ETSI TR 101 562-1 V1.3.1 (2012-02)

PowerLine Telecommunications (PLT);
MIMO PLT;
Part 1: Measurement Methods of MIMO PLT

Reference
RTR/PLT-00036

Keywords
MIMO, powerline

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Important notice

Individual copies of the present document can be downloaded from:
 http://www.etsi.org

The present document may be made available in more than one electronic version or in print. In any case of existing or perceived difference in contents between such versions, the reference version is the Portable Document Format (PDF). In case of dispute, the reference shall be the printing on ETSI printers of the PDF version kept on a specific network drive within ETSI Secretariat.

Users of the present document should be aware that the document may be subject to revision or change of status. Information on the current status of this and other ETSI documents is available at
http://portal.etsi.org/tb/status/status.asp

If you find errors in the present document, please send your comment to one of the following services:
http://portal.etsi.org/chaircor/ETSI_support.asp

Copyright Notification

Contents

Intellectual Property Rights

IPRs essential or potentially essential to the present document 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 (http://ipr.etsi.org).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Powerline Telecommunications (PLT).

The present document is part 1 of a multi-part deliverable covering the MIMO PLT as identified below:

Part 1: "Measurement Methods of MIMO PLT";

Part 2: "Setup and Statistical Results of MIMO PLT EMI Measurements";

Part 3: "Setup and Statistical Results of MIMO PLT Channel and Noise Measurements".

Introduction

In order to study and compare MIMO (Multiple Input Multiple Output) characteristics of the LVDN network in different countries, the STF 410 (Special Task Force) was set up. The present document is one of three parts of TR 101 562 which present the findings of STF 410 research.

1 Scope

Convential PLT modems (SISO) use only the phase and neutral wire of the mains grid. MIMO PLT utilizes additionally the protective earth wire.

The present document is an overview of the prevalence of the third wire in private homes and a description of the measurement setup and equipment used to perform EMI, channel and noise measurements.

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 reference 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.

Not applicable.

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] Sartenaer, T. & Delogne, P., "Powerline Cables Modelling for Broadband Communications", ISPLC 2001, pp. 331-337.

[i.2] R. Hashmat, P. Pagani, A; Zeddam, T. Chonavel, "MIMO Communications for Inhome PLC Networks: Measurements and Results up to 100 MHz", IEEE International Symposium on Power Line Communications and its Applications (ISPLC), Rio, Brasil, March 2010.

[i.3] A. Schwager, "Powerline Communications: Significant Technologies to Become Ready for Integration" Doctoral Thesis at University of Duisburg-Essen, May 2010.

[i.4] ETSI TR 102 175 (V1.1.1): "PowerLine Telecommunications (PLT); Channel characterization and measurement methods".

[i.5] Housing Statistics in the European Union 2010; The Hague: Ministry of the Interior and Kingdom Relations; Edited by Kees Dol and Marietta Haffner, OTB Research Institute for the Built Environment, Delft University of Technology; September 2010.

NOTE: Available at http://abonneren.rijksoverheid.nl/article/kennisplein-wwi/nieuwsbrief-kennisplein-wwi-december-2010/housing-statistics-in-the-european-union-2010/428/3384?mode=html-mail.

[i.6] How we are housed: Results from the 1999 American Housing Survey; Summary of U.S. housing market conditions (30 Aug. 2011).

NOTE: Available at http://www.huduser.org/periodicals/ushmc/fall00/summary-2.html.

[i.7] Canadian Housing Observer 2006; CMHC, ISBN 0-662-44559-7, adapted from Statistics Canada (Census of Canada) (30 Aug. 2011).

NOTE: Available at http://www.cmhc-schl.gc.ca/odpub/pdf/65102.pdf.

[i.8] Wikipedia, free encyclopedia; 2010/2011.

NOTE: Available at http://en.wikipedia.org.

[i.9] ETSI TR 101 562-2 (V1.2.1): "Powerline Telecommunications (PLT); MIMO PLT; Part 2: Setup and Statistical Results of MIMO PLT EMI Measurements".

[i.10] ETSI TR 101 562-3 (V1.1.1): "PowerLine Telecommunications (PLT); MIMO PLT; Part 3: Setup and Statistical Results of MIMO PLT Channel and Noise Measurements".

[i.11] IEC 60906-1: "IEC system of plugs and socket-outlets for household and similar purposes - Part 1: Plugs and socket-outlets 16 A 250 V a.c.".

[i.12] Directive 2006/95/EC of the European Parliament and of the Council of 12 December 2006 on the harmonisation of the laws of Member States relating to electrical equipment designed for use within certain voltage limits.

[i.13] IEC 60364-1: "Low-voltage electrical installations - Part 1: Fundamental principles, assessment of general characteristics, definitions".

3 Symbols and abbreviations

3.1 Symbols

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

dB	decibel (logarithmic unit)
dBm	10 * $\log_{10}$ (P / 1 mW)
Hz	Hertz
L	Inductance
m	meter
MHz	Mega Hz
nF	nanoFarads
nH	nanoHenry
R	Resistor
Ω	Ohm
Z	Impedance

3.2 Abbreviations

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

AC	Alternating Current
AMN	Artificial Mains Network
BCA	Building & Construction Authority
BNC	Bayonet Nut Connector
BS	British Standard
BSI	British Standards International
C	"Center point" of the Coupler
CEE	Conformity certification of Electrical Equipment
CIS	Commonwealth of Independent States
CM	Common Mode
DC	Direct Current
DM	Differential Mode
E	Protective Earth Contact