ARRL EMC Committee Semi-Annual Report

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For The
American Radio
Relay League

Board of Directors Meeting
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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 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, Eversource, retired
- 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. 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. James Roop, K9SE, past FCC District Director
- Mr. Mark Steffka, WW8MS, Automotive EMC engineer
- Dr. Steve Strauss, NY3B, Home Phone Networking Alliance Technical Committee
- Dr. Richard E. Dubroff, W9XW, Professor Emeritus at Missouri University of Science & Technology

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®, 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 2017, he also continued with work in a number of key areas:

- Adding updates and revisions to the ARRL RFI Web pages.
- Facilitating and providing assistance on resolving long standing power line noise cases with the FCC.
- 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:

    1) Large grow lighting devices used for indoor gardening. Unfortunately complaints from these devices are still occurring. Some of these devices have been measured to exceed the FCC limits by a considerable margin. Although complaints have been filed concerning these devices, the FCC has failed to take any visible enforcement action.

       It must be emphasized that these devices are being heard at much greater distances than normally expected from an otherwise legal device. In some cases, we have received reports of interference from devices that were found to be over ½ mile away. Hams affected by grow light interference have found this problem to be particularly difficult to solve for several reasons:

1. Because of the abnormal distances over which this interference can propagate, hams often find it difficult to find the source. An otherwise legal device at the FCC limits is typically a few hundred feet or less, thus limiting the scope of the problem to one that can be located by sniffing with a portable shortwave receiver. This is often not practical in the case of a grow light.

2. Once the source residence is located, hams are often not comfortable approaching the homeowner or filing a complaint. He or she may no longer be a neighbor, and given the nature of what they might be growing, hams often fear for their personal safety.

It must be emphasized that these grow lights are not only the worst devices we've ever tested in the Lab for conducted emissions; they often are difficult if not impossible to resolve.

2) Although LED Part 15 bulbs don't seem to have been a significant source of RFI problems in household environments, Mr. Gruber continues to recommend cautious optimism. These devices still have the potential to become a serious problem without a practical solution. If we consider bulbs that are at or near the FCC limits in a typical suburban environment, the affected ham could easily be within range of 150 or more bulbs from just two neighboring homes. Attempting to find and fix this many sources is obviously not a practical or realistic solution for the ham.

3) Non-consumer Part 18 electronic (sometimes referred to as 18B) ballasts being marketed and sold for consumer and residential purposes.

4) 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 and difficult to resolve.

5) Complaints involving Solar PV systems are on the rise. Given the complexity of contract arrangements, it can sometimes be difficult to identify the operator of these systems, i.e., the party responsible to correct harmful interference under the FCC rules.

- Working with AT&T engineering staff to help resolve RFI issues with U-Verse and other broad band systems.

- Reviewing proposed EMC related material for ARRL publications.

Summary of Recent and Ongoing Lab Activities

Working Group for Recommended Practice of Locating Power Line Noise

Mr. Gruber now serves as Chairman of a Working Group to develop a Recommended Practice for Location of Power Line Gap Noise. See **Committees** section for additional details. EMC Committee member Jerry Ramie, also serves as the Working Group's secretary.

Grow Lights

As previously reported in this document, Mr. Gruber tested four sample grow lights for conducted emissions. Each was also considerably over the FCC limits. The worst case measured 58 dB over the applicable Part 18 consumer limits. In response, ARRL General Counsel Chris Imlay filed four FCC complaints between in 2014 and 2015.

Although each of these devices measured way over the applicable FCC limit, there does not yet appear to have been any enforcement action taken by the FCC. Mr. Gruber believes that this lack of enforcement is simply unacceptable. He further advises that enforcement issues such as this be treated with a higher level of urgency within the ARRL.

