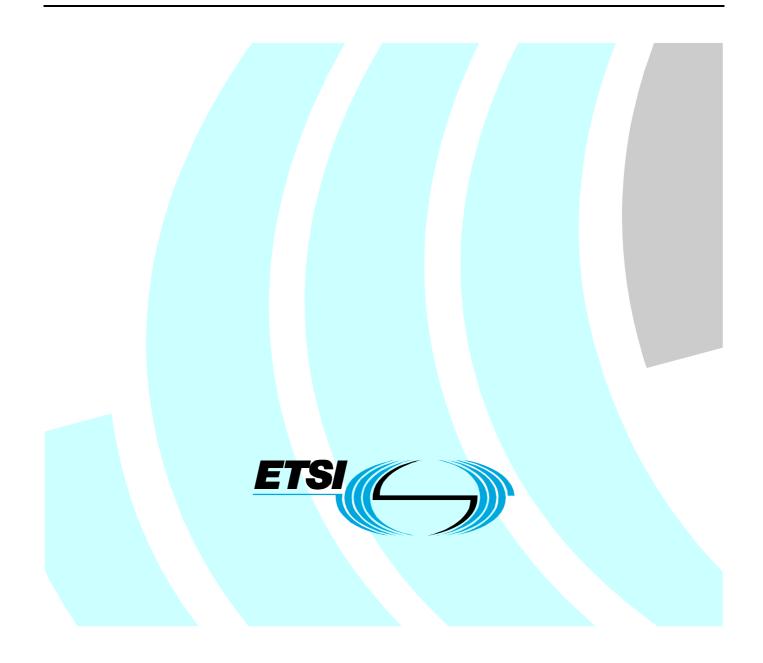# ETSI EN 302 931 V1.1.1 (2011-07)

European Standard

**Intelligent Transport Systems (ITS);
Vehicular Communications;
Geographical Area Definition**

Reference

DEN/ITS-0030021

Keywords

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Foreword

This European Standard (EN) has been produced by ETSI Technical Committee Intelligent Transport System (ITS).

National transposition dates	
Date of adoption of this EN:	19 July 2011
Date of latest announcement of this EN (doa):	31 October 2011
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	30 April 2012
Date of withdrawal of any conflicting National Standard (dow):	30 April 2012

Introduction

The present document specifies a method for location referencing. This method defines geographical areas by means of geometric shapes, i.e. circle, rectangle and ellipse. Furthermore, the present document introduces a function that can be used determine the geospatial relation of a point to the geographical area (at the centre, inside, at the border, outside).

1   Scope

The location referencing method enables ITS stations to exchange location-related information [i.1] and [i.3]. It facilitates communication protocols [i.2] and [i.4] to address geographical areas and to disseminate information in these areas.

The location referencing method is designed to minimize overhead and computational complexity.

Encoding and decoding of the geospatial information is beyond the scope of the present document.

2   References

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

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

2.1   Normative references

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

Not applicable.

2.2   Informative references

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

   [i.1]   ETSI TR 102 638: "Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Definitions".

   [i.2]   ETSI TS 102 637-3: "Intelligent Transport Systems (ITS); Vehicular Communications; Basic Set of Applications; Part 3: Specifications of Decentralized Environmental Notification Basic Service".

   [i.3]   ETSI TS 102 636-3: "Intelligent Transport Systems (ITS); Vehicular Communications; GeoNetworking; Part 3: Network architecture".

   [i.4]   ETSI TS 102 636-4-1: "Intelligent Transport System (ITS); Vehicular communications; GeoNetworking; Part 4: Geographical addressing and forwarding for point-to-point and point-to-multipoint communications; Sub-part 1: Media-Independent Functionality".

3   Definitions and symbols

3.1   Definitions

For the purposes of the present document, the following terms and definitions apply:

location referencing: method for referencing a location to facilitate the exchange of location-related information

3.2   Symbols

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

a   the distance between the center point and the short side of a rectangle (perpendicular bisector of the long side) or the length of the short semi-axis of an ellipse
b   the distance between the center point and the long side of a rectangle (perpendicular bisector of the short side) or the length of the long semi-axis of an ellipse
F   function to determine the spatial characteristics of a point P(x,y) relative to a geometric shape
P(x,y)   point in a Cartesian coordinate system
r   radius of a circle
x   abscissa of a Cartesian coordination system with the origin in the centre of the geographical area and parallel to the long side of a geometric shape
y   ordinate of a Cartesian coordination system with the origin in the centre of the geographical area and parallel to the short side of a geometric shape
θ   azimuth angle of the long side of a rectangle or the long semi-axis of an ellipse
φ   zenith angle of the long side of a rectangle or the long semi-axis of an ellipse

4   Definition of geographical areas

4.1   Overview

Geographical areas shall be specified by geometric shapes. The following geographical areas are defined:

* circular area;

* rectangular area; and

* elliptical area.

