Emergency Call Answering Service

Mobile Location Conversion Specification

Issue 5.2

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1. Introduction

The following is an outline specification for information to be provided by Mobile Network Service Providers to the Emergency Call Answering Service (ECAS) to support the conversion, by ECAS, of Mobile location information to geo-coordinates, in association with an Emergency Call.

Where appropriate, mobile location information may be transferred from the ECAS to the Emergency Services.

Part I of this specification addresses the transfer of mobile location information to the ECAS in association with an Emergency Call.

Note, in this specification an "Operator" refers to any Authorised Operator. The majority of fixed location information is expected to be provided by eircom.

1.1 Scope of the specification

This specification addresses the content and format of mobile location conversion information provided by mobile network Service Providers.

The specification is applicable to GSM, 3G and LTE networks.

2. Data requirements

2.1 Mobile location INFORMATION structure

2.1.1 2/3G Mobile Cells

The 2/3G Mobile location information structure is as follows and as described in TS 23.003:

MCC-MNC-LAC-CI where:

MCC is the Mobile Country Code (272 for Ireland)
MNC is the Mobile Network Code
LAC is the Location Area Code
CI is the Cell Identity

ECAS utilises the complete 2/3G Cell Global Identification (CGI) (i.e. the combination of all of the above items) to uniquely identify the originating cell for the emergency call and determine an associated approximate location.

Note: The LAC is not used by ECAS in isolation to identify a location, it simply forms part of the complete Cell ID.

2.1.2 4/5G Mobile Cells and CGI

Cell ID for 4/5G Cells carrying VoLTE (or VoNR in the future) originated emergency calls have a different structure to 2/3G Cell IDs.
TS 24.229 makes provision for including the originating Cell ID for VoLTE calls in the PANI header.
The format specified in TS 24.229 for inclusion of the E-UTRAN Cell ID in the PANI header should be used in providing the 4/5G cell IDs to the ECAS in advance to ensure that these can be matched at call time to the values included in the PANI header.

a "utran-cell-id-3gpp" parameter set to a concatenation of the MCC (3 decimal digits), MNC (2 or 3 decimal digits depending on MCC value) which should be obtained from the E-UTRAN Cell Global Identifier (ECGI), Tracking Area Code (4 hexadecimal digits when accessing to EPC and 6 hexadecimal digits when accessing to 5GCN) as described in 3GPP TS 23.003 [3] and the E-UTRAN Cell Identity (ECI) (7 hexadecimal digits) as described in 3GPP TS 23.003 [3]. The "utran-cell-id-3gpp" parameter is encoded in ASCII as defined in RFC 20 [212];

E.g. 272 01 1a2b f1e2d34

These elements are further described in the ECAS Mobile Location Transfer Specification.

2.2 Information Types

The 2/3G CGI or E-UTRAN CGI for the mobile cell where the emergency call originated will be passed to ECAS as follows:

- For 2/3G calls the CGI is passed as part of the destination number by suffixing the Cell Identifiers described above to the dialled number.
- For 4/5G originated emergency calls, the ECGI is passed in the PANI Header.

This is described in detail in the Mobile Location Transfer Specification.
The following information is required to enable ECAS to convert this Data to a geographic Location.

Details of the 2/3G Cell Global Identifier including details of the location of the Cell and optionally the expected coverage area for that cell.

Or

Details of the LTE CGI including eNB ID and Cell ID including details of the location of the cell and expected coverage area of the Cell.

The ECAS system will import this information from each operator as single complete file including all 2/3G cell details and all E-UTRAN cell details. For each imported file, the import process will create a report file which will contain the number of records imported and details of any rejected records.

2.3 High Level File Specifications

The format of all files must satisfy the following requirements:

1. Text, flat file format shall be used
2. Variable length fields shall be used. Each field within the record will be delimited by a pipe (|) character
3. Any unused field within a record shall be seen as two consecutive delimiters
4. No fields within the record shall be "padded out".
5. All field values within the record must be left Justified i.e. no leading spaces or tab characters...