Other Lighting Devices

As previously reported, Mr. Gruber tested a number of energy saving Part 15 & Part 18 Lighting Devices for conducted emissions. It should be emphasized that LED bulbs operate under are 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 are considerably lower than applicable Part 15 limits*. As a consequence, the ARRL Board has previously asked us to consider a proposal to reduce Part 15 limits to Part 18 levels for lighting devices. This concern was included in FCC comments filed by ARRL on October 8 on a *Notice of Proposed Rule Making* (NPRM) in ET Docket 15-170 and RM-11673. The ARRL News covered the story on October 13, 2015. Here is the URL:

www.arrl.org/news/arrl-asks-fcc-to-clarify-that-hams-may-modify-non-amateur-gear-for-amateur-use

Mr. Gruber is happy to report that there continues to be relatively few complaints of RFI from these bulbs. However, these bulbs could still be legally marketed and sold if their emissions were close to the FCC limits. The emissions in this case would be high enough to create interference issues even from nearby residences in a typical suburban neighborhood. If and when such interference occurs, the burden then falls on the device *operator* to correct problem. While this rule may work on a case-by-case basis involving a small or limited number of sources, it is not practical should many bulbs in several

houses be contributing to a wide spread problem. This concern was also included in the previously mentioned NPRM comments filed by ARRL on October 8, 2015.

An additional problem involves the sale and marketing of non-consumer rated ballasts to consumers in hardware and big box stores. These ballasts are still being sold to unsuspecting consumers and have been the subject of interference complaints to the ARRL Lab. Although ARRL General Counsel Chris Imlay first filed FCC complaints concerning this issue in 2015, Mr. Gruber is unaware of any resulting FCC enforcement action.

Solar PV Systems

In response to numerous complaints of RFI from residential solar PV systems, Mr. Gruber determined that most of the complaints involved products made by one manufacturer. He arranged a teleconference between ARRL and two of company's representatives in Israel.

Mr. Gruber, along with Bob Allison, Ed Hare and Tony Brock-Fisher represented the ARRL. The manufacturer's attorney and an engineer discussed this issue for about an hour. As a result of this discussion, the company will provide a channel for ARRL to forward complaints, which they will address on a case-by-case basis. At the time of this report, this process remains in the development stage.

Arc Fault Current Interrupter AFCI Breaker Immunity Issues

As previously reported, Mr. Gruber began receiving a few reports of "tripping breakers" from hams in early 2013. 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 worked with Eaton to identify the problem and find a solution. As a result, Eaton began to provide replacement breakers at no cost to homeowners affected by this problem. Since that time, Eaton has developed several versions of the "ham friendly" breaker. Unfortunately initial versions of this breaker were not always successful, at least in terms of fixing the RFI complaint. However, Mr. Gruber now reports the Lab is no longer receiving complaints involving current model AFCIs from Eaton or any other manufacturer.

Mr. Gruber further reports that is aware of some RFI issues involving older Eaton model AFCIs. As neighborhoods evolve and new hams are licensed, these are likely to occur for the foreseeable future. In response to this, he has written an update on this issue that will appear in the September issue of QST. In case anyone is interested it can also be downloaded for distribution at Conventions, etc.

Marketing of Drone TV transmitters that operate on Amateur, Aeronautical Radio-Navigation and FAA radar frequencies.

As previously reported, the ARRL EMC Engineer Mike Gruber and Mr. Carlson were sent information which revealed there is a serious potential problem with the marketing of video transmitters for installation on airborne drones that operate on amateur and aeronautical radio-navigation radio frequencies. The marketing of radio equipment which has obviously not been tested for FCC rules compliance is nothing new, but in addition to being a nuisance for the operators on the 23 cm band the operation of these transmitters does carry the distinct possibility of causing harmful interference which would result in a serious safety of flight issue for aircraft operations.

Messer's Gruber and Ramie wrote a report detailing numerous concerns regarding this matter September. It was subsequently submitted to General Counsel Chris Imlay in the fall of 2016 in an effort to facilitate an official FCC complaint. Their report highlighted several significant issues:

- These devices are highly illegal on a number of levels. **Most importantly, they represent a serious hazard to air traffic and the public safety.**
- Some of these devices are being marketed and sold as Amateur equipment but some of its channels conflict with air navigation equipment.
- The channels chosen for operation of these airborne transmitters demonstrate a complete disregard by the manufacturer of the established and legal assignments of frequency allocations.
- The specified output power can be several times legal Part 15 and Part 97 power output for such devices. Furthermore, given the fact that they operate from drones, can operate at relatively high altitudes, interference to aircraft navigation systems could potentially occur at greater than normal expected distances.
- These transmitters and amplifiers are being offered online by a number of internet vendors. A quick online perusal of vendors indicates that there is no shortage of suppliers of these devices.
- It is only a matter of time until amateur operations will be affected by these transmitters, but if such a device ever does interfere with the integrity of the FAA's ATC transponder radar system it would be beneficial to be able to show that we had warned the Commission of the nature and dangerous potential that these transmitters represent.

