

Amateur Radio PLC Interference Studies:

ARRL DARC JARL RSGB VERON OTHER

PLC Measurements and Studies in the US (ARRL)

ARRL Home Page: Internet: <http://www.arrl.org>

ARRL EMC Committee page: Internet: <http://www.arrl.org/tis/info/rfigen.html>

Calculated Impact of PLC on Stations Operating in the Amateur Radio Service

Internet: <http://www.arrl.org/tis/info/HTML/plc/files/C63NovPLC.pdf>

Summary: This is presentation that Ed Hare, W1RFI, ARRL Laboratory Manager, gave at the November 2002 meeting of the IEEE C63 EMC standards committee. It contains a tutorial on PLC, calculations on the interference potential from access PLC and a summary of what ARRL believes is necessary to prevent interference from carrier-current devices. ARRL's calculations estimate that the ambient noise level near PLC systems could increase as much as 70 dB.

Author: ARRL, Ed Hare, W1RFI@arrl.org

HomePlug and ARRL Joint Test Report

Internet: http://www.arrl.org/tis/info/HTML/plc/files/HomePlug_ARRL_Dec_2000.pdf

Summary: HomePlug (Internet: <http://www.homeplug.org/>) is an industry of manufacturers of in-building PLC systems designed to network computers within a building. This describes the testing that ARRL did in late 2000 with HomePlug to help establish the spectral masks (notches) that HomePlug included in its product specification to help protect Amateur Radio from harmful interference.

Author: ARRL, Ed Hare, W1RFI@arrl.org

PLC measurements in Japan: (Japan Amateur Radio League, JARL)

JARL home page: Internet: <http://www.jarl.or.jp/>

JH5ESM, a member of JARL Technical Board on EMC: Internet:

<http://www.qsl.net/jh5esm/>

JARL PLC Information Page (Japanese): Internet:

http://www.jarl.or.jp/Japanese/2_Joho/2-7_plc/powerline.htm

Official press release on PLC issue in Japan, from Ministry of Public Management, Home Affairs, Posts and Telecommunications (English)

Internet:

http://www.soumu.go.jp/joho_tsusin/eng/Releases/Telecommunications/news020809_3.html

Summary: English summary of statement from the Japanese Ministry of Public Management, Home Affairs, Posts and Telecommunications. Japanese original text is available from the Internet URL above.

Author: MPHPT

Japan's Government Concluded That It is not suitable to allow HF band for PLC (English)

Internet: http://www.jarl.or.jp/English/4_Library/A-4-1_News/jn0208.htm

Summary: On April 30, 2002, the Ministry's study group on PLC held its first public hearing with JARL, Association of Radio Industries and Business, and others. At the meeting, the results of collaborated field tests, which were held in January, 2002, were reported. The tests included monitoring leakage of electric waves from power lines -- specifically in cases of providing Internet access via power lines to homes. In this way, JARL actively cooperated with the group. As a result, MPHPT's study group officially announced in its fifth meeting on July 31 that it is too early to allow PLC between 2 MHz and 30 MHz due to hazardous effects on HF users. This news was reported by major newspapers

including Yomiuri, Asahi and Mainichi, as well as the major financial daily, Nihon Keizai Shimbun.

Author: JARL

Campaign Against Power Line Communications Operating in the HF Bands (English)

Internet: <http://www.qsl.net/jh5esm/PLC/JARLcampaignPLCe.pdf>

Summary: This paper gives a tutorial of PLC and presents summaries of the interference level from measurements made of several access PLC field tests in Japan. Japan has chosen not to allow access PLC at this time.

Author: JARL, Cosy MUTO, JH5ESM

Campaign Against Power Line Communications Operating in the HF Bands (Japanese)

Internet: <http://www.qsl.net/jh5esm/PLC/JARLcampaignPLCj.pdf>

Summary: This paper gives a tutorial of PLC and presents summaries of the interference level from measurements made of several access PLC field tests in Japan. Japan has chosen not to allow access PLC at this time.

Author: JARL, Cosy MUTO, JH5ESM

7th International Symposium on Power Line Communications and Its Applications (ISPLC2003) (English)

Internet: <http://www.darc.de/referate/evm/plc/isplc2003.html>

Summary: This is a short summary of the symposium written by Cosy MUTO, JH5ESM.

