PD IEC PAS 61174-1:2021

BSI Standards Publication

Maritime navigation and radiocommunication equipment and systems

Part 1: Route plan exchange format (RTZ) — General requirements, methods of testing and required test results

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National foreword

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PRE-STANDARD

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Maritime navigation and radiocommunication equipment and systems – Part 1: Route plan exchange format (RTZ) – General requirements, methods of testing and required test results

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 47.020.70; 47.060

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MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS –

Part 1: Route plan exchange format (RTZ) – General requirements, methods of testing and required test results

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The text of this PAS is based on the following document:	This PAS was approved for publication by the P-members of the committee concerned as indicated in the following document
Draft PAS	**Report on voting**
80/978/DPAS	80/986/RVDPAS

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INTRODUCTION

A route plan exchange format RTZ was published as Annex S of IEC 61174:2015.

This route plan exchange format is intended be used for many purposes. For example it can be used on board for route plan exchange between main and backup ECDIS, ECDIS and radar, ECDIS and optimization systems, etc.. Another example use is between ship and shore where it can be used to inform the shore about the plan of the vessel, the shore can recommend a route, the shore can optimize a route, etc.

This route plan exchange format is based on standardizing a single route plan. The application level of the sender and receiver is assumed to be able to handle multiple route plans for use cases which require availability of multiple routes, for example alternative route plans for the same voyage or route plans for different purposes.

Since publication of IEC 61174:2015, typographical errors have been identified in the original route plan exchange format. Issues relating to ambiguity in the underlying requirements have also been identified. Testing has uncovered further issues, including (among others) route import failures, highlighting a lack of robustness in the RTZ testing clauses specified in IEC 61174:2015.

During the implementation of route exchange as part of a collaborative industry project, the Sea Traffic Management (STM) Validation Project[1], an iteration of the RTZ XML schema, version 1.1, was developed in order to correct the errors that had been identified in version 1.0 and to expand the schema to accommodate the project's needs.

Further development has led to RTZ schema version 1.2 which incorporates schema version 1.1 and contains a further change by permitting extensions in the Leg element.

This PAS includes the following significant technical changes with respect to IEC 61174:2015:

- modifications to the body text of IEC 61174:2015 Annex S intended to correct typographical errors, properly align the text with the original RTZ schema, and to add clarification and remove ambiguity from the requirements;
- modifications to the testing clauses in IEC 61174:2015 6.9.2 to expand the existing tests for route plan exchange by introducing testing clauses covering the full range of requirements specified in IEC 61174:2015 Annex S;
- an updated RTZ schema to revised version 1.2 in order to expand the original schema and to correct errors and weaknesses in the original schema.

Details of the substantive changes between version 1.0 and version 1.2 of the schema are given in Annex D.

[1] https://www.seatrafficmanagement.info/projects/stm-validation/

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MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS –

Part 1: Route plan exchange format (RTZ) – General requirements, methods of testing and required test results

1 Scope

This PAS specifies requirements, methods of testing and required test results for route plan exchange format (RTZ).

This PAS has been developed to improve interoperability between equipment implementing route plan exchange format by addressing issues uncovered in the original RTZ specification (Annex S of IEC 61174:2015), and in recognition of the fact that some manufacturers have identified a pressing business need to implement an improved and expanded version of the RTZ format.

This PAS is intended to complement the original RTZ specification. This PAS provides a revised version 1.2 of the RTZ schema but retains the original version 1.0 of the schema unchanged. The intention is that compliance with this PAS can be achieved without compromising compliance with IEC 61174:2015.

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.

IEC 61174:2015, *Maritime navigation and radiocommunication equipment and systems – Electronic chart display and information system (ECDIS) – Operational and performance requirements, methods of testing and required test results*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

No terms and definitions are listed in this PAS.

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

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.2 Abbreviated terms

ECDIS Electronic chart display and information system

EUT Equipment under test

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4 Requirements

4.1 General

A route plan consists of waypoints. Each waypoint, except the first, contains information related to the leg from the previous waypoint. Descriptions of route plans are shown in Figure 1 and Figure 2. The route exchange format is a file containing an XML encoded version of the route plan. The XML route exchange file shall use the extension .rtz. A description of the RTZ format is given in 4.5. Examples of RTZ format routes are given in 4.7 and 4.8.

