

**Draft Document**

**IALA S-241**

**Product Specification**

IALA PNT Station Almanac Product Specification

**Document Revisions**

Revisions to the IALA Document are to be noted in the table prior to the issue of a revised document.

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| **Date** | **Page / Section Revised** | **Requirement for Revision** |
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# Overview

## Introduction

PNT, which stands for Positioning, Navigation, and Timing, is an essential aspect of modern technology that plays a crucial role in various fields. It integrates multiple technologies to provide users with precise location information, navigation guidance, and highly accurate time synchronization. For example, Global Navigation Satellite Systems (GNSS) such as GPS, GLONASS, Galileo, and BeiDou are central to PNT systems, using satellite signals to offer positioning and navigation services worldwide. These systems not only help people navigate in their daily lives but also serve critical areas like aviation, maritime, and military.

A PNT Station Almanac is a data product that provides comprehensive information about Positioning, Navigation, and Timing (PNT) stations. This information is crucial for various applications, including maritime navigation, aviation, and telecommunications. The almanac typically includes details such as the location, operational status, and technical specifications of PNT stations.

The PNT Station Almanac is designed to facilitate the exchange of standardized information about PNT stations between different stakeholders, such as maritime authorities, navigation service providers, and users of PNT services.

The PNT Station Almanac is a critical tool for ensuring the reliability and accuracy of positioning, navigation, and timing services. By providing standardized and detailed information about PNT stations, it supports efficient and safe navigation across various domains.

## References

### Normative References

IHO S-100 IHO Universal Hydrographic Data Model, Edition 5.2.0, June 2024

ISO 8601:2004 Data elements and interchange formats \_ Information interchange \_ Representation of dates and times

ISO/TS 19103:2005 Geographic information - Conceptual schema language

ISO 19111:2003 Geographic information - Spatial referencing by coordinates

ISO 19115-1:2014 Geographic information – Metadata (Tech Corr. 1, 2006)

ISO 19131:2007 Geographic information - Data product specifications

ISO/IEC 19505-1:2012, Information technology — Open Distributed Processing - Unified Modelling Language Version 2.4.1

ISO 3166-1 Country Codes

International Loran Association: 2007 Enhanced Loran (eLoran) Definition Document

RTCM SC 127 Minimum Performance Standards for Marine eLoran Receiving Equipment

### Informative References

ISO, 2006. ISO 19109 Geographic Information - Rules for Application Schema.

ISO, 2007. ISO 19135 Geographic Information – Procedures for Item Registration.

ISO, 2009. ISO 19136 Geographic Information - Geography Markup Language (GML).

IMO, 2008. Safety of Navigation Circular SN/Circ.243

IALA, 2012. Guideline 1088 on an Introduction to Preparing S-100 Product Specifications

## Terms, Definitions and abbreviations

### Terms and definitions

The S-100 framework is based on the ISO 19100 series of geographic standards. The terms and definitions provided here are used to standardize the nomenclature found within that framework, whenever possible. They are taken from the references cited in clause 2.1. Modifications have been made when necessary.

**application**

manipulation and processing of data in support of user requirements (ISO 19101)

**application schema**

**conceptual schema** for data required by one or more **applications** (ISO 19101)

**conceptual model**

modelthat defines concepts of a **universe of discourse** (ISO 19101)

**conceptual schema**

formal description of a **conceptual model** (ISO 19101)

**coverage**

**feature** that acts as a function to return values from its range for any direct position within its spatial, temporal or spatiotemporal **domain** (ISO 19123)

*EXAMPLE Raster image, polygon overlay, digital elevation matrix.*

**data product**

**dataset** or **dataset series** that conforms to a **data product specification**

**data product specification**

detailed description of a **dataset** or **dataset series** together with additional information that will enable it to be created, supplied to and used by another party

*NOTE: A data product specification provides a description of the universe of discourse and a specification for mapping the universe of discourse to a dataset. It may be used for production, sales, end-use or other purpose.*

**dataset**

identifiable collection of data (ISO 19115)

*NOTE: A dataset may be a smaller grouping of data which, though limited by some constraint such as spatial extent or feature type, is located physically within a larger dataset. Theoretically, a dataset may be as small as a single feature or feature attribute contained within a larger dataset. A hardcopy map or chart may be considered a dataset.*

**dataset series**

collection of **datasets** sharing the same product specification (ISO 19115)

**domain**

well-defined set (ISO/TS 19103)

*NOTE: Well-defined means that the definition is both necessary and sufficient, as everything that satisfies the definition is in the set and everything that does not satisfy the definition is necessarily outside the set.*

**feature**

abstraction of real world phenomena (ISO 19101)

*NOTE: A feature may occur as a type or an instance. Feature type or feature instance shall be used when only one is meant.*

**feature association**

relationship that links instances of one **feature** type with instances of the same or a different **feature** type (ISO19110)

*NOTE 1; A feature association may occur as a type or an instance. Feature association type or feature association instance is used when only one is meant.*

*NOTE 2: Feature associations include aggregation of features.*

**feature attribute**

characteristic of a **feature** (ISO 19101)

*NOTE 1: A feature attribute may occur as a type or an instance. Feature attribute type or feature attribute instance is used when only one is meant.*

*NOTE 2: A feature attribute type has a name, a data type and a domain associated to it. A feature attribute for a feature instance has an attribute value taken from the domain.*

**geographic data**

data with implicit or explicit reference to a location relative to the Earth (ISO 19109)

*NOTE: Geographic information is also used as a term for information concerning phenomena implicitly or explicitly associated with a location relative to the Earth.*

**metadata**

data about data (ISO 19115)

**model**

abstraction of some aspects of reality (ISO 19109)

**portrayal**

presentation of information to humans (ISO 19117)

**quality**

totality of characteristics of a product that bear on its ability to satisfy stated and implied needs (ISO 19101)

**universe of discourse**

view of the real or hypothetical world that includes everything of interest (ISO 19101)

### Acronyms

This product specification adopts the following convention for symbols and abbreviated terms:

AtoN Aid to navigation

CRS Coordinate Reference System

ECDIS Electronic Chart Display and Information System

eLoran Enhanced Loran

e-Navigation Enhanced Navigation (maritime)

