

A low level of complaints *is not* evidence of compliance (An update on the EMCIA's position on PLT)

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The two months since the last Edition of the EMC Journal was published have been busy ones for PLT.

It was not my intention to follow my article "The EMCIA's Position on PLT" [1] with another one on PLT, but three important things have happened to make me change my mind:

- 1) In August there was a meeting of leading experts and organisations in London, to discuss the EMC non-compliance of PLT in particular (but all products in general)
- 2) Also in August, DG Enterprise postponed listing EN 55022:2006 under the EMC Directive for over two years, to 1 October 2011. This was against the opinions of almost all the delegates at their EMC Working Party, and also against the advice of all the standards people consulted. See: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2009:197:0003:0003:EN:PDF>
- 3) In September, Ofcom published their update on PLT, which you can read at: <http://www.ofcom.org.uk/radiocomms/ifi/enforcement/plt/>

I'll briefly discuss the first two items, but it's the third one I really want to focus on here, and that is the subject of the title.

1) The meeting of leading experts and organisations was originally called because of the non-compliance of 'broadband PLT' products with the EMC Directive, and the apparent refusal of any of the enforcement authorities to do anything about it.

One expert pointed out, however, that PLT has been around for years, using low data rates and frequencies below 150kHz, and causing no interference problems at all. It even has its own emissions standard listed under the EMC Directive: EN 50065-1.

All agreed that they were concerned with any product that caused interference to the radio spectrum, which meant that they were not concerned with PLT *as such*, but with the more recent 'broadband PLT' that does not comply with CISPR emissions limits.

One of the experts said that his wife, while proof reading something he had written on this topic, had described it as 'Greedy PLT' – a rather nice term for something that gobbles up more spectrum than it should.

They agreed the following:

- a) They would target any products that exceeded the appropriate CISPR limits at any time.

- b) Their desired outcome was to get all products that did not conform to the appropriate CISPR limits removed from the market, and – for products already in use – to get them either removed from use, or modified to comply with the CISPR emission limits.
- c) The geographical area over which they are concerned to protect the radio spectrum is global. Naturally, they can't address the whole world at once, right from the start, so they intend to start in the UK and cover the social, economic, political and technical aspects of raising the profile of non-compliant products.

This group of experts came together just before items 2) and 3) above became public knowledge, arguably revealing the contempt of the various authorities in the EC and the UK for the EMC Directive and National implementations of it. Clearly, the group is sorely needed.

Why focus on CISPR limits? The EMC Directive [2] allows two routes to compliance with its Essential Requirements: the 'Standards Route' and the 'Technical Documentation File'.

The standards that can be used under the standards route all base their emissions limits on the CISPR limits. The 'TDF' route does not have to use any standards at all, and so is useful where products are difficult to test to standards (e.g. very large and don't fit in a test chamber, or custom equipment only ever assembled on its user's site) and also useful for start-up companies who find it hard to afford full-compliance testing costs and so rely on their EMC design skills and a few lower-cost tests.

However, whatever the 'route to compliance' chosen, all products have to comply with the Essential Requirements in Article 5:

Equipment shall be so designed and manufactured, having regard to the state of the art, as to ensure that:

(a) the electromagnetic disturbance generated does not exceed the level above which radio and telecommunications equipment or other equipment cannot operate as intended;

(b) it has a level of immunity to the electromagnetic disturbance to be expected in its intended use which allows it to operate without unacceptable degradation of its intended use.

CISPR is the only international organisation whose principal task has been setting emissions limits to protect the radio spectrum, and they have been successfully doing this for decades to the widespread satisfaction of the entire EMC industry.

So the group of experts chose compliance with the appropriate CISPR limits as the 'yardstick' for determining whether a product complies with emissions requirement highlighted above. It doesn't matter how a manufacturer claimed compliance with the EMC Directive – the crucial issue, the 'acid test' (if you like), is whether its emissions exceed the CISPR limits at any point during its operational cycle.

If they do, the product *must* be exceeding the level above which radio and telecommunication equipment or other equipment cannot operate as intended (because CISPR has spent hundreds of man-years determining this), and therefore *must* be considered to be non-compliant with the EMC Directive.

Actually, the CISPR limits are not that tough, and there are plenty of technical arguments showing, and examples of, products that comply with the CISPR limits and yet still cause interference. The limits were designed as a reasonable compromise between the cost of products to the consumer and the probability of interference to his neighbour.

