



EMC Standards Activities

Don Heirman, Associate Editor

What is the EMC Society Doing in BPL Standardization?

BPL stands for Broadband over Power Line. For those of you that have not been following the trade journals, there is a tremendous amount of interest in getting access to the Internet everywhere, as we do now with our mobile phones. Who would not want that? And what if that could be done by simply plugging your PC into the AC power outlet? As appealing as the prospect may be, what will ensure that all of these interconnections are interoperable and do not create EMC problems? If this happens, then the customer can then focus on subscribing to this Internet service based solely on features, quality, and price.

Well, enter the “rules”—standardization and our EMC Society involvement. As we have done in the past in this column, we have invited one of our standards developers to write an article on a standards subject of much interest. With this as a backdrop, we asked Ed Hare of the ARRL, the National Association for Amateur Radio, Secretary to the EMC Society Standards Development Committee, and active participant on this topic, to write this article on how the IEEE and our EMC Society are working the standardization side of this new technology. Our EMC Society concerns of course focus on EMC, as you will see in Ed’s comments below. As is always the case with guest authors, any opinions expressed by the author are those of the author, and they do not necessarily represent the views of the EMC Society.

Broadband over Power Line (BPL): EMC Standards Participation

*By Ed Hare, ARRL
Discipline Convergence*

Within the IEEE, industry standards are developed under the supervision of sponsoring IEEE Societies. Years ago, the scientific disciplines governing each standard generally were a good match for the oversight of one Society. EMC standards were best developed with the guidance of the EMC Society; standards relating to power lines were developed under the Power Engineering Society and standards governing the ways that computers communicated with each other were best developed with the help of Computer Society or the Communications Society.

The word “convergence” is often tossed about as a buzzword. It does, however, describe a very real phenomenon: modern technology is blurring the lines of what were once seen as independent disciplines. The lines between cable television and telephone service are no longer sharp. Software-Defined Radio has made radio communications and software less distinguishable.

Convergence is also being seen in the development of standards. As the merging of disciplines has technology drawing on

more than one discipline for its technical success, the development of IEEE standards may require the oversight of more than one Society.

The formation of the Study Group and Working Groups that are developing BPL standards also had to draw upon the principles of convergence, ultimately involving multiple Societies in a variety of ways. This short article describes some of the successes and bumps along that route, not to be looking backwards, but to be forward looking at the best ways to form standards groups under the guidance of multiple Societies for the future.

BPL and EMC

Broadband over Power Lines (BPL) is a technology that uses distribution and in-premise power lines to communicate broadband signals between computers. The development of an EMC standard that encompasses EMC, power distribution and computer communications technology could not be easily developed under any single IEEE Society.

In hindsight, having the EMC Society, the Power Engineering Society and the Communications Society jointly oversee the development of BPL EMC standards may seem to be an obvious choice, but getting to that end result, and the mechanisms developed to govern the interaction of the three Societies has sometimes been a challenge. Standards developed under the guidance of two Societies are not uncommon, but the interaction of three Societies with sometimes significantly different perspectives required the creation of new, still unproven, ways of permitting each Society to execute its oversight without unnecessarily limiting the ability of a multi-discipline Working Group (WG) to freely develop a standard.

History

Using power lines to conduct signals is a relatively mature technology. Until the 2000s, however, this was generally done with relatively low speed, low bandwidth signals. In the US, FCC Part 15 regulations governing “Power Line Carrier” (PLC) limits PLC technology to the exclusive use of electric utility companies at relatively high power levels using frequencies below 490 kHz. In some cases, this is rather simple: the presence or absence of a carrier on a particular frequency is used to trigger a relay, for example.

Under the regulations of most nations, unlicensed emitters of noise are allowed to exist, subject to certain limits on conducted and/or radiated emissions. The use of power lines to conduct signals has been permitted under the regulations of most countries. In the US, for example, there is a section of the FCC’s CFR 47 Part 15 rules that govern “carrier current” devices. (The term “carrier current” describes technology that intentionally conducts signals on power lines.) Under the carrier-current rules, carrier-current devices are not governed by conducted

emissions limits, but must meet the radiated emissions limits for intentional emitters.

As the concept of sending high-speed signals over power lines was extended to the distribution system that sends power throughout the service area of an electric utility company, questions about electromagnetic compatibility of such physically large broadband emitters with radio communications were raised not only in the US but also in Europe and Japan. In the US, the FCC initiated a rulemaking proceeding to examine what changes needed to be made in the rules. At the same time, the IEEE Standards Association expressed some interest in determining what IEEE standards could be used to foster the development of the nascent BPL industry.

