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ETSI GR PDL-003 AS V0.0.1 (2019-05)

**Group REPORT**

Title;

Permissioned Distributed Ledger;

PDL Application Scenarios

Release 1

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* Use **TT** style for the title.
* Use the field {TOC \t "TF" \c} for the list of figures and the field {TOC \t "TH" \c} for the list of tables.

<PAGE BREAK>

# Intellectual Property Rights *(style H1)*

This clause is always the first unnumbered clause.

Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server ([https://ipr.etsi.org](https://ipr.etsi.org/)).

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# Foreword *(style H1)*

This Group Report (GR) was authored by ETSI Industry Specification Group (ISG) Permissioned Distributed Ledger (PDL)

*[ETSI Drafting Rules](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)* [(](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)*[EDRs)](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx),* clause *2.5.*

Multi-part documents

The following block is required in the case of multi-part deliverables.

* the <common element of the title> is the same for all parts;
* the <part element of the title> differs from part to part; and if appropriate;
* the <sub-part element of the title> differs from sub-part to sub-part.

For more details see clause 2.5 of the ETSI Drafting Rules ([*EDRs*](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)).

The best solution for maintaining the structure of series is to have a detailed list of all parts and subparts mentioned in one of the parts (usually it is part 1).

If you choose this solution, the following text has to be mentioned in all of the other parts and sub-parts:

The present document is part <i> of a multi-part deliverable. Full details of the entire series can be found in part [x] [Bookmark reference].

# Modal verbs terminology *(style H1)*

*[ETSI Drafting Rules](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)* [(](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)*[EDRs)](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx), clause 2.6.*

In the present document "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx) (Verbal forms for the expression of provisions).

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# Executive summary *(style H1)*

This clause, is an optional informative element.

The "Executive summary" is used to summarize the ETSI deliverable. It should contain enough information for the readers to become acquainted with the full document without reading it. It is usually one page or shorter.

[*ETSI Drafting Rules* (*EDRs)*](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)*,* clause *2.7.*

# Introduction *(style H1)*

This GR documents and describes permissioned distributed ledger Application Scenarios. The document considers and describes the potential application scenarios for the operation of PDLs, including provision models with special emphasis on as-a-service paradigms, and PDL infrastructure governance aspects. The report provides definition of terms to be used in the scenarios and recommendations for future normative specifications.

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Clause numbering starts hereafter.

Automatic numbering **may be used** in ETSI deliverables, *if used, shall be applied anywhere in an ETSI deliverable including annexes using the appropriate ETSI styles, otherwise it may corrupt the deliverable.*

See clause 2.12.1.1 and 6.9.2 of the ETSI Drafting Rules ([*EDRs*](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)).

<PAGE BREAK>

# 1 Scope *(style H1)*

*This clause* **shall start on a new page**.

The "Scope" clause defines without ambiguity the subject of the ETSI deliverable and the aspect(s) covered, thereby indicating the limits of applicability of the ETSI deliverable or particular parts of it.

Forms of expression such as the following should be used:

This GR documents and describes permissioned distributed ledger Application Scenarios. The aim is to consider and describe the potential application scenarios for the operation of PDLs, including provision models with special emphasis on as-a-service paradigms, and PDL infrastructure governance aspects. The report will provide definition of terms to be used in the scenarios and recommendations for future normative specifications.

*[ETSI Drafting Rules](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)* [(](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)*[EDRs)](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx),* clause 2.9.

# 2 References *(style H1)*

*The "References" clause shall list all the documents cited anywhere in an ETSI deliverable including annexes. It shall consist of clause 2.1 "Normative references" and clause 2.2 "Informative references".*

More details can be found in [*ETSI Drafting Rules* (*EDRs)*](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)*,* clause 2.10.

The following text block applies.

## 2.1 Normative references *(style H2)*

As the ETSI Group Report (GR) is entirely informative it shall not list any normative references.

Normative references are not applicable in the present document.

## 2.2 Informative references *(style H2)*

Clause 2.2 *shall provide a numbered list of all informative references in an ETSI deliverable.* It is preferable that informative references are publicly available. Current practice is that the Secretariat need not check the public availability of informative references.

