

Traffic and Travel Information (TTI) — TTI messages via cellular networks —

Part 3: Basic information elements

ICS 35.240.60

National foreword

This Draft for Development is the official English language version of CEN/TS 14821-3:2003.

This publication is not to be regarded as a British Standard.

It is being issued in the Draft for Development series of publications and is of a provisional nature because technology in this area is rapidly evolving. It should be applied on this provisional basis, so that information and experience of its practical application may be obtained.

Comments arising from the use of this Draft for Development are requested so that UK experience can be reported to the European organization responsible for its conversion to a European standard. A review of this publication will be initiated 2 years after its publication by the European organization so that a decision can be taken on its status at the end of its 3-year life. Notification of the start of the review period will be made in an announcement in the appropriate issue of *Update Standards*.

According to the replies received by the end of the review period, the responsible BSI Committee will decide whether to support the conversion into a European standard, to extend the life of the Technical Specification or to withdraw it. Comments should be sent in writing to the Secretary of BSI Technical Committee EPL/278, Road transport informatics, at British Standards House, 389 Chiswick High Road, London W4 4AL, giving the document reference and clause number and proposing, where possible, an appropriate revision of the text.

A list of organizations represented on this committee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled “International Standards Correspondence Index”, or by using the “Search” facility of the *BSI Electronic Catalogue* or of British Standards Online.

Summary of pages

This document comprises a front cover, an inside front cover, the CEN/TS title page, pages 2 to 91 and a back cover.

The BSI copyright date displayed in this document indicates when the document was last issued.

This Draft for Development was published under the authority of the Standards Policy and Strategy Committee on 8 July 2003

© BSI 8 July 2003

ISBN 0 580 42231 3

Amendments issued since publication

Amd. No.	Date	Comments

English version

**Traffic and Travel Information (TTI) - TTI messages via cellular
networks - Part 3: Basic information elements**

This Technical Specification (CEN/TS) was approved by CEN on 10 May 2001 for provisional application.

The period of validity of this CEN/TS is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the CEN/TS can be converted into a European Standard.

CEN members are required to announce the existence of this CEN/TS in the same way as for an EN and to make the CEN/TS available. It is permissible to keep conflicting national standards in force (in parallel to the CEN/TS) until the final decision about the possible conversion of the CEN/TS into an EN is reached.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

Table of contents

	PAGE
TABLE OF CONTENTS	2
FOREWORD	4
INTRODUCTION	5
1. SCOPE	6
2. NORMATIVE REFERENCES	7
3. DEFINITIONS AND ABBREVIATIONS	8
3.1 Definitions	8
3.2 Abbreviations	10
4. GENERAL DEFINITIONS AND INFORMATION ELEMENTS	15
4.1 Absolute Time	15
5. AREA AND LOCATION CODING	17
5.1 General Format	17
5.2 WGS 84	17
5.3 ILOC	25
5.4 TMC-Location	25
6. COMMUNICATION ADDRESS	27
6.1 Network ID	28
6.2 Validity Range of Address	28
6.3 Flag BCD/ASCII	29
6.4 Address Length	29
6.5 Address	29
7. TEXT AND TRANSPARENT DATA	30
7.1 Format of a Text Element	30
8. EXTENDED LOCATION BLOCK	34
8.1 Number of ELB-Waypoints 1	34
8.2 Time Difference between Generation Time and ELB-Waypoint 1	34
8.3 ELB-Waypoint X	34
8.4 Flag: GPS Raw Data Present	37
8.5 GPS Raw Data	37
9. BREAKDOWN REASONS	39
10. MASTER DATA	43
10.1 Colour of Vehicle	43
10.2 Vehicle Identification Number - VIN	43
10.3 Vehicle Model	43
10.4 Year of Construction	43
10.5 Licence Plate	43
11. GEOCODES - CONTENTS AND STRUCTURING OF TERMINAL TABLES	44
11.1 Coverage of terminal table	44
11.2 Coding table for terminal devices	44

11.3	Geocoding	55
12.	EVENT CODES	58
12.1	Introduction	58
12.2	Description of the event code structure	58
12.3	Quantifiers	58
12.4	Description of the terminal device table	59
12.5	Assignment of Event Codes and Quantifiers	60
13.	CODING OF NUMBERS	75
13.1	Unsigned Integers	75
13.2	Signed Integers	75
13.3	Binomially Coded Numbers	75
14.	SPECIFICATION IN ASN.1	76
	BIBLIOGRAPHY	91

Foreword

This document(CEN/TS 14821-3:2003) has been prepared by Technical Committee CEN/TC 278 " Road transport and traffic telematics ", the secretariat of which is held by NEN, in collaboration with Technical Committee ISO/TC 204 " Transport information and control systems ".

