

ARRL EMC Committee Semi-Annual Report

Doc. # 16

For The
American Radio
Relay League

Board of Directors Meeting
July 20-21, 2018

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
- Mr. Bob Allison, WB1GCM, Assistant ARRL Laboratory Manager
- Mr. Ed B. Hudgens, WB4RHQ, ARRL Delta Division Vice Director
- Mr. Carl Luetzelschwab, K9LA, ARRL Central Division Vice Director
- Mr. Riley Hollingsworth, K4ZDH, ARRL Atlantic Division Vice Director

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, review 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 has announced that he will be retiring in the fall of 2018 as the ARRL Lab's EMC engineer. He has handled the majority of the staff work on EMC matters during the last seventeen years. In the 1st half of 2018, 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.
 - 1) 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 lighting devices, including LED and grow lights. Issues concerning grow lights have been discussed in previous EMC Committee reports. There has yet to be any visible FCC enforcement action to help alleviate this problem.

- 2) 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. Mr. Gruber is presently working with an author and Regal Beloit engineer to develop an article for QST concerning this matter.
 - 3) 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. At the present time, the problem has primarily been traced to one manufacturer of equipment. Although they are fixing the reported problems on a case by case basis, this may become a less practical approach as solar equipment proliferates, or new manufacturers enter the market.
 - 4) Wireless Power Transfer (WPT) systems. While there haven't been any reported cases of interference so far, this emerging technology could have the potential to cause significant interference problems. This may be particularly true in cases involving high power, such as in a system used to charge an electric vehicle.
 - 5) Power line noise remains a significant problem facing hams today. Cases can drag on for years without meaningful FCC enforcement, often leading to frustration on the part of the ham.
- 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

Grow light continue to be an issue. The current method for formal resolution is that Mr. Gruber refers a suspected grow light case to Laura Smith for follow-up. Ms. Smith then sends a suspect grower a letter without mentioning the ham or Amateur Radio. In a majority of the cases it has been the situation that the FCC letter is ignored

and the harmful interference remains a problem for the radio amateur. FCC enforcement has not occurred in cases that involve grow light systems.

Other Lighting Devices

Mr. Gruber reports that interference from lighting devices seems to be on the rise. Much of the problem to be caused by switching mode power supplies in low voltage lighting products. Another issue has been dimmers for LED bulbs.

It should also be noted that LED bulbs can be legally marketed and sold if their emissions are close to the FCC limits. The emissions from LED bulbs that are compliant could 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 issue has been demonstrated in an actual ongoing case in California.

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.

Solar PV Systems

As previously reported, Mr. Gruber determined that most of the complaints involved products made by one manufacturer. As a result of a subsequent teleconference with the company's engineer and attorney, the company agreed to provide a channel for ARRL to forward complaints. In turn, they agreed to address these issues on a case-by-case basis.

Since that time, the company has been responsive and appears to be making a good faith effort toward resolving these problems. As a result, some cases appear to have been fixed to the Amateur's satisfaction. However, some issues did occur along the way.

- While not necessarily an issue, it should be noted that newer cases are ongoing and have not been corrected at the time of this report.
- Repairs have not always occurred in a timely manner. This, in part, appears to have been as a result of a need to find the right approach toward solving these issues.
- The company appears to have been initially uncertain as to how to best solve the interference.

The success rate and timeliness of the repairs has yet to be determined. However, Mr. Gruber remains cautiously optimistic, at least in the case of this one company. Equipment from other companies, however, may be a different matter.

It should also be emphasized that the proliferation in residential solar PV systems can aggravate the situation. Should interference occur, there may be multiple sources, making it more difficult for hams with without specialized equipment to locate. Amateurs have already expressed concerns about the difficulty in locating the source systems when confronted with many systems in their neighborhood. This may be a real issue, especially if all buildings in the area have PV systems on them. As an example, this may soon be the situation in California, where State law requires all new buildings to have PV systems on them.

