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Comment on PLC, also called PLT or PLC

(Data communication via existing power lines or mains wiring)

to European Commission, Enterprise Directorate, Thierry Brefort, Brussels,
before 1.st October 2003

This document is submitted on behalf of Hf-spectrum users, radio amateurs world wide, especially representing 6000 radio amateurs in Austria. It is intended to answer several questions of EU on broad band power line PLC. Since PLC is using a frequency range of 2-80 Mhz (short wave) all global communication in this frequency spectrum is affected, even communication abroad. Powerline technology rises questions about EMC and the problem of “radio reception not working as intended”.

Introduction

PLC will **not** solve the growing need for broadband access, because it will need a high speed backbone net. Often DSL is used to bring the service to the pole. In rural and remote areas PLC will never be deployed due to commercial restrictions, however a 230Volt power line is installed. PLC uses the misinterpretation that PLC will provide service everywhere you have power lines. Wireless technology (WiFi) offers a lot more potential to cover rural areas.

Experience

The author has many years experience as engineer in telecommunications and electronics and as CEO of Austrian branch office of a well known multinational U.S. company. Detailed studies have been conducted by Mike Zwingl, president of Austrian Amateur Radio Society, at 4 different large scale field trials in Austria. Studies have been made in theory and practice, also covering “INHOUSE-PLC”, and have been documented by means of digital video.

Topics and Questions answered

This document will answer and comment questions about compliance, measurements and level of harmful interference caused by PLC.

Compliance (CE Mark)

First we have to ask the question: What is the purpose of EMC compliance procedures?

The procedure should ensure that no technical apparatus enters the market, that could cause or will cause interference to radio spectrum users or other electrical systems. In case of PLC units it is almost certain, that it will cause harmful interference to licensed radio services, as long as PLC modem is being used as intended and radio users are living nearby in a distance closer than two miles. If EU leaves the procedure to demonstrate compliance to the

manufacturer, and measurement methods recommended have a huge level of uncertainty due to near field measurements made in different distances, it makes the entire procedure obsolete. No product should be allowed in the market, that could not easily demonstrate an operation without causing radiation. Therefore experts know, that leaving it to network operators to demonstrate the compliance of the entire network, but not showing compliance of the individual modem (apparatus), will not at all ensure radio services to operate as intended (ITU-R recommendations !) The new proposal for a revised EMC directive in Europe represents an open backdoor to all spectrum polluters, not just PLC.

Results of European field trials:

Out of 4 trials in different cities across the country in Austria (no test took place in rural areas, where DSL is not available!) only one is still available. Most trials in Germany & Netherlands were also terminated meanwhile, due to technical, legal and commercial problems.

The trial in NEUNKIRCHEN, Austria was stopped because of problems with ASCOM's CE-mark compliance. Two more ASCOM trials in Austria are being on hold, due to financial uncertainties with Modem supplier and one trial site in LINZ is still commercially active.

All 4 trials (starting 2001) generated more than 80 (!) complaints of radio users and amateurs for harmful interference. Even national disaster relief stations (Red Cross) experienced harmful interference by MainNet PLC systems in Linz, making their participation in a nationwide exercise on 1.May 2003 impossible. The Ministry of Technology (BMVIT) asked for immediate correction of these cases, but utility companies deny to solve the EMC-problems due to uncertain legal situation.

See picture below for PLC trial locations in Austria:



Measurements:

Some measurements have been made in Austria and surprisingly most of the results are confidential. The official figures 1-2 have been made in the city Innsbruck in western part of Austria. All official measurements and written statements from the Ministry (BMVIT) show strong levels of interference and often the radiated PLC signals are much stronger than all radio signals. (see attachments)