6. Each Record shall be separated by a carriage return, line feed. (Windows text file format)
7. The last Record within each file will hold the number of records sent excluding header and trailer records (as detailed below).
8. The first record will be written as ***SOF***|**<ID>**|**INPUT** where <ID> is a Variable length operator id as described below
9. The last record will be written as ***EOF***|**Number of records in file**

The pipe (|) character has been chosen as the delimiter due to its infrequent occurrence and lack of implied meaning within addresses in Ireland as opposed to the comma (,) character which depending on the information supplied could conceivably occur as part of a field value (e.g. name and address data)

2.3.1 Operator id

A Variable length operator id will be assigned to each Operator by ECAS. This operator id shall be included in the file name and header records for all files as described below.

The operator id and other required details will be agreed between ECAS and the Operator at an operational level prior to Go-Live.

2.3.2 Header and Trailer records

Header and trailer records shall be constructed and included in all files types as follows:

2.3.2.1. Header Records

The Header record shall be pipe delimited and contain 3 fields in the following order

- The String "*SOF"
- The operator ID
- The String "INPUT"

2.3.2.2. Trailer Records

The Trailer record shall be pipe delimited and contain 2 fields in the following order

- The String "*EOF*"
- The number of Data records in the file which will be the total number of lines in the file less 2

2.3.3 File Records

A description of all fields contained within the various record types including details the allowable values are Numeric or Alpha/Numeric is given in the section 4 for the Location Area Code records, and section 4.1 for the Cell Global Identifier Records.

Note: Mobile location conversion records for both 2/3G Cells and LTE Cells should be included in a single file uploaded by Service Providers. This file will contain a mix of 2/3G Cell records and LTE E-UTRAN CGI records.

Multiple file uploads is not supported and due to the fact that full upload types only are supported would result in all records in the ECAS ERD for a given operator being replaced by the records contained in the last upload file only.

2.3.4 Record Keys

Service Providers should note that for the Mobile Location Conversion information, the following field combinations will be used as record keys and duplicates of these field combinations are not permitted within input files.

2.3.4.1. 2/3g Cell ID Records

Cell ID (or Cell Global Identifier) records will use the following field combination as a key

- MCC – Mobile Country Code
- MNC – Mobile Network Code
- LAC – Location area Code
- CI – Cell Identifier

2.3.4.2. LTE Cell ID Records

4/5G Cell ID (E-UTRAN Cell Global Identifier -ECGI) records will use the following field combination as a key

- MCC – Mobile Country Code
- MNC – Mobile Network Code
- TAC - Tracking Area Code
- ECI - E-UTRAN Cell Identity

2.4 Update Types

For Mobile Location Conversion information, only a full update is provided for. Service Providers should provide all information as part of 2 files (Location Area Codes, and Cell Ids) in a full update as required.

Service Providers should note that the information submitted by them with each update will be used to *completely replace all data for that operator* in the ECAS

databases and as a result should take care to ensure that any updates provided are complete.

2.5 Number of records per file

While it is not expected to apply or be a limiting factor for mobile location conversion information the number of records per file shall not exceed 64,000.

2.6 Processing and import errors

Records in all input files will be processed and imported sequentially. In the case where a record cannot be processed, for example the record is not correctly formatted, or field validation failed, this will be identified in the report file associated with that import file as described in the "ECAS Data Transfer Specification" document.

Service Providers should note that a threshold for processing errors will be set on a per import file basis such that if the number of processing errors encountered while processing the file exceeds this threshold, processing and further import of the records in that file will be aborted and the entire file will be rejected.

An appropriate value for this threshold will be set at the discretion of the ECAS service and notified to the operator at an operational level.

2.7 Report files

The ECAS system will generate a report file for each data file received containing details of any processing errors encountered during the import of the data file.

Service Providers shall retrieve the relevant report files from the ECAS system once processing has concluded and take immediate action to resolve any processing errors reported to ensure that the records are correctly formatted and will process correctly and will be re-submitted as part of the next update.

The high level specification for Report files will be as described in the "ECAS Data Transfer Specification document".

2.8 Frequency of updates

Service Providers shall provide Mobile Location Conversion Information updates to ECAS as required when changes occur within their network. A full update should be provided periodically in any case at a frequency to be agreed between ECAS and the operator at an operational level.

The times of day that Service Providers should perform the transfer and also retrieve report files will also be agreed between the operator and ECAS at an operational level.