References are either specific (identified by date of publication and/or edition number or version number) or non‑specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

* Use the **EX** style, add the letter "i" (for informative) before the number (which shall be in square brackets) and separate this from the title with a tab (you may use sequence fields for automatically numbering references, see clause 6.9.2 of [EDRs](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx))) (see example).

EXAMPLE:

[i.1]*[tab]* *<*Standard Organization acronym*> <*document number*> <*V#*>: "<*Title*>".* *(style EX)*

[i.2]*[tab]* ETSI TR 102 469: "Digital Video Broadcasting (DVB); IP Datacast over DVB-H: Architecture". *(style EX)*

# 3 Definition of terms, symbols and abbreviations *(style H1)*

Delete from the above heading the word(s) which is/are not applicable.

*[ETSI Drafting Rules](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)* [(](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)*[EDRs)](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx),* clause 2.11.

*Definitions and abbreviations extracted from ETSI deliverables can be useful when drafting documents and can be consulted via the* ***Terms and Definitions Interactive Database (TEDDI)*** *(*[*https://webapp.etsi.org/Teddi/*](https://webapp.etsi.org/Teddi/)*).*

## 3.1 Terms *(style H2)*

Clause numbering depends on applicability. The terms shall:

* not take the form of, or contain, a requirement.
* be presented in alphabetical order
* *have a definition that* can replace the terms in context. Additional information shall be given only in the form of examples or notes. *I**f there are several notes or examples for the same term,* *the notes and examples shall be numbered. (See examples below).*.

The following text block applies.

For the purposes of the present document, the [following] terms [given in ... and the following] apply:

* Use the **Normal** style.
* The term shall be in **bold**, and shall start with a lower case letter (unless it is always rendered with a leading capital) followed by a colon, one space, and the definition of term starting with a lower case letter and no ending full‑stop.

*<***term***>***:** *<*definition of term*>*

*EXAMPLE 1:*

**communal site:** location at which there is more than one fixed transmitter *(style Normal)*

NOTE: There are two types of communal site; one having separate equipment and antennas but housed in a common equipment room, and the other having an engineered system employing common antenna working where the isolation between equipment is determined by the filter system.  
At all communal sites equipment installed on the site meet the limits as specified in the relevant standards. *(style NO)*

*EXAMPLE 2:*

**fast channel:** channel with low latency but higher BER in comparison to the slow channel *(style Normal)*

EXAMPLE: In contrast to the slow channel, the fast channel is not interleaved. *(style EX)*

## 3.2 Symbols *(style H2)*

Clause numbering depends on applicability. The symbols list shall:

* contain the symbols and their corresponding explanations.
* be presented in alphabetical order.
* have entries not numbered.

The following text block applies.

For the purposes of the present document, the [following] symbols [given in ... and the following] apply:

* Use the **EW** style and separate this from the definition with a tab. Use the **EX** style for the last term.

*<*1st symbol*>* *[tab]<*1st Definition of symbol*>* *(style EW)*

*<*2nd symbol*>* *[tab]<*2nd Definition of symbol*>* *(style EX)*

*EXAMPLE:*

dB decibel *(style EW)*

DDI Direct Dialling-In, or direct dialling-in *(style EX)*

## 3.3 Abbreviations *(style H2)*

Clause numbering depends on applicability. The abbreviations list shall:

* contain the abbreviations and their corresponding full form.
* be presented in alphabetical order.
* have entries not numbered.

The following text block applies.

For the purposes of the present document, the [following] abbreviations [given in ... and the following] apply:

* Use the **EW** style and separate this from the definition with a tab. Use the **EX** style for the last term.

*<*1st ABBREVIATION*>* *[tab]<*Definition of abbreviation*>* *(style EW)*

*<*2nd ABBREVIATION*>* *[tab]<*Definition of abbreviation*>* *(style EX)*

*EXAMPLE:*

DPC Dynamic Power Control *(style EW)*

CCI Co-Channel Interference *(style EX)*

# 4 Permissioned Distributed Ledger Verticals

## 4.1 ICT Verticals

The ICT sector includes Stakeholders that include Service Providers, Vendors, Software developers and Service Integrators that rely on each other to provide Products and Services to Customers. Stakeholders often provide services to each other as well as team up with each other in order to provide services to other stakeholders or customers. The services offered are built on three vertical families of components, where different combinations of which, accompanied by management through software, yield Applications used by Stakeholders and Customers. The following sections discuss the three families of components, and how software turns those components into Applications.

