

# ARRL EMC Committee Semi-Annual Report

Doc. # 21

**For The  
American Radio  
Relay League**

**Board of Directors Meeting  
July 15-16, 2011**

**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. 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
- Mr. Brent Zitting, IBEC, was thanked for his past service to the EMC Committee

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

The EMC Committee held its first Webinar and Telephone Conference during the month of June. Discussion topics included:

- The Committee was informed on the status of a number of stagnant and slowly-progressing Power-line noise cases.
- A comprehensive program for addressing RFI issues. This plan involves and coordinates the ARRL Handbook, RFI Book and ARRL Web RFI pages. A standardized comprehensive program will help reduce the workload on ARRL Staff while increasing the effectiveness of Staff time. While both forums are to be moderated by Staff, one will tend to be developed towards Frequently Asked Questions and procedures while the other will be developed into more general RFI/EMI Topics. When available and required, local level help is also included when appropriate.
- The establishment of two on-line discussion forums as part of the ARRL.ORG web presence to facilitate handling of incoming RFI/Powerline noise cases and as an aid in directing members to League resources for self-help.
- The formation of a working group to address the issue power line noise. This sub-group within the Committee will work with staff to develop plans for the comprehensive RFI and Powerline noise program. While all of the members of the Committee are active in the RFI/EMC field, some members remain more

specialized in industrial and automotive areas of the field as opposed to Powerline Noise, since the greater majority of field complaints are as a result of PLN, the sub group will work on this area of PLN noise complaint resolution.

- The Committee agreed that it would recommend that specialized powerline noise locating equipment, manufactured by Radar Instruments Inc., should be obtained and located at the Newington HQ lab. The purpose of this equipment would be for the education of power utilities and other authorities in the capabilities of proper equipment when used by appropriately trained personnel. This use would be in addition to the more obvious purpose which would be the use by ARRL Lab Engineers during field investigations.

### **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 2011, he also continued with work in a number of key areas:

- Adding updates to the ARRL RFI Web pages. Some of this effort was driven by the new ARRL Web site.
- 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 this case was first reported to the ARRL in 2003, and the FCC has written the utility numerous letters concerning the matter, it is clear the utility lacked the proper equipment and expertise to correct the noise. This case was also the subject of an ARRL News article when the utility told the complainant that they wanted to charge him for locating the noise.
- 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 non-consumer Part 18 electronic ballasts being marketed and sold for consumer and residential purposes.

- Working with AT&T engineering staff to help resolve RFI issues with U-Verse systems.
- Reviewing proposed EMC related material for ARRL publications.

### **First Half 2011 Year Total RFI-Case Statistics:**

New RFI Cases – 155

New electrical power-line cases – 42

- ARRL Letters sent – 29
- FCC 1st Letters submitted – 5 (Some letters involved multiple complainants.)
- FCC 2nd Letters submitted – 1 (Note: Laura Smith issued numerous 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.)

### **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 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.

- W4FGC in Lakeland, Florida: This previously reported case also remains ongoing. Although the FCC investigated the matter, it was at a time of unusually low noise activity. It should be noted that the noise is typically present at slightly varying levels most of the time.

The utility's RFI investigator is claiming that the complainant's equipment and antenna are responsible for the noise. He also claims that the complainant's expectations are unrealistic. It should be noted that none of these claims have been validated by Mike Martin or Mike Gruber during their investigations into this noise. Finally, in May of this year, the complainant's daughter obtained the services of a 3<sup>rd</sup> party independent RFI investigator from a nearby city in Florida. This investigator was able to locate four sources of noise in the complainant's neighborhood in a relatively short period of time.

At the time of this report, the utility's RFI investigator has not responded to a certified letter concerning this matter by the complainant's daughter. It was sent

approximately two weeks ago. This case was first reported to the ARRL in January 2003 and still remains ongoing.

