	*78*	Djibouti
001001111	*79*	Gabon
001010000	*80*	Georgia
001010001	*81*	Gambia (the)
001010010	*82*	Palestine, State of
001010011	*83*	Germany
001010100	*84*	Ghana
001010101	*85*	Gibraltar

A2 - Country / Region name		
Code [9 bits]	***corresponding decimal code***	**Country / Region Name**
001010110	*86*	Kiribati
001010111	*87*	Greece
001011000	*88*	Greenland
001011001	*89*	Grenada
001011010	*90*	Guadeloupe
001011011	*91*	Guam
001011100	*92*	Guatemala
001011101	*93*	Guinea
001011110	*94*	Guyana
001011111	*95*	Haiti
001100000	*96*	Heard Island and McDonald Islands
001100001	*97*	Holy See (the)
001100010	*98*	Honduras
001100011	*99*	Hong Kong
001100100	*100*	Hungary
001100101	*101*	Iceland
001100110	*102*	India
001100111	*103*	Indonesia
001101000	*104*	Iran (Islamic Republic of)
001101001	*105*	Iraq
001101010	*106*	Ireland
001101011	*107*	Israel
001101100	*108*	Italy
001101101	*109*	Côte d'Ivoire
001101110	*110*	Jamaica
001101111	*111*	Japan
001110000	*112*	Kazakhstan
001110001	*113*	Jordan
001110010	*114*	Kenya
001110011	*115*	Korea (the Democratic People's Republic of)
001110100	*116*	Korea (the Republic of)
001110101	*117*	Kuwait
001110110	*118*	Kyrgyzstan
001110111	*119*	Lao People's Democratic Republic (the)
001111000	*120*	Lebanon
001111001	*121*	Lesotho
001111010	*122*	Latvia
001111011	*123*	Liberia
001111100	*124*	Libya
001111101	*125*	Liechtenstein
001111110	*126*	Lithuania
001111111	*127*	Luxembourg
010000000	*128*	Macao
010000001	*129*	Madagascar
010000010	*130*	Malawi
010000011	*131*	Malaysia
010000100	*132*	Maldives
010000101	*133*	Mali
010000110	*134*	Malta
010000111	*135*	Martinique
010001000	*136*	Mauritania
010001001	*137*	Mauritius
010001010	*138*	Mexico
010001011	*139*	Monaco
010001100	*140*	Mongolia
010001101	*141*	Moldova (the Republic of)
010001110	*142*	Montenegro
010001111	*143*	Montserrat
010010000	*144*	Morocco
010010001	*145*	Mozambique
010010010	*146*	Oman
010010011	*147*	Namibia
010010100	*148*	Nauru
010010101	*149*	Nepal
010010110	*150*	Netherlands (the)
010010111	*151*	Curaçao
010011000	*152*	Aruba
010011001	*153*	Sint Maarten (Dutch part)
010011010	*154*	Bonaire, Sint Eustatius and Saba
010011011	*155*	New Caledonia

A2 - Country / Region name		
Code [9 bits]	***corresponding decimal code***	**Country / Region Name**
010011100	*156*	Vanuatu
010011101	*157*	New Zealand
010011110	*158*	Nicaragua
010011111	*159*	Niger (the)
010100000	*160*	Nigeria
010100001	*161*	Niue
010100010	*162*	Norfolk Island
010100011	*163*	Norway
010100100	*164*	Northern Mariana Islands (the)
010100101	*165*	United States Minor Outlying Islands (the)
010100110	*166*	Micronesia (Federated States of)
010100111	*167*	Marshall Islands (the)
010101000	*168*	Palau
010101001	*169*	Pakistan
010101010	*170*	Panama
010101011	*171*	Papua New Guinea
010101100	*172*	Paraguay
010101101	*173*	Peru
010101110	*174*	Philippines (the)
010101111	*175*	Pitcairn
010110000	*176*	Poland
010110001	*177*	Portugal
010110010	*178*	Guinea-Bissau
010110011	*179*	Timor-Leste
010110100	*180*	Puerto Rico
010110101	*181*	Qatar
010110110	*182*	Réunion
010110111	*183*	Romania
010111000	*184*	Russian Federation (the)
010111001	*185*	Rwanda
010111010	*186*	Saint Barthélemy
010111011	*187*	Saint Helena, Ascension and Tristan da Cunha
010111100	*188*	Saint Kitts and Nevis
010111101	*189*	Anguilla
010111110	*190*	Saint Lucia
010111111	*191*	Saint Martin (French part)
011000000	*192*	Saint Pierre and Miquelon
011000001	*193*	Saint Vincent and the Grenadines
011000010	*194*	San Marino
011000011	*195*	Sao Tome and Principe
011000100	*196*	Saudi Arabia
011000101	*197*	Senegal
011000110	*198*	Serbia
011000111	*199*	Seychelles
011001000	*200*	Sierra Leone
011001001	*201*	Singapore
011001010	*202*	Slovakia
011001011	*203*	Viet Nam
011001100	*204*	Slovenia
011001101	*205*	Somalia
011001110	*206*	South Africa
011001111	*207*	Zimbabwe
011010000	*208*	Spain
011010001	*209*	South Sudan
011010010	*210*	Sudan (the)
011010011	*211*	Western Sahara*
011010100	*212*	Suriname
011010101	*213*	Svalbard and Jan Mayen
011010110	*214*	Eswatini
011010111	*215*	Sweden
011011000	*216*	Switzerland
011011001	*217*	Syrian Arab Republic (the)
011011010	*218*	Tajikistan
011011011	*219*	Thailand
011011100	*220*	Togo
011011101	*221*	Tokelau
011011110	*222*	Tonga
011011111	*223*	Trinidad and Tobago
011100000	*224*	United Arab Emirates (the)
011100001	*225*	Tunisia
011100010	*226*	Turkey

A2 - Country / Region name		
Code [9 bits]	***corresponding decimal code***	**Country / Region Name**
011100011	*227*	Turkmenistan
011100100	*228*	Turks and Caicos Islands (the)
011100101	*229*	Tuvalu
011100110	*230*	Uganda
011100111	*231*	Ukraine
011101000	*232*	North Macedonia
011101001	*233*	Egypt
011101010	*234*	United Kingdom of Great Britain and Northern Ireland (the)
011101011	*235*	Guernsey
011101100	*236*	Jersey
011101101	*237*	Isle of Man
011101110	*238*	Tanzania, the United Republic of
011101111	*239*	United States of America (the)
011110000	*240*	Virgin Islands (U.S.)
011110001	*241*	Burkina Faso
011110010	*242*	Uruguay
011110011	*243*	Uzbekistan
011110100	*244*	Venezuela (Bolivarian Republic of)
011110101	*245*	Wallis and Futuna
011110110	*246*	Samoa
011110111	*247*	Yemen
011111000	*248*	Zambia
011111001	*249*	*Reserved*
011111010	*250*	*Reserved*
011111011	*251*	*Reserved*
011111100	*252*	*Reserved*
011111101	*253*	*Reserved*
011111110	*254*	*Reserved*
011111111	*255*	*Reserved*

A2 - Country / Region name		
Code [9 bits]	***corresponding decimal code***	**Country / Region Name**
100000000	*256*	*Reserved*
100000001	*257*	*Reserved*
	…	…
	…	…
	…	…
	…	…
111101111	*495*	*Reserved*
111110000	*496*	*Reserved*
111110001	*497*	*Reserved*
111110010	*498*	*Reserved*
111110011	*499*	*Reserved*
111110100	*500*	EU Organisations
111110101	*501*	UN Organisations
111110110	*502*	International
111110111	*503*	*Reserved*
111111000	*504*	*Reserved*
111111001	*505*	*Reserved*
111111010	*506*	*Reserved*
111111011	*507*	*Reserved*
111111100	*508*	*Reserved*
111111101	*509*	*Reserved*
111111110	*510*	*Reserved*
111111111	*511*	*Reserved*

3. A3 – Provider Identifier

A3 - Provider identifier		
Code [5 bits]	***corresponding decimal code***	**Provider name (list dependent on value of A2) Examples given below are generic**
00000	*0*	*Reserved*
00001	*1*	*Reserved*
00010	*2*	*Reserved*
…	…	…
11110	*30*	*Reserved*
11111	*31*	*Reserved*

4. A4 – Hazard Category and Type

A4 - Hazard category and type		
Code [7 bits]	**Hazard category & type**	**Definition**
0000000	*not used*	
0000001	CBRNE - Air strike	Attack performed by an aircraft, usually of military type, either by bombing (or similar), firing guns or missiles.
0000010	CBRNE - Attack on IT systems	Intentional attempt to expose, alter, disable, destroy, steal or gain unauthorized access to or make unauthorised use of IT equipment.
0000011	CBRNE - Attack with nuclear weapons	From www.dhs.gov 'Attack performed with a device producing a nuclear explosion.
0000100	CBRNE - Biological hazard	Presence of hazardous biological materials that present a risk or potential risk to the health of humans, animals, plants, or the environment.
0000101	CBRNE - Chemical hazard	Presence of hazardous chemical materials that present a risk or potential risk to the health of humans, animals, plants, or the environment.
0000110	CBRNE - Explosive hazard	Presence of hazardous explosive materials that present a risk or potential risk to the health of humans, animals, plants, or the environment.
0000111	CBRNE - Meteorite impact	Meteorite entering from space into the earth atmosphere.
0001000	CBRNE – Missile attack	Missile launch.
0001001	CBRNE - Nuclear hazard	Presence of hazardous nuclear materials that present a risk or potential risk to the health of humans, animals, plants, or the environment.
0001010	CBRNE - Nuclear power station accident	Accident occurring at an installation where power is generated by a nuclear reactor.
0001011	CBRNE - Radiological hazard	Presence of hazardous radioactive materials that present a risk or potential risk to the health of humans, animals, plants, or the environment.
0001100	CBRNE - Satellite/space re-entry debris	Satellite or parts of a satellite or launcher or space vehicle entering or re-entering from space into the earth atmosphere.
0001101	CBRNE - Siren test	Test of a warning device emitting a loud noise.
0001110	ENVIRONMENT - Acid rain	Rain containing dissolved acidifying compounds, resulting from chemical pollution of the atmosphere by sulphur and nitrogen compounds. When deposited, these increase the acidity of the soil and water causing agricultural and ecological damage.
0001111	ENVIRONMENT - Air pollution	Precise threshold is according to each local standard.
0010000	ENVIRONMENT - Contaminated drinking water	Drinking water containing contaminants (germs and/or chemicals) above the quality standard. Precise threshold according to each local standard.
0010001	ENVIRONMENT - Gas leak	Uncontrolled release of natural gas or gaseous product in the environment.
0010010	ENVIRONMENT - Marine pollution	Marine pollution occurs when substances used or spread by humans, such as industrial, agricultural and residential waste, particles, noise, excess carbon dioxide or invasive organisms enter the ocean and cause harmful effects there. Precise threshold is according to each local standard.
0010011	ENVIRONMENT - Noise pollution	Disturbing or unwanted noise that may present a potential risk to the health of humans, animals and wildlife.
0010100	ENVIRONMENT - Plague of insects	Infestation of insects or pervasive influx and development of insects or parasites affecting humans, animals, crops and materials.
0010101	ENVIRONMENT - River pollution	Contamination of water in rivers, usually as a result of human activities, in such a manner that negatively affects its legitimate uses.

A4 - Hazard category and type		
Code [7 bits]	**Hazard category & type**	**Definition**
0010110	ENVIRONMENT – Suspended dust	More general, particulates are microscopic solid particles suspended in the air. The source of the particulate matter can be natural or anthropogenic having adverse effect on human health. The IARC and WHO designate airborne particulates as a Group 1 carcinogen. Particulates are the most harmful form of air pollution due to their ability to penetrate deep into the lungs, blood streams and brain, causing health problems including heart attacks, respiratory disease, and premature death.
0010111	ENVIRONMENT – UV radiation	Precise threshold is according to each local standard.
0011000	FIRE – Conflagration	A large and destructive fire that threatens human life, health, and/or property.
0011001	FIRE - Fire brigade deployment	Operation of firefighters in response to a fire or other emergency report. Note: Definition may vary, depending on the responsibility of the fire brigade in each country
0011010	FIRE - Fire gases	Potentially dangerous gases emitted from a fire.
0011011	FIRE - Forest fire	A type of wildfire in a wooded area.
0011100	FIRE - Fumes	An often-noxious suspension of particles in the air.
0011101	FIRE - Odour nuisance	Prolonged and offensive smell leading to the impairment of human well-being over a certain period of time at regular or irregular intervals.
0011110	FIRE - Risk of fire	Increased likelihood of accidental fire.
0011111	FIRE - Structure fire / Industrial fire	Fire affecting the structural parts of a building or a fire affecting an industrial site.
0100000	GEO - Ash fall	Fine (less than 4 mm in diameter) unconsolidated volcanic debris blown into the atmosphere during an eruption; can remain airborne for long periods of time and travel considerable distance from the source.
0100001	GEO - Avalanche risk	A large mass of loosened earth material, snow, or ice that slides, flows or falls rapidly down a mountainside under the force of gravity. Snow Avalanche: Rapid downslope movement of a mix of snow and ice. Debris Avalanche: The sudden and very rapid downslope movement of unsorted mass of rock and soil. There are two general types of debris avalanches - a cold debris avalanche usually results from an unstable slope suddenly collapsing whereas a hot debris avalanche results from volcanic activity leading to slope instability and collapse.
0100010	GEO - Crack in the ground/sinkhole	Collapse of the land surface due to the dissolving of the subsurface rocks such as limestone or carbonate rock by water.
0100011	GEO - Debris flow	Types of landslides that occur when heavy rain or rapid snow/ice melt send large amounts of vegetation, mud, or rock downslope by gravitational forces. Includes mud flow, rock fall.
0100100	GEO - Earthquake	Sudden movement of a block of the Earth's crust along a geological fault and associated ground shaking.
0100101	GEO - Geomagnetic or solar storm	A type of extra-terrestrial hazard caused by solar wind shockwaves that temporarily disturb the Earth's magnetosphere. Geomagnetic storms can disrupt power grids, spacecraft operations, and satellite communications.
0100110	GEO - Glacial ice avalanche	Ice calving at end of a glacier.
0100111	GEO - Landslide	Independent of the presence of water, mass movement may also be triggered by earthquakes.
0101000	GEO - Lava flow	The ejected magma that moves as a liquid mass downslope from a volcano during an eruption.
0101001	GEO - Pyroclastic flow	Extremely hot gases, ash, and other materials of more than 1,000 degrees Celsius that rapidly flow down the flank of a volcano (more than 700 km/h) during an eruption.

A4 - Hazard category and type		
Code [7 bits]	**Hazard category & type**	**Definition**
0101010	GEO - Snowdrifts	Mass of snow heaped up by the wind and deposited along an obstruction or an irregularity of the terrain.
0101011	GEO - Tidal wave	Shallow water wave caused by the gravitational interactions between the Sun, Moon, and Earth. (from USGS)
0101100	GEO - Tsunami	A series of waves (with long wavelengths when traveling across the deep ocean) that are generated by a displacement of massive amounts of water through underwater earthquakes, volcanic eruptions or landslides. Tsunami waves travel at very high speed across the ocean but as they begin to reach shallow water they slow down and the wave grows steeper.
0101101	GEO - Volcanic mud flow	(Also known as Lahar) A mud flow resulting from a volcanic event. Hot or cold mixture of earthen material flowing on the slope of a volcano either during or between volcanic eruptions.
0101110	GEO - Volcano eruption	A type of volcanic event near an opening/vent in the Earth's surface including volcanic eruptions of lava, ash, hot vapour, gas, and pyroclastic material.
0101111	GEO - Wind/wave/storm surge	An abnormal rise in sea level generated by a tropical cyclone or other intense storms.
0110000	HEALTH - Epizootic	An epidemic outbreak of disease in an animal population, often with the implication that it may extend to humans.
0110001	HEALTH - Food safety alert	Presence of unsafe food containing harmful bacteria, viruses, parasites or chemical substances that present a risk to the health of humans, animals, plants or the environment.
0110010	HEALTH - Health hazard	Potential source of danger for individual's health.
0110011	HEALTH - Pandemic	An epidemic of an infectious disease that has spread across a large region, for instance multiple continents or worldwide, affecting a substantial number of people. A widespread endemic disease with a stable number of infected people is not a pandemic. Widespread endemic diseases with a stable number of infected people such as recurrences of seasonal influenza are generally excluded as they occur simultaneously in large regions of the globe rather than being spread worldwide.
0110100	HEALTH - Pest infestation	(from GEMET)1) The occurrence of one or more pest species in an area or location where their numbers and impact are currently or potentially at intolerable levels. 2) A sudden increase in destructiveness or population numbers of a pest species in a given area.
0110101	HEALTH - Risk of infection	Present of infectious agent(s) that present a risk or potential risk to the health of humans, animals, plants, or the environment.
0110110	INFRASTRUCTURE - Building collapse	Sudden failure of the building structure resulting in its partial or total destruction.
0110111	INFRASTRUCTURE - Emergency number outage	Interruption or failure of emergency number service.
0111000	INFRASTRUCTURE - Gas supply outage	Interruption or failure of gas supply service.
0111001	INFRASTRUCTURE – Outage of IT systems	Interruption or failure of IT systems services.
0111010	INFRASTRUCTURE - Power outage	Interruption or failure of electricity distribution service.
0111011	INFRASTRUCTURE – Raw sewage	Release in the environment of untreated wastewater.
0111100	INFRASTRUCTURE - Telephone line outage	Interruption or failure of telephone service.
0111101	MET - Black Ice	WMO definition: (1) Thin, new ice on freshwater or saltwater, appearing dark in colour because of its transparency, which is a result of its columnar grain structure. On lakes, black ice is commonly overlain by white ice formed from refrozen snow or slush. (2) A popular alternative for glaze. A thin sheet of ice, relatively dark in appearance, may form when light rain or drizzle falls on a road surface that is at a temperature below 0 °C or, alternatively, when water already on the road surface subsequently freezes when the temperature thereof falls