For example, the CISPR limits for the domestic environment admit that they might not protect radio receivers that are closer than 10 metres – yet most modern households are not even as large as 10 metres in any direction, yet contain dozens of electrical appliances and electronic products. Surely a modern emissions limit needs to protect radio receivers at 1m distances?

So, by hanging their hat on compliance with the CISPR limits, the group of experts (who have yet to agree a collective name) cannot be blamed for being over-zealous.

2) The 1998 Edition of EN 55022 is currently listed under the EMC Directive. It is passing strange for a standard that covers the products experiencing the most rapid advances in technology – Information Technology and Telecommunications – to be eleven years old. Postponing its 2006 Edition for a further two years is going to cause all sorts of problems for all EMC test labs and many manufacturers, so the European Commission's DG Enterprise (who do not employ any technical staff) must surely have had a very good reason for going against the combined advice of their own EMC Working Party and all the standards experts they consulted?

Well, the reason was in fact this: the 1998 version includes some text that describes how its main emissions limits (CISPR limits!) are to be applied to tested products. Like all such text it requires a certain technical competency to understand correctly. The 2006 Edition makes the text easier to understand by including a graphic, a decision-tree or flow-chart, and the inclusion of this is the sole reason for its postponement.

Why? (I hear you asking) Well, certain manufacturers of Greedy PLT products claim to comply with EN 55022:1998, relying on the fact that most politicians, bureaucrats, journalists and EMC enforcement agencies in Europe do not have the technical competence to understand the words in its text explaining how to apply its main emissions limits.

But the graphic in the 2006 Edition would have made that text easier to understand, at which point one would have to be rather dim not to realise that the Greedy PLT products could not actually comply with EN 55022 as they were claiming.

So the European Commission postponed listing the 2006 Edition of EN 55022 under the EMC Directive, which will cause untold difficulties EMC test labs and manufacturers, for no other reason than enabling the manufacturers of Greedy PLT products to continue to fool (almost) everyone that they really do comply. Let's just take a moment to review just what benefits Greedy PLT products bring to our modern world:

- i) They allow broadband Ethernet access in the home without having to route any new cables, which can cause unsightly lumps under carpets
- ii) Er, that's it.

So who uses broadband Ethernet in their homes? Well, mostly it is teenage multi-player gamers, and people with an Internet TV service, such as BT Vision, who can use it to connect their computer to their TV without having to use an Ethernet cable.

I think it would be a very strange person indeed who could claim that this was a good enough reason for allowing Greedy PLT manufacturers to continue to flout laws that everyone else has to meet. Yet, this is exactly what DG Enterprise has just done. Proof that truth is stranger than fiction, no doubt, but that is little consolation.

Interestingly, Richard Marshall [3] is not the only EMC expert to have pointed out that Greedy PLT could satisfy 95% of their market's data transfer rate requirements if they reduced the amplitude of the signals they put on the mains to a level that would allow them to scrape in under the CISPR limits.

I understand that the PLT manufacturers choose not to take this quite reasonable step, because somehow they know that DG Enterprise will continue to allow them to get away with using their Greedy technology, and that all the EMC enforcers throughout the European Union will follow the EC's lead, because they either do not have the competence or the balls to stand up to the EC.

3) So now we eventually come down from the giddy heights of EC bureaucracy, to our own beloved Ofcom in the UK. When Ofcom subsumed the Radio Agency and its Radio Investigation Service a few years ago, people wondered how it was that an organisation that was working for the telecomms and radiocomms industry could also police that same industry.

In UK agriculture, this same approach to combining 'poachers' and 'gamekeepers' in one Agency caused various health crises, and it seems the same chickens are now coming home to roost with Ofcom. (Did you like the deft use of an agricultural cliché, there?)

Anyway, I assume that by now you have all visited the Ofcom PLT webpage whose URL I provided earlier. You might also like to visit: www.theregister.co.uk/2009/09/04/power_line_networking/, to see Bill Ray's take on the RSGB's repudiation of Ofcom's September update on PLT.

As for the group of experts mentioned in 1), the initial reactions of four of them to the PLT update were:

Expert 1): Obviously Ofcom have decided they can't be bothered to examine the RSGB's detailed case (dated 31st July 2009) for non-compliance. Their PLT update is not even accurate in so many respects, not least that it mentions M313, which is specifically aimed at cable radiation and excludes modems.

Expert 2): Having briefly examined the release, I feel that what has been left out is more important than what has been included. Virtually every section either has inaccuracies or areas that need further information.