- W2PM in Ramsey, NJ: This case involves a 69 kV transmission line with a tower in the complainant's backyard. The utility's RFI investigator initially concluded that there was a composite of noises that were being generated all along the line. The problem was not fixable. Based on a recording of the noise, Mr. Gruber concluded that there were only two noises affecting the complainant's station. Mr. Gruber found the two sources in November of 2009. Based on his reports, the utility's RFI investigator took a second look. He concluded there were hardware issues with approximately four towers that needed replacement. These towers were somewhat unique as a result of hardware incompatibility when the voltage was increased on the line several years ago to 69 kV.

Last year, the utility's RFI investigator informed Mr. Gruber that they would need to shut down the line in order to make the repairs. The repairs were expected to be completed before the start of the air conditioning season. The repairs were never started, and the utility never contacted the ARRL or complainant to advise of the schedule change. The case then went to the FCC and Laura Smith issued an advisory notice.

The case remains ongoing but there has been considerable effort on the part of the utility to fix it. The primary source tower now appears to be quiet. An attempt to work on the second tower was delayed due to access issues involving an easement. A second attempt to repair this tower appears to have failed. It case was first reported the ARRL in May of 2009. Mr. Gruber believes the remaining noise is substantially fixable and would make a great example case for stations near high voltage transmission lines.

- K3GT in Allison Park, Pennsylvania: Mr. Gruber, with the assistance of Mike Martin of RFI Services helped the FCC investigate this case in May. Matthew Urick of the FCC Field Office in Philadelphia conducted the investigation, which is located near Pittsburgh. Also present was the complainant, Bob Thacker, K3GT. The utility in this matter, Duquesne Light & Power, had wanted to charge the complainant for RFI investigations.

Although this problem had been going for over a decade, Mr. Gruber reports that they were able to demonstrate to the FCC that the noise was coming from a number of poles that they identified. By the end of the day, they had identified noise sources in all directions but one. His understanding is that the FCC will be sending the utility some form of communication in the relatively near future. Special thanks to Mike Martin for his invaluable assistance. This effort was extremely successful.

At the moment, this case remains ongoing. The FCC has yet to make a decision on it. It is, however, one of the best cases we've ever seen for FCC enforcement.

- AA9VI in Northbrook, Illinois: This case was investigated by EMC Committee member Brian Cramer, W9RFI. Also present was Committee Chairman Kermit Carlson. It was 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 reports that in many ways the RFI problems at AA9VI highlight the frustration that electric utility trouble-shooters can have resolving issues. There are individuals within the utility who are committed to resolving the problem, but their actions are sometimes mis-directed and very expensive.

In this case, the utility had identified "noisy" insulators on a 345kV transmission tower just outside the substation. The insulators were replaced, but there was no improvement for the ham. Mr. Cramer was sent on behalf of the ARRL to locate the source. From outside the substation he was able to trace the time-domain signature to a portion of the substation. The utility then located a "noisy" 354kV bus insulator, and requested an outage to replace it.

Mr. Cramer then returned to the substation with utility personnel and checked inside the substation. The signature from AA9VI did not match the noisy insulator they had identified, but it did match a 345kV bus insulator on the opposite bus.

The fact is that the utility has expended a great deal of time and money in an effort to fix the problem. But, the situation has not improved because the utility personnel lack the training and experience to identify the correct noise source. Although this noise was not particularly difficult to locate with the right training and equipment, neither the FCC nor the utility had been able to find it prior to Mr. Cramer's investigation.

Jerry Ramie reports that he has investigated a number of PG&E power line and other interference cases in northern California.

Mike Martin, K3RFI of RFI Services conducted an RFI Workshop at ARRL HQ in June. Plans and discussion remain ongoing to conduct a specialized version of the Workshop for FCC personnel in Gettysburg.

### **Committee Membership**

The EMC Committee is proud to welcome three new members .