EPSG European Petroleum Survey Group

ENC Electronic Navigational Chart

FTA Finnish Transport Administration

GNSS Global Navigation Satellite System

GPS Global Positioning System

IALA International Association of Marine Aids to Navigation and Lighthouse Authorities

ICAO International Civil Aviation Organization

IHO International Hydrographic Organization

IMO International Maritime Organization

ISO International Organization for Standardization

Loran LOng-RAnge Navigation

PNT Positioning, Navigation, and Timing

WWRNS World Wide Radionavigation System

XML Extensible Markup Language

## Product Specification metadata

|  |  |
| --- | --- |
| **Title** | PNT Station Almanac |
| **Identifier** | 1.0.0 |
| **S-100 version** | 5.2.0 |
| **Date** | October 2025 |
| **Language** | English |
| **Classification:** | **001 - unclassified** |
| **Contact:** | IALA 10, rue des Gaudines 78100 Saint Germain en Laye, France Telephone: +33 1 34 51 70 01 Fax: +33 1 34 51 82 05 |
| **URL:** | www.iala.int |
| **Maintenance:** | The product specification is maintained by IALA and amendments are performed on a needs base, up to maximum of one new release per calendar year. |

### IALA Product Specification Maintenance

This section details the process of maintaining this document.

Changes to this product specification will be released by IALA as a new edition, revision, or clarification.

#### New Edition

New editionsof this product specification introduce significant changes. *New editions* enable new concepts, such as the ability to support new functions or applications, or the introduction of new constructs or data types.

#### Revisions

Revisions are defined as substantive semantic changes to a product specification. Typically, revisions will change a product specification to correct factual errors; introduce necessary changes that have become evident as a result of practical experience or changing circumstances. A *revision* must not be classified as a clarification. *Revisions* could have an impact on either existing users or future users of a product specification. All cumulative *clarifications* must be included with the release of approved corrections.

Changes in a revision are minor and ensure backward compatibility with the previous versions within the same edition. Newer revisions, for example, introduce new features and attributes. Within the same edition, a data product of one version could always be processed with a later version of the feature and portrayal catalogues.

#### Clarification

Clarifications are non-substantive changes to this product specification. Typically, clarifications: remove ambiguity; correct grammatical and spelling errors; amend or update cross references; insert improved graphics, spelling, punctuation and grammar. A clarification must not cause any substantive semantic change to a product specification.

Changes in a clarification are minor and ensure backward compatibility with the previous versions within the same edition. Within the same edition, a data product of one clarification version could always be processed with a later version of the feature and portrayal catalogues, and a portrayal catalogue can always rely on earlier versions of the feature catalogues.

#### Version Numbers

The associated version control numbering to identify changes (n) to this product specification will be as follows:

New editions denoted as **n**.0.0

Revisions denoted as n.**n**.0

Clarifications denoted as n.n.**n**

# Specification Scope

This product specification describes one data product and therefore requires only one scope which is described below:

**Scope ID:** PNT Station Almanac datasets

**Hierarchical level:** MD\_ScopeCode - 005

**Hierarchical level name:** dataset.

**Level description:** information applies to the dataset

**Extent:** EX\_Extent.description: Global coverage of maritime areas

# Data Product Identification

This clause describes how to identify data sets that conform to the specification. A dataset that conforms to this Product Specification may be identified by its discovery metadata as defined in clause 13 of this specification. The information identifying the data product may include the following items from S-100 5.2.0 clause 11-6 (adapted from ISO 19115-1).

## 

|  |  |
| --- | --- |
| **Title** | PNT Station Almanac |
| **Alternate Title** | S-241 |
| **Abstract** | An PNT Station Almanac is a vector dataset containing all relevant information regarding the PNT Transmitting Station within a defined geographical area. |
| **Topic Category** |  |
| **Geographic Description** | EX\_GeographicDescription: E.g., official name of region |
| **Spatial Extent** | **Description:** Global  **East Bounding Longitude:** -180  **West Bounding Longitude:** 180  **North Bounding Latitude:** 90  **South Bounding Latitude:** -90 |
| **Description** |  |
| **Spatial Resolution** | All scales |
| **Purpose** | PNT Station Almanac are produced to allow the producer to exchange PNT Station information with interested stakeholders |
| **Language** | English |
| **Spatial Representation Type** |  |
| **Point of Contact** | IALA |
|  |  |

# Data Content and structure

## Introduction

An PNT Station Almanac dataset is a feature-based product. The following sub-sections contain the product application schema expressed in UML and an associated feature catalogue. The feature catalogue provides a full description of each feature type including its attributes and attribute values in the data product.

## Application Schema

The application schema conforms to the modelling conventions of UML as constrained in S-100 Part 1, and conforms to the General Feature Model described in S-100 Part 3.

An overview of the application schema is provided in the following figure (Figure 4-1). The subsequent figures provide details for feature types and their relationships.

* The feature type RadioStation is a type which is used to indicate characteristics of PNT station such as category, name and status of Radio station.
* Reference-referenceby associations are modelled by the association labelled ReferenceReferenceby, between classes RadioStation and PNTStationAlmanac in Figure 4-1 below.
* The information type PNTStationAlmanac is a type which is used to indicate transmitting information in the PNT station.
* The UML model shown in Figure 4-2below illustrates an application schema of DGNSS Station Almanac. It includes a general description of elements used to construct the application schema, and the relationships between them. These elements include feature types, information types, simple attributes, complex attributes, aggregations and associations.
* An overview of the eLoran station application schema is provided in the following figure (Figure 4-3). The subsequent figures provide details for feature types and their relationships.
* The feature type DLoranStation is a type which is used to indicate DLoran station. Reference-referenceby associations are modelled by the association labelled ReferenceReferenceby, between classes DLoranStation and DLoranStationAlmanac in Figure 4-4below.The information type DLoranStationAlmanac is a type which is used to indicate a characteristics in the DLoran Reference station.