Marketing of various units continued unabated at the time of the ARRL Lab's report. Sampling of the offerings at that time could be found using any internet search engine with the search terms "1.2GHz, transmitter". A recent search of Amazon also provided hundreds of offerings of transmitters capable of power levels between one-quarter and six watts. The FCC has in the past addressed the marketing of similar unauthorized radio frequency devices but there have been no recent Commission actions against the marketing or operation of these unauthorized devices.

Although recent complaints concerning improper marketing of non-compliant devices have been ignored by the Commission, it remains the consensus of the ARRL-EMC Committee that the potential for serious problems did warrant filing a formal complaint. Mr. Imlay prepared a filing to the Federal Communications Commission that was submitted in January 2017 (*Appendix #1 to this report*). It includes a request for action to prevent the improper marketing of the non-compliant devices.

Please note that not all drone television transmitters are at variance with the Commission's Rules and Regulations. The remediation of this situation could be easily remedied by a simple action by the Commission. Just over a decade ago, the Commission was able to stop the marketing of very similar illegal devices with a short letter to the offending marketers. It is hoped that the Commission will abate this problem with a similar action.

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. Meaningful enforcement beyond that, however, continues to be very disappointing. To the best of his knowledge, no previously reported longstanding power line noise case has been resolved during the first half of 2017 due to enforcement. While some cases have been closed, many cases can drag on indefinitely. Protracted cases are often caught in an endless loop or letter writing campaign. As a result, new cases can develop faster than old cases are resolved. There has been little or no change from the previously reported statics in this regard. The FCC has yet to issue even one NAL in a case of interference to Amateur Radio from a Part 15 or Part 18 device. Yet – some cases have dragged on for over a decade without resolution.

As previously reported, the FCC is not pursuing amateur related EMC enforcement issues in a meaningful way. At the present time, two non-power line examples of particular concern include:

1. On March 14, 2014, the following story appeared in the ARRL News: ARRL to FCC: "Grow Light" Ballast Causes HF Interference, Violates Rules.[1] This story reported a formal complaint made by the ARRL to the FCC concerning grow light ballasts that were considerably over the applicable FCC Part 18 limits. Since these devices are being marketed and sold in shops across America, and given the incredible margin by which they exceed the limits, this was a slam dunk case for FCC enforcement. Yet, at the time of this report, no enforcement has taken place and the problem continues.

   It has also been reported by EMC Committee members who are professionally employed electrical engineers in the cable-TV/cable-modem area that grow light ballast have been found to cause serious harmful interference to the operation of cable systems. Electro-Magnetic Interference from grow-light ballasts enters the

[1] The URL is www.arrl.org/news/arrl-to-fcc-grow-light-ballast-causes-hf-interference-violates-rules. Included at the end of this report as Appendix XXA.

cable system in the downstream end and causes interference to subscribers in a relatively large areas.

2. On April 24, 2014, the following story appeared in the ARRL News: ARRL FCC Cites Washington Resident for Causing Interference on Amateur Frequencies.[2] This article describes a case in Woodinville, Washington in which the FCC conducted a field investigation. Although the FCC issued a Citation & Order on the 24th of April, the same day as the ARRL News article[3]. Although the interference went away a few months ago, the FCC failed to take any action in three years to correct the problem.

   The noise in this matter was consistent with a grow light. It should be emphasized that the property owner simply ignored the FCC's Citation and Order and no further FCC enforcement took place until the interference went away for unknown reasons.

Historically, meaningful FCC enforcement beyond an advisory letter has been and continues to be disappointing. So far, most cases involving Amateur radio have been argued on the basis of harmful interference as opposed to exceeding the FCC emissions limits. The FCC rules place the burden to correct harmful interference on the *operator* of the offending device – not the distributor or manufacturer. Device operators in a typical RFI case include a power company or neighbor.