The First Meeting

Under the leadership of Jim Carlo, then the President of the IEEE Standards Association, a call for interest was issued, and a meeting was convened on 7 June 2004, in Denver, Colorado. Over 70 interested people attended, including representatives from the BPL industry, the power industry and those with radio communications interests. A series of presentations of various stakeholders outlined the technology and what standards were needed to both control and foster BPL technology.

A report from Robert Powers, one of the attendees, posted at <http://tinyurl.com/5k6qy6>, summarized the EMC issues:

“There was general agreement, of course, that solving the interference problem is a *sine qua non* for BPL - BPL won't exist/survive unless that fundamental problem is solved and standardized soon. Other critical issues for the future of BPL include construction/safety standards, and reliability issues.”

Working Groups Formed

At this meeting, a BPL Study Group (SG) was formed, with the intent of determining what standards could and should be developed under the oversight of the IEEE. The first meeting of the SG took place at the IEEE Headquarters on 20 July 2004.

After several meetings, the SG created three Working Groups (WGs). One would develop the standards governing protocols and the physical layer of the technology. This WG (given the designated number P1901 when the IEEE Project Authorization Request (PAR) was approved) is comprised of entities and will be balloted under the entity-ballot rules of the IEEE (Note: “Entities” are companies that participate with one vote for each company as opposed to the “individual” ballot rules where the balloting group is comprised of individuals). Another WG, P1675, was formed to create a standard on installation practices and safety. (The standard for this is now in recirculation ballot, after a successful ballot with technical comments.) The SG also formed a WG to create an EMC standard, P1775. (“P” stands for “project”. When the standard is published, the “P” is removed.)

P1775 and the EMC Society

As its PAR was being developed, the P1775 WG met several times. During this process, its participants determined what EMC standard(s) may be needed and what their scope and content generally should be. The process, however, soon hit a

bump. Although one participant had been insistent that an EMC standard needed the strong participation of the EMC Society, the PAR was written to include only the Power Engineering Society as sponsor. The rationale as discussed in one of the public meetings was that this was a standard for the BPL industry and that enough members of the WG were EMC Society members, and that if the WG needed any EMC help, it could call on the EMC Society.

After some rather complex negotiation between the EMC Society, the Communications Society and the IEEE, PES remained as the sponsor of the EMC standard, but the EMC Society was added as a cosponsor with its own Stephen Berger as vice chair (Stephen is chairman of the EMC Society Standards Development Committee - SDCOM). The P1775 WG chair is Aron Viner, a member of the Power Engineering and EMC Societies. Looking forward, as multi-Society groups are formed in the future, the questions of multiple sponsorship should be resolved before a PAR is submitted to the IEEE New Standards Committee of the IEEE Standards Association Standards Board.

The P1775 Standard

The P1775 standard is still being drafted. Its PAR covers two major areas: EMC Criteria (rules for judging if compatibility is achieved) and T&M procedures (immunity test methods/levels and emissions test methods). The PAR generally explains what the WG initially set out to accomplish:

“13. Scope of Proposed Project (P1775): The scope of this standard will be electromagnetic compatibility (EMC) criteria, and consensus test and measurements procedure for Broadband Power Line Communication (also known as BPL) equipment and installations. The standard will reference existing national and international standards for BPL equipment and installations. It will not include the specific emission limits, which are subject to national regulations.”

“14. Purpose of Proposed Project: By providing test and measurement guidance as well as EMC criteria, this proposed EMC standard will serve as a bridge between national spectrum regulations, power utility practice and other interested party concerns. It will also clearly identify the basic definitions of the applicable EMC parameters for BPL equipment and installations as well as measurements conditions and settings.

“15. Reason for the Proposed Project: The proposed standard is a part of a planned IEEE series of BPL standards which will cover major aspects of broadband powerline communication technology: safety, EMC, media, coexistence, interoperability and education. BPL technology has the potential for both enhanced communications capabilities and increased emissions. Owing to an absence of widely accepted EMC criteria and test methods, the industry - investors, BPL equipment manufacturers, electric utilities and ISP providers - are reluctant to move forward. The proposed project will address the most critical issue impeding the deployment of BPL technology. The resulting EMC standard will increase the level of confidence between interested parties. It will also be instrumental in guiding the design and maintenance of EMC characteristics for BPL equipment and installations.”
(Note: The author for emphasis added the underlining above.)