This Technical Specification was prepared by Working Group 7 of CEN TC278. In the field of Traffic and Traveller Information, the innovative rate is high, with many research and development projects under way in many countries, and there is a need to establish prospective standards which allow manufacturers to introduce competitive products to the market in the knowledge that they can accommodate the future issues of the standard(s) without fundamental change to equipment.

No known national Technical Specification s (identical or conflicting) exist on this subject.

CEN/TS 14821 consists of eight parts; one part describing the framework and seven parts providing detailed specifications of all components, protocols and services that are within the scope of CEN/TS 14821.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to announce this Technical Specification: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

Traffic and Traveller Information (TTI) may be disseminated through a number of services or means of communication, covering static displays, portable terminals and in-vehicle equipment.

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

This Technical Specification focuses on an application data specification whereby data is produced at a central location and is disseminated via a cellular radio network. It addresses the data specifications for both downlink and uplink existing between a central location and randomly located vehicles. It enables messages to be exchanged between different systems and service providers adopting a variety of applications specifications.

Other Technical Specifications are being produced by the CEN TC278 Working Group 4 to cover TTI dissemination via other means or services. This set of specifications is named GATS (Global Automotive Telematics Standard). GATS provides the modular framework for implementing such traffic telematics services on an open technology platform and is network - independent. In many details definitions are necessary to ensure interoperability. Therefore, those detailed definitions are given in CEN/TS 14821-8. With the development of future mobile communication systems towards UMTS / IMT2000 the bottleneck of narrow-band data communication might fade. Due to its modular structure, the GATS framework and applications are prepared for that due to its network-independence. The same holds for emerging technologies for positioning which today is almost exclusively based on GPS.

Other relevant standard developments are, independent from telematics, the application-independent Wireless Application Protocol (WAP), enabling mobile access to the Internet. It is understood that these emerging technologies might fit into the framework of telematics applications in future WAP-versions. For the time being, GATS already today independently from WAP enables access to telematics services. Utilisation of GATS on a WAP protocol stack and identifying necessary adaptation of WAP specifications (if any) is currently under investigation of the appropriate groups within WAP-Forum and GATS-Forum.

1. Scope

This Technical Specification defines the specific interfaces and functionality of traffic telematics (TT) services based on the use of cellular networks. Device manufacturers are enabled to develop terminal equipment compatible to services based on this Technical Specification. This will allow for interoperability of different terminal equipment and service providers which allows competition between service providers and terminal manufacturers. Furthermore it sets the scene for international availability of these services.

This Technical Specification specifies

- TT-specific interfaces between terminal and service centre. This especially incorporates the message sets of the application data protocols and the service-independent communication handling (including conditional access and transport protocols).
- Functionality, procedures and requirements of basic terminal components as well as their interaction with the service centre. This especially comprises conditional access and security mechanisms.
- Service Specifications, which are essential to ensure consistent behaviour of terminal and service centre.

The services incorporated within this issue comprise:

- breakdown and emergency services
- interactive traffic information services
- broadcast traffic information services
- navigation services (route assistance, route advice, homing)
- operator services
- general information services
- floating car data collection

It is envisaged that future research and development will lead to improvements on the services listed above as well as to the creation of new services. Nevertheless this Technical Specification provides the framework for seamless integration of new features and services into the existing architecture.

2. Normative references

This Technical Specification incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this Technical Specification only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN ISO 14819-2 *Traffic and Traveller Information (TTI) - TTI Messages via traffic message coding - Part 2: Event and information codes for Radio Data System - Traffic Message Channel (RDS-TMC) (ISO 14819-2:2003)*

3. Definitions and abbreviations

3.1 Definitions

For the purposes of this Technical Specification, the following terms and definitions apply:

3.1.1 Attribute (of a Traffic Information Message)

A Traffic Information Message is made up of separate parts that can be called attributes. This includes, for example, an item of information and a length of validity.

3.1.2 Authorisation

Reciprocal proof that the identity provided by the communications partner is valid

3.1.3 Broadcast Service

Data service within a cellular wireless network that allows for mono-directional dissemination of data from a service centre to multiple users in the area of signal reception

3.1.4 Bypass Description

Representation of a Bypass, consisting of a Bypass Hint and/or a Bypass Route.

