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for GSM Operation on Railways

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Railway Telecommunications (RT).

Introduction

The User-to-User Signalling Supplementary Service is widely used in the operation of GSM for Railways (GSM-R). The applications "Presentation of Functional Numbers" [i.2] and [i.3] and "Confirmation of High Priority Calls" [i.4] and [i.5] have been specified, implemented and tested in the framework of national GSM-R schemes. In defining layouts for the new features, DSD Alarm Notification, Alerting of a Controller and CHPC for enhanced Railway Emergency Call, care has been taken to ensure that existing implementations are not compromised or invalidated when laying out a framework for flexible further extension. For any such further extension, therefore, it is mandatory to define the use of UUIE in these various applications to avoid interoperability issues in the future.

1 Scope

The present document defines the contents of the User-to-User Information Element when used in the GSM-R environment. This includes the basic EIRENE features Functional Addressing, Location Dependant Addressing, Confirmation of High Priority Calls (including, but not exclusively, REC and eREC) and Presentation of Functional Numbers. In addition the present document defines layouts for further features: Enhanced Presentation of Functional Numbers, Enhanced Location Dependent Addressing, Driver's Safety Device alarm, Plain Text Messages, Presentation of the Functional Number of the initiator of a Railway Emergency Call and Alerting of a Controller. Finally, the present document describes the requirements to be followed by network operators to ensure compatibility and interoperability if they wish to define specific fields for national and/or network use. The details of such fields are outside the scope of the present document.

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the reference document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

2.1 Normative references

The following referenced documents are necessary for the application of the present document.

[1] ETSI TS 123 038 (V3.3.0): "Digital cellular telecommunications system (Phase 2+) (GSM); Universal Mobile Telecommunications System (UMTS); Alphabets and language-specific information (3G TS 23.038 Release 1999)".

[2] ETSI TS 124 007 (V3.10.0): "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); Mobile radio interface signalling layer 3; General aspects (3GPP TS 24.007 Release 1999)".

[3] ETSI TS 100 933 (V8.6.0): "Digital cellular telecommunications system (Phase 2+); Voice Group Call Service (VGCS); Stage 2 (3GPP TS 03.68 Release 1999)".

[4] ETSI TS 100 948 (V8.1.0): "Digital cellular telecommunications system (Phase 2+) (GSM); Group Call Control (GCC) protocol (GSM 04.68 Release 1999)".

2.2 Informative references

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] EIRENE SRS: "UIC Project EIRENE System Requirements Specification".

NOTE: Available at UIC EIRENE Specifications.

[i.2] MORANE F 10 T 6003 4: "FFFS for Presentation of Functional Numbers to Called and Calling Parties".

NOTE: Available at UIC GSM-R Normative Documents.

[i.3] MORANE F 12 T 6003 4: "FIS for Presentation of Functional Numbers to Called and Calling Parties".

NOTE: Available at UIC GSM-R Normative Documents.

[i.4] MORANE F 10 T 6002 5: "FFFS for Confirmation of High Priority Calls".

NOTE: Available at UIC GSM-R Normative Documents.

[i.5] MORANE F 12 T 6002 5: "FIS for Confirmation of High Priority Calls".

NOTE: Available at UIC GSM-R Normative Documents.

[i.6] eLDA IRS (V5.0): "Interface Requirements Specification enhanced Location Dependent Addressing".

NOTE: Available at UIC GSM-R Informative Documents.

[i.7] O-3151-1.0 eREC specification.

NOTE: Available at UIC GSM-R Informative Documents.

[i.8] O-3152-1.0 Definition and structure of eREC parameters.

NOTE: Available at UIC GSM-R Informative Documents.

[i.9] Void.

[i.10] Void.

[i.11] ETSI Directives.

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in the ETSI directives [i.11] and the following apply:

cab radio: radio and associated user and other interfaces installed in the cab of a locomotive and for use principally by the locomotive driver

call type: prefix used to identify the type of user number dialled

coach number: number assigned to an item of rolling stock on a permanent basis

NOTE: The coach number may form a component of a functional number used to address users/systems on an item of rolling stock.

controller: individual at a fixed location responsible for the conduct and co-ordination of some aspect of train operations

NOTE: Also known as a dispatcher, in particular the term dispatcher is used in this context in ETSI specifications relating to the VGCS and VBS.

dispatcher: individual at a fixed location responsible for the conduct and co-ordination of vehicle movements and operations

NOTE: In railway operations, the dispatcher is usually known as a controller.

driver's safety device: on-train system which monitors the alertness of the driver and provides warning and alarms to other systems as appropriate

engine number: number assigned to an item of traction stock on a permanent basis

NOTE: The engine number may form a component of a functional number used to address users/systems on an item of traction stock.

enhanced railway emergency call: railway emergency call with enhanced functionality to sub-divide the area covered by such a call

NOTE 1: Sub-divided areas which are covered by an eREC are used to include or exclude joining, crossing and parallel tracks and also shunting areas.

NOTE 2: eREC allows discrimination of railway emergency calls in order to minimize production loss.

functional addressing/numbering: term used to describe the process of addressing a call using a number representing the function a user is performing, rather than a number identifying the user's terminal equipment

functional identity: full alphanumeric description of the function performed by a called or calling party within the functional numbering scheme, identifying them by function or role rather than by a specific item of radio equipment or user subscription

NOTE: The functional identity can include characters and/or numbers.

functional number: full number used within the functional addressing scheme to contact an end user/system by function or role rather than by a specific item of radio equipment or user subscription

group call: call made to all members of a pre-defined group within a local geographical area

NOTE: Only one member of the group may talk at any instant with all other group members listening only.

international code: prefix used to identify an EIRENE network outside the network the in which the calling party is operating

location dependent addressing: term used to describe the process of addressing a particular function (typically a controller) based on the current location of the user (typically a train)

railway emergency call: call of the highest priority for informing drivers, controllers and other concerned personnel of a level of danger requiring all railway movements in a pre-defined area to follow specific operational procedures

NOTE: Two types of railway emergency calls are defined:

- train emergency calls (for railway emergencies whilst not involved in shunting operations);
- shunting emergency calls (for railway emergencies whilst involved in shunting operations).

train number: number given to a train by operational staff for a particular journey

NOTE: A train number may form a component of the functional number used to address users or systems on a train.

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

ASCII	American Standard Code for Information Interchange
BCD	Binary Coded Decimal
CBS	Cell Broadcast Service
CHPC	Confirmation of High Priority Call
CT	Call Type
DSD	Driver's Safety Device
EIRENE	European Integrated Railway radio Enhanced Network
eLDA	enhanced Location Dependent Addressing
ePFN	enhanced Presentation of Functional Number
eREC	enhanced Railway Emergency Call
FC	Function Code
FFFS	Form Fit Functional Specification

FIS	Functional Interface Specification
FN	Functional Number
GC_REF	Group Call Reference
GPS	Global Positioning System
GSM-R	Global System for Mobile-Rail
HMI	Human Machine Interface
IC	International Code
IE	Information Element
MCC	Mobile Country Code
MNC	Mobile Network Code
MORANE	Mobile Radio for Railway Networks in Europe
MSC	Mobile Switching Centre
OTDI	Originator-To-Dispatcher-Information
PFN	Presentation of Functional Number
REC	Railway Emergency Call
TLV	Tag Length Value
UIC	Union Internationale des Chemins de fer
UIN	User Identifier Number
UUI	User-to-User Information
UUIE	User-to-User Information Element
UUS	User-to-User Signalling
UUS1	User-to-User Signalling Service 1
VBS	Voice Broadcast Service
VGCS	Voice Group Call Service

4 General UUIE Format

4.1 Encoding protocol and information capacity

The general format of the User-to-User Information Elements used in GSM-R is shown in figure 1.

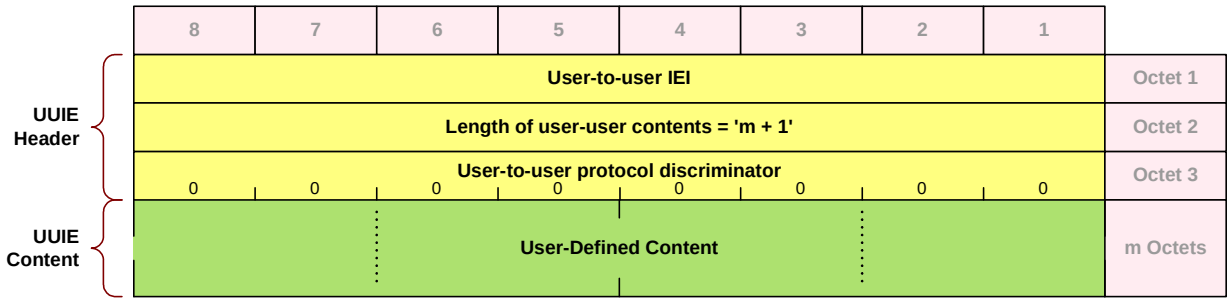


Figure 1: General ETSI coding format for User-to-User Information Elements (UUIE)

The maximum length of user-defined information (m octets in figure 1) is limited to 32 octets (35 octets for the overall maximum length of the UUIE) to ensure transparency through all mobile and fixed elements of a GSM-R network. Binary encoding should generally be used to maximize the data content in this limited space. This requires the "protocol discriminator" to be set to "User-Specific Protocol".

< User-to-User protocol discriminator >: 00000000 User Specific Protocol.

NOTE: In one special case, "Presentation of the Functional Identity of the Initiator of a Railway Emergency Call", the ETSI specifications for VGCS make necessary the use of a different encoding and protocol discriminator (see clause 6).

4.2 General encoding of the user defined content

The UUIE provides a limited space of 32 information octets. Therefore an efficient and flexible coding scheme based on the "Tag-Length-Value" (TLV) structure is used. This coding scheme allows for easy and correct decoding of received information even when information not understood by the receiving application is mixed with the desired information. This scheme also supports the inclusion of multiple user information fields of variable lengths. The general structure is illustrated in figure 2.