XML schema is provided for validation of the structure and content of the RTZ format route files. Two versions of the RTZ schema are defined: version 1.0 (provided in Annex S of IEC 61174:2015) and 1.2 (provided in Annex A of this PAS). By default, equipment shall export routes using version 1.2 of the schema. Equipment shall allow the version 1.0 schema to be selected for export. Equipment shall support the import of both version 1.0 and version 1.2 schemas. Validation shall be mandatory for files using the version 1.2 schema and optional for files using the 1.0 schema. If an imported file fails to validate it shall not be used and an indication of the reason for validation failure shall be provided. The user manual shall specify the versions and optional attributes that are supported.

One of the differences between the version 1.0 and 1.2 schema is the renaming of the *SheduleElement* type to *ScheduleElement*. In textual references, other than xml examples, this PAS uses *ScheduleElement* to refer to both items.

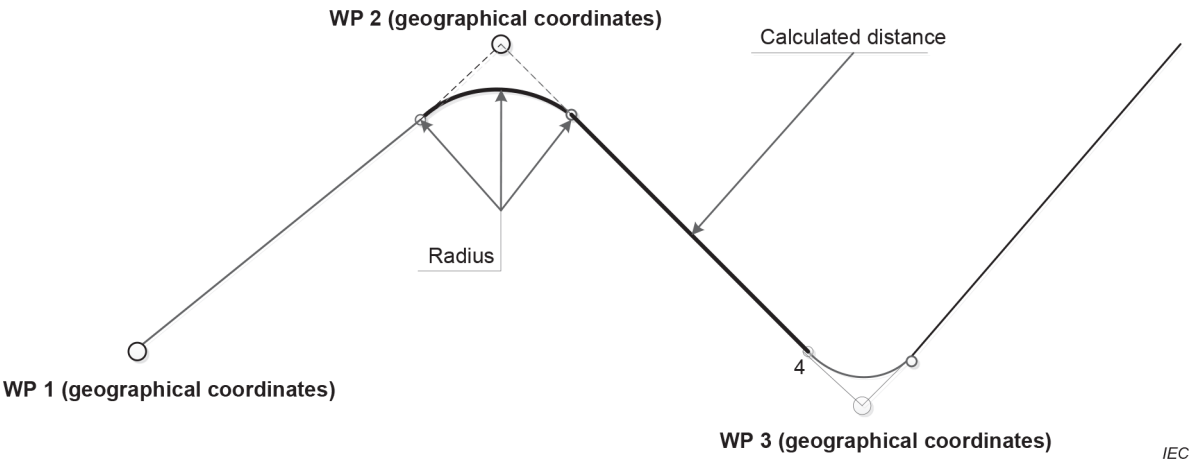
NOTE 1 The requirements in this PAS can be applied not only to ECDIS, but also to software applications importing routes from ECDIS or exporting routes to ECDIS. In order to achieve interoperability, manufacturers of non-ECDIS software applications are strongly encouraged to apply the associated tests in this PAS.

NOTE 2 This route exchange format has some limitations for applicability due to the simple geometric mode used. Application for latitudes above 70º may cause significantly different paths over the earth surface between two systems. Application to long legs such as an ocean crossing is subject to differences in the exact path over the earth surface.

NOTE 3 It is recommended that the receiver of the route exchange always performs a check against the chart database and a geometry check before use for navigation purposes.

NOTE 4 Information in addition to the route exchange format will be necessary between third parties to assure the level of accuracy and repeatability required for Track Control System purposes.

NOTE 5 RTZ version 1.1 was used by the European Union's Sea Traffic Management project, but lacked the optional Extensions in the Leg element.



The distance between waypoints is from WOL to WOL with zero "advance and transfer" or "forwarding distance".

