



Status of EMC (Electromagnetic Compatibility) Regulation (FCC/EU) for G.hn Powerline, Coax and Phoneline Devices

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HomeGrid Forum (HGF) is an industry alliance that brings together the world's best in technology innovators, silicon vendors, system manufacturers, and service providers to promote G.hn, a globally recognized gigabit home networking technology based on ITU-T standards. G.hn is the most reliable and versatile wireless home network backbone available today. Our members promote the global adoption of G.hn, a single unified, multi-sourced networking technology – over coax, copper pairs, powerline, and plastic optical fiber. HomeGrid Forum provides G.hn silicon and system certification through a strict compliance and interoperability testing program. For more information on HomeGrid Forum, please visit our website at www.homegridforum.org.

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Status of EMC (Electromagnetic Compatibility) Regulation

1 Introduction

All electronic devices can influence each other's performance and functional behavior, especially where devices are installed very close to each other inside a home. The purpose of regulating electromagnetic compatibility (EMC) is to create an environment where equipment can operate as intended without impact and without causing impact to others. Specific regulations have been designed by the Federal Communications Commission (FCC) of the United States and by the European Commission (EU) to regulate equipment. Other regulatory measures exist in other international territories. Technical EMC standards have been defined by various standardization organizations to support such regulations. The main standards organizations involved in writing EMC standards are IEC, CISPR, ANSI, CENELEC, ETSI, ITU.

G.hn technology is a multi-medium solution that works over powerline, coax, phonenumber and plastic optical fiber to connect electronic devices at Gigabit speeds. The purpose of this White Paper is to describe the regulatory framework in the USA and EU that applies to G.hn devices pertaining to electromagnetic compatibility.

An important aspect of any EMC assessment is ensuring that it addresses all emission and immunity requirements and that the methodologies used are appropriate, reliable and repeatable. How to achieve this will be the subject of a future HomeGrid Forum whitepaper.

2 FCC Regulation: In-House Broadband over Power Line (BPL) devices

➤ FCC classification of In-House BPL devices

G.hn In-House BPL devices are classified under the Electronic Code of Federal Regulations (e-CFR)⁽¹⁾ as Class B carrier current systems, operating as unintentional radiators.

System manufacturers and service providers interested in verifying the status of BPL devices should refer to Title 47, Chapter I, Subchapter A, Part 15 of e-CFR:⁽¹⁾ Subpart B (Unintentional Radiators) gives guidance on equipment characterized as unintentional radiators, including carrier current systems.

➤ Tests to apply to In-House BPL devices to be FCC compliant

Above 30 MHz the general emissions test setups, standards and methods for FCC EMC compliance for Consumer Electronics devices apply to In-Home BPL products. However, there are additional requirements on carrier current systems, which need to be compliant with the limits on radiated emissions below 30 MHz measured according to FCC rules (see §15.31 of FCC part 15, an extract of which is given below).

§15.31 Measurement standards

- (d) Field strength measurements shall be made, to the extent possible, on an open field site. [...] In the case of equipment for which measurements can be performed only at the installation site, such as [...], carrier current systems, [...], measurements for verification or for obtaining a grant of equipment authorization shall be performed at a minimum of three installations that can be demonstrated to be representative of typical installation sites.

➤ **Limits to apply to In-House BPL devices to be FCC compliant**

- **Below 30 MHz**

Conducted limits shall not apply to carrier current systems operating as unintentional radiators on frequencies below 30 MHz (§15.107, (c)).

Carrier current systems operating below 30 MHz are subject to the radiated emission limits described in §15.107, (c) (3), and §15.109, and §15.209. The applicable radiated emission limit in §15.209(a) is 30 microvolts/meter at 30 meters. This is equivalent to 29.5 dBµV/m, which can be scaled to 3 meters as shown in the table below.

Frequency (MHz)	Field strength (microvolts/meter)	dBµV/m (QP)	Measurement distance (meters)
1.705-30.0	30	29.5	30
1.705-30.0		69.5 (*)	3
(*) Extrapolated value, FCC rules specify 40 dB/decade			
Note: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector			

- **Above 30 MHz**

At frequencies above 30 MHz, the limits in the below table (copied from §15.109 (a)) apply for (Class B) In-Home BPL devices tested at 3 meters distance. Alternatively, per §15.109 (2) the measurement limits and distances from CISPR 22 (now replaced by CISPR 32) can be used.