- Mr. Gordon Beattie, W2TTT Principal Technical Architect, AT&T U-Verse
- Mr. Richard D. Illman, AH6EZ Sr Engineer, Motorola Solutions
- Mr. John M. Krumenacker, KB3PJO, DSL Design Engineer

## PAVE PAWS

Mr. Hare has continued to work with Dan Henderson, Paul Rinaldo and Chris Imlay to analyze PAVE-PAWS interference and systems. Ed has been running Longley-Rice propagation calculations on repeaters, helping to identify ways that some of the repeaters on “the list” of repeaters requiring mitigation can be kept on the air.

### **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. Most in-building BPL operates under the [HomePlug](#) industry specification, which does not use the Amateur bands and thus poses no significant threat to Amateur operation.

Access BPL provides broadband Internet access to homes and businesses, using a combination of techniques and wiring. Although some BPL feasibility trials have shut down, one US company, IBEC, continues to market BPL to rural electric cooperatives, relying heavily on government loans and grants. In-building applications are also on the rise.

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.

After past declines, the number of BPL installations in 2011 has been increasing slightly. New BPL systems are being installed in rural Virginia and other locations. Although many of the systems in the BPL database do not actually exist, it appears that there are active BPL systems in the following states or territories:

- Alabama
- Georgia
- Indiana
- Michigan
- North Carolina
- Ohio
- Pennsylvania
- Puerto Rico
- Virginia
- Wisconsin
- Small vestige systems may exist in other states

In early 2011, Ed Hare assessed BPL systems operating in Virginia and Pennsylvania. He found that some of these systems were not listed in the FCC-mandated BPL database maintained by the Utilities Telecom Council. He also found that the systems were not notching the Amateur bands universally as has been promised by the manufacturer. Notching of protected federal spectrum was also not implemented. ARRL also found that the systems measured were all operating considerably above the FCC emissions limits. ARRL filed several subsequent complaints with the FCC related to the incorrect BPL database, the lack of notching, the emissions-limits violations and a complaint to the FCC Office of Engineering and Technology about the certification of BPL devices that were capable of operating so far above the emissions limits. The errors in the BPL database were corrected, but none of the other complaints have been acted on by the FCC.

The primary focus points toward BPL to continue to be deployed in rural areas, subsidized by US-government loan, multi-dwelling and in-home BPL and grid automation. The company that is installing these rural systems has continued some notching of Amateur bands, but it has changed over from a policy of fixed, permanent notches to adding notches to the Amateur bands only in response to interference to fixed Amateur stations. Recent testing of several of these systems by ARRL staff showed widespread, strong noise in the Amateur bands, emissions limits violations and failure to notch the federal bands protected by the Part 15 FCC rules.

Mr. Hare continues to represent Amateur Radio's stake in BPL standards development on various industry committees. These include the IEEE P1775 BPL EMC committee; the [IEEE EMC Society Standards Development Committee](#) and [ANSI ASC C63<sup>®</sup>](#). The IEEE P1775 BPL EMC standard has completed its balloting process, rejecting comments provided by the IEEE EMC Society Standards Development Committee (SDCom). As a result, SDCom had chosen to seek to withdraw as a co-sponsor of the BPL EMC standard.

## FCC

Although prepared independently of the EMC Committee, Mr. Hare did the majority of the drafting of ARRL filings into the BPL rulemaking. One addressed the NTIA Phase II BPL study. Mr. Hare used the antenna models provided by the NTIA and calculated the extrapolation that one would obtain if those models were measured using the methodology proposed by the FCC to measure extrapolation. The results varied by several tens of dB, depending on just which four points were chosen for the measurement. A separate filing addressed a written exparte filing that had been done by the Utilities Telecom Council in which it misrepresented the way that industry standards address notch depth to protect radio services.

## BPL Standardization

The IEEE BPL EMC standard, Std. 1775, passed sponsor ballot. Although two of the three co-sponsors informed the IEEE RevCom that they did not believe that comments received during ballot had been properly addressed, RevCom chose to approve the

standard over the concerns of the sponsoring IEEE societies. The EMC Society subsequently voted to withdraw as a co-sponsor of the standard prior to its being published – something without precedent within the IEEE. The Power and Energy Society and the Communications Society remain as co-sponsors of this IEEE EMC standard.

