
**Intelligent transport systems — Traffic
and travel information messages via
traffic message coding —**

**Part 1:
Coding protocol for Radio Data
System-Traffic Message Channel (RDS-
TMC) using ALERT-C**

Systèmes de transport intelligents — Informations sur le trafic et les déplacements via le codage de messages sur le trafic —

Partie 1: Protocole de codage pour le système de radiodiffusion de données - canal de messages d'informations sur le trafic (RDS-TMC) avec Alert-C



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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 204, *Intelligent transport systems*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 278, *Intelligent transport systems*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This third edition cancels and replaces the second edition (ISO 14819-1:2013), which has been technically revised. The main changes compared to the previous edition are as follows:

- Additional tuning variants have been added to allow referencing of TMC services using the 64 MHz to 88 MHz band.
- The method of encrypting an RDS-TMC service, previously separately specified in ISO 14819-6, has been merged into this document as [Clause 8](#). Consequently, some renumbering of sections has occurred and encryption-specific terms, definitions and abbreviated terms have been added in [Clause 3](#).
- In some places the text has been improved and/or rearranged for greater clarity. Several typographical and grammatical errors have been corrected.

A list of all parts in the ISO 14819 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

0.1 General

Traffic and traveller information (TTI) can be disseminated through a number of services and means of communication to the end user, including static displays (e.g. variable message signs), broadcast audio to car radios, broadcast data services to in-vehicle equipment (e.g. installed navigation systems) and to nomadic device terminals (e.g. portable navigation device).

For all such services, the data to be disseminated and the message structure involved in the various interfaces require clear definition and standard formats, in order to allow competitive products to operate with any received data.

This document describes the data specification for TTI messages, together with their network layer and their service layer, which shall be conveyed by the RDS-TMC feature, specified in the IEC 62106 series.

The TTI information chain, from event to end-user, is quite complex and the Traveller Information Services Association (TISA) value chain shown in [Figure 1](#) helps to explain the key components.



Figure 1 — Traveller Information Services Association TTI value chain

Several entities (e.g. companies, businesses) take part in one or more activities to complete the activities shown in the value chain. These are described below for improved understanding:

Service provider: An organization that constructs a data service, by gathering data, processing data and supplying the data service. A service provider negotiates for the use of the necessary data bandwidth with a Broadcaster and/or Transmission Operator. A service provider is responsible for the "quality" of the data to its customers and should provide suitable customer support.

Broadcaster: A traditionally incorporated organization responsible for a continuous strand of audio programmes and their quality. A broadcaster may also be responsible for the overall co-ordination of "broadcast transmissions" (often a Broadcaster is the licensee of a national regulator). A Broadcaster may also be a service provider.

TTI services for travellers, using spoken radio reports and in-vision reports, occupy broadcast air-time and whilst valuable to some, they are considered less useful by others. Furthermore, only some are useful for travellers on the move. Due to the widespread adoption of the Radio Data System, in VHF/FM broadcasting on Band II there is the possibility of transmitting coded TTI messages digitally and "silently" using the RDS-TMC feature, which avoids the interruption of planned programmes. This TTI delivery method has several advantages: TTI messages can be decoded into the language of the end user, regardless of location, more messages can be made available and planned broadcast programme interruption is avoided. Thus, using RDS-TMC makes the delivery of TTI messages more timely and topical.

0.2 ALERT-C protocol

The ALERT-C protocol defined in this document supports a data broadcasting service for travellers, providing information about many kinds of traffic and travel events. Messages include traffic incident information relating to national and regional routes and some urban roads and other information required by a traveller, such as roadworks and weather information.

The ALERT-C protocol utilizes a standardized Event List of event messages with their code values, which also includes general traffic problems and weather situations. Being transmitted as a series of codes, RDS-TMC messages are language-independent and are presented in the language of the user's choice.

ALERT-C defines two categories of information within messages: basic and optional items. In principle, basic information is present in all messages. Optional information is added to messages where necessary.

Standard RDS-TMC user messages provide the following five basic items of explicit, broadcast information:

1. **Event description**, giving details of road event situation, general traffic problems and weather situations (e.g. congestion caused by an accident) and where appropriate its severity (e.g. resulting queue length).
2. **Location**, indicating the area, road segment or point location where the source of the problem is situated.
3. **Direction and extent**, identifying the adjacent segments or specific point locations also affected by the incident, and where appropriate the direction of traffic affected.
4. **Duration**, giving an indication of how long the problem is expected to last.
5. **Diversion advice**, showing whether end-users are recommended to find and follow an alternative route.

Optional information may be added to any message using one or more additional RDS data groups. This optional addition may give greater detail or deal with unusual situations. Any number of additional fields can in principle be added to each basic message, subject only to a maximum message length of five RDS data groups.

0.3 Document development and RDS groups

This document is based on the ALERT-C traffic message coding protocol, which was a product of DRIVE Project V1029, "RDS Advice and Problem Location for European Road Traffic". The RDS-ALERT project aimed to define standards for RDS-TMC, working in conjunction with the European Broadcasting Union (EBU) and the European Conference of Ministers of Transport (ECMT).

The document has been implemented in many countries worldwide and, after very extensive implementation experience, it has matured with many changes compared to the earliest version of the ALERT-C proposal of 1990. At that time, CEN TC 278 Working Groups developed the coding protocol described in this document, the Event List described in ISO 14819-2 and the location referencing method described in ISO 14819-3. Subsequently the TMC Forum was responsible for collecting specific additions and improvements intended for inclusion in this document. In 2008, TISA took over all responsibility (including TMC Forum legacy) for maintenance of this document, which now includes an up to date set of industry supported enhancements to RDS-TMC.

The RDS is fully described in IEC 62106 and it contains the 'hooks' to RDS-TMC detailed in this document¹⁾; it employs a group-structured data protocol. Terminal Device manufacturers should be aware that service providers broadcast the following RDS groups:

- a) type 3A groups, which carry the TMC Open Data Application (ODA) identification and service and network layer information, identifying TMC services uniquely worldwide;
- b) type 8A groups, which carry RDS-TMC messages and location information, together with TMC service tuning information; and
- c) type 4A groups, which contain the Clock Time (CT) information that is used as the time reference within TMC.

1) In this document, many "hooks" have been left for future development and indeed a few status-orientated road end-user information messages are included.

Additionally, where necessary, the following group may also be transmitted:

- d) type 0A groups, which contain Alternative Frequency (AF) information, that is used as an alternative to, or in addition to, tuning information carried in the type 8A group.

It is noted that although the 'message' information carried within the 8A group will be transmitted once with either one or two 'immediate' repeats (see 7.3), the encryption administration information and the tuning information, both also transmitted in type 8A groups, usually will not be transmitted with an 'immediate' repeat: this information is largely 'static' and repeated periodically only every several seconds or minutes. Terminal Devices therefore process every RDS group received that passes their CRC and use the data contained within once it has been verified by the reception of a second identical group, regardless of whether received 'immediately' or after several seconds or minutes.

Broadly speaking, two types of RDS-TMC services are in use: one that is broadcast without access control, and one that is broadcast with access control. The method of 'access control' was designed in 2000 and was published separately in ISO 14819-6. It described how a service provider encrypted their service and the complementary process to be adopted by terminals to decrypt the service by arrangement with the service provider. It also indicated a strategy to be followed to introduce encrypted services between 2001 and 2003, when encryption was expected to become widespread. As encrypted RDS-TMC services are now widespread, the details in ISO 14819-6 have now been merged within this document and consequently ISO 14819-6 has been withdrawn.

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Intelligent transport systems — Traffic and travel information messages via traffic message coding —

Part 1:

Coding protocol for Radio Data System-Traffic Message Channel (RDS-TMC) using ALERT-C

1 Scope

The ALERT-C protocol is designed to provide mostly event-oriented road end-user information messages.

This document specifies the messages which are presented to the user in accordance with a set of general requirements. It defines the message structure and content and its presentation to the end-user.

The message management component of this document describes the message management functions of RDS-TMC. The ALERT-C protocol distinguishes between user messages and system messages. User messages are those potentially made known to the end-user, as defined in [Clause 5](#). System messages are of use only to the RDS-TMC terminal, for message management purposes.

RDS-TMC information comprises both 'system information' and 'user messages'. System information relates to the TMC service and details the parameters that the terminal needs to be able to find, identify and decode the TMC information. System information is transmitted in type 3A groups and in type 8A groups.

User messages contain the details of the traffic events; these may use one or more type 8A groups. Most messages may be transmitted using a single type 8A group, however messages with more detail (e.g. diversion advice) may use up to a total of five, type 8A groups.

The transmission component of this document conveys the messages over-air. The ALERT-C protocol, used by RDS-TMC, has the fundamental approach of aiming to code most messages entirely within a single RDS group.

The ALERT-C Event List, which contains all event descriptions, is described in ISO 14819-2.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 4217, *Codes for the representation of currencies*

IEC 62106 (all parts), *Radio data system (RDS) — VHF/FM sound broadcasting in the frequency range from 64,0 MHz to 108,0 MHz*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1.1

access profile

ACP

unique description of a particular RDS-TMC service and subscription period

3.1.2

alternative frequency

AF

frequency used by a transmitter in an immediately adjacent area that carries the same audio programme service as the tuned programme

Note 1 to entry: Several AFs are transmitted together in a list. Where the TMC service uses the same Network as an audio service, this AF list is also used for following the TMC service.

3.1.3

application identification

AID

identification that signals the specific group type used by the *open data application* ([3.1.23](#))

3.1.4

continuity index field

field that helps to distinguish between different multi-group messages

Note 1 to entry: All groups within any particular multi-group message contain the same value of this continuity index.

3.1.5

country code

CC

non-zero integer transmitted as the *location table country code (LTCC)* ([3.1.21](#)), or if that value is zero, the *programme identification country code (PICC)* ([3.1.27](#))

3.1.6

direction and extent

identifier for adjacent segments or specific point *locations* ([3.1.17](#)) also affected by the incident, and where appropriate the direction of traffic affected

3.1.7

diversion advice

advice showing whether end-users are recommended to find and follow an alternative route

3.1.8

duration

indication of how long the problem is expected to last

3.1.9

encryption identifier

ENCID

value indicating which line in the *service key* ([3.1.30](#)) table of parameters the service provider is using in the encryption process that day

Note 1 to entry: The encryption identifier is transmitted in type 8A group variant 0.

3.1.10**end-user**

all possible *terminal* (3.1.33) clients

EXAMPLE a vehicle driver, a user of a portable or fixed TMC receiver or an intelligent client that processes the information such as in a navigation system.

3.1.11**event description**

description giving details of the traffic problem (e.g. congestion caused by an accident) and where appropriate its severity (e.g. resulting queue length) or weather situation

3.1.12**Event List**

agreed table of *event descriptions* (3.1.11) and parameters, assigned an event code value giving details of traffic problem (e.g. congestion caused by accident) and where appropriate its severity (e.g. resulting queue length) or the weather situation

Note 1 to entry: The Event List is found in ISO 14918-2.

3.1.13**expiry date**

date determined by the service provider on which a particular *terminal's* (3.1.33) ability to decrypt an encrypted service should cease (i.e. the end of the paid subscription period)

3.1.14**extended country code****ECC**

non-zero 8-bit code transmitted as the location extended table country code (LTECC), or if that value is zero, or not transmitted, the extended country code (ECC), transmitted in RDS type 1A group

3.1.15**foreign location table**

location table (3.1.18) which is different from the default location table used by the transmitter

3.1.16**INTER-ROAD**

messaging system for referencing *locations* (3.1.17) from other *location tables* (3.1.18) via special multi-group messages

Note 1 to entry: These messages are used to inform *end-users* (3.1.10) about problems in other areas, particularly in neighbouring countries or regions.

3.1.17**location**

indication of the area, road segment or point location where the source of the problem is situated

3.1.18**location table**

agreed location table for each service which contains information to indicate the area, road segment or point *location* (3.1.17) where the source of the problem is situated

3.1.19**location table number****LTN**

integer number 1...63 used to identify the *location table* (3.1.18)

Note 1 to entry: The LTN is transmitted in type 3A groups.

3.1.20

location table number before encryption

LTNBE

integer number 1...63 used to identify the *location table* (3.1.18) used by the service provider prior to the codes within the table being encrypted for transmission

Note 1 to entry: The LTNBE is transmitted in type 8A groups.

