

## PROFESSOR M. IANOZ 2006 ACTIVITIES RELATED TO PLC

### 1. Organization of a PLC session at the 18<sup>th</sup> Wroclaw International EMC Symposium, June 28 – 30, 2006, publication and presentation of a paper

As agreed with the PLC Forum Board, I have organized a session on PLC at the 18<sup>th</sup> International Wroclaw Symposium on EMC, June 28 – 30, 2006.

The session was scheduled on Thursday 29 June and 3 papers were presented.

1. C. M. Verholt, Danish Standards, Denmark, “open questions in relation to Power Line Communications and EMC”.
2. M. Ianoz, Swiss Federal Institute of Technology and M. Koch, Power Plus Communications, “Standardization and Regulatory Approaches Related to Radiated Emission Limits for Power Line Communications”.
3. M. Rubinstein, P. Favre, M. Schneider, University of Applied Sciences, Yverdon, Switzerland, A. Vukicevic, F. Rachidi, Swiss Federal Institute of Technology Lausanne, J-L. Bemudez, ABB Sécheron, Geneva, “Some Unresolved Issues Concerning EMC in Power Line Communications”.

The paper of Mr. Verholt discusses the fact that in spite of a considerable work in different standardization organizations, for already 5 years, specific standards pertaining to PLC could not yet be developed. He had analyzed the causes and highlighted the difficulties which appeared. An example is the definition of safety frequencies to be protected from any possible harmful interference, which is not the same in all the countries. He stressed the point that more laboratory work has to be performed in order to clarify different unsolved questions concerning EMC and PLC.

The paper of Ianoz&Koch presented the state of art in the standardization work and the main regulatory documents issued by the FCC in USA and by the European Commission.

Finally, the last paper of the session was the result of a work in collaboration between the Federal Institute of Technology of Lausanne and the University of Applied Sciences of Yverdon, both participating in the OPERA project. The paper addressed a few PLC technology problems whose solution is still unresolved. Regarding emissions, the need to improve our understanding of the factors influencing the *k-factor* and the conversion between the differential and the common mode were discussed. The challenges to be met by new and existing radiation mitigation techniques were presented. The requirements of PLC channel models and simulators beyond those already available were discussed. The Paper also stressed the need for field to transmission line coupling models adapted to the complex non-uniformities of the PLC channel.

Controversial discussions followed the presentations. The main skeptical attitude towards PLC came from Prof. Gonchorek from the Dresden University, but in their answers, Dr. Rubinstein and Prof. Ianoz stressed that different not yet used mitigation possibilities exist to decrease the interference due to PLC.

The session was well attended by about 50 participants.

Prof. Gonchorek chaired second session on PLC. In this session the paper of Dr. R. Vick entitled “Radiated Emission caused by Power Line Communication Systems” presented field measurements showing a higher level than the NB30 limit. An interesting discussion was presented by Prof. H. Hirsch, from the University of Duisburg in his paper “Power Line Communication – Just another Communication Technology or an

Electromagnetic Disaster". In his conclusion he wrote : " If other communication technology exploits the limits given in CISPR22 for the TC port, the interference potential will be the same as for PLC. In this context it can be concluded that PLC is just another communication technology. Discussion about the interference potential which are now raised with regard to PLC, will in future focus also on other wired broadband technology."

Unfortunately the timing of this session was not well respected, and as a result there was no time for discussions which could have been fruitful and interesting.

## **2. Presentation of the Standardization and Regulatory situation in Europe and USA at the "Asia Pacific Conference on Environmental Electromagnetics".**

In a common paper with Chinese colleagues from the North China Electric Power University, Prof. Ianoz presented at this conference the present situation in the field of standardization pertaining to PLC and the regulatory position adopted by the European Commission and by FCC in USA.

During the discussion following the presentation of the paper, Prof. Trzaska from Poland, a well-known radio amateur, mentioned the possibility of interferences due to PLC and expressed the opinion that symmetrical communication lines, or fiber optic networks are enough developed; therefore, a new technology, which was a potential source of interferences was not needed. In his answer, Prof. Ianoz underlined the interest which PLC may present for large countries, not yet covered by such networks, but where the electrical low voltage distribution network is present in each house. He gave as example China, where the symposium was taken place, but also India or Brazil, where he mentioned the GESAC project, presented at the World Summit in Brussels, December 2005.

Other Chinese colleagues asked more details about the standardization and regulatory aspects presented in the paper.

## **3. PLC developments in China**

In the same session, Dr. Zhang and Prof. Cui from the North China Electric Power University presented measurement results obtained in their laboratory (paper "PLC Studies in China as a Contribution to the Development of International Standards", by W. Zhang, Z. Yuan, X. Cui, M. Ianoz, S. Qi, X. Li).

It must be remembered (see also Prof. Ianoz presentation about "PLC activities in China" at the PLC Forum, Brussels, 15-16 September 2005), that the Telecommunication Centre of the China National Grid has given to the EMC Laboratory of the North China Electric Power University the mandate to develop :

- a measurement method for the field;
- a standard which should be used in the future as a basis for the regulation of the PLC deployment.

Therefore, during 2005 and the first half of 2006, experimental work has been initiated in this Laboratory. In order to simulate the PLC operation environment, an experimental network was set up. Its structure is presented in Fig. 1.