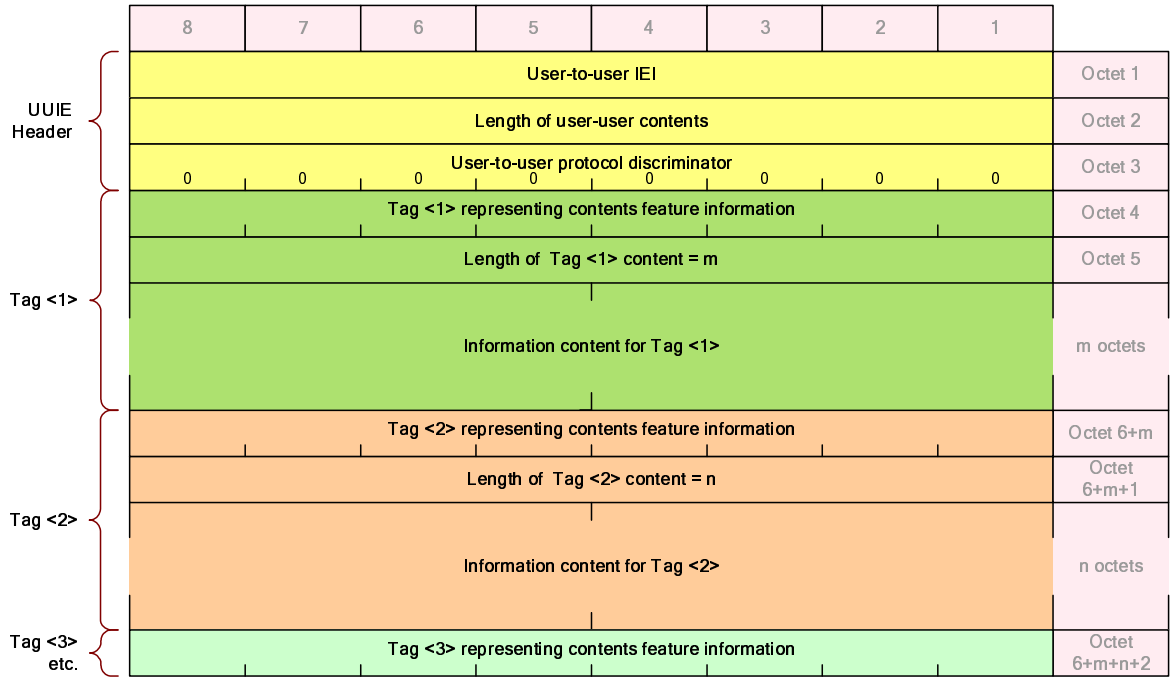


Figure 2: Generic coding format for User-to-User Information Elements (UUIE) using user specific protocol in the GSM-R context

The structure of Tag, Length, Value is repeated, as many times as there are tags in the message and enough room for them. This is the TLV structure. Restrictions on the order of TLV tags is as defined in clause 7.1.1.

4.3 Definition of tag values

The number of different tags for UUIE content complying with the TLV structure is limited to 255 where the tag range 0 to 127 is reserved for international use and the range 128 to 255 is reserved for national use.

The tags that are defined for international use are listed in table 1.

Table 1: Identification of GSM-R specific tags for international use

Tag Value	Feature
2	Acknowledgement by Receiver of a High Priority Call and response from device accepting the acknowledgement
3	Acknowledgement by Initiator of a High Priority Call
4	eREC extension for acknowledgement of a High Priority call
5	Presentation of Functional Number
6 to 8	enhanced Location Dependent Addressing
9	ePFN Information
10	User specific plain text according to alphabet indicator
11	DSD Alarm Notification
12	Alerting of a Controller Notification and Response

5 Definition of individual tag contents

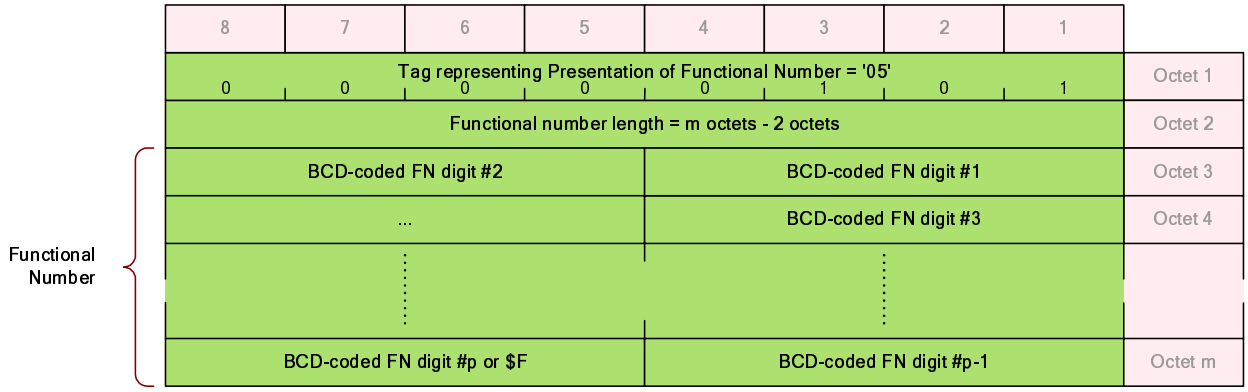
This clause defines the content of each of the tags listed in table 1. The tags may be combined with other tags in specific applications, and such uses are described in clause 7. Because tags may be combined, the illustrations in this clause only contain the tag definition and do not illustrate the complete UUIE structure and content. Clause 7 contains complete examples of that kind.

5.1 Presentation of functional number tag

According to [i.2] and [i.3], the Functional Number (FN) is always transferred in the UUS1 as an International FN, that is:

FN = IC + CT + UIN + FC

This tag can be included in any allowed call control message where it is required to transfer the FN of the sending party to the other party in the call. The general layout of the PFN tag is given in figure 3.



NOTE 1: The FN length field specifies the number of octets present to carry the FN. Each digit of a FN is encoded as a BCD digit (one nibble). The first FN digit is in bits 1 to 4 and the next digit is in bits 5 to 8 of octet 3 of the tag; the following digit is in bits 1 to 4 of next octet and so on. If the FN consists of an odd number of digits, then the last half octet (bits 4 to 7) of the FN should contain "0xF" as a filler. Therefore "0xF" can never be a valid digit within the FN.

NOTE 2: The hexadecimal value "0xF" represents the binary value of 4 bits, all set to "1".

Figure 3: General Format of PFN Tag Content

Octets consisting of two half octets, both set to "0xF", shall not be used in PFN tags as a filler; only octets containing valid BCD digits, or a single "0xF" nibble shall be included. If no valid FN is available for transmission, then a PFN tag encoded as shown in figure 4 shall be used.

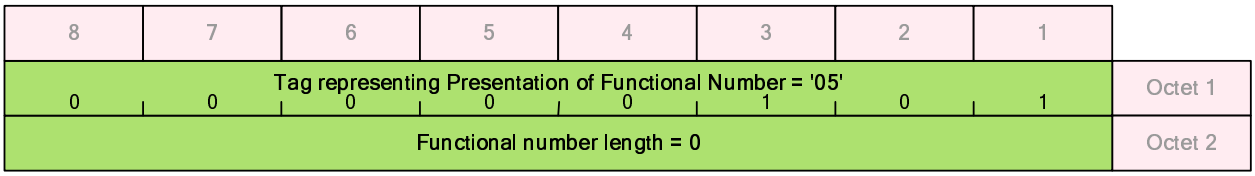


Figure 4: PFN Tag Content to Indicate "No FN Available"

5.2 Confirmation of High Priority Calls tags

The procedure for the Confirmation of a High Priority Call, including REC and eREC, is defined in [i.4] and [i.5]. UUS1 tags are used by the mobiles involved in the call and also by the network device that is responsible for collecting the confirmation messages. The tags involved are defined below.