3.1.21

location table country code

LTCC

code (in the range 1..F [hex]) assigned to each *location* (3.1.17) database, based on the country/countries the TMC service covers

3.1.22

location table extended country code

LTECC

code (in the range 10..F [hex]) assigned to each *location* (3.1.17) database, based on the country/countries the TMC service covers

Note 1 to entry: Together the LTECC, LTCC and LTN identify a location database uniquely.

3.1.23

open data application

ODA

application which provides the means for adding applications to an RDS transmission

3.1.24

other network

ON

RDS feature

3.1.25

PIN code

numeric or alphanumeric code required to be entered into a *terminal* (3.1.33) before that terminal is permitted to present decrypted RDS-TMC messages

Note 1 to entry: The value of the PIN code is calculated by the terminal manufacturer from an algorithm using terminal *serial number* (3.1.28) and one or more *access profiles* (3.1.1) as factors.

3.1.26

programme identification

PI

identification which assigns a code to each audio programme source

3.1.27

programme identification country code

PICC

first four bits of the 16-bit *programme identification* (3.1.26) code

Note 1 to entry: Usually the programme identification country code and the *location table country code* (3.1.21) on an RDS-TMC transmission have the same value, but not always nor necessarily.

3.1.28

serial number

alphanumeric identifier, unique to a *terminal* (3.1.33) (or group of terminals), determined by the manufacturer

3.1.29**service-ID****SID**

ID that is used to uniquely identify a TMC service from a service provider

3.1.30**service key****SVK**

number given in confidence by a service provider to a *terminal* (3.1.33) manufacturer, identifying which one of eight possible encryption tables the service is using for encryption

Note 1 to entry: The service key is not transmitted.

3.1.31**silent cancellation message**

description which is used to delete messages from the *end-user* (3.1.10) *terminal* (3.1.33)

3.1.32**system information**

information that enables an RDS-TMC *terminal* (3.1.33) to decode and evaluate essential data, which describes the transmission being received

Note 1 to entry: System information indicates an RDS-TMC service and comprises some service characteristics needed to select the RDS-TMC service.

3.1.33**terminal**

device that provides the user interfaces with the TMC service

Note 1 to entry: The functionality of the terminal covers a range of functions from simple terminals with a limited message repertoire and restricted *location* (3.1.17) database to more sophisticated terminals offering full TMC message features and/or a wide range of strategic and tactical location databases.

3.1.34**tuning information**

information that enables an RDS-TMC *terminal* (3.1.33) to change from one transmitter to another at boundaries of a transmitter's coverage

3.1.35**user message**

message that is potentially made known to the *end-user* (3.1.10)

Note 1 to entry: User messages contain descriptions of event, *location* (3.1.17), *direction and extent* (3.1.6), *duration* (3.1.8), etc.

3.1.36**Traveller Information Services Association****TISA**

not-for-profit membership organization established under Belgian law aimed at developing and maintaining worldwide traffic and traveller information standards such as TMC and TPEG

3.2 Abbreviated terms

AFI	alternative frequency indicator
ALERT-C	Advice and Problem Location for European Road Traffic, Version C
BCD	binary coded decimal
CT	clock time

EBU	European Broadcasting Union
ECMT	European Conference of Ministers of Transport
FLT	foreign location table
IVR	interactive voice response
MGS	message geographical scope
RDS	radio data system
rfu	reserved for future use
TMC	traffic message channel
TN	tuned network
UTC	Universal co-ordinated time

4 Application

4.1 General

Spoken broadcast traffic messages provide a valuable information service to motorists in countries throughout the world. The widespread adoption of the Radio Data System (RDS) enables traffic messages to be carried digitally and silently using the Traffic Message Channel (TMC) feature of RDS, specified in this document, without interrupting the audio programme.

The ALERT-C protocol defined in this document supports a digital, silent broadcast service for motorists, providing information about many kinds of traffic events. This includes roadworks, weather and traffic incident information relating to major national and international routes, regional routes and local roads.

Some basic information about public transport is included within the scope of the current protocol for the special case of ferries and short rail links designed to carry road vehicles, such as Alpine tunnels or the Channel Tunnel.

4.2 Definition of the TMC "travel service"

ALERT-C defines the TMC as a travel service digitally and silently broadcast using RDS, which provides an end-user with:

- event orientated end-user information on the nature, severity and probable evolution of both urban and interurban traffic problems;
- reduced frustration and uncertainty due to this provision of timely and helpful information;
- assistance with journey planning, including rerouting and rescheduling of trips to avoid current or projected strategic traffic situations;
- details of local traffic incidents which can be avoidable using minor diversions;
- status-orientated information on traffic conditions which can help to support intelligent on-vehicle route guidance equipment; and
- additional data on roadside amenities and tourism information which can in future complement and update on-vehicle mobile databases.

4.3 TMC virtual terminal

Information broadcast digitally and silently can only be interpreted by suitable RDS-TMC terminals. These RDS-TMC terminals provide the user interfaces with the TMC service. Their functionality can vary substantially according to technical developments and market requirements, which cannot be wholly predicted in advance. Instead, a virtual terminal model is defined which covers a range of terminal functions, including:

- simple terminals with a limited message repertoire and restricted location database;
- more sophisticated terminals offering full TMC message features and/or a wide range of strategic and tactical location databases;
- terminals which monitor only a single, selected TMC service, and others which employ more sophisticated search strategies of several or many channels;
- terminals which are active before the start of a journey, and others which acquire their TMC data after the journey begins; and
- terminals which provide output via speech synthesis and/or visual displays, and others which interface to more sophisticated on-vehicle route guidance equipment.

4.4 Event-orientated end-user information messages

The ALERT-C protocol defines only event-orientated end-user information messages. Provision is also made for the subsequent definition of other types of message, such as status-orientated route guidance information, or such other applications as may be desired in future.

End-user information messages are those designed primarily to service an in-vehicle terminal, offering information directly to end-users via speech synthesis and/or displays. Terminals can also be used in home and office terminals or public access terminals, to assist in pre-trip journey planning.

Event-orientated messages describe deviations from the normal traffic equilibrium state, and include problems such as congestion, roadworks, adverse weather conditions, accidents, ferry delays or cancellations, etc.

4.5 Strategic and tactical information

ALERT-C distinguishes between strategic information, of value for trip planning and route selection in the medium term, and tactical information likely to be of relevance for immediate local diversions around current traffic problems.

In more detail, broadcast traffic information comprises:

- a) immediate "tactical" information, for transmission as soon as possible, with frequent repeats;
- b) medium-term "strategic" information, for transmission at intervals, according to available channel capacity;
- c) long-term "background" information, for transmission from time to time;
- d) forecasts such as weather and expected road conditions, traffic density, coming events; and
- e) tourist and other messages, including public transport information, which can be relevant for motorists.

The ALERT-C protocol follows these guidelines, aiming to allow as many as possible of the existing spoken messages to be carried in similar forms using the digital TMC medium.

4.6 Geographic relevance

ALERT-C utilizes location coding strategies prepared in guidelines developed within the DRIVE Project. These guidelines adopt hierarchical principles of structuring the location database in accordance with EBU Broadcasts for Motorists group functional recommendations for strategic and tactical messages. This is dealt with in ISO 14819-3.

This protocol does not address the internal management of traffic messages by broadcasters in respect to geographical relevance. In the following, it is assumed that broadcasters will arrange to transmit messages with a priority that is appropriate to their geographical relevance. This means that the frequency with which a message is inserted into the message cycle is not only dependent on the event, but is also a function of the location in relation to the broadcasting area.

Extremely urgent messages (X-messages) shall be included by all relevant services that cover the respective area in which the X-message is located.

4.7 Transmitted message priority

Message priorities used by broadcasters adopting RDS-TMC should follow the current approach set out in the EBU Guidelines on Broadcasts for Motorists, revised June 1990. In the context of RDS-TMC, this may be interpreted as the following range of transmitted message priorities:

- a) **Extremely urgent information** with highest priority, for immediate broadcast, interrupting existing RDS-TMC message cycles, with very frequent repeats;
- b) **Tactical information**, for non-delayed broadcast, with frequent repeats;
- c) **Strategic information**, broadcast at intervals according to RDS-TMC channel capacity; and
- d) **Background information**, broadcast less frequently, when channel capacity permits.

The ALERT-C protocol does not address the internal management of traffic messages by broadcasters in respect of broadcast message priority. The protocol assumes that broadcasters will arrange to transmit messages at the appropriate level of priority using existing procedures such as those defined by the EBU Guidelines on Broadcasts for Motorists, revised June 1990.

RDS is a single direction broadcast system – and hence a service provider has no means of knowing if any RDS data has been successfully and correctly received by any RDS audio receiver or TMC terminal.

Several factors, including the topology of the broadcasting area, the insertion level of the RDS data signal and the location of a terminal affect its ability to receive RDS information. To optimize the possibility of a terminal receiving RDS data, all RDS groups are transmitted more than once, either immediately or periodically.

For information that is static (or static for lengthy periods), RDS groups are repeated periodically, the period between successive repeated groups may be several minutes.

For data relating to dynamically changing situations (e.g. traffic conditions), the appropriate RDS-TMC groups are repeated in quick succession. Typically, a type 8A RDS-TMC message group is transmitted, followed by between three and eleven non-TMC groups, then an exact repeat of the type 8A RDS-TMC message, another gap of between three and eleven non RDS-TMC message groups, and finally another repeat of the RDS-TMC message group. The transmission of groups according to this so-called 'immediate' repetition pattern was shown in field trials to be optimal for a terminal to acquire RDS data.

In this ALERT-C protocol, a terminal is required to receive at least two identical RDS-TMC groups, through either immediate or periodic repetitions, before it may accept the data as being valid (see [7.3](#) and [9.4](#)).

The protocol does address the separate question of message urgency within the decoder (see [5.4.5](#)). This aspect of the protocol can be used by terminal manufacturers to determine how a terminal will respond when it receives an RDS-TMC message. Depending on the duration type of the event (see Explanatory

notes in the Event List), a message is defined as dynamic or longer-lasting. Dynamic messages may be inserted more often in the periodic repetition cycle and shall be updated more often in relation to their duration. Longer-lasting messages may be transmitted less frequently.

4.8 Event List

For the purposes of event-orientated end-user-information messages, ALERT-C protocol utilizes a standard international list of traffic related event descriptions and weather information (see ISO 14819-2).

4.9 Future extensions

Provision is made for future extensions to the protocol:

- using the location numbers reserved in the upper part of the location tables; and
- by means of code combinations left unused in the present coding (e.g. continuity index 000 and 111).

5 Presentation

5.1 General

[Clause 5](#) specifies messages which may be presented to the end-user in accordance with the general requirements set out in the application component. It defines the message structure and content, and its presentation to the end-user.

5.2 TMC virtual language

TMC information is conveyed using a "virtual language" in which the codes broadcast over-air comprise addresses of information stored in databases in the terminals. These databases contain lists of road event situations, including general traffic problems and weather situations, advice, durations and other information, plus lists of locations, including intersections, road numbers and place names.

Several processes are involved in [Clause 5](#):

- a) before transmission, information concerning an event is mapped into the TMC virtual language by selection from nested menus of event descriptions and other items, or by a fully-automated traffic monitoring and reporting system;
- b) the resulting coded messages are transmitted via RDS, with frequent repetitions;
- c) in the terminal, the TMC codes are checked to see if they contain new information or are updates of already received messages. New codes are stored in memory and are subject to message management; and
- d) at appropriate times the codes are translated back into messages using look-up tables for presentation to the end-user.

In this virtual language concept, the Event List used at the source and those used in an individual terminal are not necessarily identical. For example, the messages may be input in one language and reproduced in another. Translated event descriptions are maintained by the Traveller Information Services Association (www.tisa.org).

Much of the information conveyed by the codes is implicit and is derived from secondary look-up tables stored in the terminals. These tables are not addressed by explicit fields in the broadcast information, but are derived from the context of the message itself combined with information from the message management and other RDS codes defined in IEC 62106 (all parts).

5.3 Message content

5.3.1 General

The ALERT-C protocol defines two categories of information within messages: basic and optional items. In principle, basic information items are present in all messages. Optional information may be added to messages where necessary.

Distinction is also made between explicit and implicit information. Explicit information is broadcast directly using defined codes. Implicit information is derived from the secondary look-up tables stored within the terminal, which only occasionally will be explicitly overruled using optional, additionally transmitted codes.

