

# ARRL EMC Committee Semi-Annual Report

Doc. # 20

**For The  
American Radio  
Relay League**

**Board of Directors Meeting  
July 19-20, 2013**

**Submitted By  
Kermit Carlson, W9XA  
Chairman, ARRL EMC Committee**

## **Mission Statement:**

The EMC Committee monitors developments in the Electromagnetic Compatibility (EMC) field and assesses their impact on the Amateur Radio Service. The Committee informs the ARRL Board of Directors about these activities and makes policy recommendations for further action, if appropriate.

The overall goals of the committee are:

- Advise the ARRL Board about issues related to radio-frequency interference
- Advise the ARRL HQ staff on the content of its publications
- Make recommendations to the ARRL Board and HQ staff
- Maintain contact with other organizations involved in EMC matters through established liaison individuals

## **Members of the Committee:**

- Mr. Kermit Carlson, W9XA, ARRL Central Division Vice Director, EMC Committee Chairman
- Mr. Phil Barsky, K3EW, Engineering/Management Consultant, retired
- Mr. Gordon Beattie, W2TTT, Principal Technical Architect, AT&T Enterprise IT Service Assurance
- Mr. Jody Boucher, WA1ZBL, RFI troubleshooter, Northeast Utilities
- Mr. Brian Cramer, PE, W9RFI, Electrical Interference Solutions, Inc.
- Mr. Mike Gruber, W1MG, ARRL Lab RFI Engineer, HQ Staff Liaison
- Mr. Ed Hare, W1RFI, ARRL Laboratory Manager
- Mr. Ron Hranac, N0IVN, Technical Leader, Cisco Systems; past member of the Board of Directors, Society of Cable Telecommunications Engineers
- Mr. Richard D. Illman, AH6EZ Senior Engineer, Motorola Solutions
- Mr. Steve Jackson, KZ1X, VDSL and wireless communications
- Mr. John M. Krumenacker, KB3PJO Design Engineer

- Dr. Ron McConnell, W2IOL, T1E1.4 VDSL Standards Committee
- Mr. Jerry Ramie, KI6LGY, ARC Technical Resources, Inc.
- Mr. Cortland Richmond, KA5S, EMC Engineer
- Mr. Mark Steffka, WW8MS, Automotive EMC engineer
- Dr. Steve Strauss, NY3B, Home Phone Networking Alliance Technical Committee

### **Committee Membership**

On behalf of the EMC Committee and myself, I wish to extend a warm welcome to our newest member, Phil Barsky, K3EW. As a retired System/Project Engineering Management Consultant, Phil brings a wide range of professional experience to the EMC field with particular emphasis in Interference/ Spectrum Engineering and EMI EMC Engineering. Phil's consulting career also includes power line noise and interference abatement at XM Satellite Radio. Welcome Phil.

### **Recent EMC Committee Activity and Discussion:**

The EMC Committee held one Webinar and Telephone Conference during the first half of this year. Held on January 22, the topic of discussion was an analysis of the compatibility of 135.7-137.8 kHz Amateur Radio communications and power-line control systems. The resulting whitepaper concluded that there is a significant potential for compatible sharing of the same spectrum between the PLC, which communicates through signals conducted by power transmission lines, and licensed radio transmitters which use signals radiated over the air. This document was produced for the ARRL CEO, ARRL Board and ARRL General Counsel. It was used in their response to the twelve points in FCC's ET Docket 12-338. The complete whitepaper is included as Appendix A.

### **HQ Staff:**

The role of the ARRL HQ staff consists of the following:

- Answer individual inquiries from hams (and sometimes their neighbors) about RFI problems
- Write and publish articles about RFI
- Write and publish the ARRL RFI Book
- Design and update ARRL's RFI web pages
- Maintain a database at ARRL to facilitate EMC case tracking and reporting
- Work with ARRL's D.C. office on various spectrum and RFI-related filings
- Maintain contact with industry
- Participate in standards and industry groups, as a voting member or as a liaison. This includes ANSI accredited C63<sup>®</sup>, Society of Automotive Engineers EMC and EMR committees, Home Phone Networking Alliance, VDSL, HomePlug, FCC and individual companies.

Mr. Gruber handles the majority of the staff work on EMC matters. In the 1st half of 2013, he also continued with work in a number of key areas:

- Adding updates and revisions to the ARRL RFI Web pages. One addition of note is a new page on grow light RFI. Grow light interference reports are increasing, and as the page indicates, can be particularly difficult to resolve. Here is the URL to that page: [www.arrl.org/grow-light-rfi](http://www.arrl.org/grow-light-rfi)
- Facilitating and providing assistance on resolving long standing power line noise cases with the FCC.
  - Of particular note is a case near Pittsburgh, PA. Although the original case was closed after some repairs were made to noises found during an FCC and ARRL Field Investigation, the noise remains ongoing. An extended period of time after the repairs created enough uncertainty in the remaining noise that it was decided to give the utility an opportunity to address what might be potentially new issues. At this point, the case remains ongoing.
- Testing the conducted emissions of suspect consumer electronic and electrical devices. Devices that exceed FCC specified absolute limits can be identified and reported to the FCC. Of particular concern are:
  - LED Part 15 Bulbs, which may meet Part 15 limits, but if at or near the limits, could present an RFI problem without a practical solution, especially if there are many bulbs that are contributing to the problem. As an example, a device at FCC limits could be in the range of several homes in a typical suburban environment. When considering bulbs, a conservative estimate might be 50 bulbs per household, thus putting 150 or more bulbs within range of an Amateur station with just two neighboring homes.
  - Non-consumer Part 18 electronic ballasts being marketed and sold for consumer and residential purposes.
  - Variable speed pulsed DC motors now appearing in such things as washing machines, HVAC systems and pool pumps. Furnaces and air conditioners seem to be particularly problematic.
  - Large grow lighting devices used for indoor gardening are particularly problematic in some parts of the country, especially California and Colorado. These devices can be heard at much greater distances than would normally be expected from a device that meets the FCC Part 15 or 18 limits. One light that we looked at, for example, was considerably over the limit.
- Working with AT&T engineering staff to help resolve RFI issues with U-Verse systems.
- Reviewing proposed EMC related material for ARRL publications, including the RFI Chapter in the 2014 ARRL Handbook.

## **Summary of Recent and Ongoing Lab Activities**

### Lighting Devices

As previously reported, Mr. Gruber prepared and added a grow light RFI page to the ARRL Web site. Pertaining to energy saving Part 15 & Part 18 Lighting Devices, Mr. Gruber also reports that he completed testing of one additional Part 15 bulb for conducted emissions. This raises the total number of bulbs tested to 40. The selection of bulbs now includes:

- 31 LED bulbs from a variety of retail outlets, Dayton and eBay sources.  
Note: One LED bulb marked Part 18.
- 2 red LED (used) traffic lights purchased at Dayton.
- 7 CFL bulbs in various configurations, including floodlights. These bulbs are similar in configuration to the Part 15 LED bulbs that were selected for this testing.

Mr. Gruber adds that LED bulbs operate under Part 15, while CFL's and electronic fluorescent light ballasts typically Part 18. In this case, there is an important distinction between these two rules - *Part 18 limits for consumer RF lighting device lower than applicable Part 15 limits*. As a consequence, the ARRL Board has previously asked us to look at proposal to reduce Part 15 limits to Part 18 levels for lighting devices.

The results and data from this testing help provide us with a better understanding of interference potential from LED and CFL bulbs as they currently exist. It was also used by Mr. Gruber to write an upcoming QST article. At the time of this report, it is scheduled for the September 2013 issue.

The analysis suggests that they substantially meet the applicable Part 15 or Part 18 limits in the Amateur spectrum. Those that failed primarily did so below 500 kHz. The measured emissions in most cases, however, were within our measurement tolerance. Although this might suggest a greater potential for interference to the two new proposed Amateur bands below 500 kHz, it is important to note that in all cases the limits high enough to create interference issues. Mr. Gruber emphasizes that even if an LED bulb is near the Part 15 limit, it can still be legally be sold and marketed in the United States. If and when interference occurs, the burden then falls on operator to correct problem. While this rule may work on a case-by-case basis for a small or limited number of sources, it is not practical should many bulbs in several houses be contributing to a wide spread problem.

In addition, according to the FINAL REPORT ON THE 4TH JOINT CROSS-BORDER EMC MARKET SURVEILLANCE CAMPAIGN (2011), a study that they did on LED Lighting products in Europe found that:

- There was rather low compliance with the emissions limits: 61.5% of the tested, one hundred and sixty-six (166) products were found to be compliant.
- An additional study on harmonic current emissions was carried out. When applying the same harmonic limits as those for compact fluorescent lamps, one out of two samples, 46% of the assessed LED lighting equipment failed.

A complete copy of this report is included as Appendix B in the report, or on-line at:

[http://ec.europa.eu/enterprise/sectors/electrical/files/emc/ms-campaign-fourth\\_en.pdf](http://ec.europa.eu/enterprise/sectors/electrical/files/emc/ms-campaign-fourth_en.pdf)

### **Arc Fault Current Interrupter AFCI Breaker Immunity Issues**

Mr. Gruber report that several months ago, he started receiving a few reports of “tripping breakers” from hams. Specifically, these complaints concerned AFCI breakers, or Arc Fault Circuit Interrupter type breakers. These breakers are designed to trip if they sense an arc, and are now required by the electrical code in some specified rooms for residential wiring.

In response to these complaints, Mr. Gruber with invaluable help from WIAW Station Manager Joe Carcia built a “universal” circuit breaker test fixture. Mr. Gruber purchased every AFCI breaker that he could find at local electrical supply centers and big box home supply stores. Most of the complaints that he received seem to have involved breakers made by Eaton, which is a Cutler Hammer company, a well known manufacturer of electrical equipment. As a result, he purchased both a 15 and 20 Amp Eaton AFCI breaker for these tests.

