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Intelligent transport systems — Indoor navigation for personal and vehicle ITS stations —

Part 3: Requirements and specification for indoor positioning reference data

Systèmes de transport intelligents — Navigation interne pour station personnelle et véhicule ITS —

Partie 3: Exigences et spécification pour les données de référence de positionnement intérieur

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Foreword

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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 document 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).

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This document was prepared by Technical Committee ISO/TC 204, *Intelligent transport systems*.

A list of all parts in the ISO 17438 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

With the spread of nomadic and mobile devices such as smart phones and the rapid expansion of indoor spaces, many of the services and facilities related to the transport system have become accessible to indoor spaces. Consequently, navigation in indoor space is considered a new killer application in the transport industry.

The objective of this document is to provide a basic data model and encoding format for indoor positioning reference data required for indoor navigation functionality for ITS applications. This document is intended to be used by designers, developers and providers of indoor navigation services. When implemented, this document is intended to:

1) provide developers and designers with concepts and appropriate information to implement indoor navigation services;

2) provide developers and designers with interoperable ways to use indoor navigation data from various sources for indoor navigation;

3) enable the provision of indoor navigation services to users;

4) provide developers and designers with an extendable base for indoor navigation.

Intelligent transport systems — Indoor navigation for personal and vehicle ITS stations —

Part 3: Requirements and specification for indoor positioning reference data

1 Scope

This document defines requirements and specifications for indoor positioning references, which can be referenced for positioning in indoor space, for supporting indoor navigation functionality of a personal/vehicle (P/V) ITS station.

This document defines:

a) the composition of indoor positioning references for use in obtaining indoor positions for indoor navigation of P/V-ITS-stations;

b) the schema and encoding format of indoor positioning references for P/V-ITS-stations.

This document focuses on indoor positioning references. The following issues which are adjunctive but essential for commercial navigation services are beyond the scope of this document:

— authorized and authenticated access of users and services, including security;

— payment;

— preparation of indoor data which are necessary for indoor navigation;

— low-level communication protocols required to transfer and share data from and to a roadside ITS station or a central ITS station;

— other issues dependent on implementation of an instance of indoor navigation.

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 13184-2, *Intelligent transport systems (ITS) — Guidance protocol via personal ITS station for advisory safety systems — Part 2: Road guidance protocol (RGP) requirements and specification*

ISO 17438-1, *Intelligent transport systems — Indoor navigation for personal and vehicle ITS station — Part 1: General information and use case definition*

3 Terms, definitions, symbols and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 13184-2 and ISO 17438-1 and the following apply.

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1.1
nomadic device
ND
implementation of a personal ITS station which provides communication connectivity via portable equipment such as cellular telephones, wireless communication network (3G, 4G and 5G), mobile wireless broadband (WIMAX, HC-SDMA, etc.), etc. and includes short range links, such as IEEE 802.11x, etc. to connect portable devices to the motor vehicle communications system network

Note 1 to entry: Nomadic devices that have hardware security modules and have been certified to be ITS-trusted are called a personal ITS station.

[SOURCE: ISO 23795-2:2024, 3.1.1, modified — Note 1 to entry has been added.]

3.1.2
navigation
combination of routing, route transversal and tracking

Note 1 to entry: This is essentially the common term "navigation", but the definition decomposes the process in terms used in the packages defined in ISO 19133.

[SOURCE: ISO 19133:2005, 4.15, modified — “this International Standard” has been replaced by “ISO 19133” in the definition.]

3.1.3
indoor navigation
navigation provided in indoor space

[SOURCE: ISO 17438-4:2019, 3.1.2]

3.1.4
indoor navigation data
data needed for indoor navigation, which includes indoor maps and indoor positioning infrastructure information

[SOURCE: ISO 17438-4:2019, 3.1.13]

3.1.5
indoor space
space within artificial structures such as buildings and facilities connected with transport corridors or roads

EXAMPLE A building or indoor parking lot.