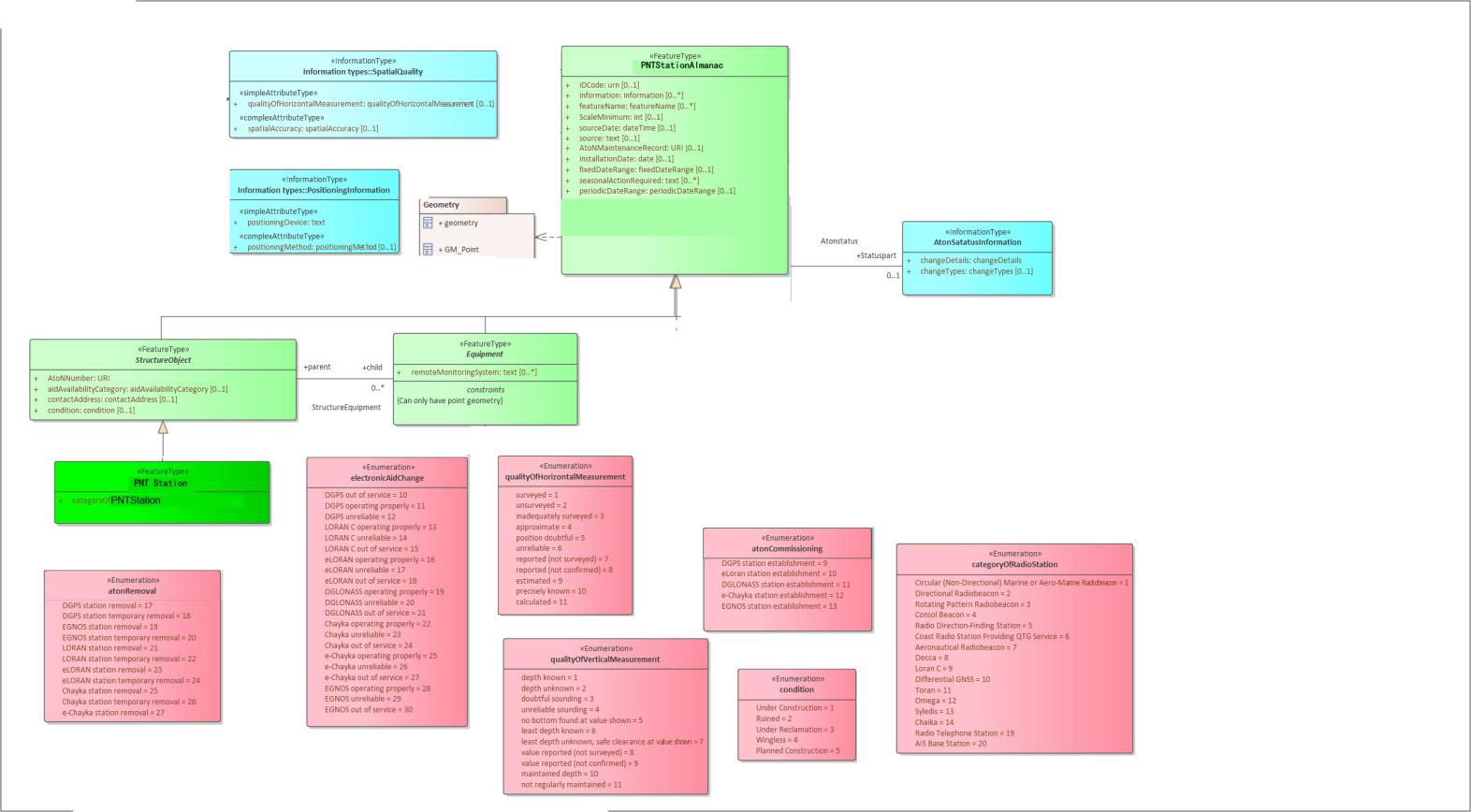


Figure 4-1 Overview of PNT Station Almanac

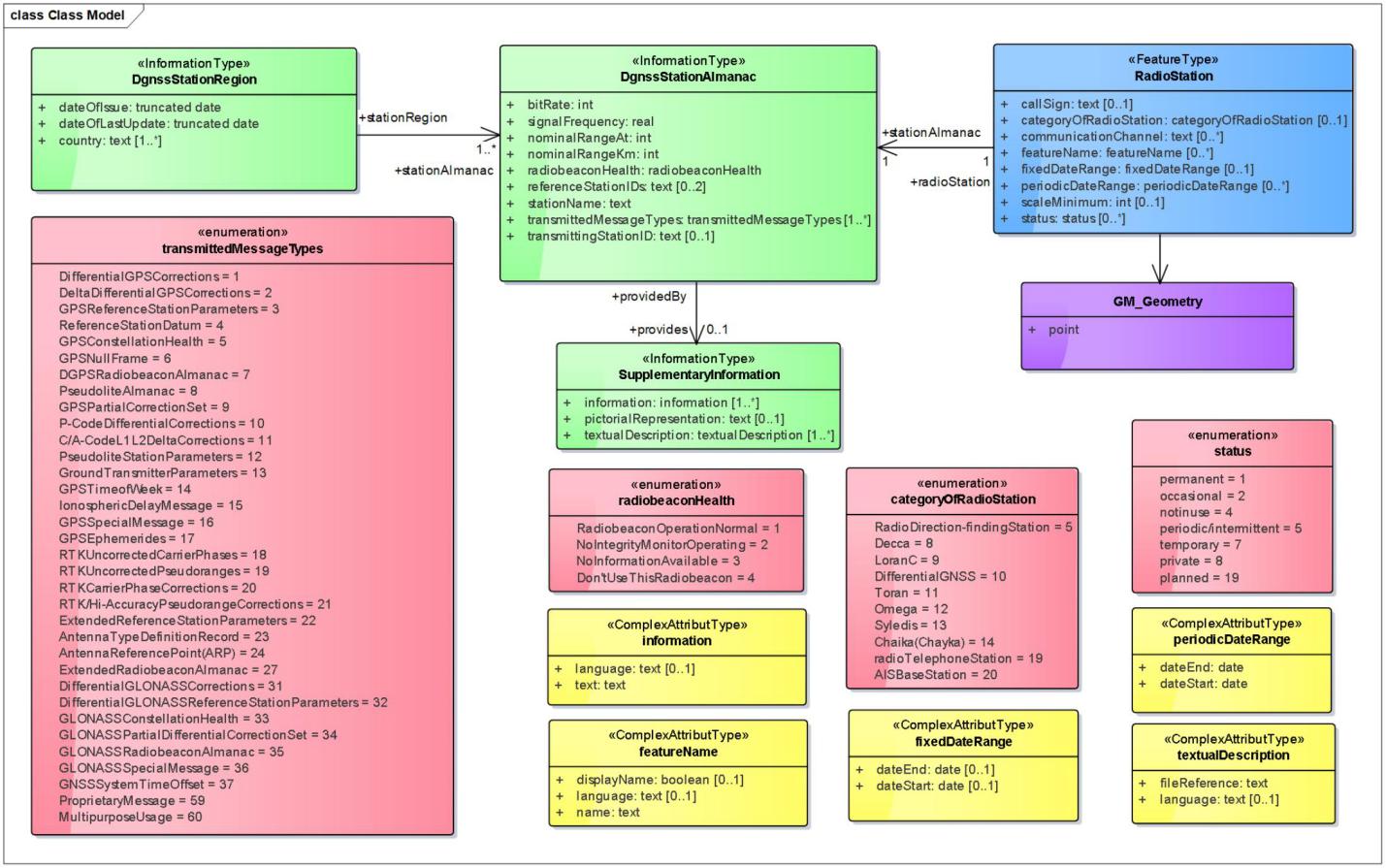


Figure 4-2 Application Schema of DGNSS Station Almanac

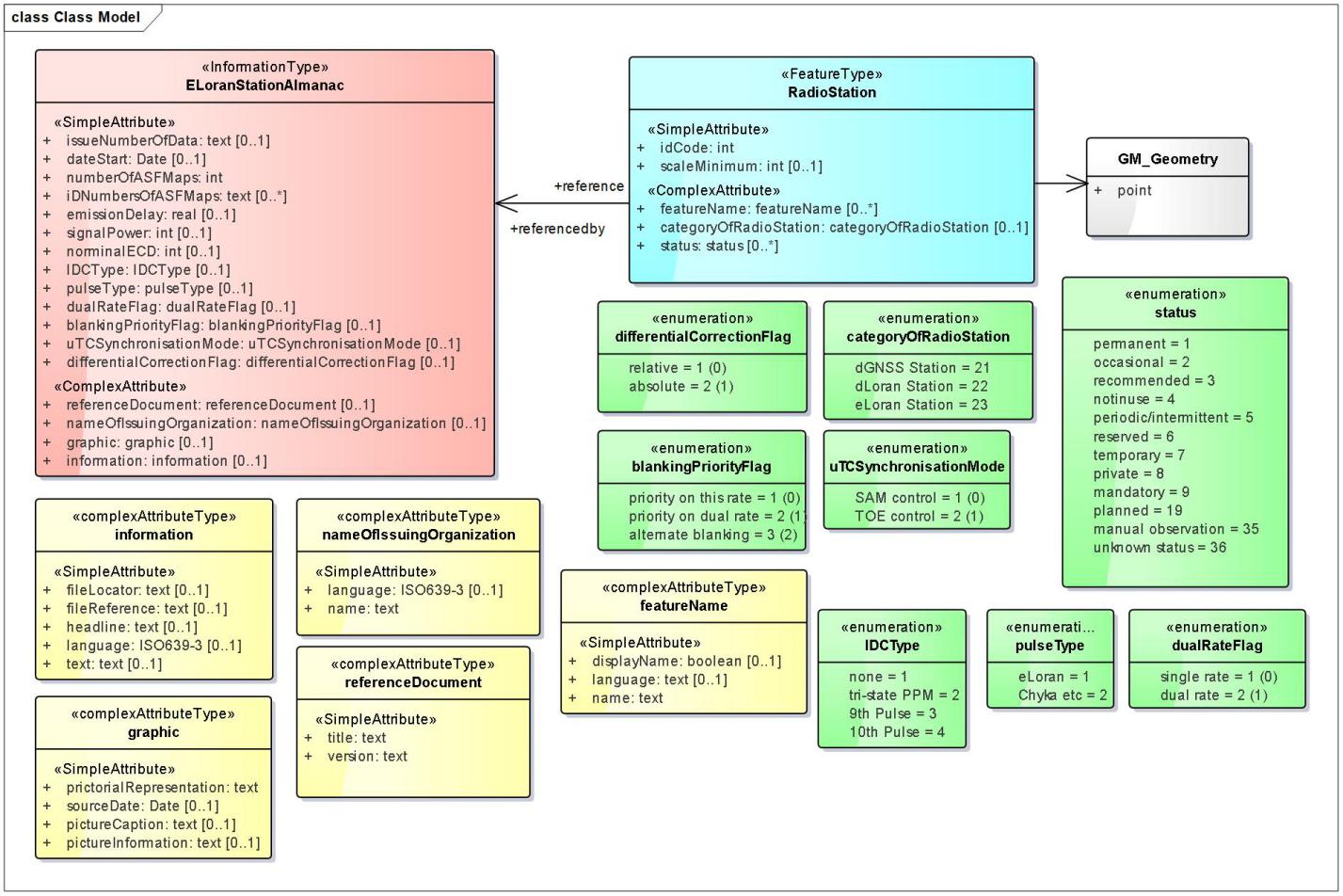


Figure 4-3 Application schema of E-loran Station Almanac

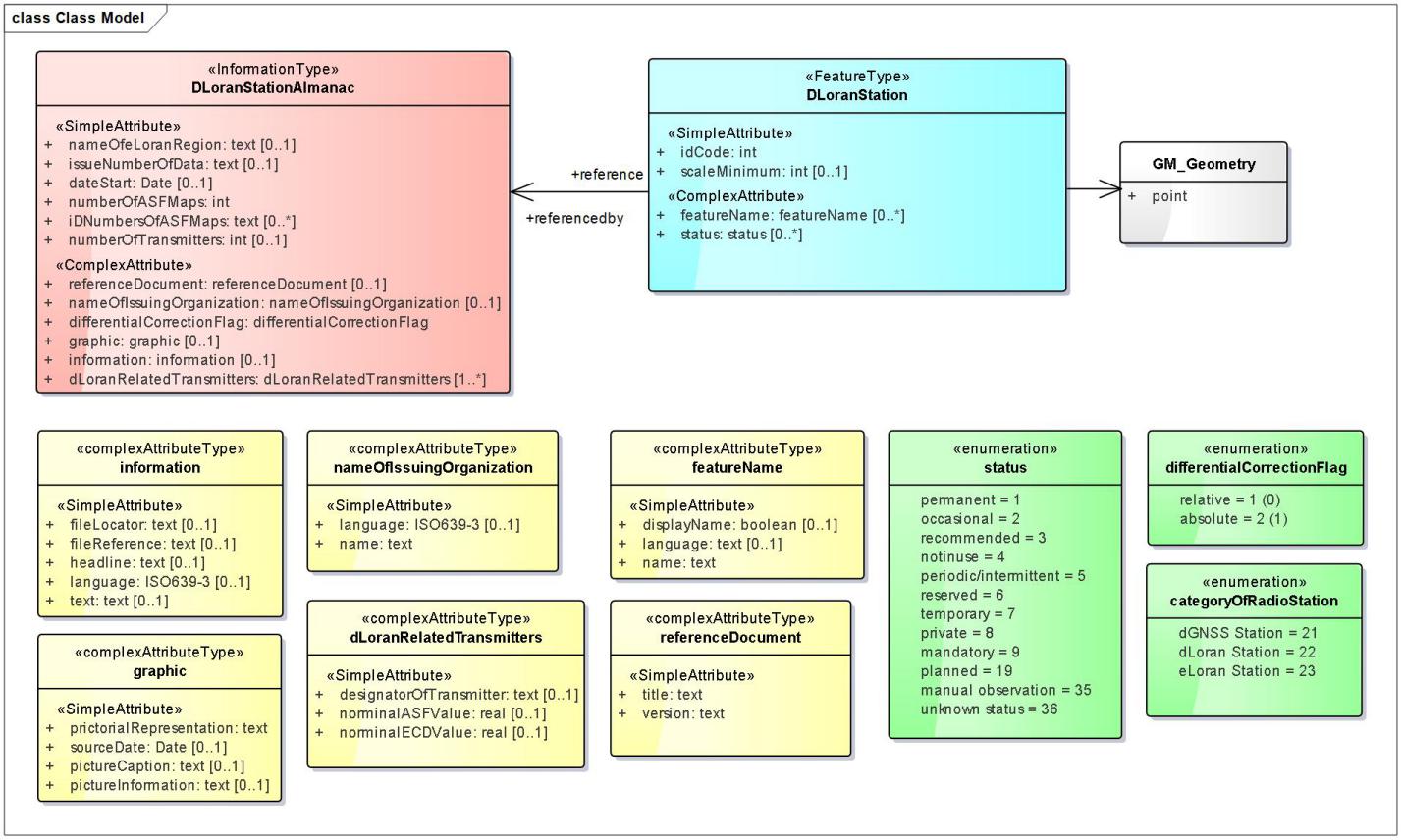


Figure 4-4 Application schema of Differential eLoran Reference Station Almanac