Figure 1 depicts all shapes in a single drawing. The shapes are detailed in the following clauses.
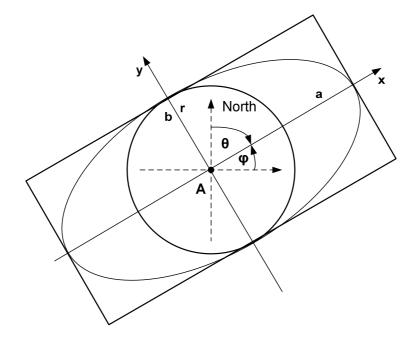

Figure 1: Overview of geometric shapes for the definition of geographical areas

4.2 Definition of a circular area

The circular area shall be described by a circular shape with a single point *A* that represents the center of the circle and a radius *r* as shown in figure 2.
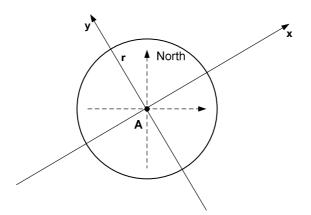

Figure 2: Circular area

4.3 Definition of a rectangular area

The rectangular area shall be defined by a rectangular shape (figure 3) with point *A* that represents the center of the rectangle and the following parameters:

a   the distance between the center point and the short side of the rectangle (perpendicular bisector of the short side);

b   the distance between the center point and the long side of the rectangle (perpendicular bisector of the long side);

θ   azimuth angle of the long side of the rectangle.
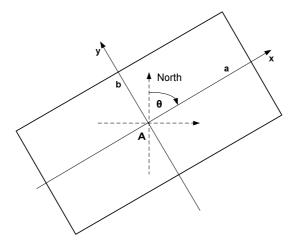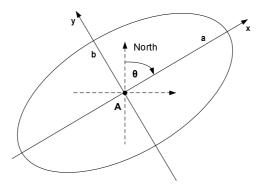

Figure 3: Rectangular area

4.4 Definition of an elliptical area

The elliptical area shall be defined by an elliptical shape (figure 4) with point *A* that represents the center of the ellipse and the following parameters:

  a the length of the long semi-axis;

  b the length of the short semi-axis;

  θ azimuth angle of the long semi-axis.

Figure 4: Elliptical area

5 Elementary geometry

5.1 Geometric function F to determine spatial characteristics of a point P(x,y)

This clause defines a function F that an ITS station can use to determine whether a point P(x,y) is located inside, outside, at the centre, or at the border of a geographical area. The function has the following properties:

$$F(x, y) \begin{cases} =1 & \text{for } x=0 \text{ and } y=0 \text{ (at the centre point)} \\ >0 & \text{inside the geographical area} \\ =0 & \text{at the border of the geographical area} \\ <0 & \text{outside the geographical area} \end{cases}$$

  where: x, y are the geographical coordinates of P.

The function F(x,y) assumes the canonical form of the geometric shapes: The Cartesian coordinate system has its origin in the center of the shape. Its abscissa is parallel to the long side of the shapes. Point P is defined relative to this coordinate system.

5.2 Geometric function F for a circular area

For a circular area the function F is defined by equation 1.

$$F(x, y) = 1 - \left(\frac{x}{r}\right)^2 - \left(\frac{y}{r}\right)^2 \tag{1}$$

5.3   Geometric function F for a rectangular area

For a rectangular area the function F is defined by equation 2.

$$F(x, y) = Minimum\left(1-\left(\frac{x}{a}\right)^2, 1-\left(\frac{y}{b}\right)^2\right) \qquad (2)$$

5.4   Geometric function F for a elliptical area

For an elliptical area the function F is defined by equation 3.

$$F(x, y) = 1-\left(\frac{x}{a}\right)^2 -\left(\frac{y}{b}\right)^2 \qquad (3)$$

Annex A (informative):
Bibliography

- EU FP7 GEONET Project: "Deliverable D2.2 Final GeoNet Specification", January 2010, ETSI Document ITSWG3(10)0011.

- ISO 17572-3 (December 2008): "Intelligent transport systems (ITS) - Location referencing for geographic databases - Part 3: Dynamic location references (dynamic profile)".

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- ISO/TS 18234-6 (June 2006): "Traffic and Travel Information (TTI) - TTI via Transport Protocol Expert Group (TPEG) data-streams - Part 6: Location referencing applications".

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History

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V1.0.0	December 2010	Public Enquiry	PE 20110405:	2010-12-06 to 2011-04-05
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