India Smart Grid Forum

ISGF White Paper

Need for Allocating a Frequency Band for Power Line Carrier Communications

Abstract

The objective of this Paper is to present a study of Power Line Communications (PLC) focussing on global standards and frequency band allocations. Some of the challenges pertaining to India in the adoption of PLC technology are also mentioned. This Paper will be sent to the Department of Telecommunications (DoT) which may consider the findings and recommendations mentioned in this report while allocating frequency bands for PLC.

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About India Smart Grid Forum

India Smart Grid Forum (ISGF) is a public private non-partisan initiative of the Ministry of Power (MoP), Government of India for accelerated development of smart grid technologies in the Indian power sector. ISGF was set up in 2010 to provide a mechanism through which academia, industry; utilities and other stakeholders could participate in the development of Indian smart grid systems and provide relevant inputs to the government's decision making.

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Abbreviations

DoT – Department of Telecommunications
ISGF – India Smart Grid Forum
PLC – Power Line Communications
TWACS – Two Way Advanced Communications System
IEEE – Institute of Electrical and Electronic Engineers
IEC – International Electrotechnical Commission
ITU – International Telecommunication Union
CENELEC - European Committee for Electrotechnical Standardization

1. Objective

The objective of this report is to present a study of Power Line Communications (PLC) focussing on global standards and frequency band allocations. Some of the challenges pertaining to India in the adoption of PLC technology are also mentioned. This report will be sent to the Department of Telecommunications (DoT) which may consider the findings and recommendations mentioned in this report while allocating frequency bands for PLC.

2. Power Line Communications

2.1 Indian scenario

PLC technology is at a nascent stage in India. It can be used for providing last mile connectivity as well as for creating a wide area network. A key requirement of this technology is the existence of a clean network of cables for carrying information. Issues such as noise generated by different loads on the power line, dynamic changes in the line impedance and absence of trained man-power capable of bespoke engineering are some of the issues that will need to be addressed in order to make this technology ready to use.

In addition to the above mentioned, there is no frequency band allocated for PLC communications in India.

2.2 Global Scenario

2.2.1 Narrowband PLC

Globally, IEEE 1901.2[1], PRIME, G3-PLC, ITU-T G.hnem[2], IEC 61334, TWACS, Meters&More and HomePlug C&C are some of the popular standards/protocols available for implementing **Narrowband PLC** systems.

The following table throws more light into the technical details:

Standard/Protocol	Frequency band	Maximum data rate
IEEE 1901.2 - 2013	<500 KHz	500 Kbps
PRIME	42-89 KHz	128.6 Kbps
G3-PLC	35-91 KHz	33.4 Kbps
ITU-T G.hnem	10-490 KHz	1 Mbps
IEC 61334	60-76 KHz	Upto 2.4 Kbps
TWACS	200-600 Hz	100 bps
Meters&More	3-148.5 KHz	28.8 Kbps (nominal) and 4.8 Kbps (effective)
HomePlug C&C	10-450 KHz	7.5 Kbps

[1] http://standards.ieee.org/findstds/standard/1901.2-2013.html

[2] Developed by ITU-T: http://ieeexplore.ieee.org/xpl/login.jsp?tp=&arnumber=6094004&url=http%3A%2F%2Fieeexplore.ieee.org%2Fxpls%2Fabs_all.jsp%3Farnumber%3D6094004

2.2.2 Broadband PLC

Globally, IEEE 1901-2010, HomePlug Green PHY and ITU-T G.hn (G.9960/G.9961) are some of the popular standards/protocols for implementing **Broadband PLC** systems.

The following table throws more light into the technical details:

Standard/Protocol	Frequency band	Maximum data rate
IEEE 1901-2010	< 100 MHz	> 100 Mbps
HomePlug Green PHY	2-30 MHz	10 Mbps
ITU-T G.hn (G.9960/G.9961)	25-200 MHz	2 Gbps

2.2.3 Frequency band allocation

Europe, USA, Japan and China are some examples of regions where frequency bands have been allocated for PLC communications. The following table mentions the regions and frequency bands allocated for PLC:

Region	Frequency band for PLC
Europe	CENELEC A: 3-95 KHz for power utilities CENELEC B: 95-125 KHz for any application CENELEC C: 125-140 KHz for in-home networking with mandatory CSMA/CA protocol CENELEC D: 140-148.5 KHz Alarm and Security systems
USA	10-490 KHz, and 2-30 MHz
Japan	10-450 KHz
China	3-500 KHz

3. Recommendations by ISGF

There is an urgent need to allocate frequency bands for both, narrowband and broadband PLC communications. The above mentioned frequency bands and standards need to be studied while allocating frequency band/bands for PLC in India. ISGF recommends the following:

1. DoT may constitute a coordination centre/wing for frequency spectrum management and planning related to **wired media** of telecommunications.

2. DoT may proceed in the direction that CENELEC has taken by allotting different frequency bands for different domains such as Power Utilities, In-Home networking, Alarms and Security systems etc. The width and other technical specifications of the bands may be different from that allocated by CENELEC, and may be decided by DoT.

Notes:

CENELEC[3] stands for 'European Committee for Electrotechnical Standardization' and is responsible for standardization in the Electrotechnical Engineering field in Europe. It works closely with International Electrotechnical Commission (IEC), a global standard-publishing body for all electrical, electronic and related technologies. CENELEC and IEC signed the [4]Dresden Agreement in 1996, for avoiding duplication of effort and reducing time when preparing standards. As a result, new standards projects are now jointly planned between CENELEC and IEC.

[3] http://www.cenelec.eu/aboutcenelec/whoweare/index.html

[4] http://www.cenelec.eu/aboutcenelec/whoweare/globalpartners/iec.html