Frequency of emission (MHz)	Field strength (microvolts/meter)
30-88	100
88-216	150
216-960	200
Above 960	500

3 FCC Regulation: Coax and Phone Line Devices

Coaxial or Phone Line devices based on G.hn technology also fall under the scope of Title 47, Chapter I, Subchapter A, Part 15 of e-CFR^[1] rules for unintentional radiators. However, no

additional requirements (other than those common to all Consumer Electronics device unintentional radiators) apply.

§15.1 Scope

(a) This part sets out the regulations under which an intentional, unintentional, or incidental radiator may be operated without an individual license. It also contains the technical specifications, administrative requirements and other conditions relating to the marketing of part 15 devices.

§15.3 Definitions.

(k) Digital device. [...] An unintentional radiator (device or system) that generates and uses timing signals or pulses at a rate in excess of 9,000 pulses (cycles) per second and uses digital techniques; inclusive [...] any device or system that generates and uses radio frequency energy for the purpose of performing data processing functions, such as [...] retrieval, or transfer. [...]

4 EU Regulation: Current status of Power Line Communications (PLC) devices

➤ Overview

All devices must comply with the EMC Directive^[2] unless they include some form of radio functionality in which case they must comply with the Radio Equipment Directive (RED)^[3] that also contains essential requirements relating to EMC.

Compliance with these directives can be demonstrated via various means. The typical approach is the use of Harmonised Standards that provide a “presumption of conformity” with the relevant Directive. A list of currently applicable Harmonised Standards is published in the Official Journal of the EU under each directive. Use of harmonised standards is voluntary and there are other approaches given in the Directives for demonstrating compliance with the essential requirements.

Where the G.hn technology is built into a device that has radio functionality (for example a Wi-Fi access point), this comes within the scope of the RED. The listing of EMC standards for Radio Equipment is still work in progress and will include both, CENELEC and ETSI standards.

➤ CENELEC Standardisation in the area of PLC

- EN 50561-1. First part of EMC emission standard for PLC (using the frequency band up to 30 MHz). Published and listed as a harmonised standard^[4] under the EMC Directive.
- EN 50561-2. Second part of EMC standard for PLC (up to 30 MHz and only for access equipment). Currently still a working draft that is under revision after the first voting round received a negative vote.
- EN 50561-3. Third part of EMC standard for PLC (from 30 MHz up to 87.5 MHz). Already published but not yet listed as a harmonised standard under either Directive.

Radiated emission limits are mandatory from 30 MHz upwards, in addition to compliance with conducted limits.

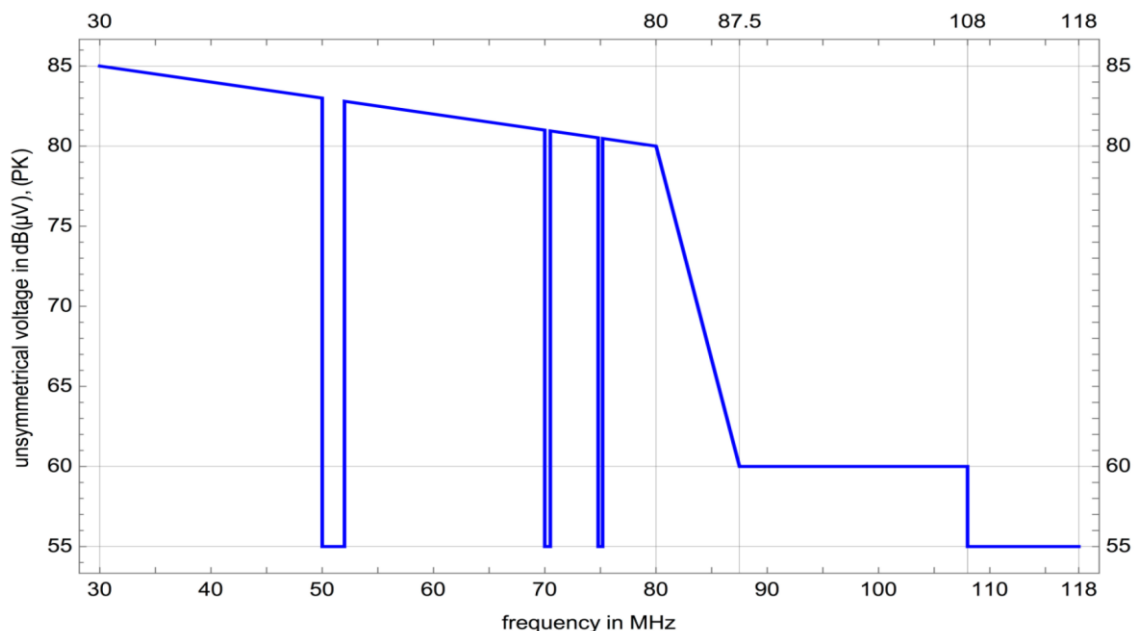
- EN 50561-4. Fourth part of EMC standard for PLC (scope is applicable to MIMO PLC equipment). The draft is currently under preparation and will cover MIMO PLC equipment using frequency band from 1.6 MHz to 87.5 MHz. The initial draft is based on the already published standards (EN 50561-1 and EN 50561-3) but may be subject to change after expert input.