A4 - Hazard category and type		
Code [7 bits]	**Hazard category & type**	**Definition**
		below freezing point. It may also be formed when supercooled fog droplets are intercepted by buildings, fences and vegetation.
0111110	MET - Coastal flooding	Occurs when dry and low-lying land is submerged by seawater.
0111111	MET - Cold wave	Extreme cold and low temperatures.
1000000	MET - Derecho	Widespread and usually fast-moving windstorms associated with convection/convective storm. Derechos include downburst and straight-line winds. The damage from derechos is often confused with the damage from tornadoes.
1000001	MET - Drought	An extended period of unusually low precipitation that produces a shortage of water for people, animals and plants. Drought is different from most other hazards in that it develops slowly, sometimes even over years, and its onset is generally difficult to detect.
1000010	MET - Dust storm	Strong winds carry particles of sand aloft, but generally confined to less than 50 feet (15 m), especially common in arid and semi-arid environments. A dust storm is also characterised by strong winds but carries smaller particles of dust rather than sand over an extensive area.
1000011	MET - Floating ice / icebergs	Floating ice in rivers or icebergs in the open sea
1000100	MET - Flood	A general term for the overflow of water from a stream channel onto normally dry land in the floodplain (riverine flooding), higher-than normal levels along the coast and in lakes or reservoirs (coastal flooding) as well as ponding of water at or near the point where the rain fell (flash floods).
1000101	MET - Fog	A suspension of very small, usually microscopic water droplets in the air, reducing visibility at the Earth's surface.
1000110	MET - Hail	Solid precipitation in the form of irregular pellets or balls of ice more than 5 mm in diameter.
1000111	MET - Heat wave	A general term for temperature variations above (extreme heat).
1001000	MET - Lightning	A high-voltage, visible electrical discharge produced by a thunderstorm and followed by the sound of thunder.
1001001	MET - Pollens	Pollens that can cause human allergies are those of anemophilous plants (pollen is dispersed by air currents.) Such plants produce large quantities of lightweight pollen (because wind dispersal is random and the likelihood of one pollen grain landing on another flower is small), which can be carried for great distances and are easily inhaled by humans.
1001010	MET - Rainfall	Rainfall greater than or equal to 50mm in past 24 hours. Note: Precise threshold is according to each local standard.
1001011	MET - Snow storm / blizzard	A low-pressure system in winter months with significant accumulations of snow, freezing rain, sleet or ice. A blizzard is a severe snowstorm with winds exceeding 35 mph (56 km/h) for three or more hours, producing reduced visibility (less than .25 mile (400 m).
1001100	MET - Snowfall	Snowfall greater than or equal to 50mm in past 24 hours. Note: Precise threshold is according to each local standard.
1001101	MET - Storm or thunderstorm	Meteorological event generating winds equal or higher than 10 on the Beaufort scale.
1001110	MET - Thawing	Gradual warning causing ground ice to degrade, potentially leading the soil surface to collapse.
1001111	MET - Tornado	A violently rotating column of air that reaches the ground or open water (waterspout).
1010000	MET - Tropical cyclone (hurricane)	A tropical cyclone originates over tropical or subtropical waters. It is characterised by a warm-core, non-frontal synoptic-scale cyclone with a low-pressure centre, spiral rain bands and strong winds. Depending on their location, tropical cyclones are referred to as hurricanes (Atlantic, Northeast Pacific), typhoons (Northwest Pacific), or cyclones (South Pacific and Indian Ocean). With a minimum wind speed of

A4 - Hazard category and type		
Code [7 bits]	**Hazard category & type**	**Definition**
		119km/h (or 74 miles/h) a tropical storm in the Atlantic or Northeast Pacific is called a hurricane.[10]
1010001	MET - Wind chill/frost	Frost is the consequence of radiative cooling resulting in the formation of thin ice crystals on the ground or other surfaces in the form of needles, feathers, scales, or fans. Frost occurs when the temperature of surfaces is below freezing and water vapor from humid air forms solid deposits on the cold surface. Freeze occurs when the air temperature is at (32˚F/0˚C) or below over a widespread area for a climatologically significant period of time. Use of the term is usually restricted to advective situations or to occasions when wind or other conditions prevent frost. Frost and freeze are particularly damaging during the crop growing season.
1010010	MET - Tropical cyclone (typhoon)	A tropical cyclone originates over tropical or subtropical waters. It is characterised by a warm-core, non-frontal synoptic-scale cyclone with a low-pressure centre, spiral rain bands and strong winds. Depending on their location, tropical cyclones are referred to as hurricanes (Atlantic, Northeast Pacific), typhoons (Northwest Pacific), or cyclones (South Pacific and Indian Ocean). With a minimum wind speed of 119km/h (or 74 miles/h) a tropical storm in the Atlantic or Northeast Pacific is called a hurricane.[10]
1010011	RESCUE - Dam failure or bursting of a dam	Incident at a dam potentially leading to the uncontrolled release of the dam content
1010100	RESCUE - Dike failure or bursting of a dike	Incident at a dike potentially leading to the uncontrolled release of water
1010101	RESCUE - Explosive ordnance disposal	Activity to render safe all types of ordnance, including explosive, chemical and biological. It covers land and underwater location, identification, render-safe, and recovery (or disposal) of ordnance.
1010110	RESCUE - Factory accident	Incident at an industrial site affecting the surrounding area
1010111	RESCUE - Mine hazard	Any of the dangers peculiar to the winning and working of coal and minerals. These include collapse of ground, explosion of released gas, inundation by water, spontaneous combustion, inhalation of dust and poisonous gases, etc.
1011000	SAFETY - Bomb/ammunition discovery	Unexpected presence of bomb or ammunition
1011001	SAFETY - Demonstration	A march or gathering of people taking part in to show their opposition to something or their support for something
1011010	SAFETY - Hazardous material accident	An unexpected uncontrolled release of substances that have the potential to harm a person or the environment upon contact.
1011011	SAFETY - Life Threatening situation	Emergency situation that requires immediate intervention to save the life of the persons concerned.
1011100	SAFETY - Major event	Planned happening which may generate significant disruption in road traffic or transport
1011101	SAFETY - Missing person/abduction	Unaccounted person whose health status (alive/dead) cannot be confirmed.
1011110	SAFETY - Risk of explosion	Intentional use of explosive materials aiming at killing or damaging the health of humans, animals, plants, or the environment.
1011111	SAFETY - Safety warning	Announcement of a potentially dangerous situation or event to the public impacting their safety.
1100000	SAFETY - Undefined flying object	Presence of an unidentified flying object which may present a risk or potential risk to the health of humans, animals, plants, or the environment.

[10] Hurricanes and typhoons are the same weather phenomenon. A tropical cyclone is a generic term used to describe a rotating, organized system of clouds and thunderstorms that originates over tropical or subtropical waters and has closed, low-level circulation. The classification as a hurricane, typhoon or tropical cyclone depends upon where the storm originates in the world. Although, in this list of hazards hurricanes and typhoons are identified separately.

A4 - Hazard category and type		
Code [7 bits]	**Hazard category & type**	**Definition**
1100001	SAFETY - Unidentified animal	Presence of an unidentified animal which may present a risk or a potential risk to the health of humans, animals, plants, or the environment.
1100010	SECURITY - Chemical attack	Intentional use of dangerous chemical materials aiming at killing or damaging the health of humans, animals, plants, or the environment.
1100011	SECURITY - Guerrilla attack	Paramilitary armed forces carrying violent actions.
1100100	SECURITY - Hijack	Airplane or other vehicle under the control of hijackers.
1100101	SECURITY - Shooting or danger due to weapons	Dangerous use of firearm(s) or weapons in a populated area.
1100110	SECURITY - Special forces attack	Military armed forces carrying violent actions.
1100111	SECURITY - Terrorism	Terrorist action aiming at generating a high number of victims or major material damage.
1101000	TRANSPORT - Aircraft crash	Aircraft crash
1101001	TRANSPORT - Bridge collapse	Structural failure of a bridge resulting in its partial or total destruction.
1101010	TRANSPORT - Dangerous goods accident	Accident occurrence associated with and related to the conveyance of dangerous goods by air, road, inland waterways and sea, which results in fatal or serious injury to a person or major damage to property or environment.
1101011	TRANSPORT - Inland waterway transport accident	Ship accident on an inland waterway.
1101100	TRANSPORT - Nautical disaster/Maritime/Marine Security	Sinking ship or any other event occurring at sea which may present of security or safety risk.
1101101	TRANSPORT - Oil spill	Leak of oil or pollutant from a ship or other transportation mean resulting in pollution.
1101110	TRANSPORT - Road traffic incident	Announcement of road traffic disruption.
1101111	TRANSPORT - Train/rail accident	Accident occurring on a railway and involving train(s) and/or other vehicles.
1110000	TRANSPORT - Tunnel accident	Car crash or railway accident occurring in a tunnel.
1110001	OTHER - Test alert	Test alert message for end-to-end testing.
1110010	*reserved*	
1110011	*reserved*	
1110100	*reserved*	
1110101	*reserved*	
1110110	*reserved*	
1110111	*reserved*	
1111000	*reserved*	
1111001	*reserved*	
1111010	*reserved*	
1111011	*reserved*	
1111100	*reserved*	
1111101	*reserved*	
1111110	*reserved*	
1111111	*reserved*	

5. A5 – Severity

A5 - Severity	
Code [2 bits]	**Severity**
00	Unknown
01	Moderate - Possible threat to life or property
10	Severe - Significant threat to life or property
11	Extreme - Extraordinary threat to life or property

6. A6 – Hazard Onset, Week Number

A6 - Hazard onset, week number	
Code [1 bit]	**Week**
0	Current
1	Next

7. A7 – Hazard Onset, Time of the Week

A7 - Hazard onset, time of the week	(UTC Time)
Code [14 bits]	**Day/Hour/Min**
00000000000000	*not used*
00000000000001	MONDAY - 00:00 AM
00000000000010	MONDAY - 00:01 AM
00000000000011	MONDAY - 00:02 AM
00000000000100	MONDAY - 00:03 AM
00000000000101	MONDAY - 00:04 AM
00000000000110	MONDAY - 00:05 AM
00000000000111	MONDAY - 00:06 AM
00000000001000	MONDAY - 00:07 AM
00000000001001	MONDAY - 00:08 AM
00000000001010	MONDAY - 00:09 AM
00000000001011	MONDAY - 00:10 AM
00000000001100	MONDAY - 00:11 AM
00000000001101	MONDAY - 00:12 AM
00000000001110	MONDAY - 00:13 AM
00000000001111	MONDAY - 00:14 AM
00000000010000	MONDAY - 00:15 AM
…	…
00001011001111	MONDAY - 11:58 AM
00001011010000	MONDAY - 11:59 AM
00001011010001	MONDAY - 00:00 PM
00001011010010	MONDAY - 00:01 PM

A7 - Hazard onset, time of the week	(UTC Time)
Code [14 bits]	**Day/Hour/Min**
00001011010011	MONDAY - 00:02 PM
…	…
00010110011100	MONDAY - 11:55 PM
00010110011101	MONDAY - 11:56 PM
00010110011110	MONDAY - 11:57 PM
00010110011111	MONDAY - 11:58 PM
00010110100000	MONDAY - 11:59 PM
00010110100001	TUESDAY - 00:00 AM
00010110100010	TUESDAY - 00:01 AM
00010110100011	TUESDAY - 00:02 AM
00010110100100	TUESDAY - 00:03 AM
00010110100101	TUESDAY - 00:04 AM
00010110100110	TUESDAY - 00:05 AM
…	…
00101100111111	TUESDAY - 11:58 PM
00101101000000	TUESDAY - 11:59 PM
00101101000001	WEDNESDAY - 00:00 AM
00101101000010	WEDNESDAY - 00:01 AM
00101101000011	WEDNESDAY - 00:02 AM
…	…
01000011011111	WEDNESDAY - 11:58 PM
01000011100000	WEDNESDAY - 11:59 PM

A7 - Hazard onset, time of the week	(UTC Time)
Code [14 bits]	Day/Hour/Min
01000011100001	THURSDAY - 00:00 AM
01000011100010	THURSDAY - 00:01 AM
01000011100011	THURSDAY - 00:02 AM
…	…
01011001111111	THURSDAY - 11:58 PM
01011010000000	THURSDAY - 11:59 PM
01011010000001	FRIDAY - 00:00 AM
01011010000010	FRIDAY - 00:01 AM
01011010000011	FRIDAY - 00:02 AM
…	…
01110000011111	FRIDAY - 11:58 PM
01110000100000	FRIDAY - 11:59 PM
01110000100001	SATURDAY - 00:00 AM
01110000100010	SATURDAY - 00:01 AM
01110000100011	SATURDAY - 00:02 AM
…	…
10000110111111	SATURDAY - 11:58 PM
10000111000000	SATURDAY - 11:59 PM
10000111000001	SUNDAY - 00:00 AM
10000111000010	SUNDAY - 00:01 AM
10000111000011	SUNDAY - 00:02 AM
…	…
10011101010010	SUNDAY - 11:45 PM
10011101010011	SUNDAY - 11:46 PM
10011101010100	SUNDAY - 11:47 PM

A7 - Hazard onset, time of the week	(UTC Time)
Code [14 bits]	Day/Hour/Min
10011101010101	SUNDAY - 11:48 PM
10011101010110	SUNDAY - 11:49 PM
10011101010111	SUNDAY - 11:50 PM
10011101011000	SUNDAY - 11:51 PM
10011101011001	SUNDAY - 11:52 PM
10011101011010	SUNDAY - 11:53 PM
10011101011011	SUNDAY - 11:54 PM
10011101011100	SUNDAY - 11:55 PM
10011101011101	SUNDAY - 11:56 PM
10011101011110	SUNDAY - 11:57 PM
10011101011111	SUNDAY - 11:58 PM
10011101100000	SUNDAY - 11:59 PM
10011101100001	*not used*
10011101100010	*not used*
10011101100011	*not used*
10011101100100	*not used*
…	…
…	…
11111111111011	*not used*
11111111111100	*not used*
11111111111101	*not used*
11111111111110	*not used*
11111111111111	*not used*

8. A8 – Hazard Duration

A8 - Hazard duration	
Code [2 bits]	Duration [h]
00	Unknown
01	Duration < 6
10	6 <= Duration < 12
11	12 <= Duration < 24

9. A9 – Selection of Guidance Library

A9 – Selection of Guidance to react library		
Code [1 bit]	Selection	Comments
0	International Guidance Library	This library is developed and maintained by the EU.
1	Country/Region Guidance Library	Country/Region guidance library to be developed and maintained by local authorities.

10. A10 – Version of Library

A10 – Version of library	
Code [3 bits]	**version #**
000	#1
001	#2
010	#3
011	#4
100	#5
101	#6
110	#7
111	#8

11. A11 – Guidance to React Library – List A and List B

A11 - Guidance to react – International library (List A)		
LIST A: General required action		
Code [10 bits – bits 0-4]	**Instruction Code**	**Instruction list - EN**
00000	IC-A-01	[*empty*]
00001	IC-A-02	You are in the danger zone, leave the area immediately. Listen to radio or media for directions and information.
00010	IC-A-03	You are in the danger zone, leave the area immediately and reach the evacuation point indicated by the area plotted in yellow. Listen to radio or media for directions and information.
00011	IC-A-04	Seek shelter in a building immediately. Stay under cover and stay informed.
00100	IC-A-05	Seek out a cellar or interior rooms on lower floors.
00101	IC-A-06	If you are in an alpine terrain, start descending immediately and seek for shelter.
00110	IC-A-07	Quickly move into interior rooms. If you are in a vehicle: Stop driving immediately on the edge of the road. If a building is nearby, seek shelter in that building.
00111	IC-A-08	If you are in open terrain and you cannot find shelter, lie face-down on the ground and protect your head and neck with your hands, in a hollow where possible
01000	IC-A-09	Prepare for evacuation. Take only the essentials with you, especially ID cards, passport, credit cards and cash. Evacuate only after the instruction of the emergency authorities.
01001	IC-A-10	Prepare emergency food and relief material: Check and restock your equipment and supplies of water, food, medicine, cash and batteries.
01010	IC-A-11	Stay away from glass surfaces such as windows and glass doors. There is a risk of injury from glass splinters.
01011	IC-A-12	Reduce your power consumption to a minimum.
01100	IC-A-13	Reduce your water consumption to a minimum.
01101	IC-A-14	Boil water before drinking it or using it in the kitchen.
01110	IC-A-15	Keep at least one metre away from any conversation partners. Avoid physical contact with other people such as kissing and shaking hands. Wash your hands regularly and thoroughly.
01111	IC-A-16	Do not drink any tap water. Avoid any skin contact with tap water. Only drink mineral water from a bottle. Turn off the water supply to your house.
10000	IC-A-17	Watch out for escaping gas. This can be indicated by hissing noises or a typical gas odour. Do not use matches, lighters or the like: naked flames in combination with leaking gas can lead to explosions and fires.

A11 - Guidance to react – International library (List A)		
LIST A: General required action		
Code [10 bits – bits 0-4]	**Instruction Code**	**Instruction list - EN**
10001	IC-A-18	Do not go outside and do not use your car.
10010	IC-A-19	Do not touch any objects that seem suspicious to you. Debris can cause additional hazards such as fires and explosions. Inform the emergency services about damage and debris.
10011	IC-A-20	Do not enter smoke-filled rooms. Deadly gases can form there.
10100	IC-A-21	Do not enter cellars or underground car parks.
10101	IC-A-22	Do not leave pets or livestock outside.
10110	IC-A-23	Do not touch any dead animals. Report any findings of dead wild animals to the authorities.
10111	IC-A-24	Avoid driving
11000	IC-A-25	Avoid all items with metal parts such as umbrellas and bicycles. Do not bathe or shower during a thunderstorm. Bathing and showering can be life-threatening.
11001	IC-A-26	Avoid rooms directly underneath the roof truss. Avoid very large rooms, such as halls, in which the ceiling is not supported by pillars.
11010	IC-A-27	Avoid going outdoors. Keep away from trees, towers and masts. Keep at least 20 m away from power lines. Watch out for flying objects and falling objects.
11011	IC-A-28	Avoid the danger area
11100	IC-A-29	Avoid going out when it is not necessary
11101	IC-A-30	This is only a test. You do not have to take any action or to adopt any particular sheltering behaviour
11110	IC-A-31	This replaces the warning previously in effect for this area.
11111	IC-A-32	Conditions have improved and are no longer expected to meet alert criteria.