3.1.5 Bypass Hint

Representation of a hint for a Bypass

3.1.6 Bypass Link

Prominent waypoints on a Bypass Route

3.1.7 Bypass Route

Representation of the route for a Bypass

3.1.8 Cell Broadcast

Broadcast service of the GSM network

3.1.9 Data telegram

Digital message exchanged between two systems

3.1.10 Delivery Notification

Network acknowledgement for successful/ unsuccessful delivery of a message to the mobile device

3.1.11 Functional Road Class

A classification based on the importance of the road element in the connectivity of the total road network

3.1.12 Functional Road Class 0

Motorways

3.1.13 Functional Road Class 1

All non-Motorways that are part of a connection used for nation wide traffic and transport

3.1.14 Geocode

Geocodes are unique identifiers unmistakably defining important points on road networks. Geocodes can be derived from / converted into WGS84 co-ordinates by the algorithm described in ENV ISO 14821 3.

3.1.15 Hardware service agents

Partner companies of the traffic telematics service providers who are authorised to install onboard equipment into vehicles and to maintain it

3.1.16 Homing

Simple form of guidance to destination, in which the direction and straight-line distance of the destination are indicated

3.1.17 Information Element

Information unit of a message

3.1.18 Intersection

Junction of two or more roads

3.1.19 Length of a Speech Report

Length of a Speech Report, including pauses, in tenths of a second

3.1.20 Mobile Originated

Data telegram sent from the onboard equipment to the Service Centre.

3.1.21 Mobile Terminated

Data telegram sent by the Service Centre to the onboard equipment.

3.1.22 Onboard equipment

A system, generally mobile, interacting with the service centre to handle traffic telematics services

3.1.23 Road Junction

Intersection of two or more roads

3.1.24 Route description

Description of a route showing the geometry of street intersections, manoeuvre instructions, street and place names, and geographical co-ordinates

3.1.25 Service centre

System produced by the traffic telematics operators / service providers to handle traffic telematics services

3.1.26 Short Message Service

Packet-based form of data transfer within the GSM network

3.1.27 Speech connection

Communications channel between two systems for the bi-directional transmission of speech

3.1.28 Speech Report

Traffic Information Report transmitted by a speech system

3.1.29 Terminal Device

Generally mobile system interacting with the service centre for implementation of telematics services

3.1.30 TINFO

Traffic Information Report

3.1.31 TINFO Version

Unique identification of a Traffic Message, consisting of a number and a time stamp

3.1.32 Traffic Data

Data for qualification of Traffic Events. This includes:

Values: speed, traffic flow, traffic density

Places: position, place designation

Facts: description of situation

3.1.33 Traffic Event

An occurrence on a road or in an area that is worthy of reporting, such as a traffic jam, wrong-way driver, or fog.

3.1.34 Traffic Information

Technical representation of a Traffic Situation within the onboard equipment, accomplished by a number of Traffic Information Reports.

This Traffic Information can be displayed to the customer via suitable terminals.

3.1.35 Traffic Information Report

Technical representation of a Traffic Event produced by processing traffic data.

Each Traffic Reports uniquely identified by a number, the TINFO ID, a time stamp, the TINFO version.

Note: If the Traffic Event changes, the time stamp changes, but the TINFO ID number does not.

3.1.36 Traffic Situation

The total number of all Traffic Events taking place that deserve reporting within an area. The Traffic Situation is always linked to an area. Thus, for example, an areas could be a conurbation or a geometrically demarcated area; an example is the radius around a point.

3.1.37 Voice connection

Circuit-switched channel between two systems for bi-directional voice transmission

3.1.38 Waypoint

Significant points on the route

3.2 Abbreviations

For the purposes of this Technical Specification, the following abbreviations apply:

3.2.1 % ott

percent of the time

3.2.2 ADP

Application Data Protocol, i.e. a message set for a telematics service

3.2.3 AM

Acknowledge Message

3.2.4 ASN.1

Abstract Syntax Notation

3.2.5 BC

Broadcast

3.2.6 BCS

Broadcast Service

3.2.7 CA

Conditional Access

3.2.8 CAS

Conditional Access and Security

3.2.9 CB

Cellular Broadcast

3.2.10 CBC

Cipher Block Chaining

3.2.11 CLI

Calling Line Identification

3.2.12 CRM

Calling Request Message

3.2.13 CSD

Circuit Switched Data

3.2.14 DES

Data Encryption Standard: symmetrical encryption procedure

3.2.15 DRM

Digital Road Map

3.2.16 DSC

Data Service Centre: depending on the mobile communication network

3.2.17 ELB

Extended Location Block

3.2.18 FCD

Floating Car Data

3.2.19 FCDGM

FCD General Message

3.2.20 FCDPM

FCD Parameter Message

3.2.21 FCDNSM

FCD Notification Set-up Message

3.2.22 FCDRM

FCD Revoke Message

3.2.23 FCDVDSUM

FCD Virtual Detection Site Update Message

3.2.24 GATS

Global Automotive Telematics Standard

3.2.25 GEM

General Error Message

3.2.26 GPS

Global Positioning System NAVSTAR GPS

3.2.27 GSM

Global System for Mobile Communication

3.2.28 IE

Information Element

3.2.29 ICV

Initial Chaining Value

3.2.30 L_max

Max. length of transferable data in **one** data transaction

3.2.31 MAC

Message Authentication Code

3.2.32 MNA

Mobile Network Address

3.2.33 MF

Mandatory Fixed format

3.2.34 MO

Mobile Originated Message

3.2.35 MT

Mobile Terminated Message

3.2.36 MV

Mandatory Variable format

3.2.37 N_min

Minimum number of ELB waypoints

3.2.38 OBU

Onboard Unit, synonymously used telematics device, telematics terminal

3.2.39 OF

Optional Fixed format

3.2.40 OV

Optional Variable format

3.2.41 PDU

Protocol Data Unit

3.2.42 PFA

Probability of false alarm (i.e. estimated error is too large)

3.2.43 PMD

Probability of missed detection (i.e. estimated error is too small)

3.2.44 RSA

Asymmetrical encryption procedure by Rivest, Shamir and Adleman

3.2.45 SAE

Society of Automotive Engineers, Inc.

3.2.46 SMS

Short Message Service

3.2.47 SMSC

SMS Centre

3.2.48 SV

Space Vehicle

3.2.49 TEG

Telematics Expert Group – Group within the WAP-Forum Ltd.

3.2.50 TINFO

Traffic Information Report

3.2.51 TOC

Telematics Operator Code

3.2.52 TRP

Transport Protocol

3.2.53 TT

Traffic telematics

3.2.54 TTI

Traffic and Traveller Information

3.2.55 TTFF

Time to First Fix

3.2.56 UTC

Universal Time Co-ordinated

3.2.57 VDS

Virtual Detection Site

3.2.58 vel, V

Velocity

3.2.59 VIN

Vehicle Identification Number

3.2.60 WAP

Wireless Application Protocol

3.2.61 WGS84

World Geodetic System 84

4. General Definitions and Information Elements

4.1 Absolute Time

4.1.1 General

Absolute time stamps are transmitted in a unified format which allows to specify date and time with a resolution of 1 second. The basis for the time referencing is UTC. Therefore time zones are not distinguished.

Each time reference is given with the elements year, month, day (of month), hour, minute and second. The coding of these elements is shown in the subsequent sections. The definition of bit order is given in 4.3.2 of ENV 14821-1.

4.1.2 Year

Table 4-1: Coding Format for the Year IE

Value	Coding	Year
0	0 0 0 0 0 0	1990
1	0 0 0 0 0 1	1991
⋮	⋮	⋮
63	1 1 1 1 1 1	2053

4.1.3 Month

Table 4-2: Coding Format for the Month IE

Value	Coding	Month
0	0 0 0 0	Reserved
1	0 0 0 1	January
⋮	⋮	⋮
12	1 1 0 0	December
13 - 15	1 1 0 1 - 1 1 1 1	Reserved

4.1.4 Day

Table 4-3: Coding Format for the Day IE

Value	Coding	Day
0	0 0 0 0 0	Reserved
1	0 0 0 0 1	1.
⋮	⋮	⋮
31	1 1 1 1 1	31.

4.1.5 Hour

Table 4-4: Coding Format for the Hour IE

Value	Coding	Hour
0	0 0 0 0 0	0
1	0 0 0 0 1	1
⋮	⋮	⋮
23	1 0 1 1 1	23
24 - 31	1 1 0 0 0 - 1 1 1 1 1	Reserved

4.1.6 Minute

Table 4-5: Coding Format for the Minute IE

Value	Coding	Minute
0	0 0 0 0 0 0	0
1	0 0 0 0 0 1	1
⋮	⋮	⋮
59	1 1 1 1 0 0	59
60 - 63	1 1 1 1 0 1 - 1 1 1 1 1 1	Reserved

4.1.7 Second

Table 4-6: Coding Format for the Second IE

Value	Coding	Minute
0	0 0 0 0 0 0	0
1	0 0 0 0 0 1	1
⋮	⋮	⋮
59	1 1 1 1 0 0	59
60 - 63	1 1 1 1 0 1 - 1 1 1 1 1 1	Reserved

5. Area and Location Coding

5.1 General Format

Area coding used to define some specific geographical positions, areas etc. For TTI, several distinct formats are used to describe locations, depending on the nature of the location and system requirements. For this reason a location reference always consists of two parts:

a location type IE, which defines the method of coding and

a location IE, which contains the information coded according to the corresponding location type.

The definition of bit order is given in ENV 14821-1.