[SOURCE: ISO 17438-1:2016, 3.1.2]

3.1.6
ITS station
ITS-S
entity in a communication network, comprised of application, facilities, networking and access layer components specified in ISO 21217 that operate within a bounded secure management domain

[SOURCE: ISO 13184-2:2016, 3.5]

3.1.7
personal/vehicle ITS station
P/V-ITS-S
ITS station implemented in a vehicle or personal mobile device

[SOURCE: ISO 17438-4:2019, 3.1.4, modified — "personal mobile device" has been replaced by "mobile device" in the definition.]

3.1.8
roadside ITS station
R-ITS-S
system that receives and processes vehicular and pedestrian information within a certain zone

Note 1 to entry: The system is installed at the roadside.

[SOURCE: ISO 13184-2:2016, 3.9, modified — "and determines the situation, in order to provide the safety warning and parking guide service to vehicles and pedestrians" has been removed from the definition.]

3.1.9
central ITS station
central ITS-S
C-ITS-S
implementation of an ITS-S in a central ITS subsystem

[SOURCE: ISO 17438-4:2019, 3.1.6]

3.1.10
indoor positioning
determination of a location in an indoor space

[SOURCE: ISO 17438-4:2019, 3.1.7]

3.1.11
client-based indoor positioning
indoor positioning executed at a personal/vehicle ITS station (P/V-ITS-S)

[SOURCE: ISO 17438-4:2019, 3.1.8]

3.1.12
server-based indoor positioning
indoor positioning executed at a central ITS station (C-ITS-S)

[SOURCE: ISO 17438-4:2019, 3.1.9]

3.1.13
indoor positioning infrastructure
infrastructure used to determine locations of personal/vehicle ITS stations (P/V-ITS-S) in an indoor space

EXAMPLE Wi-Fi, Bluetooth, etc.

[SOURCE: ISO 17438-4:2019, 3.1.11]

3.1.14
indoor positioning reference
information to support indoor positioning

Note 1 to entry: Detailed specifications and contents of indoor positioning references depend on the specific indoor positioning technologies.

EXAMPLE A good example of an indoor positioning reference is information about indoor positioning infrastructure. For Wi-Fi based positioning, the indoor positioning infrastructure information includes the Wi-Fi APs information, such as location, SSID, and RSSI values of APs.

[SOURCE: ISO 17438-4:2019, 3.1.12, modified — Example 1 and Example 2 have been combined into a single Example.]

3.1.15
fingerprint map
map including information about specific positioning resources at target locations.

Note 1 to entry: Examples of positioning resources are WiFi, BLE, LTE, etc.

Note 2 to entry: For Wi-Fi based positioning, WiFi fingerprint map can be defined.

Note 3 to entry: The concrete concept of a fingerprint map for indoor positioning can be a form of the indoor positioning reference.

3.1.16
WGS84 coordinate system
reference system used in the satellite-based positioning system, Global Positioning System (GPS)

Note 1 to entry: The World Geodetic System (WGS) is a standard for use in cartography, geodesy and navigation. The latest version is WGS84.

[SOURCE: ISO 13184-2:2016, 3.11, modified — "NAVSTAR Global Positioning System" has been updated to "Global Positioning System" in the definition.]

3.2 Abbreviated terms

AP	access point
ASN	abstract syntax notation
BLE	bluetooth low energy
BS	base station
C-ITS-S	central ITS station
CID	cell identifier
CRS	coordinate reference system
EPSG	European Petroleum Survey Group
GNSS	global navigation satellite system
GPS	global positioning system
ITS	intelligent transport systems
ITS-S	ITS station
LTE	long term evolution
M/O	mandatory/optional
MBR	minimum bounding rectangle
MCC	mobile country code
MNC	mobile network code
MO	maximum occurrence

