Commission Joint Workshop on PLC

Brussels, 16 October 2003

Position Paper of the UK Administration

Introduction

The UK has embarked upon a program to deliver "Broadband Britain" and is also fully committed to e-Europe. To realise these objectives by achieving, to the greatest practicable extent, ubiquitous availability of affordable broadband Internet access, requires a mixture of technologies, both wired and wireless.

However, in the case of wired broadband services it has to be recognised that there is a risk of disruption to radio services from signals unintentionally radiating from the cables used. Some suggest that the solution to this problem is to provide such services by means of fibre optic cables to the home but, in the vast majority of cases, this is not currently, and will not for the foreseeable future, be an economic possibility.

The mixture of technologies appropriate to a particular location will be affected by a number of factors, both technical and commercial. It will vary from country to country on account of the degree to which particular technologies, e.g. CATV, are already widely deployed.

For economic reasons, in many cases, broadband services to the home and small businesses will be delivered by means of cables that already exist for the delivery of other services, e.g. telephone, cable television, or electric power, even though these cables were not originally designed for this purpose.

In order to ensure that services may co-exist in an effective manner, it is clear that some constraints must apply to their behaviour, e.g. in respect of unintended emissions at radio frequencies. However, due to the nature of the signals involved and the characteristics of the cables used and their installation environment, it is inevitable that these emissions will often not be negligible, and that a trade-off between telecom service capability and disturbance to radio services is unavoidable. **This issue is common to many broadband technologies – it is not unique to PLC**.

PLC is seen by some as employing a particularly unsuitable transmission medium, the electricity supply network. It is argued for example, that the topology of the electricity supply network, inside and outside the home, means that it is inherently more invasive and therefore more likely to be in close proximity to a radio receiver. However, this need not, per se, constitute a reason for impeding the exploitation and further development of this technology. What matters is how much disturbance it causes to radio services in real life, rather than in theory, and how that compares with other technologies.

The current situation creates considerable regulatory uncertainty for organisations intending to deploy high-speed broadband services, especially where these are to be delivered by means of PLC.

The UK is actively seeking ways to reduce this uncertainty, and has welcomed, in principle, the European Commission's recent initiative aimed at considering an alternative approach to the regulation of PLC systems.

The ultimate goal must be to achieve a common approach to the regulation of broadband networks of all types throughout the EU, but this is proving difficult to achieve. Until that is achieved the UK recognises that all must strive to achieve whatever practical and sustainable progress can be made which will support and facilitate the realisation of the EU's, and the Member States', objectives in respect of the deployment and use of broadband services taking into account the wider public interest.

PLC in the UK

Technical trials have been taking place in two small towns in Scotland, Campbeltown and Crieff, run by Scottish and Southern Energy (SSE), the local electricity company. Neither town has any other form of wired broadband access. These are being supported financially by regional development agencies alongside other projects aimed at expanding the availability of broadband Internet services.

The trials also have the support of both the Scottish Executive (the devolved Government for Scotland) and the DTI (representing the UK Central Government). The Scottish Executive has its own broadband strategy, which like the UK's is technology and supplier neutral, but which recognises and addresses the relative lack of broadband availability 63%) compared to the overall UK (85%), and the special challenges of deployment in the more remote and rural areas. *(See also Annex B)*

The current number of users connected in Crieff is around 100. The service started mid-2002. The users are a mixture of domestic customers and small businesses. About 50% of the town's electricity distribution network is carrying PLC signals, and the intention is to increase this proportion as service is expanded to other areas of the town.

The equipment used is mainly from Ascom and Main.net, and similar to equipment in use in other Member States. Backhaul from the electricity substations to the local concentrator is done by means of BT wired circuits. Some higher speed equipment is being trialled on one of the town's substations.

Measurements taken by the RA show levels of emissions comparable to those recorded in other European locations where similar equipment is being used. The full report is available from the RA website (http://www.radio.gov.uk).

The current number of users connected in Campbeltown is around 50. The service started in late 2002. The users are a mixture of domestic customers and small businesses. This represents about a 5% market penetration. This system has been constrained by satellite backhaul reliability problems.