Author: JARL, Cosy MUTO, JH5ESM

On Radio Interference Assessments of Access PLC System

Internet: <http://www.qsl.net/jh5esm/PLC/isplc2003/isplc2003a2-3.pdf>

Summary: Access PLC system is considered one of the "last mile" solutions.

However, HF PLCs using overhead distribution would be an interference source to radio communications services and scientific observations in this band. This paper describes assessment test results in Japan. One of them is carried out as a part of government's investigation. Bad LCL characteristics of mains results large amount of radio interference, and thus the deregulation in Japan is shelved.

Authors: Cosy MUTO, Norikazu MORI and Toshiyuki KONDOH

Note: Presented at the ISPLC2003 Symposium.

On Radio Interference Assessments of Access PLC System -- Presentation Material

Internet: <http://www.qsl.net/jh5esm/PLC/isplc2003/isplc2003a2-3presentation.pdf>

Summary: This file is the presentation material from the above paper.

Authors: Cosy MUTO, Norikazu MORI and Toshiyuki KONDOH

The following 2 papers were also presented at the ISPLC2003 Symposium:

Interference measurements in HF and UHF bands caused by extension of power line communication bandwidth for astronomical purpose

Internet: <http://www.qsl.net/jh5esm/PLC/isplc2003/isplc2003a7-1.pdf>

Summary: Power line communication (PLC) system which extends the available frequency bandwidth up to 30 MHz has been proposed in Japan. The electromagnetic interference problems on PLC had been investigated by the PLC study group organized by the Ministry of Public Management Home Affairs, Post and Telecommunications (MPHPT). The study group held collaborated field experiments of the PLC facility and we measured interferences caused by the PLC facility in the HF and UHF bands in order to evaluate the influences of the expansion of PLC bandwidth on radio astronomical observations. In the field experiment, two sets of PLC modems (SS and OFDM) were tested as an access system. During the PLC

modems were on, the HF spectra observed showed strong increase of the noise-floor level, and it was found that the PLC noise exceeded the level of galactic noise by more than 30 dB. In UHF band, spurious emission around 327 MHz was identified. In both HF and UHF band, the interferences exceeded the limit of harmful interference level for radiop astronomical observation which is given in Recommendation ITU-R TA769-1. Safety distances where the Recommendation was satisfied are estimated to be 219 km and 12 km at 9.2 MHz and 327 MHz, respectively. PLC seems to be a harmful interference source for the radio astronomical observation in both HF and UHF bands.

Authors: F.Tsuchiya, H.Misawa, T.Nakajo, I.Tomizawa, J.Nakajima, M.Ohishi, M.Tokumaru, T.Ono and A.Morioka

Sharing studies between the radio astronomy telescopes and the power line communication systems in the HF region

Internet: <http://www.qsl.net/jh5esm/PLC/isplc2003/isplc2003a7-4.pdf>

Summary: Radio Astronomy has frequency allocations in 13.36-13.41 MHz and 25.55-25.67 MHz on a primary basis worldwide. These bands are extensively used by radio astronomers to observe electromagnetic waves emitted by the Sun, the Jupiter and other large, gaseous planets in the solar system. The powers from a single PLC system in the above radio astronomy bands are --33 dBW and --29.2 dBW respectively and therefore the PLC systems seem to be a harmful interference source for the radio astronomical observation in the HF band. It is necessary to keep an adequate separation distance to avoid harmful interference to the radio astronomy telescope, and we calculated the separation distance based on the free-propagation method. We obtained a value of 424 km. If the PLC system is widely deployed, it is sure that the interference level increase greatly and the separation distance will become much larger. Thus it was recognized that it is quite difficult to share frequencies with the PLC systems and radio astronomy telescopes, at least, in Japan, and that a new technology to dramatically reduce leaked emissions from the power lines are crucial for the PLC systems to coexist with other radiocommunications services.