P/V-ITS-S	personal/vehicle its station
R-ITS-S	roadside its station
RSSI	received signal strength indicator
SSID	service set identifier
TA	timing advance
UUID	universally unique identifier
WGS	World Geodetic System

4 Requirement and conformance

4.1 Requirements

This document defines use cases and message interfaces between a P/V-ITS-S and a C-ITS-S for supporting client-based indoor positioning functionality. In the definitions of data types for supporting the client-based indoor positioning, there are mandatory, optional or conditional fields. Mandatory fields shall be provided and conditions for conditional fields shall be satisfied. These are the requirements embedded in the definition of data types for supporting client-based positioning.

Specific encoding of each data type can be adapted for implementation. There can be additional requirements for specific encoding.

4.2 Conformance

For the purpose of conformance to the client-based indoor positioning for which messages are defined in Clause 7, multiplicity of the elements in a message should be observed through their implementations.

5 Conventions

This document is based on the conventions of ASN.1 (Abstract Syntax Notation One) formats.

6 Indoor positioning references for positioning at P/V-ITS-stations

6.1 Overview

The GNSS signal which is generally used to calculate the positions of mobile devices outdoor cannot be acquired in indoor space. Therefore, for positioning in indoor spaces, other positioning technologies are needed. For indoor positioning, various technologies and infrastructures can be used and information for supporting the indoor positioning should be constructed in advance according to the types of indoor positioning. The indoor positioning references are shared between a P/V-ITS-S and a C-ITS-S, according to the architecture of the indoor navigation implemented.

Indoor positioning can be categorized into two groups, depending on where it runs:

a) client-based indoor positioning; and

b) server-based indoor positioning.

In the client-based indoor positioning architecture, the positioning, i.e. the calculation of a P/V-ITS-S, is executed in the P/V-ITS-S. Therefore, the P/V-ITS-S needs to obtain the indoor positioning references from a C-ITS-S, which normally maintains them. In the server-based indoor positioning architecture, a C-ITS-S calculates the position of a P/V-ITS-S dependent on the request for positioning from the P/V-ITS-S. Therefore, the P/V-ITS-S does not need to obtain the indoor positioning references. This document defines

the specification, requirements and messages for the indoor positioning references directly used in the client-based indoor positioning.

Further to this, client-based indoor positioning can be categorized into another two groups:

1) positioning using information regarding the positioning infrastructure installation; and

2) positioning using indoor positioning references, such as a fingerprint map, constructed from indoor positioning resources obtained in advance in the target indoor space.

Positioning as described in point 1) requires the installation coordinates of the positioning infrastructure, such as the installation coordinates of WiFi APs when WiFi indoor positioning is used for calculating the current position of a P/V-ITS-S, which is generally based on concepts of the triangulation. However, due to privacy and security reasons, such installation coordinates are not normally open, so they are often not available.

Positioning as described in point 2) requires pre-acquired resources, i.e. indoor positioning references, such as the signal strength (RSSI) map of WiFi APs when WiFi indoor positioning is used for calculating the current positioning of a P/V-ITS-S. Such information can be shared with appropriate permissions.

6.2 Scope of indoor positioning references

The scope of indoor positioning references depends on the type of indoor positioning technologies or methods available. In this document, the scope of indoor positioning references is limited to the fingerprint map format using the following positioning resources, taking into consideration the public availability of indoor positioning methods, the spread of indoor positioning infrastructure, and the possibility of obtaining related information:

— WiFi;

— BLE;

— LTE;

— Geomagnetic.

In addition to the resources for indoor positioning, other types of positioning resources may be additionally considered according to the configuration of systems and services to be implemented and the type of indoor positioning to be used.

6.3 Use cases of indoor positioning references

Use cases regarding indoor positioning references for P/V-ITS-S (client)-based positioning are described in ISO 17438-4:2019, UC 2.4 – Retrieving an indoor positioning reference.