There is little controversy between the P1775 stakeholders that the immunity portion of the document fully addresses

immunity concerns. The test methods are based on IEC standards in the 61000-4-X series, with test levels and immunity limits chosen to represent typical levels from those standards. Utilities and BPL manufacturers have various immunity environments from which to choose the test level appropriate for ensuring adequate levels of service.

The emissions portion of the document addresses only test methods. There is some disagreement among the P1775 participants as to whether this portion of the document fully addresses the clauses in the PAR that stipulate that "Compatibility Criteria" must be included (instead of emissions limits). Some stakeholders believe that the lack of criteria defining the compatibility of BPL systems with other technologies will thwart the stated goals of building bridges and increasing the level of confidence. There is still movement to introduce a Compatibility Criteria section in the P1775 draft, but this issue has not been resolved to date. Another concern, expressed by one stakeholder, is that the test methodology for emissions draws too heavily on the US FCC regulations.

Aron Viner, the WG Chair, has reached out to the EMC Society. He gave a presentation to interested members of the EMC Society Standards Development Committee (SDCom) at its 2007 meeting in Portland, Oregon to show the progress of the standard and how EMC is being addressed. The SDCom was fully informed and had the chance to ask detailed questions.

Ready for Ballot?

In the fall of 2007, the WG voted that its work was complete and that the standard was ready for ballot. In a standard that is sponsored by a single Society, the draft would normally be sent to that Society's SDCom (or equivalent). Through its SDCom, the Society would determine whether the standard was ready for ballot, or whether it should go back to the WG for more work.

For a standard with three sponsoring Societies, however, it is not necessarily that simple. It could be argued that the most logical step would be to have each Society follow its normal procedures to approve sending the standard to sponsor ballot. When all three Societies approved sending it to ballot, if this method were used, it would go to ballot. A number of issues were raised by the WG. What would happen to the draft if two of the Societies agreed that the standard was ready for ballot, but the third did not? Would two of three Societies be sufficient? This could put a Society into the position of being a sponsor of a standard it did not approve.

A number of proposals were discussed between the three Societies. One was to have each Society approve the standard, in its usual way. Another was to form a panel comprised of representatives from each Society. The latter was the general agreement between the Societies, but, as always, the devil is in the details. What voting standard would govern this group? Would a simple majority be required? Would a consensus of 75%, the same consensus applied to other IEEE sponsor ballots, suffice? Another proposal was that a majority would be sufficient, as long as at least one member from each Society voted to move the standard to sponsor ballot. The WG felt strongly, however, that no one Society should be able to block the standard going to ballot, so, after significant negotiation the three Societies agreed that a panel of 12 would be formed, comprised of four members from each Society. A 60% consensus of this group



Broadband over Power Lines (BPL) technology uses distribution and in-premise power lines to communicate broadband signals between computers. Will you soon be able to access the Internet by simply plugging your PC into an AC power outlet?

would move the standard to sponsor ballot. This still left the situation where four members of one Society voting against going to ballot would not hold sway if the other eight members voted to go to ballot as that was a two-thirds approval which is obviously more than the 60 percent requirement. It did, however, show that each member's vote is necessary for a decision.

In the fall of 2007, the draft was sent to this group, fondly called the "12 wise men" informally by a number of participants (although they weren't all men). Unfortunately, one of the EMC Society representatives on this group had passed away before the vote, so the EMC Society found and approved a replacement. Equally unfortunately, one of the group did not respond to the email vote conducted by the IEEE. It turned out that neither event affected the outcome, but the problems that surfaced indicated that if this process were used in the future, some refinement of the procedures governing the voting of the panel would be needed.

However, in this instance, the panel voted that the standard was not ready for ballot and the draft was sent back to the working group. The reasons ranged from technical to editorial. One member of the panel identified over 200 problems, most of which were obvious editorial issues. Other members voted to send the standard to ballot with no comments whatsoever.

Back to the Working Group

The standard was sent back to the WG. The Chair appointed a Task Group (TG4) to respond to the comments received from the panel and to make any necessary changes to the document. Although one of the members of TG4 was also one of the Com-Soc representatives on the panel, the Chair decided that no one involved in the voting should participate in resolving his or her own comments, so no other members of the panel were included.

Virtually all of the editorial comments received from the panel were deemed necessary and were accepted and included in the revision to the standard. Errors in the figures were corrected. Some of the technical comments were accepted and incorporated; in other cases, they were not, generally because the WG had already addressed that point by a WG vote and made a majority decision on that technical issue.