In a typical case, one or more letters will be sent by the FCC in Gettysburg to an offending device operator. Beyond that, a typical case will be referred to the local FCC field office for an investigation. From what we've seen, most field investigations result in a conclusion of convenience. As a typical example, the agent may conclude that the noise is insufficient to meet the criteria for harmful interference, thus ending the case. Other complainants have reported a lack of follow-up after an investigation, especially if the source was not active during the initial field investigation

Also from what we've seen, FCC field agents often do not have the proper training or equipment to correctly identify and locate power line noise. Their equipment seems better suited for locating such things as transmitters. Even if the source is known, or if the source is a consumer device in a nearby home, we've yet to see one in which the FCC issued an NAL or forfeiture. Some cases like this have dragged on for a considerable period of time with no resolution.

Furthermore, from what we've seen so far, the FCC Field Office reduction has had a significant and negative impact on FCC field resources. Despite the Commission's enthusiastic claims for a centralized "Tiger Team" approach, it has only made matters worse. To the best of Mr. Gruber's knowledge, it has yet to be even one Amateur case

[2] The URL is www.arrl.org/news/fcc-cites-washington-resident-for-causing-interference-on-amateur-frequencies.
[3] The URL is http://transition.fcc.gov/Daily_Releases/Daily_Business/2014/db0424/DA-14-536A1.pdf.

investigated by a Tiger Team. It also appears that FCC enforcement issues have become problematic for other radio services as well.

FCC Enforcement Concerns

While a lack of meaningful enforcement in cases involving device operators has been the norm for a considerable period of time, the two examples described in the previous section plus two more appear to demonstrate a continuing and alarming trend.

In summary:

1. The first involves grow light manufacturers. The ARRL has so far filed four complaints of devices that were grossly over the applicable FCC limits. Although the first complaint was filed on March 14, 2014, so far there has been no apparent enforcement action by the Commission. **In fact, the Commission has yet to even acknowledge or respond to any of these complaints.**

2. The second is an apparent lack of response to an FCC Citation & Order that was issued on April 24, 2014. The Citation and Order was ignored by the recipient and he interference continued unabated for three years. Although the interference is no longer an issue, **the FCC never took any meaningful action in this matter.**

3. The third example concerns the three illegal marketing of Part 18 non-consumer lighting devices. Although all three complaints were filed by the ARRL in 2015 the FCC has yet to take any action and the problem continues. **In fact, the Commission has yet to even acknowledge or respond to any of these complaints.**

4. The fourth example is particularly alarming. On January 12, 2017, the ARRL filed a complaint involving illegal TV transmitters for use on drones installations has channels that directly conflict with critical air navigation transponder frequencies. Furthermore, they can operate at six times legal Part 15 or 97 power levels and from a platform that is hundreds of feet in the air. These devices continue to be sold, allegedly as ham equipment. **To the best of Mr. Gruber's knowledge, the FCC has yet to take any action in this matter or even acknowledge this complaint.**

It must be emphasized that even if there is an ongoing FCC effort in any of these matters, they have now been ongoing for a considerable period of time with no known formal FCC action. Even if there was to be an FCC action at this point, it would not be timely enough to achieve maximum impact as a future deterrent.

With the proliferation of new types of lighting devices, including grow lights, not to mention such things as switching mode power supplies, battery chargers, pulsed dc motors in appliances, etc., meaningful enforcement is badly needed. A lack of

enforcement in RFI matters would no doubt be disastrous for both hams and other services as well. If the FCC does nothing about something as egregious as a threat to air navigation and the public safety, grow lights, proper follow-up it to a Citation & Order, or illegal marketing of industrial devices, it would fundamentally call into question the FCC's credibility as an enforcement body. It would also seem unlikely that meaningful enforcement could be expected in other interference matters as well.

Mr. Carlson, Mr. Hare and Mr. Gruber continue to recommend visible Board-Level follow-up with the Commission in these matters.

First Half 2017 Year Total RFI-Case Statistics:

New RFI Cases – 106
New electrical power-line cases – 18

- ARRL Letters sent – 19
- FCC 1st Letters submitted – 13 (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 could possibly be follow-up in nature and therefore require 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; and there has been no change to the process of processing cases presented through the Agreement. Although none of the previously reported cases have been successfully resolved as a result of FCC enforcement, the Committee is continuing in the process of addressing this issue.

<u>KI6IBS Power Line Noise Investigation</u>

In an effort to develop a power line noise case for ARRL consideration as a higher level FCC complaint, Messer's Gruber and Ramie investigated the case of Eric Schreiber, KI6IBS, in March and April of 2015. This case is located in Pleasant Hill, CA and first reported to ARRL on April 24, 2012. The utility in this matter is PG&E.