5.2.1 CHPC tag definition for mobile device

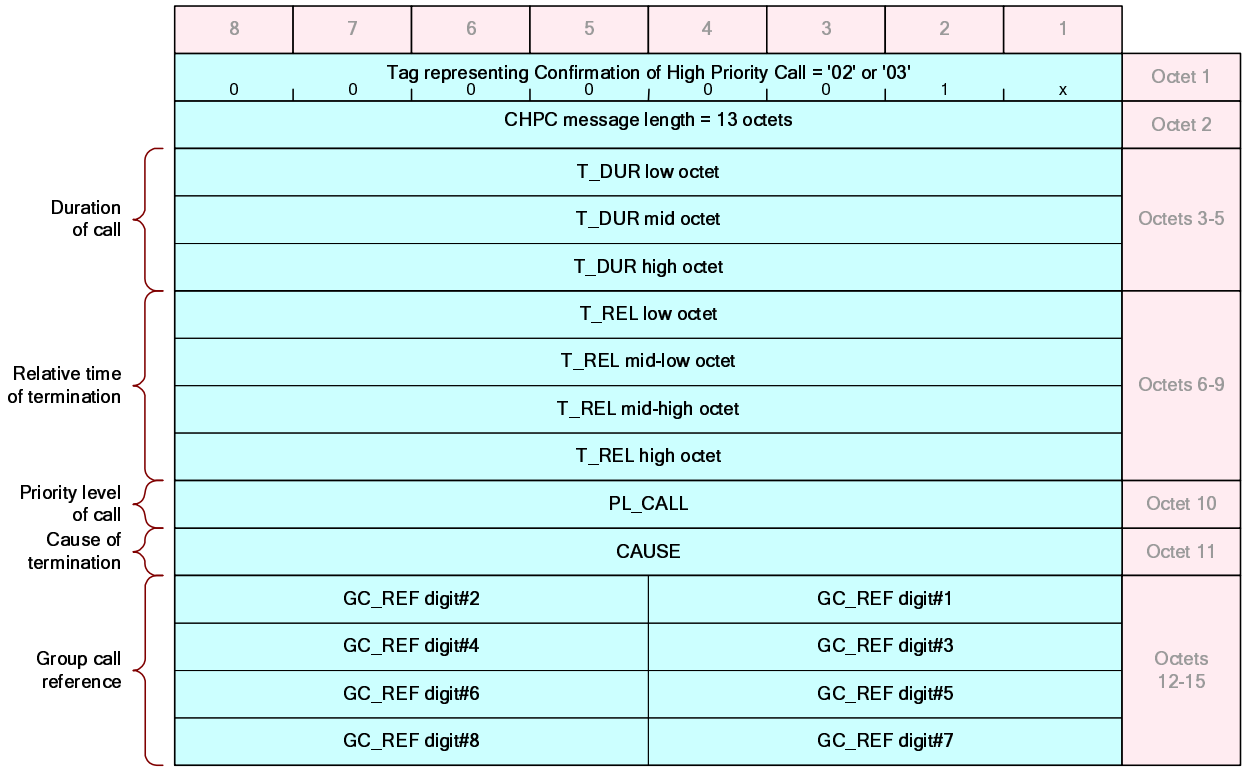


Figure 5: CHPC tag content for mobile device

The tag content is identical in structure for both the call initiator and the call recipients and is illustrated in figure 5, only the tag value differs for the two cases. The information is included in a SETUP message. The fields of the message have the following interpretation:

- T_DUR: A 24-bit unsigned integer specifying the duration of the call in units of 100 ms.
- T_REL: A 32-bit unsigned integer specifying the interval between the end of the call and the transmission of the confirmation message in units of 100 ms.
- PL_CALL: An 8 bit value giving the priority level of the call as follows (this is a general encoding and in practice value 0x05 is the one usually to be employed):
  - 0x00 no priority specified in call;
  - 0x01 eMLPP priority of 4 (Railway Information);
  - 0x02 eMLPP priority of 3 (Railway Operation);
  - 0x03 eMLPP priority of 2 (Public Emergency/Group Calls);
  - 0x04 eMLPP priority of 1 (Command and Control);
  - 0x05 eMLPP priority of 0 (Railway Emergency).
- CAUSE: An 8 bit value giving the reason for termination of the call as follows:
  - 0x00 no error;
  - Bits #1 to 4 (least significant bits) system errors;
  - Bit #1 mobile was powered off when receiving (power fail);
  - Bit #2 call was interrupted due to radio link error;

- Bit #3 reserved;
- Bit #4 reserved;
- Bits #5 to 8 (most significant bits) user actions;
- Bit #5 call was left on user command;
- Bit #6 reserved;
- Bit #7 reserved;
- Bit #8 reserved.

- GC_REF: A 4-octet value giving the group call reference of the call [3], encoded as 8 nibbles with each nibble being a BCD value representing one digit of the group call reference.

If this tag is being sent as part of the confirmation sequence of an eREC that the mobile station determined it should not join then the values of some of the above fields shall be set to specific, non-intuitive, values as follows:

- T_DUR: A 24-bit unsigned integer of value 00 00 00.
- T_REL: A 32-bit unsigned integer giving the interval between the decision not to join the call and the transmission of the confirmation message in units of 100 ms.
- PL_CALL: An 8 bit value giving the priority level of the call - unchanged from basic usage given above.
- CAUSE: An 8 bit value giving the reason for termination of the call - always 0x00 (no error).
- GC_REF: A 4-octet value giving the group call reference of the call - unchanged from basic usage given above.

5.2.2 CHPC tag definition for collecting network device

The network device which collects the confirmation messages is required to indicate back to the sending mobile device whether the information has been successfully received and stored or not. The tag is included in a RELEASE_COMPLETE message which shall have the release cause value of "Normal Call Clearing". The tag content is illustrated in figure 6.

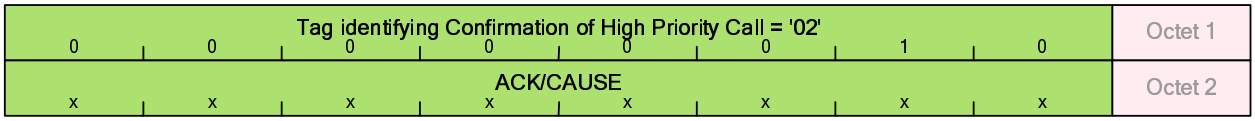


Figure 6: CHPC tag layout for collecting network device

NOTE: This is the only tag where there is no length field following the tag identity octet in the UUS1 content. The tag value is the same as that used by a receiving mobile, but has a completely different content which is not ambiguous, because the direction of the information defines the correct context. The ACK/CAUSE values are listed below:

- 0x00 ACK no error
- 0x01 NACK-1 error, repetition should take place
- 0x80 NACK-2 fatal error, **NO** repetition to take place
- 0x02 to 0x7f reserved for internal use
- 0x81 to 0xff reserved

5.2.3 CHPC eREC extension tag definition for mobile device

In the framework of eREC service, this tag is used in addition to the tags defined in clause 5.2.1 to transfer eREC specific data.

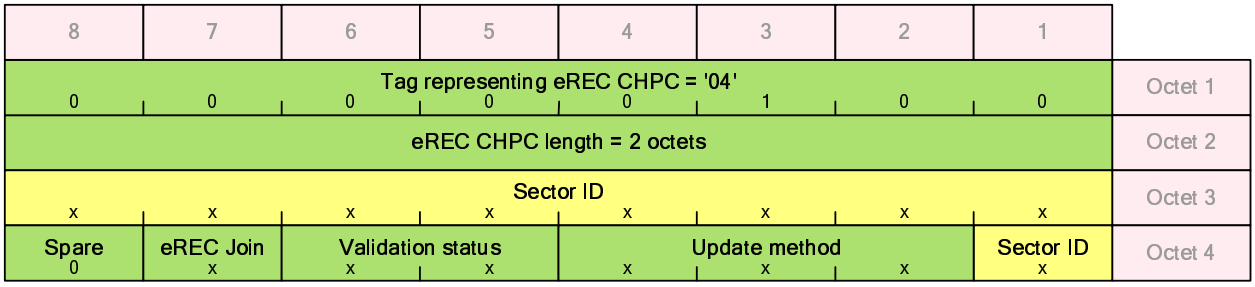


Figure 6a: eREC CHPC tag content for mobile device

The tag content is identical in structure for both the call initiator and the call recipients and is illustrated in figure 6a. The circumstances under which this tag is included as part of the CHPC process is described in [i.4] and [i.5]. An explanation of the purpose of the fields included in the tag is provided in [i.7] and [i.8]. The information shall be included in a SETUP message. The fields of the message shall have the following interpretation:

- Sector ID: Coded in 9 bits, each bit representing one eREC sector ID in the range [1..9]. Setting a bit to "1" means the corresponding sector ID was active at the time of the call being acknowledged.

  Octet 3 contains sector IDs 1 to 8, with the least significant bit giving the state of sector ID 1 and the most significant bit giving the state of sector ID 8. The least significant bit of octet 4 gives the state of sector ID 9.

  In the case of CHPC for the initiation of an eREC this field shall include the current active sector ID for call initiation. Consequently it shall one and only one active sector ID, or no active sector ID if the mobile station is in eREC standby mode.

  In the case of CHPC for the reception of an eREC, this field shall include all the active sector IDs for call reception, or no active sector ID if the mobile station is in eREC standby mode.

- Update method: Coded in 3 bits in octet 4 with bit 2 being the least significant. This field gives the method used for the last eREC sector ID update performed by the mobile station as follows:

  - 000B: No update performed since last eREC registration;
  - 001B: Last update performed from the mobile station HMI;
  - 010B: Last update performed using USSD update method;
  - 011B: Last update performed using balise update method;
  - All other values are reserved for future use and shall not be used until defined.

- Validation status: Coded in 2 bits in octet 4 with bit 5 being the least significant. This field gives the status of the sector ID validation(s) performed by the mobile station since the last sector ID update as follows:

  - 00B: No validation performed since the most recent eREC sector ID update;
  - 01B: All validations performed successfully since the most recent eREC sector ID update;
  - 10B: At least one validation has failed since the most recent eREC sector ID update (this means that at least one sector ID provided in the most recent sector ID update has been deactivated by the validation process);
  - 11B: Reserved for future use - shall not be used.

- eREC Join: Coded in bit 7 of octet 4 with the value "0" meaning that the call was not joined by the mobile station and the value "1" meaning that the call was joined. The value "1" shall be used by the eREC call initiator.

5.3 Enhanced presentation of functional number

In some situations it has been identified that presenting only the FN of a subscriber may not provide sufficient information for the other party/parties in the call. A tag has therefore been defined which allows for presentation of three further pieces of information, all of which are optional. These are defined in table 2.

Table 2: Information content of enhanced PFN

Position	Contents	Status	Comment
1	ASCII Text Information (e.g. "Nice Signaller 1")	O	ePFN Information
2	Country Information	O	
3	Call Type	O	
NOTE: O = optional information			

The definition of the overall tag structure is shown in figure 7. In order to make efficient use of the limited space, CSN.1 coding according to [2] is used in ePFN information field. The encoding of the three optional fields is defined in table 3.