Expert 3): Quote: "On the evidence, Ofcom has not so far found that there is a breach of the EMC essential requirements." This is clearly not true.

Expert 4): The Lord Nelson approach! (see panel below)

Horatio Lord Nelson, commanding the English Fleet, is said to have put his telescope to his blind eye and said "I see no ships".

Although the quotation is almost certainly incorrect, the expression is now commonly used whenever someone refuses to see what is plainly obvious to all, if they would only take the trouble to look.

I'm sure that Ofcom's September PLT Update will be written about extensively in the future, not least their decision to pay for an 'independent study' of Greedy PLT, when they have already been provided with all the information that any reasonable enforcer would need to get any other product taken off the market in double-quick time.

The Ofcom PLT update states that all of their 143 complaints to date are from "radio enthusiasts" – but the UKQRM website (<http://www.ukqrm.org/>) also lists incidents where Greedy PLT has interfered with wireless computer mice and other non-radio-reception interference incidents. It also shows that *Greedy PLT can slow down a broadband internet connection*.

The not-so-subtle message being given out by the Ofcom PLT update is that the only people complaining are hobbyists – that *nothing serious* is being affected.

The unspoken assertion is that since most of us receive our media digitally, either over the air or by the Internet, we should care less about the hobbies of a few nerds. This argument is incorrect, as shown in c) below, because digital media don't give us any indication of interference, they just stop working and people assume the products are broken.

However, the radio amateur and shortwave listening community are the radio spectrum's "canaries in a coal mine" (see following panel). Because of the sensitivity of their activities, they are often the first to notice interference, and the majority of us ignore their complaints at our peril.

What started out as a few complaining hobbyists, could become an interference menace that could even threaten the UK Government's "Digital Britain" initiative [4].

Canaries (the little yellow singing birds, not the islands off the North African coast) were until surprisingly recently used by miners to indicate problems with air quality underground.

Being so sensitive to air quality, they provided a warning of poisonous or flammable gases before they became too dangerous to the (much larger) miners.

For background, see: http://en.wikipedia.org/wiki/Animal_sentinels, and http://news.bbc.co.uk/onthisday/hi/dates/stories/december/30/newsid_2547000/2547587.stm

The expression "Canaries in a Coal Mine" is now widely used wherever an especially sensitive or aware group of people detect a serious problem that is not yet apparent to the wider populace, see for example the climate change website: <http://www.canariesinacoalmine.com/countdown.php>.

The pop group of the same name have nothing to do with our subject, but you might enjoy their music.

Now, at last, we come to the issue I would like to focus on, that is the title of this article, the Ofcom statements that:

"Evaluating the complaints received and the evidence so far obtained, Ofcom has concluded that there does not at present appear to be significant public harm arising from this situation."

They are clearly tying compliance with the Essential Requirements of the EMC Directive to the number of complaints received and some kind of public harm issue. They are forced to rely on this extremely dubious approach, because any test lab that tests Greedy PLT products shows that they are always at least 30dB above the CISPR limits, and Ofcom have been provided with such tests results even if they have never tested PLT themselves.

The test itself takes about an hour and any EMC test lab can do it and provide a report for under £400. Tim Williams did it himself, and described his results in detail in [5]. They correspond very closely with the full-compliance laboratory test results that the RSGB have provided to Ofcom, and others have provided to Trading Standards.

dB can be a tricky concept, so to get things in perspective I'll just point out that having emissions 30dB above the CISPR limit is the equivalent of plugging *at least* 1,000 barely-EMC-legal products into the same mains socket, and all operating them all at the same time. (Some experts argue it is equivalent to 100,000 barely-legal products.)

However, to return to the title and main focus of this article: a low level of complaints *is not* evidence of compliance, for several very good reasons, many of which are sufficient to give the lie to this approach entirely on their own:

- a) The EMC Directive's Essential Requirements (quoted earlier) are clearly concerned with the *ability* of a product's emissions to interfere with radio receivers (etc.). They are not concerned with whether a product actually does interfere and cause complaints, but with whether it *could*.

So having a low number of complaints of interference *cannot be used as an argument* for compliance with the EMC Directive. (And Ofcom's comment about 'public harm' has nothing at all to do with any concepts of legal EMC compliance.)

- b) The claim that a low level of complaints means that a product must therefore be compliant with the EMC Directive, is based on the well-worn fallacy that where there is no evidence of a problem, there must therefore be no problem.

This common but mistaken belief was explored in some detail in my article "*Absence of proof is not proof of absence*" [6], which pointed out that William Cowper had seen through this false logic about 200 years ago.

