

# ETSI TS 103 899 V2.1.1 (2025-07)



## **Intelligent Transport Systems (ITS); Vehicular Communications; Geographical Area Definition; Release 2**

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**Reference**

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RTS/ITS-00107

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**Keywords**

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ITS, location

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# Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Intelligent Transport Systems (ITS).

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# Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

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# 1 Scope

The present document specifies the Release 2 of the Geographical Area Definition.

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## 2 References

### 2.1 Normative 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 referenced document (including any amendments) applies.

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Not applicable.

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## 3 Definition of terms, symbols and abbreviations

### 3.1 Terms

For the purposes of the present document, the following terms 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 centre 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 centre 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
$\theta$	azimuth angle of the long side of a rectangle or the long semi-axis of an ellipse
$\varphi$	zenith angle of the long side of a rectangle or the long semi-axis of an ellipse

### 3.3 Abbreviations

Void.

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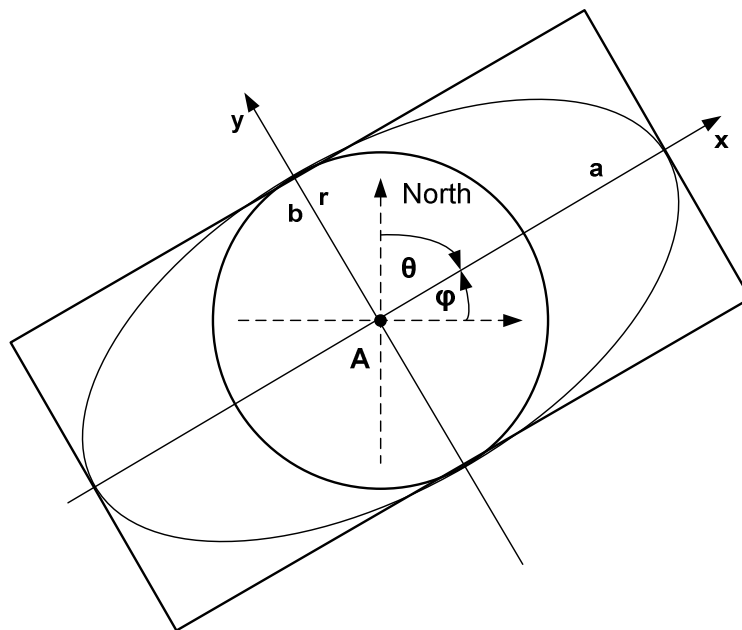
## 4 Definition of geographical areas

### 4.1 Overview

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

- circular area;
- rectangular area; and
- elliptical area.

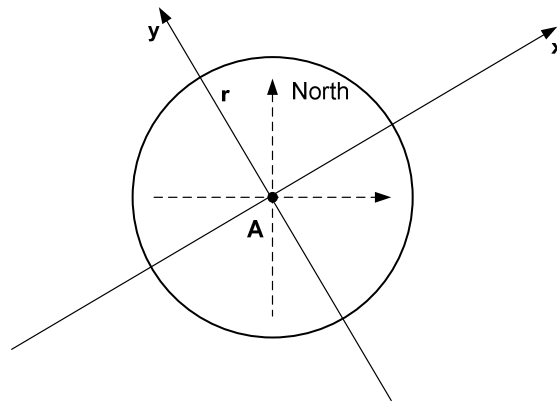
Figure 1 depicts all shapes in a single drawing. The shapes are detailed in the following clauses.



**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 centre of the circle and a radius  $r$  as shown in figure 2.

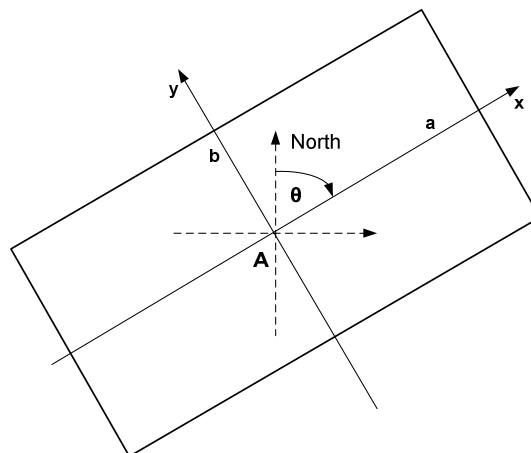


**Figure 2: Circular area**

### 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 centre of the rectangle and the following parameters:

- a the distance between the centre point and the short side of the rectangle (perpendicular bisector of the short side);
- b the distance between the centre point and the long side of the rectangle (perpendicular bisector of the long side);
- $\theta$  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 centre of the ellipse and the following parameters:

- a the length of the long semi-axis;
- b the length of the short semi-axis;
- $\theta$  azimuth angle of the long semi-axis.

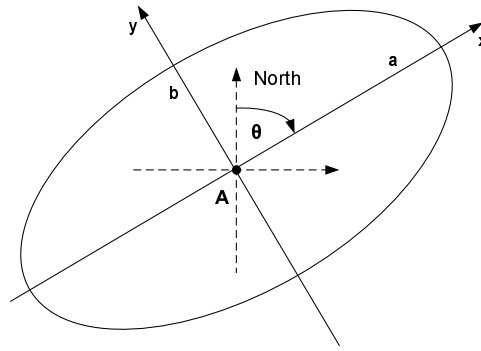


Figure 4: Elliptical area

## 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 centre 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).

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

### 5.3 Geometric function F for a rectangular area

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

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



## 5.4 Geometric function F for an elliptical area

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

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

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## 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)".
- SAE J2266 (October 2004): "Location Referencing Message Specification (LRMS)".
- 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".
- National Imagery And Mapping Agency, Department of Defense (NIMA) Technical Report TR 8350.2: "World Geodetic System 1984", 3<sup>rd</sup> edition, January 2000.

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## History

Document history		
V1.1.1	July 2021	Publication as ETSI EN 302 931
V2.0.0	July 2022	Publication
V2.1.1	July 2025	Publication