RDS-TMC user messages provide the following five basic items of explicit, broadcast information:

- a) **Event description**, giving details of the weather situation or traffic problem (e.g. congestion caused by accident) and where appropriate its severity (e.g. resulting queue length);
- b) **Location**, indicating the area, road segment or point location where the source of the problem is situated;
- c) **Direction and extent**, identifying the adjacent segments or point locations also affected by the event, and where appropriate the direction of traffic affected;
- d) **Duration**, giving an indication of how long the problem is expected to last; and
- e) **Diversion advice**, showing whether end-users are recommended to find and follow an alternative route.

5.3.2 Event description (11 bits)

The event descriptions used by this document are listed in the Event List (ISO 14819-2). Many event descriptions are single phrase descriptions. In addition to these, the Event List contains event descriptions in which two or more phrases have been combined, so that they may be used (similarly as a single phrase description) in a single-group message. The event descriptions in the Event List are grouped into update classes. These are used to regulate updating and cancellation of messages (see [6.4](#) and [6.5](#)). Several attributes are attached to each event description in the Event List. These are described in [5.4](#) and in the Explanatory notes in the Event List.

5.3.3 Primary location (16 bits)

Where the source of a problem (e.g. an accident; a bottleneck) occurs at a defined TMC location, its primary location may be broadcast using the relevant location number.

Where the source of a directional problem (e.g. queue) occurs between two TMC point locations, its primary location may be broadcast using the location number of the nearest downstream point, measured in the direction of traffic affected.

Where such an event is defined to be bi-directional (see [5.4.6](#)) its primary location may be broadcast using either of the two nearest defined TMC locations which straddle the event.

Where a terminal receives a TMC message referring to a location not included in its database, it shall produce no message output to the end-user.

The highest 2048 location numbers shall not be used for geographical objects. They are reserved for special purposes. Some of these numbers are used in 'INTER-ROAD' messages to indicate the number of a foreign location table (i.e. a location table different from the default table used by the transmitter, see [6.7](#)).

Other location numbers with a special function are:

- number 65533: indicates that the message is intended for all listeners, regardless of their position or destination and regardless of any geographic selection filter they may have activated in their terminal. This may be used for general, not necessarily urgent, information about the TMC-service, or for countrywide severe weather warnings. Instead of the location name, a terminal may present a phrase such as '(message) for all users';
- number 65534: 'silent' location code (again ignoring any geographic filter in a terminal), to indicate that no location name or alternative phrase shall be presented at all. This may also be used for general information messages, and may be useful for some other purposes; and
- number 65535 (the highest 16-bit number): for location-independent updating or cancelling of messages.

Messages with location 65533 and 65534 are subject to the normal updating rules given in 6.4, i.e. they may only overwrite, or be overwritten by, messages with the same special location number, provided that also the other rules in 6.4 are satisfied.

5.3.4 Direction and extent (4 bits)

5.3.4.1 General

This information within messages identifies the direction (1 bit) and a location extent (3 bits) of up to seven "steps" through adjacent, defined TMC locations also affected by the event. The last step in this chain identifies a secondary TMC location, which, together with the primary location, straddles the event.

5.3.4.2 Direction (1 bit)

The direction bit (0 = positive, 1 = negative) shall indicate the direction of queue growth for all event types defined as directional, i.e. it is opposite to the direction of traffic flow affected. The convention specifying positive and negative directions along each road shall be fixed at the time of coding the definitive location database.

When an event is defined bi-directional, thus affecting both directions, the direction bit is only used for locating the secondary location (5.3.4.3).

5.3.4.3 Extent (3 bit)

The extent identifies a chain of up to seven steps through adjacent defined TMC locations, also affected by the event. The last step in this chain identifies the secondary location, which together with the primary location straddles the event.

When the event affects only one TMC location, the extent is zero.

Where occasionally the event affects more than seven adjacent point locations, they should normally be described at the segment level as being located within one or more segments. If exceptionally this is not adequate, further locations affected may be defined using optional additional information (see 5.5.2), adding up to 24 steps to the chain of steps.

5.3.5 Duration (3 bits)

The duration code in messages provides for eight levels of expected continuation of the problem. The interpretation of the duration code depends on the nature and the duration type of the event as defined in the Event List (see ISO 14819-2; see also 5.4 of this document).

For single-group messages, the duration is a basic item, coded in a pre-allocated 3-bit field (see also 7.4). For multi-group messages, the duration is an optional item (see 5.5). Also, more detailed stop-times and start-times of problems may be defined within multi-group messages (see 9.4).

Estimating a valid duration is often difficult. Also, the information can be distracting, especially if it is of limited accuracy. Therefore, use of Code 0 in the first three following tables is recommended wherever there is uncertainty about duration. Where end-users can reasonably make their own assumptions about the likely duration, Code 0 should be used. Finally, terminal manufacturers may choose to make the presentation of duration a user-selectable option. The non-spoken duration is coded as 0 and is not allowed in multi-group messages.

In the case of dynamic events with an 'information' nature (as specified in the Event List [ISO 14819-2]), the duration code indicates periods relating to an end-user's current journey. These durations are defined as: "The situation is expected to continue for..."

Code	Meaning	Decrement?
0	(no explicit duration to be given)	do not decrement
1	for at least the next 15 minutes	do not decrement
2	for at least the next 30 minutes	decrement after 15 minutes
3	for at least the next 1 hour	decrement after 30 minutes
4	for at least the next 2 hours	decrement after 1 hour
5	for at least the next 3 hours	decrement after 1 hour
6	for at least the next 4 hours	decrement after 1 hour
7	for the rest of the day	do not decrement

Dynamic events with a 'forecast' nature shall be accompanied by durations that indicate how soon the situation is expected. These durations are defined as:

Code	Meaning	Decrement?
0	(no explicit start-time to be given)	do not decrement
1	within the next 15 minutes	do not decrement
2	within the next 30 minutes	decrement after 15 minutes
3	within the next 1 hour	decrement after 30 minutes
4	within the next 2 hours	decrement after 1 hour
5	within the next 3 hours	decrement after 1 hour
6	within the next 4 hours	decrement after 1 hour
7	later today	do not decrement

Some events are expected to last for longer periods, as identified in the Event List. In the case of information events, these durations are defined as "The situation is expected to continue..."

Code	Meaning	Decrement?
0	(no explicit duration to be given)	do not decrement
1	for the next few hours	do not decrement
2	for the rest of the day	do not decrement

3	until tomorrow evening	decrement at midnight
4	for the rest of the week	decrement Friday midnight
5	until the end of next week	decrement Sunday midnight
6	until the end of the month	do not decrement
7	for a long period	do not decrement

Longer period events described in the Event List as 'forecast' events shall be accompanied by time horizons, which indicate when the situation is expected. These durations are defined as:

Code	Meaning	Decrement?
0	(no explicit time horizon given)	do not decrement
1	within the next few hours	do not decrement
2	later today	do not decrement
3	tomorrow	decrement at midnight
4	the day after tomorrow	decrement at midnight
5	this weekend	do not decrement
6	later this week	do not decrement
7	next week	do not decrement

As indicated above, some duration codes shall be decremented in the terminal at the end of each time period specified. For this purpose, RDS type 4A group shall be transmitted and used as time base.

Each new week starts at midnight on Sunday evening (i.e. 00:00, Monday morning, see ISO 8601-1 and ISO 8601-2).

Thus, "the end of next week" shall be decremented within the terminal to "the rest of the week" at midnight on Sunday evening. "Until tomorrow evening" shall be decremented to "for the rest of the day" at midnight on the day of message receipt. "For at least the next four hours" shall be decremented to "at least the next three hours" one hour after it was last received. This will ensure that a terminal will present reasonable durations or time horizons even if it could not update the respective message.

The infrastructure is also expected to decrement the duration at the times indicated above (duration countdown).

For international message exchange and for transmission, Co-ordinated Universal Time (UTC) shall be used. For presentation to the end-user, local time (based on the time zone at the terminal side) shall be used.

Some messages in the Event List are allocated a default of "no explicit duration to be given". With these messages, any permitted value defined above may be used to set persistence (see [6.5.2](#)).

The duration type specified in the Event list may be overridden using control codes defined in [5.5.3](#).

5.3.6 Diversion advice (1 bit)

The diversion bit, included in single-group messages only, indicates whether end-users are recommended to find and follow an alternative route around the traffic problem described elsewhere in the message. The messages are defined as:

Code	Meaning
0	(no diversion recommended)
1	end-users are recommended to avoid the area if possible.

For multi-group messages where the diversion bit is not present, a control code is defined, which has the same effect as the diversion bit (see [5.5.3](#)). If pre-defined diversion routes exist, they may be given to the end-users.

With bi-directional events, pre-defined diversion advice is given only for one direction (from secondary to primary location), as it is not always possible to decide whether diversion advice for the opposite direction is also wanted.

5.4 Implicit information

5.4.1 Road class and road number

See ISO 14819-3.

5.4.2 Road segment

See ISO 14819-3.

5.4.3 Area, region and country

See ISO 14819-3.

5.4.4 Pre-assigned diversion advice

In some countries, motorway diversions are pre-assigned. These diversion routes may be stored in the terminal memory along with the location and extent codes that address them. Thus, if the diversion bit is set, this route may be recommended to the end-user (see [5.3.6](#)).

5.4.5 Urgency within the terminal

Each of the event descriptions listed in the Event list carries one of three levels of default urgency stored within the terminal:

- X Extremely urgent, (present to all end-users immediately).
- U Urgent, (present to end-users having selected this location, immediately).
- (blank) Normal urgency, (make available to end-users on request).

Manufacturers are expected to use these levels to implement features that draw the end-user's attention to specific messages, according to their urgency.

The urgency of a multi-event message (see [5.5.9](#)) is equal to that of the most urgent of the constituent events.

It is also possible to transmit any message with an urgency other than its default, by using an optional additional control code (see [5.5.3](#)). The service providers are responsible for deciding which priority a given message should have, based not only on the urgency but also on location in relation to the service area (see [4.6](#)).

5.4.6 Directionality

Each event description listed in the Event List has one of two default indications of direction, which may indicate either:

- a) only one direction of traffic affected (indicated by the direction bit, see [5.3.4.2](#)); or
- b) both directions affected by the event.

A multi-event message that contains any unidirectional event, is by default unidirectional.

The unidirectional default code may be overruled by explicitly sending two separate messages, one for each direction of traffic flow. The ALERT-C protocol also provides for an optional, additional control code that inverts the default directionality of a message, as defined in [5.5.3](#). If a bi-directional message is applied to a point location along a road, or to a road or road segment (as defined in ISO 14819-3), it should be made clear in presenting the message to the end-user (by additional words or other means) that both directions of traffic are affected.

5.4.7 Duration type

Each event code carries one of two duration types, defined in the Event list. These indicate whether an event is normally expected to be dynamic, or longer lasting. Interpretation of the duration field depends on this parameter. An optional, additional control code may invert the normal duration status (see [5.5.3](#)).

5.4.8 Nature

Each event description is defined as information or a forecast description in the Event List. Some event descriptions are defined as silent, i.e. they produce no spoken message. Their functions are described in [Clause 6](#).

5.4.9 Update class

Each event code belongs to an update class in the Event List. This is used for message management, e.g. updating or deletion of messages.

5.4.10 Quantifier type

Some event descriptions have an additional quantifier, of which the type is specified in the Event list (see also [5.5.6](#)).

5.5 Optional message content

5.5.1 General

Optional information may be added to any message using one or more additional RDS groups. This optional addition may give greater detail or may deal with unusual situations. Any number of additional fields may in principle be added to each basic message, subject only to a maximum message length of five RDS groups (see [7.2](#)).