## 4.2 The Connectivity Vertical

Connectivity provides the ability to move data through space…

## 4.3 The Compute Vertical

Compute is the act of performing computations on data…

## 4.4 The Storage Vertical

Storage allows moving data through time…

## 4.5 The Applications

Any ICT Application must have at least one component of the above three verticals, and often an Application will include a mix of all three. An example would be an application such as Dropbox™ that offers storage, but in order to provide such storage it must also include certain connectivity elements to move the data back and forth, and computational capabilities to identify users, calculate usage, perform billing and so forth. Another example would be an on-demand CE VLAN connectivity platform that allows a customer to order and activate connectivity between endpoints through a GUI (compute) and automatically bills customer for usage (compute and storage).

Applications may be offered to individual users and enterprises, as well as be consumed by other ICT stakeholder to generate other applications.

### 4.5.1 Retail Applications

Retail applications are offered to end users, who may be employees of a company using the application to perform their day to day job or individuals using the application for their own personal use. Retail applications may be made available through a wholesale supply chain or through a single supplier. E-mail would be the immediate example of a retail application.

### 4.5.2 Wholesale Applications

Wholesale applications are used by wholesale ICT stakeholders as part of a supply-chain…

# 5 Permissioned Distributed Ledger Horizontals

## 5.1 ICT Horizontals

This section discussed aspects of ICT Applications that occur, in various forms, across the board, and carry common characteristics…

## 5.2 The Security Horizontal

While security can be implemented as an application by itself (e.g. Firewall) this section discusses the security aspects of applications in a more general term. That includes: A. **Access-Control**: The ability to restrict access to or use of an application based on criteria such as identity, payment method and balance, location. B. **Transaction-Security**: The ability to preserve confidentiality or information during execution of a transaction and the ability to prevent malicious or unintended execution of a transaction. C. **Fraud-Prevention**: The ability to identify and mitigate fraudulent transactions.

Blockchain in general and PDL in particular are considered secure protocols. However – they are not hermetically sealed against fraud or malicious acts. The weak spots are typically related to collection and verification of data and it is recommended that those aspects are carefully designed and secured.

## 5.3 The Economic Incentive Horizontal

One of the key benefits of PDL is improved economic management. This is often evidenced in reduction of cost, but in many cases it can also be realized through an increase in revenue from existing services/applications and from an ability to yield new revenues through the introduction of new services and applications that would be difficult to realize in absence of PDL technology.

## 5.4 The Operational Incentive Horizontal

PDL is often implemented as a replacement to complex platforms that may include multiple inter-dependent systems. It has been demonstrated through several PoCs *[ref to be included]* that a few lines of code embedded in a smart contract can replace the functionality of an entire systems.

## 5.5 The Disintermediation Horizontal

The industry as a whole and the wholesale supply chain in particular, could benefit form disintermediation. The Telecommunications industry has a long history of operation in an equal-level playing field of federated operators. Services such as international voice traffic and the public internet operate in absence of a centralized intermediating or controlling entity. Distributed ledgers, both Permissioned and Permissionless, operate in a similar self-managed manner with no hierarchy of a top-level entity. There are certain applications in the ICT sector that rely on intermediaries (e.g. mobile settlements) and PDL has the potential to replace such intermediaries.

## 5.6 The Identity Management Horizontal

While Identity-Management has its roots in the Security Horizontal, the functionality PDL provides extends its use beyond it. Identity management can be used in applications related to DRM, payments, digital signatures and more…

# 6 Permissioned Distributed Ledger Governance

## 6.1 The need for Governance

Permissionless ledgers, such as Bitcoin, are self-governed through the open-source code that runs them. PDLs, on the other hand, may use less stringent verification of transactions, and distribute tokens to participants without need to spend resources for PoW or PoS. Governance is then required in order to manage and operate the PDL. The functions governance should perform would be: A. Selectively admitting new participants into the platform. B. Managing software development. C. Establishing the rules and processes.