Arc Fault Current Interrupter AFCI Breaker Immunity Issues

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, Mr. Gruber wrote an update during the 2nd half of 2017. This update appeared in the September 2017 issue of QST. It can also be downloaded from the ARRL Web site for distribution at conventions, club meetings, etc. This single page download has proven very helpful in the few cases that were reported to ARRL in the first half of 2018.

Power Line Noise

On February 28, 2018, Messrs. Hare and Gruber assisted two FCC field agents in locating some noise sources that were plaguing the East Hartford, Connecticut, fire alarm system. This system is operated by the City's Fire Department, and power line noise has been severe enough to render several alarms in the system inoperable when using a new receiving system at the fire station.

Messrs. Hare and Gruber demonstrated the use of Radar Engineers equipment, and located several sources at the time of their visit. The utility in this matter, Eversource, subsequently hired Mike Martin, a well-known professional RFI investigator, to perform a complete RFI investigation in May.

WPT Wireless Power Transmission Systems

In the early months of 2018 the EMC Committee discussed a radically "new" form of Wireless Power Transmission that was the subject of a FCC grant for an STA (by the Texzon Corporation) that would investigate power transmission ala Nickola Tesla's concept from the 1911 era. It was universally decided that the reason for that STA was flawed and lacking a legitimately rigorous scientific basis. However, some applications of WPT are now commercially available that rely on a magnetically coupled power distribution scheme, albeit at a range approaching physical contact. Most of the smaller charging devices examined such as cellphone chargers appear to be of no concern as

potential sources of harmful interference. It is in a few potential applications when the power being transferred wirelessly will range into the kilowatt level or higher that there is a growing concern.

Messrs. Hare, Allison and Carlson held a Webinar with Gene Saltzburg, AB2ZM, of General Motors on June 19, 2018. The purpose of this discussion was wireless charging systems for electric vehicles, and the potential for interference that they cause. While it is premature to say for certain what interference this emerging technology may cause, the potential would seem to be there. Mr. Saltzburg was able to share some helpful information in this area. See Appendix I for additional information.

In appendix 1, the typical conductive (plug-in) EV charging system is compared to the Wireless Power Transmission system in the second slide. The third slide depicts the “executive summary” block diagram of the typical WPT-EV charging system.

Mr. Carlson has been in contact with representatives from the IARU that are examining the present regulatory environment that would control emissions from WPT-EV (Wireless Power Transmission – Electric Vehicle) systems. An international framework of emission standards will be required to adequately protect amateur spectrum from harmful interference.

It is apparent that most vehicle manufacturers will be using WPT-EV systems designed and built by third parties. At this time there are only limited development systems being tested in the States. The practical issue of 20-30 kW wireless power transmission system as potential emitters of harmful interference in residential settings is of great concern. This is not only a concern because of the potential for emission at the intended fundamental frequency (usually mentioned is the 75-90 kHz range of frequencies) but because of the potential for fields at the harmonics of those frequencies. One potential design features a variable frequency system that sweeps the frequency in order to locate the operating point of best coupling to the vehicle’s WPT charging system.

Because of the lack of EMC test data and the lack of access to operating systems the present efforts have been to gain access to WPT-EV systems for testing of emissions prior to final design and release. The ARRL Lab and EMC Committee are working to arrange for a access for field testing at the earliest opportunity.

WPT-EV systems under consideration are presently only 75-80% efficient which might indicate a significant barrier to market acceptance. Also, the safety aspects of large magnetically coupled power systems involve problems ranging from biological concerns of field exposures to incidental heating of objects in the field. Despite these apparent short-comings of present system designs there is great concern for the potential of extreme levels of harmful interference from this specific use of the RF spectrum.