A PLC router and PLC modems composed of the LAN at nominal rates of 14Mbps, 45Mbps and 200Mbps to simulate the PLC internet access have been used. The field was measured with a loop antenna which gives the magnetic field value. The conversion to electric field was performed by multiplying the measured values by the vacuum impedance (377 ohms).

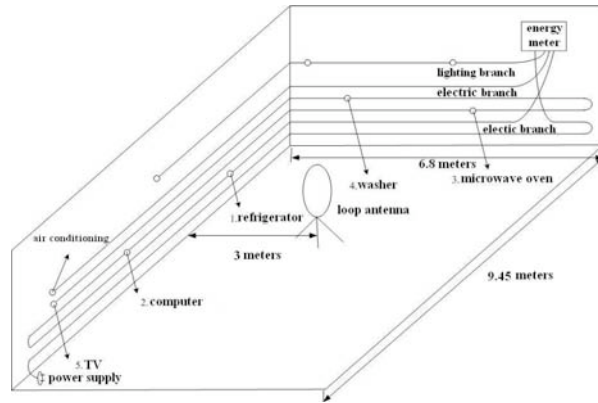


Fig.1 – The North China Electric Power University experimental set up

An example of the radiated electric field measured in the room together with a comparison with 3 limits is presented in Fig.2.

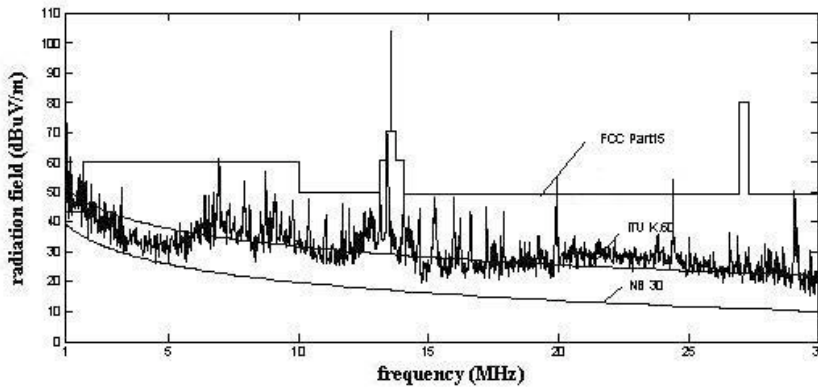


Fig.2 - Measured radiated field of a 14Mbps network compared with three limits

It can be seen that the radiated measured field level is higher than the NB30 limit, superposes to the ITU K60 limit and is low, except one or two peaks than the FCC Part 15 limit. At a higher transmission rate, the field level is higher, but remains acceptable with respect to the FCC Part 15 limit (fig. 3).

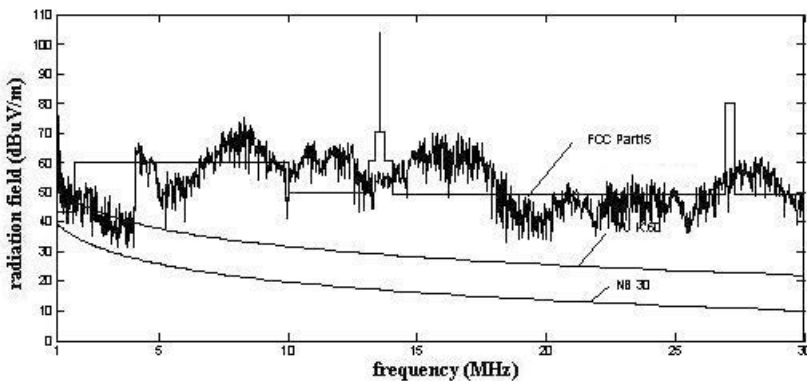


Fig.3 - Radiation field of 200Mbps network compared with three limits

It is interesting to note that another measurement result shows that in standby, the PLC modem radiation compares with the background field level (fig. 4).

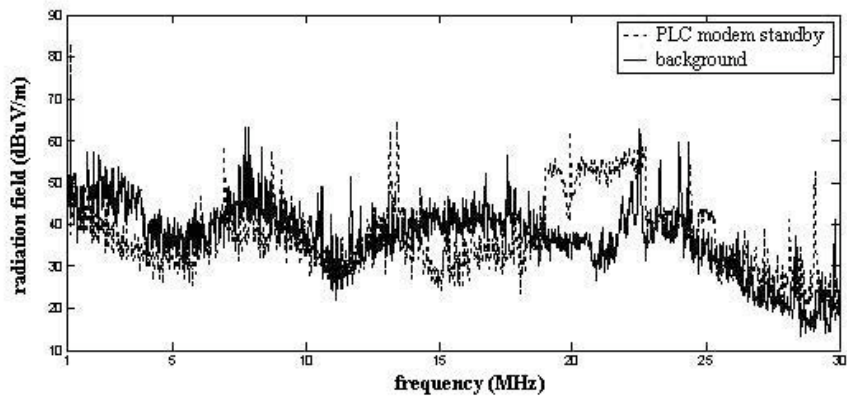


Fig.4 - Radiation field of 45Mbps PLC modem in standby compared to the background

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