

Space - Use of GNSS-based positioning for road
Intelligent Transport Systems (ITS) - Part 1: Definitions
and system engineering procedures for the
establishment and assessment of performances

EESTI STANDARDI EESSÕNA

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English version

Space - Use of GNSS-based positioning for road Intelligent Transport Systems (ITS) - Part 1: Definitions and system engineering procedures for the establishment and assessment of performances

Espace - Utilisation de la localisation basée sur les GNSS pour les systèmes de transport routiers intelligents - Partie 1: Définitions et procédure d'ingénierie système pour l'établissement et la vérification des performances

Raumfahrt - Anwendung von GNSS-basierter Ortung für Intelligente Transportsysteme (ITS) im Straßenverkehr - Teil 1: Definitionen und Systemtechnikverfahren für die Festlegung und Überprüfung von Leistungsdaten

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European foreword

This document (EN 16803-1:2016) has been prepared by Technical Committee CEN-CENELEC/TC 5 “Space”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2017, and conflicting national standards shall be withdrawn at the latest by April 2017.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association.

EN 16803, *Space — Use of GNSS-based positioning for road Intelligent Transport Systems (ITS)* consists of the following parts:

- Part 1: *Definitions and system engineering procedures for the establishment and assessment of performances*
- Part 2¹: *Performance assessment tests of GNSS-based positioning terminals*
- Part 3¹: *Security aspects of performance assessment tests*

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

¹ In preparation.

Introduction

The civil applications of geopositioning are undergoing exponential development. The latest market analysis for the GNSS systems shows 2 major fields of application which, all together, practically share the whole of the market:

- intelligent Transport Systems (ITS), mainly in the Road ITS domain;
- location Based Services (LBS), accessible on smartphones and tablets.

When a *Road ITS system* needs GNSS positioning, which is the case for most of them, there is the question of the choice of the type of terminal or of its minimum performances which are necessary to satisfy the system's final requirements at user level. To meet these requirements, the system includes a processing module called *Road ITS application* which uses the outputs (*PVT* = Position-Velocity-Time) of a *GNSS-based positioning terminal (GBPT)* to provide the service with a given *End-to-end performance*. Consequently, this latter depends on the quality of the positioning outputs, which are highly variable with respect to the operational conditions of the system, but also on the performance of the *Road ITS application* itself.

Figure 1 represents the breakdown of a *Road ITS systems* into its 2 main components.

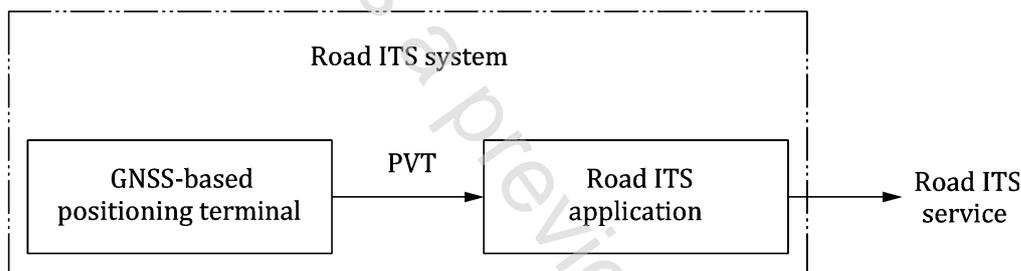


Figure 1 — The two main components of a Road ITS system

The main *Road ITS systems* concerned by this issue are:

- GNSS-based Road User Charging systems (road, parking zone, urban...);
- localized emergency calls (eCall);
- electronic tachograph;
- taximeter;
- regulated freight transport systems (hazardous substances, livestock, etc.);
- “Pay-as-you-drive” insurance;
- road management systems, traffic information systems;
- advanced Driver Assistance Systems (ADAS);
- etc.

Some *Road ITS systems* are considered as “safety critical”, because their failure may cause human death or injury and others are “liability critical”, because they include financial or regulatory aspects. In some cases, their development is subject to an official certification/homologation process.

Particularly for those systems, there exists a strong need to be able to prove they do meet their *End-to-end performance* requirements related to positioning, but, presently, there is no standard that supports such certification process.

The performance management approach proposed in this European Standard is based on a classical system engineering approach and is a support for engineers facing the problem of handling the performances of a *Positioning-based road ITS system* all along the system development.