From a PLC point of view, these trials are deemed a success by the operator. The Crieff trial, in particular, has reported high levels of customer satisfaction, according to independent research, from both business and domestic users and there have been no complaints of interference to radio reception. As a result the trial is to continue beyond its originally intended completion date so long as there is customer demand.

SSE has a significant backhaul capability within its own control in North West Scotland (Tayside and Grampian) and this may encourage the deployment of further systems.

SSE has recently started commercial trials in Stonehaven in Scotland and Winchester in Southern England. Both locations have other broadband services available. In Winchester this includes both ADSL from BT and services from a cable TV operator. The equipment used is the same as for the technical trials. SSE believes that its service is sufficiently delineated from its competition (e.g. it can deliver greater bandwidth than standard BT ADSL) that it can compete on commercial grounds. There are too few users and not enough time has yet elapsed to gain any useful information from them.

Other electricity companies are taking an active interest in the possibility of deploying PLC but they are being deterred by the current degree of regulatory uncertainty.

There is also active interest in using PLC technology to provide some backhaul from electricity substations.

UK history with setting enforcement limits for emissions from DSL and PLC systems

The limits used for enforcement purposes in relation to emissions from telecom circuits carrying ADSL are contained in MPT 1570. There is currently no equivalent provision relating to higher speed/bandwidth services such as VDSL and PLC.

It should be noted that there is no requirement for systems to meet MPT 1570 at the time of installation or in normal use. It is used only as a benchmark in the event that there is a complaint of interference and other means of remedying the problem have failed.

MPT 1570 resulted from a lengthy consultation involving radio users, telecom operators, and others. However, the gulf between, in particular, the radio users and the telecom operators, over the severity of the limits was large and irreconcilable. Eventually a decision on a compromise level was taken by the Government.

The decision on this compromise level was accompanied by an obligation on the system operators to attempt to resolve any complaints of radio reception that emanated from a system, regardless of whether or not the emissions involved exceeded the limits in MPT 1570. Further, the limits were to be reviewed after 2 years or less depending upon the level of unresolved complaints.

These levels were described at the time by the broadcasters as unacceptable and having the potential effect of preventing many hundreds of thousands of the population listening to MF (medium-wave) radio stations. The Government accepted that there would be potential for disturbance to MF broadcasting but its own estimates of the extent were very much lower than the figures mentioned by the broadcasters.

The telecom operators concluded that they could now roll out ADSL with an acceptable degree of commercial and operational risk, as essential to the Government's commitment to the realisation of Broadband Britain.

Over 1.4 million ADSL lines are now in use in the UK. To date there has been only one confirmed complaint of interference from ASDL. This was caused by faulty DIY wiring in a private home and was rectified by BT at no charge. The concerns voiced by the radio users appear not to have been realised, although some still feel that the true extent of interference will not become apparent until a greater level of deployment has been achieved.

Following the work on lower frequency systems, further consultation was carried out on the need for emissions limits for VDSL and PLC systems *(Technical Working Group on the Compatibility of VDSL & PLT with Radio Services in the Range 1.6 MHz to 30 MHz)*. This suffered the same extreme levels of divergence of positions as for ADSL. A report on this work is available on the RA website (http://www.radio.gov.uk , *see also Annex A*).

To date, the Government has not yet taken any decision on introducing enforcement limits for such systems and has been waiting to discover whether any potential solution might be forthcoming from the work in the CLC/ETSI JWG, but this too seems to have encountered the same problems.

It is noted that some of the limits stated by radio users as essential, both in the UK national work and in the CLC/ETSI work are so strict that they would imply the cessation of many existing telecom and IT systems in widespread deployment - clearly not a realistic situation.

The UK Administration is currently convinced, particularly in light of its earlier consultations and then subsequent practical experience with ADSL, that it is not possible to achieve a consensus on purely technical grounds on any particular limit on unintended emissions, especially for PLC, and that other means of achieving an appropriate balance in the public interest are needed.