Figure 1 – Description of route plan – Distance between WP 2 and WP 3

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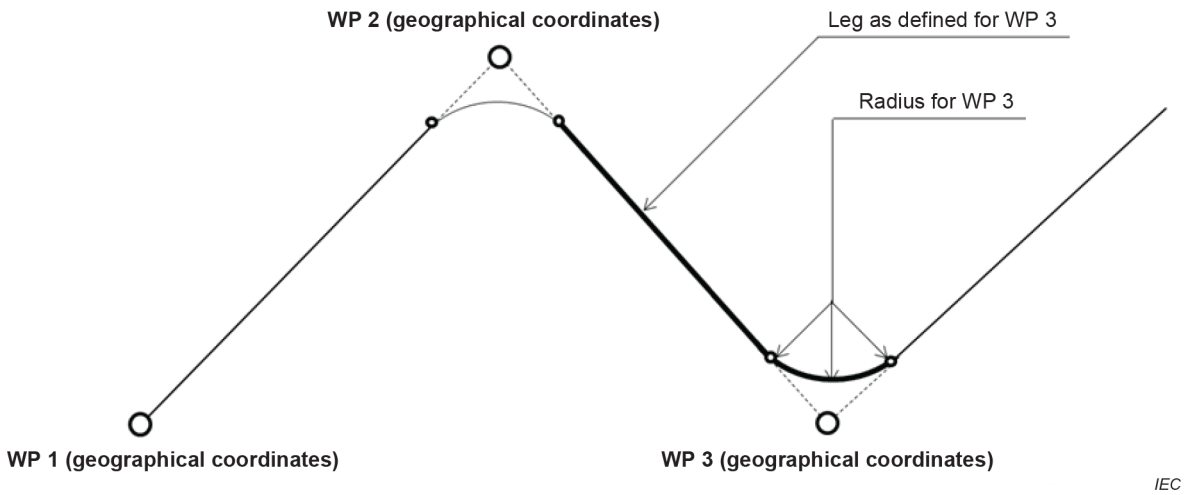

Figure 2 – Description of route plan – Leg parameters belonging to WP 3

4.2 RTZP data container

RTZP data containers are standard ZIP archive files used to compress the size of the route exchange files.

The RTZP data container file .rtzp stores a single XML file **.rtz**, which conforms to the XML schema described in 4.6.

A single RTZP file shall be limited in compressed size to 10 MB.

Use of the RTZP data container is optional. When used without the RTZP data container the filename extension of the route exchange shall be **.rtz** and when used with the RTZP data container the extension shall be **.rtzp**. Within the RTZP data container the filename extension of the route exchange shall be **.rtz**. The user manual shall specify whether the RTZP data container is supported.

The filename of the RTZP data container shall be the same as the content of the attribute routeName described in 4.5.3.

In addition to the **.rtz** file a number of free-format files may be placed in the RTZP data container. The semantic data link between the XML nodes and files may be documented using a HTTP like scheme "rtz://<URI>", where "<URI>" identifies a file name inside the RTZP data container.

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For example:

```
<extensions>
  <extension manufacturer="Acme" version="2.1"
    name="AuxRouteInfo-9674F26E-EAFB-4319-AE24-08D5BA69D895">
    <property name="source"
      value="http://services.acme.com/auto_route/?id=3e891884e620970e5303fd2399427986"/>
    <property name="attachment" value="rtz://assignement-13.04.2013.docx"/>
    <property name="attachment" value="rtz://MFD_original.rt3"/>
  </extension>
</extensions>
```

4.3 High-level description of the RTZ format

The logical design of a route consists of three independent units:

- a block with general information about the route;
- a block with route geography (geometry) information which consists of blocks describing individual legs. Legs are listed in the order they appear on the route;
- a block that contains a set of route schedules. Each block can be extended by manufacturers to fit their needs.

Each block can be extended by manufacturers to fit their needs.

4.4 Adaption to third-party extensions and handling of optional data

4.4.1 Generic idea

Extended information in most cases refers to the geography (geometry) of a route.

It shall be possible to import and export RTZ files with extensions from different manufacturers.

4.4.2 Unique identification of a waypoint

Each waypoint in a route has a unique composite ’id’.

RTZ extensions shall use this composite identifier to link their data to the geography. This allows an application that does understand the extension to identify when third-party software has modified the related element (see 4.4.4).

The identifier consists of two parts:

- id, which allows the finding of a waypoint in the list; This ‘id’ is not intended to be a sequence number (i.e. does not need to relate to the position of the waypoint in the route);
- revision, which allows the determination of modifications of a waypoint since the entry of the data into a file extension.

id is an integer,

revision is a monotonically increasing integer.

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4.4.3 Creation of new waypoints

After creation of the waypoint the **revision** attribute shall have the value of 0.

4.4.4 Change of geographic data for a waypoint

When the data of a Waypoint or associated Leg changes, including the addition of a manufacturer extension, the software shall increase the revision number revision. This allows third-party software that works with the extension to find out that the data to which it is associated may no longer be valid.

4.4.5 Waypoint removal

When deleting a waypoint from a route, all the waypoint data including Leg and any Schedule data associated with the removed Waypoint shall be deleted and the ids of other waypoints within the route shall remain unchanged.

NOTE Deletion of the waypoint may result in schedules for other waypoints becoming invalid or being updated.