This overall performance management approach can be summarized as follow:

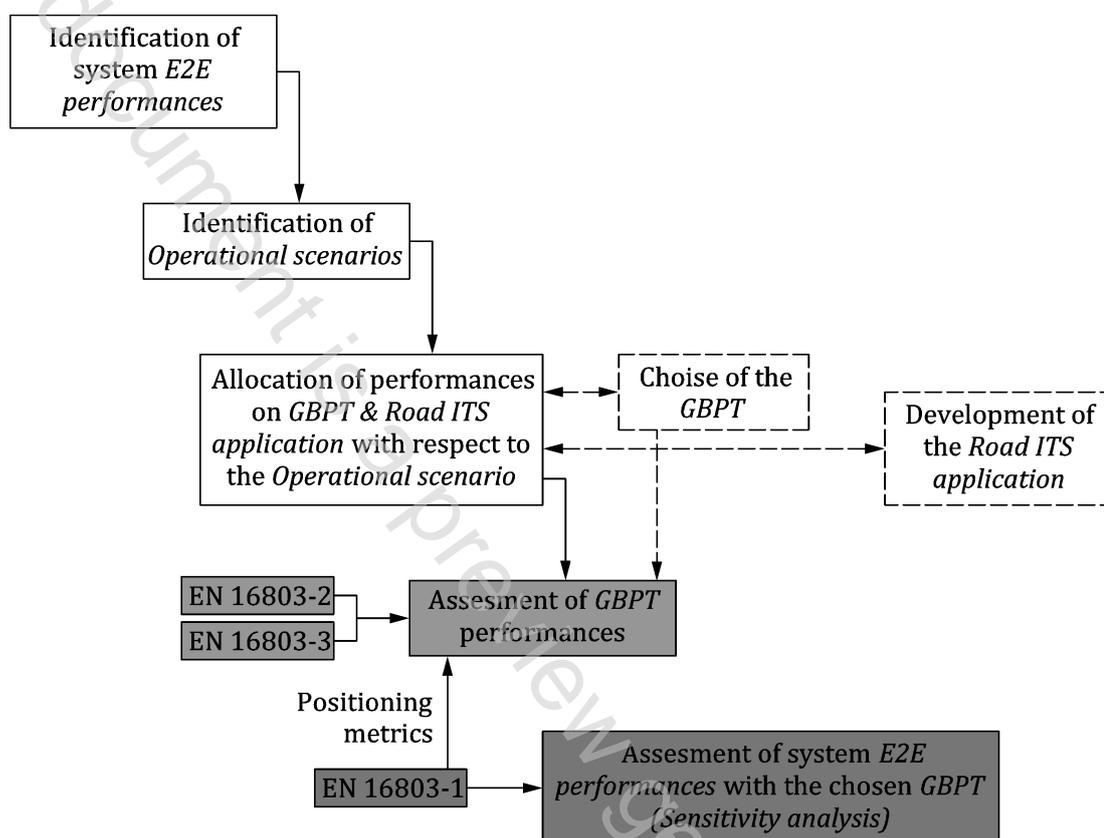


Figure 2 — Logic of the overall performance management approach

The starting point of any performance management of a *Positioning-based road ITS system* **should** be the definition and clear statement of the *E2E performances* which are targeted by the system to design and/or test, as expressed by the customer.

In the context of this European Standard, the system breakdown into components is the one that has been introduced above:

- The GNSS-based positioning terminal (GBPT)
- The Road ITS application

The interface between these two components is assumed to be the *PVT* information, together with some auxiliary information, for instance *Integrity* information if the *GBPT* is designed to support this kind of feature.

Performance requirements are generally stated as requirements on the outputs of a given system component, assuming that the other components feeding it with input information do respect their own performance requirements.

Hence, the performance allocation of the *E2E performances* between the system components **should** follow the general scheme below.