This use case describes the sequence by which a P/V-ITS-S requests an indoor positioning reference and a C-ITS-S returns it. The message definition and the flow of messages are also defined in ISO 17438-4.

7 Definition of indoor positioning references

Indoor positioning references in the form of a fingerprint map include values to be used for the indoor positioning, such as WiFi RSSI and BLE RSSI, that can be obtained at a specific location in an indoor space.

The indoor positioning references are transferred to a P/V-ITS-S from a C-ITS-S using the "`reference`" attribute of the "`indoor-positioning-reference`" message defined in ISO 17438-4:2019, 8.13.

Although the data type of the "`reference`" attribute within the "`indoor-positioning-reference`" message defined in ISO 17438-4 8.13 is defined as "Binary", it should be translated or replaced with the detail specification of the "`IndoorPositioningReferences`" data type defined in this clause.

The whole ASN.1 schema for indoor positioning references shall be as defined in Annex A of this document.

Table 1 defines the "IndoorPositioningReferences" data type, describing indoor positioning references.

Table 1 — Definition of IndoorPositioningReferences

Type	**Name**	**IndoorPositioningReferences**		
	Description	Describes the indoor positioning references constructed to support indoor positioning in an indoor space.		
Attributes				
Name	**Type**	**M/O**	**MO**	**Description**
title	IA5String	O	1	Title of the indoor positioning references, i.e. a fingerprint map.
id	IA5String	M	1	Identifier of the indoor positioning references.[a]
crs	UTF8String	O	1	Identifier of the coordinate reference system,[b] which is used for specifying locations in the indoor positioning references.
boundary	PolygonRegion	O	1	Geographical boundary of the indoor positioning references. This can be a form of MBR (minimum bounding rectangle).[c]
creationDate	DATE-TIME	O	1	Date and time at which the indoor positioning references were constructed.
updateDate	DATE-TIME	O	1	Date and time at which the indoor positioning references were last updated.
referenceTypes	IndoorPositioningReferenceType	M	N	Types of the indoor positioning references.[d]
references	IndoorPositioningReference	M	N	Set of the indoor positioning reference.[e]
note	IA5String	O	1	Additional description about the indoor positioning references.
Notes				
[a] The method for constructing an identifier of the indoor positioning references is out of the scope of this document and more consensus is needed for its standardization. [b] Specified in ISO 19111. It can be EPSG codes in string format. If not specified, WGS84 (EPSG 4326) coordinate system is used as default. [c] See ISO 17438-4:2019, Annex A for the definition. [d] See Table 7 for the definition. [e] See Table 2 for the definition.				

ASN.1 Schema

```
IndoorPositioningReferences ::=  SEQUENCE {
   title             IA5String     OPTIONAL,
   id                IA5String,
   crs               UTF8String    OPTIONAL,
   boundary          PolygonRegion OPTIONAL,
   creationDate      DATE-TIME,
   updateDate        DATE-TIME     OPTIONAL,
   referenceTypes    SEQUENCE OF IndoorPositioningReferenceType,
   references        SEQUENCE OF IndoorPositioningReference,
   note              IA5String     OPTIONAL,
   ...
}
```

Example

```
{
   title             "an example of indoor positioning references",
```

Table 1 *(continued)*

```
    id                  "IPR001",
    creationDate        "2023-10-14T15:30:00",
    referenceTypes      { WiFi-Fingerprint, BLE-Fingerprint },
    references          { ... },  -- refer to the example of Table 2
    note                "created as an example"
}
```

Table 2 defines the "IndoorPositioningReference" data type, describing positioning resources of a specific indoor location, which can be used for indoor positioning.