Whenever you hear someone using this sort of an argument, it means one of two things:

- either they are insufficiently educated to understand the logical fallacy in what they are saying; or,
- they know very well what they are saying – but assume that you won't catch them out (which is rather insulting).

The latter usage – where they are trying to put one over on you – is very popular with politicians, and with less-than-safety-conscious manufacturers trying to defend product liability lawsuits by fair means or foul. I believe that Ofcom personnel are well-educated, so assume they are using such a discredited argument because someone has told them what to say.

- c) Modern digital technologies do not reveal interference like their analogue forbears did, leading to under-reporting of interference cases.

In the 'old days' of analogue, interference was obvious as noise or distortion, and one could easily distinguish between, for example, motor car ignition, hair-driers and other receiver's local oscillators. But these days our digital radio and television either give a good sound and picture, or they give nothing at all. So when they are interfered with, the user assumes they are broken and takes them back to the shop for repair or replacement.

This is exactly what caused the demise of ITV Digital in 2002, with a financial loss of about £600 million and loss of 1700 jobs. The Government had only permitted them to transmit with a weak signal, so interference was a big problem. Being digital products, many customers received no picture at all and simply assumed their sets were broken.

All our media have already gone, or are rapidly going, digital, so complaints of interference will be replaced by products being returned under warranty. Of course, when the returned sets are tested back at the factory they are found to be working perfectly. Replacing the product with a new one will probably result in the same problem occurring again and again with each customer.

Dealing with no-fault warranty returns represents a large cost on UK manufacturers and agents for overseas companies. But I suppose the bright side is that there will be lots of extra business for repair shops, for out-of-warranty products. Unfortunately they will never be able to fix the 'fault' in the product.

I wonder if Intellect (<http://www.intellectuk.org/>) are lobbying Ofcom to protect their manufacturing members from this unjustifiable cost to their businesses? They should be!

For digital communications, like Ethernet and xDSL (used to carry broadband Internet over telephone wires) the effect of interference is to slow the data rate. Many's the office Ethernet system that goes slow due to interference – which could simply be due to an Ethernet cable in a ceiling void being routed too close to a fluorescent light fitting – but because the digital protocols hide the interference from the system's users, their typical response is to assume some large software task is being carried out, or "there must be a lot of people logged on".

- d) [7] makes certain assumptions about how many people can be bothered to make an official complaint. British people are not great complainers, preferring to grumble to try to get sympathy, rather than remove the reasons for the complaint.

Along these lines, I am reliably informed that, some years ago, the new Labour Government in the UK wanted to decrease the number of complaints of radio interference. They achieved this by removing the interference complaint forms from Post Offices and making them only available by download from a website (as now), and requiring them to be accompanied by a fee, which might be refundable if the complaint was found to be justified.

These measures immediately reduced the rate of interference complaints to one-tenth of their previous levels. I leave it to the reader to decide whether the effect of the measures was to cause some actual interference problems to fail to be brought to official attention.

- e) Issue 83 of the EMC Journal carried a Banana Skins column, as usual. This one was unusual in that it was dedicated to a report by Pete Alsop, an Ofcom Senior Field Engineer. He's one of the guys that goes out to find out the truth, and fix, complaints of interference, and he and his colleagues have an enviable record of success.

Pete had responded to a request of mine to Ofcom to show what technologies were causing the most complaints of interference, and here are the top three offenders for the whole of the UK for the period January 2007 to May 2009, a period of 31 months:

Lighting Systems 252 complaints
Thermostats 223 complaints
Aerial Amplifiers 197 complaints

Pete pointed out that, generally speaking, their work results from devices that have been incorrectly installed and/or have developed a fault of some description, not as a result of being poorly designed with regards to EMC.

If we consider lighting systems, there must be about as many as there are people living in the UK – about 60 million. Many of these lighting installations will be over a decade old, so it is hardly surprising that age, damage, faults, etc., could make this technology the worst case for causing interference, with 252 complaints over the surveyed period of 31 months, an average rate of about 8 complaints/month, or 0.13 complaints per month per million installed systems.

At the time of writing that column, the Ofcom PLT webpage said there were 81 complaints of interference due to PLT. Ofcom have stated that there were no complaints about PLT before August 2008, when a magazine carried an article about it.