4.4.6 Waypoint modification

The data that software is not able to recognize (e.g. extensions and optional elements and optional attributes) shall be written back into the modified file without modification.

The data that software is able to recognize (e.g. extensions and optional elements and optional attributes known by the manufacturer) shall be handled as declared by the manufacturer. When importing a route, manufacturer extension data that is recognized shall be checked (e.g. by using the composite 'id' described in 4.4.2) and, where the application determines that modifications by an external 3rd party application may have invalidated the data, appropriate action shall be taken. The manufacturer shall declare the appropriate action to be taken which will depend on the nature of the extension, and may range from removal of the extension to maintaining it unchanged.

NOTE Modification of the waypoint can result in schedules becoming invalid or being updated.

4.5 Detailed RTZ format description

4.5.1 File components

The RTZ file consists of:

- the mandatory XML processing instruction, which allows the specification of the encoding of string data;
- a root <route> node, which includes the URIs of the namespaces used;

  NOTE An example of a namespace is available in 4.6.
- the version attribute in the format "**Major.Minor**".

The file encoding shall be UTF-8.

A single RTZ file shall be limited in uncompressed size to 1 MB.

There shall be an indication to the user if file size constraint will be exceeded through modification to route plan.

4.5.2 Route node description

This is the only "root" element of the RTZ file.

It has one mandatory attribute "version" that contains the version of the RTZ schema.

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Version is specified as a combination of two numbers separated with a dot. The first number corresponds to the major version. It is changed following significant modifications to the document structure.

The second number corresponds to the minor version and indicates format changes that do not affect compatibility.

The **Route** node consists of a sequence of the following child nodes:

- **RouteInfo** node that contains basic information on the route;
- **Waypoints** node that describes the geographical components of the route;
- **Schedules** node that describes calculated schedule and timing defined by a user;
- **Extensions** node that allows for extending the format to fit the particular needs of a manufacturer.

4.5.3 RouteInfo node description

The **RouteInfo** node provides a place to store information related to the whole route.

Information is stored in the following attributes:

Attribute	Description	Format	Status	Comment
routeName	name of the route	String	Mandatory	
routeAuthor	Author of route	String	Option	
routeStatus	Status of route	String	Option	
validityPeriodStart	Start of validity period	ISO 8601	Option	
validityPeriodStop	Stop of validity period	ISO 8601	Option	
vesselName	Ship's name	String	Option	
vesselMMSI	Ship's MMSI	XXXXXXXXX	Option	
vesselIMO	Ship's IMO number	XXXXXXX	Option	
vesselVoyage	Number of the voyage	String	Option	
vesselDisplacement	Ship's displacement	Integer	Option	Unit: tons
vesselCargo	Ship's cargo	Integer	Option	Unit: tons
vesselGM	Metacentric height	XX.XX	Option	Metacentric height of the ship for intended voyage. Unit: metres
optimizationMethod	Route is optimized to meet KPI	String	Option	Could be fixed speed, Lowest Fuel Consumption, Fixed ETA
vesselMaxRoll	Ship's max roll angle allowed	XX	Option	Unit: degrees
vesselMaxWave	Ship significant wave height limit	XX.X	Option	Unit: metres
vesselMaxWind	Ship's max wind speed limit	XX.X	Option	Unit: metres
vesselSpeedMax	Ship's max speed	XX.X	Option	Unit: knots, Speed through water
vesselServiceMin	Ship's preferred service speed window_min	XX.X	Option	Unit: knots, Speed through water

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Attribute	Description	Format	Status	Comment
vesselServiceMax	Ship's preferred service speed window_max	XX.X	Option	Unit: knots, Speed through water
routeChangesHistory	Cause of route change, Originator and Reason	String	Option	

For example:

```
<routeInfo routeName="AROUNDtheSKAGEN"

            vesselName="ACME"

            validityPeriodStart="2014-01-03T03:15:00Z"

            validityPeriodStop="2014-01-06T10:15:00Z"

            vesselMMSI="xxxxxxxxx"

            vesselVoyage ="xxxx"/>
```

Additionally, the node may contain child extensions.

4.5.4 Waypoints node description

The **Waypoints** node contains data related to the geometry of the route.

As minimum, it shall contain a sequence of Waypoint nodes that describe every leg of the route.

The order of the **Waypoint** nodes follows the order of the legs.

Before the sequence of **Waypoint** nodes it is possible to insert a **DefaultWaypoint** node, which may be used to define default values of attributes for newly created legs and for legs with attributes that have not been explicitly supplied except for the geometry data.