A11 - Guidance to react – International library (List B)		
LIST B: Monitoring + Required action		
Code [10 bits- bits 5-9]	**Instruction Code**	**Instruction list - EN**
00000	IC-B-01	[*empty*]
00001	IC-B-02	Check with the weather services and local authorities for additional information
00010	IC-B-03	Find out the location of the information points set up by the authorities on official channels (radio, internet, TV, social networks…)
00011	IC-B-04	Sensitive or vulnerable people should not go out unless they must.
00100	IC-B-05	Rescue operation under process by security forces and emergency services. Avoid moving to facilitate security and emergency actions.
00101	IC-B-06	Protect the most vulnerable and hear from your loved ones. Be aware of their special needs and support, as required. If you notice distressed or vulnerable persons, call the emergency services. Provide first aid if necessary but do not put yourself in any danger.
00110	IC-B-07	Pay attention to announcements made by the police, fire brigade and by officials.
00111	IC-B-08	Stay aware, keep listening to official instructions broadcast on the radio, television, websites and social networks pages
01000	IC-B-09	If you need help leaving your home, call the emergency services.
01001	IC-B-10	Only make phone calls in serious emergencies to avoid overloading the mobile network.
01010	IC-B-11	Extreme intensity weather phenomena expected. The weather is very dangerous and implies high level of threat to health, even the life hazard. BE AWARE and keep up to date with the latest weather forecast.
01011	IC-B-12	Severe weather expected. BE PREPARED. Take precautions and keep up to date with the latest weather forecast. Severe damages to people and properties may occur, especially to those vulnerable or in exposed areas.
01100	IC-B-13	Moderate intensity weather phenomena expected. BE AWARE, keep up to date with the latest weather forecast. Moderate damages to people and properties may occur, especially to those vulnerable or in exposed areas

A11 - Guidance to react – International library (List B)		
LIST B: Monitoring + Required action		
Code [10 bits- bits 5-9]	**Instruction Code**	**Instruction list - EN**
01101	IC-B-14	BE PREPARED to protect yourself and your property. Flooding of properties and transport networks is expected. Disruption to power, communications and water supplies are possible. Evacuation may be required. Dangerous driving conditions due to reduced visibility and aquaplaning
01110	IC-B-15	Do not go near or in flooded waters. Do not walk or drive on a submerged road. Flood waves may surprise you, the river bank may collapse or you could be sucked in a manhole or hit by a floating debris. Keep drains and shafts clear so that the water can drain away. Secure and/or move assets away from vulnerable area (car along the river, basements).
01111	IC-B-16	Take shelter in the most resistant part of a permanent building, a municipal shelter if possible, and keep away from windows. BE AWARE of the “eye of the storm”, the calm area in its centre. It will be followed by an inversion and the strengthening of winds. Do not go outside and do not use your car. Wait until the alert is over.
10000	IC-B-17	TAKE PRECAUTIONS, High temperatures are expected. Protect yourself from the heat and avoid physical and sports activities. Wet your body several times a day. Drink plenty of water and eat light food.
10001	IC-B-18	Forest fire danger. Under these conditions fires may develop and spread rapidly resulting in damage to property and possible loss of human and/or animal life. Do not throw away any burning cigarettes or matches to the environment. Do not make a fire outdoors. Do not light any fireworks. Do not barbeque in open places. Vegetation is easily ignited and large areas may be affected. Follow the instructions from the local authorities.
10010	IC-B-19	Risks of fire. Use permanent fireplaces when barbecuing. Make sure your fire is completely extinguished before you leave. Only light fireworks with the permission of the municipality, keep a safe distance from the forest and have water to hand.
10011	IC-B-20	Keep as far away as possible from coastal areas, beaches and rivers. Get immediately to the highest ground possible and wait until the alert is over. If you are in danger of being overtaken by waves, climb onto a roof or up a solid tree, or cling on to a floating object carried along by the water.
10100	IC-B-21	Do not go to sea and keep as far away as possible from the coast and wait until the alert is over. If you are at sea, don’t return to port. Keep away from the coast. Waves are much less dangerous out at sea.
10101	IC-B-22	Leave the affected area immediately and seek higher ground or move to higher parts of the building. Listen to radio or media for directions and information
10110	IC-B-23	Indoors: during the quake, take shelter near a wall or a solid piece of furniture. Outside: during the quake, keep away from anything that might collapse. In a car: during the quake, stop as far away from buildings as you can. After, be prepared for aftershocks. If you are indoor, leave by the stairs.
10111	IC-B-24	Leave the impact site immediately and cover your mouth and nose with improvised respiratory protection (cloth, garment, surgical mask). This protects you from dust, but not from gaseous hazardous substances. Seek out a building. Move wherever possible at a right angle to the wind direction as this is the quickest way to leave the danger zone with a possible cloud of hazardous substances.
11000	IC-B-25	Switch off the ventilation and air conditioning systems. Close all windows, doors and shutters. Cover your mouth and nose and breathe through a facemask or an improvised respiratory protection (cloth, garment, surgical mask) if the air is filled with smoke and ashes
11001	IC-B-26	Have iodine tablets ready. DO NOT take the iodine tablets now. If this becomes necessary, we will inform you in good time.
11010	IC-B-27	Take the iodine tablets NOW according to the package insert.
11011	IC-B-28	Avoid watering your plants during the hottest hours, avoid using water for secondary uses such as washing your car.
11100	IC-B-29	Seek shelter if you cannot leave the area immediately.
11101	IC-B-30	*reserved*
11110	IC-B-31	*reserved*
11111	IC-B-32	This replaces the warning previously in effect for this area.

12. A12 – Ellipse Centre Latitude

A12 - Ellipse centre latitude			
Code [16 bits]	**angle [deg°]**	**interval [deg°]**	**interval [m]**
0000000000000000	-90,000	0,002746624	305,75
0000000000000001	-89,997		
0000000000000010	-89,995		
0000000000000011	-89,992		
0000000000000100	-89,989		
0000000000000101	-89,986		
0000000000000110	-89,984		
0000000000000111	-89,981		
0000000000001000	-89,978		
0000000000001001	-89,975		
0000000000001010	-89,973		
0000000000001011	-89,970		
…	…		
0011111111111110	-45,005		
0011111111111111	-45,002		
0100000000000000	-44,999		
0100000000000001	-44,997		
…	…		
0111111111111110	-0,004		
0111111111111111	-0,001		
1000000000000000	0,001		
1000000000000001	0,004		
…	…		
1011111111111110	44,997		
1011111111111111	44,999		
1100000000000000	45,002		
1100000000000001	45,005		
…	…		
1111111111110100	89,970		
1111111111110101	89,973		
1111111111110110	89,975		
1111111111110111	89,978		
1111111111111000	89,981		
1111111111111001	89,984		
1111111111111010	89,986		
1111111111111011	89,989		
1111111111111100	89,992		
1111111111111101	89,995		
1111111111111110	89,997		
1111111111111111	90,000		

13. A13 – Ellipse Centre Longitude

A13 - Ellipse centre longitude			
Code [17 bits]	**angle [deg°]**	**interval [deg°]**	**interval [m]**
00000000000000000	-180,000	0,002746603	305.75 x cos (Lat)
00000000000000001	-179,997		
00000000000000010	-179,995		
00000000000000011	-179,992		
00000000000000100	-179,989		
00000000000000101	-179,986		
00000000000000110	-179,984		
00000000000000111	-179,981		
00000000000001000	-179,978		
00000000000001001	-179,975		
00000000000001010	-179,973		
00000000000001011	-179,970		
…	…		
00111111111111110	-90,005		
00111111111111111	-90,002		
01000000000000000	-89,999		
01000000000000001	-89,997		
…	…		
01111111111111110	-0,004		
01111111111111111	-0,001		
10000000000000000	0,001		
10000000000000001	0,004		
…	…		
10111111111111110	89,997		
10111111111111111	89,999		
11000000000000000	90,002		
11000000000000001	90,005		
…	…		
11111111111110100	179,970		
11111111111110101	179,973		
11111111111110110	179,975		
11111111111110111	179,978		
11111111111111000	179,981		
11111111111111001	179,984		
11111111111111010	179,986		
11111111111111011	179,989		
11111111111111100	179,992		
11111111111111101	179,995		
11111111111111110	179,997		
11111111111111111	180,000		

14. A14 – Ellipse Semi Major Axis

A14 - Ellipse semi-major axis (L_M)		
Code [5 bits]	**Value of n**	**Length [km]**
00000	0	0,216
00001	1	0,292
00010	2	0,395
00011	3	0,535
00100	4	0,723
00101	5	0,978
00110	6	1,322
00111	7	1,788
01000	8	2,418
01001	9	3,269
01010	10	4,421
01011	11	5,979
01100	12	8,085
01101	13	10,933
01110	14	14,784
01111	15	19,992
10000	16	27,035
10001	17	36,559
10010	18	49,439
10011	19	66,855
10100	20	90,407
10101	21	122,255
10110	22	165,324
10111	23	223,564
11000	24	302,322
11001	25	408,824
11010	26	552,846
11011	27	747,603
11100	28	1010,970
11101	29	1367,116
11110	30	1848,727
11111	31	2500,000

15. A15 – Ellipse Semi Minor Axis

A15 - Ellipse semi-minor axis (L_m)		
Code [5 bits]	**Value of n**	**Length [km]**
00000	0	0,216
00001	1	0,292
00010	2	0,395
00011	3	0,535
00100	4	0,723
00101	5	0,978
00110	6	1,322
00111	7	1,788
01000	8	2,418
01001	9	3,269
01010	10	4,421
01011	11	5,979
01100	12	8,085
01101	13	10,933
01110	14	14,784
01111	15	19,992
10000	16	27,035
10001	17	36,559
10010	18	49,439
10011	19	66,855
10100	20	90,407
10101	21	122,255
10110	22	165,324
10111	23	223,564
11000	24	302,322
11001	25	408,824
11010	26	552,846
11011	27	747,603
11100	28	1010,970
11101	29	1367,116
11110	30	1848,727
11111	31	2500,000

16. A16 – Ellipse Azimuth Angle

A16 – Ellipse azimuth angle	
Code [6 bits]	**angle [deg°]**
000000	-90,00
000001	-87,19
000010	-84,38
000011	-81,56
000100	-78,75
000101	-75,94
000110	-73,13
000111	-70,31
001000	-67,50
001001	-64,69
001010	-61,88
001011	-59,06
001100	-56,25
001101	-53,44
001110	-50,63
001111	-47,81
010000	-45,00
010001	-42,19
010010	-39,38
010011	-36,56
010100	-33,75
010101	-30,94
010110	-28,13
010111	-25,31
011000	-22,50
011001	-19,69
011010	-16,88
011011	-14,06
011100	-11,25
011101	-8,44
011110	-5,63
011111	-2,81
100000	0,00
100001	2,81
100010	5,63
100011	8,44
100100	11,25
100101	14,06
100110	16,88
100111	19,69
101000	22,50
101001	25,31
101010	28,13
101011	30,94
101100	33,75

A16 – Ellipse azimuth angle	
Code [6 bits]	**angle [deg°]**
101101	36,56
101110	39,38
101111	42,19
110000	45,00
110001	47,81
110010	50,63
110011	53,44
110100	56,25
110101	59,06
110110	61,88
110111	64,69
111000	67,50
111001	70,31
111010	73,13
111011	75,94
111100	78,75
111101	81,56
111110	84,38
111111	87,19

17. A17 –Selection of Main Subject for Specific Settings

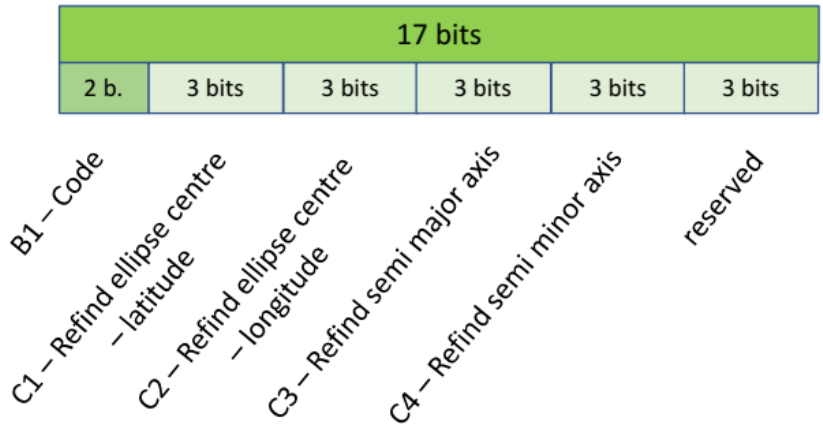
A17 - Specific settings - main subjects		
Code [2 bits]	**Main subjects**	**Comments**
00	B1 - Improved resolution of main ellipse	The parameters improve the resolution of the centre of the ellipse and of its axes.
01	B2 - Position of the centre of the hazard	When centre of hazard is different from the centre of the ellipse. It is expressed in degrees of latitude and longitude in offset of the centre of the ellipse, with a limitation of +/- 10 degrees.
10	B3 - Second ellipse definition	Geometry of this second ellipse is computed from the original ellipse (shift, size and rotation).
11	B4 - Quantitative and detailed information related to hazard category and type	Option to provide quantitative or more detailed information related to the hazard category and type.

18. A18 – Specific Settings

18.1. B1 – Improved Resolution of Main Ellipse

The definition of the improved resolution of the main ellipse is covered by the Specific Setting fields C1 to C4.

A17 and A18 - Specific Settings:
B1 – Improved resolution of main ellipse



B1 - Improved resolution of main ellipse		
Code [15 bits]	**Number of Bits**	**Specific Parameters of Main Subject**
Bits 0-2	3	C1 - Refined ellipse centre location - latitude
Bits 3-5	3	C2 - Refined ellipse centre location - longitude
Bits 6-8	3	C3 - Refined semi-major axis length

B1 - Improved resolution of main ellipse		
Code [15 bits]	**Number of Bits**	**Specific Parameters of Main Subject**
Bits 9-11	3	C4 - Refined semi-minor axis length
Bits 12-14	3	*reserved*

18.1.1. C1 - Refined Ellipse Centre Location – Latitude

C1 - Refined ellipse centre location - latitude				
Code [3 bits]	**Factor**	**Delta angle [deg°]**	**Refined interval [deg°]**	**Refined interval [m]**
000	0	0,000000	0,000343328	38,22
001	1	0,000343		
010	2	0,000687		
011	3	0,001030		
100	4	0,001373		
101	5	0,001717		
110	6	0,002060		
111	7	0,002403		

18.1.2. C2 - Refined Ellipse Centre Location – Longitude

C2 - Refined ellipse centre location - longitude				
Code [3 bits]	**Factor**	**Delta angle [deg°]**	**Refined interval [deg°]**	**Refined interval [m]**
000	0	0,000000000	0,000343325	38.22 x cos (Lat)
001	1	0,000343325		
010	2	0,000686651		
011	3	0,001029976		
100	4	0,001373301		
101	5	0,001716627		
110	6	0,002059952		
111	7	0,002403278		

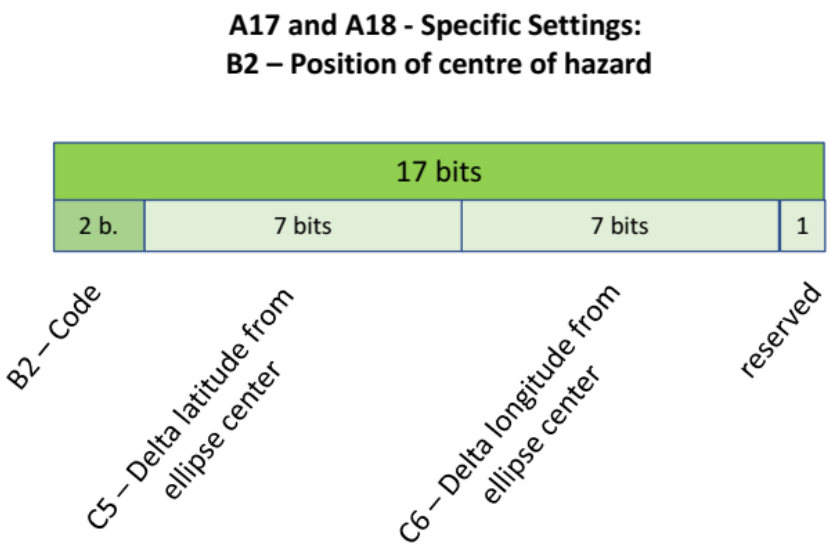
18.1.3. C3 - Refined Ellipse Semi-Major Axis Length

C3 - Refined ellipse semi-major axis length	
Code [3 bits]	**x**
000	0
001	0,125
010	0,250
011	0,375
100	0,500
101	0,625
110	0,750
111	0,875

18.1.4. C4 – Refined Ellipse Semi-Minor Axis Length

C4 - Refined ellipse semi-minor axis length	
Code [3 bits]	**x**
000	0
001	0,125
010	0,250
011	0,375
100	0,500
101	0,625
110	0,750
111	0,875

18.2. B2 - Position of the Centre of the Hazard



B2 – Position of centre of hazard		
Code [15 bits]	**Number of Bits**	**Specific Parameters of Main Subject**
Bits 0-6	7	C5 - Delta latitude from Ellipse Centre
Bits 7-13	7	C6 - Delta longitude from Ellipse Centre
Bit 14	1	*reserved*

18.2.1. C5 - Delta-Latitude from Main Ellipse Centre

C5 - Delta latitude from main ellipse centre	
Code [7 bits]	**Delta Latitude [deg°]**
0000000	-10,000000000
0000001	-9,843750000
0000010	-9,687500000
0000011	-9,531250000
0000100	-9,375000000
0000101	-9,218750000
0000110	-9,062500000
0000111	-8,906250000
0001000	-8,750000000
0001001	-8,593750000
0001010	-8,437500000
0001011	-8,281250000
0001100	-8,125000000
0001101	-7,968750000
0001110	-7,812500000
0001111	-7,656250000

C5 - Delta latitude from main ellipse centre	
Code [7 bits]	**Delta Latitude [deg°]**
0010000	-7,500000000
0010001	-7,343750000
0010010	-7,187500000
0010011	-7,031250000
0010100	-6,875000000
0010101	-6,718750000
0010110	-6,562500000
0010111	-6,406250000
0011000	-6,250000000
0011001	-6,093750000
0011010	-5,937500000
0011011	-5,781250000
0011100	-5,625000000
0011101	-5,468750000
0011110	-5,312500000
0011111	-5,156250000

C5 - Delta latitude from main ellipse centre	
Code [7 bits]	**Delta Latitude [deg°]**
0100000	-5,000000000
0100001	-4,843750000
0100010	-4,687500000
0100011	-4,531250000
0100100	-4,375000000
0100101	-4,218750000
0100110	-4,062500000
0100111	-3,906250000
0101000	-3,750000000
0101001	-3,593750000
0101010	-3,437500000
0101011	-3,281250000
0101100	-3,125000000
0101101	-2,968750000
0101110	-2,812500000
0101111	-2,656250000
0110000	-2,500000000
0110001	-2,343750000
0110010	-2,187500000
0110011	-2,031250000
0110100	-1,875000000
0110101	-1,718750000
0110110	-1,562500000
0110111	-1,406250000
0111000	-1,250000000
0111001	-1,093750000
0111010	-0,937500000
0111011	-0,781250000
0111100	-0,625000000
0111101	-0,468750000
0111110	-0,312500000
0111111	-0,156250000
1000000	0,156250000
1000001	0,312500000
1000010	0,468750000
1000011	0,625000000
1000100	0,781250000
1000101	0,937500000
1000110	1,093750000
1000111	1,250000000
1001000	1,406250000
1001001	1,562500000
1001010	1,718750000
1001011	1,875000000
1001100	2,031250000
1001101	2,187500000
1001110	2,343750000
1001111	2,500000000

C5 - Delta latitude from main ellipse centre	
Code [7 bits]	**Delta Latitude [deg°]**
1010000	2,656250000
1010001	2,812500000
1010010	2,968750000
1010011	3,125000000
1010100	3,281250000
1010101	3,437500000
1010110	3,593750000
1010111	3,750000000
1011000	3,906250000
1011001	4,062500000
1011010	4,218750000
1011011	4,375000000
1011100	4,531250000
1011101	4,687500000
1011110	4,843750000
1011111	5,000000000
1100000	5,156250000
1100001	5,312500000
1100010	5,468750000
1100011	5,625000000
1100100	5,781250000
1100101	5,937500000
1100110	6,093750000
1100111	6,250000000
1101000	6,406250000
1101001	6,562500000
1101010	6,718750000
1101011	6,875000000
1101100	7,031250000
1101101	7,187500000
1101110	7,343750000
1101111	7,500000000
1110000	7,656250000
1110001	7,812500000
1110010	7,968750000
1110011	8,125000000
1110100	8,281250000
1110101	8,437500000
1110110	8,593750000
1110111	8,750000000
1111000	8,906250000
1111001	9,062500000
1111010	9,218750000
1111011	9,375000000
1111100	9,531250000
1111101	9,687500000
1111110	9,843750000
1111111	10,000000000

