

# ETSI TS 103 909 V1.1.1 (2012-12)



## **Power Line Telecommunications (PLT) Narrow band transceivers in the range 9 kHz to 500 kHz Power Line Performance Test Method Guide**

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## Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Powerline Telecommunications (PLT).

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## Introduction

Customers need not only a standards based power line communications (PLC) technology, but also that one that is able to meet their business requirements. A standardized PLC technology that does not fully meet the customer's requirements can undermine the general acceptance of PLC as a technology. Therefore, it is important to verify that a proposed technology can meet these requirements under realistic channel conditions. A link budget and data rate test measurement method can be used for this purpose.

A potential PLC modem customer can also use field trials to evaluate the suitability of a particular product for their application, but field trials cannot easily expose the technology to all possible types of impairments, thus limiting the effectiveness of the trials. However, a properly designed test method can easily expose the technology to all possible types of impairments; the link budget and data rate test method can then be correlated with field studies. After this correlation is established, it is possible to reduce field trial requirements significantly and accelerate technology deployments.

One purpose of a standardized test method is to include real world noise characteristics that represent something more challenging than the typical case likely found in a field trial. A test method can emulate the 95<sup>th</sup> to 99<sup>th</sup> percentile level of each type of noise that occurs on the power line. A field trial that could replicate this level of real world challenge would require a very large sample size to find the hardest 1 % to 5 % of cases. A standardized test method addresses this limitation of field trials.

Clear results from a standardized test method provide a way to communicate quantitative information to a customer, including suitability of the technology for their requirements at an early stage of their product evaluation, development, and deployment.

The test measurements can be made by an independent test house. Independent testing provides credibility to enable faster mass market penetration of the technology. The test results enable the customer to know beforehand the suitability of the technology they buy, without the need to go through time-consuming pilot phases.

# 1 Scope

The present document describes test techniques that can be used to determine the performance of narrow band power line communications technologies using any modulation technique in the frequency range 9 kHz to 500 kHz.

# 2 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.

Referenced documents which are not found to be publicly available in the expected location might be found at <http://docbox.etsi.org/Reference>.

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

## 2.1 Normative references

The following referenced documents are necessary for the application of the present document.

- [1] CISPR 11:2009+A1:2010: "Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement".
- [2] CISPR 15:2009: "Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment".
- [3] CISPR 16-1-1:2010: "Specification for radio disturbance and immunity measuring apparatus and methods - Part 1-1: Radio disturbance and immunity measuring apparatus - Measuring apparatus".
- [4] CISPR 22:2008: "Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement".
- [5] CENELEC EN 50065-1:2011: "Signalling on low-voltage electrical installations in the frequency range 3 kHz to 148,5 kHz - Part 1: General requirements, frequency bands and electromagnetic disturbances".
- [6] Title 47 of the Code of Federal Regulations (CFR) Part 15, Radio Frequency Devices.

NOTE: Available at [www.fcc.gov/oet/info/rules/](http://www.fcc.gov/oet/info/rules/).

- [7] ISO/IEC 14908-3:2012: "Information technology -- Control network protocol -- Part 3: Power line channel specification".

## 2.2 Informative references

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.

- [i.1] TS 103 908 (V1.1.1): "PowerLine Telecommunications (PLT); BPSK Narrow Band Power Line Channel for Smart Metering Applications [CEN EN 14908-3:2006, modified]".
- [i.2] IEEE P1901.2: "Standard for Low Frequency (less than 500 kHz) Narrow Band Power Line Communications for Smart Grid Applications".

## 3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

|                    |                                                    |
|--------------------|----------------------------------------------------|
| AC                 | Alternating Current                                |
| ADC                | Amperes Direct Current                             |
| BPSK               | Binary Phase Shift Keying                          |
| CISPR              | Committee International Special Radio Perturbation |
| CRC                | Cyclic Redundancy Rate                             |
| DBPSK              | Differential Binary Phase Shift Keying             |
| DCR                | Direct Current Resistance                          |
| DQPSK              | Differential Quadrature Phase Shift Keying         |
| DR <sub>LINK</sub> | Data Rate Link Layer                               |
| DR <sub>PKT</sub>  | Data Rate Packet Level                             |
| EN                 | European Norm                                      |
| FCC                | Federal Communications Commission                  |
| FM                 | Frequency Modulation                               |
| IEEE               | Institute of Electrical and Electronics Engineers  |
| LB <sub>LINK</sub> | Link Budget Link Layer                             |
| LB <sub>PHY</sub>  | Link Budget Physical Layer                         |
| LED                | Light Emitting Diode                               |
| MAC                | Medium Access Control layer                        |
| MER                | Message Error Rate                                 |
| OSI                | Open Systems Interconnect                          |
| PHY                | Physical Layer (protocol layer)                    |
| PL                 | Power Line                                         |
| PLC                | Power Line Carrier                                 |
| PRIME              | Powerline Related Intelligent Metering Evolution   |
| RMS                | Root Mean of Squares                               |
| US                 | United States                                      |
| UUT                | Unit Under Test                                    |
| VAC                | Voltage Alternating Current                        |
| VDC                | Voltage Direct Current                             |

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## 4 Overview

### 4.1 Overview

The present document defines a set of standardized test methods for characterizing power line communications (PLC) technologies, particularly within the frequency range of 9 kHz to 500 kHz.

In a typical power line environment, many devices are connected to the AC mains. An examination of real-world AC mains environments reveals that these various devices generate a wide variety of noise, which can be classified into four categories:

- Tonal noise.
- Periodic impulse noise.
- Random impulse noise.
- Intentional communicator noise.

The present document describes tests for these four noise types, and includes a test for a noiseless environment. These test types are described in the following clauses.