All of the 81 complaints about PLT had arrived over a period of about 10 months, an average rate of about 8 complaints/month – just as bad as the worst-case offender, lighting systems. However, at that time only 423,000 BT Vision products had been purchased, and if we ignore that at the start of the period there were far fewer products sold, and if we assume that all BT Vision customer use their PLT units (which they don't), we get 18.9 complaints per month per million Greedy PLT products installed. (The real figure will be significantly higher.)

So we can say that the rate of complaints from Greedy PLT is already running *at least at 145 times the rate* of Ofcom's worst-case interferer, lighting systems.

The reason for this very high rate, is that the interference complaints about PLT are all caused by its *intentionally-designed high levels of mains emissions*, not due to age, damage, faults, bad installation, etc., the causes of the vast majority of the complaints about all other technologies. (PLT

units are almost impossible to install incorrectly, you just plug them into the mains socket and plug the Ethernet cable into them.)

The September PLT Update from Ofcom now says that the total number of complaints is 143. This represents an average rate of 11 complaints/month, showing that the rate of complaints is increasing. I understand that it is actually running at 14 complaints per month at the time of writing, making Greedy PLT the technology that is causing the worst interference over the whole UK.

If we assume that all Ofcom complaint rates stay constant – which they won't because the number of PLT products in use is increasing rapidly – PLT complaints would top Ofcom's all-time list of complained-about technologies in about 18 months. Will Ofcom then still be claiming that the level of complaints indicates there is not a problem?

BT Vision's marketing goal is to sell 3 million of their products by 2010. Reaching this marketing goal implies a complaint rate of over 57 per month. And if everyone in the UK used a Greedy PLT, like everyone uses a lighting system, the Ofcom complaint rate would be around 1,140 per month. But by then the issue would have had so much national media exposure that complaint rates would probably be 10 times higher than these estimates, if not more.

- f) How many complaints would it take Ofcom to say that Greedy PLT was non-compliant?

This is not specified anywhere in the September Ofcom PLT Update, making its statements rather obviously based upon political obfuscation than legal or technical definitions.

- g) Richard Marshall's excellent article [7] used careful reasoning to show that the number of complaints received by Ofcom (at the time he was writing) were consistent with Greedy PLT actually being a 100% reliable *interferer* and therefore non-compliant with the EMC Directive.

He based his argument solely on calculating the likelihood that a Radio Amateur or Short-Wave Listener would find themselves within 150 metres of one of the 423,000 owners of a BT Vision product (which bundled a Greedy PLT unit solely to avoid customers having to run unsightly Ethernet cables from their computer to their TV).

So Ofcom's figures for the number of complaints do not show that Greedy PLT is compliant, as they claim, but exactly the opposite!

Ofcom's complaint figures actually indicate that Greedy PLT products are 100% reliable interferers, or 'jammers' as such technologies are sometimes called.

To sum up, a (claimed) low level of complaints of interference from Greedy PLT products, cannot justifiably be used to claim that such products comply with the EMC Directive.

The conclusions of the September Ofcom PLT update are therefore completely incorrect.

- [1] Keith Armstrong, “*The EMCIA’s position on PLT*”, The EMC Journal, Edition 83, July 2009, pages 19-21, www.theemcjournal.com
- [2] EMC Directive, http://eur-lex.europa.eu/LexUriServ/site/en/oj/2004/l_390/l_39020041231en00240037.pdf
- [3] Richard Marshall, “*Headroom for PLT: is it necessary? (Signal/Noise ratio considerations for PLT)*”, The EMC Journal, Issue 81, March 2009, pages 30-31, <http://www.compliance-club.com/PLT/Richard%20Marshall%20EMCJ%20Issue%2081.pdf>
- [4] See the Editorial: “*Call it what you like...it still interferes with the Radio Spectrum*”, The EMC Journal, Issue 83, July 2009, page 5, www.theemcjournal.com, and the UK Government’s Digital Britain site: http://www.culture.gov.uk/what_we_do/broadcasting/5631.aspx/

- [5] Tim Williams, “*RF Emissions of Powerline Ethernet adaptors*”, The EMC Journal, Edition 82, May 2009, pages 15-18, <http://www.compliance-club.com/PLT/Tim%20Williams%20EMCJ%20Issue%2082.pdf>
- [6] Keith Armstrong, “*Absence of proof is not proof of absence*”, EMC Journal, Issue 78, September 2008, pages 16-19, www.compliance-club.com/pdf/Issue78.PDF
- [7] Richard Marshall, “*BT Vision; the radio interference iceberg*”, The EMC Journal, Issue 83, July 2009, pages 22-24, www.theemcjournal.com

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