18.2.2. C6 —Delta-Longitude from Main Ellipse Centre

C6- Delta longitude from ellipse centre	
Code [7 bits]	**Delta Longitude [deg°]**
0000000	-10,000000000
0000001	-9,843750000
0000010	-9,687500000
0000011	-9,531250000
0000100	-9,375000000
0000101	-9,218750000
0000110	-9,062500000
0000111	-8,906250000
0001000	-8,750000000
0001001	-8,593750000
0001010	-8,437500000
0001011	-8,281250000
0001100	-8,125000000
0001101	-7,968750000
0001110	-7,812500000
0001111	-7,656250000
0010000	-7,500000000
0010001	-7,343750000
0010010	-7,187500000
0010011	-7,031250000
0010100	-6,875000000
0010101	-6,718750000
0010110	-6,562500000
0010111	-6,406250000
0011000	-6,250000000
0011001	-6,093750000
0011010	-5,937500000
0011011	-5,781250000
0011100	-5,625000000
0011101	-5,468750000
0011110	-5,312500000
0011111	-5,156250000
0100000	-5,000000000
0100001	-4,843750000
0100010	-4,687500000
0100011	-4,531250000
0100100	-4,375000000
0100101	-4,218750000
0100110	-4,062500000
0100111	-3,906250000
0101000	-3,750000000
0101001	-3,593750000
0101010	-3,437500000
0101011	-3,281250000
0101100	-3,125000000

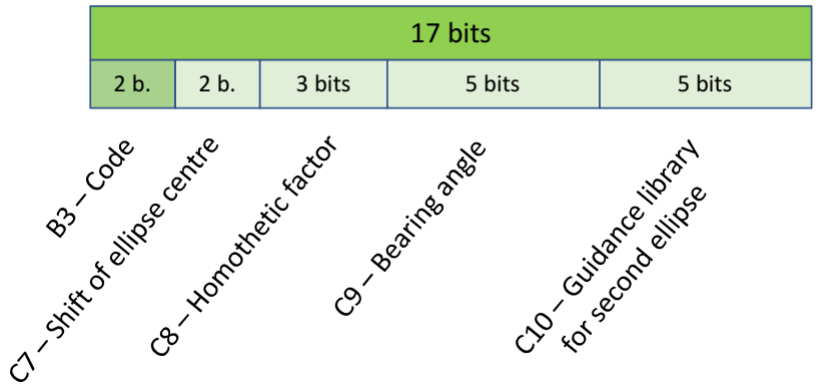
C6- Delta longitude from ellipse centre	
Code [7 bits]	**Delta Longitude [deg°]**
0101101	-2,968750000
0101110	-2,812500000
0101111	-2,656250000
0110000	-2,500000000
0110001	-2,343750000
0110010	-2,187500000
0110011	-2,031250000
0110100	-1,875000000
0110101	-1,718750000
0110110	-1,562500000
0110111	-1,406250000
0111000	-1,250000000
0111001	-1,093750000
0111010	-0,937500000
0111011	-0,781250000
0111100	-0,625000000
0111101	-0,468750000
0111110	-0,312500000
0111111	-0,156250000
1000000	0,156250000
1000001	0,312500000
1000010	0,468750000
1000011	0,625000000
1000100	0,781250000
1000101	0,937500000
1000110	1,093750000
1000111	1,250000000
1001000	1,406250000
1001001	1,562500000
1001010	1,718750000
1001011	1,875000000
1001100	2,031250000
1001101	2,187500000
1001110	2,343750000
1001111	2,500000000
1010000	2,656250000
1010001	2,812500000
1010010	2,968750000
1010011	3,125000000
1010100	3,281250000
1010101	3,437500000
1010110	3,593750000
1010111	3,750000000
1011000	3,906250000
1011001	4,062500000

C6- Delta longitude from ellipse centre	
Code [7 bits]	**Delta Longitude [deg°]**
1011010	4,218750000
1011011	4,375000000
1011100	4,531250000
1011101	4,687500000
1011110	4,843750000
1011111	5,000000000
1100000	5,156250000
1100001	5,312500000
1100010	5,468750000
1100011	5,625000000
1100100	5,781250000
1100101	5,937500000
1100110	6,093750000
1100111	6,250000000
1101000	6,406250000
1101001	6,562500000
1101010	6,718750000
1101011	6,875000000
1101100	7,031250000

C6- Delta longitude from ellipse centre	
Code [7 bits]	**Delta Longitude [deg°]**
1101101	7,187500000
1101110	7,343750000
1101111	7,500000000
1110000	7,656250000
1110001	7,812500000
1110010	7,968750000
1110011	8,125000000
1110100	8,281250000
1110101	8,437500000
1110110	8,593750000
1110111	8,750000000
1111000	8,906250000
1111001	9,062500000
1111010	9,218750000
1111011	9,375000000
1111100	9,531250000
1111101	9,687500000
1111110	9,843750000
1111111	10,000000000

18.3. B3 - Secondary Ellipse Definition

A17 and A18 - Specific Settings:
B3 – Second ellipse definition



B3 – Secondary ellipse definition		
Code [15 bits]	**Number of Bits**	**Specific Parameters of Main Subject**
Bits 0-1	2	C7 - Shift of second ellipse centre
Bits 2-4	3	C8 - Homothetic factor of second ellipse
Bits 5-9	5	C9 - Bearing angle of second ellipse
Bits 10-14	5	C10 – Guidance library for second ellipse

18.3.1. C7 – Shift of Second Ellipse Centre

C7 – Shift of second ellipse centre	
Code [2 bits]	**Shift Factor**
00	0
01	1
10	2
11	3

18.3.2. C8 – Homothetic Factor of Second Ellipse

C8 – Homothetic factor of second ellipse	
Code [3 bits]	**Homothetic Factor**
000	0,25
001	0,5
010	0,75
011	1
100	1,25
101	1,5
110	1,75
111	2

18.3.3. C9 – Bearing Angle of Second Ellipse

C9 – Bearing Angle of second ellipse	
Code [5 bits]	**Degree**
00000	0
00001	11,25
00010	22,5
00011	33,75
00100	45
00101	56,25
00110	67,5
00111	78,75
01000	90
01001	101,25
01010	112,5
01011	123,75
01100	135
01101	146,25
01110	157,5
01111	168,75
10000	180

C9 – Bearing Angle of second ellipse	
Code [5 bits]	**Degree**
10001	191,25
10010	202,5
10011	213,75
10100	225
10101	236,25
10110	247,5
10111	258,75
11000	270
11001	281,25
11010	292,5
11011	303,75
11100	315
11101	326,25
11110	337,5
11111	348,75

18.3.4. C10 –Guidance Library for Second Ellipse

C10 – Guidance library for second ellipse		
LIST C: Specific action for second ellipse		
Code [5 bits]	**Instruction code**	**Instruction list - English**
00000	IC-C-01	[*empty*]
00001	IC-C-02	Prepare for evacuation. Take only the essentials with you, especially ID cards, passport, credit cards and cash. Evacuate only after the instruction of the emergency authorities.
00010	IC-C-03	Prepare emergency food and relief material: Check and restock your equipment and supplies of water, food, medicine, cash and batteries.
00011	IC-C-04	Be prepared to protect yourself and your property. Flooding of properties and transport networks is expected. Disruption to power, communications and water supplies are possible. Evacuation may be required. Dangerous driving conditions due to reduced visibility and aquaplaning.
00100	IC-C-05	Have iodine tablets ready. DO NOT take the iodine tablets now. If this becomes necessary, we will inform you in good time.
00101	IC-C-06	Keep your smartphone charged to be able to receive further instructions and information
00110	IC-C-07	Avoid using lifts.
00111	IC-C-08	Avoid the danger area.
01000	IC-C-09	Avoid driving.
01001	IC-C-10	Rescue operation under process by security forces and emergency services. Avoid moving to facilitate security and emergency actions.
01010	IC-C-11	Check with the weather services and local authorities for additional information.
01011	IC-C-12	Find out the location of the information points set up by the authorities on official channels (radio, internet, TV, social networks…).
01100	IC-C-13	Sensitive or vulnerable people should not go out unless they must.
01101	IC-C-14	Protect the most vulnerable and hear from your loved ones. Be aware of their special needs and support, as required. If you notice distressed or vulnerable persons, contact the emergency services. Provide first aid if necessary but do not put yourself in any danger.
01110	IC-C-15	Pay attention to announcements made by the police, fire brigade and by officials.
01111	IC-C-16	Stay aware, keep listening to official instructions broadcast on the radio, television, websites and social networks pages.
10000	IC-C-17	Only make phone calls in serious emergencies to avoid overloading the mobile network.
10001	IC-C-18	*reserved*
10010	IC-C-19	*reserved*
10011	IC-C-20	*reserved*
10100	IC-C-21	*reserved*
10101	IC-C-22	*reserved*
10110	IC-C-23	*reserved*
10111	IC-C-24	*reserved*
11000	IC-C-25	*reserved*
11001	IC-C-26	*reserved*
11010	IC-C-27	*reserved*
11011	IC-C-28	*reserved*

C10 – Guidance library for second ellipse		
LIST C: Specific action for second ellipse		
Code [5 bits]	**Instruction code**	**Instruction list - English**
11100	IC-C-29	*reserved*
11101	IC-C-30	*reserved*
11110	IC-C-31	This is only a test. You do not have to take any action or to adopt any particular sheltering behaviour.
11111	IC-C-32	Conditions have improved and are no longer expected to meet alert criteria.

Note: The 'empty field' (code '*00000'*) is to be automatically selected when the secondary ellipse is used in the '*evacuation'* configuration (see ***Figure 9***), i.e. to locate a safe geographic area/point to gather. Therefore, there is no specific instruction for the secondary ellipse, when used in this configuration.

18.4. B4 - Quantitative and Detailed Information related to Hazard Category and Type

B4 - Quantitative or detailed information related to hazard category and type			
Hazard category and type (see A4) (selected subset)	**Code [15 bits]**	**Number of Bits**	**Lower-Level Fields**
Earthquake		15	
	0-3	4	D1 - Magnitude on Richter Scale
	4-6	3	D2 - Seismic coefficient
	7-10	4	D3 - Azimuth from centre of main ellipse to epicentre
	11-14	4	D4 - Vector length between centre of main ellipse and epicentre
Tsunami / tidal wave		15	
	0-2	3	D5 – Wave height
	3-14	12	*reserved*
Cold wave / heat wave		15	
	0-3	4	D6 –Temperature range
	4-14	11	*reserved*
Tropical cyclone (hurricane)		15	
	0-2	3	D7- Hurricane categories
	3-6	4	D8 – Wind speed
	7-9	3	D9 - Rainfall amounts
	10-14	5	*reserved*
Tropical cyclone (typhoon)		15	
	0-2	3	D36 - Typhoon categories
	3-6	4	D8 – Wind speed
	7-9	3	D9 - Rainfall amounts
	10-14	5	*reserved*
Tornado		15	
	0-3	4	D8 – Wind speed
	4-6	3	D9 - Rainfall amounts
	7-9	3	D11 – Tornado probability
	10-14	5	*reserved*

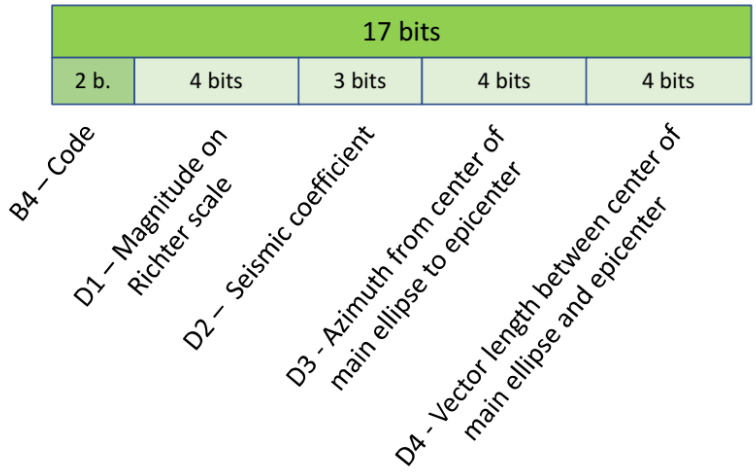
B4 - Quantitative or detailed information related to hazard category and type			
Hazard category and type (see A4) (selected subset)	**Code [15 bits]**	**Number of Bits**	**Lower-Level Fields**
Storm or thunderstorm		15	
	0-3	4	D8 – Wind speed
	4-6	3	D9 - Rainfall amounts
	7-9	3	D10 – Damage category
	10-12	3	D16 – Lightning intensity
	13-14	2	*reserved*
Hail		15	
	0-3	4	D12 - Hail scale
	4-14	11	*reserved*
Rainfall		15	
	0-2	3	D9 – Rainfall amounts
	3-6	4	D13 - Visibility
	7-14	8	*reserved*
Snowfall		15	
	0-4	5	D14 – Snow depth
	5-8	4	D13 - Visibility
	9-14	6	*reserved*
Flood		15	
	0-1	2	D15 – Flood severity
	2-14	13	*reserved*
Lightning		15	
	0-2	3	D16 – Lightning intensity
	3-14	12	*reserved*
Wind chill/frost		15	
	0-3	4	D8 – Wind speed
	4-7	4	D6 - Temperature range
	8-14	7	*reserved*
Derecho		15	
	0-3	4	D8 – Wind speed
	4-6	3	D9 - Rainfall amounts
	7-9	3	D16 – Lightning intensity
	10-12	3	D11 – Tornado probability
	13-14	2	*reserved*
Fog		15	
	0-2	3	D17 – Fog level
	3-6	4	D13 - Visibility
	7-14	8	*reserved*
Snow storm / blizzard		15	
	0-3	4	D13 - Visibility
	4-7	4	D8 – Wind speed
	8-14	7	*reserved*
Drought		15	
	0-1	2	D18 – Drought level
	2-14	13	*reserved*
Avalanche risk		15	
	0-2	3	D19 - Avalanche warning level
	3-14	12	*reserved*
Ash fall		15	
	0-2	3	D20 – Ash fall amount and impact

B4 - Quantitative or detailed information related to hazard category and type			
Hazard category and type (see A4) (selected subset)	**Code [15 bits]**	**Number of Bits**	**Lower-Level Fields**
	3-14	12	*reserved*
Wind/wave/storm surge		15	
	0-3	4	D8 – Wind speed
	4-6	3	D5 – Wave height
	7-14	8	*reserved*
Geomagnetic or solar storm		15	
	0-2	3	D21 – Geomagnetic scale
	3-14	12	*reserved*
Terrorism		15	
	0-2	3	D22 – Terrorism threat level
	3-14	12	*reserved*
Forest fire / risk of fire		15	
	0-2	3	D23 – Fire risk level
	3-14	12	*reserved*
Contaminated drinking water / marine pollution		15	
	0-2	3	D24 – Water quality
	3-14	12	*reserved*
UV radiation		15	
	0-3	4	D25 – UV index
	4-14	11	*reserved*
Risk of infection / pandemic		15	
	0-4	5	D26 - Number of cases per 100 000 inhabitants
	5-10	6	D35 - Infection type
	11-14	4	*reserved*
Noise pollution			
	0-3	6	D27 – Noise range
	4-14	4	*reserved*
Air pollution			
	0-2	6	D28 – Air pollution index
	3-14	4	*reserved*
Marine pollution / river pollution		15	
	0-2	3	D24 – Water quality
	3-14	12	*reserved*
Outage of Gas supply / IT systems / Power systems / Emergency number / Telephone line		15	
	0-4	5	D29 – Outage - estimated duration
	5-14	10	*reserved*
Radiological hazard, nuclear hazard and nuclear power station accident		15	
	0-3	4	D30 – Nuclear event scale
	4-14	11	*reserved*
Chemical hazard		15	
	0-3	4	D31 – Hazard class
	4-14	11	*reserved*
Biological hazard		15	
	0-1	2	D32 - Biohazard level

B4 - Quantitative or detailed information related to hazard category and type			
Hazard category and type (see A4) (selected subset)	**Code [15 bits]**	**Number of Bits**	**Lower-Level Fields**
	2-3	2	D33 – Biohazard type
	4-14	11	*reserved*
Explosive hazard		15	
	0-1	2	D34 - Explosive hazard type
	2-14	13	*reserved*

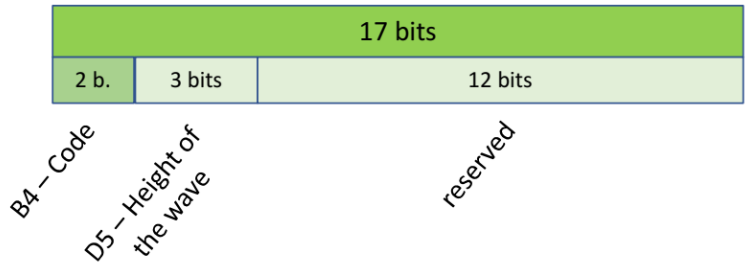
18.4.1. A18 – B4 GEO - Earthquake

A17 and A18 - Specific Settings:
B4 – Quantitative & detailed information
A4 – GEO – Earthquake (0100100)



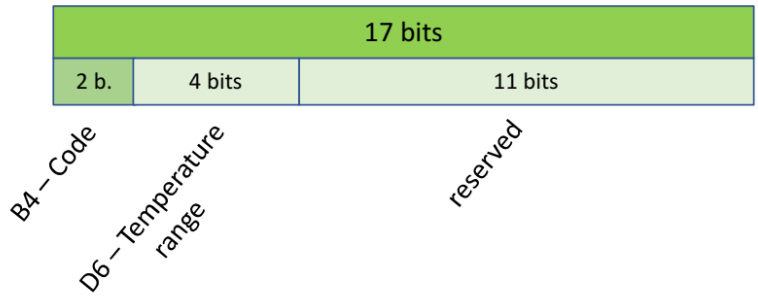
18.4.2. A18 – B4 GEO - Tsunami

A17 and A18 - Specific Settings:
B4 – Quantitative & detailed information
A4 – GEO – Tsunami (0101100)