## 6.2 Governance Methods

As stated in the previous paragraph – Permissionless ledgers would typically be self-managed. PDLs require a governing body that could be: A. A select group of representatives from the PDL membership. B. An external panel of experts. C. A mix of both.

## 6.3 Governance Structure

The governance body may be appointed or elected or consist of a mix of appointed and elected members. Election of board members can be based on seniority (e.g. Senior members’ vote weights more) or size (e.g. Weight of vote is proportional to turnover or headcount of the voting member), or could be based on a single and equal vote per member.

## 6.4 Governing the Governance

Governance involves the delicate task of both generating the rules and enforcing them. When bootstrapping a PDL based platform it is recommended that measures are taken to prevent a hostile takeover of the governing body in a manner that can lead to irreversible consequences.

From clause 4, the technical content of the ETSI deliverable shall be inserted. Each clause **shall have a title** For numbered clauses the title shall be placed after its number

A clause can have numbered subdivisions, e.g. 5.1, 5.2, 5.1.1, 5.1.2, etc. This process of subdivisions may be continued as far as the sixth heading level (e.g. 6.5.4.3.2.1).

For numbering issues, see clause 2.12.1 of the [*EDRs*](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx).

* Use the **Heading** style appropriate to its level (see ETSI styles" table in [*editHelp!*](https://portal.etsi.org/Services/editHelp!/Standardsdevelopment/Drafting/Styles/Styleslistingtable.aspx)website).
* Separate the number of the heading and the text of the heading with a tab.
* Treat clause titles as normal text (i.e. **no additional capitalization**), **but** no full stop.

Notes and examples

Notes and examples integrated in the text shall only be used for giving additional information intended to assist the understanding or use of the ETSI deliverable. Notes and examples shall not contain requirements. For more details see clauses 5.5 and 2.12.1 of the [EDRs](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)).

A single note in a clause shall be preceded by "NOTE" in upper case. When several notes occur within the same element (e.g. clause, figure or table), they shall be designated "NOTE 1:", "NOTE 2:", "NOTE 3:", etc.

Use the **NO** style.

Separate NOTE: from the text of the note with a tab.

EXAMPLE:

NOTE 1: Text formatted with the **NO** style will be formatted **with** a space after the paragraph. (Style NO)

NOTE 2: This is the second note contained in a clause. *(Style NO)*

A single example in a clause shall be preceded by "EXAMPLE:" in upper case. When several examples occur within the same element (e.g. clause, figure or table), they shall be designated "EXAMPLE 1:", "EXAMPLE 2:", "EXAMPLE 3:", etc.

When there is a danger that it may not be clear where the example ends and the normal text continues, then the end of the example may be designated by "END of EXAMPLE".

Use **EX** style.

Separate EXAMPLE: from the text of the example with a tab.

EXAMPLE:

EXAMPLE 1: This is the first example of the clause. *(Style EX)*

EXAMPLE 2: This is the second example of the clause. *(Style EX)*

END of EXAMPLE

Figures

Figures shall be prepared in accordance to clauses 5.1 and/or 7.2 of the [*EDRs*](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx). Details concerning "[Supported file formats](https://portal.etsi.org/Services/editHelp!/Howtostart/Supportedfileformats.aspx)" and "How to copy a figure" are available in[*editHelp!*](https://portal.etsi.org/edithelp/Files/other/Graphics_editHelp!.pdf) website. For an easy application of the ETSI styles download "The ETSI styles toolbar" from [*editHelp!*](https://portal.etsi.org/Services/editHelp!/Standardsdevelopment/Drafting/Styles.aspx) website.

* The figure number and title shall be below the figure. An explicit figure title is optional.
* *Notes to figures* ***shall*** *be treated independently from notes integrated in the text,* see clause 5.1.5 of the [*EDRs*](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx) *for more details.*
* *To generate a list of figures see clause 2.3.2 of the* [*EDRs*](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)*.*
* Use **TF** style for the figure number and title.
* Use **FL** style on the paragraph which contains the figure itself.
* Use **NF** style for the notes to figures. Separate "NOTE:" from the text of the note with a tab.
* If applicable, the figure number is followed by a colon, a space and the table title.
* Maximum width for figures is 17 cm and maximum height is 22 cm.
* For automatic figure numbering see clause 6.9.2 of the [EDRs](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx).