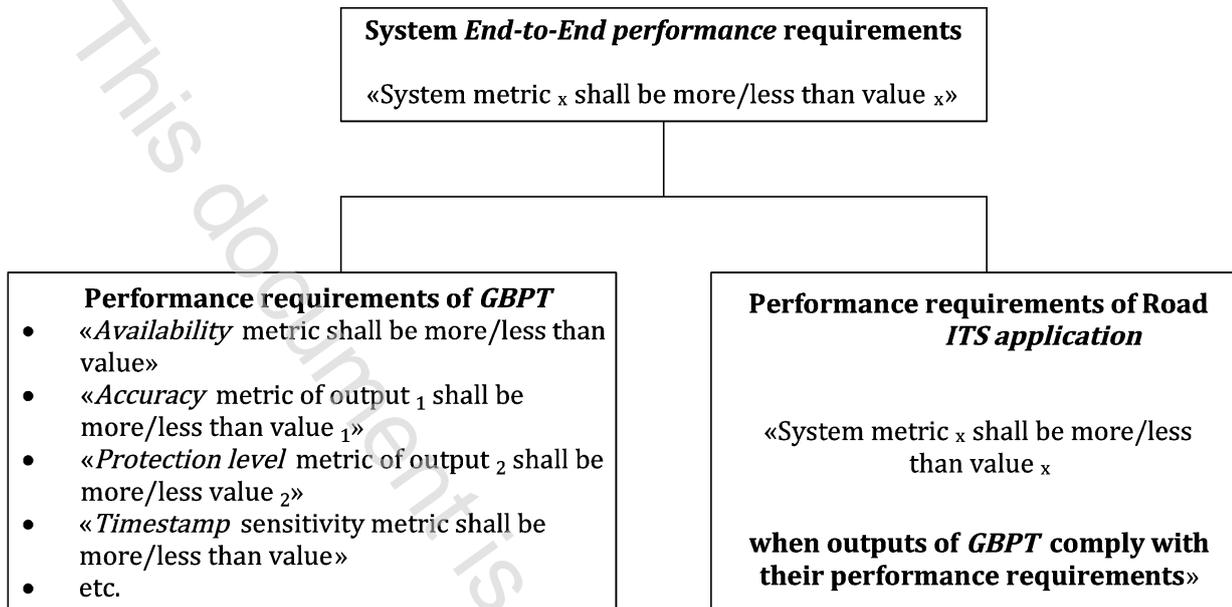


Figure 3 — Generic performance allocation process

The performance requirements of the *Road ITS application* are actually the same ones as the system *E2E performance* requirements, but expressed under the condition that the *GBPT* respects certain performances requirements.

NOTE Depending on the application, performance requirements may need to be put only on the position output or only on the velocity output by the *GBPT*.

Due to the specificities of GNSS performances, which have to be defined statistically and which are highly dependent on the operational conditions, margins **should** be planned in the performance allocations, in order to allow the system to meet its performance requirements, even when, in certain conditions, one of its component does not strictly meet its own requirements.

1 Scope

EN 16803-1 addresses the final stage of the performance management approach, i.e. the assessment of the whole *Road ITS system* performance equipped with a given *GBPT*, using the *Sensitivity analysis* method.

EN 16803-1 addresses the assessment of *GBPT* performance, since it identifies and defines the positioning performance features and metrics to be used in the definition of the *GBPT* performance requirements.

This EN gives definitions of the various items to be considered when specifying an *Operational scenario* and provides a method to compare finely two environments with respect to their effects on GNSS positioning performance.

This EN gives definition of the most important terms used all along the document and describes the architecture of a *Road ITS system* based on GNSS as it is intended in this standard.

This EN does not address:

- the performance metrics to be used to define the *Road ITS system* performance requirements, highly depending on the use case and the will of the owner of the system;
- the performance requirements of the various kinds of *Road ITS systems*;
- the tests that are necessary to assess *GBPT* performances (field tests for this purpose will be addressed by EN 16803-2² and EN 16803-3²).

2 Terms and definitions

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

2.1 General terms

2.1.1

digital map

Digital description of the road network and of a certain number of attributes assigned to the elements of this network

Note 1 to entry: Takes the form of a geo-referenced database at the data processing level.

2.1.2

epoch

time at which a GNSS measurement is made

2.1.3

GNSS

Global Navigation Satellite Systems

general acronym designating satellite positioning systems

2.1.4

GPS

Global Positioning System

name of the GPS-Navstar American satellite positioning system

2.1.5

ITS

Intelligent Transport Systems

systems applying information, communication and positioning technologies to the transport domain

2.1.6

navigation

action of leading a vehicle or pedestrian to a given destination, by calculating the optimal trajectory and giving guidance with reference to this trajectory and its real time position

2.1.7

navigation message

data transmitted by the GNSS satellites and necessary for the position computation

² In preparation.