A 4-bit label specifies each of sixteen types of additional information. Each label is followed by a data field of defined length. The label types and data field lengths are as follows:

Label	Data field	Type of information
0	3 bits	Duration (code 000 is not allowed for optional content)
1	3 bits	Control code

2	5 bits	Length of route affected
3	5 bits	Speed limit advice
4	5 bits	Quantifier
5	8 bits	Quantifier
6	8 bits	Supplementary information code
7	8 bits	Explicit start time (or time when problem was reported) for end-user information only
8	8 bits	Explicit stop time for end-user information and message management
9	11 bits	Additional event
10	16 bits	Detailed diversion instructions
11	16 bits	Destination
12	16 bits	Precise location reference
13	16 bits	Cross linkage to source of problem, on another route
14	0 bits	Separator
15	6 bits	Other information as defined by sub-labels

5.5.2 Combination of additional information

In composing multi-group messages, a service provider shall satisfy the following rules:

- a) label 0, label 7, label 8, label 13 and each control code under label 1 (see 5.5.3) may be used only once per message (this implies the maximum problem extent $7 + 8 + 16 = 31$ steps);
- b) label 14 may be used as a separator between different parts of a message ("information blocks"). Some types of additional data fields are allowed only once per information block (see below), to avoid ambiguity. Separators can be helpful for terminals to make messages easier to understand for end-users, by grouping the message content syntactically. For instance, a terminal could use label 14 to make a short pause in spoken output;
- c) the following labels may be used at most once per information block (i.e. before the first separator, between two subsequent separators, after the last separator, or per message if the message contains no label 14):
 - label 2 (length of route affected);
 - label 3 (speed limit advice).
- d) the remaining labels (4, 5, 6, 9, 10, 11, 15) may be used more than once (see further clauses for the use of these labels); and
- e) if a detailed diversion route is valid for one or more specific destinations only, the destination(s), i.e. a label 11 plus data field for each, shall immediately precede the (first) diversion instruction (i.e. label 10 plus data field). If destination(s) are used in connection with other (e.g. supplementary) information, they shall not directly be followed by label 10 (in such cases a separator before label 10 is recommended). If the diversion bit is set (with label 1, code 5), then an additional detailed diversion route may only be given for (a) specific destination(s), and the use of a separator (label 14) between label 1 and the subsequent labels 11 and 10 is recommended (see also 5.5.11 and 5.5.10);
- f) label 15 shall only be used as the last label.

5.5.3 Control codes (label 1)

Each control code may be applied only once to any message. Their meanings are as follows; a detailed description is defined in [Clause 6](#).

ALERT-C defines eight terminal control codes that may be used in a 3-bits field following label 1 in any multi-group message. Their meanings are:

Code	Meaning
------	---------

0	Default urgency increased by one level
1	Default urgency reduced by one level
2	Default directionality of message changed
3	Default dynamic or longer-lasting provision interchanged
4	Default spoken or unspoken duration interchanged
5	Equivalent of diversion bit set to "1"
6	Increase the number of steps in the problem extent by eight
7	Increase the number of steps in the problem extent by sixteen

Regarding Codes 0 and 1, urgency changes shall also wrap around so that increasing the most urgent level creates the least urgent of the three, and vice-versa.

Regarding Code 2, messages are either directional or bi-directional. Use of Code 2 reverses this status.

Code 3 changes the timescale of events, from dynamic to longer term or vice-versa.

Code 4 changes the default spoken duration from spoken to unspoken or vice-versa.

Use of Code 5 shall be equivalent to setting the diversion bit to "1" in a single-group message (see also [5.3.6](#)).

Codes 6 and 7 deal with problems which extend further than is provided in the message problem extent field. When Code 6 is appended to a message, the number of steps indicated in the message shall be increased by eight. Code 7 provides for a further eight steps, where necessary, increasing the number of steps by sixteen.

5.5.4 Length of route affected (label 2)

The length of route affected may be added (at most once per information block), for use with events that do not already contain this information. The meaning of the data codes is as follows:

0	Problem extends for more than 100 km
1-10	Length of problem from 1 km to 10 km (1 km interval)
11-15	Length of problem from 12 km to 20 km (2 km interval)
16-31	Length of problem from 25 km to 100 km (5 km interval)

5.5.5 Speed limit (label 3)

One speed limit advice per information block may be added to any message. The meaning of the data codes is as follows:

1-26	Maximum speed from 5 km to 130 km/h (5 km/h interval)
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5.5.6 Additional quantifiers (labels 4 and 5)

Some event descriptions have an additional quantifier, of which the type is specified in the Event list. Label 4 shall precede a 5-bit quantifier field and label 5 an 8-bit quantifier field. Which one is to be used depends on the event; see the Event List.

5.5.7 Supplementary information (label 6)

One or more supplementary phrases may be added to any message, using the codes defined in ISO 14819-2.

5.5.8 Start and stop times (labels 7 and 8)

One start-time and/or one stop-time may be added once to any message. Time and date codes shall use Co-ordinated Universal Time (UTC) and Modified Julian Day (MJD). The presentation will not use this information directly, but conversion to local time and date will be made in the terminal's circuitry. For this purpose, RDS type 4A groups shall be transmitted and used to determine the local time. The meanings of the start and stop time codes are as follows:

0-95	00:00 to 23:45 (15 minute interval)
96-200	Hour and day, starting at midnight following message receipt (1 hour interval)
201-231	1 st to 31 st day of the month (1 day interval)
232-255	15 th to 31 st December (half month interval)

A data code in the range 0-95 indicates a time during the current day. For example, a start time received at 09:00 with a code of 42 means "problem expected from 10:30 this morning" whereas the same code received at 11:00 means "problem reported at 10:30 this morning".

A data code in the range 96-200 indicates a time within the next few days. For example, a stop time received at 09:00 on Friday with a code of 153 means "until 09:00 Monday". A start time of 153 means "from 9:00 Monday". These codes shall be updated by broadcasters at midnight each day (i.e. at 00:00 UTC), by decrementing the code by 24. If the result in a code is less than 96, the appropriate code in the range 0 - 95 is to be calculated. For example, a stop time with code 153 first transmitted on Friday will be decremented to 129 on 00:00 Saturday, to 105 on 00:00 Sunday and to code 36 on 00:00 on Monday.

A data code in the range 201-231 indicates a date during the next 31 days. For example, a stop time received on the 20th August with a code of 218 means "until 18th September".

A data code in the range 232-255 indicates a date during the next 12 months. For example, a stop time received in September with a code of 236 means "until mid-March next year" while 239 means "until the end of April next year".

Start times are for end-user information only, and do not affect terminal message management. Stop times override the normal terminal message management strategy, defined in 6.4, as well as providing an explicit announcement to the end-user.

5.5.9 Multi-event messages (label 9)

With label 9, one or more additional event codes may be added to any message, forming a multi-event message with the event coded in the first message group. The primary location, direction and extent given in the first group (see 5.3) apply to the whole message.

A multi-event message shall not contain a silent event (i.e. an event indicated by 'S' in the Event List).

If a multi-event message contains a duration code (following label 0), this code shall be interpreted, as described in 5.3.5, according to the nature and duration type (see Event List) of the last event preceding the label 0 in the sequence of additional information. (This last preceding event may be the first-group event).

Any quantifier (following label 4 or 5) added to a multi-event message shall be taken to apply to the last event (which may be the first-group event) preceding the quantifier in the sequence of additional information. If this last preceding event does not allow for a quantifier, or only for a quantifier with a different field length, or has already been matched to a quantifier, the given quantifier shall be ignored.

The urgency of a multi-event message is equal to that of the most urgent of the constituent events. If all constituent events are bi-directional, the multi-event message is bi-directional, otherwise it is unidirectional.

5.5.10 Detailed diversion instructions (label 10)

Information about a diversion route may be given by adding one or more locations along that route to the message. Each location along the diversion shall be identified by label 10 followed by a 16-bit location code, which refers to the same TMC location table database as that used for the same primary location in the message.

Up to three different diversion routes may be specified, preferably separated by label 14, and subject to the maximum of five groups per message. The second (and, if present, the third) route may only be given for specific destination(s), which means that the label(s) 10 and location(s) specifying that route shall be preceded by at least one label 11 plus location code (see also 5.5.2, rule e) and 5.5.11). The locations along one diversion route shall be given directly after one another, i.e. with no labels other than 10 in between.

The first location along the detailed diversion should be interpreted as "Diversion recommended via (location)", and subsequent locations as "... and then via (location)". The sequence of points along the diversion shall be the same as the sequence of diversion fields in the message.

Where detailed diversions are recommended in both directions, separate messages shall be used for each direction.

5.5.11 Destinations (label 11)

In particular cases, general diversion advice (code 5 under label 1), a detailed diversion (see above) or other instruction or advice (under label 3, 6 or 9) can be relevant only for traffic heading for one or more particular destination(s). Each such destination may be indicated using label 11 followed by a 16-bit location code (referring to the same database as the primary location). The destination(s) is/are then followed by the information to which they apply (which are all items until the next label 11 or 14 or the end of the message). See 5.5.2 for some additional rules.

A destination given at the end of an information block applies to preceding information, which may be or include the first group event, e.g. a trip/journey time (from the primary location to that destination).

A destination shall be interpreted as "for traffic heading towards (location)", but directly following one label 11 as "... and (location)".

5.5.12 Precise location reference (label 12)

5.5.12.1 General

Any message may be sent with a precise location reference. The precise location reference gives the location of the start and end of the event with reference to an existing TMC primary location (see ISO 14819-3).

The data sent as label 12 shall specify the hazard distance (D1) and information on reliability, status and direction of change of the hazard point. Label 12 may only be used once per message.

If the traffic problem has non-zero length, one of the following two options shall be used to indicate its length: proper choice of event code, or Optional Message Content label 2 (Length of route affected), which requires the use of an additional group.

When the TMC message contains more than 1 event, then, if used, the precise location reference shall be the maximum distance D1 of all actual locations of the individual events which are contained in the message. Thus, the event with a hazard point closest to the secondary location shall be chosen for the precise location reference.

5.5.12.2 Coding of the hazard distance (D1), reliability, status and direction

The available 16 bits are divided into 11 bits for the description of the distance between hazard location and the pre-defined primary location (with a resolution of 100 m/bit), 2 bits to indicate the accuracy of the reported precise location, and 3 bits to indicate the reliability of the precise information, the type of the problem, and the direction of change of the location. The use of the bits is as follows:

bits 0-10	distance of hazard point location from pre-defined primary location (i.e. distance D1) with 100 m resolution	
bits 12/11	hazard location accuracy:	0/0 = 100 m accuracy or better 0/1 = 500 m accuracy or better 1/0 = 1 km accuracy or better 1/1 = accuracy more imprecise than 1 km
bit 13	hazard location reliability	0 = reliable 1 = approximate (confirmation desired)
bits 15/14	hazard point dynamics	0/0 = static (e.g. road works, black ice, hazard point is stationary) 0/1 = dynamic, approaching (e.g. tail of traffic jam queue, hazard point moves towards the secondary location) 1/0 = dynamic, receding (e.g. tail of traffic jam queue, hazard point moves towards the primary location) 1/1 = dynamics and movement unknown (hazard point may be moving in unknown direction)

5.5.12.3 Coding of the traffic problem length (L)

In case of a non-zero length traffic problem, its length shall be indicated (at choice, depending on the situation) in one of two ways: proper choice of event code (e.g. code 102 to indicate stationary traffic for 1 km) or use of label 2, length of route affected, as defined in 5.5.4.

5.5.13 Cross linkage to source of problem (label 13)

Any message may be cross-linked to another location, which constitutes the source of the traffic problem reported. In this case, instead of the cause of the problem being located at or before the primary location of the main message, it is located near to the cross-linked location.

Use of this option may be illustrated by means of an example. If an accident on Route 1 causes a queue onto Route 2, it can be reported on Route 2 by means of a message "accident, queuing traffic" whose primary location is on Route 2 (at the intersection with Route 1), cross-linked to the actual accident location on Route 1. Any queue length or affected length quantifier for the Route 2 message should give only the affected length on Route 2. The situation on Route 1 may be described by separate messages, which shall not utilize the cross-linkage field.

On receipt of this information the terminal should announce the traffic problems on Route 2, caused by an accident near the specified Route 1 location.

In multi-event messages, the source of problem shall be linked to the last preceding event (which may be the first group event).

5.5.14 Separator (label 14)

Label 14 may be used as a separator between different parts of a message (information blocks). Some types of additional data fields are allowed only once per information block (see below). To avoid ambiguity, separators may be helpful for terminals to make messages easier to understand for end-

users, by grouping the message content syntactically. For instance, a terminal may use label 14 to make a short pause in spoken output.

5.5.15 Other information as defined by sub-labels (label 15)

Label 15 is used to refer to a further range of 64 sub-labels. The sub-labels indicate types of additional information defined as follows:

Label	Sub-label	Data field	Type of Information
15	0		Reserved for future use
15	1		Indicates that the following telephone number is available for users to call to receive telephone-based information from an IVR service.
15	2		Indicates that the following telephone number is available for the user to report information to a service provider.
15	3...62		Reserved for future use
15	63		Reserved for future use

TISA has agreed to coordinate requests to use sub-labels 3...62 in conjunction with label 15.

5.5.16 Reference to telephone services (label 15, sub-label 1-2)

5.5.16.1 General

Sub-labels 1 and 2 in conjunction with label 15 may be used to indicate that the following telephone number is available for users to call to receive telephone-based information (sub-label 1), typically from an IVR service, or contribute information by telephone (sub-label 2).