Authors: by M.Ohishi, J.Nakajima and M.Tokumaru

Other JARL PLC Web Pages (Japanese)

http://www.jarl.or.jp/Japanese/2_Joho/2-7_plc/powerline.htm

<http://www.geocities.co.jp/Technopolis-Mars/7270/index.html>

<http://www.watch.impress.co.jp/internet/www/article/2001/1219/jarl.htm>

<http://www.geocities.co.jp/Technopolis-Mars/7270/geobook.html>

<http://www.jarl.gr.jp/plc/report1/>

PLC Measurements in the Netherlands (Vereniging voor Experimenteel Radio Onderzoek in Nederland) (VERON)

VERON Home Page Internet: <http://www.veron.nl/main.htm>

The Radio Amateur and the Effects of the Use of the 230-Volt Power Line for Broadband Data Communications

Internet: http://www.darc.de/referate/emv/plc/VERON_PLC_Report.pdf

Summary: This 38-page technical paper starts with a PLC tutorial, then outlines the test methods and results of PLC testing by Dutch amateurs. At the turn of the year 2002 a series of measurements was conducted to evaluate the risks of interference by PLC for the amateur station PA0KDF. Both in-house and outside field strength measurements were taken and compared with the CEPT proposed radiation limits (NB 30, Norwegian Limit and BBC limit). In addition the coupling between the mains wiring and the antennas of the amateur station was determined. In an audio test, where use was made of amateur antennas and receiver, the level of interference in the HF amateur bands was evaluated. Only

in the case of the strictest limit, the BBC limit, adequate protection was provided against mains injected interference signals. In addition measurements were performed to find the "normal" interference levels on the mains wiring. Firstly it became apparent that the present interference levels in a quiet rural area are far below the CISPR 22 limits and secondly, injection of interference signals with a level equal to the CISPR 22 limit level causes harmful interference to the reception of signals in the amateur bands.

Author: Koos Fockens, PA0KDF

HF radio reception compatibility test of an in-house PLC system using two brands of modems.

Internet: <http://www.arrl.org/tis/info/HTML/plc/files/ModemRPRTVeron11-04-03.pdf>

Summary: Tests have been performed on the EMC of two types of in-house PLC modems, developed according to the HomePlug® standard, that recently appeared on the European market. Some measurements were done in a laboratory set-up (mains disturbance voltage, field strength, background noise), other were performed in the house of the author (interference on amateur radio receiving antenna, background signals and noise on mains). One type PLC modem seems just to meet the mains disturbance limit in EN55022 for residential environment, the second type showed a level which was approximately 20 dB higher. Under the condition that the in-house PLC modem complies with the current EN55022 B standard, and that the modem additionally uses notches for the bands of the amateur services according to the Homeplug® standard, the general conclusions drawn were: Only when a reasonable well constructed outdoor antenna is used the interference from the modems is probably not a threat to the radio amateur service; Outside the notches harmful interference may be caused to the broadcasting services; In the laboratory environment with many PCs running, as well as in the author's home environment, the background mains disturbance level was 30 or more dB's below the EN55022 B limit.

Author: VERON EMC Committee, Koos Fockens, PA0KDF

PLC Measurements in Great Britain (Radio Society of Great Britain) (RSGB)

RSGB Home Page - <http://www.rsgb.org/>

RSGB EMC Committee Page Internet: <http://www.rsgb.org/society/emcc.htm>

RSGB EMC Committee Information Pages Internet: http://www.qsl.net/rsgb_emc/

Notes on the Final Report of the RA's TWG on the Compatibility of DSL and PLT with Radio Services 1.6 to 30MHz Compiled by the RSGB for the benefit of Radio Amateurs

Internet: http://www.qsl.net/rsgb_emc/Notes%20on%20Fin%20Rpt%20Ver%201.pdf

Summary: This Radio Society of Great Britain summary of the work of the British government's Radio Communications Agency Technical Working Group on DSL and PLC the WG's position on PLC, the extent of the interference problems reported and expected with PLC and lists a number of papers that have been produced by companies and organizations that support this conclusion.

Author: RSGB

The DSL/PLC WG Final Report - UK Technical Working Group (TWG) on Compatibility Between Radio Services and VDSL + PLT Systems Operating between 1.6 and 30 MHz

Internet: <http://www.radio.gov.uk/topics/interference/documents/dslplt.htm>

Summary: This summary report of the British Radiocommunications Agency (RA) TWG concludes, "Field tests were undertaken by Agency officials to determine the possible levels of emissions from VDSL and PLT access systems respectively. The scope of this practical work was, by agreement, necessarily limited due to constraints on time and available facilities. It is accepted therefore that the significance of the results is correspondingly limited insofar as neither the