2.9 Timeliness of updates

Updates to Mobile Location Conversion information should be submitted to ECAS as soon as is practical following updates to the information available on the Operator's systems.
Service Providers shall endeavour to make updated information available to ECAS prior to or as soon as possible after a new installation is configured within its internal systems or in the case of a change to a mobile cell site affecting range or area covered is identified.
The requirement to provide information on new or updated Cell sites also applies and is particularly important for temporary or mobile cells deployed providing additional capacity at large events. The location details for these planned cells should be provided to the ECAS at least 24 hours before the scheduled event starts.

2.10 Data consistency

The Operator shall always ensure that an accurate and consistent representation of the required Mobile Location Conversion Information has been supplied to ECAS as the last full update provided.

2.11 Data Accuracy

Service Providers shall be responsible for the accuracy of its Mobile Location Conversion Information.
Service Providers shall ensure that data submitted to ECAS is accurate for the purposes of determining caller location.

Service Providers are reminded of the importance of supplying complete and accurate information to ECAS. This is especially relevant to the expected or approximate coverage area for Cells. To assist ECAS and indeed the emergency services Service Providers should endeavour to provide all available information including direction and coverage area where this information can be considered to be reasonably accurate. In the case where an operator has information to indicate that the details on Cell direction or coverage may not be accurate (e.g. coverage problems reported etc.) then values for these fields should not be supplied until the operator has resolved any associated issues or confirmed updated values. In situations such as this Service Providers should submit an update to ECAS to reflect the known information on Cell coverage as soon as possible.

2.11.1 General Accuracy issues

Obviously, there are a number of issues which will limit the accuracy of location information generated using this system. Some of these are outlined below:

1. Cell size uncertainty. A caller may be located anywhere within a cell, and hence uncertainty as to their actual location will be proportional to the cell size.

2. Radio issues. There is a possibility that a caller using a cell is not located in the predicted coverage area of that cell but in another area. This situation is a result of the nature of mobile radio systems, with overlapping cells, dynamic power outputs and dynamic radio propagation characteristics.

3. Cell map error. The representation of cells used in this specification allows only a simplistic representation of what, in reality, is a complex map.

4. Incorrect CGI conversion information. *Service Providers should endeavour to avoid this situation where possible in submitting information to ECAS.*

As a result of these issues, the probability that a caller is within the area indicated by the relevant cell map is assumed to be no more than "reasonably high" however no measurement of actual system accuracy has been made.

2.12 File Names

2.12.1 Input files

File names of all input files presented to ECAS by Service Providers shall be in the following format

ECAS_<INFO>_<TYPE>_<OPID>_<DATE>.DAT

Where:

<DATE> is the date that the export was performed by the Operator in the format YYYYMMDD.

<OPIP> is the 5 digit operator id assigned to the Operator by ECAS. This ID will be assigned at an operational level between to the Operator by ECAS.

<INFO> is a two character string indicating the type of information being submitted in this update file. The <INFO> string shall have the following values

- "ML" for Mobile Location Conversion information detailing Location area code records
- "MC" for mobile Location Conversion information detailing Cell Global Identifier records.

<TYPE> is a one character string indicating if the update is a full or incremental update where "F" denotes a full update and "I" indicates that this file relates to an incremental update. In the case of Mobile Location Conversion Information, the update type will always be "F" for full.

The ".DAT" file extension indicates that this file is an input file.

2.12.2 Report files

Report file names generated by the import process will be named exactly as per the input files with the exception of the file extension which will be ".REP" i.e.

ECAS_<INFO>_<TYPE>_<OPID>_<DATE>.REP

2.13 Capitalisation within a file

Service Providers shall send records with mixed case letters, as appropriate to the field value e.g. Normal personal names and place names towns counties should be lowercase starting with a capital or as appropriate to the business name e.g. AIB Bank.

2.14 Location information fields

Geographic Location or position information should be provided for all Cell Global Identifier records. The format for this information will be Latitude and Longitude.

3. Cell shapes

The specification supports one basic cell shape: an ellipse in the case where the optional coverage area and direction have been provided. The ellipse shall approximate the likely coverage area of the Cell and should be defined by the following:

- A Point representing the Base station as the origin of the coverage ellipse.
- The Azimuth or direction of coverage – the Angle with reference to True North between 000º and 359º.
- The approximate or expected Coverage area of the Cell/Ellipse in square kilometres.

The shapes are indicated in the figures below. More complex shapes such as polygons are not supported and altitude is not supported.

In the case of the point shape, the point refers to the Base Station or Node B.