Figure numbering

Figures may be numbered sequentially throughout the ETSI deliverable without regard to the clause numbering, e.g. first figure is figure 1 and the twentieth figure is figure 20.

Figures may also be numbered taking account of clause numbering.

EXAMPLE 1: First figure in clause 5 is figure 5.1, second figure in clause 5.1.1 is figure 5.2, third figure in clause 5.2.3 is figure 5.3.

EXAMPLE 2: First figure in clause 7.3.2 is figure 7.3.2.1, fifth figure in clause 7.3.2 is figure 7.3.2.5.

One level of subdivision only is permitted (e.g. table 1 may be subdivided as 1 a), 1 b), 1 c), etc.). See also clause 2.12.1.0 of the [*EDRs*](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)*.*

Figures of an annex shall be preceded by the letter designating that annex followed by a full-stop (e.g. figure B.1, figure C.4.1.1). The numbering shall start afresh with each annex.

Layout of a figure

EXAMPLE:

Figure *(style FL)*

NOTE: This is a note to figure 1. *(style NF)*

Figure 1: Details of apparatus *(style TF)*

Tables

Tables shall be prepared in accordance to clauses 5.2 of the [*EDRs*](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx). For an easy application of the ETSI styles download "the ETSI styles toolbar" from[*editHelp!*](https://portal.etsi.org/Services/editHelp!/Standardsdevelopment/Drafting/Styles.aspx) website*.*

* The figure number and title shall be above the table itself. An explicit table title is optional.
* *If the table continues over more than one page, the column headings* ***shall*** *be repeated on all pages after the first.*
* *Notes to figures* ***shall*** *be treated independently from notes integrated in the text,* see clause 5.1.5 of the [*EDRs*](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx) *for more details.*
* *To generate a list of figures see clause 2.3.2 of the* [*EDRs*](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)*.*
* *For numbering issues see clause 5.1.3* of the [*EDRs*](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)*.*

Details concerning "ETSI Styles" for tables are available on the[*editHelp!*](https://portal.etsi.org/Services/editHelp!/Standardsdevelopment/Drafting/Styles/Styleslistingtable.aspx) website.

|  |
| --- |
| * Use the following styles: * **TH** for the table number and title. * **TAH** for table headings * **TAL** for text left aligned * **TAC** for text centred * **TAR** for text right aligned * **TAN** for the note to table. Separate NOTE: from the text of the note with a "Ctrl" + "→" (tab). Include notes to a table within its borders in one cell, at the bottom. * **TB1** for the list of level 1 * **TB2** for the list of level 2 * If applicable, the table number is followed by a colon, a space and the table title. * To repeat the column heading on all pages, use the table headings tool (**Table, Heading Rows Repeat**). * For automatic figure numbering see clause 6.9.2 of the [EDRs](http://portal.etsi.org/Help/editHelp!/Howtostart/ETSIDraftingRules.aspx)). |

Centre tables horizontally.

The "space between columns" is 0,1 pt or 0,05 cm (default cell margins Left 0,05 pt & Right 0,19 pt).

Maximum width for tables in portrait orientation: 17 cm and for landscape orientation: 22 cm.

Set table columns widths in centimetres (not inches).

Use borders to separate the rows and columns of tables, as appropriate; the precise format will depend on the structure of each table, but be consistent throughout a deliverable (or series of related deliverables). Borders should be ¾ pt single line.

Each table shall be followed by an empty "Normal" style paragraph (↵ "Enter" key).

Table numbering

Tables may be numbered sequentially throughout the ETSI deliverable without regard to the clause numbering, e.g. the first table is table 1 and the twentieth table is table 20.

Tables may also be numbered taking account of clause numbering.

EXAMPLE 1: First table in clause 5 is table 5.1, second table in clause 5.1.1 is table 5.2, third table in clause 5.2.3 is table 5.3.

EXAMPLE 2: First table in clause 7.3.2 is table 7.3.2.1, fifth table in clause 7.3.2 is table 7.3.2.5.