### International

CISPR, a major international standardization group, had tried to develop a BPL standard, but was unable to muster sufficient votes to adopt a position in either direction. CENELEC, a group of European nations, picked up on the project. CENELEC now has a draft standard out for vote, with a closing date of August 2011. This draft accomplished what CISPR was unable to do and may adopt a proposal that correctly measures BPL signals, but at a level of conducted emissions equivalent to a level slightly higher than what the FCC permits. However, there are several important provisions in this standard that are of direct interest to Amateur Radio. The standard mandates that BPL systems *not* use the Amateur bands, with a notch depth equivalent to the current conducted emissions limits in CISPR 22. This is equivalent to a notch depth of 35 to 50 dB, depending on what assumptions are used to correlate the quasi-peak levels in CISPR 22 with the peak and average levels in the CENELEC standard. The standard also mandates adaptive notching to protect HF broadcast spectrum.

ARRL's information on BPL is found at [www.arrl.org/bpl](http://www.arrl.org/bpl).

### **Smart-Grid and Related Standardization**

The ARRL white paper "*Electric Utility Communications, Applications and Smart Grid Technologies*" posted at [www.arrl.org/electric-utility-communications-applications-and-smart-grid-technologies](http://www.arrl.org/electric-utility-communications-applications-and-smart-grid-technologies) was previously edited into three PowerPoint versions for delivery to Communications, Power and EMC audiences. Each version features the League's logo on the opening slide and the ARRL white paper in the Bibliography as a major source. The EMC version was submitted mid-year to the IEEE - EMC Society Distinguished/Respected Lecturer program for consideration. It was accepted in late 2010 and is now available through their Distinguished Lecturer program, thus allowing smaller Chapters of the EMC Society to have the travel & lodging expenses for the speaker picked up by the Society. The "EMC & Smart Grid reliability" message will be more widely heard because of EMC Committee work.

A previously described PowerPoint report, commissioned by the League under its logo, on the inaugural activities of the **P2030 Smart Grid Interoperability Guide** working group meetings was re-purposed and given by Andy Drozd, the Chairman of the IEEE EMC Society Standards Development Committee and Past President of the EMC Society.

Mr. Drozd gave this report to a workshop at Connectivity week in Santa Clara in June, 2010, resulting in the formation of the new NIST-EMI Working Group. (Note: P2030 did not want any EMC content in their documents.) The Presentation was also re-purposed and given to the NIST Home-to-Grid Domain Experts Working Group (H2G-

DEWG) on September 17, 2010. This resulted in the SDCOM of the EMC Society authoring a derivative of the P2030 white paper pertaining to the Home Area Network portion of the smart grid. This white paper was delivered by Jerry to the H2G-DEWG a few weeks later. The H2G-DEWG then began a work item to draft a consensus document on Home-to-Grid EMC concerns. Efforts to reach compromise with the "no immunity testing required" position of the Consumers Electronics Association are now being lead by Ghery Phetit of Intel. (a League member who's acting as liaison between the NIST-H2G-DEWG and the EMC Society SDCOM) In effect, ARRL - EMC Committee work is now driving smart grid policy discussions in the US, both in the Home-to-Grid and Transmission & Distribution DEWGs.

### **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 also helped prepare some responses to Technical Information Services (TIS) questions for ARRL members.

Mr. Steffka also reports that General Motors continues to work on an RFI complaint (via the League) regarding a 2010 truck. This issue was taken very seriously and they are pursuing a workable solution. Various engineering personnel are discussing the implementation of a short term solution to address the immediate needs of any customers experiencing this problem, as well as (more importantly) a long term solution that will eliminate this problem from future products. Mr. Steffka also points out that they were initially unaware of this problem. ARRL involvement in this case was very useful to GM and their engineering team.