Interference from AM Broadcast Stations

In March, a group of noted 160 Meter DX and Contest operators contacted the ARRL Lab and EMC Committee Chair Kermit Carlson, W9XA, regarding harmful interference to amateur operations on 1920 kHz. The source was determined to be a relatively new installation for a re-located AM Broadcast station with authorization for 4 kW (Daytime) of transmitter power output into a directional antenna system. Reports of reception were made by amateurs more than 70 miles from the suspected source. With the help of several of the amateurs, it was successfully determined that there was a spurious emission that was well above the FCC limits for out of band emissions. The first investigation of the problem by the station engineers did not indicate a problem at the output sampling coupling from the transmitter. After a series of field strength readings had been made using a calibrated Potomac Instruments Field Strength Meter that indicated a significant problem, the ARRL Chief Counsel was able to help convince the station management to check again for a problem. The issue was determined to be improper grounding at the tower base in the lighting systems' isolation transformers. Once this problem was identified and repaired the spurious emission on 1920 kHz was greatly reduced.

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 operation of these transmitters had the potential of causing harmful interference and therefore a serious safety of flight issue for aircraft operations.

As a result of these issues, ARRL Lab tested two of these transmitters and developed a detailed report concerning this matter. General Counsel Chris Imlay subsequently filed an official FCC complaint on January 11, 2017. In his letter to the FCC Spectrum Enforcement Division, he described the transmitters as “blatantly illegal at multiple levels,” and noted that they used frequencies intended for navigational aids, air traffic control radar, air route surveillance radars, and global positioning systems and not Amateur Radio frequencies, as the marketer had purported. He then went on to say that these transmitters, “represent a real and dangerous threat to the safety of flight, especially when operated from a drone platform that can be hundreds of feet in the air.”

In an apparent response to Mr. Imlay's complaint, the FCC issued an Order on December 19, 2017 to Lemonier Holdco LLC (formerly known as FPV Manuals LLC). This Order imposed a \$180,000 civil penalty on the company for marketing noncompliant audio-visual transmitters intended for use on drones.

In a new development during the first half of 2018, the FCC issued a *Notice of Apparent Liability* (NAL), to HobbyKing, the distributor mentioned in the original ARRL complaint in 2017. This NAL, issued on June 5, 2018, alleges that HobbyKing appears to have sold audio/video transmitters (A/V) intended for use with unmanned aircraft, such as drones, marketing them as Amateur Radio equipment in some instances. **The FCC's NAL went on to propose fining HobbyKing and associated entities \$2.8 million for apparently marketing noncompliant RF devices and failing to comply with Commission orders.**

See Appendix 2 for the ARRL News Story on June 7, 2018 and the FCC's NAL.

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 2018 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.**

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. Two examples that come to mind include:

- An apparent grow light case that resulted in a field investigation after some time: The agent conducted the investigation when the lights were off and closed the case. The agent had not checked to see when the lights were typically on and declined to return when the lights would likely be on.

- An apparent doorbell transformer case that resulted in an FCC field investigation: The source was located in a home and, with modern locating equipment, most sources like this are relatively easy to find. Despite an offer to loan our Radar Engineers Model 245 locator, the FCC declined our offer and the problem continues. The current status of this case with the FCC is unknown at this time.

It appears that FCC field agents do not always have the proper training or equipment to correctly identify and locate power line and other noise sources. 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.

Finally, from what we've seen so far, the FCC Field Office reduction continues to have 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 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 issues described in the previous EMC Committee reports remain ongoing. A brief summary includes but not limited to:

1. Grow Lights and other devices being marketed and sold that exceed the FCC limits, in some cases by a considerable margin.
2. Illegal marketing of Part 18 non-consumer lighting devices. Non-consumer devices are being marketed to consumers for residential environments. These devices are only intended for commercial and industrial environments.
3. Field investigations are almost non-existent with abnormally long waiting times.
4. Field investigations being conducted in such a way that the outcome will not be favorable to the Amateur. Examples include cases in which the investigation took place at times when the source was known to be off, checking for noise at random (unaffected) frequencies, etc.