## Meta features application schema

Meta features include data coverage, data quality, datums and areas with established characteristics for navigational systems of marks (buoyage direction and system of marks). The application schema for meta features is depicted in Figure 15.

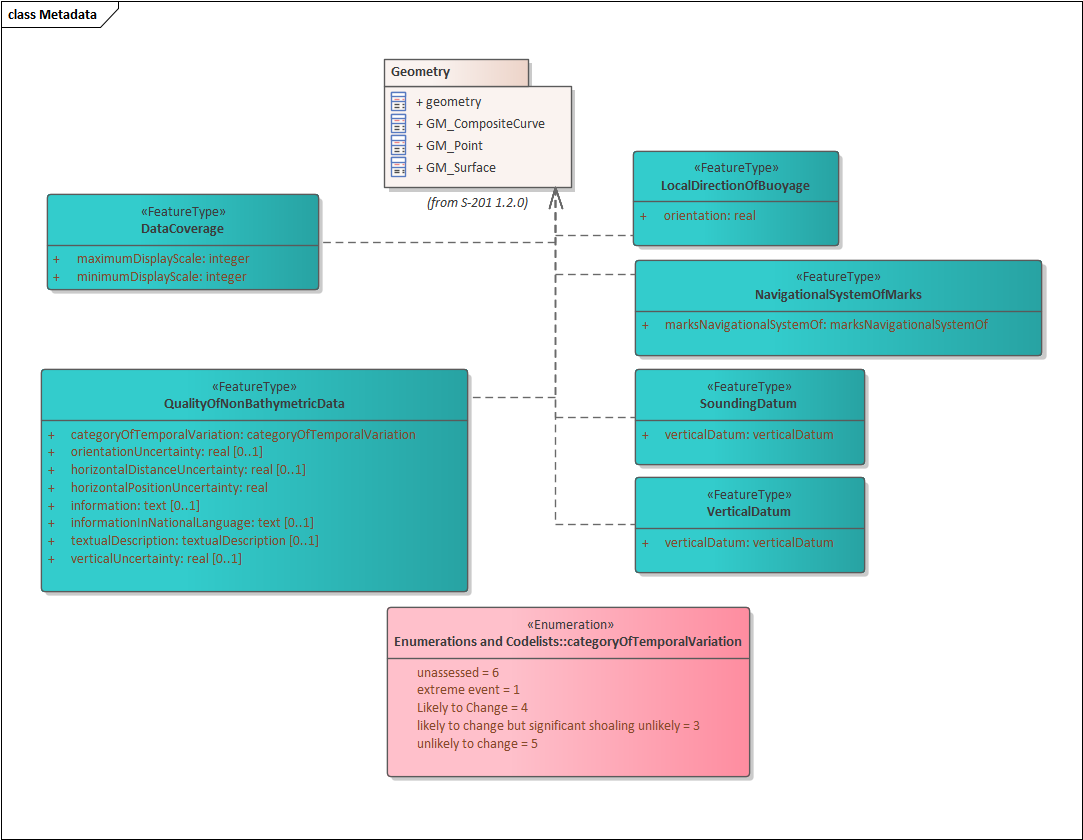


Figure 4.5 Meta features application schema

## Feature Catalogue

The Feature Catalogue describes the feature types, information types, attributes, attribute values, associations and roles which may be used in the product. It also assigns the geometric primitives. The S-241 Feature Catalogue is available in an XML document which conforms to the S-100 XML Feature Catalogue Schema. A draft version of the feature catalogue is to be finished.