### **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 couple of these cases have required Mr. Hranac's involvement and ARRL follow up. One of those cases is nearing satisfactory resolution, based on recent feedback from both the cable company and the complainant.

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

Mr. Beatty reports that he has developed an extended use for the form that he created to help assimilate data associated with broadband service complaints to other areas. He provided a version of this after the last EMC Committee conference call.

Dr. Strauss reports there are no issues relative to EMI [conducted or radiated] that have been reported that he is aware of during the past quarter. Dr. Strauss' company also no longer participates nor supports HPNA technology.

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

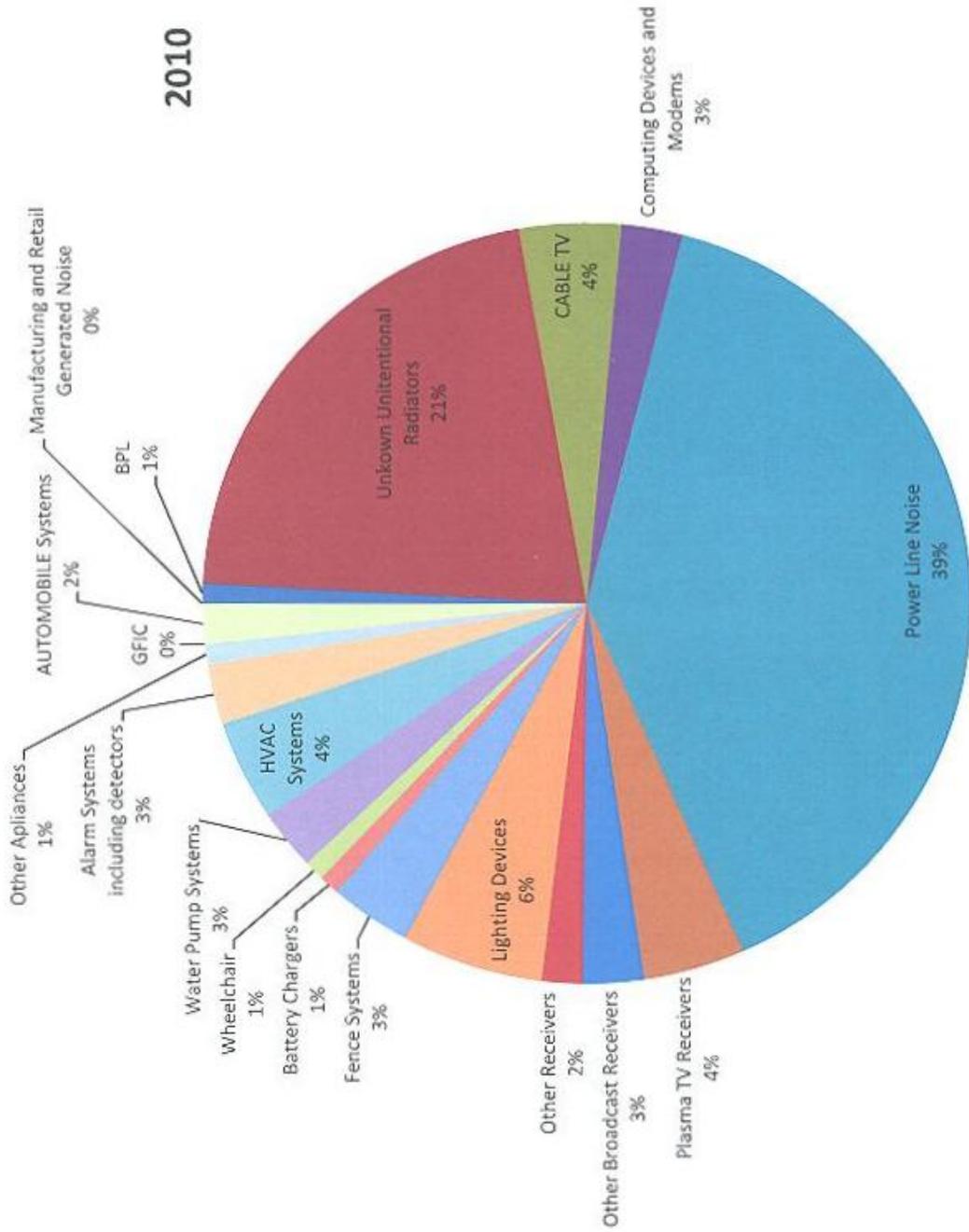
The ARRL HQ staff maintains a database of RFI reports and cases. This is used primarily as a case-management tool for the several hundred RFI cases ARRL handles every year, but the information the Lab staff are gathering about types of interference cases, involved equipment and frequencies will provide a wide range of reporting capability. Here are some statistics from the database for the 1<sup>st</sup> half of 2011 and compared to the three previous years:

Category of Case Reported to ARRL Lab/EMC Engineer	2008	2009	2010-1	2010-2	2011-1
BPL	2	1	3	0	0
Unknown Unintentional Radiators	49	65	25	32	51
CABLE TV	11	26	5	3	4
Computing Devices and Modems	15	21	3	1	1
Power Line Noise	81	113	46	44	42
Plasma TV Receivers	8	12	5	5	7
Other Broadcast Receivers	3	2	3	4	0
Other Receivers	1	4	2	6	2
Other Transmitters	11	1	0	2	5
Broadcast Transmitters	2	2	1	2	1
Lighting Devices	12	12	7	8	8
Fence Systems	3	4	4	0	1
Battery Chargers	6	2	1	0	0
Wheelchair	0	0	1	0	1
Water Pump Systems	1	1	3	0	1
HVAC Systems	5	4	5	6	2
Alarm Systems including detectors	3	4	3	3	0
Other Appliances	12	7	1	2	2
GFIC	5	1	0	1	0
AUTOMOBILE Systems	12	8	2	2	0
Manufacturing and Retail Generated Noise	1	2	0	1	0
AT&T U-Verse Systems	3	10	2	8	2

Data from this table now appears in tabular form. 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 indicted, *more hams suffer from power line noise right now than will ever suffer from BPL.*

The following graph indicates the percentage of calls and emails to the ARRL Laboratory and to the ARRL EMC Engineer, Mr Gruber, for help during 2010 as compiled from the ARRL EMC database. Similar percentages were observed during the years 2008 and 2009. The record clearly indicates that Power Line Noise is the most commonly encountered RFI problem to Amateur installations referred to the ARRL for assistance.

2010



## **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<sup>®</sup> EMC committee. Mr. Hare is the Primary ARRL C63<sup>®</sup> representative; Mr. Carlson is the Alternate. Mr. Hare ended his term as Chair of Subcommittee 5, Immunity, but continues to serve as its Vice Chair. Mr. Hare also leads the C63<sup>®</sup> committee's Task Force on testing below 30 MHz. Mr. Ramie serves as the C63<sup>®</sup> Secretary and as a member of the Below 30 MHz Task Group. The C63<sup>®</sup> 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.

ARRL also continues its participation in the Society of Automotive Engineers EMC and EMR Committees. Mr. Hare is the ARRL representative on those committees. Mr. Steffka also serves on the committees, representing his employment in the automotive industry.

## **FCC Rules**

Messrs. Gruber and Hare have proposed the following five suggestions for changes in the FCC rules:

1. Presently there are no Part 15 radiated emissions limits for unintentional emitters below 30 MHz. This had been a relative non-issue until the proliferation of plasma TVs. Our experience has shown that direct radiation at HF from a plasma display can be problematic and difficult to fix. One suggestion therefore would be to add absolute radiated emissions limits in this case to the HF spectrum. (Note: In the cases looked at by the Lab, the interference was relatively short range. While reducing the frequency of the limits may not completely solve the problem, it should help in some cases.)
2. Fluorescent lights with electronic ballasts, electronic ballasts and CFLs typically operate under Part 18. Part 18 has a separate set of absolute limits for "RF Lighting Devices." These limits are then broken down into consumer and non-consumer devices. Note: The limits are higher for non-consumer devices, similar to Part 15A and 15B for digital devices.