On 25 March 2008, P1775 met in Boxboro, Massachusetts to consider the changes to the document and to craft a response to the members of the panel who had submitted comments. The WG voted to accept most of the changes drafted by TG4. It also identified a number of additional errors and problems in the draft, including the addition and subtraction of definitions. The WG Chair tasked TG4 to now make needed editorial changes to the document, ranging from correcting wording inconsistencies, to correcting clause-numbering issues.

At this point, two new members were added to TG4, including one of the EMC Society representatives from the panel of 12.

P1775 is expected to meet again in June 2008. At this point, it expects to consider the addition of an EMC Criteria section and finalize the changes to the document and once again send the draft to the sponsors for approval to send it to sponsor ballot.

Hindsight

Most of the bumps along the road have been resolved, but the process of approving draft standards with multiple sponsors as being ready for ballot still needs to be closely examined. Problems such as the replacement of representatives and how to handle non voters can be easily resolved, but when one considers that some of the 12 people voted to send this standard to ballot without comment, even though the WG later determined that over 100 editorial changes were needed, this strongly suggests that the more eyes that look at a draft, the better.

The process of having the entire SDCOM of sponsoring Societies approve standards as being ready for ballot brings a lot of eyes to focus on the draft. At each of our Society's SDCOM meetings, the members were continually kept informed on these developments and gave advice to our four members of the review committee. This then gave more "eyes" to bear.

Foresight

The issues as to whether the P1775 standard properly addresses the EMC discipline will be determined at sponsor ballot. EMC Society members are encouraged to ballot on any IEEE standard that falls into their areas of interest. (The easiest way to do this is to join the Standards Association and selecting specific interest areas in the user profile area of the SA website. The IEEE will then send notices of standards ready for ballot in those

interest areas.) Like any other standard that goes for sponsor ballot, any issues still open in P1775 will be resolved through sponsor ballot.

More importantly, the process of involving multiple Societies is forging new ground. The SA has Standards Coordinating Committees (SCCs) to also accommodate this work. But this is now another level of development and leadership, which has to match the needs of the Societies. In this instance, having three Societies working directly was chosen. But by looking at the successes and rough spots in what was negotiated to involve these three Societies in the creation of P1775, we hope this article will help the EMC Society and other Societies refine the process of integrating multiple Societies in future Standards activities.

Comment from the Associate Editor: As you can see, the EMC Society is quite involved in the work on this exciting new technology and is looking at EMC aspects to allow it to work as intended in the electromagnetic environment where it is installed. If you go to the proceedings of the annual EMC Society symposium via IEEE Xplore, you will be able to search on "BPL" or "PLT" to find out more on the subject.

Biography:



Ed Hare is shown in the car he equipped with test equipment and an HF transceiver to assess the compatibility of BPL in various trial areas.

Ed Hare is employed by ARRL, the National Association for Amateur Radio. ARRL represents the radiocommunications and EMC interests of the licensed Amateur Radio Service. He is a member of the IEEE EMC Society and the Standards Association. He is active in a number of standards committees. As a member of the P1775 BPL EMC standards working group, he is offering an inside view of the progress of the standard. Among other participation in the standards arena, he also serves on the EMC Society Standards Development Committee as Secretary and on the American National Standards Institute (ANSI) Accredited Standards Committee (ASC) C63® EMC committee, as the ARRL primary representative and as the Chairman of Subcommittee 5, Immunity. As an aside, his Amateur call sign is W1RFI, an interesting choice for someone involved in EMC. He may be contacted via e-mail at w1rfi@arrl.org.

EMC

Measurement of Radio-Noise Emissions (ANSI C63.4) and Introduction to Measurement Uncertainty Workshops

August 15-16, 2008

Detroit, Michigan

Detroit Marriott Hotel at the Renaissance Center

There will be two special workshops held just prior to the 2008 IEEE International Symposium on EMC in Detroit, Michigan. The ANSI C63.4 workshop will take place on August 15 (full day) and August 16 (morning). The Introduction to Measurement Uncertainty workshop will take place the afternoon of August 16. Those responsible for determining compliance with FCC Rules and Regulations (and CISPR 22) of their own or their

client's products will find the ANSI C63.4 workshop invaluable. The measurement uncertainty workshop will review the work contained in the draft ANSI C63.23 on the subject, currently under development. Expert instructors include Don Heirman (Don HEIRMAN Consultants) and Bill Hurst (Federal Communications Commission), among others.

For more information and to register, visit www.emc2008.org and click on the "ANSI C63 Workshop" – Note early registration ends June 20!

Questions? Contact Janet O'Neil, workshop registrar, at 425-868-2558 or j.n.oneil@ieee.org.