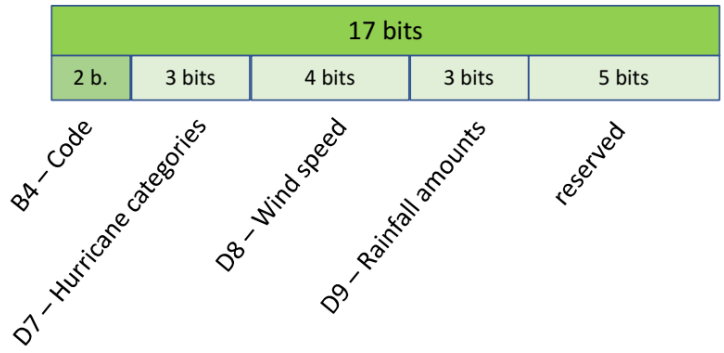
18.4.3. A18 – B4 MET – Cold Wave and Heat Wave

A17 and A18 - Specific Settings:
B4 – Quantitative & detailed information
A4 – MET – Cold wave (0111111)
or
A4 – MET – Heat wave (1000111)



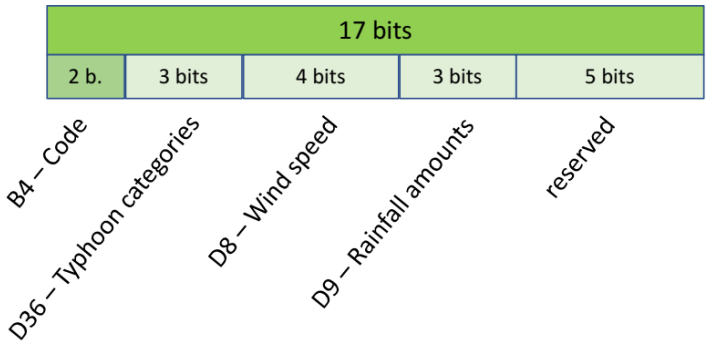
18.4.4. A18 – B4 MET – Tropical Cyclone (hurricane)

A17 and A18 - Specific Settings:
B4 – Quantitative & detailed information
A4 – MET – Tropical cyclone (hurriance) (1010000)



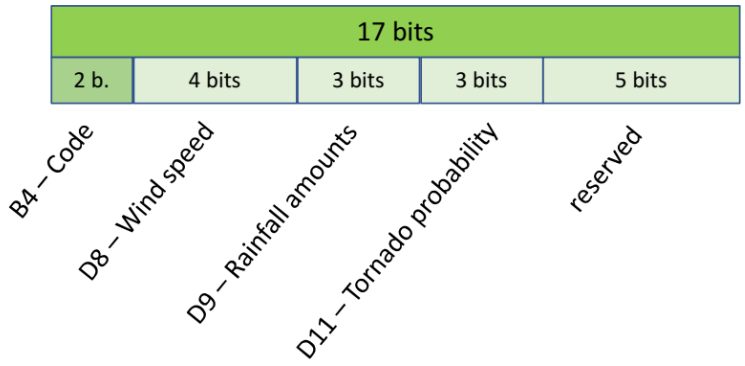
18.4.5. A15 – B4 MET - Tropical Cyclone (typhoon)

A17 and A18 - Specific Settings:
B4 – Quantitative & detailed information
A4 – MET – Tropical cyclone (typhoon) (1010010)



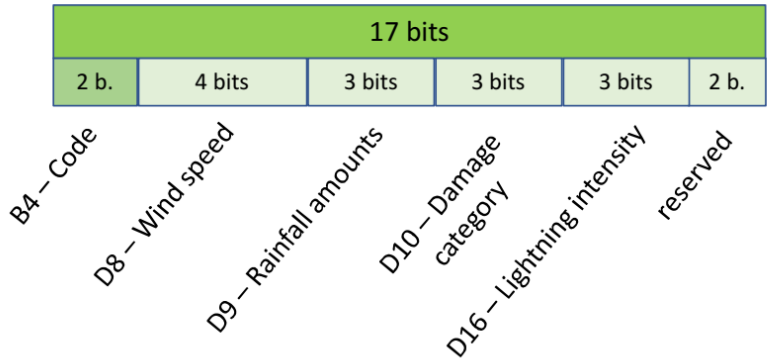
18.4.6. A15 – B4 MET - Tornado

A17 and A18 - Specific Settings:
B4 – Quantitative & detailed information
A4 – MET – Tornado (1001111)



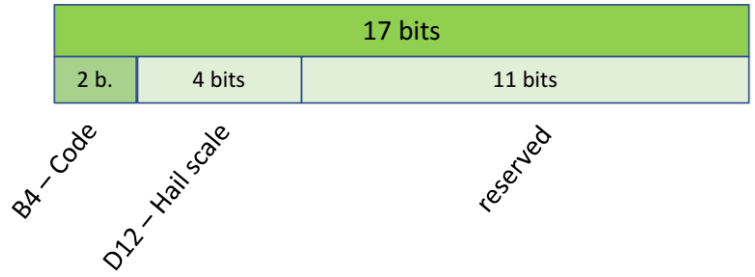
18.4.7. A15 – B4 MET - Storm or Thunderstorm

A17 and A18 - Specific Settings:
B4 – Quantitative & detailed information
A4 – MET – Storm or thunderstorm (1001101)



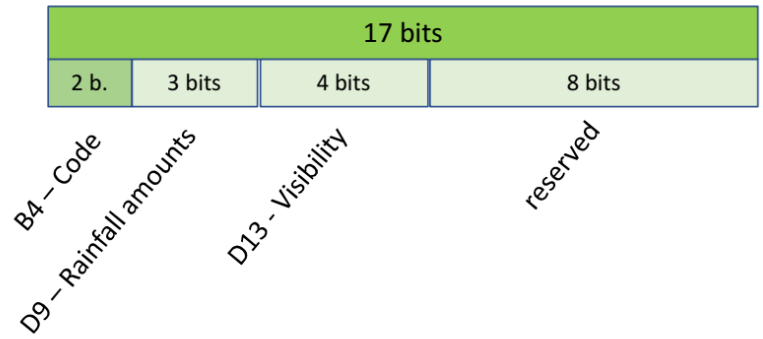
18.4.8. A15 – B4 MET - Hail

A17 and A18 - Specific Settings:
B4 – Quantitative & detailed information
A4 – MET – Hail (1000110)



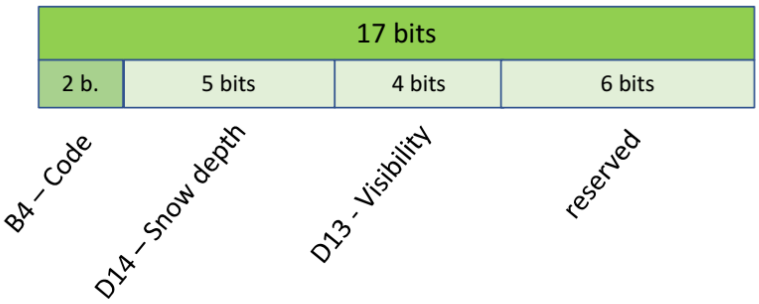
18.4.9. A15 – B4 MET - Rainfall

A17 and A18 - Specific Settings:
B4 – Quantitative & detailed information
A4 – MET – Rainfall (1001010)



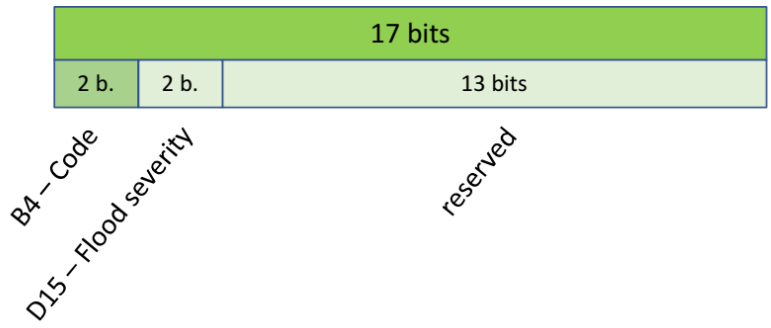
18.4.10. A15 – B4 MET – Snowfall

A17 and A18 - Specific Settings:
B4 – Quantitative & detailed information
A4 – MET – Snowfall (1001100)



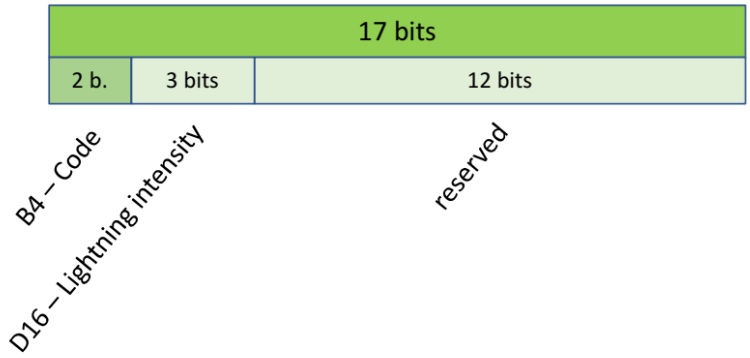
18.4.11. A15 – B4 MET - Flood

A17 and A18 - Specific Settings:
B4 – Quantitative & detailed information
A4 – MET – Flood (1000100)



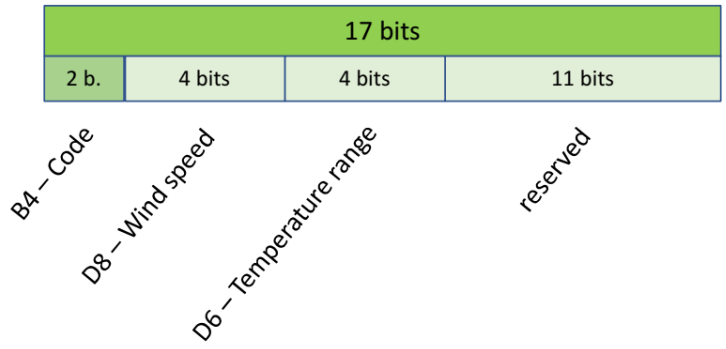
18.4.12. A15 – B4 MET – Lightning

A17 and A18 - Specific Settings:
B4 – Quantitative & detailed information
A4 – MET – Lightning (1001000)



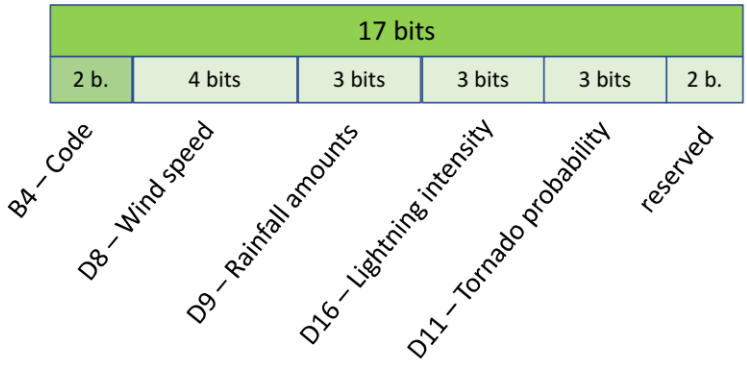
18.4.13. A15 – B4 MET - Wind Chill / Frost

A17 and A18 - Specific Settings:
B4 – Quantitative & detailed information
A4 – MET – Wind chill / frost (1010001)



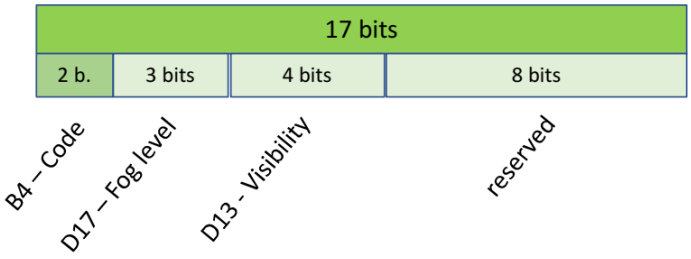
18.4.14. A15 – B4 MET – Derecho

A17 and A18 - Specific Settings:
B4 – Quantitative & detailed information
A4 – MET – Derecho (1000000)



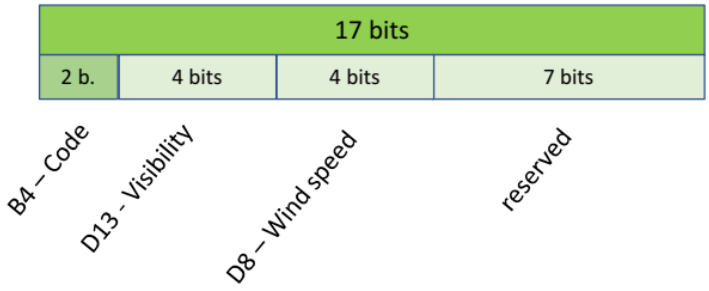
18.4.15. A15 – B4 MET – Fog

A17 and A18 - Specific Settings:
B4 – Quantitative & detailed information
A4 – MET – Fog (1000101)



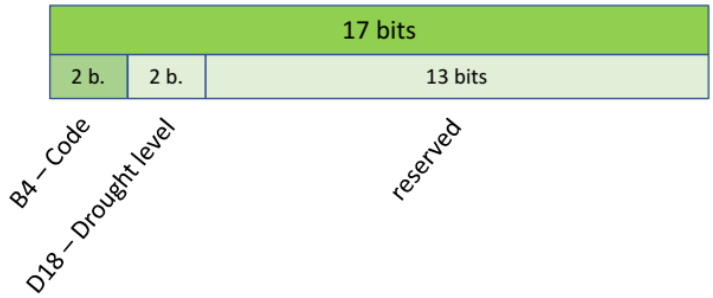
18.4.16. A15 – B4 MET – Snow Storm / blizzard

A17 and A18 - Specific Settings:
B4 – Quantitative & detailed information
A4 – MET – Snow storm / blizzard (1001011)



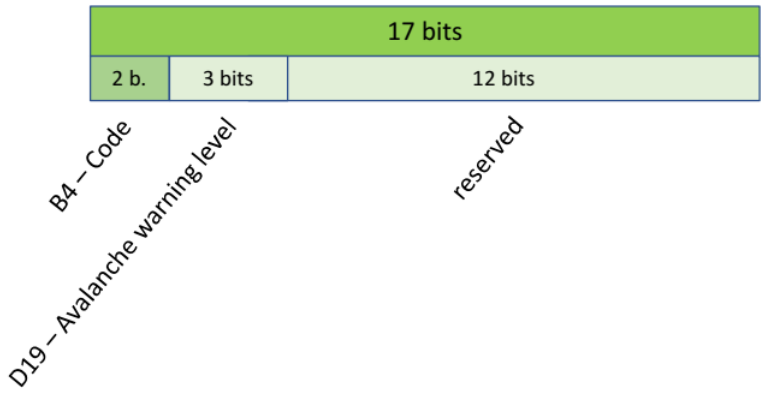
18.4.17. A15 – B4 MET – Drought

A17 and A18 - Specific Settings:
B4 – Quantitative & detailed information
A4 – MET – Drought (1000001)



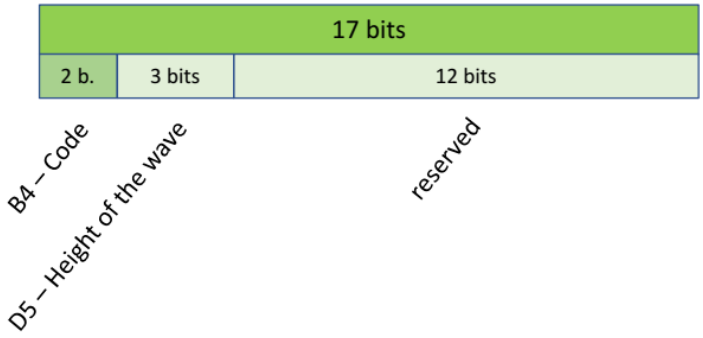
18.4.18. A15 – B4 GEO – Avalanche Risk

A17 and A18 - Specific Settings:
B4 – Quantitative & detailed information
A4 – GEO – Avalanche risk (0100001)



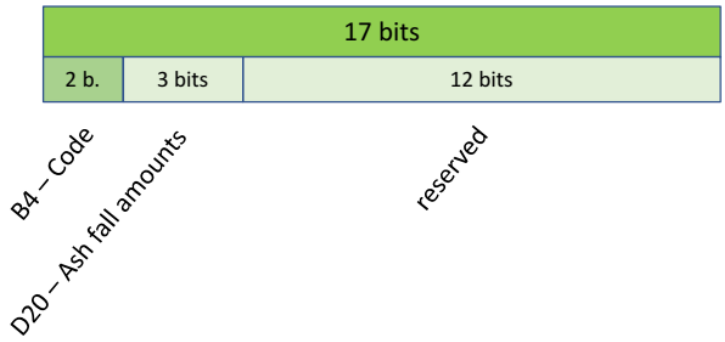
18.4.19. A15 – B4 GEO – Tidal Wave

A17 and A18 - Specific Settings:
B4 – Quantitative & detailed information
A4 – GEO – Tidal wave (0101011)



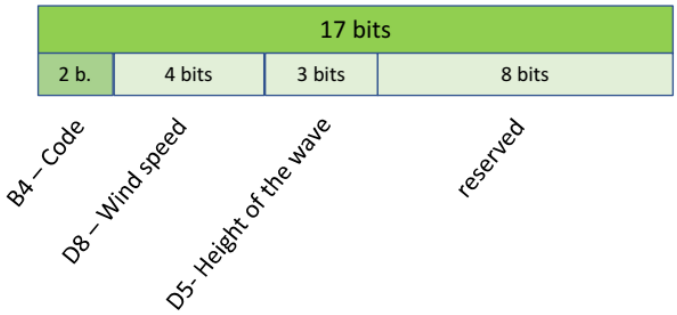
18.4.20. A15 – B4 GEO – Ash Fall

A17 and A18 - Specific Settings:
B4 – Quantitative & detailed information
A4 – GEO – Ash fall (0100000)



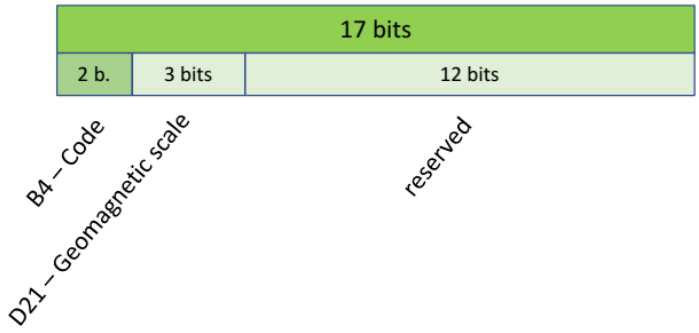
18.4.21. A15 – B4 GEO – Wave/Wind/Storm Surge

A17 and A18 - Specific Settings:
B4 – Quantitative & detailed information
A4 – GEO – Wind/wave/storm surge (0101111)