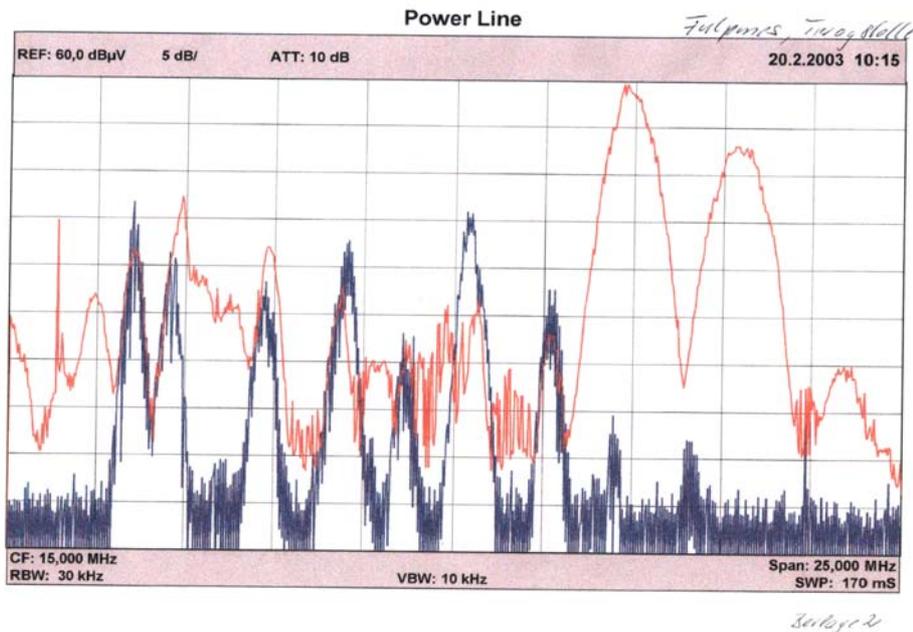


Figure 1: red line shows PLC field strength

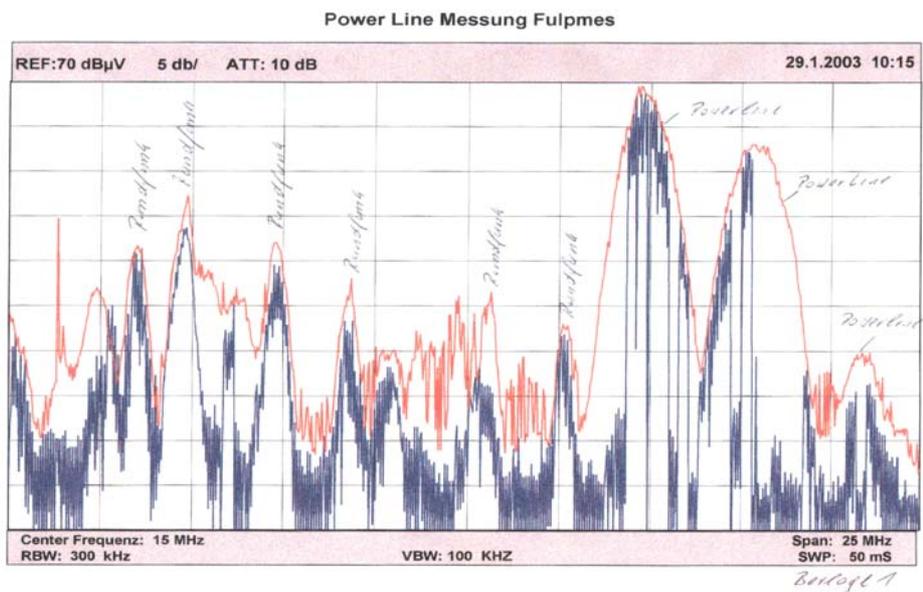


Figure 2: red line shows PLC radiation higher than radio signals



Figure 3:
Bandwidth used by one discrete PLC carrier

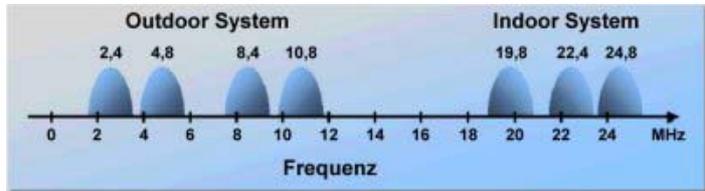


Figure 4:
Frequencies used by ASCOM PLC transmitters

All figures above show the effect of ASCOM PLC systems

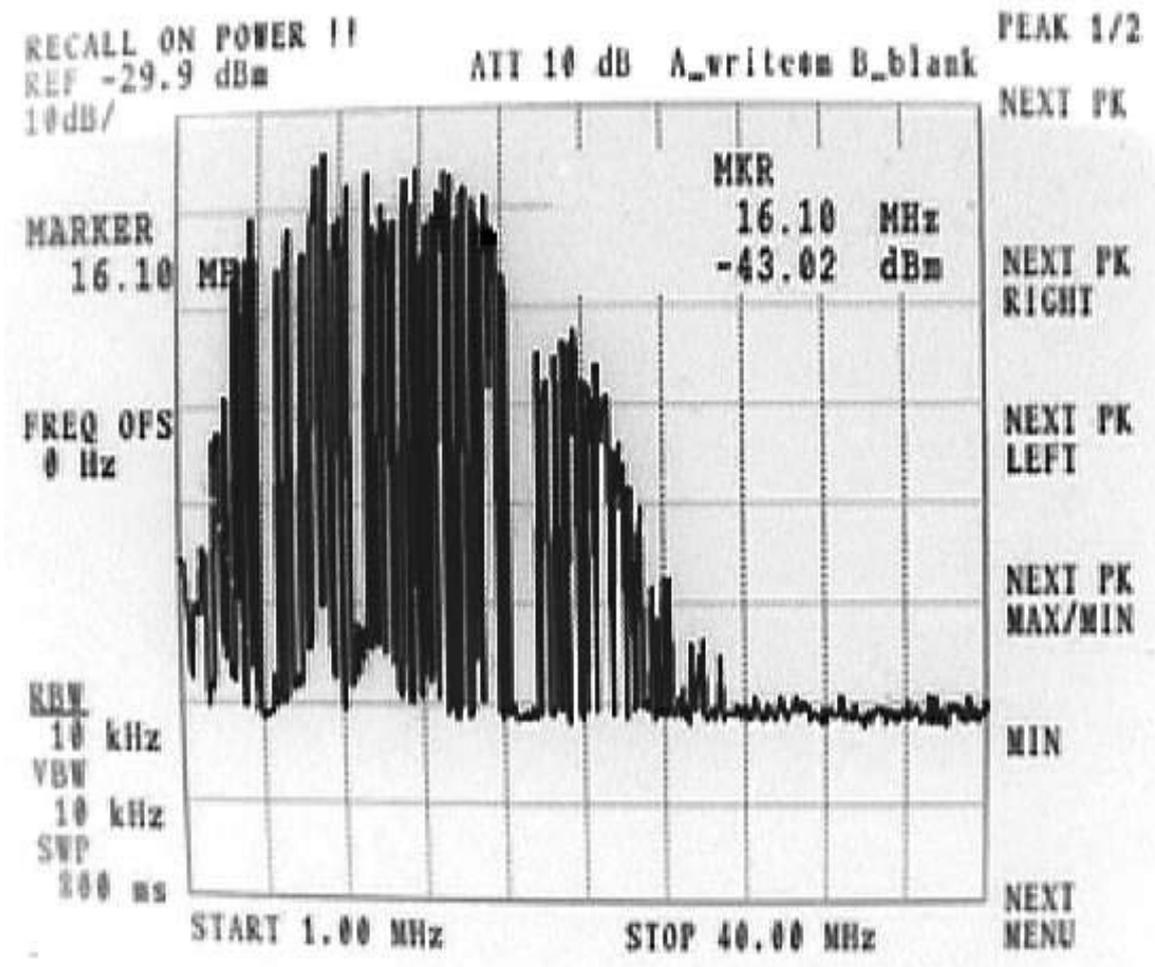


Figure 5: Spectrum used by M@inNet PLC system-
spread spectrum DSS frequency hopping between 2-26Mhz plus harmonics

Planning parameters for short wave broadcasting and Amateur Radio Service:

Planning parameters for short wave broadcasting service are described in ITU-R recommendations (40dbyV/m minus 34db S/N) and show, that after the deployment of PLC all transmitters would need an increase of +30db (1000 times more) in power. Since broadcasting transmitters today use already up to 500kW, a further increase can be considered impossible. Therefore the Signal to Noise ratio will be insufficient for analogue and digital (DRM) radio broadcasting. (for details see study of radio Netherlands, BBC Research and ARRL)

Video/Audio files

Several detailed video files are available at <http://www.powerline-plc.info/video/> to show the level of interference caused by PLC systems in real world. (see also ARRL, BBC) The systems operated in these field trials claim to operate within the EMC limits of EN55022A, and still the level of **harmful interference is huge**.

White Papers of BBC Research

The effect of PLC on reception of radio and the increase of noise floor worldwide due to cumulative effects of PLC are described in White papers from BBC research. Also the effect on aeronautical communications with airplanes is alarming.