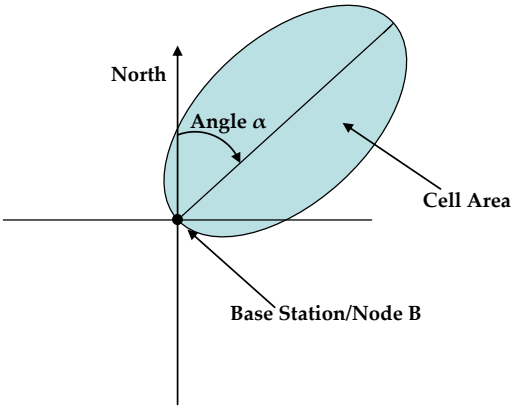

Figure 1: Cell modelled with an ellipse

4. Cell Info Records for 2/3G Cells

Mobile location Conversion information records should be included in the upload files submitted by each operator for all 2/3G Cells on that Service Providers network using the record format described here

4.1 2/3G CGI Record Format

Cell ID or Cell Global Identifier records should be provided for all Cell sites in the Operator's network. CGI Description records should be provided in files formatted and named as described in Section 2 and the records should be formatted as described below.

4.1.1 2/3G CGI Records

ID	Field	Mandatory	Type	Value	Definition
1.	MCC	Yes	N	272	Fixed
2.	MNC	Yes	N	01 - Vodafone, 02 - Three 03 - Meteor	Or other values assigned by Comreg. 2 Digit Zero filled Numeric value
3.	LAC	Yes	N	1 to 65532 Set by mobile operator	5 Digit Zero filled numeric value.
4.	CI	Yes	N	1 to 65533 Set by mobile operator	5 Digit Zero filled numeric value.
5.	Latitude of Base Station/Node B	Yes	AN	See note 2	Latitude in decimal degrees prefixed with N or S. See note 2 below. Reference system WGS 84 shall be used.
6.	Longitude of Base Station/Node B	Yes	AN	See note 2	Longitude in decimal degrees prefixed with E or W. See note 2 below Reference system WGS 84 shall be used.
7.	Angle α	No	N	0 to +359°	See Section 2.11
8.	Cell area	No	N		[Km²]
9.	Address	No	AN		Address of the Cell (where applicable). Free format.

Note 1: As the record format for this text file is delimited, all fields are required. The heading "mandatory" in the table above is used to indicate there a value must be provided or a null or empty value (represented as 2 consecutive delimiters) may be provided.

Note 2: Position values for the Cell site i.e. Fields 5 and 6, the Latitude and longitude should be provided as a string in exactly the following format.

Latitude (5) NDD.dddd

Longitude (6) WDD.dddd

The degrees decimal values excluding the N or W qualifier will be treated as a number, will include a decimal point and does not require leading zeros.

Where N and W denote North or West. All locations in Ireland will be "West" however the W indicator should be used as opposed to a –E or negative East value.

Table 1: CGI record

E.g.

272|06|54321|12345|N53.12345|W8.1234567|270|13.52|Some Fake Mast Address

5. Cell Info Records for 4/5G Cells

Mobile location conversion information records for all LTE Cells on an Service Providers network that are capable of carrying voice traffic including emergency calls should be included in the upload file using the format and rules specified in this section. The format specified below for E-UTRAN Cell Global identifiers is in line with the format specified in TS 24.229 for inclusion of the Cell ID in the PANI header.

5.1 LTE Cell IDs.

E-UTRAN Cell Global Identifiers (ECGI) differ from 2/3G Cell IDs in the lengths of individual ECGI components and also in the use of hexadecimal digits.

- The 2/3G LAC components are replaced with a Tracking Area Code which may be between 4 (EPC) and 6 (5GCN – future use) hexadecimal digits.
- The E-UTRAN Cell ID (ECI) is 7 hexadecimal digits.

The number of components in the Full or Global Cell ID does however remain unchanged (albeit TAC becomes LAC) and as a result of the use of a delimited file format, both 2/3G and 4/5G cell information may be combined in the same data file and submitted to the ECAS.

5.2 LTE Cell ID Record Format

Cell ID or Cell Global Identifier records should be provided for all LTE Cell sites in the Operator's network. CGI Description records should be provided in files formatted and named as described in Section 2 and the records should be formatted as described below.

