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## PLC and xDSL Situation in Germany (with a look over the border)

In January 1999 the regulating administration for telecommunications and posts (RegTP) in Germany had issued a limiting curve for the "radiation of telecommunications services in and alongside of cables" (including CATV, xDSL, and PLC) for the frequency range 9 kHz to 3 GHz according to table 1:

**Table 1**  
**Limiting curve of german administration RegTP (NB30)**

Frequency Range (MHz)	Limit of fieldstrength in 3 meter distance, measured in dB( $\mu$ V/m); B = 9 kHz (10 kHz); <b>peak detector</b>
0.009 to 1	$40 - 20 * \log_{10}(f/\text{MHz})$
>1 to 30	$40 - 8.8 * \log_{10}(f/\text{MHz})$
>30 to 1000	27 (equivalent to radiated power of 20 dBpW)
>1000 to 3000	40 (equivalent to radiated power of 33 dBpW)

This curve is part of a plan for the frequency allocation in Germany and called "NB30". In an hearing on this subject held in March 1999 in Bonn it became obvious that the limits of this table would please xDSL operators but not PLC operators. On the other hand all radio services and associated industries, even the broadcasters, stated that these limits were to high and would cause interference to their services and their business.

NB30 has been approved by the german country council on March 30<sup>th</sup>, 2001. The hope of radio amateurs that the broadcasters of all german countries would object to this plan via their country governments and ask to lower the radiation limits of the NB30 by 10 to 20 dB did not come true.

### The situation in Germany after the approval of NB30

For the understanding of the background for the NB30 limits it should be known that even today, almost ten years after the deregulation of telecommunications in Germany, after dividing the old german Bundespost into four parts (postal services, telecommunications, post-banking, and regulation of telecommunications) there are still evident personal links existing between the regulation of telecommunication (RegTP, which now is a government administration under the ministry of economy) and the telecommunications sector (now a commercial entity called Deutsche Telekom).

It can be assumed that Deutsche Telekom will have tried out what radiation level should be sanctioned if they want to start using normal telephone cables for VDSL. The NB30 levels seem to have been set so high that VDSL will be possible without any (or major) problems (according to unconfirmed reports VDSL would cease at a level of about 13 dB below NB30). PLC in reality would need much higher radiation levels, up to 40 dB more. Under the NB30 regime all telecommunications operators, including CATV, Telekom, and PLC would need to arrange their operating levels in order not exceed the NB30 fieldstrengths limits. This would require tight and continuous control by the administration, of course. As a consequence PLC would be unable to compete with Deutsche Telekom

### Effect of NB30 on Radio Services

For the cooperation of DARC within CEPT SE35 I have written a small Basic program showing what receiver input level could be expected by various regulations considered. When employing a half wave antenna 10 meters from a house in which a telecommunication system meeting the NB30 limits is operating the calculated receiver input signals in SSB bandwidth will be as follows:

Band, MHz	1,8	3,6	7	14	21	28
S-Meter	S9 +12 dB	S9 +3 dB	S8	S6-7	S5-6	S5

For the time being the distribution of radio amateurs within the normal population in Germany is too thin to get sufficient experience with PLC trials, and this situation has not changed within eight months after the introduction of NB30. With the exception of a recent new case which still has to be examined all PLC trial areas selected so far do not include a radio amateur's residence. When driving into a new PLC trial area by car it has been shown that the interference may be as high as S9+ in the 80 m band, confirming the calculations. On another location in the same city it has been difficult to find any interference using a portable HF broadcast receiver during a PLC presentation which had been attended by radio amateurs (it is rumoured, however, that this building is connected to the internet via a radio link). It seems that we have to learn to distinguish between high and low level PLC and different (more or less expensive) forms of installations.

### **Situation for PLC operators**

After the introduction of the NB30 all PLC operators in Germany were trying to live with the low emission level, but obviously this seems to be difficult. SIEMENS decided to leave the PLC business in March 2001, because they had opted for the so-called "chimney solution" (an idea of a frequency range without radiation limits for PLC), and power companies which were due to use SIEMENS equipment are now supplied by ASCOM. ASCOM however has declared in a newspaper that they were unable to supply all PLC main outlets with sufficient low failure rate because "the NB30 levels simply cannot enable this". This shows that PLC operators have their problems in the noisy mains environment; they have to introduce repeaters, and the technology becomes more costly and less promising. Another drawback has been confirmed recently by an ASCOM spokesman: He still denied that PLC radiation would interfere with amateur radio, stating that the ASCOM system does not operate on amateur bands, but he conceded that the emissions of powerful amateur transmitters may block PLC operations!