See reference:

- <http://www.bbc.co.uk/rd/pubs/whp/whp067.html> Trial in Crieff U.K. +audio samples
- <http://www.bbc.co.uk/rd/pubs/whp/whp004.html> Cumulative effects
- <http://www.bbc.co.uk/rd/pubs/whp/whp063.html> Protect Radio Service
- <http://www.bbc.co.uk/rd/pubs/whp/whp055.html> Do EMC limits protect broadcasting?
- <http://www.bbc.co.uk/rd/pubs/whp/whp013.html> Emission limits and noise floor
- <http://www.bbc.co.uk/rd/pubs/whp/whp012.html> AM broadcasting and PLT/xDSL

Interference from Inhouse PLC

Inhouse PLT raises the same issues as access PLC, but currently some systems (Intellon) use notches in the spectrum to protect amateur radio service. This is a great improvement and shows the way into the right direction to prevent most likely interference, but in general the physics are not different for INHOUSE PLT. All frequencies used between 4,3 and 21 Mhz are suffering harmful interference, depending on the proximity and LCL factor of the cabling. Inhouse PLT is also operating in a totally uncontrolled environment, so network parameters will change all the time.

See Intellon chipset spectrum with notches below:



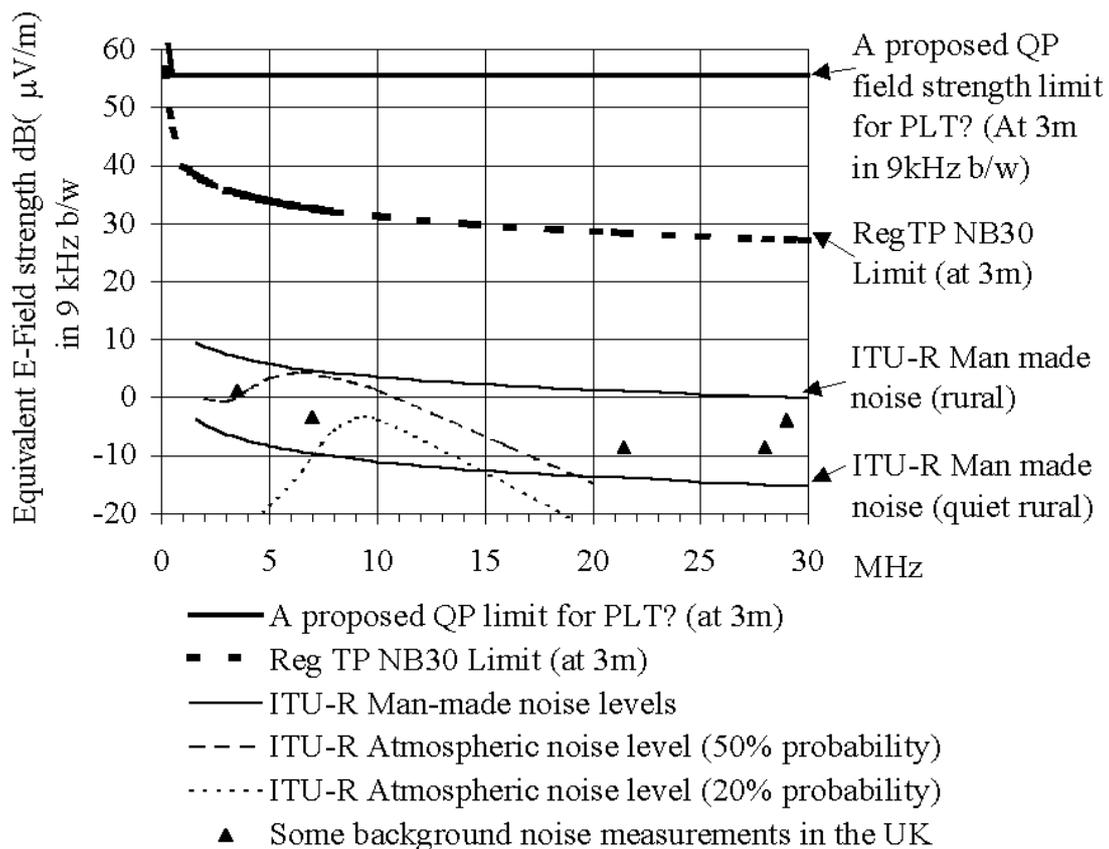
Figure 2. Test Signal PSD Mask

ITU radio regulations

Since short wave spectrum is so valuable to the world, it should not be regulated by national authorities. Therefore ITU was founded and even countries like Iraq, Afghanistan, Cuba, etc are obeying the ITU regulations. It could be considered fatal for the civilized world, if USA and Europe are now starting to neglect these international contracts.

By these important contracts all national authorities are responsible for taking necessary steps to prevent harmful interference to allocated radio services and to prevent pollution of the spectrum. Even now the current EMC directive and EN55022 is only a compromise and does not fully achieve these goals. An even more relaxed EMC limit is unacceptable under terms and conditions of ITU regulations in order to ensure radio reception to work as intended.