Four different location types are distinguished according to Table 5-1.

Table 5-1: Defined values for Location Type

Value	Code	Location Type
0	0 0	ILOC
1	0 1	WGS 84 (low resolution: 50 m)
2	1 0	WGS 84 (high resolution 1 m)
3	1 1	TMC Location

For each of the four location types there is an appropriate definition for the location field.

5.2 WGS 84

The location coding is done by means of WGS84 coordinates (latitude, longitude) to define points. Additionally length parameter and angles may occur.

A number of different shapes are defined to allow for flexible location referencing. They are distinguished by the area type identifier as first IE of each element. The following shapes are defined:

Table 5-2: Definition of Area Types

Shape	Area Type
Point (latitude, longitude)	0 0 0 0
Circle	0 0 0 1
Ellipse	0 0 1 0
Square	0 0 1 1
Rectangle	0 1 0 0
Polygon / Polygonal Line	0 1 0 1
Corridor	0 1 1 0
Sector	0 1 1 1
reserved	1000 - 1111

The formats for low and high resolution differ only in the word lengths of latitude and longitude. Therefore the coding is described for both resolutions together.

5.2.1 Parameter Coding

5.2.1.1 Coordinates for Low Resolution

Only WGS84-coordinates are given in TTI messages.

The Longitude may vary in the range $-180^{\circ} \dots +180^{\circ}$. 0° corresponds to the Greenwich Meridian. Positive numbers correspond to east, negative numbers to west longitude.

The Latitude may vary in the range $-90^{\circ} \dots +90^{\circ}$. -90° corresponds to the south pole, 0° to the equator and $+90^{\circ}$ to the north pole.

The coordinates are transmitted as binary numbers (2 complement) in units of 2^{-11} degrees, which corresponds to approximately 54 m in north direction. The resolution in longitude is approximately 54 m at the equator, 46 m at 30° latitude (central europe) and 18 m at 70° latitude. The field width is 20 bits for each coordinate.

5.2.1.2 Coordinates for High Resolution

Only geographical WGS84-coordinates are given in TTI messages.

The Longitude may vary in the range $-180^{\circ} \dots +180^{\circ}$. 0° corresponds to the Greenwich Meridian. Positive numbers correspond to east, negative numbers to west longitude.

The Latitude may vary in the range $-90^{\circ} \dots +90^{\circ}$. -90° corresponds to the south pole, 0° to the equator and $+90^{\circ}$ to the north pole.

The coordinates are transmitted as binary numbers (2 complement) in units of 2^{-17} degrees which corresponds to approximately 0.85 m in north direction. The field width is 26 bit for each coordinate.

5.2.1.3 Length Parameter

All width parameters are given in metres. The coding is in binomial form (see 13) with parameters

$$C = 10 \text{ m}$$

$$x = 0.1$$

The transmitted value N is coded in 7 bits ($0 \leq N \leq 127$). This results in a range of possible lengths between 1 m and 1807 km. ($N=0$ leads to $l=0$, which may lead to a degradation of geometrical shapes)

5.2.1.4 Angles

Angles are given in degrees with a resolution of 1° . The range is $0^{\circ} \dots 360^{\circ}$ leading to a field width of 9 bit. The coding is done as an unsigned integer (binary number). The angles are measured in clockwise direction.

5.2.2 Definition of Shapes

5.2.2.1 Point

A point is described by the two coordinates (WGS 84: latitude and longitude). The coding of the location is summarized in Table 5-3.

Table 5-3: Coding of Location IE in case of a point (WGS84 Position)

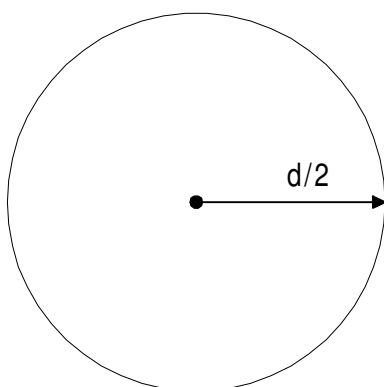
Information Element	Type	Length (bits) for Low Resolution	Length (bits) for High Resolution
Area Type	MF	4	4
Longitude	MF	20	26
Latitude	MF	20	26

The coding of latitude and longitude is performed according to 5.2.1.1 resp. 5.2.1.2.

5.2.2.2 Circle

A circle is defined by the geographical coordinates of its center (WGS 84) and the radius (half diameter = $d/2$) as illustrated in Figure 5-1.

Figure 5-1 : A circle described by its centre and radius



The coding of the location is summarized in Table 5-4.

