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IEEE Standard for Power Line Communication Equipment—Electromagnetic Compatibility (EMC) Requirements—Testing and Measurement Methods

Sponsored by the

Power System Communications Committee
of the
IEEE Power & Energy Society

and the

Standards Committee
of the
IEEE Communications Society

IEEE
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USA

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Abstract: Electromagnetic compatibility (EMC) criteria and consensus test and measurements procedures for broadband over power line (BPL) communication equipment and installations are presented. Existing national and international standards for BPL equipment and installations are referenced. This standard does not include the specific emission limits, which are subject to national regulations.
Keywords: BPL, BPL emissions, BPL immunity, broadband over power line communication, electromagnetic compatibility, EMC, emissions measurements, IEEE 1775, measurement methods, PLC, power line communication, power line communication equipment, smart grid, testing methods

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Introduction

This introduction is not part of IEEE Std 1775-2010, IEEE Standard for Power Line Communication Equipment—Electromagnetic Compatibility (EMC) Requirements—Testing and Measurement Methods.

Power line communication (PLC) technology has developed over a long period of time.

As early as 1838 Edward Davy proposed remote electricity supply metering for the purpose of checking the voltage levels of the batteries at unmanned sites in the London-Liverpool telegraph system. The first carrier-current system for mains signaling was established in 1893 by the Swiss Electricity Board. The carrier frequency transmission of voice over power lines began in the 1920s. Due to low attenuation and low noise in the transmission lines at the carrier frequencies (15 KHz to 500 KHz), a distance of 900 km between transmitter and receiver could be attained with a power of 10 W. In 1930 Ripple Carrier Signaling was implemented in Germany over medium- and low-voltage distribution power lines. Such systems typically operated in the frequency band 125 Hz to 3000 Hz, so a carrier signal propagated with low losses.

Advances in communication technology in the late 1990's led to new research and development activities related to data communication through the power grid. Known widely as *power line communications* (PLC), this technology is also named *broadband over power line* (BPL), *power line telecommunication* (PLT), and *power line technology* (PLT). PLC created a mix of high expectations and concerns mainly due to perceived EMC problems and absence of regulatory and standardization framework to address them.

In 2000 several European countries independently proposed EMC regulations for PLC. Later, the Joint Working Group of CENELEC and ETSI started developing a standard covering the EMC aspects of wire-line telecommunications networks including their in-home extension. The standard scope is focusing on the limits and in situ measurements procedures for EMI measurements. Currently the standard is under development.

In 2004 the regulatory uncertainty in the U.S. ended when the FCC approved the Report and Order "Amendment of Part 15 regarding new requirements and measurement guidelines for Access Broadband over Power Line Systems" (ET Docket No. 04-37). The Amendment: (a) defines the Access and In-House BPL system; (b) contains the emission limits for them; and (c) describes in detail the measurement procedure for emissions measurements from BPL equipment verification and certification. However, immunity requirements and testing were not covered under this document. In the U.S., narrowband carrier-current systems are regulated by the Federal Communication Commission (FCC) under CFR 47 Part 15 Rules for unintentional radiators. Therefore, for such systems the methods provided by ANSI C63.4 are fully applicable for emissions measurements.[a]

In 2004 the IEEE published IEEE Std 643™-2004 [B31] for low-frequency power line communications covering 50 kHz to 450 kHz band operations.[b]

In 2005 CENELEC published EN 50412-2-1, which is the first immunity standard for PLC equipment.

In 2007 the Japanese Ministry of Interior and Communication (MIC) published "Japanese (radio) Regulations for the Broadband PLC (or PLT or BPL)," which is part of Japanese Radio Law and Ordinance regulating radio equipment.

In 2008 CISPR sent out for circulation the Draft Amendment to CISPR 22, which will describe the limits and method of measurement of broadband telecommunication equipment over power lines.

Both the Japanese and CISPR documents are applicable for In-premises BPL devices.

[a] Information on references can be found in Clause 2.
[b] The numbers in brackets correspond to those of the bibliography in Annex G.

The growing concerns from PLC manufacturers and utility operators about the absence of an internationally recognized EMC measurement and testing methodology for PLC equipment and installations was addressed when in 2004 IEEE Standards Association established the PLC EMC Working Group [P1775] to develop this standard. The Working Group is co-sponsored by the Power & Energy Society and Communication Society. The standard is solely focused on EMC measurement techniques and does not attempt to establish regulatory limits for PLC devices or systems.

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1. Overview

1.1 Scope

The scope of this standard is electromagnetic compatibility (EMC) criteria and consensus test and measurements procedures for broadband over power line (BPL) communication equipment and installations. The standard references existing national and international standards for BPL equipment and installations. It does not include the specific emission limits, which are subject to national regulations.[1]

1.2 Purpose

This standard is a part of a planned IEEE series of BPL standards that will cover major aspects of BPL communication technology: safety, EMC, media, coexistence, interoperability, and education. By providing test and measurement guidance as well as EMC criteria, this EMC standard will serve as a bridge between

[1] And local regulations, should they exist.