This indication shall always be made as supplementary information to an event. The indication may be sent as supplementary information to a null event, to the event "travel information telephone service available" or to any other event, and may be sent with any location code, or with location code 65533 or 65534 for presentation as a general information message without any specific location reference.

EXAMPLE "Travel information telephone service available. For more information call 1234 (£0.10/min)" or "Child abduction in progress. To report information call 911 (Free)".

[Table 1](#) describes the structure and order for the data fields to be sent within the free text of a multi-group message. The data fields are described in detail in the following subclauses.

Table 1 — Structure of label 15, sub label 1-2 data

Label: 15
Sub-label: 1 or 2
Telephone number 1
Telephone number 2
...
Telephone number <i>n</i>
<option>
IVR option number 1
IVR option number 2
...
IVR option number <i>n</i>

Table 1 (continued)

<end>
Time unit of call cost
Numerical value of call cost
Currency lookup reference

5.5.16.2 Telephone number

Each telephone number shall be coded as a variable length string. By default the telephone number shall be defined using numbers. Each digit of each telephone number shall be coded as a 4 bit BCD (binary coded decimal) value with the addition of "+", "*" and "#". The value 14 shall indicate that the following values are IVR menu option numbers. The value 15 shall be used to indicate the end of the telephone number or option information. The value 13 shall indicate that the following values are not 4-bit BCD but 5-bit Alpha characters to allow representation of numbers such as "555-INFO". These values are described fully in [Tables 2](#) and [3](#).

Table 2 — Numerical value coding in telephone numbers

Telephone digit	Coded value	
0	0	0000
1	1	0001
2	2	0010
3	3	0011
4	4	0100
5	5	0101
6	6	0110
7	7	0111

Telephone digit	Coded value	
8	8	1000
9	9	1001
+	10	1010
#	11	1011
*	12	1100
<alpha>	13	1101
<option numbers follow>	14	1110
<end>	15	1111

Table 3 — Alpha value coding in telephone numbers

5 BIT CODE		Meaning (text displayed)	Dialled number
0	00000	<switch to numbers>	
1	00001	A	2
2	00010	B	2
3	00011	C	2
4	00100	D	3
5	00101	E	3
6	00110	F	3
7	00111	G	4
8	01000	H	4
9	01001	I	4
10	01010	J	5
11	01011	K	5
12	01100	L	5
13	01101	M	6
14	01110	N	6

5 BIT CODE		Meaning (text displayed)	Dialled number
16	10000	P	7
17	10001	Q	7
18	10010	R	7
19	10011	S	7
20	10100	T	8
21	10101	U	8
22	10110	V	8
23	10111	W	9
24	11000	X	9
25	11001	Y	9
26	11010	Z	9
27	11011	<space> for clarity only	Not Dialed
28	11100	"-" (dash) for clarity only	Not Dialed
29	11101	<Option Letters follow>	
30	11110	<Option Numbers follow>	

Table 3 (continued)

5 BIT CODE		Meaning (text displayed)	Dialled number
15	01111	0	6

5 BIT CODE		Meaning (text displayed)	Dialled number
31	11111	<End of telephone number>	

e.g. To code "555-TRAFFIC" takes 61 bits:

5	5	5	<alpha>	"."	"T"	"R"	"A"	"F"	"F"	"I"	"C"	<end>
5	5	5	13	28	20	18	1	6	6	9	3	31
4 bits	4 bits	4 bits	4 bits	5 bits	5 bits	5 bits	5 bits	5 bits	5 bits	5 bits	5 bits	5 bits

5.5.16.3 Time

The unit of time for the description of the call cost shall be defined with a code comprising 3 bits as in [Table 4](#):

Table 4 — Call cost time period coding

Code		Meaning
0	000	Free
1	001	Per second
2	010	Per minute
3	011	Per hour
4	100	Per call
5	101	Per day (multiple calls on any individual day incur single cost)
6	110	Variable fees apply
7	111	(Undefined) not displayed

e.g.

- per minute; £1.50/min,
- per call; £1/call.

If the given unit of time defines the call as free or subject to variable network charges then no further data is included in the transfer.

The receiver shall provide suitable translations to display the call cost time-periods in users' selected languages.

e.g.

- per minute, /min,
- per sec, /sec,
- per call, each call,
- Variable costs, Costs Vary, Variable Network Charges apply,
- Free Call or Toll Free.

5.5.16.4 Cost information

Cost shall be signalled using an integer value to define the digits and a decimal multiplier to provide correct adjustment to an appropriate number of decimal places. Cost information shall not be sent if the call time-period is free or variable.

An integer value shall be sent representing the numerical cost. The actual value shall be determined based on the multiplier - dividing the integer by 10 or 100 or 1 000 to get the displayed cost value.

Multiplier	Cost	Position	Currency
2 bits	14 bits	1 bit	1 byte

A total of 17 bits shall be used to code the cost value: decimal multiplier, cost, currency symbol and currency symbol position indicator.

Cost: integer value representing the cost (14 bits).

Decimal multiplier: represents the decimal multiplier (2 bits):

Value	Meaning
0	integer
1	/10
2	/100
3	/1 000

Currency position: defines whether the currency symbol should be placed before or after the currency value. A value of '1' indicates the currency symbol shall be placed in front of the cost number, e.g. "\$25", "£1" or "GBP1.00". A value of '0' indicates the currency symbol shall be placed after the cost number, e.g. "1.20EUR" or "1GBP".

Currency symbol: defines the currency symbol that shall be displayed, according to the ISO 4217 currency definitions. Implementation within the receiver may either display the 3 alpha characters from the ISO 4217 currency definition or substitute the actual desired local character.

EXAMPLE "GBP" or "£" could be shown for code number 049. "£1.20" can be coded as Multiplier = 2, Cost = 120, Position = 1 and Currency = 049 ("GBP" or "£" from ISO 4217).

6 Message management

6.1 General

[Clause 6](#) deals with the message management functions of RDS-TMC. For the broadcaster, message management functions include message insertion, deletion, repetition, and updating. Similarly, in the terminal, message management functions include the identification of new messages and deletion of old ones, updating messages.

The ALERT-C protocol therefore defines the following items:

- system information;
- tuning information;
- message insertion;
- message repetition;
- message updating;
- message deletion; and
- control codes.

A distinction is made between user messages and system messages. User messages are those potentially made known to the end-user, as defined in [Clause 5](#). System messages are of use only to the RDS-TMC terminal, for message management purposes.

6.2 System messages

6.2.1 General

Two types of system messages are defined:

- a) system information; and
- b) tuning information.

System information is conveyed in type 3A groups with the application identification (AID) for ALERT-C.

Tuning information is transmitted in the type 8A group in the variants:

(4) X3 - X0 = 0100 to (12) X3 - X0 = 1100 with X4 = 1.

They are described in detail in [7.5.2](#).

6.2.2 Location table

System information also is used to indicate the service ID of the transmitter and the location table to which the location codes in messages from this transmitter refer. Every table has place for location codes between 1 and 65535. However, the highest 2048 codes are reserved and are not available for national location codes:

0:	reserved for future use
1..63487:	available for location coding
63488..64511:	special location codes for future extensions
64512..65532:	for INTER-ROAD messages (see 6.7)
65533..65535:	special codes (see 6.5.5)

The use of the bits in system information is described in [7.5](#).

Not all the 64 possible location table numbers (each table contains up to 65,536 locations) may be defined for each Country Code that is defined in the RDS specification IEC 62106 (all parts). Ranges of table numbers are defined in such a way as to prevent any ambiguity of location. For allocation see the latest version of ISO 14819-3.

The RDS-TMC Service-ID indicates that RDS-TMC messages received from this transmitter may be used to update messages from all other transmitters with the same country code, location table number and RDS-TMC Service-ID. Messages from transmitters with a different country code, location table number and/or Service-ID shall be updated independently.

6.2.3 Terminal requirements

Although the basic message elements are bearer independent, this protocol describes the transmission via the RDS. This implies some limitations in channel capacity and terminal processing capacity, which shall be reflected in certain restrictions and requirements, which are detailed in [7.5.2.3](#).

Recognition of an RDS-TMC service shall be accomplished by detection of a type 3A group carrying the AID CD46 or CD47. The type 3A group indicates the group used to carry RDS-TMC messages on that channel, which shall be type 8A groups.

A terminal shall be able to store in memory at least 300 RDS-TMC messages. Messages are required to be stored in the terminal until they cease to be valid, are updated or are deleted according to the procedures detailed in [6.4](#).

This maximum applies to all non-silent ALERT-C user messages; there is no reason to store silent cancellation messages, which serve only to delete a message as detailed in [6.5.4](#) below.

Service providers are expected to ensure that the number of RDS-TMC messages that they have transmitted which have not been specifically cancelled, or will have automatically expired, does not exceed 300 per transmitter.

6.2.4 Change of database numbers

Fundamental changes in the location database can (very occasionally) need a change of the database number on the transmitter side and a change of the corresponding database in the terminals.

If the default location database is changed, it is in the responsibility of the broadcaster to make sure that a correct identification of the messages is always possible. This changing may be achieved by using the following rules:

- the changing procedure shall only be performed during the hour after midnight;
- the transmitter information will be broadcast with the new database number starting at 00:00 hr;
- during this period, all messages to be transmitted shall be coded following the INTER-ROAD concept (see [6.7](#));
- for messages generated before this period, which would expire after this period, an adaptation of their duration is necessary ensuring their expiration at midnight;
- after this period, INTER-ROAD messages shall be re-coded to normal messages if they refer to the new database number to conserve channel capacity;
- multi-group messages with five groups should be avoided during this period, as it is not always possible to recode them entirely in INTER-ROAD messages;
- INTER-ROAD messages referring to other database numbers are not affected by database number changes;
- the “Foreign Location Table” code (see [6.7.2](#)) shall be decided on a per-message basis (e.g. location of the old database may also be in the new database).

These rules will ensure that all terminals are notified about the location database number change. The terminal has no guarantee that all old messages will be maintained after a change of database number.

If the Service-ID has to be changed, it may be done in a similar way as for the location database number. During the hour of change of Service-ID, the broadcaster shall delete all messages (with silent cancellation messages) from the old service, and only then may switch to the new Service-ID and insert new messages from the new service.

6.3 Message repetition

Messages may be inserted several (or multiple) times. This message repetition will serve to reduce acquisition time and improve the reception reliability of urgent messages. The frequency of message repetition should increase as a function of broadcast message priority, as indicated in [4.7](#).

6.4 Message updating

At the transmitter, messages are updated simply by removing the old message from the cycle and inserting the new message as if it were a completely new one.

In the terminal, a new message overwrites an existing stored message if it:

- has the same primary location, drawn from the same location table, as the existing message or the special location code 65535; and

- has the same value of the direction bit; and
- contains an event that belongs to the same update class as any event (a multi-group message may have more than one event) in the existing message; and
- comes from the same RDS-TMC service. (i.e. a service with the same LTN and SID) as the existing message; and
- if the message relates to a forecast event (update classes 32 – 39), the same duration.

Any user message not fulfilling all of these conditions shall be treated as a separate new message and have no effect on any message stored in the terminal.

Provided the conditions above are fulfilled, a multi-group message may update a single-group message and vice-versa.

In no circumstances should an incomplete multi-group message update or overwrite any elements of an existing stored message.

6.5 Message deletion

6.5.1 General

The following rules for message deletion apply to complete as well as incomplete messages existing in a terminal's memory.

Four mechanisms are provided for deleting messages from the memory of the terminals.

6.5.2 Message persistence

Messages are deleted if no refresh has been received within a specified persistence period, which is related to the duration.

For dynamic events, as defined in the Event List, the duration codes shall be interpreted as:

Code	Persistence period (after last receipt of the message)
0	15 minutes (no message to end-user)
1	15 minutes (with message to end-user)
2	30 minutes
3	1 hour
4	2 hours
5	3 hours
6	4 hours
7	until midnight on the day of message receipt

For information and silent events defined as longer period in the Event List, the duration codes shall be interpreted as:

Code	Persistence period
0	1 hour
1	2 hours
2	until midnight on the day of message receipt
3...7	until midnight on the day after message receipt

For forecast events defined as longer period in the Event List, the duration code shall be interpreted as:

Code	Persistence period
0	1 hour
1	2 hours
2	until midnight on the day of message receipt
3...7	until midnight on the day after message receipt

If the available part of a message does not specify a duration or detailed stop-time, duration code 0 shall be assumed.

A multi-event message without a duration code or a detailed stop-time shall have a persistence period of 15 minutes if at least one of the events is defined as dynamic, otherwise it shall be 1 hour.