**Name:** PNT Station Almanac

**Scope:** Ocean, Coastal, Ports, Harbours and Inland waters

**Version Number:** 1.0.0

**Version Date:** 2025-10

**Producer:** IALA

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URL : https://www.iala.int

**Language:** English

## Feature Types and Feature Instances

Features have two aspects – feature type and feature instance. A feature type is a class and is defined in a Feature Catalogue. Feature types contain descriptive attributes and do not contain any geometry (i.e. information about the shape and position of a real-world entity). A feature instance is a single occurrence of the feature type and represented as an object in a dataset. A feature instance is located by a relationship to one or more spatial instances. A feature instance may exist without referencing a spatial instance.

S-241 makes use of the following feature types:

### Meta

Meta features contain information about other features within a dataset. Information defined by meta features override the default metadata values defined by the dataset descriptive records. Meta attribution on individual features overrides attribution on meta features.

### Feature Relationship

A feature relationship links instances of one feature type with instances of the same or a different feature type.

### Information Types

Information types are identifiable pieces of information in a dataset that can be shared between other features. They have attributes but have no relationship to any geometry; information types may reference other information types.

### Attributes

S-241 defines attributes as either simple or complex.

S-241 uses several types of simple attributes; they are listed in the following table:

|  |  |
| --- | --- |
| **Type** | **Definition** |
| Enumeration | A fixed list of valid identifiers of named literal values |
| Boolean | A value representing binary logic. The value can be either True or False. The default state for Boolean type attributes (i.e. where the attribute is not populated for the feature) is False. |
| Real | A signed Real (floating point) number consisting of a mantissa and an exponent |
| Integer | A signed integer number. The representation of an integer is encapsulation and usage dependent. |
| CharacterString | An arbitrary-length sequence of characters including accents and special characters from a repertoire of one of the adopted character sets |
| Date | A date provides values for year, month and day according to the Gregorian Calendar. Character encoding of a date is a string which must follow the calendar date format (complete representation, basic format) for date specified by ISO 8601.  EXAMPLE 19980918 (YYYY-MM-DD) |
| Time | A time is given by an hour, minute and second. Character encoding of a time is a string that follows the local time (complete representation, basic format) format defined in ISO 8601.  EXAMPLE 183059 or 183059+0100 or 183059Z |
| Date and Time | A DateTime is a combination of a date and a time type. Character encoding of a DateTime shall follow ISO 8601  EXAMPLE 19850412T101530 |
| Codelist | A type of flexible enumeration. A code list type is a list of literals which may be extended only in conformance with specified rules. |
| Truncated date | One or more components of the Date type are omitted. |

Table 4.1 - Simple feature attributes

Complex attributes are aggregations of other attributes that are either simple or complex. The aggregation is defined by means of attribute bindings.



Figure 4.6- text Content - a complex attribute

## Units of Measure

The following units of measure is used in PNT Station Almanac datasets;

* Orientation is given in decimal degrees
* Radio frequency is given in hertz
* Uncertainty is given in metres
* Distances are given in metres or nautical miles

## Geometry

Geometric representation is the digital description of the spatial component of an object as described in S-100 and ISO 19107. This product specification uses three types of geometries: GM\_Point, GM\_OrientableCurve, and GM\_OrientableSurface.

# Coordinate Reference Systems (CRS)

## Introduction

The single coordinate reference system is separated into the horizontal and vertical components.

## Horizontal Geodetic Datum

WGS84 (World Geodetic System of 1984) must be used for the horizontal reference system for spatial data.

**Horizontal coordinate reference system:** WGS 84

**Projection:** None

**Vertical coordinate reference system:** Although all coordinates in a data set must refer to the same horizontal CRS different Vertical Datums can be used for the depth component of a coordinate tuple. Therefore the vertical CRS can be repeated. For each Vertical CRS a unique identifier is defined. Those identifiers will be used to indicate which Vertical CRS is used. Units must be in meters.

**Temporal reference system:** Gregorian calendar

**Coordinate reference system registry:** [EPSG Geodetic Parameter Registry](http://www.epsg-registry.org/)

**Date type (according to ISO 19115):** 002 - publication

## Vertical Datum

Vertical datum shall be selected from the list in verticalDatum enumeration. If the local datum value is used, additional information must be provided using the comment attribute in the metadata, or information attribute on the feature instance. Positive value is above vertical datum and negative is below vertical datum.

## Projection

S-240 data products are un-projected.

## Temporal reference system

Time is measured by reference to Calendar dates and Clock time in accordance with ISO 19108:2002 Temporal Schema clause 5.4.4.

# Data Quality

## Introduction

Data Quality is considered to be meta information and for S-241 it is divided into three parts:

* Data Compliance and integrity
* Positional accuracy
* Lineage

## Data Compliance and Integrity

S-241 datasets must be validated using the conformance checks that are listed in S-158:100. The data quality elements listed in S-100 Part 4C that are applicable to S-241 are indicated in the table of conformance checks listed in S-158:100.

Datasets must not be published unless they pass all the compliance checks designated as “Critical”.

The detailed results of applying compliance checks listed in S-158:100 are not required to be reported as part of the exchange set. They may be conveyed as support files or by separate arrangement.

S-241 product specification follows the Category 3 in the S-100 compliancy categories considering the followings

* The Product Specification contains an object model which is available as a Feature Catalogue from the IHO S-100 GI Registry and is compliant with the S-100 spatial model
* The Product Specification adheres to the minimum requirements of S-100 Part 11. The Product Specification specifies which of the S-100 Part 10 encoding methods is used. Metadata is according to S-100 Part 4, a profile of Part 4 or an extension according to Part 4 rules.
* The Product Specification uses only an encoding method defined in S-100 Part 10.

## Positional accuracy

S-241 positional accuracy data quality indicators do not use the model of data quality elements defined in S-100 Part 4c.