Table 2 — Definition of IndoorPositioningReference

Type	**Name**	**IndoorPositioningReference**		
	Description	Describes indoor positioning resources, which can be used for indoor positioning.		
Attributes				
Name	**Type**	**M/O**	**MO**	**Description**
id	IA5String	O	1	Identifier of the indoor positioning reference.[a]
location	Location	M	1	A specific location where the indoor positioning references are provided.[b] [c]
wifiReference	WiFiPositioningReference	O	N	WiFi resources which can be used for indoor positioning at the given location.[d]
bleReference	BLEPositioningReference	O	N	BLE resources which can be used for indoor positioning at the given location.[e]
lteReference	LTEPositioningReference	O	N	LTE resources which can be used for indoor positioning at the given location.[f]
geomagReference	GeomagPositioningReference	O	N	Geo-magnetometer resources which can be used for indoor positioning at the given location.[g]
note	IA5String	O	1	Additional description about the indoor positioning references.
Notes				
[a] The method for constructing an identifier of the indoor positioning reference is out of the scope of this document and more consensus is needed for the standardization.				
[b] The coordinate reference system is given by the "crs" attribute of "IndoorPositioningReferences".				
[c] See ISO 17438-4:2019 Annex A for the definition.				
[d] See Table 3 for the definition.				
[e] See Table 4 for the definition.				
[f] See Table 5 for the definition.				
[g] See Table 6 for the definition.				

ASN.1 Schema

```
IndoorPositioningReference ::= SEQUENCE {
    id                  IA5String    OPTIONAL,
    location            Location,
    wifiReference       SEQUENCE OF WiFiPositioningReference    OPTIONAL,
    bleReference        SEQUENCE OF BLEPositioningReference     OPTIONAL,
    lteReference        SEQUENCE OF LTEPositioningReference     OPTIONAL,
    geomagReference     SEQUENCE OF GeomagPositioningReference  OPTIONAL,
    note                IA5String    OPTIONAL,
    ...
}
```

Example

Table 2 *(continued)*

```
{
   location {    x-coordinate    233133.6619126556,
                 y-coordinate    420606.8170485072
              },
   wifiReference     {...},    -- refer to the example of Table 3
   bleReference      {...},    -- refer to the example of Table 4
   lteReference      {...},    -- refer to the example of Table 5
   geomagReference   {...},    -- refer to the example of Table 6
   note       "an example of an indoor positioning reference"
}
```

Table 3 defines the "WiFiPositioningReference" data type, describing the WiFi resources of a specific indoor location.

NOTE See Annex B for an example of Wifi positioning references.

Table 3 — Definition of WiFiPositioningReference

Type	**Name**	**WiFiPositioningReference**		
	Description	Describes a WiFi observation value of a specific indoor location.		
Attributes				
Name	**Type**	**M/O**	**MO**	**Description**
ssid	IA5String	O	1	SSID (service set identifier) of the WiFi device sensor.
macAddress	OCTECT STRING	M	1	Mac address of the WiFi device chip.
rssi	INTEGER	M	1	A WiFi signal value in dBm.
note	IA5String	O	1	Additional description about the indoor positioning references.
Notes				
(none)				

ASN.1 Schema

```
WiFiPositioningReference ::= SEQUENCE {
   ssid              IA5String     OPTIONAL,
   macAddress        OCTET STRING,
   rssi              INTEGER,
   note              IA5String     OPTIONAL,
   ...
}
```

Example

```
{
   ssid          "CCC_WLAN",
   macAddress    "c8675e368894",
   rssi          -75,
   note          "an example of WiFi observation"
}
```

Table 4 defines the "BLEPositioningReference" data type, describing BLE resources of a specific indoor location.