6.5.3 Detailed stop-time

RDS-TMC also provides for an alternative method of message management based on detailed stop-time. Where a detailed stop-time of the incident is known with reasonable certainty, a broadcaster may indicate the stop-time using codes defined in [S.5.8](#). In this case, the message is retained in memory until the detailed stop-time is reached, or until midnight on the day after message receipt (whichever is the sooner).

A message may contain both a stop-time and a duration time. Then the stop-time or the duration or midnight on the day after message receipt (whichever is the sooner) determines the persistence period.

6.5.4 Non-silent and silent cancellation messages

The Event list contains several non-silent (i.e. message to be announced to the end-user) cancellation descriptions such as "problem cleared". Messages with such an event code are handled as normal messages and obey the normal rules. The (spoken) announcement (see [6.6](#) on message presentation) shall be made whether or not an original message has been overwritten in the terminal.

The Event List also provides for one silent cancellation message (SCM) per update class. Response to a SCM is governed by the same rules as for message updating, in that an existing message is only cancelled if it meets the stated criteria. A SCM shall not contain any optional information. Therefore, it shall not be a multigroup message except in case of silent cancellation of an INTER-ROAD message (see [6.7](#)).

6.5.5 Null message

The special silent event value 2047 ("Null Message", see ISO 14819-2) and the special location code 65535 may be used for three more general types of silent cancellation messages:

- the message uses the event value 2047 and the location code 65535. This message may be used as a general cancellation message to perform a full cancellation of all messages that come from the same RDS-TMC service as defined by AFI = 1 or when the message comes from a non-conflicting service referenced with the tuning variants 6, 7, 8, 9 or 11;

- b) the message uses the event value 2047 and any location code. This message may be used as a general cancellation message to perform a full cancellation of all messages for that location code that come from the same RDS-TMC service as defined by AFI = 1 or when the message comes from a non-conflicting service referenced with the tuning variants 6, 7, 8, 9 or 11;
- c) the message uses a silent cancellation event and location code 65535. This message may be used as a general cancellation message to perform a full cancellation of all messages with an event code in the same update class as the silent cancellation event that come from the same RDS-TMC service as defined by AFI = 1 or when the message comes from a non-conflicting service referenced with the tuning variants 6, 7, 8, 9 or 11.

6.6 Message presentation

With respect to the presentation of messages to the user, the protocol recommends (and, in fact, assumes) the following terminal functions:

- a) on user request, all validated non-silent messages existing (completely or partially) in the terminal's memory at that moment shall be presented. Extremely urgent messages shall be presented first, followed by urgent and, finally, normal-urgency messages;
- b) each newly (completely or partially) received, non-silent and urgent or extremely urgent message shall automatically and as soon as possible after receipt be presented, unless it is identical to (a part of) a message existing already in memory.

Information obtained from a not validated or unlinked message group shall never be presented.

Immediate presentation as described in b) may be suppressed if the presentable contents of the new message do not differ from the presentable contents of an overwritten message.

New extremely urgent messages have priority over those messages awaiting 'presentation'.

In both functions a) and b), presentation of a message may be suppressed (or postponed) by user-selectable options such as a specific service or selected, geographic or urgency 'filters', 'mute' functions, etc. In some cases, presentation of partially received messages is forbidden by the protocol, e.g. for INTER-ROAD messages at least the first two message groups shall be available.

It is recommended that presentation as described in a) follows not only upon an explicit user request, but also upon a switch to another geographic selection filter, the cancelling of a 'mute' function and similar changes of 'mode'.

6.7 Out of area referencing

6.7.1 Structure of the INTER-ROAD concept

RDS-TMC messages normally refer to locations from the default location table for the transmitter (see 6.2.2). It is, however, also possible to reference locations from other tables via special multi-group messages: so-called 'INTER-ROAD messages' (see 6.7.2). These messages may be used to inform end-users about problems in other areas, particularly in neighbouring countries or regions.

In INTER-ROAD messages, each location is uniquely specified by adding the location table country code and location table number to the original location code (the 16-bit location code itself may be used in every table and is therefore not unique). In the terminal, such an extended location code may be interpreted by means of an 'INTER-ROAD database', which is, in principle, a composition of (parts of) all or most national databases. In practice, a manufacturer can choose to compose it from any group of RDS-TMC location databases that are of interest for end-users to be combined.

The complete reference to a location in an INTER-ROAD database is the sequence: location table country code (4-bit)/location table number (6-bit)/location code (16 bit).

6.7.2 INTER-ROAD messages

INTER-ROAD messages may and are be transmitted mixed with the transmission of normal RDS-TMC messages. It is not be necessary to have separate transmitting sessions.

An INTER-ROAD message can be recognized by the location field in the first message group, which is filled with a specific foreign location table (FLT) code. Consequently, INTER-ROAD messages always have a minimum of two RDS-TMC groups and messages with five RDS-TMC groups cannot entirely be transformed into an INTER-ROAD message.

- The 16-bit FLT code in the location field is the key to the correct part in the INTER-ROAD database. The FLT code is composed of: 6-bit set to "1", followed by a 4-bit location table country code and a 6-bit location database number.
- As the reference in the INTER-ROAD database is country/database/location, the first part of it is now fixed by the FLT code in the location field.
- A number range of locations, from 64512 to 65532, will be reserved in each TMC location database for the FLT codes.
- In the second message group, the terminal will find the code for the actual primary location related to the event. This location code is given in bits Y11 - Z12 (see [9.4.3](#)), without preceding label. The remainder of the second group and any additional groups may be used for optional information coded in free format as described in [5.5](#).

Any other location code in the message, i.e. each code preceded by label 10, 11 or 13 (see [5.5](#)) and the secondary location code implied by the extent code (see [5.3.4.3](#)), refers to the same foreign location table as the primary location. An INTER-ROAD message may be interpreted if, in the terminal, the appropriate (part of the) foreign location database has been inserted/installed, either as a single database or (more likely) as part of an INTER-ROAD database. If the terminal cannot find both the primary and the secondary location in its database(s), it shall produce no message output to the user.

6.7.3 Updating and cancellation of INTER-ROAD messages

The updating rules of [6.4](#) fully apply to INTER-ROAD messages. Thus, an INTER-ROAD message may only be updated or refreshed by an INTER-ROAD message with the same primary location from the same foreign location table. INTER-ROAD messages are associated with the same service ID (see [6.2.2](#)) as normal messages coming from the same transmitter. Silent cancellation of an INTER-ROAD message may be performed by a SCM (see [6.5.4](#)) within its first group, the FLT code, and in its second group, the primary location code of the INTER-ROAD message(s) to be cancelled. Similarly, the "Null Message" described in [6.5.5](#) under b) may be applied to a foreign location.

A message with the special location code 65535 in its first group overwrites (or, in case of a SCM, cancels) all messages, including all INTER-ROAD messages, within the same update class and from the same RDS-TMC service (see [6.4](#) and [6.5.5](#)). The restriction on update class may be lifted by using event code 2047 (see [6.5.5](#), under a)).

If code 65535 is given in bits Y11 - Z12 of the second group of an INTER-ROAD message, the updating and cancellation rules in [6.4](#) and [6.5.5](#) shall only be applied to INTER-ROAD messages with the same FLT code.

EXAMPLE An INTER-ROAD message with event code 2047 in its first group and location code 65535 in its second group cancels all INTER-ROAD messages with the same FLT code and from the same service.

Consequently, an RDS-TMC service wishing to perform a cancellation of all messages concerning locations from its own default location database, but not of non-expired INTER-ROAD messages, shall do this by an INTER-ROAD SCM (Silent Cancellation Message) with its own FLT code (i.e. own location table country code and location table number) in its first group, and code 65535 in its second group.

7 Transmission using RDS type 8A and type 3A groups

7.1 General

[Clause 7](#) conveys over-air messages. This clause specifies the mapping of the messages defined by [Clauses 5](#) and [6](#) into the RDS groups of the network and lower layers. At this level, identification is also provided of the number of RDS groups used to convey each message and codes to identify, link and synchronize sequences of two or more groups.

7.2 Format of type 8A groups

RDS-TMC information is conveyed in RDS type 8A groups. [Figure 2](#) shows the format of type 8A groups that are used to convey all RDS-TMC messages. Transmitter information messages are also broadcast using only one group.

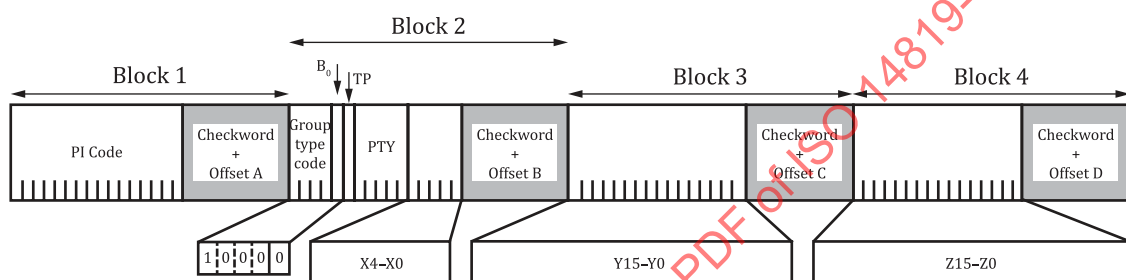


Figure 2 — RDS type 8A groups, showing the bit and block structure, defined for RDS-TMC

Sequences of two or more type 8A groups are used to convey additional information from the optional message content defined in [5.5](#). Each multi-group RDS-TMC message comprises a first group with basic information, which is always sent, first followed by the other groups, in sequence. The maximum number of groups comprising any one RDS-TMC message is five.

7.3 Group repetition

8A data messages are sent with an origination followed by an immediate repetition of each group in the transmission. Each group shall be sent at least twice in succession, before the next group is sent. 8A Tuning Information (see [9.3](#)) and 8A Encryption Admin information, is generally not sent with an immediate repeat – this data is static for a long period and will be repeated periodically, according to the repetition rates stated.

It is recommended that groups are accepted as valid only after two bit-by-bit (for the TMC-bits, except the continuity index) identical copies of the same group have been received, either through transmission or message repetitions. The use of the RDS error correction is up to the manufacturer of a terminal.

For multi-group messages, the first group is repeated, then the second, etc. If, for example, there are three groups in Message A (A1, A2, A3) and two in Message B (B1, B2) then the sequence of groups with an immediate repetition of one is:

A1 A1 A2 A2 A3 A3 B1 B1 B2 B2 C1...

Similarly, the sequence of groups with an immediate repetition of two is:

A1 A1 A1 A2 A2 A2 A3 A3 A3 B1 B1 B1 B2 B2 B2 C1...

RDS groups other than type 8A groups may come in between immediate repetitions, but no other type 8A group shall do so.

7.4 Single-group user messages

Single-group user messages are indicated in 7 by two bits in Block 2, bit X4 and the single-group user message identifier (bit X3). These bits are defined as follows for single-group messages:

X4	X3
0	1

Type 8A groups constituting single-group messages may follow any other type of RDS group without restriction (see [9.1](#) for details of timing between two 8A groups).

Bit X4 = 1 is used for tuning information and for future use.

The TMC data fields in a message are defined in [5.3](#) as:

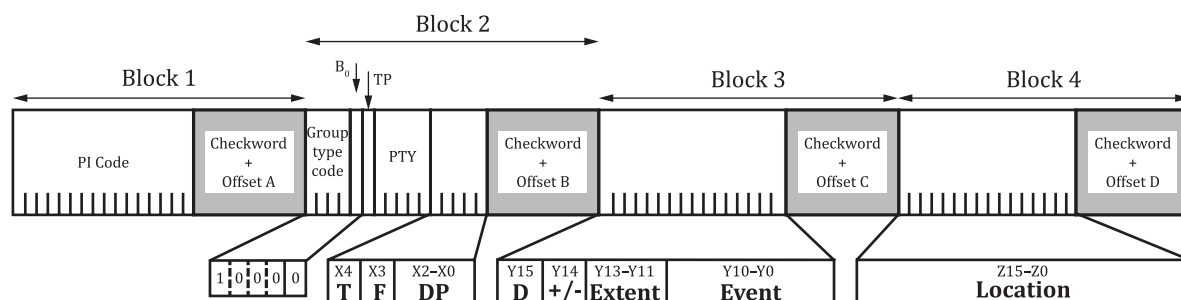
1. event (11 bits);
2. location (16 bits);
3. direction (1 bit)
4. extent (3 bits);
5. duration (3 bits); and
6. diversion advice (1 bit).