Since first reported to us, PG&E has responded to numerous FCC and ARRL communications. PG&E also claims to have made significant effort toward resolving it. Although the noise at KI6IBS is intermittent and primarily active at higher temperatures, it was severe and not particularly difficult to find when using proper modern methods and equipment. The people that PG&E were sending out did not have the right equipment, or if they did, they didn't know how to use it.

Although Mr. Gruber has forwarded this report to PG&E's attorney Jonathan Pendleton on June 12, 2015, the problem remains ongoing. Laura Smith at the FCC was also a CC recipient of this report. While there was a subsequent attempt to fix this problem, it was unsuccessful. PG&E failed to conduct a technically competent RFI investigation in response to Mr. Gruber's report.

Mr. Gruber reports that this case is solid. The only potential issue might be the intermittent nature of the noise in cooler weather. Given the extraordinary effort it requires to groom and develop a case to this level, Mr. Gruber recommends to the Board that it be used for a timely and higher level complaint at the FCC. He also notes that Mr. Schreiber continues to periodically ask about the status of his case with the ARRL. Since his case is being handled at a higher level within the ARRL, he has been unable to advise Mr. Schreiber in this regard**.**

K7GMF Power Line Noise Complaint

Tom Lopez of Cochise Arizona first reported his power line noise problem to ARRL over ten years ago. Despite numerous FCC letters and an investigation by Mike Martin, the problem continues. This case was first reported to the ARRL in 2004, over a decade ago. At present, Laura Smith reported in 2005 that she had sent this case to the field office. This case is still pending a field investigation after two years. More complete details on this case are in the January 2017 EMC Committee Report.

Smart Grid & EMC Standardization Efforts

Mr. Ramie (KI6LGY) writes about the updates our efforts in these areas:

1) **IEEE-P1613 development**

The three sponsoring Committees within the Power & Energy Society (Substations, T&D and Power Systems Relaying Committee) have merged into two sponsoring Committees. (T&D and Power Systems Relaying) They have both undertaken a review of the draft P1613, which was sent out to their Members. T&D members made a few clarifying suggestions, which were promptly implemented.

Push-back from some T&D Committee members has now begun to take shape. There was a negative discussion about P1613 at their recent meeting in early May, which I was unable to attend because of a conflict. It seems that a manufacturer of distribution hardware hadn't noticed the changes that were brought into the previous IEEE-1613 pair of Standards for Communications Networking Equipment. (they don't make networking equipment, but they make equipment that communicates with such gear) In effect, they were asking "Why didn't we hear about these shortcomings before?" Only the manufacturers are upset. The utilities on the T&D Committee tend to like the document, as it protects them from buying unreliable gear.

In response to the T&D Manufacturers' concerns about lack of context or explanations for the changes we've implemented, we have opened up the draft and are inserting Informative "Notes" that indicate why a change was made or a new test requirement was added. The Use Cases that Ed Hare provided will also be added to the document with attribution. This may take another month or two of editing, but at least nobody has asked us to change a test yet. The utilities have been supportive.

To bring the T&D manufacturers up to speed and to blunt their criticisms, everyone was provided with a Presentation on the new draft IEEE-P1613(201x) that they are reviewing now. The Presentation will be given at the Smart Grid EMC Tutorial session during the IEEE - EMC Symposium later this summer. It explains the initial NIST gap-finding process within SGIP, then the gap-filling extension of the old IEEE-1613 with the newer IEEE-1613.1 for communications networking equipment and finally the additional testing requirements in this new draft immunity Standard P1613 for all IEDs. (whether they communicate or not)

We hope to schedule a time to discuss T&D manufacturers' concerns and address as many of them as possible through explanation and teaching. We have to sell. There may be a need to travel. We need to give T&D manufacturers and their customers (the Utilities) enough information so that they are comfortable with elevating this document to a successful "Consensus" ballot and hopefully moving it to the IEEE for a formal Standards ballot. We'll be lucky if we get there this year... more likely next.