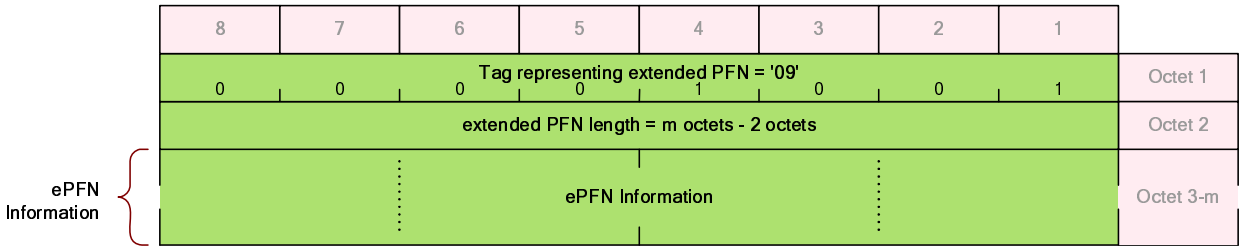


Figure 7: Overall structure of ePFN tag

Table 3: CSN.1 definition of ePFN information content

```
<ePFN Info> ::=
      {0 | 1 <Length of ASCII string : bit (5)> <IA5 ASCII octet string>}
      {0 | 1 <MCCdigit1 : bit(4)> <MCCdigit2 : bit(4)> <MCCdigit3 : bit(4)>
               <MNCdigit1 : bit(4)> <MNCdigit2 : bit(4)> <MNCdigit3 : bit(4)>}
      {0 | 1 <CT>}
      {<spare bits>};

<Length of ASCII string> indicates the number of octets in the <IA5 ASCII octet string>.

<IA5 ASCII octet string > ::= <octet : bit(8) * (val(Length of ASCII string))>;

<CT> ::= <digit2 : bit(4)> <digit1 : bit(4)>;

<spare bits> ::= <null | <spare bits> {<bit> = 0} -- number of bits added is selected to
                                                    ensure "ePFN Info" occupies the minimum
                                                    quantity of octets, padded with "0" bits
                                                    in any unused locations at the end ;
```

Examples of the encoding defined in table 3 are provided in clause 7.3.

5.4 Presentation of text strings

According to UUI specification the IE can contain a text string composed of IA5 characters, but this requires use of the appropriate User-to-User Protocol Discriminator value. There are also difficulties if characters from different language sets are to be transferred. Finally, the use of the raw IA5 encoding scheme is reserved for presentation of decompressed OTDI for emergency calls, as described in clause 6.3.

If an application requires to send plain text in a UUIE then this tag shall be used. This tag contains the plain text preceded by the alphabet indicator as illustrated in figure 8. The alphabet indicator is selected according to the CBS data coding scheme [1].

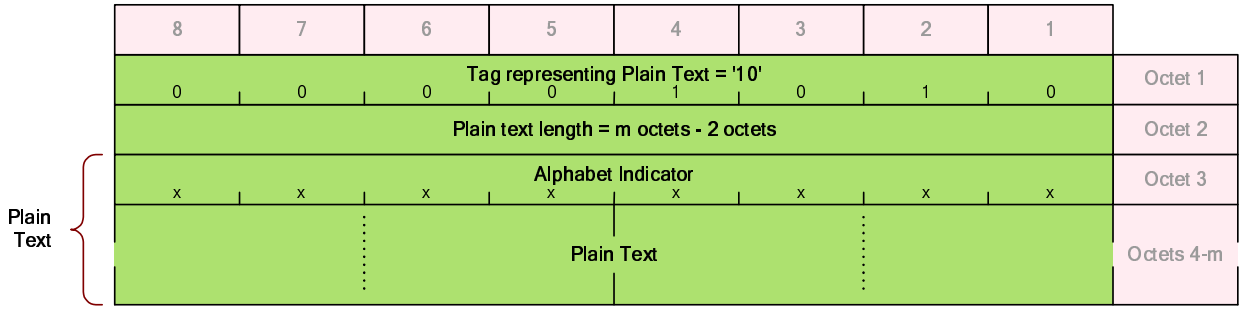


Figure 8: Coding of plain text tag

5.5 Transfer of train position

The UIC ad-hoc working group on enhanced Location Dependent Addressing (eLDA) has defined a mechanism for transferring the location of a train to the fixed GSM-R infra-structure during call setup. A full discussion of this topic can be found in [i.6]. This mechanism was originally devised so that a call might be routed with greater precision than is possible with the basic cell-based routing specified within EIRENE, but it also finds uses in providing a static indication of a train's position, such as when indicating a DSD alarm condition. The transfer mechanism is based on the use of UUS1. An example of the proposed tag is given in figure 9. This example represents the transfer of the following position: (Further details may be found in [i.6]).

1) Latitude: 89 59 59.99 S.
2) Longitude: 179 59 59.99 East.
3) Height: 1 234 m.
4) Speed: 210 Km/hr.
5) Heading: 120º.
6) Elapsed time: 2 012 s.
7) Distance: 95 000 m.
8) Scale: 10 m.

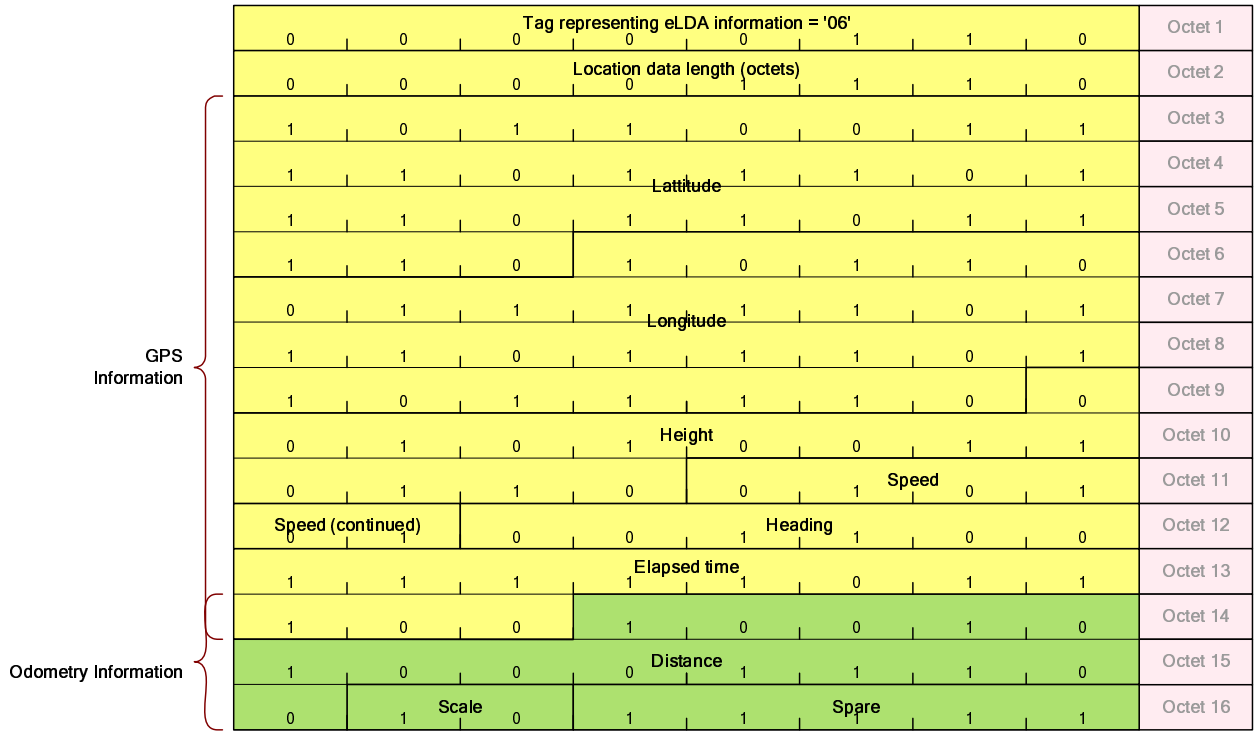


Figure 9: Example of eLDA information tag

5.6 Notification DSD alarm condition

When a driver becomes incapacitated it is important to notify the responsible dispatcher of the situation so that the necessary steps to ensure safety can be taken. The method for providing the notification is by the use of a special UUS1 tag. The content of this tag is defined in figure 10.

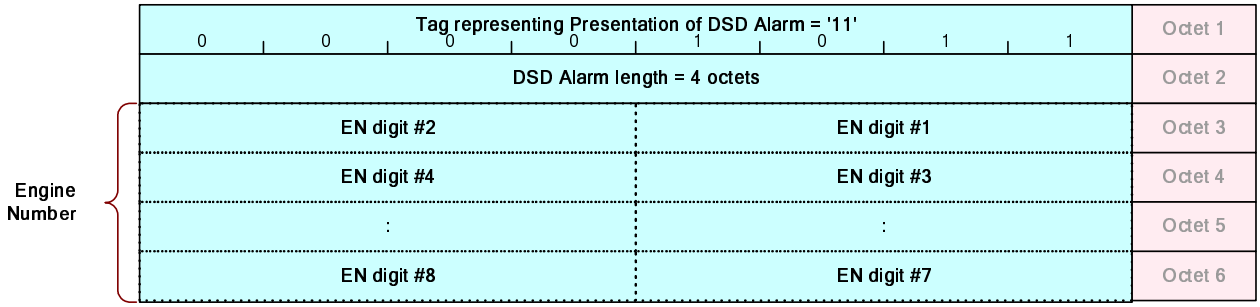


Figure 10: DSD alarm tag layout

The content of the tag is the 8 digits of the locomotives engine number as defined in EIRENE SRS [i.1]. Each digit is represented by its BCD value in one nibble. The engine number has a fixed length with an even number of digits, so no nibble fill character is needed.

5.7 Notification of a request to alert a controller

At times during a shunting group call it is required to request that a controller that had previously left the call rejoin the call to respond to a query from a member of the call. The method for providing the request, and the response from the recipient's equipment, is by use of a special UUS1 tag. The content of the tag is defined in figure 11.