Quasi-Peak Part 18 limits from 3 to 30 MHz for consumer and non-consumer RF lighting devices are 48 dB<sub>μV</sub> and 70 dB<sub>μV</sub>, respectively. For consumer devices, these are the lowest of any specified limits in Parts 15 and 18 of the rules. It is also important to note that, in the case of Part 18 lighting devices, the FCC

created a special set of lower limits just for them. Apparently, the difficulty in eliminating interference from a widespread proliferation of Part 18 bulbs in homes and neighborhoods is something that concerned the FCC when they wrote these rules.

Unlike fluorescent bulbs however, the new LED bulbs operate under Part 15. The limits for these bulbs are 56 dB<sub>μV</sub> from 0.5 to 5 MHz, and 60 dB<sub>μV</sub> from 5 to 30 MHz. These newer LED bulbs are becoming increasingly ubiquitous in many stores and homes. Unlike their Part 18 equivalent however, they have also become a source of interference. The suggestion would be to reduce the Part 15 limits for lighting devices to Part 18 lighting device limits from 3 to 30 MHz. Essentially, make the limits for Part 15 and 18 bulbs the same, thus reducing the RFI potential from newer LED bulbs before they become a major problem.

3. Part 18 rules specify labeling for RF lighting devices are as follows:

**§ 18.213 Information to the user.**

*Information on the following matters shall be provided to the user in the instruction manual or on the packaging if an instruction manual is not provided for any type of ISM equipment:*

- (a) The interference potential of the device or system*
- (b) Maintenance of the system*
- (c) Simple measures that can be taken by the user to correct interference.*
- (d) Manufacturers of RF lighting devices must provide an advisory statement, either on the product packaging or with other user documentation, similar to the following: This product may cause interference to radio equipment and should not be installed near maritime safety communications equipment or other critical navigation or communication equipment operating between 0.45–30 MHz. Variations of this language are permitted provided all the points of the statement are addressed and may be presented in any legible font or text style.*

As the above indicates, including (d), the RFI potential is not required to appear on the outside of the package. One could easily buy a fluorescent light or ballast and not know there are issues until he opens the box. The suggestion would be to require an obvious warning on the outside of the package, similar to what appears on the box of a Part 15 unintentional emitter. The suggested wording would be similar to its Part 15 equivalent. In addition, part c of the above rules should be referenced and give the location of this information.

4. Part 18 specifies two sets of limits for RF Lighting Devices – consumer and non-consumer. (Note: Some manufactures specify Part 18A and 18B on their products, similar to Part 15. This is not spelled out in Part 18 however.) A quick look at a local “big box” store will show that many ballasts are non-consumer

rated. The label is not on the box but rather in very small print in the device or on a sheet inside the box. The suggestion would be to require consumer and non consumer labeling on the outside of the box. The labeling must also be large enough to be obvious to the consumer at the time of purchase.

In addition, some fluorescent light fixtures with electronic ballasts do not specify the type of ballast inside. The suggestion would be to also add labeling to the outside of the box in the case of a light fixture. It should be clear to the consumer that the device is or is not suitable for residential use.

5. Add intentional emitter radiated emissions limits for Part 15 incidental emitters in the case of power lines, associated hardware and electric motors. Although power line noise is the most reported source of known interference to the ARRL, and often the most difficult to solve, there are presently no specified limits for power lines (or any other) incidental emitters.

### **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).

In closing I would like to thank Mr Mike Gruber, W1MG, and Mr. Ed Hare , W1RFI , for their dedicated work and their invaluable help in the preparation of this report.

**Respectfully Submitted,**

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