Table 5-4: Coding of Location IE in case of a circle

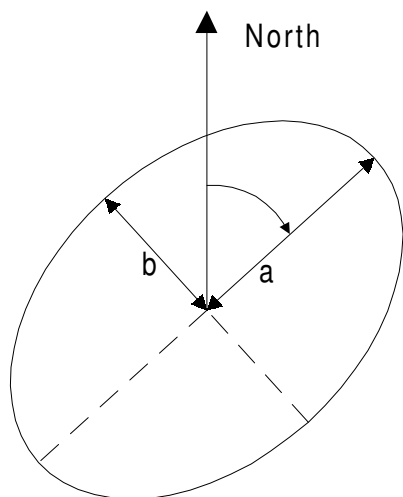
Information Element	Type	Length (bits) for Low Resolution	Length (bits) for High Resolution
Area Type	MF	4	4
Center: Longitude	MF	20	26
Center: Latitude	MF	20	26
Radius ($d/2$)	MF	7	7

The coding of latitude and longitude is performed according to 5.2.1.1 resp. 5.2.1.2. The radius IE is coded according to 5.2.1.3.

5.2.2.3 Ellipse

An ellipse may have arbitrary eccentricity and orientation. It is defined by its center, a major half axis (a), a minor half axis (b) and the angle between the north direction and the major half axis, see Figure 5-2.

Figure 5-2: Definition of an Ellipse



The coding of the location is summarized in Table 5-5.

Table 5-5: Coding of Location IE in case of an ellipse

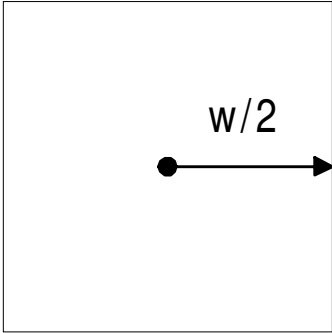
Information Element	Type	Length (bits) for Low Resolution	Length (bits) for High Resolution
Area Type	MF	4	4
Center: Longitude	MF	20	26
Center: Latitude	MF	20	26
Major Half Axis (a)	MF	7	7
Minor Half Axis (b)	MF	7	7
Angle between Major Half Axis and North direction ()	MF	9	9

The coding of latitude and longitude is performed according to 5.2.1.1 resp. 5.2.1.2. The coding for the half axes is according to 5.2.1.3 and for the angle according to 5.2.1.4.

5.2.2.4 Square

A square is defined by the coordinates of the center and the half width $a/2$. The sides lay in north-south and east-west direction as illustrated in Figure 5-3.

Figure 5-3: Definition of a square



The coding of the location is summarized in Table 5-6.

Table 5-6: Coding of Location IE in case of a square

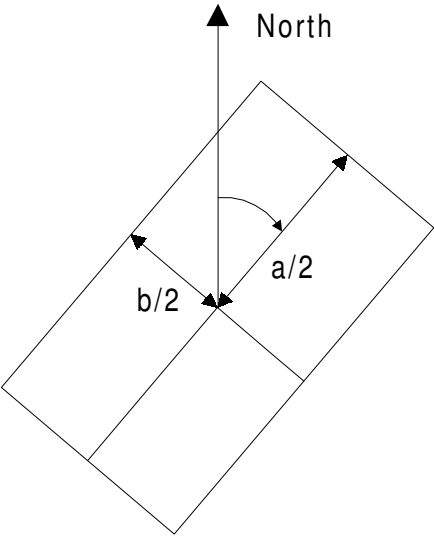
Information Element	Type	Length (bits) for Low Resolution	Length (bits) for High Resolution
Area Type	MF	4	4
Center: Longitude	MF	20	26
Center: Latitude	MF	20	26
Half Width ($w/2$)	MF	7	7

The coding of latitude and longitude is performed according to 5.2.1.1 resp. 5.2.1.2. The coding for the half axes is according to 5.2.1.3.

5.2.2.5 Rectangle

A rectangle may have an arbitrary orientation. It is defined by its center, a major half axis ($a/2$), a minor half axis ($b/2$) and the angle between the north direction and the major half axis (), see Figure 5-4.

Figure 5-4: Definition of a rectangle



The coding of the location is summarized in Table 5-7.

Table 5-7: Coding of Location IE in case of a rectangle

Information Element	Type	Length (bits) for Low Resolution	Length (bits) for High Resolution
Area Type	MF	4	4
Center: Longitude	MF	20	26
Center: Latitude	MF	20	26
Major Half Side (a/2)	MF	7	7
Minor Half Side (b/2)	MF	7	7
Angle between Major Half Side and North direction ()	MF	9	9

The coding of latitude and longitude is performed according to 5.2.1.1 resp. 5.2.1.2. The coding for the half sides is according to 5.2.1.3 and for the angle according to 5.2.1.4.