The initial results of this testing indicated that the AFCI breakers were surprisingly robust. They were operated them in the basement of WIAW during code practice sessions. They were simply not tripping, even with multiple transmitters all operating simultaneously at 1,000+ watts. Even the suspect Eaton breakers, which he purchased at Home Depot, were not tripping.

Puzzled, Mr. Gruber then asked a complainant if he could send a sample or two of the problematic breakers. Shortly thereafter, he received two samples and tested them at WIAW. The initial tests indicated that there was indeed a problem. At somewhere between 25 and 50 watts, they would trip. Interestingly enough, these breakers were smaller than the ones that he had purchased and had a yellow (as opposed to a white) reset button. The part numbers were also very similar and the breakers were clearly meant to be interchangeable.

Mr. Gruber’s best understanding of the problem at this point is that Eaton has redesigned their AFCI breaker, possible adding some new microprocessing circuitry. The older breakers were still on the shelf at Home Depot, and the newer model was used at the complainant’s residence and neighborhood. Based on his testing so far, the AFCI problem is primarily linked to one manufacturer (Eaton), and more specifically, only the latest model of Eaton breaker. It is not quite the universal problem that some seem to fear. However, with today’s cookie-cutter sub developments, this could become particularly problematic for a ham. High density housing where every service entrance panel is filled with Eaton breakers is an obvious recipe for disaster. Mr. Gruber will continue working with Eaton to find a solution to this problem.

## Status on FCC Enforcement and Outstanding EMC Cases

Mr. Gruber reports that the FCC has been sending letters to utilities (and consumers) with some regularity. Although meaningful enforcement beyond that has historically been very disappointing, a notable exception occurred on April 23<sup>rd</sup> of this year. The FCC's Tampa Field Office issued a *Citation and Order* Ruben D. Lopez Jr of Pomona Park, Florida. This *Citation* was in response to interference complaints to Amateur Radio from an irrigation well pump at Lopez's farm or residence. The complainant in this matter is Richard H Sanders, WA4DJS.

Of particular significance is that the FCC required the Part 15 device operator to cease using the device until the interference was corrected. The complete Citation and Order is included as Appendix C in this document. Mr. Gruber reports that this level of enforcement in cases involving Part 15 interference to Amateur Radio is very rare. In fact, he thinks it might be a first.

Here is a brief timeline in this case:

05-18-2010	FCC's Laura Smith submits case to ARRL	
05-21-2010	ARRL Letter	
07-15-2010	1st FCC Letter.	URL Below
08-11-2010	FCC's Laura Smith reports no response to 1st FCC letter.	
02-28-2011	2nd FCC Letter	URL Below
04-23-2013	Citation and Order	URL Below

Here are some additional URL's that pertain to this case:

ARRL News Story:

[www.arrl.org/news/florida-man-cited-for-causing-harmful-interference-to-radio-amateurs](http://www.arrl.org/news/florida-man-cited-for-causing-harmful-interference-to-radio-amateurs)

Citation and Order:

[http://transition.fcc.gov/Daily\\_Releases/Daily\\_Business/2013/db0423/DA-13-805A1.pdf](http://transition.fcc.gov/Daily_Releases/Daily_Business/2013/db0423/DA-13-805A1.pdf)

Second FCC Letter:

[http://transition.fcc.gov/eb/AmateurActions/files/Water11\\_03\\_15\\_5238.html](http://transition.fcc.gov/eb/AmateurActions/files/Water11_03_15_5238.html)

First FCC Letter:

[www.fcc.gov/eb/AmateurActions/files/AM\\_In10\\_09\\_21\\_5187.html](http://www.fcc.gov/eb/AmateurActions/files/AM_In10_09_21_5187.html)

With regard to power line noise, no previously reported longstanding power line noise case has been resolved during the first half of 2013. While some cases have been closed, there were roughly five times more new cases during this same time period.

Looking at total picture, less than 20% of the known FCC power line cases have been resolved since the beginning of 2009.

Here are some updated but approximate statistics from the database after ten and a half years:

- 3,609 total RFI cases.
- 1,025 Power Line Noise cases. Note: There are likely to be more since approximately 1/3 unknown sources are power line noise.
- 186 cases involved one or more FCC letters.
- 53 cases involved 2 or more FCC letters.

As previously reported, here are some FCC Statistics from January 2009 to December 2011:

- 73 letters sent involving Power Line Noise.
- 50 cases remain ongoing. Note: It is possible that some of these cases have been corrected but not reported as such to ARRL.
- 13 and possibly 14 cases known to be fixed.
- 2 complainants moved.
- 3 cases involve an unknown status.
- 1 case on hold.
- 3 cases disregarded. Note: Reasons might include inappropriate behavior or lack of complaint credibility.