One level of subdivision only is permitted (e.g. table 1 may be subdivided as 1 a), 1 b), 1 c), etc.). See also clause 2.12.1.0 *of the* [*EDRs*](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)*.*

Tables of an annex shall be preceded by the letter designating that annex followed by a full-stop (e.g. table B.1, table C.4.1.1). The numbering shall start afresh with each annex.

Layout of a table

The title shall be above the table. An explicit table title is optional. See the following examples. The first word in the heading of each column shall begin with a capital letter. The units used in a given column shall generally be indicated within the column heading.

EXAMPLE:

Table 1: Electrical properties *(style TH)*

|  |  |  |  |
| --- | --- | --- | --- |
| **Type** *(style TAH)* | **Linear density (kg/m)** *(style TAH)* | **Inside diameter (mm)** *(style TAH)* | **Outside diameter (mm)** *(style TAH)* |
| Text*(style TAL)* | Text *(style TAC)* | Text *(style TAR)* |  |
| NOTE 1: This is a note to table. *(style TAN)*  NOTE 2: This is a merged cell. *(style TAN)* | | | |

Mathematical formulae

Mathematical formulae shall be prepared in accordance to clause 5.3 of the [*EDRs*](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)*.* Details concerning tools that shall be used for editing "Mathematical formulae" are available on the *[editHelp!](https://portal.etsi.org/Services/editHelp!/Tohelpyouinyourwork/Furtherresources/Mathematicalformulae.aspx)* website.

For an easy application of the ETSI styles download "the ETSI styles toolbar" from *[editHelp!](https://portal.etsi.org/Services/editHelp!/Standardsdevelopment/Drafting/Styles.aspx)* website.

* Use **EQ** style.
* Insert one tab before the equation to centre it.
* For automatic equation numbering see clause 6.9.2 of the [EDRs](http://portal.etsi.org/Help/editHelp!/Howtostart/ETSIDraftingRules.aspx).

Equation numbering

If it is necessary to number some or all of the formulae in an ETSI deliverable in order to facilitate cross‑referencing, Arabic numbers in parentheses shall be used, beginning with 1:

EXAMPLE 1:

x2 + y2 < z2 (style EQ) (1)

Equations may be numbered sequentially throughout the ETSI deliverable without regard to the clause numbering, e.g. first equation is equation 1 and the twentieth equation is equation 20.

Equations may also be numbered taking account of clause numbering.

EXAMPLE 2: First equation in clause 5 is equation 5.1, second equation in clause 5.1.1 is equation 5.2, third equation in clause 5.2.3 is equation 5.3.

EXAMPLE 3: First equation in clause 7.3.2 is equation 7.3.2.1, fifth equation in clause 7.3.2 is equation 7.3.2.5.

Equations of an annex shall be preceded by the letter designating that annex followed by a full-stop (e.g. table B.1, table C.4.1.1). The numbering shall start afresh with each annex.

## 4.1 User defined subdivisions of clause(s) from here onwards *(style H2)*

<Text>.

Annexes

Each annex **shall:**

* start on a new page (insert a page break between annexes A and B, annexes B and C, etc.).
* be designated by a heading comprising the word "Annex" followed by a capital letter designating its serial order, beginning with "A".
* have its heading followed by the indication "(normative):" or "(informative):", and by the title on the next line.

*[ETSI Drafting Rules](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)* [(](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)*[EDRs)](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx),* clause 2.13.

*Numbers given to the clauses, tables, figures and mathematical formulae of an annex shall be preceded by the letter designating that annex followed by a full-stop. The numbering* ***shall start afresh with each annex****. A single annex shall be designated "Annex A".*

Clauses in annex A shall be designated "A.1", "A.2", "A.3", etc. (further details in clause 2.12.1 of the [*EDRs*](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)).

* Use the **Heading 9** style. Insert a line break ("shift" + ↵ "enter") between the colon and the title.
* For all annex clause headings use the appropriate Heading styles, starting from **Heading 1,** e.g. for clause A.1 use **Heading 1**, for clause A.1.1 use **Heading 2**. ("ETSI Styles" are available on the[*editHelp!*](https://portal.etsi.org/Services/editHelp!/Standardsdevelopment/Drafting/Styles/Styleslistingtable.aspx) website ).