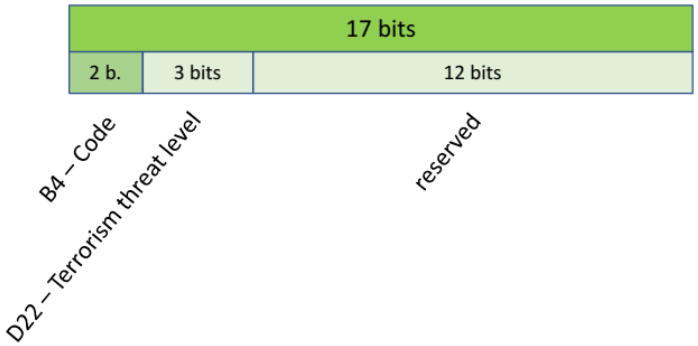
18.4.22. A15 – B4 GEO – Geomagnetic or Solar Storm

A17 and A18 - Specific Settings:
B4 – Quantitative & detailed information
A4 – GEO – Geomagnetic or solar storm (0100101)



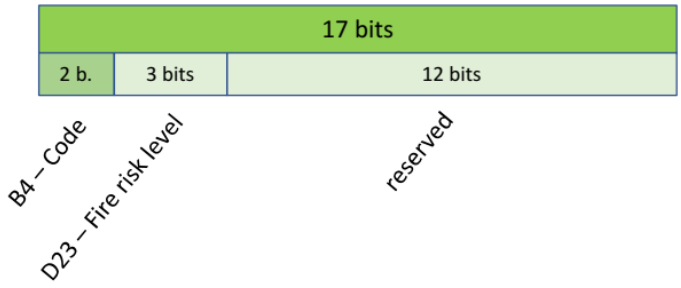
18.4.23. A15 – B4 SECURITY - Terrorism

A17 and A18 - Specific Settings:
B4 – Quantitative & detailed information
A4 – SECURITY - Terrorism (1100111)



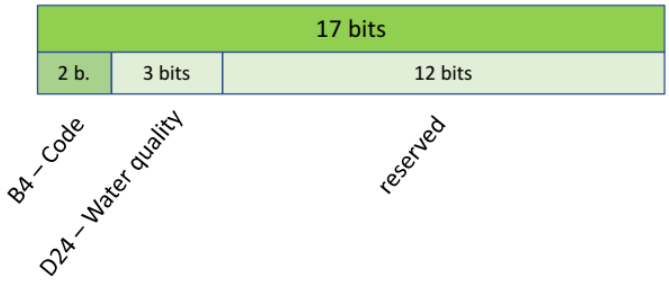
18.4.24. A15 – B4 FIRE– Forest Fire or Risk of Fire

A17 and A18 - Specific Settings:
B4 – Quantitative & detailed information
A4 – FIRE – Forest fire (0011011)
or
A4 - FIRE – Risk of fire (0011110)



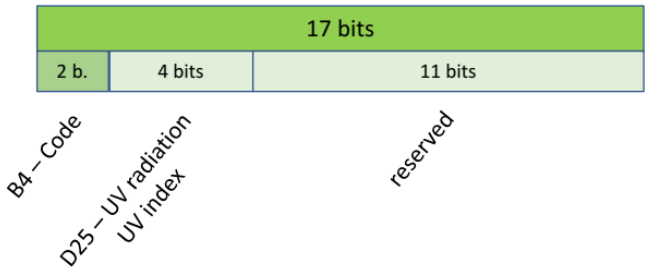
18.4.25. A15 – B4 ENVIRONMENT – Contaminated Drinking Water or Marine Pollution or River Pollution

A17 and A18 - Specific Settings:
B4 – Quantitative & detailed information
A4 – ENVIRONMENT – Contaminated drinking water (0010000)
or
A4 – ENVIRONMENT – Marine pollution (0010010)
or
A4 – ENVIRONMENT – River pollution (0010101)



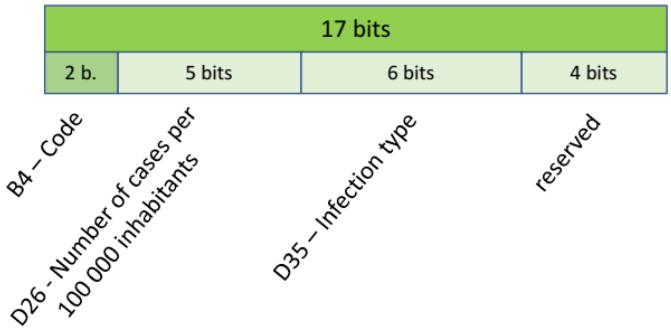
18.4.26. A15 – B4 ENVIRONMENT – UV Radiation

A17 and A18 - Specific Settings:
B4 – Quantitative & detailed information
A4 – ENVIRONMENT – UV radiation (0010111)



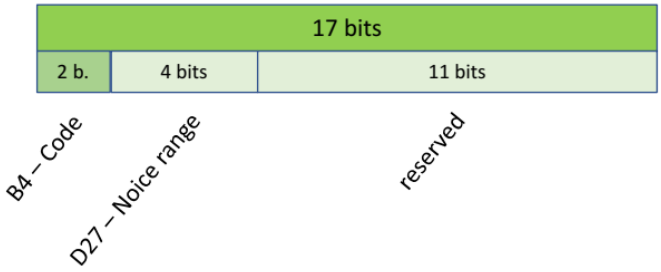
18.4.27. A15 – B4 HEALTH – Risk of Infection or Pandemic

A17 and A18 - Specific Settings:
B4 – Quantitative & detailed information
A4 – HEALTH – Risk of infection (0110101)
or
A4 - HEALTH– Pandemia (0110011)



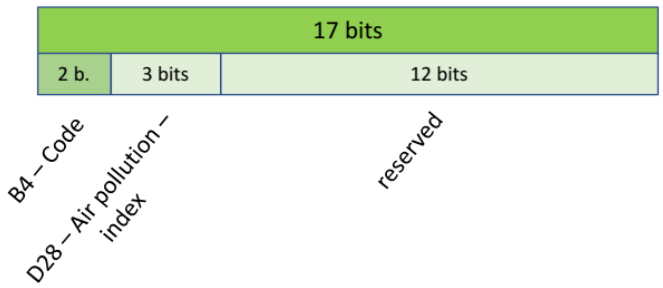
18.4.28. A15 – B4 ENVIRONMENT – Noise Pollution

A17 and A18 - Specific Settings:
B4 – Quantitative & detailed information
A4 – ENVIRONMENT – Noise pollution (0010011)



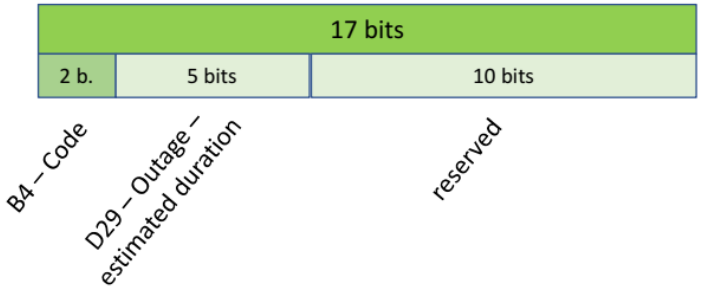
18.4.29. A15 – B4 ENVIRONMENT – Air Pollution

A17 and A18 - Specific Settings:
B4 – Quantitative & detailed information
A4 – ENVIRONMENT – Air pollution (0001111)



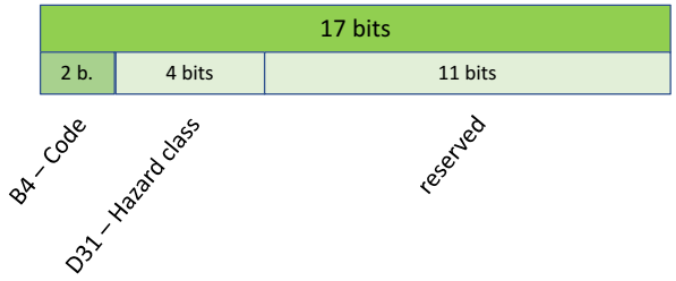
18.4.30. A15 – B4 INFRASTRUCTURE – Gas supply outage or Outage of IT systems or Power outage or Emergency number outage or Telephone line outage

A17 and A18 - Specific Settings:
B4 – Quantitative & detailed information
A4 – INFRASTRUCTURE – Gas supply outage (0111000)
or
A4 – INFRASTRUCTURE – Outage of IT systems (0111001)
or
A4 – INFRASTRUCTURE – Power outage (0111010)
or
A4 – INFRASTRUCTURE – Emergency number outage (0110111)
or
A4 – INFRASTRUCTURE – Telephone line outage (0111100)



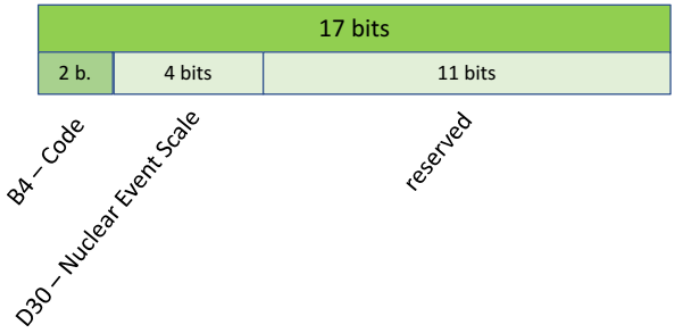
18.4.31. A15 – B4 CBRNE – Chemical Hazard

A17 and A18 - Specific Settings:
B4 – Quantitative & detailed information
A4 – CBRNE – Chemical hazard (0000101)



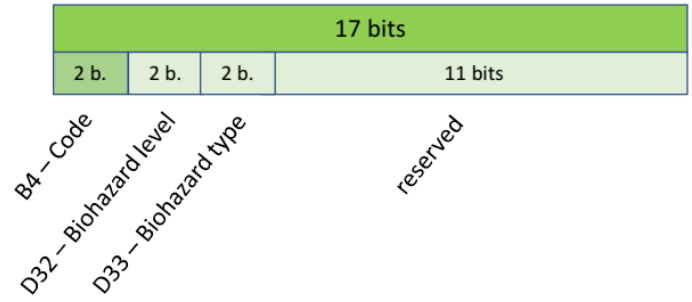
18.4.32. A15 – B4 CBRNE – Radiological Hazard or Nuclear Hazard or Nuclear power station accident

A17 and A18 - Specific Settings:
B4 – Quantitative & detailed information
A4 – CBRNE – Radiological hazard (0001011)
or
A4 – CBRNE – Nuclear hazard (0001001)
or
A4 – CBRNE – Nuclear power station accident (0001010)



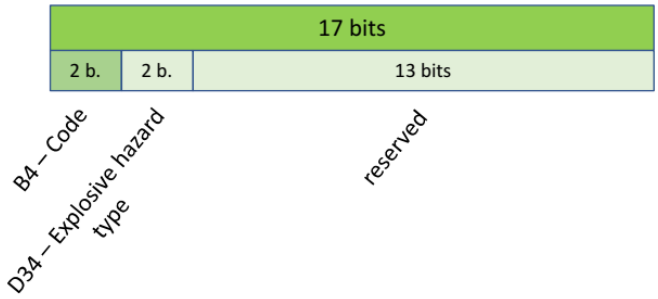
18.4.33. A15 – B4 CBRNE – Biological Hazard

A17 and A18 - Specific Settings:
B4 – Quantitative & detailed information
A4 – CBRNE – Biological hazard (0000100)



18.4.34. A15 – B4 CBRNE – Explosive Hazard

A17 and A18 - Specific Settings:
B4 – Quantitative & detailed information
A4 – CBRNE – Explosive hazard (0000110)



18.4.35. B4 – Lower-Level Fields Tables

18.4.35.1. D1 – Magnitude on Richter Scale

D1 - Magnitude on Richter Scale		
Code [4 bits]	**Magnitude**	**Description**
0000	1.0-1.9	Micro
0001	2.0-2.9	Minor
0010	3.0-3.9	Minor
0011	4.0-4.9	Light
0100	5.0-5.9	Moderate
0101	6.0-6.9	Strong
0110	7.0-7.9	Major
0111	8.0-8.9	Great
1000	9.0 and greater	Great

REFERENCE: The Richter magnitude scale, see Richter magnitude scale - Wikipedia.

18.4.35.2. D2 – Seismic Coefficient

D2 - Seismic Coefficient	
Code [3 bits]	**Seismic Coefficient**
000	2
001	3
010	4
011	5 weak
100	5 strong
101	6 weak
110	6 strong
111	7

18.4.35.3. D3 – Azimuth from Centre of Main Ellipse to Epicentre

D3 - Azimuth from Centre of Main Ellipse to Epicentre			
Code [4 bits]	**Azimuth [deg°]**	**Intervals [deg°]**	**Max. Azimuth [deg°]**
0000	0	22,5	337,5
0001	22,5		
0010	45		
0011	67,5		
0100	90		
0101	112,5		
0110	135		
0111	157,5		
1000	180		
1001	202,5		
1010	225		
1011	247,5		
1100	270		
1101	292,5		
1110	315		
1111	337,5		

18.4.35.4. D4 – Vector Length between Centre of Main Ellipse and Epicentre

D4 – Vector length between centre of Main Ellipse and epicentre	
Code [4 bits]	**Factor of semi-major axis length of main ellipse**
0000	0,25
0001	0,5
0010	0,75
0011	1
0100	2
0101	3
0110	5
0111	10
1000	20
1001	30
1010	40
1011	50
1100	70
1101	100
1110	150
1111	200

REFERENCE: The factor is applied to the length of the semi-major axis of the main ellipse.

18.4.35.5. D5 – Wave Height

D5 – Wave height	
Code [3 bits]	**Wave Height [m]**
000	H ≤ 0,5
001	0.5 < H ≤ 1,0
010	1,0 < H ≤ 1,5
011	1,5 < H ≤ 2,0
100	2,0 < H ≤ 3,0
101	3,0 < H ≤ 5,0
110	5,0 < H ≤ 10,0
111	H > 10,0

REFERENCE: Scientists use two measures to describe ocean waves: height and length. Wave height is defined as the height of the wave from the wave top (the wave crest) to the bottom of the wave (the wave trough). The wave length is defined as the horizontal distance between two successive crests or troughs. https://www.ndbc.noaa.gov/educate/waves.shtml

18.4.35.6. D6 – Temperature Range

D6 – Temperature range	
Code [4 bits]	**Temperature [°C]**
0000	T ≤ -30
0001	-30 < T ≤ -25
0010	-25 < T ≤ -20
0011	-20 < T ≤ -15
0100	-15 < T ≤ -10
0101	-10 < T ≤ -5
0110	-5 < T ≤ 0
0111	0 < T ≤ 5
1000	5 < T ≤ 10
1001	10 < T ≤ 15
1010	15 < T ≤ 20
1011	20 < T ≤ 25
1100	25 < T ≤ 30
1101	30 < T ≤ 35
1110	35 < T ≤ 45
1111	T > 45

18.4.35.7. D7 – Hurricane Categories

D7 – Hurricane categories	
Code [3 bits]	**Hurricane categories**
000	Category 1/5 hurricane: Very dangerous winds will produce some damage. Winds range from 120 to 150 km/h. Falling debris could strike people, livestock and pets, and older mobile homes could be destroyed. Protected glass windows will generally make it through the hurricane without major damage. Frame homes, apartments and shopping centres may experience some damage, and snapped power lines could result in short-term power outages.
001	Category 2/5 hurricane: Extremely dangerous winds will cause extensive damage. Winds range between 150 and 180 km/h. There is a bigger risk of injury or death to people, livestock and pets from flying debris. Older mobile homes will likely be destroyed, and debris can ruin newer mobile homes, too. Frame homes, apartment buildings and shopping centres may see major roof and siding damage, and many trees will be uprooted. Residents should expect near total power loss after a Category 2 hurricane, with outages lasting anywhere from a few days to a few weeks.
010	Category 3/5 hurricane: Devastating damage will occur. In a Category 3 hurricane, winds range from 180 to 210 km/h. There is a high risk of injury or death to people, livestock and pets from flying and falling debris. Nearly all older mobile homes will be destroyed, and most new ones will experience significant damage. Even well-built frame homes, apartments and industrial buildings will likely experience major damage, and the storm will uproot many trees that may block roads. Electricity and water will likely be unavailable for several days to a few weeks after the storm.
011	Category 4/5 hurricane: Catastrophic damage will occur. During a Category 4 hurricane, winds range from 210 to 250 km/h. At these speeds, falling and flying debris poses a very high risk of injury or death to people, pets and livestock. Again, most mobile homes will be destroyed, even newer ones. Some frame homes may totally collapse, while well-built homes will likely see severe damage to their roofs, and apartment buildings can experience damage to upper floors. A Category 4 hurricane will blow out most windows on high-rise buildings, uproot most trees and will likely down many power lines.

D7 – Hurricane categories	
Code [3 bits]	**Hurricane categories**
100	Category 5/5 hurricane: Catastrophic damage will occur. In a Category 5 hurricane, the highest category hurricane, winds are 250 km/h or higher. People, livestock and pets can be in danger from flying debris, even indoors. Most mobile homes will be completely destroyed, and a high percentage of frame homes will be destroyed. Commercial buildings with wood roofs will experience severe damage, metal buildings may collapse and high-rise windows will nearly all be blown out. A Category 5 hurricane is likely to uproot most trees and ruin most power poles. People should expect long-term water shortages and power outages.

REFERENCE: In its current version, it only measures the wind speeds produced by a hurricane.

REFERENCE: Saffir-Simpson Hurricane Wind Scale

18.4.35.8. D8 – Wind Speed

D8 – Wind speed	
Code [4 bits]	**Wind speed**
0000	Beaufort 0. 0 km/h < v < 1 km/h - Calm
0001	Beaufort 1. 1 km/h < v < 5 km/h - Light Air
0010	Beaufort 2. 6 km/h < v < 11 km/h - Light Breeze
0011	Beaufort 3. 12 km/h < v < 19 km/h - Gentle Breeze
0100	Beaufort 4. 20km/h < v < 30 km/h - Moderate Breeze
0101	Beaufort 5. 31 km/h < v < 39 km/h - Fresh Breeze
0110	Beaufort 6. 40 km/h < v < 50 km/h - Strong Breeze
0111	Beaufort 7. 51 km/h < v < 61 km/h - Near Gale
1000	Beaufort 8. 62 km/h < v < 74 km/h - Gale
1001	Beaufort 9. 75 km/h < v < 88 km/h - Strong Gale
1010	Beaufort 10. 89 km/h < v < 102 km/h - Storm
1011	Beaufort 11. 103 km/h < v < 117 km/h - Violent Storm
1100	Beaufort 12. V > 118 km/h - Hurricane
1101	*not used*
1110	*not used*
1111	*not used*

REFERENCE: Beaufort Wind Scale. Developed in 1805 by Sir Francis Beaufort, U.K. Royal Navy. https://www.spc.noaa.gov/faq/tornado/beaufort.html

18.4.35.9. D9 – Rainfall Amounts

D9 - Rainfall amounts	
Code [3 bits]	**Rainfall amounts [mm / hour]**
000	p ≤ 2.5
001	2.5 < p ≤ 7.5
010	7.5 < p ≤ 10
011	10 < p ≤ 20
100	20 < p ≤ 30
101	30 < p ≤ 50
110	50 < p ≤ 80
111	80 < p

REFERENCE: https://www.jma.go.jp/jma/kishou/know/yougo_hp/amehyo.html

18.4.35.10. D10 – Damage Category

D10 - Damage category	
Code [3 bits]	**Damage category**
000	Category 1 - Very dangerous winds will produce some damage. Scale 1 and Intensity 1
001	Category 2 - Extremely dangerous winds will cause extensive damage. Scale 1 and Intensity 2
010	Category 3 - Devastating damage will occur. Scale 1 and Intensity 3
011	Category 4 - Catastrophic damage will occur. Scale 2 and Intensity 1
100	Category 5 - Catastrophic damage will occur. Scale 2 and Intensity 2
101	Category 5 - Catastrophic damage will occur. Scale 3 and Intensity 3
110	*not used*
111	*not used*

REFERENCE: Based on Saffir-Simpson classification plus additional details from the Japanese Meteorological Agency to better interpret a given category.