5.2.2.6 Polygon / Polygonal Line

A polygon is defined by a series of points. The number of points may vary in the range 1 ... 16. The points are connected in the order they appear in the message.

This shape can be used to describe polygons (closed) as well as a polygonal line (open). They are distinguished using the Open/Closed Flag. In case of a polygon the last point is connected to the first one. For both cases examples are given in Figure 5-5.

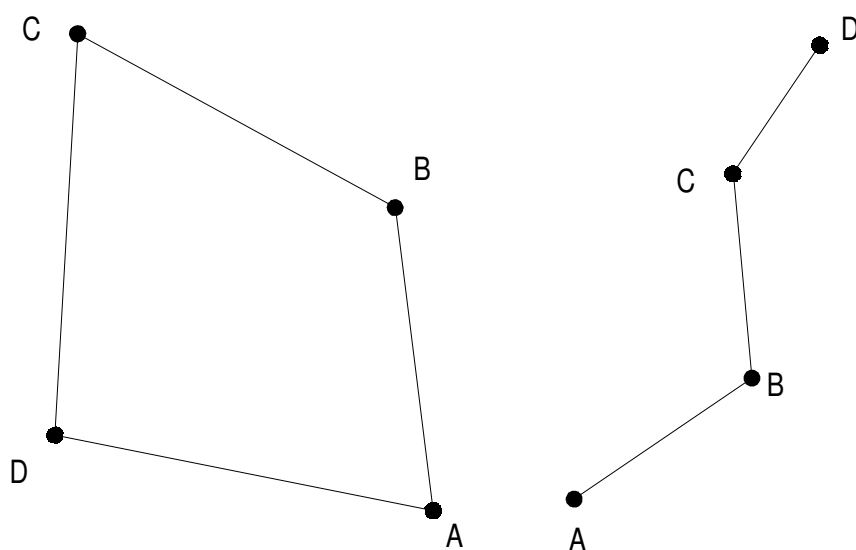


Figure 5-5: Definition of a Polygon / Polygonal Line

The coding of the location is summarized in Table 5-8.

Table 5-8: Coding of Location IE in case of a Polygon / Polygonal Line

Information Element	Type	Length (bits) for Low Resolution	Length (bits) for High Resolution
---------------------	------	----------------------------------	-----------------------------------

Area Type	MF	4	4
Open/Closed Flag	MF	1	1
Number of Points	MF	4	4
1. Point: Longitude	MF	20	26
1. Point: Latitude	MF	20	26
⋮			
Point N: Longitude	MF	20	26
Point N: Latitude	MF	20	26

The coding of latitude and longitude is performed according to 5.2.1.1 resp. 5.2.1.2.

5.2.2.6.1 Open/Closed Flag

The flag determines, whether the last point is connected to the first one (polygon) or not (polygonal line).

Table 5-9: Flag Open/Closed

Value Open/Closed Flag	Type of shape
0	Open (polygonal line)
1	Closed (polygon)

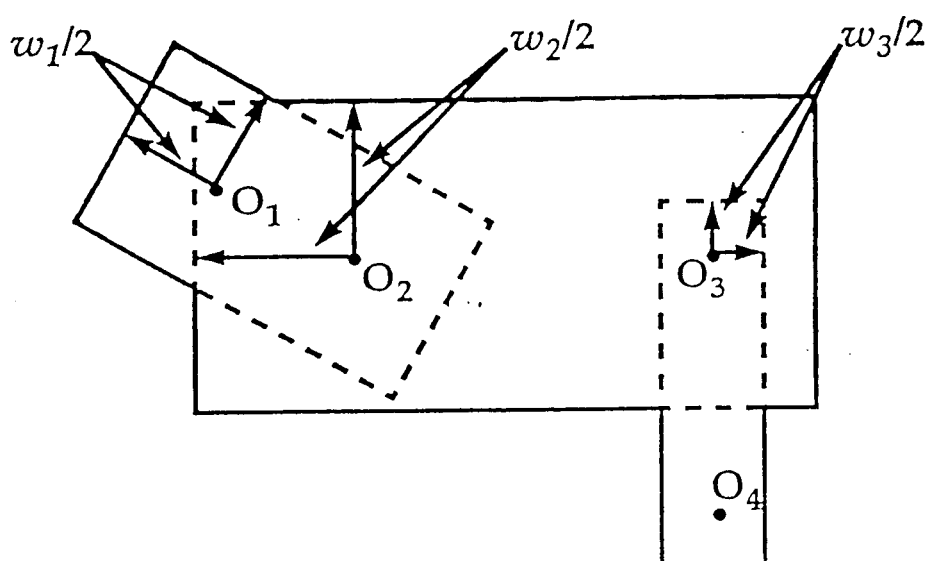
5.2.2.6.2 Number of Points

The Number of points is given as a binary number. The maximum value of $N=16$ is indicated by all zeros.