5.2.1 LTE CGI Records

ID	Field	Mandatory	Type	Value	Definition
1.	MCC	Yes	N	272	Fixed
2.	MNC	Yes	N	01 - Vodafone, 02 - O2 03 - Meteor 05 - H3GI	Or other values assigned by Comreg. 2 Digit Zero filled Numeric value
3.	TAC	Yes	AN	See notes 3 and 4.	**Variable length alphanumeric field containing the hexadecimal TAC value.**
4.	ECI	Yes	N	See Note 4.	**Variable length alphanumeric field containing the hexadecimal ECI value.**
5.	Latitude of Base Station/Node B	Yes	AN	See note 2	Latitude in decimal degrees prefixed with N or S. See note 2 below. Reference system WGS 84 shall be used.
6.	Longitude of Base Station/Node B	Yes	AN	See note 2	Longitude in decimal degrees prefixed with E or W. See note 2 below Reference system WGS 84 shall be used.
7.	Angle α	No	N	0 to +359°	See Section 2.11
8.	Cell area	No	N		[Km^2]
9.	Address	No	AN		Address of the Cell (where applicable). Free format.

Note 1: As the record format for this text file is delimited, all fields are required. The heading "mandatory" in the table above is used to indicate there a value must be provided or a null or empty value (represented as 2 consecutive delimiters) may be provided.

Note 2: Position values for the Cell site i.e. Fields 5 and 6, the Latitude and longitude should be provided as a string in exactly the following format.

Latitude (5) NDD.dddd

Longitude (6) WDD.dddd

Where N and W denote North or West. All locations in Ireland will be "West" however the W indicator should be used as opposed to a –E or negative East value.

The degrees decimal values excluding the N or W qualifier will be treated as a number, will include a decimal point and does not require leading zeros.

Note 3: Due to the potential for varying length values in the TAC field, padding should be used and the presented value should be zero padded if required to either 4 6 characters in length depending on whether the TAC field is for a 4G or 5G cell.

Note 4: Operators should ensure the use of padding and combination of 4G and 5G cell information does not lead to duplicate values in the combined ECGI.

Table 2: CGI record

E.g.

272|06|1f2e|1f2e3d4|N53.12345|W8.1234567|270|13.52|Some Fake Mast Address

or

272|06|1f2e3c|1f2e3d4|N53.12345|W8.1234567|270|13.52|Some Fake Mast Address

6. Data types and field validation

It should be noted that it is the responsibility of the operator to ensure that information submitted can be successfully imported into the ECAS databases.

6.1.1 Alphabets

Text and character fields shall support the Irish and English alphabets only.

6.2 Capitalisation within a file

All name and address fields should be supplied in mixed case as used to represent address fields.

6.3 Allowable data Characters

The following Characters are the **only** valid Data Characters within a Record

Character	Printer Graphic	Field Types	Position in Field
Space	Space	AN	Anywhere except first or last Character in a populated field
Full stop	.	AN	Anywhere except first Character in a populated field
Ampersand	&	AN	Anywhere except first Character in a populated field. Ampersand can be used instead of the word 'and' e.g. John & Mary etc.
Back slash	\	AN	Anywhere
Forward slash	/	AN	Anywhere
Left Parenthesis	(	AN	Anywhere.
Right Parenthesis	)	AN	Anywhere
Minus	-	AN	Anywhere except first Character in a populated field

Apostrophe	‘	AN	Anywhere except first Character in a populated field
Comma	,	AN	Anywhere except first Character in a populated field
A to Z	A to Z	AN	Anywhere in Alpha or Alpha/Numeric fields
a to z	a to z	AN	Anywhere in Alpha or Alpha/Numeric fields
Vowels with fada	Á,á,É,é, Í,í,Ó,ó, Ú,ú	AN	Anywhere in Alpha or Alpha/Numeric fields.
0 to 9	0 to 9	AN, N	Anywhere in Numeric or Alpha/Numeric fields
Colon	:	AN	Anywhere except first Character in a populated field
At symbol	@	AN	Anywhere except first Character in a populated field
Plus	+	AN	Anywhere except first Character in a populated field
Quotation Mark	“	AN	Anywhere
Question Mark	?	AN	Anywhere except first Character in a populated field
Percentage Sign	%	AN	Anywhere except first Character in a populated field

TABLE II: Allowable Data Characters.

Service Providers shall note that as the pipe (|) character is to be used as the field delimiter within records; this character is not permitted as part of a field value and should be omitted if present.