It must be emphasized that any FCC enforcement effort in any of these matters will have the maximum impact if it takes place in a timely fashion. Some cases have 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 electronic devices and technology, some of which have the potential to cause a considerable interference problem, some meaningful FCC

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 grow lights, or 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. Gruber continues to recommend some sort of visible Board level follow-up in these matters where appropriate. He would also would like to say that he is greatly encouraged by the two enforcement action in June of 2018.

First Half 2018 Year Total RFI-Case Statistics:

New RFI Cases – 114

New electrical power-line cases – 25

- ARRL Letters sent – 15
- FCC 1st Letters submitted – 4 (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:

The two previous cases described in previous EMC Committee reports remain ongoing and for over 5 years. These cases are located in Pleasant Hill, California and Cochise, Arizona.

Mr. Carlson continues to investigate and monitor four cases in the Midwest. One of the four cases was been completely remedied in June by the power utility using techniques that are the same as those in the developing recommended practices under development in the IEEE-P1897 Working Group Chaired by Mr. Gruber.

FCC Field Investigation of Concern

A problematic case in Santa Ana, California, was the subject of an FCC field investigation during the second half of 2017. The case started in March of 2017 when the complainant called Mr. Gruber at the ARRL RFI desk. The source was an unknown and radiating from a nearby uncooperative neighbor's house.

The case ran through the normal channels, i.e., an ARRL Letter followed by an FCC letter. The neighbor finally agreed to allow the FCC to investigate the matter at her home approximately in August of 2017. The first field investigation took place on August 30, 2017. A second followed on September 6, 2017.

The noise characteristics are consistent with a bad doorbell transformer, probably in the homeowner's garage. The FCC field investigation failed to locate the actual source of the noise. The homeowner will only allow FCC field agents into her home to locate the source, and at this point, the FCC appears to have possibly dropped the case. To the best of the complainant's knowledge, the last known FCC visit was Friday, October 13, 2017. One encouraging incident occurred in late December when an FCC agent called the complainant and asked him to keep a log of the interference.

Mr. Gruber has been working with Laura Smith to use this case as an opportunity to demonstrate the ARRL's interference locating techniques and equipment. Work at Ms. Smith's end is ongoing at the time of this report.

See Appendix 3 for more complete details on this case.

Smart Grid & EMC Standardization Efforts

Mr. Ramie, KI6LGY, updates our efforts in these areas:

1) IEEE-p1613 (Immunity Type-testing of Intelligent Electronic Devices used in substations & distribution)

The draft document is basically complete, but it's still stuck in the working group. There was a meeting in Pittsburgh in early May, and it wasn't all friendly. Even though the document was written to the Project Authorization Request (PAR) that we were given, it was clear that the working group now cannot tolerate the wide scope of the document. It currently covers anything with a microprocessor used anywhere in the power system, whether it communicates or not. There will be a webinar meeting in a couple of weeks to discuss de-scoping the document to something more narrow or returning to its original scope, covering just Communications Networking Devices in substations. (routers, switches, etc.)

This rejection of the broader IED content (in both substation and distribution settings) is driven by a handful of distribution equipment makers that have not tried to limit the tests or levels but rather limit who they apply to. All the specified testing is good, as long as somebody else has to do it! Even though we wrote the draft for all IEDs, the working group has changed their minds and wants a lessened scope. The utilities aren't happy about this de-scoping but seem politically weak in this organization. The manufacturers will probably win out in this struggle, and parts of the P1613 draft document will be ported over to related Standards for substations, such as pC37.90.2 (Radiated RF immunity), C37.90.3 (ESD) and C37.90.1 (EFT & SWC). This process may take another year or two as these other Standards come up for renewal. We will need to be present or the manufacturers will gut them all.