Complaints and the likelihood of interference

It is evident from work presented by the UK and other Member States, that the levels of emissions from a number of types of wired telecom systems can be high enough to disturb reception of some radio services, yet the level of complaints remains very low. In the case of PLC, unintended emissions primarily fall in the HF (short-wave) bands where received signal levels are generally lower than in the medium wave broadcast bands and the potential for interference appears higher.

For a complaint to occur there needs to be someone trying to use a radio service in a location where such emissions are high enough to disturb it. For instance, if there is no one in a town that listens to HF radio services there will be no complaints about HF reception, even if there are systems emitting high levels of unintended signals.

In much of Europe it is arguably the case that very few people listen to HF broadcasts. A new digital radio broadcast system, DRM (Digital Radio Mondiale) is being developed and currently trialled, but the extent to which it may be used for domestic reception within Europe is impossible to predict.

In many cases it is now possible to listen to many of the same (and more) stations over the Internet as more and more broadcasters find this a more reliable and cost-effective way of reaching distant audiences. The BBC now has a particularly impressive on-line service and is investing large sums to extend it. There are several other uses of HF communication, including by the military, but, except for amateur radio, these are not normally exploited in a residential environment.

The existing levels of interference from other sources may be high enough to mask the added effects of the telecom system. Some common types of IT equipment have been shown, in practice, to create relatively high levels of unintended emissions.

The PLC system may have a means of avoiding emissions in sensitive bands and/or in sensitive locations (e.g. some systems are deliberately designed to avoid operating in the amateur bands for mutual protection).

Professional HF users normally place their aerials away from potential sources of interference.

There are many other factors that affect the potential for interference, and it is accepted, too, that there are also occasions where interference is caused, and the radio user either does not realise this, or the cause cannot be identified.

Therefore, it is not valid to ascertain the probability of interference occurring simply by reference to the field strength of unintended emissions at any particular point. It is not proportionate to expect unintended emissions from all telecom systems to be kept extremely low at all points in the network, e.g. where there is little likelihood of a `victim' being located, as this can place impossible and un-necessary constraints on the design and operation of a system and introduce great regulatory uncertainty as to compliance.

Cumulative Effects

Concerns have been expressed regarding the cumulative effects of a large number of installations on reception of radio services both nearby and at a distance, including the possible effects on aeronautical communications. Although a number of theoretical models exist which aim to predict these effects, there is a lack of practical evidence with which to validate them. Many independent studies have been completed, but in the absence of validation, the application of any mathematical model will always be subject to debate, and no firm conclusions are possible on the likely impact of mass deployment of PLC on radio services. Without more practical experience of broadband systems it is not possible to verify the actual effects of mass deployment.

If some predictions concerning the cumulative effects of PLC are correct, it is surprising that there are not already obvious difficulties arising from the existing extremely large population of systems of other technologies of which the close-up emissions characteristics are known. In some cases these have been demonstrated to be significantly higher than those from modern broadband systems, including PLC.

However, it is noted that there are several millions of ADSL lines in service, and that there are already some sizeable PLC installations, with no obvious detrimental cumulative effects having so far been determined.

The EMCD and the role of standards

Much of the debate over the control of emissions from wired broadband systems is related to conformity with the EMCD. The UK has serious misgivings as to the application of the EMCD to widely distributed items such as wired telecom networks which contain cables that have not been designed to carry high frequency signals, which are subject to constant alteration, and where it is impractical to carry out measurements on a complete system.

Whilst it would be ideal for there to be a degree of regulatory certainty provided by the existence of a Harmonised Standard which would give a presumption of conformity for a system, one could only enjoy that presumption if one could reliably claim to be meeting the standard.

It is impossible for any system operator to perform field measurements at every point in his system. Even if he could, any subsequent change in the network would invalidate the results. This would suggest that the only practicable method of determining conformity would have to relate to signals which could be measured at specific points in the system, for instance on the ports of equipment connected to the cables within the system.

However, this approach can only be relied upon to fulfil the objectives of the EMCD itself, of avoiding interference, where the radiation efficiency of the interconnecting cables is known, and where the level of the signals necessary for the proper functioning of the system lie some way below the limiting levels laid down in the standard.