VDSL or PLT access test arrangement was truly representative of likely practical commercial deployments. Nevertheless, sufficient data was gathered which enabled TWG to conclude that there is a finite possibility of interference to radio systems when operated within a few metres of cables or wires associated with VDSL or PLT systems. The propagation characteristics of the HF bands are unique in that it is possible, under certain conditions, to provide extended communications over exceptionally long distances, several thousand kilometres being a reasonable expectation under ideal conditions. This means that the bands are particularly valuable for international broadcasting; military applications; long distance maritime and aeronautical communication & navigation, and as a challenging recreational pursuit for amateur radio enthusiasts looking to develop techniques to establish contact over increasingly long distances taking account of prevailing conditions. But such extended propagation is variable, depending very much on seasonal conditions and natural changes in the ionosphere. This means that planning HF systems requires quite different techniques and assumptions to those used in higher order bands, where the limit of expected service area can be predicted with a high level of confidence." This committee report does not represent the official position of the British government.

Author: UK Technical Working Group

RSGB EMC PLT Position Paper

Internet: http://www.qsl.net/rsgb_emc/emcplc.pdf

Summary: The Radio Society of Great Britain raises a very robust objection to the current commercial proposals for PLT in the High Frequency spectrum with the currently suggested radiation levels. The Society will take all measures open to it to oppose the introduction of such mains HF signalling. The Society supports the introduction of broadband technologies provided they do not exceed a level allowing radio and telecommunications apparatus to operate as intended. The Radio Society of Great Britain recommends that all proposals for standards that would allow PLT to operate in the High Frequency spectrum be firmly rejected unless the signal levels are within the existing standards for mains conducted emissions or unless a specific frequency allocation is made for PLT that is compatible with radio services in the HF band.

Author: RSGB

PLT Test Information Including Sound Bites

Internet: http://www.qsl.net/rsgb_emc/PLTREP.pdf

Summary: This report summarizes field tests of PLC made by the Radio Society of Great Britain. As already reported elsewhere, it is difficult or almost impossible to capture and present the emissions from new broadband-communication systems using spread-spectrum-technologies at low or unknown data-rates (stand-by) by simple use of a spectrum analyser. Nevertheless even at these very low data rates, the harmful effect of these emissions on radio systems all over the spectrum used for radio communication is at once evident, as soon as emissions exceed the conventional limits.

Author: RSGB

Notes on RSGB Observations of HF Ambient Noise Floor

Internet: http://www.qsl.net/rsgb_emc/RSGBMeasurements_1b.pdf

Summary: A summary of the RSGB HF ambient noise measurements.

Author: RSGB

Background Noise on HF Bands

Internet: http://www.qsl.net/rsgb_emc/emcslides.html

Summary: Slide presentation on PLC made at an RSGB Amateur Radio convention.

Author: RSGB, Robin Page-Jones (G3JWI)

Notes on the RSGB Investigation of PLT Systems in Crieff

Internet: http://www.qsl.net/rsgb_emc/CRIEFF%20Notes%20Version_1.html

Summary: A summary of the RSGB field measurements made of the Crieff field trials. The report noted interference, but felt that more study was needed to quantify it more precisely.

Author: RSGB, Robin Page-Jones (G3JWI)

PLT and the Future of the HF Spectrum - from RadCom Feb. 2003

Internet: http://www.qsl.net/rsgb_emc/RadCom02PLT.pdf

Summary: Op Ed

Author: RSGB

See also RSGB files in PLC Audio section of this page.

PLC Measurements in Germany (Deutscher Amateur-Radio-Club) (DARC)

DARC Home Page - <http://www.darc.de/>

DARC PLC Web Page - Internet: <http://www.darc.de/referate/emv/plc/>

DARC Press Release and Position Paper on PLC

Internet: <http://www.darc.de/referate/emv/plc/PLC-in-Germany-3-2001-Press-release.pdf>

Summary: PLC in Germany, update March, 2001.

Author: DARC

PLT - A Risky Undertaking

Internet: <http://www.darc.de/referate/emv/plc/PLT-Market-version.pdf>

Summary: This paper outlines some of the reasons that PLT may present problems, including EMC.

Author: Gaston Bertels, EUROCOM Chairman

PLC in Germany - Strategic Discussion Paper

Internet: <http://www.darc.de/referate/emv/plc/plt-strategic-paper-june%202001.pdf>

Summary: This paper gives the background for strategic activities with the purpose of achieving compatibility between the radio amateur service and networks communication (including power lines communication).