Field tests and studies have demonstrated that NB30 levels will not allow radio to operate as intended, but cause harmful interference.



Recommendation

Since all studies clearly show that a coexistence of PLC and radio service is not possible, EU should seek for frequency allocations for PLC according to ITU rules. This is the only correct procedure for introduction of an “so important service” as “broadband to the home”. PLC should be considered another “wireless” radio data service, because judged by physics, this is what it represents most! There is not a single trial or relevant study in Europe or U.S., that does not indicate cases of interference of PLC to licensed radio spectrum users. All other statements are just political statements or “wishful thinking”. To establish NOTCHES for all AMATEUR frequencies could resolve a great deal of possible cases of interference, because this group of HF users is operating in close proximity to power lines and usually at the natural noise level. However, broadcasting and other HF users will still be badly affected.

Conclusion

PLC or PLT or BPL is an interesting but old idea that in history already suffered from problems with radiation and interference. Since technology has evolved some needs for future broadband communications can be seen, but given the existing wiring structure physics does not allow PLC to use the same frequency range as existing radio services. Therefore rigid coordination of allocated frequency range and power is important. PLC will not solve the existing problems of offering broadband data services in remote areas. The dream of having a DSL like service on all power lines is simply commercially not feasible. Utility companies will offer these services only in densely populated communities in order to make profit and offer shareholder value.

The Austrian Amateur Radio Society therefore strongly recommends to the EU and national authorities to **NOT RELAX the LIMITS** for EU EMC Directive in general or for PLC in specific.

Otherwise EU will sacrifice the entire HF spectrum for a very questionable short term effect, that cannot be reversed in future.

For additional information see following **attachments**:

1. Digital video file (3MB) demonstrating the high level of interference to all HF users
2. List of incorrect statements from PLC proponents
3. Study of ARRL and Radio Netherlands on reduced coverage
4. Studies of BBC Research on cumulative effect, protection of radio service
5. Study of BBC research on PLT trial in Crieff, U.K.
6. Official measurement protocols of Austrian authorities following complaints about [M@inNet](#) and ASCOM PLC systems
7. Measurements on Inhouse PLC modems carrying CE mark, but exceeding EN55022B

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<i>False Argument</i>	<i>Correct Answer</i>
PLC operates alongside mains wiring	PLC is more acting as a wireless transmitter, using the mains wiring as ANTENNAS
PLC will bring cheap broadband to European population	PLC will need high level of investments and only be commercially available in urban areas with high number of customers. This is because a repeater can only cover 200 m distance.
PLC will create new competition in telecom market	PLC will create a new monopoly. Utility companies already have a huge regional power and dominate already all vital communal activities. For citizens there is no choice and no escape. (Water, electricity, gas, public transportation, cable television, garbage removal, etc.. see www.linzag.at or www.rwe.de)
PLC offers service on all wall outlets	Much higher speed, flexibility and mobility is offered by WiFi systems (wireless 2,4 and 5 GHz). Ingress noise blocks PLC signals on many wall outlets.
EMC directive protects radio services	“Certified Body” option is used as backdoor to bypass all harmonised standards (CE-0682)
PLC already has 50.000 happy users	Numbers often represent number of potential customers, living in areas supplied by same electricity network, but not internet data service users. Often all these houses are polluted by PLC- “Electro Smog”.
PLC offers broadband 10 MBit/sec data rate	Since it is a shared medium that divides data rate by number of users, PLC has only limited potential to cover future broadband needs. It will need additional frequency bands or filtering to increase speed and number of users.
PLC more important than old fashioned Radio on short-wave	Short-wave frequencies are a natural resource of highest value to worldwide communication. Low power, mobile transmitters allow information to travel huge distances without the means of satellites. On contrary studies (i.e. Sweden) show, that private use of broad band access is 90% dominated by patent infringements (music, games and video) and sex+porn downloads. Furthermore PLC will stop the rollout of “fibre to the home” in Europe, which will leave Europe behind in future infrastructure demand.
Amateur Radio is just a hobby	Amateurs have been mainly involved in inventing and optimising current wireless technologies and still contribute to it today. Amateur Radio service represents great social value in education, disaster relief and space operations. Amateurs have launched and built 50 satellites and will even launch a communication transponder to Mars in 2004. You will find average engineers but also kings, astronauts, politicians, CEOs and celebrities among this group of HF radio enthusiasts. (His Excellency King of Spain, Thailand, Jordan..)

Attachment 2 : statements