2) IEEE-pC37.90.2 (Radiated RF Immunity testing of protective substation equipment)

The progress on this document has been very good. The substation equipment makers on the working group do not oppose bringing in the content from the P1613 draft (above) and improving it for their use. All of them already do EMC testing, many at third-party labs. We have produced new content that is now being dropped into the IEEE Standards template to make our first working draft. Work is progressing smoothly without objections from the manufacturers and with the support of the utilities present on the working group. This effort will probably be successful and will result in this test being removed from p1613 and merely cited. We can expect this same process to unfold with the other two C37-series immunity Standards in the next couple of years.

3) SEPA-EMI Issues Working Group (EMC Standards & implementation guidance for utility equipment mfgs.)

The League is continuing to support work with the former Smart Grid Interoperability Panel (SGIP) originally under NIST, now a working group within SEPA. (Smart Electric Power Alliance) The EMI Issues Working Group did the original work defining the missing tests for utility equipment that became IEEE-1613.1(2013). That Standard was the vehicle that brought American utilities into harmonization with the Europeans on specifying reliable communications networking equipment that could resist interference by demonstrating "immunity" to simulated interference during required type-testing. The utilities liked it so much that they sponsored the Project Authorization Request (PAR) for P1613 under the Power System Relaying & Controls Committee (PSRCC) to become the replacement for IEEE-1613.1 (2013) to cover all IEDs. (see item 1 above)

Our next product will be a white paper to help third-party EMC labs (members of ACIL) implement the immunity type tests discussed above.

4) IEEE-P1897 Recommended Practice for Powerline Noise Mitigation

Mike Gruber is the Chair of this Working Group that's discussing the best practices for utilities to employ for resolving powerline noise complaints. The Vice Chair, Brian Cramer, W9RFI, of Exelon, is also a member of the EMC Committee. Additional EMC Committee members in the Group also include Mr. Ramie, KI6LGY, who serves as its secretary, Mr. Hare, W1RFI, Mr. Beattie, W2TTT, Mr. Boucher, WA1ZBL, Mr. Hranac, N0IVN, and Mr. Carlson, W9XA. Although not a member of the EMC Committee, it should be noted that Atlantic Division Vice Director Riley Hollingsworth, K4ZDH, is also a Working Group member.

Mr. Ramie noted that we want consensus with the utility industry and feels it is attainable. Progress has been slow, as the Working Group insists on reading the document together at each meeting. Relationships are cordial, however. This has been going on for two and one-half years! It is assumed that we can have text ready to ballot

and push out of this Working Group up to our Sponsoring EMC Society Standards Development & Education Committee by the end of 2018.

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 only one report of a possible cable-related interference problem in the San Francisco Bay Area (the FCC had also been contacted). Our cable liaison, Mr. Ron Hranac (N0IVN), corresponded with senior engineering staff at the cable company, and after investigation, all parties agreed that the interference wasn't from any utility. The FCC acknowledged that it was likely grow lights supporting plant growth inside the home, which was unrelated to cable TV signal leakage or interference. A second event, not involving any actual interference, was correspondence to ARRL HQ from an individual concerned that the cable TV industry's use of the latest cable modem technology (DOCSIS 3.1) had the potential to cause interference. Mr. Hranac prepared an informative response, which was forwarded to the concerned party. Mr. Hranac also noted that he received no reports or complaints directly, indicating that most cable systems are either clean or are addressing complaints effectively.

DSL, U-Verse & Home Phone Networking Alliance

Mr. Beattie continues to assist with broadband service and other EMC complaints received by the ARRL. In addition, Mr. Beattie has been making progress with the processes that AT&T uses to address these issues with ARRL and internally." Mr. Beattie continues to regularly brief company field staff and executives on this topic."

Input From Committee Members

Mr. Roop reports that he doesn't have any new input. However, he would like to provide the following anecdotal observation:

"I replaced my noisy (acoustic and RF) heat pump with a new variable speed system. So far the electronically commutated motors in the new HVAC system are a lot quieter than the old system. We'll see if my optimism holds after I finish the installation of a SteppIR vertical 40' from the compressor."