Table 4 — Definition of BLEPositioningReference

Type	Name	BLEPositioningReference		
	Description	Describes a BLE observation value of a specific indoor location.		
Attributes				
Name	**Type**	**M/O**	**MO**	**Description**
uuid	OCTECT STRING	O	1	UUID of the BLE device.
macAddress	OCTECT STRING	M	1	Mac address of the BLE chip.
major	INTEGER	M	1	Major number of the BLE device.
minor	INTEGER	M	1	Minor number of the BLE device.
rssi	INTEGER	M	1	A WiFi signal value in dBm.
note	IA5String	O	1	Additional description about the indoor positioning references.
Notes				
(none)				

ASN.1 Schema

```
BLEPositioningReference ::= SEQUENCE {
   uuid           OCTET STRING    OPTIONAL,
   macAddress     OCTECT STRING (SIZE(6)),
   major          INTEGER,
   minor          INTEGER,
   rssi           INTEGER,
   note           IA5String     OPTIONAL,
   ...
}
```

Example

```
{
   macAddress    "BC7E8BE31687",
   major         0,
   minor         0,
   rssi          -65,
   note          "an example of a BLE observation"
}
```

Table 5 defines the "`LTEPositioningReference`" data type, describing LTE resources of a specific indoor location.

Table 5 — Definition of LTEPositioningReference

Type	Name	LTEPositioningReference		
	Description	Describes an LTE observation value of a specific indoor location.		
Attributes				
Name	**Type**	**M/O**	**MO**	**Description**
serv	INTEGER	M	1	Represents the serving cell.
mcc	INTEGER	M	1	Mobile country code (MCC) of the mobile communication. It is used to identify the country to which a mobile subscriber belongs.
mnc	INTEGER	M	1	Mobile network code (MNC) of the mobile communication. It is used to identify the network to which a mobile subscriber belongs.
band [a]	INTEGER	M	1	Frequency band of the mobile communication.
pci	INTEGER	O	1	Physical cell identifier.

Table 5 *(continued)*

cid	INTEGER	M	1	Cell identifier.
rsrq	INTEGER	M	1	Indicates quality of the received signal in dBm.
rsrp	INTEGER	M	1	The average power received from a single reference signal in dBm.
rssi	INTEGER	M	1	Represents the entire received power including the wanted power from the serving cell as well as all co-channel power and other sources of noise.
ta	INTEGER	O	1	Timing advance (TA), when available, can be used to confine the possible location of a cellular base station (BS) antenna to a thin annular band with a centre.
note	IA5String	O	1	Additional description about the indoor positioning references.
Notes				
(none)				

ASN.1 Schema

```
LTEPositioningReference ::= SEQUENCE {
   serv       INTEGER,
   mcc        INTEGER,
   mnc        INTEGER,
   band       INTEGER,
   pci        INTEGER      OPTIONAL,
   cid        INTEGER,
   rsrq       INTEGER,
   rsrp       INTEGER,
   rssi       INTEGER,
   ta         INTEGER      OPTIONAL,
   note      IA5String     OPTIONAL,
   …
}
```

Example

```
{
   serv   2,
   mcc    450,
   mnc    05,
   band   1350,
   pci    22,
   cid    35288887,
   rsrq   -4,
   rsrp   -73,
   rssi   -51,
   ta     6,
   note   "an example of LTE observation"
}
```

Table 6 defines the "`GeomagPositioningReference`" data type, describing geo-magnetometer resources of a specific indoor location.

Table 6 — Definition of GeomagPositioningReference

Type	Name	GeomagPositioningReference		
	Description	Describes a geo-magnetometer observation value of a specific indoor location.		
Attributes				
Name	**Type**	**M/O**	**MO**	**Description**
magX	REAL	M	1	Geo-magnetic value of X-axis in microtesla (μT).
magY	REAL	M	1	Geo-magnetic value of Y-axis in microtesla (μT).
magZ	REAL	M	1	Geo-magnetic value of Z-axis in microtesla (μT).
note	IA5String	O	1	Additional description about the indoor positioning references.
Notes				
(none)				

ASN.1 Schema

```
GeomagPositioningReference ::= SEQUENCE {
   magX      REAL,
   magY      REAL,
   magZ      REAL,
   note      IA5String    OPTIONAL,
   ...
}
```

Example

```
{
   magX   32.199112,
   magY   -51.56486,
   magZ   171.77245,
   note   "an example of geomagnetometer observation"
}
```

Table 7 defines the "`IndoorPositioningReferenceType`" codelist, enumerating the types of indoor positioning references.