2) **SEPA-SGIP-EMI Issues Working Group**

The Smart Grid Interoperability Panel (originally under NIST) was recently merged with SEPA. (Smart Electric Power Alliance) The EMI Issues Working Group within SGIP did the initial work identifying the missing immunity tests for utility communications networking equipment that became IEEE-1613.1(2013). It was the organization that helped American utilities harmonize their acquisitions with the Europeans for specifying reliable communications networking equipment that could resist malfunctions by demonstrating "immunity" to simulated interference scenarios during type-testing.

The work is continuing under SEPA. Our next product will be a white paper on EMC Testing Setups for performing the tests in the draft IEEE-P1613 immunity testing Standard for all IEDs discussed above. EMC test labs (through ACIL) want this content generated so that they understand how to run the tests. Communicating with the Equipment Under Test (EUT) while simulated interference is being delivered to it and simultaneously monitoring its performance is sometimes tricky. The Presentation developed from the white paper will be given at the EMC Symposium.

3) **IEEE-P1897 Recommended Practice for Powerline Noise Mitigation**

Everyone on the committee is getting along well. We had a discussion about breaking up the remaining work into several parts to speed things up, but the consensus of the group was that we should review the working draft together at each meeting. When we run into

problematic text, we form a smaller task group to generate that paragraph or section and bring it back to the working group. We've been working on the draft this way for about 18 months and we're about half done. It will probably take another 18 months to finish. We want consensus with the electric utility industry. If we're addressing their concerns in good faith, it should be attainable. I am now assuming that we can have the text ready to ballot by the end of next year.

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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 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. During the past six months, ARRL received no reports of problems. Our cable liaison, Mr. Ron Hranac (N0IVN), also noted that he received no reports or complaints directly, indicating that most cable systems are either clean or are addressing complaints effectively.

Mr. Hranac also reports the following note of interest:

Shortly after the initial deployment of long term evolution (LTE) "cellular" technology in the U.S. in 2010, LTE service providers discovered the presence of leaking cable TV digital signals in the 698 MHz to 806 MHz LTE spectrum, causing interference to LTE tower uplinks. The cable TV industry responded by developing digital-compatible, multi-band signal leakage detectors, which are now becoming more widely deployed. The new detectors allow cable operators to monitor for leakage in the VHF spectrum and UHF spectrum, even in cable networks that have migrated to mostly- or all-digital operation. (Until the past few years, signal leakage monitoring was largely confined to frequencies in or near the 108 MHz to 137 MHz VHF aeronautical band.) Mr. Hranac suspects that the use of the newer leakage detection devices may be contributing – at least to some extent – to the apparent reduction in leakage-related interference complaints to amateur radio operation.

DSL, U-Verse & Home Phone Networking Alliance

Mr. Beattie continues to assist with broadband service complaints to the ARRL. In addition, Mr. Beattie has been working toward formalizing the process that AT&T uses to address these issues with ARRL.

Based on a previously reported complaint from Arizona, Mr. Beattie also reported that CenturyLink is doing something different than other xDSL carriers. Specifically, they are increasing their DSLAM signal level in the specific spectrum where the interference is occurring. If the source is an Amateur station in the transmit mode, the DSLAM can create interference to that same station when in the receive mode.

Mr. Gruber also reports that there has been a reduction in interference reports from CenturyLink DSL systems. As previously reported, the interference appears to be caused by radiation from the phone lines due to a fault or imbalance on the lines. The problem occurs in the upper portion of the 75 meter band above 3.8 MHz. One such complaint in Idaho was detailed in the last EMC Committee Report. Although CenturyLink did not directly respond to Mr. Gruber's letter, there was a significant and mostly successful effort to fix the problem. The complainant seemed happy with the results and Mr. Gruber may close the case. At the time of this report there are no other open cases involving CenturyLink.

In another case, Mr. Beattie and other AT&T personnel provided valuable troubleshooting support to a Tucson-area couple who had engaged Tucson Electric Power regarding power line noise interference to their 40m operation. Mr. Beattie and other AT&T personnel investigated TEP's suggestion that power supplies at an AT&T's cell site were causing interference to the couple's HF operation. While no relevant noise was found at the site, AT&T isolated the issue to one or more TEP transmission poles. The Amateur Radio operators are now waiting for a response from TEP. The FCC, ARRL and AT&T were copied on this latest communication and are standing by pending TEP's response.