However, positional accuracy must be evaluated and must be indicated in dataset metadata or spatial attribute metadata as provided in the application schema. This specification does not prescribe a specific required level of positional accuracy.

## Lineage

Lineage and process step information elements are not required to be present in S-241 datasets distributed to end user. They may be included as extra metadata in exchange sets distributed to vendors and distributors.

Required source information about S-241 datasets is limited to the source and distribution information contained in discovery metadata described in S-100 Part 4a and Section 12 of this product specification.

# Data Capture and classification

The Data Capture and Classification Guide (DCEG) is to be planned in annex A.

# 

# Data Maintenance

## Introduction

Datasets are replaced by new editions that must be considered a whole replacement of the previous version. Delta change datasets are not permitted. Updates and Reissues are not used in S-241. Each edition of a dataset shall have an edition number that is greater than the previous version by one. First edition of a dataset shall have edition number set to 1.

## Maintenance and Update Frequency

Datasets are maintained as needed in accordance with data producer policy.

# Portrayal

The Portrayal catalogue is found in Annex D.

# Data Product format (encoding)

## Introduction

The GML encoding of S-241 datasets is based on the S-100 profile of GML 3.2.1. This is described in S-100 Edition 5.2.0 Part 10b.

Format Name: GML, Specification: S-100 profile of GML Part 10b.

File Name: S-241 Data Product Format Schemas - Annex B. （To be developed）

## Encoding of Latitude and Longitude

Values of latitude and longitude must be expressed with a precision of 7 decimal places. Coordinates must be encoded as decimals in the format described below. The encoding is indicated by multiplication factor fields defined in the dataset identification record by the S-100 GML schemas.

## Encoding of coordinates as decimals

Values should be encoded as decimal numbers with 7 or fewer digits after the decimal. The normative encoding is in degrees, with an accuracy of 10-7 degrees, i.e., 7 digits after the decimal point.

The decimal point must be indicated by the “.” character.

Trailing zeroes after the decimal point (and the decimal point itself if appropriate) may be omitted at producer discretion, but the accuracy must still be as indicated (e.g., 10-7 degrees for coordinates of default accuracy).

Latitude and longitude multiplication factors held in the Dataset Structure Information field under [coordMultFactorX] and [coordMultFactorY] must be set to a value corresponding to the encoding, e.g., {1} for coordinates encoded in decimal degrees.

Example: A longitude = 42.0000 is converted into X = longitude \* coordMultFactorX = 42.0000 \* 1 = 42.0000000.

## Numeric Attribute Encoding

Floating point and integer attribute values must not contain leading zeros. Floating point attribute values must not contain non-significant trailing zeros.

## Text Attribute Values

Character strings must be encoded using the character set defined in ISO 10646-1, in Unicode Transformation Format-8 (UTF-8).

## Mandatory Attribute Values

There are four reasons why attribute values may be considered mandatory:

* They determine whether a feature is in the display base
* Certain features make no logical sense without specific attributes
* Some attributes are necessary to determine which symbol is to be displayed
* Some attributes are required for safety of navigation

All mandatory attributes are identified in the Feature Catalogue and summarised in Annex A – Data Classification and Encoding Guide.

## Unknown Attribute Values

When a mandatory attribute code or tag is present, but the attribute value is missing, it means that the producer wishes to indicate that this attribute value is unknown. Missing mandatory attributes must be “nilled” with a GML *nilReason* attribute giving the reason for omission.

Optional attributes must be omitted altogether if the value is unknown or missing. They must not be “nilled.”

## Structure of dataset files

The order of data objects in each dataset file is described below:

Dataset identification information

Dataset structure information

Spatial records for by-reference geometries

Point

Multi point

Curve

Composite Curve

Surface

Information objects

Feature objects (Geometry may be encoded inline or by reference.)

Meta features

Geo features

S-241 Collection objects

## Object identifiers

Features, information types, collection objects, meta features, and geometries (inline or by reference) are all required by the schema to have a **gml:id** attribute with a value that is unique within the dataset. The **gml:id** values must be used as the reference for the object from another object in the same dataset or another dataset.

All geographic feature classes in S-241 have the idCode attribute. This attribute shall be used to hold the Maritime Resource Name (MRN) identifier for the feature instance.

## Dataset validation

Fields may be repeated or omitted as permitted by the XML schemas and the validation tests. Since XML schema cannot encode rules for conditional presence or attributes, these rules are checked by Schematron rules or other validation code.

## Data coverage

All areas of a dataset must be covered by a DataCoverage meta feature.

## Data overlap

S-241 datasets must not overlap other S-241 datasets, except as addressed in Clause 4.7.

## Data quality

One or more QualityOfNonBathymetricData features must cover the dataset.

## Data extent

Datasets must not cross the 180° meridian of longitude.

# Data Product Delivery

This clause specifies the encoding and delivery mechanisms for an S-241 dataset. Data which conforms to this product specification must be delivered by means of an exchange set.

|  |  |  |
| --- | --- | --- |
| **Name** | **ISO 19131 Elements** | **Value** |
| Format name | DPS\_DeliveryInformation.deliveryFormat > DPS\_DeliveryFormat.formatName | GML\* |
| Version | DPS\_DeliveryInformation.deliveryFormat > DPS\_DeliveryFormat.version | 3.2.1 |
| Specification description | DPS\_DeliveryInformation.deliveryFormat > DPS\_DeliveryFormat.specification | GML\* |
| Language | DPS\_DeliveryInformation.deliveryFormat > DPS\_DeliveryFormat.language | English |
| Character set | DPS\_DeliveryInformation.deliveryFormat > DPS\_DeliveryFormat.characterSet > MD\_CharacterSetCode | 004 – utf8 |

*Table 11.1 Data product delivery*

\* GML is an XML encoding for the transport and storage of geographic information, including both the geometry and the properties of geographic features, between distributed systems. The XML Schema for the GML application schema is provided in a schema document S-241 Data Product Format Schemas – Annex B.xsd which imports other schema(s) defining common types. These files are available in the IHO Geospatial Information Registry. Feature instances must validate against S-241 Data Product Format Schemas – Annex B.xsd and conform to all other requirements specified in this data product specification, including all constraints not captured in the XML Schema document.