EXAMPLE:

<PAGE BREAK>

Annex A:  
Title of annex *(style H9)*

<Text>.

<PAGE BREAK>

Annex B:  
Title of annex *(style H9)*

# B.1 First clause of the annex

## B.1.1 First subdivided clause of the annex

<Text>.

<PAGE BREAK>

Annex <L>:  
Authors & contributors *(style H9)*

The annex entitled "Authors & contributors" is optional. When present it describes the list of persons and companies that contributed to the elaboration of the present Group Report.

The following people have contributed to the present document:

**Rapporteur**:  
Title, Firstname, Lastname, company

**Other contributors**:Title, Firstname, Lastname, company

<PAGE BREAK>

Annex <L+1>:  
Bibliography *(style H9)*

The "Bibliography" annex identifies additional reading material not mentioned anywhere in an ETSI deliverable including annexes. These publications might or might not be publicly available (no check is made by the Secretariat).

The Bibliography **shall include** list of standards, books, articles, or other sources on a particular subject which are not cited anywhere in an ETSI deliverable including annexes.

The Bibliography **shall not include** *documents listed in clauses 2.1 and 2.2.*

*[ETSI Drafting Rules](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)* [(](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)*[EDRs)](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx),* clause 2.14.

* Use **Heading 9** style for the "Bibliography" annex, see clause 2.13 of the [EDRs](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx) for examples.
* For the listed material use the **Normal** style or bulleted lists (e.g. **B1+**), do not use numbered references.

*EXAMPLE 1:*

*<*Publication*>*:"*<*Title*>".<*Edition*>*. *<*Year*>*, *<*Issue designation*>*, *<*Page location*>*. *(style Normal)*

WEAVER, William. "Command performances". December 1985, vol. 42, n° 12, p. 126-133). *(style Normal)*

*EXAMPLE 2:*

* <Publication>: "<Title>". *(style B1+)*
* ETSI EN 300 066: "ElectroMagnetic Compatibility and Radio Spectrum Matters (ERM); Float-free maritime satellite Emergency Position Indicating Radio Beacons (EPIRBs) operating in the 406,0 MHz to 406,1 MHz frequency band; Technical characteristics and methods of measurement". *(style B1+)*

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Annex <L+2>:  
Change History *(style H9)*

*The "Change history/Change request (history)" is an optional informative element.*

*The "Change history/Change request (history)" annex, if present, describes the list of changes implemented in a new version of the ETSI deliverable. It shall be presented as a table.*

"ETSI styles" for tables are available in[*editHelp!*](https://portal.etsi.org/Services/editHelp!/Standardsdevelopment/Drafting/Styles/Styleslistingtable.aspx) website.

| Date | Version | Information about changes |
| --- | --- | --- |
| October 2011 | 1.1.1 | First publication after approval (30 September - 2 October 2011; Prague) |
| February 2012 | 1.2.1 | Implemented Change Requests:  Error message information clarifications  update of figure 3 clause 9.2  These CRs were approved by <ISG shortname> (3 - 5 February 2012; Sophia)  Version 1.2.1 prepared by the Rapporteur |

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# History *(style H1)*

*The "History" clause shall start on a new page and be the final unnumbered clause of an ETSI deliverable.*

*History shall be prepared in accordance to clause 2.16 of the* [*EDRs*](https://portal.etsi.org/Services/editHelp!/Howtostart/ETSIDraftingRules.aspx)*.*

Use **Heading 1** style for the title.

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| --- | --- | --- |
| **Document history** | | |
| V.0.0.1 | May 2019 | Earliest Draft |
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|  |  |  |
|  |  |  |
|  |  |  |

A few examples:

|  |  |  |
| --- | --- | --- |
| **Document history** | | |
| V1.1.1 | April 2018 | Publication |
| V1.2.2 | June 2017 | Pre-Processing done before TB approval e-mail: <mailto:edithelp@etsi.org> |
| V1.3.0 | July 2018 | Clean-up done by ***editHelp!*** e-mail: <mailto:edithelp@etsi.org> |
|  |  |  |
|  |  |  |

*Latest changes made on 2018-10-22*