These message data fields are carried within single-groups as follows:

Table 5 — TMC data fields carried within single-groups

Data field	MSB	LSB
duration/persistence	X2	X0
diversion advice	-	Y15
direction	-	Y14
extent	Y13	Y11
event	Y10	Y0
location	Z15	Z0

The data field bit allocations are illustrated in [Figure 3](#).



Key

- T = 0 indicates user message
- T = 1 indicates tuning information (or reserved for future use)
- F = 0 indicates multi-group message
- F = 1 indicates single-group message
- DP = duration and persistence values
- D = 0 indicates no diversion is recommended
- D = 1 indicates that drivers are advised to follow the indicated diversion
- +/- = 0 indicates positive direction
- +/- = 1 indicates negative direction

Figure 3 — RDS-TMC single-group full message structure

7.5 System messages

7.5.1 General

This subclause covers very complex, inter-related parameters and requires very careful consideration when establishing a service and designing terminal products. Advice and consultation with the “TMC community” should be sought before proceeding.

Two types of system message are currently defined:

- System information; and
- Tuning information.

7.5.2 System information

7.5.2.1 Introduction

RDS-TMC is defined within the overall RDS system to use an open data Application (ODA), which inherently requires RDS type 3A groups to signal the presence of RDS-TMC. Each ODA is allocated an application identification (AID) and additionally, in the case of RDS-TMC, the fixed group type 8A is used.

Two AIDs are assigned for TMC operational services: CD46 and CD47. These two ODAs and associated AIDs differ in the rules under which the identification of the Location Table parameters shall be transmitted.

Additionally, one AID is assigned for the testing of (CD46 or CD47 based) services: OD45. Transmissions using OD45 are for test purposes only. Normal, production version TMC terminals shall ignore TMC transmissions with this AID.

The RDS type 3A group has capacity which the application itself uses for additional information as described in [7.5.2.2](#).

The System Information enables an RDS-TMC product to decode and evaluate essential data, which describes the transmission being received. The System Information indicates an RDS-TMC service and comprises some service characteristics needed to select the RDS-TMC service.

7.5.2.2 Format of the System Information in the type 3A group

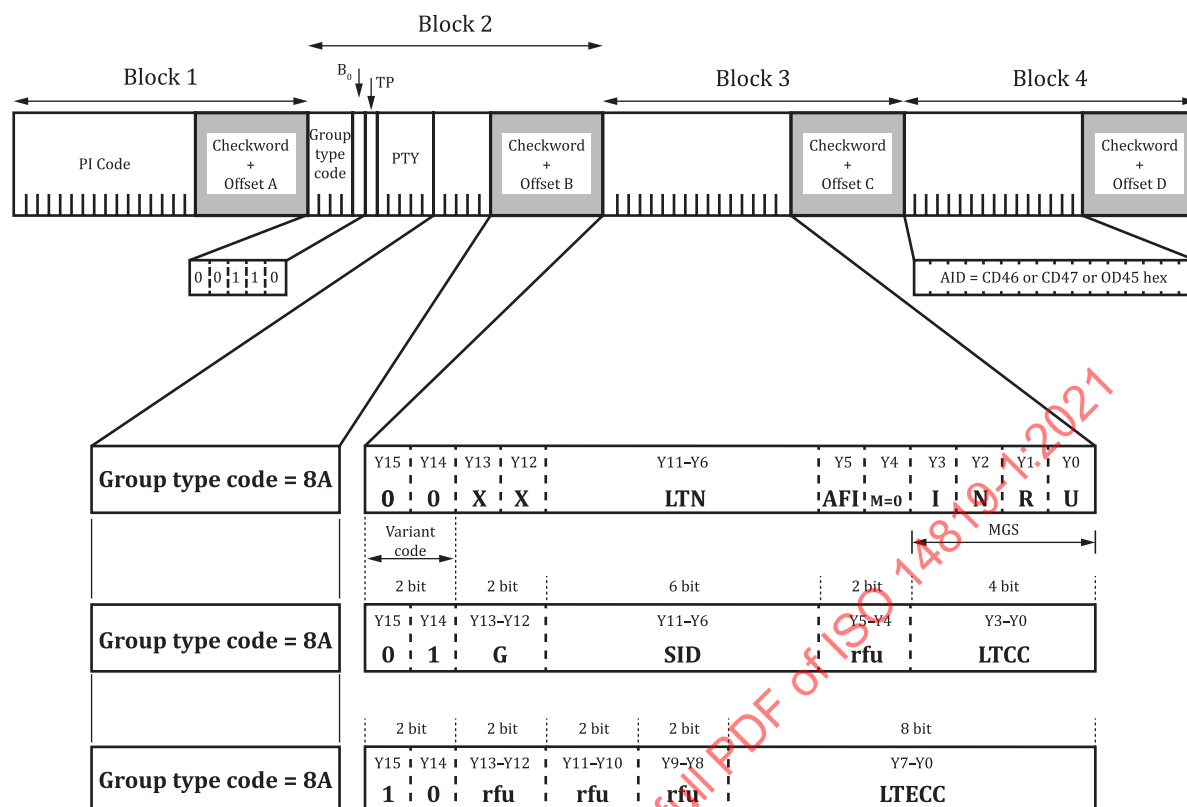
The System Information shall be transmitted in variants 0 (00), 1 (01), and 2 (10) of Block 3 of the type 3A group. All variants shall be transmitted for all services, as only the elements in all three variants taken together, uniquely identify a location table and TMC service worldwide. The parameters of these System Information variants are shown in [Figure 3](#).

Previous versions of this document permitted variant 2 to be optional for services using AID = CD46. For a first transitional period, which will end on 31st December 2023, transmissions without variant 2 may remain on-air.

From 1st January 2024, a second transitional phase will start where the usage of variant 2 is mandatory. Only in regions where the absence of LTECC transmission still allows the detection of a unique location table based on LTCC and LTN (within the boundaries of continents such as Europe, North America and Australasia), the usage of variant 2 remains optional.

Receivers shall be prepared to handle absence of LTECC transmissions.

The second transitional period will end on 31st December 2028. From 1st January 2029, the transmission of LTECC is mandatory for all regions.

**Key**

LTN	location table number (6 bits)
LTCC	location table country code (4 bits)
AFI	alternative frequency indicator (1 bit)
MGS	message geographical scope (total of 4 bits)
I	international (1 bit)
N	national (1 bit)
R	regional (1 bit)
U	urban (1 bit)
G	gap parameter (2 bits)
SID	service identifier (6 bits)
M	mode of transmission (1 bit) (always set to 0)
LTECC	location table extended country code (8 bits)

Figure 4 — RDS type 3A group structure, RDS-TMC carrying system information

Terminal devices shall ignore any bit defined as rfu.

7.5.2.3 System Information

The supplied System Information comprises the LTCC, LTN and LTECC. Together, these three elements uniquely define a location table worldwide. Note, however, that in the case of encrypted TMC services, the LTN in the type 3A group will be set to '0', indicating encryption, and the 'true' LTN is transmitted in a type 8A variant 0 group. The principles and methodology of encryption and decryption are also described in [Clause 8](#).

The LTCC, LTECC and LTN combinations assigned to each country are given either in ISO 14819-3, or, when not, they are allocated by TISA.

Note as well that the country code and extended country code identifying the origin of the audio programme service on a transmitter (PICC and ECC respectively) may not match the country code and extended country code (LTCC and LTECC) of the TMC service on that transmitter.

When RDS-TMC services were started, it was assumed that the PICC and the LTCC would always be equal, and as such LTCC was not explicitly transmitted. As TMC services expanded, it was recognized that the PICC could not always equal the LTCC, especially in countries with multiple PICC codes, or in the case of a transmitter relaying programme from another country. In 2012, explicit transmission of LTCC was included in type 3A groups variant 1, and terminal manufacturers are now expected to use this to determine the location table in use. As not all service providers have yet added the transmission of LTCC, if LTCC is still zero in a broadcast, terminals should use PICC.

Service providers who have a need to set LTCC to a different value to PICC shall ensure that in doing so, older terminals still using PICC will not mis-identify the service. In case of doubt, TISA can advise. In any case, AID = CD47 may always be used without constraint, as older terminals not evaluating LTCC do not recognize CD47.

The type 3A group also has an AFI bit which describes the MGS and the SID of the TMC service.

If AFI = 1, then all the alternative frequencies carried by the RDS audio service and transmitted in type 0A groups are also used for the TMC service. If AFI = 0, then any alternative frequencies come exclusively from the tuning information transmitted in type 8A groups.

The four bits of the MGS indicate the geographical relevance of the RDS-TMC service.

The definition of the geographical relevance is as follows:

- International (I = 1): in addition to national (see below), gives strategic INTER-ROAD messages for at least the major events in neighbouring countries.
- National (N = 1): covers at least all strategic information for at least the transmitter broadcast area and nation-wide continuity is guaranteed (e.g. by AFI and/or tuning information). An example of a national service would be a service covering all of Germany.
- Regional (R = 1): gives tactical information for at least all motorways in the region and all other major roads of regional importance. An example of a regional service would be the WDR, covering only North Rhine Westphalia.
- Urban (U = 1): covers at least all major (through going) axes, ring roads etc. in the broadcasting area, gives more roads and more details than a regional service.

The Service-ID is linked to the LTCC and LTECC.

Service providers will be allocated a SID in the range 1 – 63 by a national coordinating authority. SID = 0 is reserved for general services carrying urgent traffic safety messages, which should be receivable by all TMC terminal devices.

8 Method of encrypting an RDS-TMC service

8.1 General

RDS-TMC services can be provided (typically by public-service broadcasters) as 'free-to-air', or alternatively as commercial services where the costs of operating the service are recovered by terminal device manufacturers paying a subscription to the service provider to receive and decode the service. To avoid a proliferation of different methods for encrypting services, a standard method was agreed upon, which is described in this clause. In essence, the method encrypts the sixteen bits that describe the location code, according to one of 256 pre-defined mathematical bit manipulations. The particular algorithm in use on a service on each day is communicated by the service provider to the terminal device manufacturer, such that the terminal can decrypt the service.

8.2 Summary of TMC data elements in type 3A groups

To present any message, the terminal shall have access to the location table identified by the LTN. The parameter LTN is transmitted in Block 3 of the group as shown in [Figure 3](#) above.

An LTN with a value of 1...63 indicates a non-encrypted service or one that is 'encrypted' using the alternative strategy described in [8.13](#).

An LTN with value '0' in the type 3A group indicates a service encrypted using the method described below. The LTN used by the service provider, the codes of which are now to be encrypted, is given by the element location table number before encryption (LTNBE), transmitted in the Encryption Administration Group, described in [8.7](#).

8.3 Summary of TMC data elements in type 8A groups

Traffic messages use one or more type 8A groups. The structure of the most commonly used message using a single group is shown in [Figure 3](#) above.

Block 4 contains the 16-bit location code, indicating the area, highway segment or point of the source of the traffic situation.

It is these sixteen bits that are encrypted using the method described below.

A periodic transmission of a special Encryption Administration group, type 8A group variant 0, provides some of the values used by the terminal in the process to decrypt the 16-bit location code. The remaining values are not transmitted, but rather exchanged confidentially between the service provider and the terminal manufacturer.

8.4 Principles of the Encryption and Conditional Access methodology

The principle adopted in this specification for TMC Encryption and Conditional Access can be described simply as:

- The service provider uses a bit-manipulation technique to encrypt the sixteen bits forming all location codes transmitted in every TMC message, which renders the information worthless. The primary location element is transmitted both in single group messages and in the first group of multi-group messages; other location codes, which are used to describe diversions, may be included in a group other than the first group of multi-group messages.
- The location code is encrypted according to certain pre-defined parameters of an encryption algorithm. Each combination of parameters is referred to by two values: the 'service key' and the 'encryption identifier'. As the combination of parameters are pre-defined and stored within each terminal, provided the terminal is advised which combination of service key and encryption identifier is in use, it is able to decrypt the location code.
- The service provider, under commercial arrangements with the terminal manufacturer, advises which 'service key' their service will use – the 'service key' is not transmitted information.
- The service provider transmits an 'encryption identifier' that identifies the values of the parameters used to encrypt messages on that day.
- Before a message may be decrypted, the individual terminal shall have been activated for that particular RDS-TMC service.
- Activation of a particular terminal is allowed: a) for a specific service, and b) until a certain date. These are determined according to the business model and agreements between the service provider and terminal manufacturer. The combination of service and time-period is referred to as the 'Access Profile'.
- The terminal manufacturer determines the PIN code required to be entered to activate a particular terminal for a specific 'Access Profile', or combination of Access Profiles. Different PIN codes will

hence activate the terminal for different combinations of services, or periods of time. The PIN to activate a particular terminal is either input by the manufacturer or communicated to the service provider or other party responsible for providing customer support.