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 2018 and compared to the previous six years:

Category of Case Reported to ARRL Lab/EMC Engineer	2012	2013	2014	2015	2016	2017	1 st Half 2018
BPL	0	0	0	0	0	0	0
Unknown Unintentional Radiators	66	68	81	49	70	73	36
CABLE TV	3	4	4	4	2	2	3
Satellite TV		2	3	1	0	2	0
Computing Devices and Modems	3	5	6	8	3	12	4
Power Line Noise	53	52	51	43	47	44	25
Plasma TV Receivers	5	3	5	1	3	1	0
Other Broadcast Receivers	4	4	4	0	1	1	1
Other Receivers	1	1	4	1	6	5	0
Other Transmitters	2	2	4	3	3	2	6
Broadcast Transmitters	6	6	2	5	1	3	0
Lighting Devices	4	10	15	7	19	6	3
Confirmed & Suspect Grow Lights ¹	---	2	16	6	12	11	6
Fence Systems	0	3	3	0	2	0	2
Battery Chargers / Power Supplies	3	4	5	7	9	6	1
Wheelchair	0	0	0	0	0	0	0
Water Pump Systems	1	2	2	0	0	1	0
HVAC Systems	3	10	6	5	12	6	2
Alarm Systems including detectors	4	2	4	2	3	4	1
Other Appliances	7	7	4	3	10	7	2
GFIC / AFCI	5	7	25	6	5	6	5
AUTOMOBILE Systems	2	7	1	1	3	5	1
Manufacturing and Retail						0	
Generated Noise	0	1	2	0	0		0
AT&T U-Verse Systems	8	3	4	6	1	2	0
PV Systems	---	2	1	3	10	24	5
Doorbell Transformers	---	2	3	0	2	2	1
Other	36	16	16	15	30	16	10

¹ 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 consistently remains as one of the most reported and problematic RFI problem reported to the ARRL Lab.

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, Mr. Ramie, KI6LGY; Mr. Gruber, W1MG for their contribution of material for this report.

I would like to dedicate this July 2018 EMC Committee Report to Mr. Mike Gruber, W1MG, who has tirelessly promoted the interest of all amateur radio operators through his work in the ARRL Laboratory. Mike has recently announced his plans to retire from the League in the fall of this year.

Prior to joining the ARRL staff, Mike was an electrical engineer in both the air traffic control and aerospace industry. He holds a B.S.E.E. degree from the University of Bridgeport and an A.S.E.T from Hartford State Technical Institute. Mike was first licensed in 1974 as WN1SVF and he holds both an Extra class and a commercial radio license.

While at the ARRL, Mike served as the Product Review Test Engineer for seven years and he has been the EMC Engineer with the ARRL since 2002, primarily assisting in interference matters and working with the FCC. Since serving in this capacity he has handled literally thousands of powerline noise and other Part 15 interference cases. He also has written numerous articles and edited ARRL books primarily pertaining to RFI the ARRL RFI Book (3rd edition).

Mike holds membership in the IEEE, The IEEE EMC Society, The IEEE PES, The IEEE Standards Association, the ARRL and the RSGB.

I am extremely please to be able to say that he plans to remain active with the EMC Committee. We all owe Mike Gruber, W1MG, a great debt of gratitude for his hard work and great efforts on the behalf of all radio amateurs. Thank you Mike !

I would also like to take this opportunity to thank all of the EMC Committee members for their ongoing service to the ARRL and the Amateur Radio community.

Respectfully Submitted,

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

List of Appendices

Appendix 1 Wireless Power Transfer (WPT) Graphics, Gene Saltzberg, AB2ZM

Appendix 2A *ARRL Drone Transmitters Complaint Spurs Proposed \$2.8 Million FCC Penalty*, ARRL News, June 7, 2018

Appendix 2B FCC NAL regarding drone transmitter violations, June 5, 2018

Appendix 3 Problematic RFI Case in Santa Ana, California