The problem with broadband telecom systems is that the levels needed for the proper functioning of the systems can lie significantly above the levels which the radio users maintain must be met in order to protect their services, and that the radiation efficiency of the cables varies somewhat.

If the radio users' concerns are justified, this means that the limiting factor is not what the telecom system operator must inject onto the wires for the system to work, but what is radiated as a result, bringing the debate full circle. This is especially true of PLC.

What really matters is whether an unacceptable level of interference is being caused to a particular person in a particular location, not what is happening everywhere on the system. Having to meet an identical emissions limit at all points in a system, as some would claim would be the case with a standard, would needlessly constrain the operation of the system under these circumstances.

This means that producing a Harmonised Standard that gives a presumption of conformity is nigh on impossible for such systems if conformity is assessed on a literal basis. Under these circumstances, any such standard would be discarded in favour of the Technical Construction File approach, even assuming that the wider applicability issues described above could ever be overcome.

The only way around this problem might be to assess types of systems on a statistical probability basis, for instance as a result of assessing combinations of elements of real or simulated systems, although this does not provide any specific assurance as to the actual levels of unintended emissions at specific points in the vicinity of a real system.

A Way Ahead

Current evidence suggests that PLC could play a useful part in the realisation of Broadband Britain and e-Europe, but that regulatory uncertainty is deterring investment in it, and this, in turn, makes it difficult to gain experience of its operation in sufficient a range of environments.

Since it seems unlikely that a Harmonised Standard under the EMCD will, in the foreseeable future, provide some relief from this uncertainty, it is important to consider other ways of facilitating deployment of PLC, whilst retaining a regulatory influence on any undesirable side effects of its operation which might occur.

The UK suggests the following:

1. In order for PLC to be given an equitable opportunity to demonstrate its capabilities and characteristics, and for the technology to progress, it is essential that more systems are brought into service and their characteristics monitored.

2. It should be accepted that conformity with any particular technical standard is not essential (indeed this would be contrary to the New Approach).

3. Operators of such systems should give undertakings on how problems of real-life interference would be handled. Ideally reasonable attempts should be made to resolve any cases notified.

4. Interference complaints should be allowed to occur `naturally'. That is that they should not be the result of a deliberate attempt to identify potential sources of interference.

5. It should be accepted by all parties that there are no absolute assurances given that **all** interference complaints will be resolved, but a record should be kept and that further action may be taken if there are deemed to be too many unresolved complaints.

6. The balance between the interests of radio users and the interests of the users of the PLC system will be a matter for the Administration to determine in the public interest. Ideally, this should be based on objective criteria, but UK experience suggests that this is not realisable in practice.

7. Investigations should be carried out into better methods of assessing the interference potential of PLC equipment and systems, and in particular the practical effects of this on use of the HF spectrum.

It is recognised that this approach is based more on `enforcement' than on `compliance'. From a practical point of view this is inevitable. The ability to `enforce' is always needed, although a realistic `compliance' system can help to reduce the number of times that enforcement action is required.

At the end of the day, it is the responsibility of the overall regulatory system to ensure that an appropriate level of electromagnetic compatibility is sustained.

Conclusion

The balance between the exploitation of broadband Internet delivery mechanisms and the impact on radio services cannot be regarded as a technical matter alone, since, in the ultimate, a clean radio spectrum could only be achieved by the total absence of all sources of unintentional radio frequency emissions. A compromise has to be struck between the risk of interference and the ability to deploy a service, because **NO RISKS = NO SERVICES**.

For economic and social reasons, Europe needs affordable broadband Internet delivery to homes and businesses and this has to be achieved with the technology that is available. Regulatory discrimination between different types of technology has, therefore to take full account of this need and to strike an appropriate balance, in the wider public interest, between its exploitation and any resultant disruption to radio services.

Electromagnetic Compatibility does not imply an absolute assurance of no interference between wired systems, such as PLC, and radio services.

PLC, in its earliest manifestations, acquired a bad name for itself which has tended to follow the technology as it has developed to the present day. This `reputation' should not be permitted to cloud the judgment of its modern day successors which must be assessed on their own merits alongside one another and against competing technologies.