18.4.35.11. D11 – Tornado Probability

D11 – Tornado probability	
Code [3 bits]	**Tornado probability**
000	**Non-Threatening** - Threat: No discernible threat to life and property. - Minimum Action: Listen for forecast changes; review tornado safety rules. - Potential Impact: None expected; strong wind gusts may still occur.
001	**Very Low** - Threat: A very low threat to life and property. - Minimum Action: Preparations should be made for a very low likelihood (or a 2 to 4% probability) of tornadoes; isolated tornadoes of F0 to F1 intensity possible. - Potential Impact: The potential for isolated locations to experience minor to moderate tornado damage.
010	**Low** - Threat: A low threat to life and property. - Minimum Action: Preparations should be made for a low likelihood (or a 5 to 14% probability) of tornadoes; scattered tornadoes of F0 to F1 intensity possible. - Potential Impact: The potential for scattered locations to experience minor to moderate tornado damage.
011	**Moderate** - Threat: A moderate threat to life and property. - Minimum Action: Preparations should be made for a moderate likelihood (or a 15 to 29% probability) of tornadoes; many tornadoes (even families) of F0 to F1 intensity possible. - Potential Impact: The potential for many locations to experience minor to moderate tornado damage (see below). Some tornadoes may have longer damage tracks.
100	**High** - Threat: A high threat to life and property. - Minimum Action: Preparations should be made for a high likelihood (or a 30 to 44% probability) of tornadoes; scattered tornadoes possible with isolated tornadoes of F2 to F5 intensity also possible. - Potential Impact: The potential for isolated locations to experience major tornado damage (see below), among scattered locations of minor to moderate tornado damage. Some tornadoes may have longer damage tracks.
101	**Extreme** - Threat: An extreme threat to life and property. - Minimum Action: Preparations should be made for a very high likelihood (or a 45% probability or greater) of tornadoes; many tornadoes (even families) possible with scattered tornadoes of F2 to F5 intensity also possible. - Potential Impact: The potential for scattered locations to experience major tornado damage (see below), among many locations of minor to moderate tornado damage. Some tornadoes may have longer damage tracks
110	*not used*
111	*not used*

Note: By a large majority, F0 & F1 tornadoes occur more often than F2 to F5 tornadoes.

F0 Tornado Damage – Minor tornado damage; damage to chimneys, a few downed trees and power lines, large signs blown over, damaged porches and screen houses, and damaged lighter-weight outbuildings. Tornado wind speeds of 118 km/h (73 mph) or less.

F1 Tornado Damage – Moderate tornado damage; mobile homes moved off foundations or overturned, roof surfaces peeled off buildings, cars blown off roads, several large trees downed and some power outages. Tornado wind speeds of 119 km/h (74 mph) to 180 km/h (112 mph).

F2 to F5 Tornado Damage – Major tornado damage (up to complete destruction); mobile homes completely demolished, numerous large trees snapped off or totally uprooted, small debris objects (lawn mowers, smaller sections of roofs) become airborne missiles. Increasingly larger areas of power outages. Structural damage to sturdy buildings becomes a concern, beginning with roof and wall failures. In the worst situations, well-constructed walls fail or are even removed. Large debris objects (cars, larger sections of roofs) become airborne missiles causing further structural failures. Trees debarked. Tornado wind speeds 181 km/h (113 mph) or greater, but in worse case situations 418 km/h (260 mph) or greater.

REFERENCE: NOAA – https://www.weather.gov/mlb/tornado_threat

18.4.35.12. D12 – Hail Scale

D12 – Hail scale	
Code [4 bits]	**Hail scale**
0000	H0 Hard hail. Typical hail diameter of 5 mm, No damage
0001	H1 Potentially damaging. Typical hail diameter of 5-15 mm. Slight general damage to plants, crops
0010	H2 Significant. Typical hail diameter of 10-20 mm. Slight general damage to fruit, crops, vegetation
0011	H3 Severe. Typical hail diameter of 20-30 mm (size of a walnut). Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
0100	H4 Severe. Typical hail diameter of 25-40 mm (size of a squash ball). Widespread glass damage, vehicle bodywork damage
0101	H5 Destructive. Typical hail diameter of 30-50 mm (size of a golf ball). Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries
0110	H6 Destructive. Typical hail diameter of 40-60 mm. Bodywork of grounded aircraft dented, brick walls pitted
0111	H7 Destructive. Typical hail diameter of 50-75 mm (size of a tennis ball). Severe roof damage, risk of serious injuries
1000	H8 Destructive. Typical hail diameter of 60-90 mm (size of a large orange). Severe damage to aircraft bodywork
1001	H9 Super Hailstorms. Typical hail diameter of 75-100 mm (size of a grapefruit). Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open
1010	H10 Super Hailstorms. Typical hail diameter > 100 mm (size of a melon). Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open

Note: Hail is commonly classified according to diameter of the hailstones

H0, being hard hail with diameter 5 mm causing no damage to H10, being super hailstorms with diameter >100 mm and causing extensive structural damage with risk of severe or fatal injuries to people

REFERENCE: TORRO Hailstorm Intensity Scale – https://www.torro.org.uk/research/hail/hscale

18.4.35.13. D13 – Visibility

D13 – Visibility	
Code [4 bits]	**Visibility**
0000	Dense fog: visibility < 20 m
0001	Thick fog: 20 m < visibility < 200 m
0010	Moderate fog: 200 m < visibility < 500 m
0011	Light fog: 500 m < visibility < 1000 m
0100	Thin fog: 1 km < visibility < 2 km
0101	Haze: 2 km < visibility < 4 km
0110	Light haze: 4 km < visibility < 10 km
0111	Clear: 10 km < visibility < 20 km
1000	Very clear: 20 km < visibility < 50 km
1001	Exceptionally clear: visibility > 50 km
1010	*not used*
1011	*not used*
1100	*not used*
1101	*not used*
1110	*not used*
1111	*not used*

REFERENCE: International visibility code with meteorological range

18.4.35.14. D14 – Snow Depth

D14 - Snow depth	
Code [5 bits]	**Snow depth [cm]**
00000	0 < daily snow depth ≤ 20
00001	20 < daily snow depth ≤ 40
00010	40 < daily snow depth ≤ 60
00011	60 < daily snow depth ≤ 80
00100	80 < daily snow depth ≤ 100
00101	100 < daily snow depth ≤ 120
00110	120 < daily snow depth ≤ 140
00111	140 < daily snow depth ≤ 160
01000	160 < daily snow depth ≤ 180
01001	180 < daily snow depth ≤ 200
01010	200 < daily snow depth ≤ 220
01011	220 < daily snow depth ≤ 240

D14 - Snow depth	
Code [5 bits]	**Snow depth [cm]**
01100	240 < daily snow depth ≤ 260
01101	260 < daily snow depth ≤ 280
01110	280 < daily snow depth ≤ 300
01111	300 < daily snow depth ≤ 320
10000	320 < daily snow depth ≤ 340
10001	340 < daily snow depth ≤ 360
10010	360 < daily snow depth ≤ 380
10011	380 < daily snow depth ≤ 400
10100	400 < daily snow depth ≤ 420
10101	420 < daily snow depth ≤ 440
10110	440 < daily snow depth ≤ 460
10111	460 < daily snow depth ≤ 480
11000	480 < daily snow depth ≤ 500
11001	500 < daily snow depth ≤ 520
11010	520 < daily snow depth ≤ 540
11011	540 < daily snow depth ≤ 560
11100	560 < daily snow depth ≤ 580
11101	580 < daily snow depth ≤ 600
11110	daily snow depth > 600
11111	*not used*

18.4.35.15. D15 – Flood Severity

D15 - Flood severity	
Code [2 bits]	**Flood severity**
00	**Minor Flooding** - minimal or no property damage, but possibly some public threat.
01	**Moderate Flooding** - some inundation of structures and roads near stream. Some evacuations of people and/or transfer of property to higher elevations.
10	**Major Flooding** - extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations.
11	**Record Flooding**

REFERENCE: NOAA Glossary, https://forecast.weather.gov/glossary.php?word=FLOOD

18.4.35.16. D16 – Lightning Intensity

D16 - Lightning intensity	
Code [3 bits]	**Intensity**
000	LAL 1 - No thunderstorms
001	LAL 2 - Isolated thunderstorms. Light rain will occasionally reach the ground. Lightning is very infrequent, 1 to 5 cloud to ground strikes in a 5-minute period.
010	LAL 3 - Widely scattered thunderstorms. Light to moderate rain will reach the ground. Lightning is infrequent, 6 to 10 cloud to ground strikes in a 5-minute period.
011	LAL 4 - Scattered thunderstorms. Moderate rain is commonly produced Lightning is frequent, 11 to 15 cloud to ground strikes in a 5-minute period.
100	LAL 5 - Numerous thunderstorms. Rainfall is moderate to heavy. Lightning is frequent and intense, greater than 15 cloud to ground strikes in a 5-minute period.
101	LAL 6 - Dry lightning (same as LAL 3 but without rain). This type of lightning has the potential for extreme fire activity and is normally highlighted in fire weather forecasts with a Red Flag Warning.

REFERENCE: NOAA Lightning Activity Level (LAL) Definition.
https://graphical.weather.gov/definitions/defineLAL.html

18.4.35.17. D17 – Fog Level

D17 – Fog level	
Code [3 bits]	**Fog level**
000	Level 1 of 5: Slight fog or Mist. On land, object appear hazy or blurry. Road and rail traffic are unhindered. On sea, horizon cannot be seen. Lights and landmarks can be seen at working distances.
001	Level 2 of 5: Slight fog. On land, railroad traffic takes additional caution. On sea, Lights on passing vessel are generally not distinct at distances under 1 mile. Fog signals are sounded.
010	Level 3 of 5: Moderate fog. On land, rail and road traffic is obstructed. On sea, Lights on passing vessels are generally not distinct at distances under 1 mile. Fog signals are sounded. On river, navigation is unhindered but extra caution is required.
011	Level 4 of 5: Moderate fog. On land, rail and road traffic impeded. On sea, lights on ships and other vessels cannot be seen at distances of 4 miles or less. On river, navigation is suspended.
100	Level 5 of 5: Thick fog. On land, all traffic is impeded and totally disorganised. On sea, lights on ships and other vessels cannot be seen at distances of 4 miles or less. On river, navigation is suspended.

18.4.35.18. D18 – Drought Level

D18 – Drought level	
Code [2 bits]	**Drought level**
00	D1 – Moderate Drought – PDSI = -2.0 to -2.9 Some damage to crops, pastures Streams, reservoirs, or wells low, some water shortages developing or imminent Voluntary water-use restrictions requested
01	D2 – Severe Drought – PDSI = -3.0 to -3.9 Crop or pasture losses likely Water shortages common Water restrictions imposed
10	D3 – Extreme Drought – PDSI = -4.0 to -4.9 Major crop/pasture losses Widespread water shortages or restrictions
11	D4 – Exceptional Drought – PDSI = -5.0 or less Exceptional and widespread crop/pasture losses Shortages of water in reservoirs, streams, and wells creating water emergencies

REFERENCE: Drought Classification – Palmer Drought Severity Index (PDSI) - https://droughtmonitor.unl.edu/About/AbouttheData/DroughtClassification.aspx

18.4.35.19. D19 – Avalanche Warning Level

D19 – Avalanche warning level	
Code [3 bits]	**Warning level**
000	**1 – Low.** Generally stable conditions. Triggering is generally possible only from high additional loads in isolated areas of very steep, extreme terrain. Only small and medium natural avalanches are possible.
001	**2 – Moderate.** Heightened avalanche conditions on specific terrain features. Triggering is possible, primarily from high additional loads, particularly on the indicated steep slopes. Very large natural avalanches are unlikely.
010	**3 – Considerable.** Dangerous avalanche conditions Triggering is possible, even from low additional loads, particularly on the indicated steep slopes. In certain situations, some large, and in isolated cases very large natural avalanches are possible.
011	**4 – High.** Very dangerous avalanche conditions. Triggering is likely, even from low additional loads, on many steep slopes. In some cases, numerous large and often very large natural avalanches can be expected.
100	**5 – Very high.** Extraordinary avalanche conditions. Numerous very large and often extremely large natural avalanches can be expected, even in moderately steep terrain.

REFERENCE – EU Avalanche Danger Scale from EAWS (European Avalanche Warning Service) -– https://www.avalanches.org/standards/avalanche-danger-scale/

18.4.35.20. D20 – Ash Fall Amount and Impact

D20 – Ash fall amount and impact	
Code [3 bits]	**Ash fall amount and impact**
000	Less than 1 mm ash thickness. Possible impact: Will act as an irritant to lungs and eyes. Possible minor damage to vehicles, houses and equipment caused by fine abrasive ash. Possible contamination of water supplies, particularly roof-fed tank supplies. Dust may affect road visibility and traction for an extended period.
001	1-5 mm ash thickness. Possible impact: Will act as an irritant to lungs and eyes. Minor damage to vehicles, houses and equipment caused by fine abrasive ash. Possible contamination of water supplies, particularly roof-fed tank supplies. Electricity and water supplies may be cut or limited. Dust may affect road visibility and traction for an extended period. Roads may need to be cleared to reduce the dust nuisance and prevent storm-water systems from becoming blocked. Possible crop damage. Some livestock may be affected.
010	5-100 mm ash thickness. Possible impact: Will act as an irritant to lungs and eyes. Damage to vehicles, houses and equipment caused by fine abrasive ash. Most buildings will support the ash load but weaker roof structures may collapse at 100 mm ash thickness, particularly if the ash is wet. Possible contamination of water supplies, particularly roof-fed tank supplies. Electricity and water supplies may be cut or limited. Road transport may be halted due to the build-up of ash on roads. Cars still working may soon stop due to clogging of air-filters. Rail transport may be forced to stop due to signal failure bought on by short circuiting if ash becomes wet. Likely crop damage. Most pastures will be killed by over 50 mm of ash. Some livestock may be affected.
011	100-300 mm ash thickness. Possible impact: Will act as an irritant to lungs and eyes. Damage to vehicles, houses and equipment caused by fine abrasive ash. Buildings that are not cleared of ash will run the risk of roof collapse, especially large flat roofed structures and if ash becomes wet. Possible contamination of water supplies, particularly roof-fed tank supplies. Electricity and water supplies may be cut or limited. Road transport may be halted due to the build-up of ash on roads. Cars still working may soon stop due to clogging of air-filters. Rail transport may be forced to stop due to signal failure bought on by short circuiting if ash becomes wet. Likely crop damage. Most pastures will be killed by over 50 mm of ash. Some livestock may be affected.
100	> 300 mm ash thickness. Possible impact: Will act as an irritant to lungs and eyes. Damage to vehicles, houses and equipment caused by fine abrasive ash. Buildings that are not cleared of ash will run the risk of roof collapse, especially large flat roofed structures and if ash becomes wet. Possible contamination of water supplies, particularly roof-fed tank supplies. Electricity and water supplies may be cut or limited. Road unusable until cleared. Rail transport may be forced to stop due to signal failure bought on by short circuiting if ash becomes wet. Heavy kill of vegetation. Livestock and other animals killed or heavily distressed.

REFERENCE: In order to assess the hazard and to allow the definition of risk within certain areas, five impact zones can be used. The thicknesses given are for uncompacted ash.

18.4.35.21. D21 – Geomagnetic Scale

D21 - Geomagnetic scale	
Code [3 bits]	**Geomagnetic scale**
000	**G1 - Minor** Power systems: Weak power grid fluctuations can occur. Spacecraft operations: Minor impact on satellite operations possible. Other systems: Migratory animals are affected at this and higher levels; aurora is commonly visible at high latitudes.
001	**G2 - Moderate** Power systems: High-latitude power systems may experience voltage alarms, long-duration storms may cause transformer damage. Spacecraft operations: Corrective actions to orientation may be required by ground control; possible changes in drag affect orbit predictions. Other systems: HF radio propagation can fade at higher latitudes, and aurora has been seen as low as 55° geomagnetic lat.
010	**G3 - Strong** Power systems: Voltage corrections may be required, false alarms triggered on some protection devices. Spacecraft operations: Surface charging may occur on satellite components, drag may increase on low-Earth-orbit satellites, and corrections may be needed for orientation problems. Other systems: Intermittent satellite navigation and low-frequency radio navigation problems may occur, HF radio may be intermittent, and aurora has been seen as low as 50° geomagnetic lat.
011	**G4 - Severe** Power systems: Possible widespread voltage control problems and some protective systems will mistakenly trip out key assets from the grid. Spacecraft operations: May experience surface charging and tracking problems, corrections may be needed for orientation problems. Other systems: Induced pipeline currents affect preventive measures, HF radio propagation sporadic, satellite navigation degraded for hours, low-frequency radio navigation disrupted, and aurora has been seen as low as 45° geomagnetic lat.
100	**G5 - Extreme** Power systems: Widespread voltage control problems and protective system problems can occur; some grid systems may experience complete collapse or blackouts. Transformers may experience damage. Spacecraft operations: May experience extensive surface charging, problems with orientation, uplink/downlink and tracking satellites. Other systems: Pipeline currents can reach hundreds of amps, HF (high frequency) radio propagation may be impossible in many areas for one to two days, satellite navigation may be degraded for days, low-frequency radio navigation can be out for hours, and aurora has been seen as low 40° geomagnetic lat.

REFERENCE: Geomagnetic Storm Scale from NOAA Space Weather Scale - https://www.swpc.noaa.gov/noaa-scales-explanation

18.4.35.22. D22 – Terrorism Threat Level

D22 - Terrorism threat level	
Code [3 bits]	**Threat level**
000	Very low threat level. A violent act of terrorism is highly unlikely. Measures are in place to keep the population safe.
001	Low threat level. A violent act of terrorism is possible but unlikely. Measures are in place to keep the population safe.
010	Medium threat level. A violent act of terrorism could occur. Additional measures are in place to keep the population safe.
011	High threat level. A violent act of terrorism is likely. Heightened measures are in place to keep the population safe.
100	Critical threat level. A violent act of terrorism is highly likely and could occur imminently. Exceptional measures are in place to keep the population safe.