➤ Additional Information

A PLC device placed on the market and/or put into service that is compliant with EN 50561-1 benefits from the “presumption of conformity” given by the listing of this standard in the Official Journal of the EU under the EMC Directive and hence can be considered to meet the essential requirement of this directive regarding electromagnetic emissions. Devices that are either outside the scope of EN 50561-1 or that do not fully comply with it will need to demonstrate compliance with the essential requirements of the EMC Directive using an appropriate conformity assessment procedure. The application of EN 50561-3, or another appropriate standard, could be used by the manufacturer as part of a technical assessment within a conformity assessment procedure.

A market surveillance campaign of PLC equipment by the [Administrative Cooperation Groups \(AdCos\)](#) is expected during 2018.

EN 50561-3: Maximum conducted unsymmetrical disturbance signal level (in dB μ V) for frequencies between 30 and 118 MHz (RBW = 120 kHz)



$$85 \text{ dB}\mu\text{V}_{(\text{PK})(\text{unsym})} \cong -81 \text{ dBm}/\text{Hz}_{(\text{RMS})(\text{sym})}^{(*)}$$

^(*)RMS to PK \cong 11 dB (Experimental value)

For G.hn devices that use frequencies below 30 MHz then the relevant immunity standard under the EMC Directive is EN 50412-2-1:2005 "Power line communication apparatus and systems used in low-voltage installations in the frequency range 1,6 MHz to 30 MHz - Part 2-1: Residential, commercial and industrial environment - Immunity requirements". For all other devices then either the Generic Standard EN 61000-6-1 or ITE standard EN 55024 (to be superseded by EN 55035) could be used for demonstrating compliance with the essential requirement related to immunity.

5 EU EMC Standards for Coax & Phone Line devices

Coaxial and Phone Line devices based on G.hn technology are generally classified as Information Technology devices and come within the scope of EN 55032 (CISPR 32) for emissions and EN 55024 (CISPR 24) for Immunity.

CISPR 32 applies to multimedia equipment (MME) (§ 3.1.23) defined as equipment that is information technology equipment (§ 3.1.20), audio equipment (§ 3.1.6), video equipment (§ 3.1.29), broadcast receiver equipment (§ 3.1.7), entertainment lighting control equipment (§ 3.1.15) or combinations of these and having a rated AC or DC supply voltage not exceeding 600 V. Equipment within the scope of CISPR 13 or CISPR 22 is within the scope of CISPR 32.

Under the EMC Directive EN 55032 superseded EN 55022 on 05 March 2017. CISPR 22 has been withdrawn internationally and replaced by CISPR 32.

CISPR 24 has now been replaced by CISPR 35 so at some point in the future EN 55024 will be superseded by EN 55035. EN 55035 has not yet been listed under the EMCD or RED but it is understood to have been approved for listing under both Directives.

6 References:

- [1] Electronic Code of Federal Regulations (e-CFR):
<https://www.ecfr.gov/cgi-bin/text-idx?SID=fbf2be14069aeb23b2638cecb3fa88b6&mc=true&node=pt47.1.15&rgn=div5>
- [2] EU EMC Directive 2014/30/EU
<http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32014L0030>
- [3] EU Radio Equipment Directive 2014/53/EU
<http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32014L0053>
- [4] Listing of harmonised standards for EU EMC Directive 2014/30/EU
https://ec.europa.eu/growth/single-market/european-standards/harmonised-standards/electromagnetic-compatibility_en