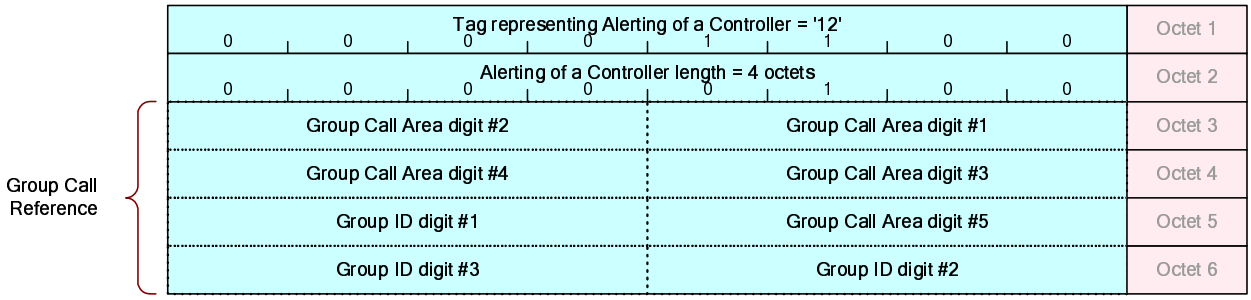


Figure 11: Alerting of a controller tag layout

The content of the tag is the 8 digits of the Group Call Reference [3] of the call. Each digit is represented by its BCD value in one nibble. The Group Call Reference has a fixed length with an even number of digits, so no nibble fill character is needed. The order of the digits is the same as in other tags where this type of information is encoded.

6 Transfer of functional number of initiator of railway emergency call

6.1 Introduction

When a network and the mobiles using it employ the IMMEDIATE SETUP 2 message to initiate a REC or eREC the originator's FN shall be placed in the compressed OTDI Information Element of that message. This clause fully specifies the parts of the FN information to be inserted in that information element. Furthermore, the compressed OTDI IE is only applicable to IMMEDIATE SETUP 2 and this call setup message is unavailable in the fixed network.

The MSC will convert the information into decompressed OTDI for delivery by means of UUS1 to other subscribers of the REC/eREC within a conventional SETUP message. This conversion is specified in [4]. Clause 7.2 contains an example of the content of the compressed OTDI and decompressed UUS1 resulting.

NOTE: The format of the decompressed UUIE does not conform to the general GSM-R UUIE format described in clause 4.

6.2 Compressed OTDI encoding

This IE provides 40 bits for the information field of the user. [4] states the following about the encoding of these bits:

- "The compressed otdi information element specifies an integer N in 40 bit binary representation; bit 8 of octet 1 is the most significant bit and bit 1 of octet 5 is the least significant bit. The integer denotes compressed originator-to-dispatcher information".

Consequently it is not possible to consider using the UUS1 encodings described elsewhere in the present document. The 40 bit integer can represent a decimal number in the range 0 to 1 099 511 627 775, for practical purposes, in relation to functional numbers, the maximum range is 0 to 999 999 999 999 (i.e. 12 digits). The maximum length of a FN, including International Code is 15 digits (coach number), therefore to encode as compressed OTDI, the International Code is omitted.

The omission of the International Code does not generally lead to ambiguity, since the FN being transferred will usually be a CT2 train number. This will be registered in the same country as that in which the REC/eREC originates. At the international border the IC is assumed to be the same as the network in which the REC/eREC originates. This is because the train will register its functional number immediately after attaching to a new network.

In cases where no train number is available, an engine number will be sent. These are always registered in the "home" network of the mobile and the International Code cannot be derived from that of the group call reference.

6.3 Conversion of compressed OTDI into UUIE

The MSC shall convert the received compressed OTDI into UUIE of the UUS1 according to the following definition found in [4]:

- "The corresponding decompressed originator-to-dispatcher information is given by the following attributes:
  - User-user protocol discriminator: IA5 characters.
  - User-user information: The user-user information is a string of 12 digits which are the decimal representation of the integer N with leading zeros. Each digit after decompression is coded in one octet. The bits 1 to 7 are used for the coding of the IA5 character, and bit 8 is coded as '0'."

This procedure does not make any provision for railway-specific interpretation, such as reconstruction of the International Code. The railway application within the device which receives the call is responsible for performing this action.

7 Examples of use

7.1 Examples according to general UUIE format

7.1.1 Presentation of functional number

When the PFN tag is present in the UUIE in a GSM-R application, it shall always be the first such tag. This is to ensure compatibility with applications that do not understand the more complex tags such as the train position tag. There is a specific exception to this rule in respect of the CHPC application, and this is explained in clause 7.1.2.

7.1.2 Confirmation of High Priority Calls Application

Two alternative arrangements of the tags in the UUIE are permissible for the CHPC application when either the mobile station or its serving network are not eREC capable. Both contain a PFN tag and a CHPC tag and are referred to as "Format A" and "Format B". There is no preference for which shall be used by any device sending such a confirmation message, and the capturing device shall be able to accept either format without error. The two alternative layouts are shown in figures 12 and 13 respectively.

When both the mobile station and its serving network are eREC capable, the CHPC eREC extension tag defined in clause 5.2.3 shall be included in the information sent by the mobile station. The mobile station can utilize either "Format A" or "Format B", but the CHPC eREC extension tag shall be placed after the non-eREC CHPC tags (that is it shall be the third tag in the UUIE). An example of the confirmation of an eREC based on "Format B" is shown in figure 13a.