It is recognised that the designers and implementers of PLC systems are striving to deploy systems that minimise the risk of interference to radio services, and this is welcomed and to be encouraged.

Whether PLC will be a commercial success is not for regulators to decide.

Regrettably, but not unexpectedly, it seems unlikely that any practical solution to the issue of common European emissions limits for broadband systems will be available as a result of work in the standards bodies in the immediate future. It is appreciated how strongly all parties would like to have agreed European-wide standards.

In these circumstances, the UK seems to be left with little alternative but to reconsider its position on the introduction of local limits covering systems such as PLC, at least for the purposes of enforcement, in order further to reduce market uncertainty. Although the prospect of unilateral UK action might seem a retrograde step, it could actually prove beneficial in helping to point the way to a pragmatic, practical, and sustainable common European solution, and hasten its arrival.

The UK does not underestimate the potential value to all parties of agreement on a single Europe-wide approach to this issue, and will continue to strive with the Commission and the Member States to realise, at the earliest opportunity, such a conclusion.

Department of Trade and Industry

13 October 2003

Annex A

Extracts from Management Summary of :

COMPATIBILITY OF VDSL & PLT WITH RADIO SERVICES IN THE RANGE 1.6 MHz TO 30 MHz

FINAL REPORT OF THE TECHNICAL WORKING GROUP
October 2002

In any consideration of compatibility, there are clearly conflicting interests between on the one hand, the requirement of the telecommunication industry to deploy broadband wired networks with minimum regulatory burden and on the other radio users who need to ensure protection of their services. The purpose of the TWG was not to attempt to reconcile telecommunication and radio interests but to ascertain the technical issues concerned with determining compatibility. It is nevertheless clear that any future regulations to control emissions would also need to take into account the economic; social and financial issues associated with enabling broadband telecommunications and protecting radio services.

But given the range of official policy issues associated with public telecommunications, and no less so with protection of essential radio use, the matter of compatibility of DSL and PLT with radio services impacts on a number of government policy interests. Official TWG membership therefore included representation from all interested government departments and was not limited to those with a primary interest as users of radio spectrum. Meeting government objectives of enabling broadband telecommunication whilst protecting essential official use of radio spectrum is a matter for collective agreement between relevant departments, and ultimately Ministers. It was therefore not a matter that could be determined in TWG.

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.

Limited field measurements have shown that undue interference to radio reception at distances of more than a few meters from a single VDSL or PLT line is most unlikely. But it is suggested that given the unique propagation characteristics of HF spectrum, the summation of emissions from large numbers of such lines operating within a given area might cause interference to a victim receiver at some distance. Estimating the probability of this “cumulative” interference is feasible using mathematical modelling but is not

possible with sufficient reliability at the present time due to the absence of any practical validation.

Neither telephone lines used for VDSL, nor power cables used for PLT were designed to carry radio frequency (RF) signals efficiently. The extent of their "inefficiency" at RF has been the subject of much study and for a given type of wire or cable may be readily determined through theoretical calculation and practical validation. But it becomes difficult to relate this to any practical PLT and/or VDSL implementation where other factors such as the degree to which cables and wires may be buried underground; their consistency of construction and the effects of termination become relevant. It is reasonable to assume however that in general terms the topology and method of delivery of broadband networks will, when all other factors are discounted, affect the probability of interference to radio systems in close physical proximity. This is significant when considering the two quite different broadband technologies examined by the TWG.

In summary, it is clear from the work of the TWG, and during the preparation of this Final Report, that there exists a significant gap between the stated protection requirements of the radio users and the commercial requirements of telecommunication operators. Notwithstanding the TWG's uncertainty over emission levels due to the limited scope of field measurements; in the absence of any quantitative analysis of the effects of interference on practical radio systems, it is difficult to state objectively the operational implications for HF users from the introduction of VDSL or PLT.