In summary, Mr. Gruber reports the following comments concerning FCC enforcement:

- Less than 20% of the PLN cases involving the FCC from 2009 to 2011 are now fixed.
- Some cases have lingered for many years without satisfactory resolution.
- Cases are often caught in an endless loop or letter writing campaign.
- Of the approximately 1,000 ARRL power line noise cases, the FCC
  - Has never issued even one NAL.
  - Issued only about 4 citations. Note: Remarkably, the same noise level that prompted the Lakeland citation was later deemed not to meet FCC's criteria to be harmful interference.
- Present protracted power line noise case examples include cases in Pittsburgh, Illinois and Colorado. It is important to note that Mr. Gruber was personally able to find noise at each of these locations in less than one hour of looking.
- Bottom Line: The FCC is clearly not doing its job!

### **First Half 2013 Year Total RFI-Case Statistics:**

New RFI Cases – 109

New electrical power-line cases – 25

- ARRL Letters sent – 6 (Note: One letter involved four complainants.)
- FCC 1st Letters submitted – 5 (Note: Laura Smith may have issued FCC letters based on need and input from the ARRL. These letters were not formally

submitted by ARRL and therefore not included in this total. Many of these letters were follow-up in nature and therefore required custom legal language. The effectiveness of these letters has yet to be determined.)

- FCC 2nd Letters submitted – 1

### **Electric Utilities:**

Power-line interference has continued to be the single number one known interference problem reported to ARRL HQ. It can also be one of the most difficult to solve. Fortunately, Laura Smith clearly remains interested in RFI matters and continuing with the Cooperative Agreement. In addition, the Committee is continuing in the process of forming a working group to address this issue of power line noise.

The following power line noise cases are of particular interest. Some have been previously discussed in semi-annual reports.

K3GT in Allison Park, Pennsylvania: As previously reported, this case had been ongoing for over a decade. The FCC had issued five letters in this matter between 2002 and 2011. Mr. Gruber, with the assistance of Mike Martin of RFI Services helped the FCC investigate this case in May of 2011. Matthew Urick of the FCC Field Office in Philadelphia officially conducted the investigation, which is located near Pittsburgh. Also present was the complainant, Bob Thacker, K3GT.

Subsequently, Mr. Hare visited the complainant in 2012 for a meet and greet session. During this time, without any locating equipment, he assessed the situation. Given the length of time that had transpired since the FCC's last letter, and uncertainty regarding some of the sources, the complainant has agreed to a start over. Mr. Thacker has done some noise locating and presently working with the utility to resolve the remaining interference. At present, this matter remains ongoing.

- AA9VI in Northbrook, Illinois: As previously reported, this case was investigated by EMC Committee member Brian Cramer, W9RFI. Also present was Committee Chairman Kermit Carlson. It had also been previously investigated by the FCC and first reported to the ARRL on December 10, 2007. At the time of Mr. Cramer's investigation, the FCC field agents had been unable to locate the source of the problem.

Mr Cramer has now taken employment with ComEd. As a result, Mr. Cramer can no longer represent ARRL interests in this case. Mr. Gruber reports that the case remains ongoing.

- W0ZK in Northglenn, Colorado: This is another case that seems to have been dropped by the FCC. The noise started in early 2007 and was investigated by ARRL personnel, including TC Bob Witte and EMC Committee member Ron Hranac, N0IVN in early 2008. Bob Witte subsequently provided a report on the

RFI on March 26, 2008. It identified several sources, and as a result, the ARRL Letter is issued on March 27, 2008.

In July of 2008, Bob Witte emailed Mike Gruber for update. Mr. Gruber reported that Riley had just retired on July 3<sup>rd</sup> and that he no longer has a contact at the FCC. Mr. Witte then emailed Jon Sprague of the FCC's Denver office asking for options. Kathy Berthot issued the first FCC letter on August 7, 2008. Subsequently, Laura L. Smith issued a second FCC Letter on February 20, 2009. Approximately three months later, Ms. Smith reported that Xcel Energy has retained outside counsel in this matter.

During an ARRL Convention, Mr. Gruber visited the site on June 1, 2009. He conclusively locates two sources using signature analysis. In addition, he observed a third offending noise source that ceased before he could pinpoint it. Later that September, Ms. Smith asks complainant for an update. She also reported that she had discussed this case with Xcel's attorney. Two months later, Mr. Witte asks Ms. Smith for an update. He also reported that Xcel did not appear to have taken any new action on this case.

In October of 2010, Ms. Smith reported that she was checking on case status with the Denver Field Office. In September 2011, however, the complainant reported that his case appeared to have been dropped. He was not able to get a response from either the FCC or utility. The last report from the complainant in the first half of 2013 indicated that the noise continues, although intermittently at times. This case remains ongoing and essentially unchanged from the last Semi-Annual EMC Committee report.