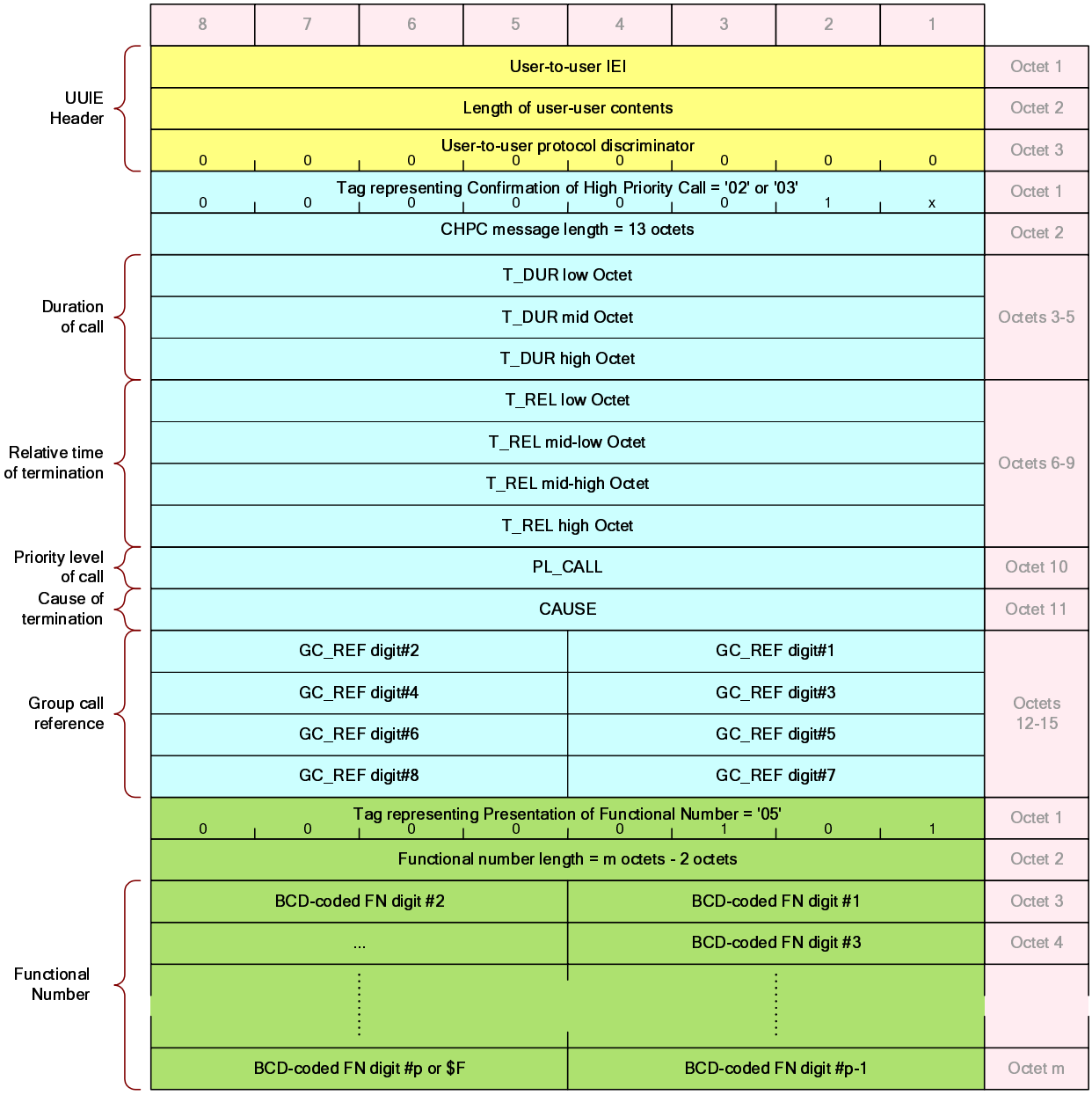


Figure 12: CHPC "Format A" tag layout

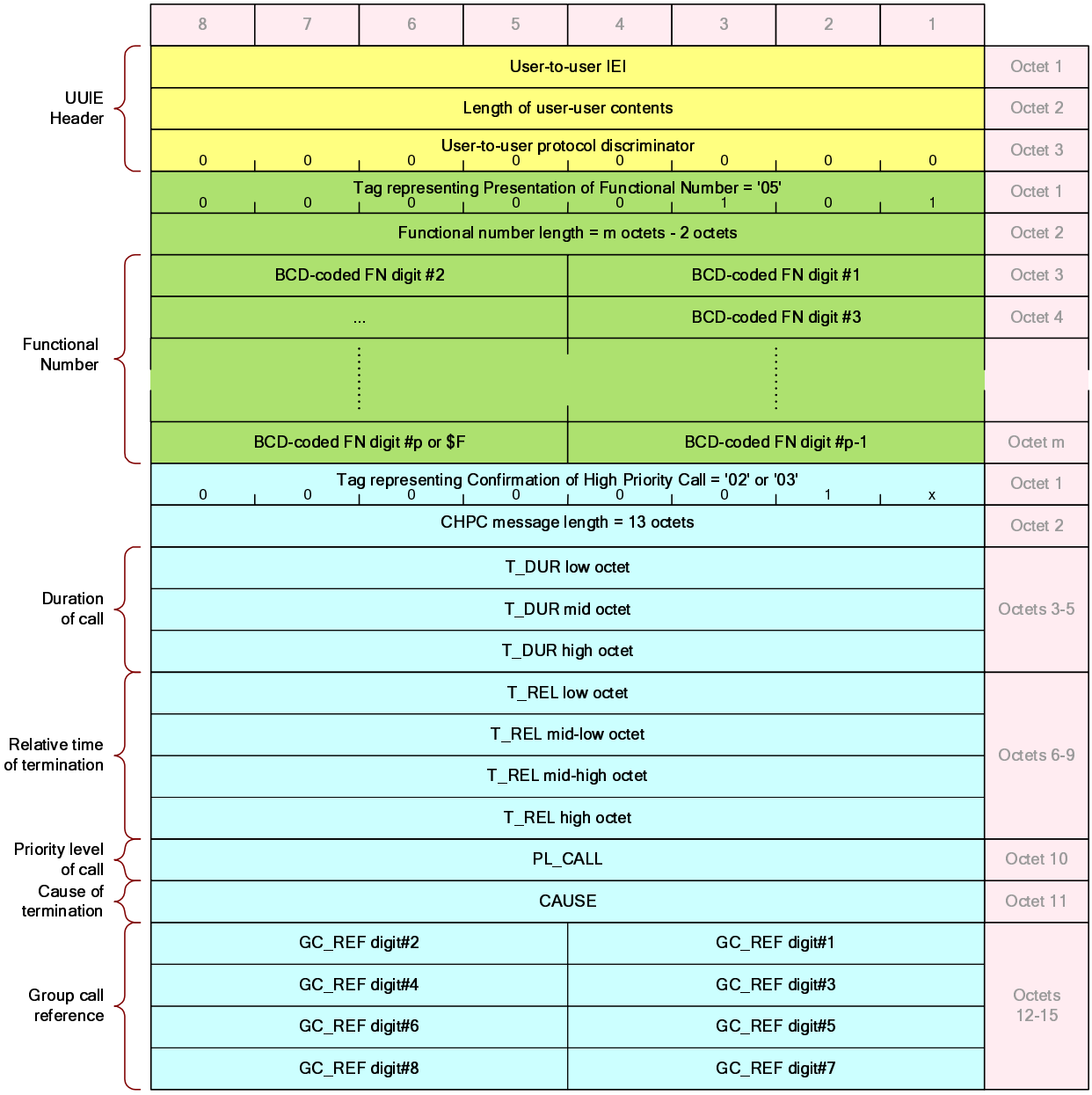
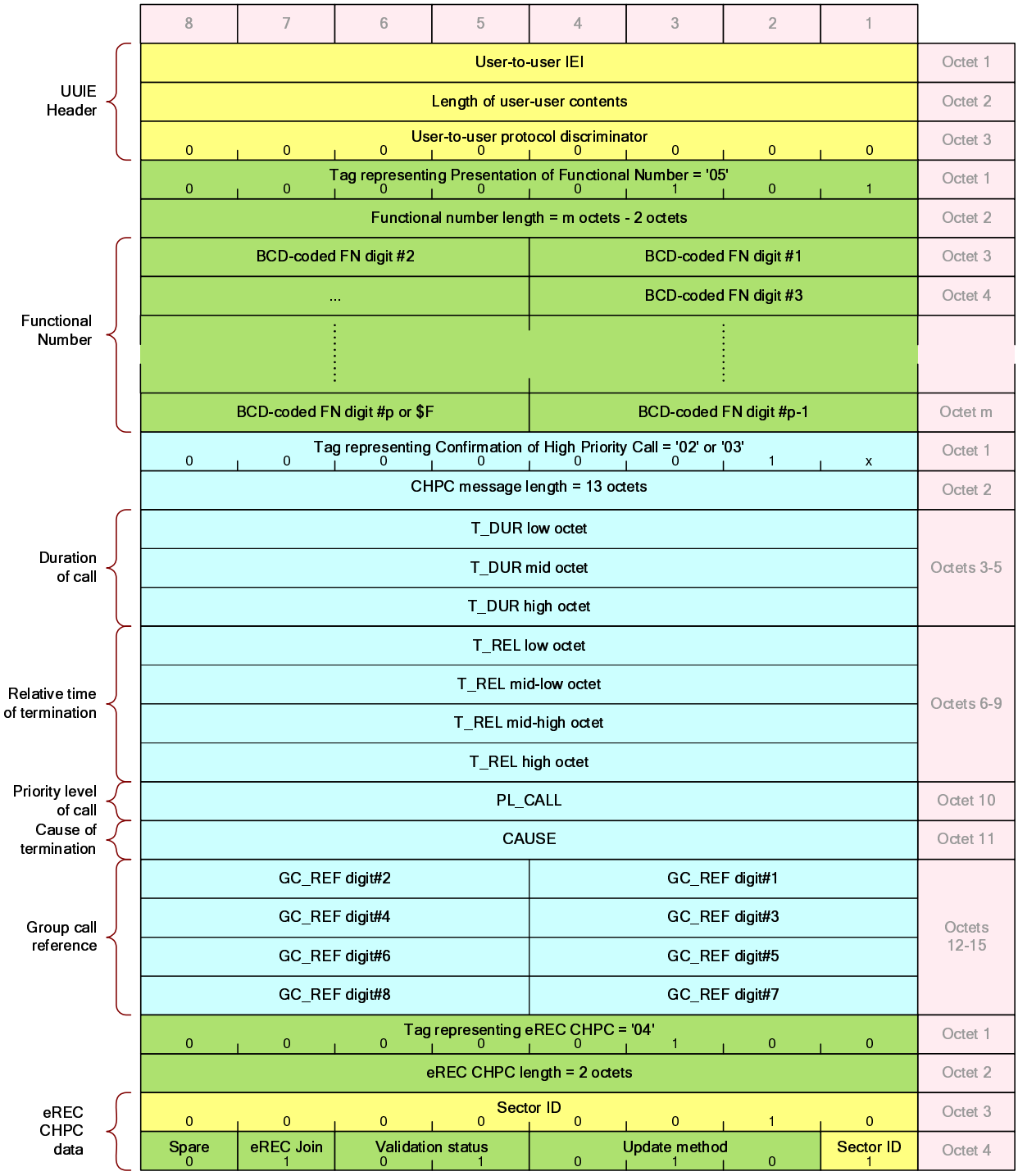


Figure 13: CHPC "Format B" tag layout



NOTE 1: In this figure the eREC CHPC uses the following values as examples:
Sector IDs 2 and 9 are active
The USSD update method was employed most recently
All validations of sector ID have been successful since the last sector ID update
The call was joined.
NOTE 2: No example values for the other fields of the CHPC message are included.

Figure 13a: CHPC for eREC based on "Format B" tag layout

7.1.3 Enhanced presentation of functional number

When the ePFN tag is used to provide the extra information that it carries, it shall always be used in conjunction with the normal PFN tag. To avoid interworking issues with applications that do not understand the ePFN tag the PFN tag shall be placed first in the UUIE. The required arrangement of the tags is shown in figure 14.

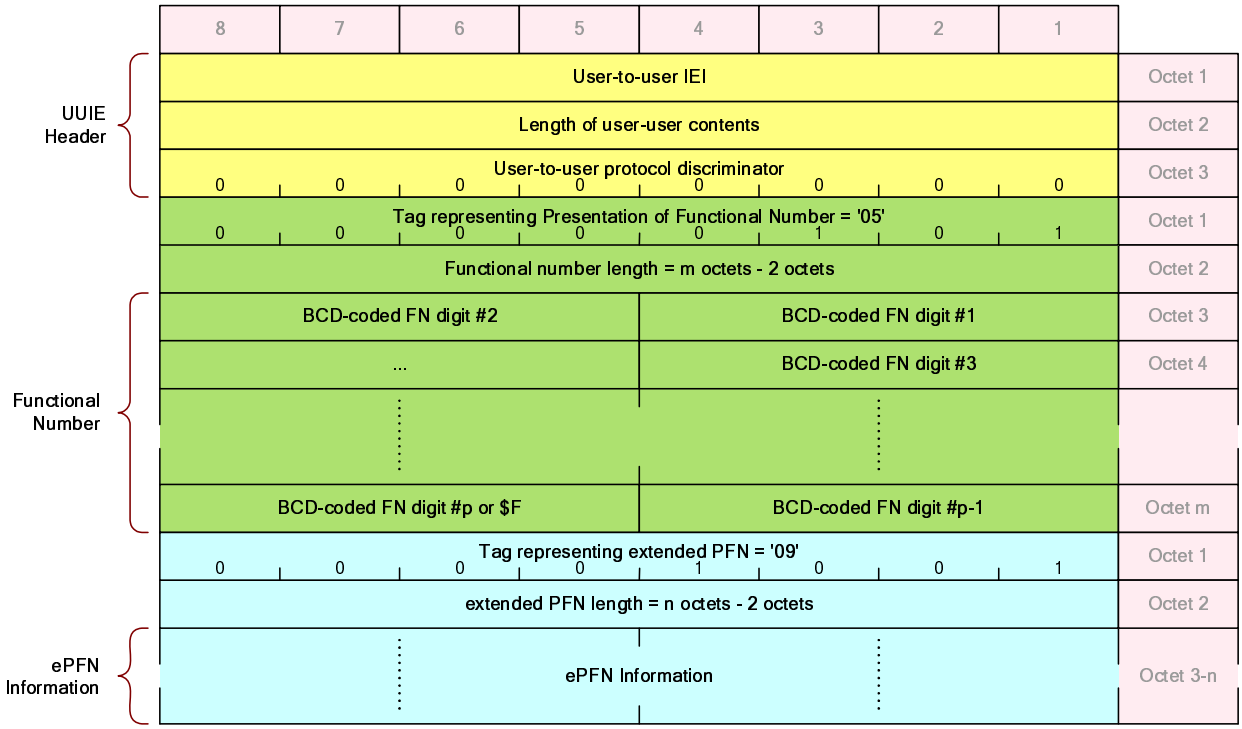


Figure 14: ePFN tag layout

7.1.4 Transfer of train position for eLDA

When train position is being provided by an on-train system, such as GPS, for use in eLDA it shall be transferred to the fixed infra-structure in the UUIE of the SETUP message initiating the call. The train position tag shall always be used in conjunction with the PFN tag. As already stated, the PFN tag shall be placed first in the UUIE. The arrangement is shown in figure 15. If train-based eLDA is being used then the use of ePFN in the same SETUP may be impossible because of the limited length of the UUIE. If there is sufficient space for both the ePFN and train position tags then they may be placed in either order following the PFN tag.