## Exchange set

S-241 datasets are grouped into exchange sets. Each exchange set consists of one or more AtoN Information datasets with an associated XML metadata file and a single Exchange Catalogue XML file (CATALOG.XML) containing metadata. It may also include one or more support files.

**Units of Delivery**: Exchange Set

**Transfer Size**: Unlimited

**Medium Name**: Digital data delivery

Each dataset must be contained in a physically separate, uniquely identified file on the transfer medium.

Each exchange set has a single exchange catalogue which contains the discovery metadata for each dataset and references to any support files.

Support files are supplementary information which are linked to the features and information types by attributes. The attributes containing these links are described in the application schema and feature catalogue.

An exchange set may be encapsulated into a form suitable for transmission by a mapping called a transmission encoding. An encoding translates each of the elements of the exchange set into a logical form suitable for writing to media and for transmission online. An encoding may also define other elements in addition to the exchange set contents (i.e., media identification, data extents etc.) and also may define commercial constructs such as encryption and compression methods.

If the data is transformed (e.g., for encryption or compression purposes) its content must not be changed. Digital signature and data security should be covered by a Memorandum of Understanding between involved parties.

This product specification does not define the transmission encoding which must be used as a default for transmission of data between parties.

The exchange set elements are as follows:

Mandatory Elements

* AtoN datasets – GML encoding of features/attributes and their associated geometry and metadata.
* Exchange Catalogue – the XML encoded representation of exchange set catalogue features [discovery metadata].

Optional Elements

* Supplementary files – These are contained within the exchange set as files and the map from the name included within the dataset and the physical location on the media is defined within the Exchange Catalogue.
* Feature Catalogue – If it is necessary to deliver the latest feature catalogue to the end user it may be done using the S-241 exchange set mechanism for datasets – i.e., include the updated feature catalogue in an exchange set.
* Portrayal Catalogue - If it is necessary to deliver the latest portrayal catalogue to the end user it may be done using the S-241 exchange set mechanism for datasets – i.e., include the updated portrayal catalogue in an exchange set.

## Datasets

Datasets are distributed as files which are part of exchange sets structured as described in this specification. The distribution media are left to the discretion of the producer and distributor.

The following types of dataset files may be produced and contained within an exchange set:

* New dataset and new edition of a dataset (base dataset): Each new edition of a dataset must have the same name as the dataset that it replaces. A new edition can also be PNT almanac that has previously been produced for this area.
* Cancellation: The dataset is cancelled and is deleted from the system. The structure for a cancellation is described in clause 11.5.

## Dataset size

Datasets should not exceed 50 MB.

## Dataset file naming

Dataset files shall be named

241CCCCXXXXXXXX\_EEE.GML

The file name forms a unique identifier where:

* The first three characters are always “241” and identify the dataset as an S-241 dataset.
* CCCC – the next four characters identify the issuing agency by its alphanumeric agency code in the IHO producer code register in the IHO GI Registry (i.e., the IHO is identified as “AA”, not “1810”). Where the agency code consists of fewer than four characters, sufficient zeros must be suffixed to make the length exactly four characters (e.g., “AA00” for IHO).
* XXXXXXXX – the next eight characters may be used in any way by the producer to provide the unique file name.
* EEE – new (first) editions use 000, and increment until a limit of 999 (mandatory).
* GML – the character sequence “GML” or “gml”.
* The following characters are allowed in the dataset name: A to Z, 0 to 9 and the special character \_ (underscore).

## Cancellations

Cancellation should be in line with the functionality documented in S-100 Ed 5.2. Where a dataset is cancelled and its name is reused at a later date, the issue date must be greater than the issue date of the cancelled dataset. When the dataset is cancelled, it must be removed from the system.

## Support Files

Dataset support files offer supplementary information that can be included in an exchange set.

Support files may be in any of the support file formats defined in the S-100 enumeration S100\_SupportFileFormat (defined in Part 17) except that “Other” may not be used.

## Support File Naming

All support files must have unique universal file identifiers. The file identifier of support information should not be used to describe the physical content of the file. The support file metadata that accompanies the file will inform the user of the name and purpose of the file.

## Support file management

When a support file is created, or a subsequent version is issued, it must carry its own issue date and be supported with a digital signature which authenticates it against the producer’s public key included in the exchange set metadata.

The type of support file is indicated in the “purpose” field of the discovery metadata. Support files carrying the “deletion” flag must be removed from the system. When a feature pointing to a text, picture or application file is deleted or updated so that it no longer references the file, the system software must check to see whether any other feature referenced the same file, before that file is deleted.

Each support file must be used only once in the exchange set.

Support files should be stored in a separate folder within the exchange set.

## Exchange Catalogue

The exchange catalogue acts as the table of contents for the exchange set. The catalogue file of the exchange set must be named CATALOG.XML. No other file in the exchange set may be named CATALOG.XML. The contents of the exchange catalogue are described in S-100 Part 17.

XML schemas for the exchange catalogue are located at <http://registry.iho.int/>

# Metadata

## Introduction

The metadata description is based on the S-100 metadata document section, which is a profile of the ISO 19115 standard. These documents provide a structure for describing digital geographic data and define metadata elements, a common set of metadata terminology, definitions and extension procedures.

The realisation of exchange set classes, the exchange set catalogue, and the structure of exchange sets are the same as in S-100.

Since the class S100\_DatasetDiscoveryMetadata aggregates ISO 19115 metadata (class S100\_19115DatasetMetadata), metadata conforming to ISO 19115 is required to be included. Metadata for each support file is required if the exchange set contains support files.

## Metadata classes

Details for the S-100 metadata classes are depicted in S-100 Part 17.

**S100\_ExchangeCatalogue**

Each Exchange Set has a single S100\_ExchangeCatalogue which contains meta information for the data and support files in the Exchange Set.

**S-241 specific Data Set Discovery Metadata**

S-241 DataSetDiscoveryMetadata does not include updateNumber, updateApplicationDate, navigationPurpose.

The attribute notForNavigation must be set to True.

The attribute issueTime is a mandatory attribute in S-241 (optional in S-100)