- W4FGC in Lakeland, Florida: Although this case is well over ten years old, it was never fixed. Mr. Gruber reports that he has spent probably more time on this case than any other. Despite his effort, little or no improvement occurred as a result of sources located by the utility. Unfortunately, this case is now closed. As previously reported, Mr. Flynn is now 91 years old and no longer able to continue the Power Line Noise battle. In January, Mr. Gruber sent the complainant an official ARRL Certificate of Appreciation for his effort. Here is the text from that Certificate:

*On behalf of the American Radio Relay League, the ARRL Laboratory and all concerned Amateurs, we wish to express our greatest appreciation to James Clinton Flynn, W4FGC, for his steadfast support and assistance in the establishment of a working cooperative agreement between the ARRL and the Federal Communications Commission. His tireless persistence was essential toward one of the first FCC field investigations involving harmful interference to Amateur Radio caused by a public utility. Furthermore, be it known that his help established an important precedent toward the handling and resolution of all future such cases. We salute Mr. Flynn for this effort.*

### **Broadband over Power Line (BPL):**

Broadband over power line (BPL) is the use of electrical wiring or power-distribution lines to carry high-speed digital signals. There are two types of BPL of concern to amateurs. Both *in-building* and *access* BPL have signals that occupy most or all of the HF range, extending into VHF. The power-line or electrical wiring can act as an antenna and radiate these signals. In-building BPL can be used to network computers within a building. It uses the building wiring to carry digital signals from one computer to another.

Access BPL provides broadband Internet access to homes and businesses, using a combination of techniques and wiring. As of July 2013, there are only a handful of BPL systems still in operation in the US and none are being expanded in any way as the major US BPL manufacturers have all shut down any production of access BPL equipment.

In-premise BPL is continuing to be sold, but at this point, none of the several industry standards on BPL protocols permit the use of the Amateur bands.

BPL is also one of several options for the developing smart-grid technologies, although it is far from being the front runner in current smart-grid deployments. The reliability of using BPL on overhead and underground distribution lines is not sufficient to make BPL the first choice of smart-grid backbone technology.

### Smart-Grid and Related Standardization

Mr. Ramie reports on an EMI Issues White Paper and Smart Grid Standardization Efforts as follows:

The NIST-SGIP issued the EMI Issues [white paper](#) in December, 2012

The five “gap” immunity tests missing from utility equipment tested for the US (under IEEE-1613) vs. what is required in Europe (under IEC-61850-3) are shown in **red** below. See Table.

The EMII Working Group asked the IEEE-PES Substations C2 subcommittee to include the five gaps in their upcoming extension of IEEE-1613, called IEEE-P1613.1

### Immunity Tests for Utility Equipment

	<u>Immunity Tests</u>
<b>Conducted</b>	<b>IEC 61000-4-6</b> <b>IEC 61000-4-16</b>
<b>Radiated</b>	<b>IEEE C37.90.2</b>
<b>Magnetic fields</b>	<b>IEC 61000-4-8</b> <b>IEC 61000-4-10</b>
<b>ESD</b>	<b>IEEE C37.90.3</b>
<b>EFT</b>	<b>IEEE C37.90.1</b>
<b>Surge</b>	<b>IEC 61000-4-5</b>
<b>Surge Withstand</b>	<b>IEEE C37.90.1</b>

**Gaps in American Utility EMC Standards:**

These five “gap” immunity tests (also shown in table below) were referenced in the P1613.1 draft in January, 2013.

- IEC-61850-3 invoked the test levels for substation products that were copied into the draft and called out for products used in **Zone A** (inside the substation fence) as shown in the middle column.
- **Zone B** is defined in the P1613.1 draft as outside the substation fence in the distribution network and allows a lower test level in each case. (as per 61000-2-5 from the EMII White Paper)

**Immunity Test Levels for Utility Communications Equipment**

Standard	Zone A (from IEC-61850-3)	Zone B (from White Paper)
IEC 61000-4-5 (Surge)	Installation <u>Class 4</u>	Installation <u>Class 3</u>
IEC 61000-4-6 (Conducted RF)	Level 3: <u>10Vemf</u>	Level 2: <u>3Vemf</u>
IEC 61000-4-8 (60Hz magnetic)	Level 5: <u>100A/m + 1,000A/m</u>	Level 4: <u>30A/m + 300A/m</u>
IEC 61000-4-10 (Oscillatory Magnetic)	Level 5: <u>100A/m (peak)</u>	Level 4: <u>30A/m (peak)</u>
IEC 61000-4-16 (Common Mode Disturb.)	Level 4: <u>30V + 300Vrms</u>	Level 3: <u>10V + 100Vrms</u>



The NIST-SGIP ceased to exist on New Year’s Day and the SGIP 2.0, Inc. took its place. It is an industry-sponsored forum to assure that the thousands of components in a modern electric grid can interoperate and communicate with each other. The members of SGIP resolve standards coordination issues and identify gaps that might impact seamless connectivity.