Table 7 — Definition of IndoorPositioningReferenceType

Code list	Name	IndoorPositioningReferenceType	
	Description	Enumerates the types of indoor positioning references.	
Code values			
Name	**Code**	**Description**	
WiFi-AP-Location	1	Indoor positioning using locations of WiFi APs.	
WiFi-Fingerprint	2	Indoor positioning using fingerprint maps of WiFi signal.	
BLE-AP-Location	3	Indoor positioning using locations of BLE devices.	
BLE-Fingerprint	4	Indoor positioning using fingerprint maps of BLE signal.	
LTE-AP-Location	5	Indoor positioning using locations of LTE stations.	
LTE-Fingerprint	6	Indoor positioning using fingerprint maps of LTE signal.	
Geomag-Fingerprint	7	Indoor positioning using fingerprint maps of strength of geo-magnetic field.	
… (More codes can be added depending on an extension)			
Notes			

Table 7 *(continued)*

(none)
ASN.1 Schema

`IndoorPositioningReferenceType ::= ENUMERATED {`
`  WiFi-AP-Location  (1),`
`  WiFi-Fingerprint  (2),`
`  BLE-AP-Location  (3),`
`  BLE-Fingerprint  (4),`
`  LTE-AP-Location  (5),`
`  LTE-Fingerprint  (6),`
`  Geomag-Fingerprint  (7),`
`  ...`
`}`

Annex A
(normative)

ASN.1 module

A.1 General

The ASN.1 basic notation is specified in ISO/IEC 8824-1.

Applicable encoding of the types and values specified in Clause A.2 depend on the usage. ASN.1 BASIC-PER, UNALIGNED, as specified in ISO/IEC 8825-2, typically applies for communications over narrowband wireless links. XML encoding typically applies for communications between infrastructure devices, or transmitted by CV2X (or similar).

The following ASN.1 module containing the definitions of the data dictionaries in Clause 7 is specified in Clause A.2:

```
- INaviPos {iso(1) standard (0) INavi (17438-3) inavipos (1) majorVersion1 (1) minorVersion0
(0)}
```

These ASN.1 definitions are provided in machine-readable format at the following address: https://standards.iso.org/iso/17438/-3/ed-1/en

This ASN.1 module is presented in Clause A.2 for information purposes only.

In case of differences between the ASN.1 presentation in the electronic attachment and the description in this document, the presentation in the electronic attachment shall prevail.

A.2 ASN.1 Module INaviPos

```
INaviPos {iso(1) standard (0) INavi (17438-3) inavipos (1) majorVersion1 (1) minorVersion0
(0)}

DEFINITIONS AUTOMATIC TAGS::=BEGIN

-- definitions for indoor positioning references.
--
-- This ASN.1 Schema defines the composition and structure of the indoor
-- positioning references.
-- The scope of indoor positioning references currently defined in this document
-- includes references in forms of fingerprint maps, using WiFi, BLE, LTE
-- and/or Geo-magnetometer for indoor positioning.
--

-- IndoorPositioningRefernces
IndoorPositioningReferences ::=  SEQUENCE {
   title            IA5String     OPTIONAL,
   id               IA5String,
   crs              UTF8String    OPTIONAL,
   boundary         PolygonRegion OPTIONAL,
   creationDate     DATE-TIME,
   updateDate       DATE-TIME     OPTIONAL,
   referenceTypes   SEQUENCE OF IndoorPositioningReferenceType,
   references       SEQUENCE OF IndoorPositioningReference,
   note             IA5String     OPTIONAL,
   ...
}

-- IndoorPositioningReference
IndoorPositioningReference ::=  SEQUENCE {
   id               IA5String     OPTIONAL,
```