5.2.2.7 Corridor

A corridor is the area given by the outer shape of several rectangles. The description uses a series of points and half-widths, as illustrated in Figure 5-6 (in this example points $O_1 \dots O_4$ and half-widths $w_1/2 \dots w_3/2$). The rectangles are connected subsequently, and the intended area is the union of the individual rectangles.

Figure 5-6: Definition of a corridor



The coding of the location is summarized in Table 5-10.

Table 5-10: Coding of Location IE in case of a corridor

Information Element	Type	Length (bits) for Low Resolution	Length (bits) for High Resolution
Area Type	MF	4	4
Number of Points	MF	3	3
Longitude Point 1	MF	20	26
Latitude Point 1	MF	20	26
Half Width 1	MF	7	7
⋮			
Longitude Point N	MF	20	26
Latitude Point N	MF	20	26
Half Width N	MF	7	7

5.2.2.7.1 *Number of Points*

The number of points describing the Corridor may vary from 2 to 9. The number N is calculated from the IE contents (IE) as

$$N = IE + 2$$

5.2.2.7.2 *Longitude / Latitude*

The coding of latitude and longitude is performed according to 5.2.1.1 resp. 5.2.1.2. The coding for the half-widths is according to 5.2.1.3.

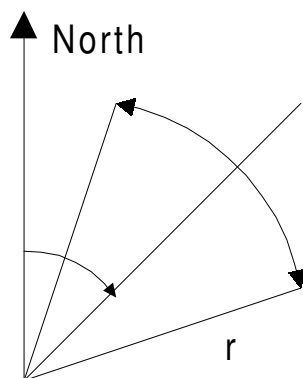
5.2.2.7.3 *Half-Width*

The half width is coded with the binomial formula described in 5.2.1.3. The half-width submitted with the last point has no effect on the shape.

5.2.2.8 *Sector*

A Sector is defined by the center (WGS 84) the radius, the angle against north direction and the opening angle as illustrated in Figure 5-7.

Figure 5-7 : Definition of a sector



The coding of the location is summarized in Table 5-11.

Table 5-11: Coding of Location IE in case of a sector

Information Element	Type	Length (bits) for Low Resolution	Length (bits) for High Resolution
Area Type	MF	4	4
Center: Longitude	MF	20	26
Center Latitude	MF	20	26
Radius	MF	7	7
Direction	MF	9	9
Opening Angle	MF	9	9

The element coding is described in 5.2.1 (center coordinates: 5.2.1.1 and 5.2.1.2, radius: 5.2.1.3 and both angles: 5.2.1.4).

5.3 ILOC

The method, called ILOC referencing, was developed between September 1995 and October 1997 by the ERTICO Committee on Location Referencing, following earlier work in the framework of the Socrates project. The method provides a location referencing scheme that is independent from the map database and has no need for doing any pre-coding.

An intersection locations (ILOC) exists where two or more roads, having different road descriptors, meet. The ILOC descriptor consists of the WGS84 co-ordinate pair of the approximate centre of the ILOC (in 10 microdegrees), plus the first five characters of 3 road descriptors, of different road sections connecting at the ILOC. Main road descriptors are road numbers and road names.

For transmission within the application data protocol layer the coding is as follows:

Table 5-12: Coding Format of the Location IE in case of an ILOC

Information Element	Type	Length (bits)
Geographical Coordinates	MF	52
Road Descriptor 1	MV	var.
Road Descriptor 2	MV	var.
Road Descriptor 3	MV	var.

The coding of the coordinate pair conforms to 5.2.1.2 (WGS 84 with high resolution).

The road descriptors are text elements of up to 5 characters. The coding is done as specified for the data type Text and Transparent Data. Road descriptors may be empty.

5.4 TMC-Location

TMC Locations are locations identified by Local Authorities. The format of the location IE with a length of 30 bits is given in Table 5-13. The coding of the four parts is specified within the ALERT C protocol.

Table 5-13: Coding Format of Location IE in case of a TMC Location

Information Element	Type	Length (bits)
EBU Country Code	MF	4
Database Number	MF	6

PLOC	MF	16
Extent	MF	4

6. Communication Address

6.1 General

Communication addresses submitted in the application data protocol are used to establish communication with a third party. To allow effective signalling, additional information is given to identify the type of connection.

If no address is submitted, the IE „Network ID“ is set to „unknown“, the IE „Address Length“ is set to zero and the IE „Address“ is not present.