- Problems with the EMC tests in C12.1 were uncovered during the P1613.1 work in January.
- A preliminary report from the IEEE-P1613.1 writing group was given to the SGIP2-EMI Issues Working Group on 2/25/13.
- The EMC testing problems in C12.1 were also presented to the IEEE-EMC Society SDECom on 3/6/13.

**EMI Issues Working Group Conclusions:**

- Before/after assessment of EUT Acceptance (accuracy) is called out in clause 4.7.3
- But, before/after assessment is not used in other “disturbance” Tests No. 9, 11, 12, 18, 19, 19a, 21, 30 & 31
- Before/after assessment assumes the EUT was changed or damaged by the stimulus
- Before/after assessment is incorrect (redundant) for an un-changed, un-damaged EUT
- EUT Assessment during the testing is suitable for non-destructive tests that may only disrupt critical functions (like EFT, SWC, Radiated & Conducted RF immunity, ESD)
- This approach harmonizes with other International Standards identified as appropriate by the EMI Issues working group.

### Recommendations:

In April, the SGIP2-EMII working group expanded the IEEE-P1613.1 report into Recommendations to address the EMC testing problems in the upcoming reaffirmation version of the Standard. The C12.1 Standard will be withdrawn at the end of this year, unless it is re-affirmed. The EMII working group Chair (Galen Koepke of NIST) delivered the Recommendations at the C12.1 meeting in Chicago on May 1, 2013.

The response was muted, but slightly positive. (Particularly among smart meter customers) The EMII working group agreed to take the lead by working directly with the C12.1 writing group to fix the faulty EMC tests called out in C12.1.

**C63<sup>®</sup>** ANSI-ASC-C63<sup>®</sup> assigned a joint task force at their May 8, 2013 meeting to review the EMC testing problems in C12.1 (2008) and report their findings to the Subcommittee 1 & 5 Chairs and to the SGIP2 - EMI Issues Working Group.

The following **C63<sup>®</sup> Joint Task Force on C12.1** Conclusions were delivered to the SGIP2 - EMI Issues Working Group, with the C12.1 writing group in attendance, on 6/17/13:

- Follow the recommendations of the EMII Working Group in amending C12.1
- Harmonize with IEEE-1613 and its extension IEEE-1613.1 for a list of tests to run
- Add two tests from IEEE-1613.1 (IEC-61000-4-10 & IEC-61000-4-16)
- Use IEEE-1613.1 test levels for Zones A & B (substation boundary being the divider)
- Use a relative “error shift” between perturbed and un-perturbed meters to assess acceptance to established criteria during tests (with the exception of destructive surge testing, which may need the “before/after” or “survivability” test method)
- Use the setups and methods cited in C63.4 for emissions testing (Figure 7 for example)

## Recent Events:

- The IEEE-P1613.1 ballot closed 6/6/13 with 97% affirmation.
- ANSI-ASC-C63<sup>®</sup> task force recommendations were delivered to the EMI Issues Working Group on 6/17/13
- The EMII working group and C12.1 writing group began taking up the recommendations in early July.
- Just before the preparation of this report, the NEMA-ANSI C12.1 writing group informed the EMII Working group that they do not have enough time this year to implement the recommendations of SGIP2 and ASC-C63<sup>®</sup>. It's not clear whether they will include the flawed EMC tests in their next draft later this year (unacceptable) or just delete the EMC tests altogether. (preferable) They intend to put their document out this year, regardless. They are promising to address EMC "at a later date." That remains to be seen. I am trying to keep the IEEE-EMC Society SDECom, the SGIP2-EMI Issues working group and the ASC-C63<sup>®</sup> Joint Task force on C12.1 informed so their members can negatively comment on the document late this year if the flawed EMC tests are included.
- I plan on writing a magazine article to inform utilities about the weaknesses in the EMC tests of C12.1 so they can demand change from the metering companies that control the C12.1 writing group. I will recommend that the test be deleted.
- John Tengdin, the Chair of C2.1 that wrote P1613.1, and I are submitting a slight modification ("rogue comment") to modify the P1613.1 text in order to have the COM card inside a smart meter tested like any other communications device. That is, the full suite of immunity tests are applied to the finished product. (Meter + card) This would force the metering companies to do the EMC immunity testing correctly since the COM card manufacturers must depend on the meter to remain running in order for their card to pass the tests. (They can't pass the tests unless the meter they are mounted in passes the tests) It's an end-run that accomplishes the same goal; correct EMC immunity testing of smart meters and the communications cards within them.