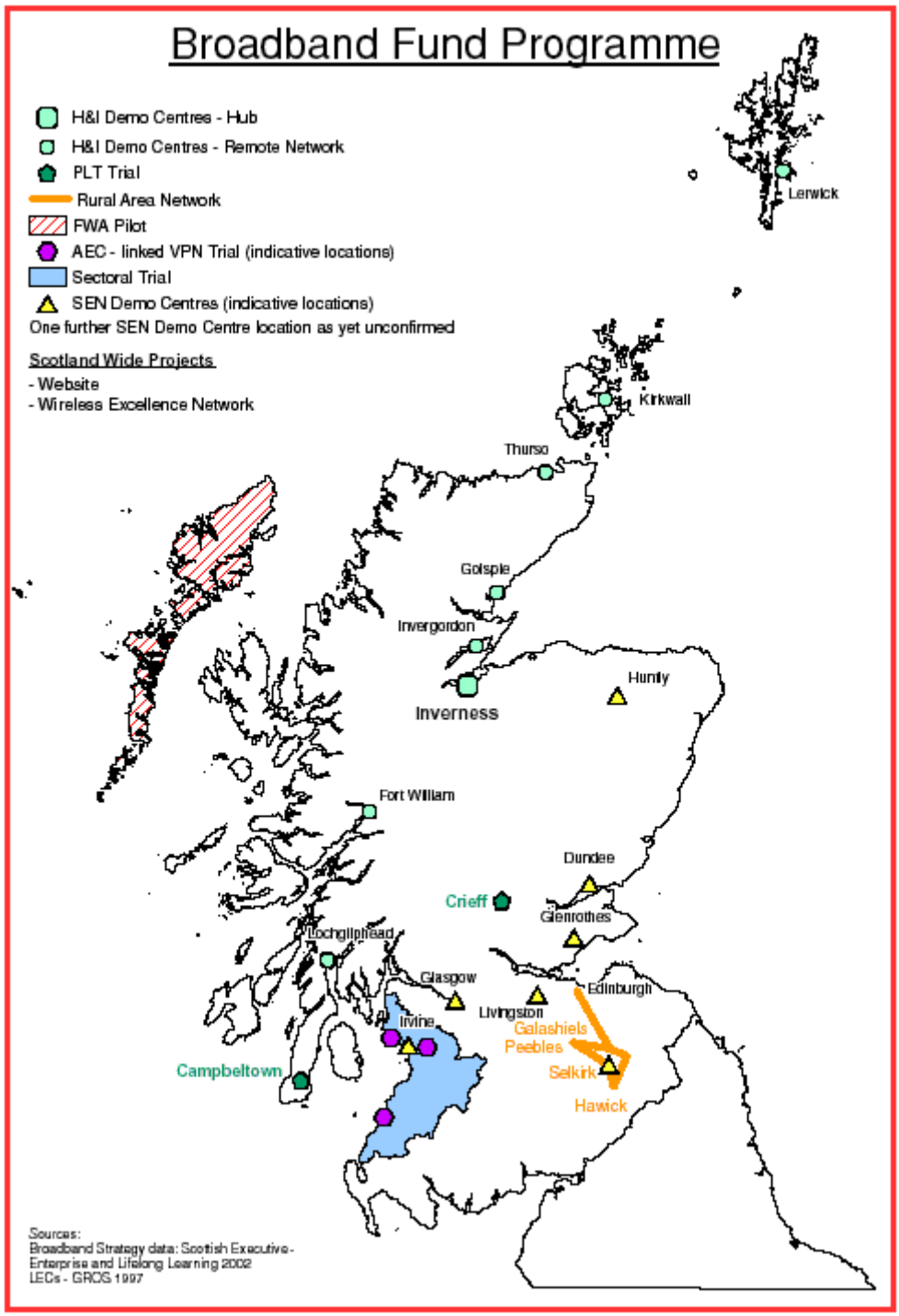
As indicated above, further modelling work is also proposed, to ascertain the cumulative effects of interference from DSL and PLT particularly to aeronautical services as soon as practical validation tests are completed.

Source: UK Radiocommunications Agency - full report available via ***http://www.radio.gov.uk***

Annex B

SCOTTISH EXECUTIVE

Illustration of Broadband Promotion Activities in Scotland



Source: Scottish Executive (http://www.scotland.gov.uk)