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 first half of 2017 and compared to the previous six years:

Category of Case Reported to ARRL Lab/EMC Engineer	2011	2012	2013	2014	2015	2016	1st Half 2017
BPL	0	0	0	0	0	0	0
Unknown Unintentional Radiators	78	66	68	81	49	70	36
CABLE TV	7	3	4	4	4	2	0
Satellite TV			2	3	1	0	1
Computing Devices and Modems	7	3	5	6	8	3	3
Power Line Noise	65	53	52	51	43	47	18
Plasma TV Receivers	14	5	3	5	1	3	0
Other Broadcast Receivers	0	4	4	4	0	1	0
Other Receivers	3	1	1	4	1	6	4
Other Transmitters	9	2	2	4	3	3	2
Broadcast Transmitters	4	6	6	2	5	1	0
Lighting Devices	13	4	10	15	7	19	2
Confirmed & Suspect Grow Lights[4]	---	---	2	16	6	12	5
Fence Systems	2	0	3	3	0	2	0
Battery Chargers / Power Supplies	1	3	4	5	7	9	2
Wheelchair	1	0	0	0	0	0	0
Water Pump Systems	2	1	2	2	0	0	0
HVAC Systems	6	3	10	6	5	12	2
Alarm Systems including detectors	0	4	2	4	2	3	2
Other Appliances	8	7	7	4	3	10	3
GFIC / AFCI	1	5	7	25	6	5	3
AUTOMOBILE Systems	3	2	7	1	1	3	3
Manufacturing and Retail Generated Noise	0	0	1	2	0	0	0
AT&T U-Verse Systems	8	8	3	4	6	1	0
PV Systems	---	---	2	1	3	10	12
Doorbell Transformers	---	---	2	3	0	2	2
Other	---	36	16	16	15	30	6

[4] It can be difficult to confirm a Grow Light. As a result, a number of other grow lights may appear as Unknown Sources. Based on their signatures, a number of Unknown Sources are most likely Grow Lights but remain unconfirmed.

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 has 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

- 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

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. 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.

Mr. Hare is the Primary ARRL C63® representative; Mr. Carlson is the Alternate. Mr. Hare serves as the Chair of Subcommittee 5, Immunity. Mr. Hare also serves on Working Groups developing standards for the measurement of LF and HF wireless power-transfer devices, lighting devices and a Working Group writing recommended procedures to test various forms of Industrial, Scientific and Medical devices.

Mr. Ramie serves as the C63® Secretary and as a member of Subcommittee 5. 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). SDECom serves as the EMC Society standards board, overseeing the development of all IEEE EMC Standards. He was also elected to serve a two-year term, starting January 1, 2017, as the IEEE EMC Society Vice President of Standards.

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

A list of the planned, recent and ongoing EMC activities at the ARRL Laboratory includes:

- Continue to identify and test devices that operate above the FCC limits, including lighting devices.
- Develop standardized methods of locating RFI sources of harmful interference to Amateur Radio stations. Work with other Industry Groups to develop methods of best practices for location sources such as lighting controls, motor controls and power line noise.
- Test a number of devices that belong to staff and/or local hams that have caused instances of harmful interference.

Mr. Gruber continues as Chairman of a Working Group to develop a Recommended Practice for Location of Power Line Gap Noise. Additional EMC Committee members in this group include Messrs. Cramer as Co-chairman, Ramie, Carlson, Hare and Boucher. This P1897 Working Group is sponsored by the EMC Society. The first formal meeting was held on December 10, 2015 and development on a set of best practices continues with monthly meetings.

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.

As a note of personal thanks, I would like to recognize Mr. Hare, W1RFI, and Mr. Ramie, KI6LGY and the EMC Committee for their contribution of material for this report. I am especially compelled to recognize Mr. Gruber, W1MG, the ARRL EMC Engineer for his tireless dedication to the Amateur Community as demonstrated through his work in the field of ElectroMagnetic Compatibility.

Respectfully Submitted,

Kermit A Carlson W9XA
EMC Committee Chairman
Director Central Division

List of Appendices

1. Appendix 1 Letter to Ricardo Durham, Acting Chief Spectrum Enforcement Division, Enforcement Bureau, Federal Communications Commission, "Urgent Complaint of Equipment Authorization and Important Violations and of Potential Interference to FAA Radar and Amateur Radio Facilities". January 11, 2017; C. Imlay, ARRL.