## Final Comments:

- 1) FHSS emissions on 902-928MHz do not cause audible interference to FM operation. Meters transmit only 45 seconds per day at 1 watt, so interference is unlikely. The cellular GPS beacons are primary users of the band and cause a 1-second cadence to be audible in most of the band, although FM operation can continue with some annoyance.
- 2) We have not received any In-Premises BPL complaints that I am aware of. Deep notching of the amateur bands appears to have worked.
- 3) Additional, realistic immunity testing of utility communications equipment has been implemented in the Draft 47 of P1613.1. All "smart grid" utility products communicate. Mr. Tengdin and I made sure the five "gap" immunity tests reported in the EMII White Paper were in the P1613.1 draft, approved with 97%

affirmation. We called out two test levels, Zone A (inside the substation fence) and Zone B (outside the substation fence). This was important work accomplished only because of ARRL funding. We both hope the new Standard will be used for meters as well.

- 4) It would be wise for the US to require that high-level EM mitigations be in place at major utility nodes for protection against geomagnetic storms and EMP, as both are high-impact, low-frequency events.

### **Automotive EMC:**

The Headquarters staff continues to send all reports of automotive EMC problems to interested people in the automotive industry. While these reports are advisory, they are helpful to the industry in planning for future designs. Mr. Steffka is also planning an evaluation of hybrid and electric vehicles' HF band RFI characteristics. He continues to help prepare automotive related responses to Technical Information Services (TIS) questions for ARRL members.

### **Cable Television:**

As a whole, the cable industry continues to do a good job at adhering to the FCC's regulations about signal leakage and interference. ARRL has received only a few reports of problems, indicating that most cable systems are either clean or are addressing complaints effectively. Only a handful of these cases have required Mr. Hranac's involvement and ARRL follow up. There have been some cases involving wideband noise in the MF and HF range that were initially thought to be cable TV-related interference, but after investigation were found to be Part 15 or other devices coupling interference to the cable TV support strand and coaxial cable shield outer surface via National Electrical Code and/or National Electrical Safety Code required neutral bonds.

### **DSL, U-Verse & Home Phone Networking Alliance**

Mr. Beatty continues to assist with broadband service complaints to the ARRL. Very few complaints were received since January.

Dr. Strauss indicates he has nothing new to report relative to the Committee.

### **RFI-Case Database:**

The ARRL HQ staff maintains a database of RFI reports and cases. This is used primarily as a case-management tool for the several hundred RFI cases ARRL handles every year, but the information the Lab staff are gathering about types of interference cases, involved equipment and frequencies will provide a wide range of reporting capability. Here are some statistics from the database for the 1<sup>st</sup> half of 2013 and compared to the four previous years:

Category of Case Reported to ARRL Lab/EMC Engineer	2008	2009	2010	2011	2012	2013-1
BPL	2	1	3	0	0	0
Unknown Unintentional Radiators	49	65	57	78	66	36
CABLE TV	11	26	8	7	3	2
Satellite TV						1
Computing Devices and Modems	15	21	4	7	3	3
Power Line Noise	81	113	90	65	53	25
Plasma TV Receivers	8	12	10	14	5	1
Other Broadcast Receivers	3	2	7	0	4	1
Other Receivers	1	4	8	3	1	0
Other Transmitters	11	1	2	9	2	1
Broadcast Transmitters	2	2	3	4	6	3
Lighting Devices	12	12	15	13	4	4
Fence Systems	3	4	4	2	0	2
Battery Chargers	6	2	1	1	3	0
Wheelchair	0	0	1	1	0	0
Water Pump Systems	1	1	3	2	1	1
HVAC Systems	5	4	11	6	3	5
Alarm Systems including detectors	3	4	6	0	4	1
Other Appliances	12	7	3	8	7	4
GFIC / AFCI	5	1	1	1	5	5
AUTOMOBILE Systems	12	8	4	3	2	1
Manufacturing and Retail Generated Noise	1	2	1			
AT&T U-Verse Systems	3	10	10	8	8	0
Other					36	13

It is important to note that power line noise has consistently been the most reported and problematic RFI problem reported to the ARRL Lab. As Committee member Ed Hare indicated, *more hams suffer from power line noise right now than will ever suffer from BPL.*

#### **ARRL RFI Forums:**

The two RFI forums remain ongoing in the ARRL forums pages. These forums provide self help and discussion for members. They are monitored and moderated by HQ Lab staff and other volunteers. The pages are:

- RFI - Questions and Answers

- RFI questions and are answered by other members and RFI experts. Members can post questions and read answers about solutions to an RFI problem they are having. The link is:  
[www.arrl.org/forum/categories/view/20](http://www.arrl.org/forum/categories/view/20)
- RFI - General Discussion
  - This forum is a place to discuss technical issues associated with RFI and Amateur Radio. The link is:  
[www.arrl.org/forum/categories/view/21ssion](http://www.arrl.org/forum/categories/view/21ssion)