Author: DARC

PLC in Germany 1

Internet: <http://www.darc.de/referate/emv/plc/DARC-PLC-paper-1.pdf>

Summary: RTA and DARC e.V. present this document as a contribution to inform the amateur radio community on the issue of PLC and as discussion material to be used in public relations efforts. Latest developments are taken into account. The overall conclusion is that PLC is not recommended.

Author: The paper is a common effort of DF7VX, DJ6AN, DJ1ZB, Mrs Volmer, DL2CH, DJ8CY, DF5DP, DF4JI, DL9MH and DF9IC and of the member societies of the RTA. Translation by ON4WF.

PLC in Germany 2

Internet: <http://www.darc.de/referate/emv/plc/DARC-PLC-paper-2.pdf>

Summary: PLC and xDSL situation in Germany, March 2001.

Author: DARC Standards Group March 26, 2001 Hans-Joachim Brandt, DJ1ZB

PLC in Germany Report 11/2001

Internet: <http://www.darc.de/referate/emv/plc/DARC-PLC4xRPRT.pdf>

Summary:

Author: DARC

PLC and xDSL Situation in Germany (with a look over the border)
Internet: <http://www.darc.de/referate/emv/plc/c3.4-rev1-PLC5RPRT.pdf>
Summary: PLC and xDSL situation in Germany, June 2002.
Author: DARC

PLC - DARC HQ Info (in German)
Internet: <http://www.darc.de/referate/emv/plc/darc-plcinfo.pdf>
Summary: A six-page DARC overview of PLC, including some technical data and info about NB-30, the European version of FCC Part 15. PLC has the potential to impact HF, including HF broadcasting and amateur. This file contains a summary of what DARC has been doing to combat PLC; and provides a list of articles in CQ DL on the topic.
Author: DARC

PR Information on SE 35 (in German)
Internet: <http://www.darc.de/referate/emv/plc/pubrel2.html>
Summary: IARU-EUROCOM and DARC Take Position on HF Limits on PLC Radiation
Author: DARC
See also DARC files in PLC Audio section.

PLC in Other Countries

PLC in Finland
Internet: <http://www.darc.de/referate/emv/plc/plc-oh.pdf>
Summary: PLC for the present rejected by Finnish Telecommunication Minister. In the Finnish Amateur Radio League's monthly magazine "Radioamatööri" 06/2001 on pages 12 to 17, there is an article about a session held on PLC in the Finnish Telecommunication Administration Center (Telehallintokeskus, THK) on May 16 th , 2001. The Finnish Minister of Transport and Telecommunication, Mr. Olli-Pekka Heinonen, had answered to the question of a Member of Parliament regarding the introduction of PLC in Finland: For the present, because of the technical problems encountered, introduction of PLC technology is not possible.
Author:

PLC in Norway (German only)
Internet: <http://www.darc.de/referate/emv/plc/PLT-in-Norwegen.pdf>
Summary: The Power Grid as Telecommunications Grid -- Investigation by Telecommunications Authorities Concerning the Prevention of Radiocommunication Interference to Electronic Equipment
Author:

PLC in Poland
Internet: <http://www.darc.de/referate/emv/plc/plc-in-poland.html>
Summary: Translation of newspaper article.
Author: Daily Warsaw Newspaper "SUPER-EXPRESS" - 12.11.2001

PLC -- European General Information
PLC Amendment - Proposal to the European Commission
Internet: <http://www.darc.de/referate/emv/plc/eu-amendment-plc.pdf>

PLC Action - IARU Region 1
Internet: <http://www.darc.de/referate/emv/plc/PLC-WGs-1.pdf>

PLC EU - AMENDMENTS 21-85 (draft)

Internet: <http://www.darc.de/referate/emv/plc/454136PA.pdf>

Status on EMC requirements for PLC equipment and networks 20-6-02

Internet: http://www.darc.de/referate/emv/plc/status-plc_iaru-r1.pdf

PLT Symposium Friedrichshafen 2002

Internet: <http://www.darc.de/referate/emv/plc/plt-symposium.pdf>

Summary: MINUTES OF THE PLT SYMPOSIUM. Held on Saturday 29 th June 2002 at the Friedrichshafen, Hamradio 2002.

Authors: Chairman: Karl Vogel, DK9HU. DARC, Secretary: Peter Kirby, G0TWW. RSGB