18.4.35.23. D23 – Fire Risk Level

D23 - Fire risk level	
Code [3 bits]	**Fire risk level**
000	Danger level 1/5 (low or none danger). Small fires cannot be entirely ruled out, but require a high energy input. Lightning hardly ever causes a fire. Rate of spread: Generally slow. Characteristics: Surface or crawling fires, crowns of trees are not affected, topsoil does not burn. Fire-fighting: Forest fire is easy to extinguish. Behaviour: Do not carelessly discard cigarettes, tobacco products or lighters.
001	Danger level 2/5 (moderate danger). Local fires can start spontaneously. Lightning only rarely causes a conflagration. Rate of spread: Slow to medium. Characteristics: Surface or crawling fires, crowns of trees are rarely affected, topsoil is burnt a little or not at all. Fire-fighting: Forest fire is ordinarily easy to extinguish. Behaviour: Do not carelessly discard cigarettes, tobacco products or lighters. Always watch barbecue fires and immediately extinguish stray sparks.
010	Danger level 3/5 (considerable danger): Burning matches and flying sparks from barbecue fires can ignite a fire. Lightning can also trigger widespread fires. Rate of spread: High in open terrain, medium in the forest. Characteristics. Topsoil is partly burnt; individual crown fires are possible. Fire-fighting: Forest fire can be extinguished only by experts using modern equipment. Behaviour: Light barbecue fires only in existing fire places. Always watch the fire and immediately extinguish stray sparks.
011	Danger level 4/5 (high danger). Burning matches, flying sparks from barbecue fires and lightning will very probably ignite a fire. Rate of spread: High, including in forests. Characteristics: Intense surface fires can ignite the crowns of individual trees, spotting is possible, burning topsoil. Fire-fighting: Forest fire is difficult to extinguish and commands extensive resources. Behaviour: As a general rule, do not make any fires outdoors. Permanent fire places (concreted base) in locations designated by the authorities can be used with the utmost caution. Do not make fires in strong winds.
100	Danger level 5/5 (very high danger). Fires can start at any time. Rate of spread: Very high over a long period. Characteristics: Very intense burning, extensive crown fires, long-distance spotting. Fire-fighting: Forest fire is virtually impossible to extinguish. Behaviour: Do not make any fires outdoors. Follow the instructions and observe the fire bans imposed by the local authorities.

REFERENCE: Swiss federal council - https://www.natural-hazards.ch/home/dealing-with-natural-hazards/forest-fire/danger-levels.html

18.4.35.24. D24 – Water Quality

D24 - Water quality	
Code [3 bits]	**Water quality**
000	Excellent water quality
001	Good water quality
010	Poor water quality
011	Very poor water quality
100	Suitable for drinking purposes
101	Unsuitable for drinking purpose
110	*not used*
111	*not used*

REFERENCE: United Nations Environment Programme - Global Drinking Water Quality Index Development and Sensitivity Analysis Report - https://www.un.org/waterforlifedecade/pdf/global_drinking_water_quality_index.pdfhttps://www.un.org/waterforlifedecade/pdf/global_drinking_water_quality_index.pdf

18.4.35.25. D25 – UV Index

D25 –UV index	
Code [4 bits]	**UV Index**
0000	Index 0 - 2 Low. No protection needed. You can safely stay outside using minimal sun protection.
0001	Index 3/11 Moderate. Protection needed. Seek shade during late morning through mid-afternoon. When outside, generously apply broad-spectrum SPF-15 or higher sunscreen on exposed skin, and wear protective clothing, a wide-brimmed hat, and sunglasses.
0010	Index 4/11 Moderate. Protection needed. Seek shade during late morning through mid-afternoon. When outside, generously apply broad-spectrum SPF-15 or higher sunscreen on exposed skin, and wear protective clothing, a wide-brimmed hat, and sunglasses.
0011	Index 5/11 High. Protection needed. Seek shade during late morning through mid-afternoon. When outside, generously apply broad-spectrum SPF-15 or higher sunscreen on exposed skin, and wear protective clothing, a wide-brimmed hat, and sunglasses.
0100	Index 6/11 High. Protection needed. Seek shade during late morning through mid-afternoon. When outside, generously apply broad-spectrum SPF-15 or higher sunscreen on exposed skin, and wear protective clothing, a wide-brimmed hat, and sunglasses.
0101	Index 7/11 High. Protection needed. Seek shade during late morning through mid-afternoon. When outside, generously apply broad-spectrum SPF-15 or higher sunscreen on exposed skin, and wear protective clothing, a wide-brimmed hat, and sunglasses.
0110	Index 8/11 Very high. Extra protection needed. Be careful outside, especially during late morning through mid-afternoon. If your shadow is shorter than you, seek shade and wear protective clothing, a wide-brimmed hat, and sunglasses, and generously apply a minimum of SPF-15, broad-spectrum sunscreen on exposed skin.
0111	Index 9/11 Very high. Extra protection needed. Be careful outside, especially during late morning through mid-afternoon. If your shadow is shorter than you, seek shade and wear protective clothing, a wide-brimmed hat, and sunglasses, and generously apply a minimum of SPF-15, broad-spectrum sunscreen on exposed skin.
1000	Index 10/11 Extreme. Extra protection needed. Be careful outside, especially during late morning through mid-afternoon. If your shadow is shorter than you, seek shade and wear protective

D25 –UV index	
Code [4 bits]	**UV Index**
	clothing, a wide-brimmed hat, and sunglasses, and generously apply a minimum of SPF-15, broad-spectrum sunscreen on exposed skin.
1001	Index 11/11 Extreme. Extra protection needed. Be careful outside, especially during late morning through mid-afternoon. If your shadow is shorter than you, seek shade and wear protective clothing, a wide-brimmed hat, and sunglasses, and generously apply a minimum of SPF-15, broad-spectrum sunscreen on exposed skin.

The UV Index is a scale, ranging from 0 (low) to 11+ (extreme), that indicates the intensity of solar UV radiation reaching Earth's surface on a given day. A UV Alert is issued only when the UV Index forecast is at least 6 and also is statistically higher than normal

REFERENCE: UV Index scale by United States Environmental Protection Agency
https://www.epa.gov/sunsafety/uv-index-scale-0

18.4.35.26. D26 – Number of Cases per 100 000 Inhabitants

D26 - Number of cases per 100 000 inhabitants	
Code [5 bits]	**Number of cases per 100 000 inhabitants**
00000	0 - 9
00001	10 - 20
00010	21 - 50
00011	51 - 70
00100	71 - 100
00101	101- 125
00110	126 - 150
00111	151 - 175
01000	176 - 200
01001	201 - 250
01010	251 - 300
01011	301 - 350
01100	351 - 400
01101	401 - 450
01110	451 - 500
01111	501 - 750
10000	751 - 1000
10001	> 1000
10010	> 2000
10011	> 3000
10100	> 5000

Note: The epidemic threshold depends on the country and the disease. In France for example the epidemic threshold for the seasonal flu is about 175 cases per 100000 inhabitants and about 280 for the gastroenteritis.

18.4.35.27. D27 – Noise Range

D27 - Noise range	
Code [4 bits]	**Noise range**
0000	40 < dB ≤ 45
0001	45 < dB ≤ 50
0010	50 < dB ≤ 60
0011	60 < dB ≤ 70
0100	70 < dB ≤ 80 (loud)
0101	80 < dB ≤ 90 (very loud)
0110	90 < dB ≤ 100 (very loud)
0111	100 <dB ≤ 110 (very loud)
1000	110 < dB ≤ 120 (extremely loud)
1001	120 < dB ≤ 130 (extremely loud)
1010	130 < dB ≤ 140 (threshold of pain)
1011	dB > 140 (pain)
1100	*not used*
1101	*not used*
1110	*not used*
1111	*not used*

18.4.35.28. D28 – Air Quality Index

D28 - Air quality index	
Code [3 bits]	**Air quality index**
000	Index value 0 - 50. Good. Green. Advisory: None
001	Index value 51 - 100. Moderate. Yellow. Unusually sensitive individuals should consider limiting prolonged outdoor exertion
010	Index 101 - 150. Unhealthy for sensitive groups. Orange. Children, active adults and people with respiratory disease, such as asthma, should limit prolonged outdoor exertion
011	Index 151 - 200. Unhealthy. Red. Children, active adults and people with respiratory disease, such as asthma, should limit prolonged outdoor exertion. Everyone else should limit prolonged outdoor exertion.
100	Index 201 - 300. Very unhealthy. Purple. Children, active adults and people with respiratory disease, such as asthma, should limit prolonged outdoor exertion. Everyone else should limit outdoor exertion.

D28 - Air quality index	
Code [3 bits]	**Air quality index**
101	Index 301 - 500. Hazardous. Brown. Everyone should avoid all physical activity outdoor.

Note: World air quality index. In more than 800 counties across the nation, air pollution levels are measured daily and ranked on a scale of 0 for perfect air all the way up to 500 for air pollution levels that pose an immediate danger to the public. The AQI further breaks air pollution levels into five categories, each of which has a name, an associated colour, and advice to go along with it.

REFERENCE: U.S. Air Quality Index (AQI). https://www.airnow.gov/aqi/aqi-basics/

18.4.35.29. D29 – Outage Estimated Duration

D29 – Outage estimated duration	
Code [5 bits]	**Estimated duration**
00000	0 < duration < 30 min
00001	30 min ≤ duration < 45 min
00010	45 min ≤ duration < 1 h
00011	1 h ≤ duration < 1h 30min
00100	1h 30min ≤ duration < 2 h
00101	2 h ≤ duration < 3 h
00110	3 h ≤ duration < 4 h
00111	4 h ≤ duration < 5 h
01000	5 h ≤ duration < 10 h
01001	10 h ≤ duration < 24 h
01010	24 h ≤ duration < 2 days
01011	2 days ≤ duration < 7 days
01100	7 days ≤ duration
01101	Unknown
01110	*not used*
01111	*not used*
10000	*not used*

18.4.35.30. D30 – Nuclear Event Scale

D30 - Nuclear event scale	
Code [4 bits]	**Nuclear event scale**
0000	Unknown
0001	Level 0/7. Deviation. No safety significance

0010	Level 1/7. Anomaly. Overexposure in excess of statutory annual limits. Minor problems with safety components with significant defence-in-depth remaining. Low activity lost or stolen radioactive source, device, or transport package.
0011	Level 2/7. Incident. Impact on people and environment: Exposure of the public in excess of 10 mSv. Exposure of workers in excess of the statutory annual limits. Impact on radiological barriers and control: Radiation levels in an operating area of more than 50 mSv/h. Significant contamination within the facility into an area not expected by design. Possible cause: Significant failures in safety provisions but with no actual consequences. Found highly radioactive sealed orphan source, device or transport package with safety provisions intact. Inadequate packaging of a highly radioactive sealed source.
0100	Level 3/7. Serious incident. Impact on people and environment: Exposure in excess of ten times the statutory annual limit for workers. Non-lethal deterministic health effect (e.g., burns) from radiation. Impact on radiological barriers and control: Exposure rates of more than 1 Sv/h in an operating area. Severe contamination in an area not expected by design, with a low probability of significant public exposure. Possible cause: Near-accident at a nuclear power plant with no safety provisions remaining. Lost or stolen highly radioactive sealed source. Misdelivered highly radioactive sealed source without adequate procedures in place to handle it.
0101	Level 4/7. Accident with local consequences. Impact on people and environment: Minor release of radioactive material unlikely to result in implementation of planned countermeasures other than local food controls. Impact on radiological barriers and control: Release of significant quantities of radioactive material within an installation with a high probability of significant public exposure.
0110	Level 5/7. Accident with wider consequences. Impact on people and environment: Limited release of radioactive material likely to require implementation of some planned countermeasures. Major health impact from radiation is likely. Impact on radiological barriers and control: Severe damage to reactor core. Release of large quantities of radioactive material within an installation with a high probability of significant public exposure. This could arise from a major criticality accident or fire.
0111	Level 6/7. Serious accident. Impact on people and environment: Significant release of radioactive material likely to require implementation of planned countermeasures.
1000	Level 7/7. Major accident. Impact on people and environment: Major release of radioactive material with widespread health and environmental effects requiring implementation of planned and extended countermeasures.

REFERENCE: International Nuclear and Radiological Event Scale (INES) by IAEA (International Atomic Energy Agency).

18.4.35.31. D31 – Chemical Hazard Type

D31 - Chemical hazard type	
Code [4 bits]	**Chemical hazard type**
0000	Explosives
0001	Flammable gases
0010	Flammable aerosols and aerosols
0011	Oxidizing gases
0100	Gases under pressure
0101	Flammable liquids
0110	Flammable solids

D31 - Chemical hazard type	
Code [4 bits]	**Chemical hazard type**
0111	Self-reactive substance/mixture
1000	Pyrophoric liquids. Pyrophoric materials are often water-reactive as well and will ignite when they contact water or humid air.
1001	Pyrophoric solids. Pyrophoric materials are often water-reactive as well and will ignite when they contact water or humid air.
1010	Self-heating substance/mixture
1011	Water-reactive - emits flammable gases
1100	Oxidising liquids
1101	Oxidising solids
1110	Organic peroxides
1111	Corrosive to metals

Note: Classification based on the Globally Harmonised System of Classification and Labelling of Chemicals issued by United Nations Economic Commission for Europe (UNECE).

18.4.35.32. D32 – Biohazard Level

D32 - Biohazard level	
Code [2 bits]	**Biohazard level**
00	**Biohazard Level 1/4:** Often pertains to agents that include viruses and bacteria, this biosafety level requires minimal precaution, such as wearing face masks and maintaining no close contact. The biological hazard examples in the first level include E. coli and other non-infectious bacteria.
01	**Biohazard Level 2/4:** Usually causing severe diseases to humans, the second level classifies agents that can be transmitted through direct contact with infected materials. HIV and hepatitis B are some biological hazard examples that pose moderate risks to humans.
10	**Biohazard Level 3/4:** Mainly through respiratory transmission, pathogens that are highly likely to become airborne can cause serious or lethal diseases to humans. Mycobacterium tuberculosis, the bacteria that causes tuberculosis, is an example of a level-3 biohazard.
11	**Biohazard Level 4/4:** Extremely dangerous pathogens that expose humans to life-threatening diseases, the fourth and last level requires workers to utilise maximum protection and containment. Some biological hazard examples are the Ebola virus and the Lassa virus.

REFERENCE: Biosafety in Microbiological and Biomedical Laboratories (BMBL) 6th Edition https://www.cdc.gov/labs/BMBL.html.

18.4.35.33. D33 – Biohazard Type

D33 - Biohazard type	
Code [2 bits]	**Biohazard type**
00	Biological agents. These include bacteria, viruses, parasites, and fungi (such as yeasts and molds).
01	Biotoxins. These refer to a group of substances with a biological origin that are toxic and poisonous to humans. Often, biotoxins are produced by plants, bacteria, insects, or certain animals, among

D33 - Biohazard type	
Code [2 bits]	**Biohazard type**
	others. Continuous exposure to these may cause, at the very least, a series of inflammatory reactions throughout the body.
10	Blood and blood products. While blood isn't considered a biological hazard, it can still bring potential risks if it's contaminated or its source is in any way infected. Also, blood products such as red blood cells, white blood cells, plasma, tissues, and platelets are also hazardous if not properly handled.
11	Environmental specimens. Generally, these refer to plants, soil, or water that potentially contain biological agents (include bacteria, viruses, parasites, and fungi) and biotoxins.

18.4.35.34. D34 – Explosive Hazard Type

D34 - Explosive hazard type	
Code [2 bits]	**Explosive hazard type**
00	**PE1** - Mass explosion hazard in which the entire body of explosives explodes as one.
01	**PE2** - Serious projectile hazard but does not have a mass explosion hazard.
10	**PE3** - Fire hazard and either a minor blast hazard or a minor projection hazard, or both, but does not have a mass explosion hazard. Explosives which give rise to considerable radiant heat or which burn to produce a minor blast or projection hazard.
11	**PE4** - Fire or slight explosion hazard, or both, with only local effect. Explosives which present only a low hazard in the event of ignition or initiation, where no significant blast or projection of fragments of appreciable size or range is expected.

REFERENCE: https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/mineralsmetals/files/pdf/expl-expl/cbpe-cpep-eng.pdf

18.4.35.35. D35 – Infection Type

D35 - Infection type	
Code [6 bits]	**Infection type**
000000	Anthrax
000001	Avian influenza in humans
000010	Botulism
000011	Brucellosis
000100	Campylobacteriosis
000101	Chikungunya virus disease
000110	Chlamydia infections
000111	Cholera
001000	COVID-19
001001	Creutzfeldt - Jakob Disease-variant (vCJD)

D35 - Infection type	
Code [6 bits]	**Infection type**
001010	Cryptosporidiosis
001011	Dengue
001100	Diphtheria
001101	Echinococcosis
001110	Giardiasis
001111	Gonorrhoea
010000	Hepatitis A
010001	Hepatitis B
010010	Hepatitis C
010011	HIV infection and AIDS
010100	Infections with haemophilus influenza group B
010101	Influenza including Influenza A(H1N1)
010110	Invasive meningococcal disease
010111	Invasive pneumococcal disease
011000	Legionnaries' disease
011001	Leptospirosis
011010	Listeriosis
011011	Lyme neuroborreliosis
011100	Malaria
011101	Measles
011110	Meningoccocal disease, invasive
011111	Mumps
100000	Pertussis
100001	Plague
100010	Pneumoccocal invasive diseases
100011	Poliomyelitis
100100	Q fever
100101	Rabies
100110	Rubella
100111	Rubella, congenital
101000	Salmonellosis
101001	Severe Acute Respiratory Syndrome (SARS)
101010	Shiga toxin /verocytotoxin -producing Escherichia coli (STEC/VTEC)
101011	Shigellosis
101100	Smallpox
101101	Syphilis
101110	Syphilis, congenital
101111	Tetanus
110000	Tick-borne encephalitis
110001	Toxoplasmosis, congenital
110010	Trichinellosis

D35 - Infection type	
Code [6 bits]	**Infection type**
110011	Tuberculosis
110100	Tularaemia
110101	Typhoid and paratyphoid fevers
110110	Viral haemorrhagic fevers
110111	West Nile virus infection
111000	Yellow fever
111001	Yersinosis
111010	Zika virus disease
111011	Zika virus disease, congenital
111100	Nosocomial infections
111101	Antimicrobial resistance
111110	unidentified infection
111111	*not used*

REFERENCE: European Centre for Disease Prevention and Control - EU case definitions - https://www.ecdc.europa.eu/en/all-topics/eu-case-definitions

18.4.35.36. D36 – Typhoon Categories

D36 - Typhoon categories	
Code [3 bits]	**Typhoon category**
000	Scale 1 and Intensity 1
001	Scale 1 and Intensity 2
010	Scale 1 and Intensity 3
011	Scale 2 and Intensity 1
100	Scale 2 and Intensity 2
101	*not used*
110	*not used*
111	*not used*

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