### **Committees:**

ARRL continues to be represented on professional EMC committees. Messrs. Hare and Carlson continue to represent the interests of Amateur Radio on the ANSI ASC C63® EMC committee. Mr. Hare is the Primary ARRL C63® representative; Mr. Carlson is the Alternate. Mr. Hare serves as the Vice Chair of Subcommittee 5, Immunity. Mr. Hare also leads the C63® committee's Task Force on testing below 30 MHz, which has completed writing a section of an intentional emitter measurement standard that correctly and scientifically extrapolates field strength measurements below 30 MHz. This material was incorporated into the ANSI C63.10 standard on the measurement of unlicensed intentional emitters (transmitters). The standard had a successful ballot in March 2013 and is now in ANSI public review. Mr. Ramie serves as the C63® Secretary and as a member of the Below 30 MHz Task Group. The C63® committee is working on developing industry standards for immunity, emissions and testing of electronic devices. ARRL serves as a resource to the committee to protect the interests of Amateur Radio. Subcommittee 1 continues to work on a variety of EMC projects, primarily related to test site standardization. Subcommittee 5 deals with immunity and immunity measurement issues. Subcommittee 8 deals with various types of medical equipment. The multiple ARRL EMC-Committee representation on C63 watches immunity and testing developments.

Mr. Hare also serves on the IEEE EMC Society Standards Development and Education Committee (SDECom) as its Secretary. SDECom serves as the EMC Society standards board, overseeing the development of all IEEE EMC Standards. He was also appointed to serve on the IEEE EMC Society Board of Directors, to fill the remaining term of a deceased Board member.

Related to committee work, Mr. Hare also maintains informal contact with a number of industry groups, including HomePlug and the HomeGrid Forum (in-premise BPL industry groups), Society of Cable Telecommunications Engineers, Society of Automotive Engineers and the Electric Power Research Institute, as a few examples.

### **FCC Rules**

As initially reported in the July 2011 EMC Committee report, Messrs. Gruber and Hare have proposed five suggestions for changes in the FCC rules. These proposals remain under review and are included as Appendix D in this document.

Also, in support of that effort, here is a summary of planned, recent and ongoing Lab activities:

- Radiated emissions limits below 30 MHz in FCC Part 15 rules for unintentional emitters such as plasma TVs.
  - Test and document an actual TV in Annapolis, MD.
  - Document cases from database.
- Lower limits in Part 15 for non-CFL lighting to possibly harmonize with the lower limits for fluorescent bulbs in Part 18 rules.
  - Document cases from database. Obtain and test bulbs.
  - Mr. Gruber completed a related article for an upcoming issue of QST
- Better external labeling on packaging for Part 18 fluorescent bulbs and ballasts.
  - Document items sold in major stores.
  - Testing as required.
- Specific radiated and/or conducted emissions limits for certain incidental emitters such as motors or power lines.
  - Document large number of power-line cases.
- Pulse-width motor controllers used in appliances.
  - Test a number of devices that belong to staff and/or local hams.

### **The Future of EMC and Amateur Radio:**

Interference to hams appears to be the present major work of the committee. Although immunity problems still do occur, this is being addressed at the national and international standards level. RFI from unlicensed devices poses a major real threat to Amateur Radio at this time. This will continue to require significant Committee and ARRL staff attention. To the extent possible with existing staff, or with additional resources, the ARRL should increase its contact with standards organization, industry groups and individual companies, and continue to work on all aspects of RFI problems and solutions.

ARRL's information about RFI can be read at:

[www.arrl.org/radio-frequency-interference-rfi](http://www.arrl.org/radio-frequency-interference-rfi).

I would like to give my sincere note of thanks to the ARRL Laboratory staff for their hard work and diligence in the furtherance of the interests of the amateur community with regards to Electromagnetic Compatibility.

I would also like to thank Mr. Jerry Ramie, KI6LGY, for his extraordinary efforts within SGIP and C63 to help guide industry standards towards reasonable and valid standards. In this age where *Industry* establishes the greater majority of EMI/EMC standards, these working group established standards have become central to protecting our E/M environment. It is by working within the various EMI/EMC Standards Committees and working groups that we are at the best position to have an effective impact on our radio environment. Mr Ramie's effort in this area has been invaluable.

I am especially indebted to Mr. Mike Gruber, W1MG, for his efforts in preparing this ARRL EMC Committee report.

**Respectfully Submitted,**

**Kermit A Carlson W9XA  
EMC Committee Chairman  
ViceDirector Central Division**

## Appendices

Appendix A – JULY 2013 EMC COMMITTEE REPORT Appendix\_A.pdf

EMC Committee Whitepaper prepared in response to Docket 12-338 filed  
04Feb13

Appendix B – JULY 2013 EMC COMMITTEE REPORT Appendix\_B\_Lights.pdf

PDF of FINAL REPORT ON THE 4TH JOINT CROSS-BORDER EMC  
MARKET SURVEILLANCE CAMPAIGN (2011)

Appendix C – JULY 2013 EMC COMMITTEE REPORT Appendix\_C\_Citation.pdf

PDF of FCC Citation and Order DA 13-805

Appendix D – JULY 2013 EMC COMMITTEE REPORT Appendix\_D.pdf

ARRL Laboratory Staff recommendations for changes to FCC Rules