This has been demonstrated during a PLC trial in Fulpmes/Tirol (Austria) where PLC could be blocked by less than 5 watts transmitter power (independent of the PLC transmitting level), thus confirming earlier reports of RSGB that PLC can be blocked by HF transmissions. But NB30 regulations say that "telecommunications operators using all kinds of cables have to tolerate interference from radio services", therefore under the NB30 regime in Germany no problems for amateur radio are expected because of this PLC deficiency. This result should also make clear that every future test on PLC installations conducted by radio amateurs should not only include listening (and measuring), but if ever possible also transmitting, to demonstrate this deficiency of PLC.

PLC trials in Germany have been conducted by RWE, Oneline, EnBW, and MainNet. Oneline, liaised to E.ON, however decided in early 2002 to stop all PLC activities in Germany and in Finland. Newspapers have reported the MainNet data speed to be rather low. Mainnet PLC test areas have also been installed in Finland and in Arnheim, the Netherlands. There were also rumours about unreliable operation of ASCOM PLC modems. Obviously because of all these uncertainties it has been reported in June 2002 that the RWE power company would also stop all PLC activities or would try to outsource them.

Other reports say that the strategy of PLC operators may have changed. They have realized that xDSL is developing much faster than PLC in highly industrialized countries. Therefore PLC operators increase their activities in less developed countries, those with a good electricity supply net but relatively few telephone terminals, such as Brasil, India, and even Japan and Russia. A swiss newspaper had reported that Ascom had been tasked by Russian power company Energomegasbit to install 20000 PLC terminals in Zhelesnogorsk , a city with about 100000 inhabitants 400 km south of Moscow.

No reports have been received so far on the marketing of PLC in-house only equipment in Germany, designed for in-house communications between audio or computer components and the like, to save cabling. Available in supermarkets, operated by technically ignorant persons and because of possible interference to neighbour radio amateurs this type of PLC equipment is regarded extremely critical when appearing on the market.

### **Standardization efforts**

Within CEPT SE (Spectrum Engineering) a special working group SE35 has been established in early 2000 to recommend a limit for the radiation of telecommunications networks. Representation of radio users is good (including NATO, broadcasters, DARC and RSGB), and after preliminary support for NB30 by several European administrations a range of possible limits have now been offered to SE, from NB30 down to NB30 minus 30 dB. Even CEPT SE must have noticed that the task to find a real compromise limit between the requirements of telecommunications operators and radio services seems to be rather difficult. Some smaller countries like Norway and Ireland support a limit 20 dB below NB30 (a level earlier proposed by the U. K. but withdrawn later), whilst Denmark recommends not to establish a limit for the radiation of telecommunications networks but to recommend a set of limits for the protection of radio services only. Because of such diverging views SE has abstained from deciding on a limit during its June 2002 meeting.

In the U.K. regulation MPT1570 of August 2001 is covering the range 9 kHz to 1.6 MHz only, with limits almost comparable to NB30. Limits for the HF range had been scheduled for February 2002 but are still under consideration. It is said that in the U. K. two different bodies are responsible for radio and cable communications; obviously they also face the technical problems which make a compromise decision very difficult, if not impossible.

CISPR/I is also busy to incorporate limits into CISPR 22 for the radiation of telecommunications cables including mains wiring on an international basis, and here a definite pressure of PLC representatives is observed to introduce the U. S. FCC Nr 15 radiation limits which are up to 30 dB stronger than NB30 and not frequency dependant (not adapted to natural noise characteristics). It even became apparent that the European Commission had written to all European administrations on the issue of radiation limits, stressing the need for common harmonized limits and also addressing the feasibility of the FCC Nr 15 levels. This also seems to have been the result of intense PLC lobbying, because in the M313 Mandate text the Commission had mentioned the British and the German national regulations only as guidance for a possible solution. European administrations are now carefully studying the U.S. FCC regulations and commenting the differences to European EN 55022 and EN 300 386 standards. But so far EBU (the European Broadcasting Union) only has made clear in a document to SE35 that in any case FCC Nr 15 applications are not allowed to interfere with authorized radio services.