Additionally, the node may contain a child extensions node.

4.5.5 DefaultWaypoint node description

The **DefaultWaypoint** node allows the route file to provide a definition of default values of attributes for newly created waypoints and legs. Additionally, it allows the definition of default values of attributes for waypoints and legs where data has not been explicitly supplied. The user manual shall specify whether the equipment uses the default waypoint to set defaults and, if not, shall specify how defaults are set (e.g. using default settings set by the mariner on the ECDIS).

For example:

```
<waypoints>

    <defaultWaypoint revision="1" radius="1.4">

        <leg starboardXTD="0.5" portsideXTD="0.5" geometryType="Loxodrome"/>

    </defaultWaypoint>
```

If the **DefaultWaypoint** node is provided, then it may be used to provide values for attributes for newly created waypoints and legs and shall be used to provide values for attributes for waypoints and legs where data has not been explicitly supplied.

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For example:

`<waypoints>`
`  <defaultWaypoint revision="1" radius="1.4">`
`  <leg starboardXTD="0.3" portsideXTD="0.3"`
`  geometryType="Loxodrome"/>`
`  </defaultWaypoint>`
	Defaults settings for all waypoints

`  <waypoint id="33" revision="1">`
`  <position lat="53.0492" lon="8.87731"/>`
`  </waypoint>`
	For this waypoint default settings applied

`  <waypoint id="17" revision="3" radius="0.3">`
`  <position lat="53.0513" lon="8.87509"/>`
`  <leg starboardXTD="0.4" portsideXTD="0.5"`
`  geometryType="Orthodrome"/>`
`  </waypoint>`
	For this waypoint user settings applied:
	Port XTD = 0,5 NM
	Starboard XTD = 0,4 NM
	Turn radius = 0,3 NM
	Geometry type is orthodrome

4.5.6 Waypoint node description

The **Waypoint** node contains the geographical description of a leg between waypoints.

Information is stored in the following attributes:

Attribute	Description	Format	Status	Comment
id	Unique identifier	Integer	Mandatory	It does not have to be equal to the index of the waypoint
revision	Waypoint revision	Integer	Mandatory	Index of revision
name	Waypoint	String	Option	
radius	Turn radius	Real	Option	Unit: NM
position	Geographic point	GM_Point	Mandatory	Unit: degrees
leg	Leg attributes		Option	Not required for the first waypoint. Required for other waypoints.

The **Position** node contains the latitude and longitude of the waypoint.

Attribute	Description	Format	Status	Comment
lat	Latitude	Real	Mandatory	Unit: degrees with decimal
lon	Longitude	Real	Mandatory	Unit: degrees with decimal

The **Leg** node contains attributes of the leg leading from the previous waypoint to the waypoint that contains the leg node (see Figure 2).

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Attribute	Description	Format	Status	Comment
starboardXTD	Starboard XTD	Real	Option	Unit: NM with decimal
portsideXTD	Portside XTD	Real	Option	Unit: NM with decimal
safetyContour	Planned Safety contour	Real	Option	Unit: metres
safetyDepth	Planned Safety depth	Real	Option	Unit: metres
geometryType	Geometry type of leg	Enumeration	Option	loxodrome (= rhumb line) or orthodrome (= great circle)
speedMin	Lowest cruising speed	Real	Option	Unit: knots, Speed over ground
speedMax	Highest allowed speed	Real	Option	Unit: knots, Speed over ground
draughtForward	Static Draught Forward	Real	Option	Unit: metres
draughtAft	Static Draught Aft	Real	Option	Unit: metres
staticUKC	Minimum UKC on the leg	Real	Option	Unit: metres
dynamicUKC	Minimum Dynamic UKC on the leg	Real	Option	Unit: metres
masthead	Height of masthead	Real	Option	Unit: metres Calculated from keel
legReport	Reporting information	String	Option	Part of annotated route plan
legInfo	Nice to know	String	Option	e.g. telephone / web / service point Could be relevant in approach to harbour or VTS
legNote1	Notes regarding the ETD/ETA	String	Option	
legNote2	Local remarks	String	Option	

If an optional attribute is absent the appropriate parameter may be taken from the element **DefaultWaypoint**.

For the case when geometryType is absent, this attribute should be considered as “Loxodrome”.

Additionally, the node may contain a child **extensions** node.

4.5.7 Storing date and time for legs

Date and time parameters that are associated with the corresponding legs are stored as strings of calendar date and UTC in extended format according to ISO 8601.

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