Figure 15: Arrangement of tags for train-based eLDA

7.1.5 Notification of a DSD alarm condition

The requirement from EIRENE is to transfer the train number, engine number and train location (optional). This can be achieved by using a combination of three existing tags: the PFN tag, the train position tag and the DSD tag. The layout for the combined use of these tags is given in figure 16. In keeping with the flexibility offered by the encoding scheme, the train position and DSD tags can be placed in the either order after the PFN tag. Receiving applications shall be able to interpret either sequence. There is no space left for use of the ePFN tag in this application.

In this application the PFN tag would normally include the train number and the driver function code of the engine detecting the alarm, but would be coded as "No FN Available" as specified in figure 4 if no train number were registered. No special function code for a DSD alarm is required. Note that the notification is not to result in a connected call. Once the information has been captured by the receiving application, the call should be rejected using DISCONNECT or RELEASE_COMPLETE. No response UUIE tag is defined or required for this application.

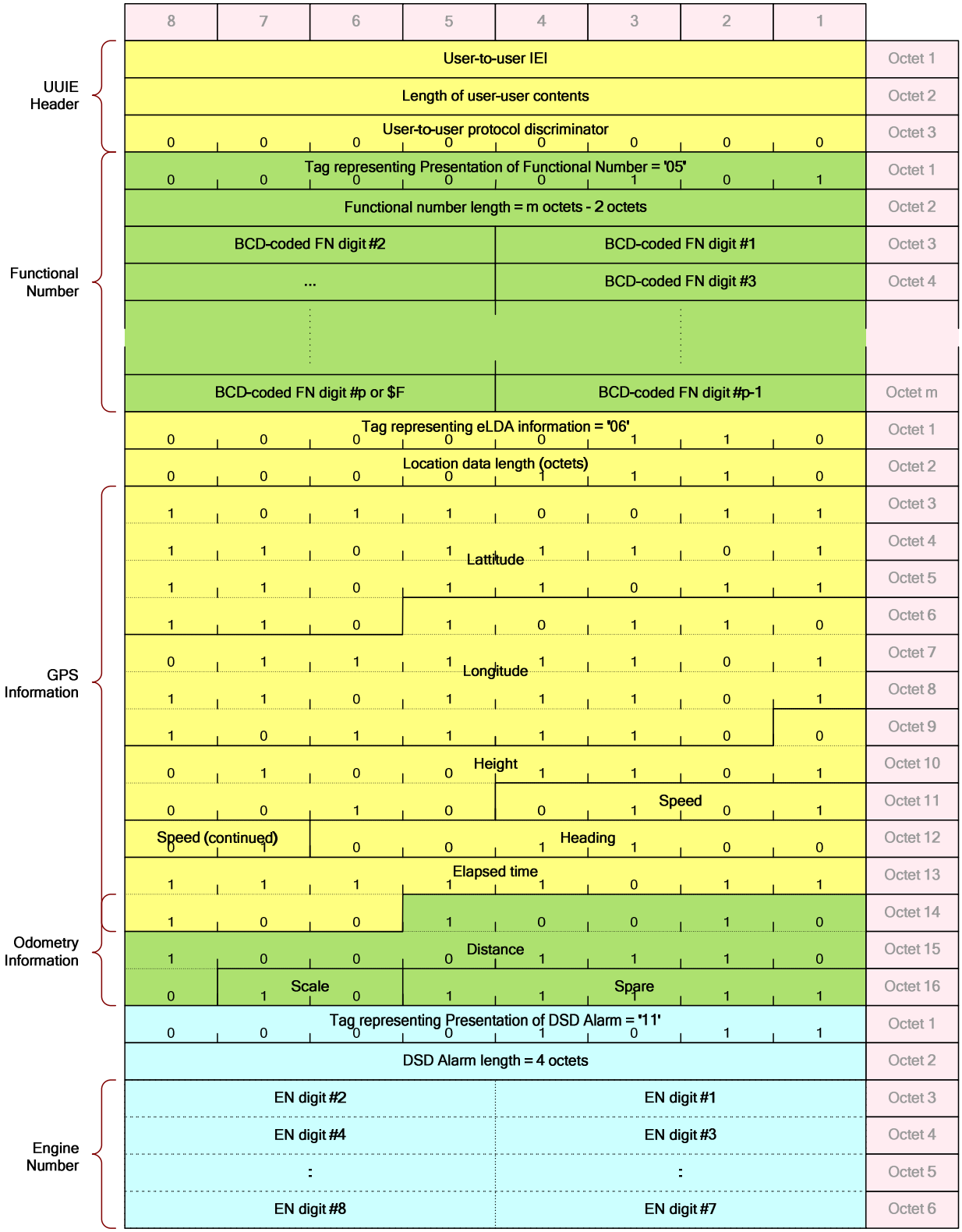


Figure 16: Example of combined tag usage for DSD

7.1.6 Notification of request to alert a controller

The functionality "Alerting of a controller" shall be realized by transfer of a UUIE from the mobile station to the dispatcher terminal in the SETUP message. The tags involved are shown in figure 17.

Note that the notification may result in a connected call or may result in the call being rejected after capturing of the transferred information; this behaviour is dependent on the national implementation.

If the call is connected then normal call signalling shall be used, with the functional number of the recipient being returned as defined in [i.2].

If the call is rejected then once the information has been captured by the receiving application, the call shall be released immediately using RELEASE_COMPLETE or DISCONNECT message in a similar fashion to that specified for the CHPC application. The message shall contain a UUIE which carries the functional number of the dispatcher and the received alerting of a controller tag.

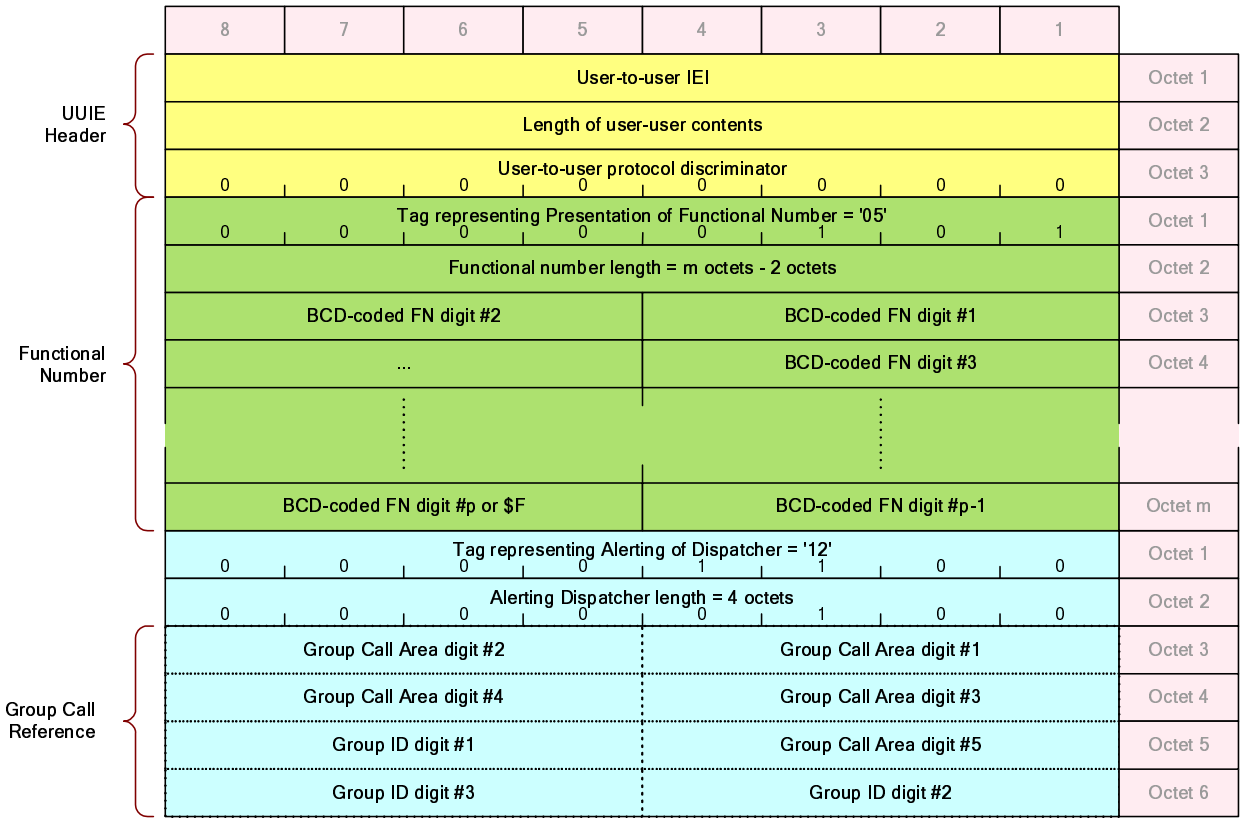


Figure 17: Arrangement of tags for the alerting of a controller process

7.2 Example of transfer of functional number of initiator of a railway emergency call

The following example shows the format of compressed and decompressed OTDI which is used for the transfer of the functional number of the initiator of a railway emergency call.