- Once activated, the terminal uses a bit-manipulation technique to decrypt the transmitted location code, hence recovering the original location code, and making the message valid.

The encryption/decryption methodology used is based on certain elementary bit-level functions available for all high-level language compilers. The functions require the introduction of parameters to control the bit manipulation process. The encryption/decryption process is symmetrical: the parameters used by both the service provider for encryption and by the terminal equipment for decryption are derived from the same service key tables.

8.5 Encryption by the service provider

In addition to the requirements that a service provider already needs to enable a 'free-to-air' RDS-TMC service, the following are also required to be able to offer an encrypted TMC service as specified:

- a copy of one of the eight service key tables, each of which details thirty-two different sets of parameters and values which may be used to encrypt the location codes;

NOTE A Service Key table (and its reference number) is obtained from the TISA office.

- software to encrypt location codes using the sets of parameters and values in the service key table used;
- the ability to transmit and set appropriate values for the parameters in the Encryption Administration group to describe the service and the encryption parameters in use. The Encryption Administration group is a type 8A group with bits X4-X0 = 00000 and bits Y15-Y13 = 000;
- an arrangement with terminal equipment suppliers, which allows their terminals to be activated to receive the service provider's encrypted service. As part of this arrangement, the service provider advises the terminal manufacturer which Service Key they will use, and whether the agreement is a 'lifetime' one, or for a certain period only. The parameters which identify the service (i.e. location table country code, location table extended country code, service identifier and location table number before encryption), the service key and the 'expiry date' together form the access profile for that service;
- if the service provider has also entered into an alliance with other service providers (to collectively offer, for example, a pan-European TMC service), the Access Profiles of the other alliance partners as well.

8.6 Use of type 8A groups for RDS-TMC encryption

RDS-TMC data is carried within a type 8A group. Bits X4 – X0 indicate the usage of the remaining bits, Y15 – Y0 and Z15 – Z0.

When bits X4 – X0 = 00000 this indicates an encrypted service, all other values of bits X4 – X0 indicate non-encrypted services. Bits Y15 – Y13 are used to indicate variants.

Variant 0 indicates the Encryption Administration group, which is used to detail the encryption parameters. This is described in [8.7](#) and illustrated in [Figure 5](#).

Variants 1 – 7 are currently undefined and may later be assigned for use for other RDS-TMC encrypted services.

8.7 Encryption Administration group

8.7.1 General

The Encryption Administration group ([Figure 5](#)) comprises the service identifier (SID), the encryption identifier (ENCID) and the location table number before encryption (LTNBE). Also included are two test bits.

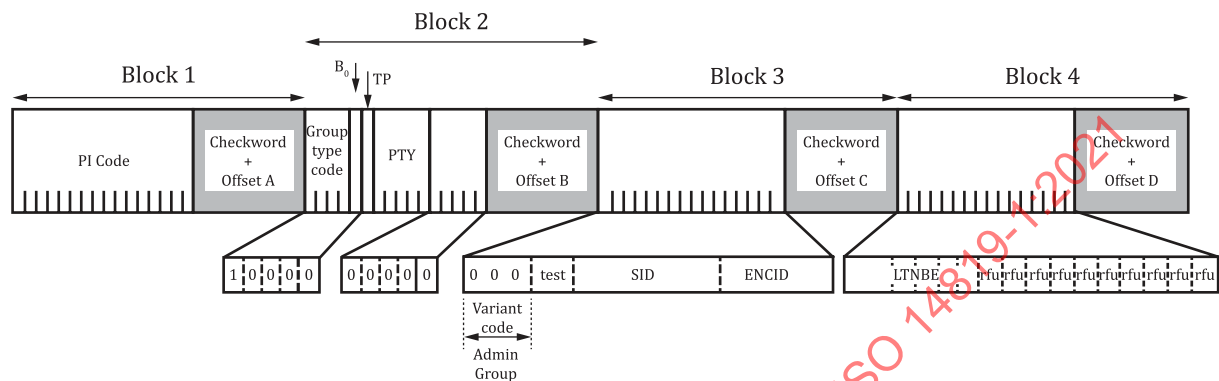


Figure 5 — Type 8A group, variant 0, Encryption Administration Group

8.7.2 Service identifier (SID)

The SID is a 6-bit number transmitted in bits Y10 – Y5. The assignment of SID is generally allocated to a service provider by the relevant government or roads authority in each country.

Providing RDS-TMC as an encrypted service, rather than non-encrypted, does not affect the value of the SID transmitted.

The SID transmitted in this group shall be the same as transmitted in variant 1 of the type 3A group. SID is included in the Encryption Administration group for completeness, such that all the elements required by a terminal to determine whether a TMC service may be offered are included within a single group.

8.7.3 Encryption identifier (ENCID)

To minimize the overhead potentially required when encrypting data, the parameters used to encrypt the location codes are stored in eight service key tables in the terminal equipment. Each of the eight service key tables has thirty-two 'lines'. Each 'line' gives the values of three parameters used to encrypt the sixteen bits of the location code.

The service provider decides which set of parameter values will be used to encrypt the location codes used for messages transmitted on that day. The 'line' in the service key table used is advised to the terminal by the value of variable ENCID, transmitted as bits Y4 - Y0 in the Encryption Administration group.

The service key tables are not publicly available but are made available to service providers and terminal manufacturers under confidentiality agreements by TISA. For reasons of secrecy, actual service key tables are therefore not published in this specification. However, subclause 8.4 provides part of a fictitious service key table to illustrate the principle of encryption, which is based on elementary bit-level functions available for all high-level language compilers.

The functions are:

- Bit-wise rotate right the original location code expressed in binary, by a given number of bits.
- Position a given binary value at a given Start Bit.
- Apply an XOR operation between the given value and the rotated location code.

The resultant value is the encrypted location code that is transmitted.

8.7.4 Location table number before encryption (LTNBE)

To provide any RDS-TMC service, non-encrypted or encrypted, it is required that the terminal equipment have a copy of the location codes used by the service provider. The service provider shall transmit the LTN to identify which table of codes is used by default on his service.

When the service is being offered non-encrypted, the LTN used is transmitted directly in the type 3A group, variant 0, as described in [7.5.2.2](#).

Where the service is encrypted as described in this document, the source LTN, which contains the codes which were subsequently encrypted, is indicated indirectly using bits Z15 – Z10, LTNBE, in the Encryption Administration group. The value of LTN (in type 3A groups) shall be set to '0', to indicate that the service is encrypted.

The LTNBE has the range 1 – 63, and the value transmitted identifies the number of the location table the service provider is using. Consequently, the value of LTNBE used on any service is country specific, and additionally may be service provider specific. The assignment of LTN (and hence LTNBE) is described in ISO 14819-3:2021, Annex B, and generally is allocated to a service provider by the relevant Government or roads authority in each country.

8.7.5 Test Bits

The use of the test bits is described in [8.8.2](#).

8.8 Encrypting location codes

8.8.1 General

Each of the eight service key tables contains thirty-two entries and instructions as to how the original location code is to be encrypted. The service provider's TMC server applies the instructions according to the table entries for that day's chosen ENCID.

Table 6 — Example service key table showing encryption parameter values

ENCID	Rotate right (hex)	Start Bit	XOR value (hex)
0	0	0	0
1	8	1	19
2	4	3	9B
3	C	6	7E
4	2	7	39
...	1	8	4B
31	3	1	AB

As an example of encrypting a location code, [Table 7](#) shows the process of encoding location code 1234 (hex) with the parameters values for ENCID 4 from [Table 1](#).

Table 7 — Showing encryption of location code 1234 (hex) using ENCID 4 parameter values

Encryption process	Bits	15...12	11...8	7...4	3...0
TMC Server applying bit manipulation according to the values for ENCID 4	Original location code (hex)	1	2	3	4
	Original location code expressed in Binary	0001	0010	0011	0100
	Rotate right 2 bits	0000	0100	1000	1101
	39 (hex) starting at bit 7	0001	1100	1000	0000
	Result after XOR operation	0001	1000	0000	1101
Values transmitted	Hence transmitted encrypted Location code (hex)	1	8	0	D
	ENCID Value transmitted in Encryption Administration Group	4			

The service provider shall always use the same service key table but may change the encryption parameters and hence the ENCID once per day, if desired. However, any change shall be made at 04:00 local time only.

If a change to the ENCID is made, then to prevent the possibility of messages being incorrectly decrypted by applying a wrong ENCID, no other traffic message conveying type 8A group (i.e. those with bits X4 – X0 in the range 00001 – 01111) shall be transmitted between 03:58 and 04:02 local time.

It is a requirement that transmitters on which an RDS-TMC service is provided transmit RDS CT (Clock Time) groups (type 4A groups). The time is transmitted as UTC ± local offset.

8.8.2 Test mode

Bits Y12 and Y11 are used to allow service providers and terminal manufacturers to test various aspects of the encryption process.

The four possible states of bits Y12 and Y11 are shown in [Table 8](#):

Table 8 — Use of test bits

Y12	Y11	Meaning
0	0	Location code not encrypted, terminal shall ignore ENCID, and instead shall use encryption parameters with values 0,0,0.
0	1	Location code encrypted, but terminal shall ignore ENCID and instead use encryption parameters pre-advised by the service provider. (Which of course shall be 'pre-stored' within the terminal).
1	0	Reserved for future use.
1	1	Full encryption used as described in this specification.

8.8.3 Repetition rate

Although the elements within the Encryption Administration group are relatively static, as described, the ENCID value may change daily. Consequently, before a terminal is able to decrypt any message, it shall have received an Encryption Administration group previously that day and checked the ENCID to determine the encryption parameters being used on this service. (A day is determined to have begun at 04:00 Local Time – see [8.7](#)).

As different terminals are being turned-on at different times throughout the day, the service provider is required to transmit this group reasonably frequently. This group should preferably be transmitted at least once (with immediate repetitions) every ten seconds. The minimum repetition rate shall be once every twenty seconds.

8.9 Access to decrypted services by a terminal

In order to offer **any** RDS-TMC service, the manufacturer of the terminal equipment shall be able to decode the type 3A group variant 0 information primarily to ascertain the LTN in use on that service. To produce valid messages, the terminal shall have access to the location table identified by that number.

To use an encrypted RDS-TMC service, in addition to the requirements needed for a non-encrypted service, the terminal manufacturer requires:

- notification from the service provider of the service key table being used on the service;
- a copy of the appropriate service key table, available from TISA;
- to be able to decode the Encryption Administration group which details the source location table (LTNBE) the codes of which have been encrypted, and the encryption parameters in use on that day (ENCID).

These are required to be able to decrypt and hence recover the location codes transmitted on the services offered by service providers with whom a commercial arrangement exists.

8.10 'Activation' of a terminal

8.10.1 General

It is the intent of this specification to allow for every terminal to be individually activated to receive encrypted RDS-TMC services. Theoretically this allows for a service provider to offer an end-user any combination of RDS-TMC services required and subscription periods, to fulfil the requirements of different business models.

Each individual terminal shall be activated by its own PIN code, which is either input by the end-user, or may be pre-loaded into the terminal at manufacture, or any point in the commercial chain according to the business model required.

The PIN code is a numeric or alphanumeric value, computed using manufacturer-specific algorithms, representing:

- the combination of services and subscription periods the terminal is authorized to decode;
- the electronic serial number of the terminal;
- together with any other manufacturer-required access codes (e.g. theft security code).

Depending on the business model and relationship between business partners, any of the service provider, the terminal manufacturer or the car industry can be responsible for the PIN code generation and distribution. If the PIN code needs to be assigned by the service provider, they shall have access to the serial number of the terminal. This may be done by making the serial number available through the end-user or by allowing the service provider to have access to the terminal manufacturers' internal database.

Alternatively, the terminal manufacturer can generate a PIN code on behalf of the service provider.

The length and format of the PIN code and the algorithm used to generate it, is terminal and business model specific, but is a value calculated from consideration of the following elements:

8.10.2 Serial number of terminal

As it is the intent to prohibit widespread unauthorized activation of terminals, the electronic 'serial number' of each terminal shall be parameter that contributes to the determination of each terminal's activation PIN code.