Standardization work on PLC in ETSI and CENELEC has not achieved any remarkable progress, neither in the operation of access and in-house PLC frequency ranges nor in the level of permissible PLC radiation. After the ambiguous outcome of the "PLC Workshop" before the European Commission on March 5<sup>th</sup>, 2001, the Commission has issued a Mandate M313 to prepare and adopt harmonised standards covering the electromagnetic compatibility requirements (emission and immunity) for telecommunication networks using power lines, coaxial cables, and telephone wires (xDSL technology). ETSI and CENELEC have adopted the Mandate, in spite of the problem that immunity is also an issue, whilst the intention of the cable operators is to employ all these cables as they are, without any means to improve their immunity. In the Joint Working Group ETSI/CENELEC dealing with this Mandate 313 the representation of cable operators is overwhelming, a limit has not yet been fixed so far, but in the discussion very relaxed limits like NB30 plus 10 dB or even 20 dB and FCC Nr 15 (70 dB(uV/m) are predominating. At present these attempts in the JWG must be regarded very dangerous for radio services. Concerning the diverging views on the Mandate in the U. K. a campaign has started in the JWG looking for volunteers to influence their administrations to speak with a single voice when deciding on Mandate 313.

The reasons to strive for relaxed limits is obvious. PLC experiments in Germany have shown that PLC cannot be operated satisfactorily under the NB30 regime. In a measuring campaign in an ASCOM PLC trial installation in Switzerland conducted by USKA it became also evident that the ASCOM system had been operated at a level 10 dB above NB30. But as long as NB30 has a certain chance to become European standard, the final chance for PLC in Europe is to press for higher radiation levels like FCC Nr 15 in any possible standardization regime.

In spite of the ongoing work on Mandate 313 it may look odd that the European Commission has pressed Germany to withdraw NB30. Among the various reasons given (the EMC Directive would be sufficient to deal with radio interference cases, but why the European Commission is calling for Mandate 313?) this may have been done for principal reasons only. After establishing a European standard on the limitation of radiation from telecommunications networks member states of the European Community have to withdraw conflicting national standards. But NB30 is not a standard, it is merely a radiation limit in combination with the plan of frequency allocations in Germany. Now this frequency allocation plan has been revised and no longer refers to NB30 or any other limit. But NB30 still continues to exist as the German proposal for a radiation limit in standardization bodies.

## **xDSL services**

Compared to the PLC problems Deutsche Telekom is successfully continuing to introduce ADSL in Germany. Meanwhile more than two millions of "T-DSL" terminals will be in operation in Germany, and the demand is still higher than industry can deliver equipment. As a spectrum up to 1.1 MHz is employed only, German radio amateurs claim having no interference problems from their own T-DSL operations so far. This seems to be in contrast to the situation in the U. K. where ADSL interference to radio has even been discussed publicly in The Times and is also of concern to AEROCNTRL, obviously because British Telecom is employing standard unshielded twisted pair (UTP) telephone cable for ADSL. According to radio amateurs being employees of Deutsche Telekom shielded twisted pair (STP) cables are installed in Germany for T-DSL; these cables are even developed further, increasing the wire diameter to reduce attenuation.

Furthermore Deutsche Telekom has published first plans to introduce VDSL with a bit rate of 14 Mbit/s. The first solution will cover a spectrum up to 12 MHz, using 64QAM modulation. But later plans are to reduce the spectrum to 5 MHz employing 256 QAM, maintaining the same bit rate. It is claimed that this technology will comply with the German NB30 proposal, but even this would mean a threat to radio amateurs if the distance to such a VDSL operated cable would be less than 200 meters. The second VDSL solution would have the advantage that at least the main broadcast bands above 5 MHz would not be interfered. Until now, however, no interference complaints related to VDSL have been received from German radio amateurs. In a British Telecom document to SE35 it has been mentioned, however, that VDSL would develop an interfering fieldstrength of about 30 dB(uV/m) at 1 meter from a dropwire. In 10 meters distance this would cause a calculated receiver input signal of S8 at 1.8 MHz decreasing to S5 at 14 MHz.

Deutsche Telekom will also improve T-DSL even further. It is planned to deliver 5 MB whilst still keeping the upper frequency limit below 1.5 MHz.

## **Radio Regulations**

Finally it has been emphasized in this SE35 document that article RR S15.12 in the ITU Radio Regulations:

"Administrations shall take all practicable and necessary steps to ensure that the operation of electrical apparatus or installations of any kind, including power and telecommunication distribution networks . . . does not cause harmful interference to a radiocommunication service and, in particular, to the radionavigation or any other safety service operating with the provisions of these Regulations"

is still a very clear statement to the current legal situation of cable systems in relation to radio services. Therefore this RR article S15.12 may gain increased importance for the future of all radio services because it may become the only help in cases of interference from telecommunications services after standards on emission limits from telecommunications cables following the present trends finally should have been established in Europe and world-wide. On the other hand it has been stated in ETSI that European Right will supercede other (older) Rights, therefore it may be questioned whether the Radio Regulations remain an obligation for administrations in interference cases under Mandate 313 in Europe.

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