A cab radio is registered as lead driver of train with train number 12345 in a GSM-R network with International Code 069. This cab radio has therefore registered with the functional number 06921234501. The number to be transferred in the compressed OTDI is 21234501 which converts to the hexadecimal value 0x0001440345. On the air interface (in the IMMEDIATE SETUP2 message), these octets are represented as shown in figure 18.

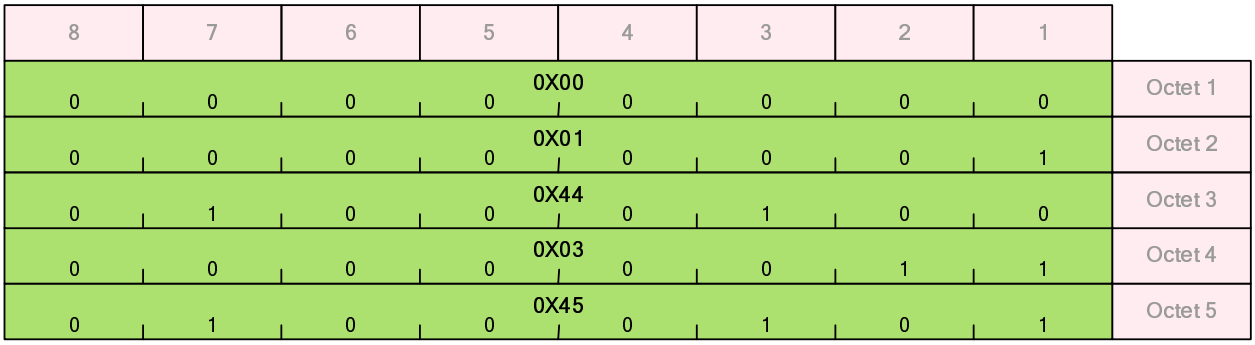


Figure 18: Compressed OTDI encoding example

The MSC converts the compressed OTDI octets back into the 12 digit integer 000021234501 which are represented in the UUS1 IE shown in figure 19.

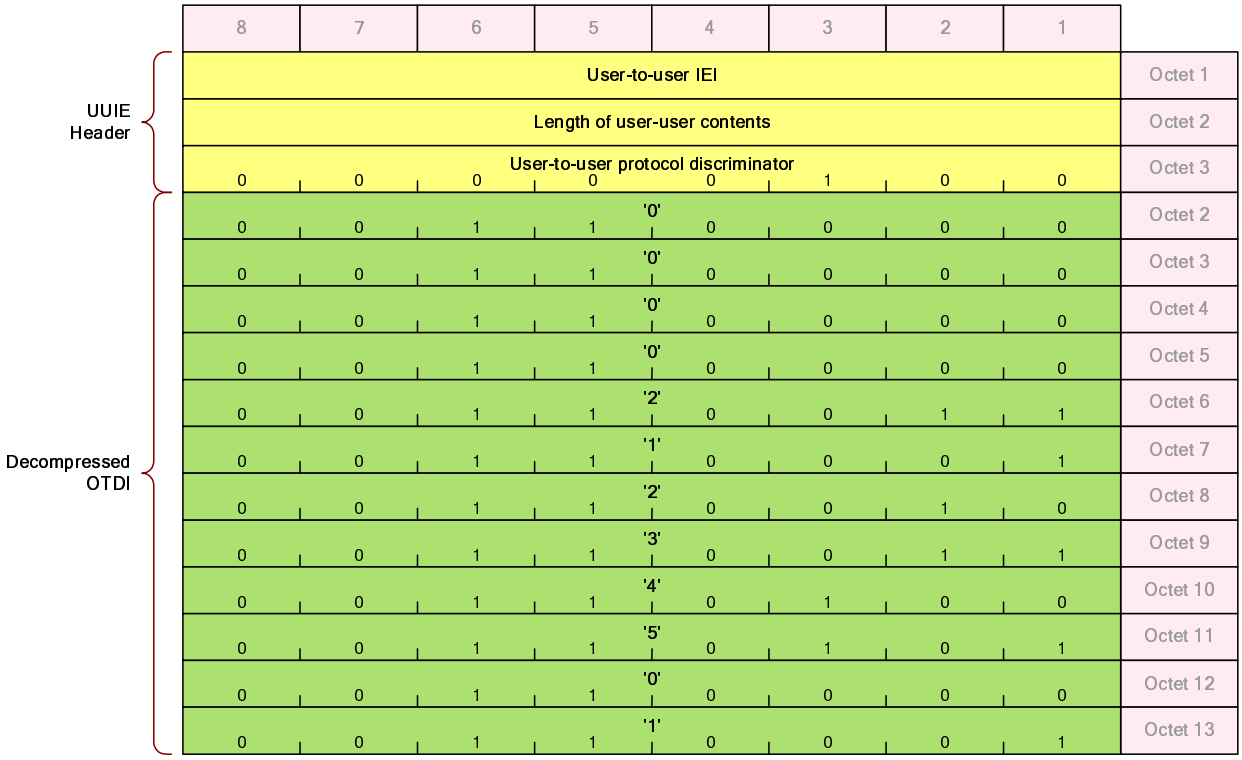


Figure 19: Example of expansion of compressed OTDI

7.3 Examples of encoding of ePFN tag

The example shown in figure 20 is the encoding of the ePFN tag when it contains only the 3 character string "ABC".

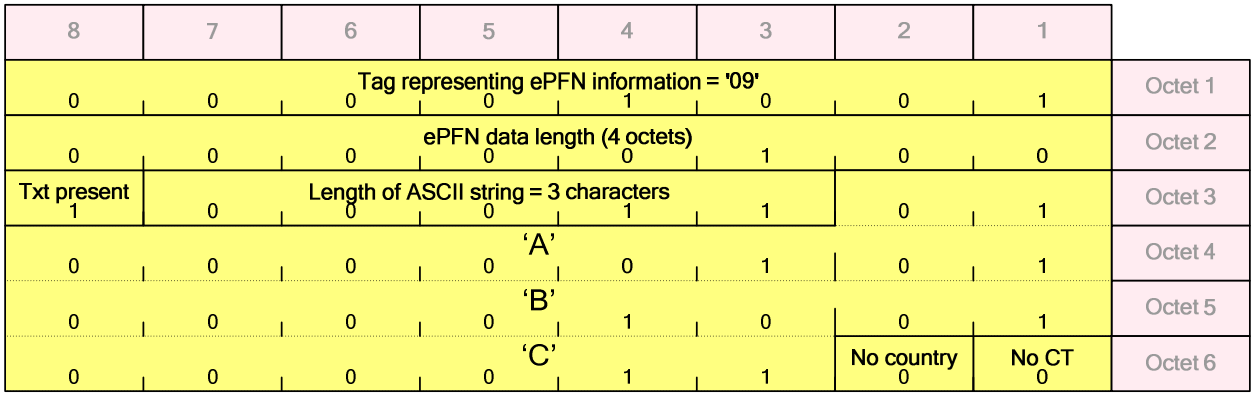


Figure 20: Example 1 of enhanced Presentation of Functional Number

The example shown in figure 21 is the encoding of the ePFN tag when it contains no text, but does contain the network identity "239 31". No Call type is present so 5 spare bits shall be added to ensure that a complete quantity of octets are defined.

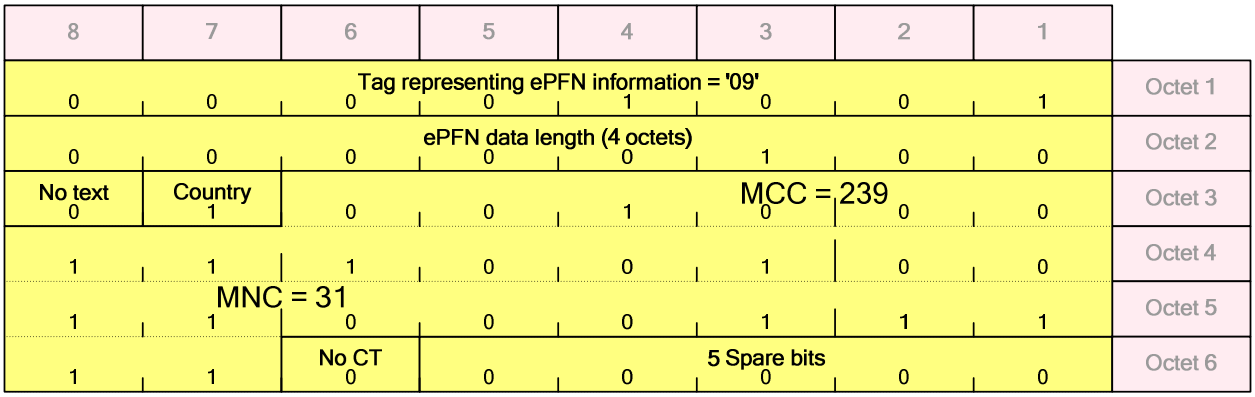


Figure 21: Example 2 of enhanced Presentation of Functional Number

Annex A (informative): Bibliography

- ETSI TS 102 281: "Railways Telecommunications (RT); Global System for Mobile communications (GSM); Detailed requirements for GSM operation on Railways".
- ETSI TS 124 008 (V3.20.0): "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); Mobile radio interface Layer 3 specification; Core network protocols; Stage 3 (3GPP TS 24.008 Release 1999)".
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History

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