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
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Chairman, ARRL EMC Committee

Mission Statement:

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

The overall goals of the committee are:

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

Members of the Committee:

- Mr. Kermit Carlson, W9XA, ARRL Central Division Vice Director, EMC Committee Chairman
- Mr. Phil Barsky, K3EW, Engineering/Management Consultant, retired
- Mr. Gordon Beattie, W2TTT, Principal Technical Architect, AT&T Enterprise IT Service Assurance
- Mr. Jody Boucher, WA1ZBL, RFI troubleshooter, Northeast Utilities, 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. 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

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 2nd half of 2014, 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:

    - Large grow lighting devices used for indoor gardening have become increasingly problematic in all geographic areas of the country. As previously reported, the Lab has purchased and tested four separate ballast units and each exceeds the applicable Part 18 consumer limits by a significant margin – nearly 60 dB in one case. 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.

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.

- LED Part 15 Bulbs have so far not proven to be a significant source of RFI complaints. Nonetheless, 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.
- Non-consumer Part 18 electronic ballasts being marketed and sold for consumer and residential purposes. Note: Both the consumer and non-consumer limits Part 18 limits were exceeded in the case of all four ballasts tested by the ARRL Lab.
- 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.

- 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

Grow Lights

As previously reported in this document, Mr. Gruber tested four sample grow lights for conducted emissions. They were purchased from both local retailers and on-line sources. Three different manufacturers were included in this survey – Lumatek, Quantum and Galaxy. They were selected on the basis of complaints that from the field. Not surprisingly, each was also considerably over the FCC limits. The worst case measured 58 dB over the applicable Part 18 consumer limits. ARRL General Counsel Chris Imlay used the resulting Lab report as the basis for an FCC complaint, which was covered in the ARRL News.

The status of the FCC complaint filed by Mr. Imlay remains ongoing.

Other Lighting Devices

As previously reported January's EMC Committee report, 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 look at proposal to reduce Part 15 limits to Part 18 levels for lighting devices.

Mr. Gruber is happy to report that there continue to be very 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.

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 with invaluable help from W1AW Station Manager Joe Carcia built a "universal" circuit breaker test fixture. Using this fixture, he and Mr. Carcia tested as many breakers as they could find during W1AW broadcasts and other transmissions. The final results of this testing indicated that most of the AFCI breakers were surprisingly robust. The only problem breakers were a new – and only the new - model Eaton breaker at the time. Note: Eaton and Cutler Hammer are both part of the same company. Some Cutler Hammer breakers may have also had RFI issues, but the samples we tested were not a problem.

As previously reported, Mr. Gruber worked with Eaton to identify and test prototype breakers. At this point, production of the problematic breakers are about to be discontinued. The new Eaton "Ham Friendly" breakers will be entering the market and the problem substantially corrected.

In cases where older breakers are improperly tripping, Eaton continues providing assistance. The ham or homeowner can call one of two individuals at Eaton and they

have been replacing the old breakers on a one-for-one basis free of charge. Complete details, including name and contact information, appeared in the November 19, 2013 ARRL news story, *ARRL Helps Manufacturer to Resolve Arc Fault Circuit Interrupter RFI Problems*.[1]

Power Supply Conducted Emissions Investigation

Mr. Gruber noted a significant increase in conducted emission from an EtherWAN "ethernet switch" when an unterminated CAT5 cable was connected to it. This device could test very quiet in a lab, but be very noisy when used in actual practice. It should also be noted that the power supply was internal to the device, and the problem went away when an outboard power supply was used in place of the internal switching supply.

A subsequent investigation with EMC Committee member Gordon Beattie also resulted in a similar observation. Mr. Beattie reported that a number of power supplies had apparently met Part 15 emissions limits but generated more noise than expected in an actual residential environment. Messer's Beattie and Gruber subsequently investigated this phenomenon in the ARRL Lab. They concluded it is caused by relatively low RF impedance at the load side of the power supply. In an actual real world environment, cables and wires connected to the load side of the power supply can cause this phenomenon to occur.

This investigation remains ongoing.

Status on FCC Enforcement and Outstanding EMC Cases

Mr. Gruber reports that the FCC has been sending letters to utilities (and consumers) with regularity. Meaningful enforcement beyond that has historically been very disappointing. To the best of his knowledge, no previously reported longstanding power line noise case has been resolved during the second half of 2014 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 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.
As previously reported, the FCC is not pursuing amateur related EMC enforcement issues in a meaningful way. At the present time, two 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.[2] 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

[1] The URL is www.arrl.org/news/arrl-helps-manufacturer-to-resolve-arc-fault-circuit-interrupter-rfi-problems.
[2] 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 1A.

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.

While it may be understandable for the Commission not to comment on an ongoing investigation, it is clear that timely FCC enforcement is not happening. It has now been approximately ten months since the ARRL's news story on this matter. Meaningful FCC enforcement when warranted is essential toward protection of all spectrum, not just the ham bands.

It has 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 cable system in the downstream end and causes interference to subscribers in a relatively large areas. As previously noted in the Summer-2014 EMC Committee report, emissions from some grow-light ballasts have measured 58 dB above the FCC limits. In other words, these devices are presenting problems to cable distribution systems often with coupling to the ground and power of residences with the conducted levels far in excess of what is encountered in typical amateur installations.

2. On April 24, 2014, the following story appeared in the ARRL News: ARRL FCC Cites Washington Resident for Causing Interference on Amateur Frequencies.[3] This article describes a case in Woodinville, Washington in which the FCC conducted a field investigation. Although this investigation resulted in a finding of harmful interference from a nearby property, possibly caused by a lighting device, the property owner subsequently failed to respond to the Commission. As a result, the Commission released a Citation & Order on the 24th of April, the same day as the ARRL News article. However, as of late November the interference was confirmed to be ongoing.

   The noise in this matter is consistent with a grow light. At this point, it appears that the property owner has simply ignored the FCC's Citation and Order. Furthermore, to the best of Mr. Gruber's knowledge at this time, no additional enforcement has taken place. Failure to respond to an FCC citation and order would seem to be another slam dunk case, yet to the best of Mr. Gruber's knowledge, there has been no FCC follow-up in this matter, even after approximately nine months.

Historically, meaningful FCC enforcement beyond an advisory letter has been 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

[3] The URL is www.arrl.org/news/fcc-cites-washington-resident-for-causing-interference-on-amateur-frequencies.

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.

From what we've seen, FCC field agents 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.

While a lack of meaningful enforcement in cases involving device operators has been the norm for a considerable period of time, the two cases previously described in this section appear to demonstrate an alarming trend. The first case involves a manufacturer, and the second, an apparent lack of response to an FCC Citation & Order. It must be emphasized that even if there is an ongoing FCC effort in either or both of these matters, any resulting enforcement will certainly not be timely enough to achieve maximum impact as a future deterrent.

Note: Consider that over-the-limit grow light ballasts have been on the market for several years now. They are now proliferating across the country and causing interference to other services, including the cable industry. It's not just Amateur radio anymore. These devices are ridiculously over the FCC limits, yet there has been no meaningful response from the Commission in all this time.

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 it in RFI matters would no doubt be disastrous for both hams and other services as well. These are no longer just technical problems. Additional lobbying and advocacy resources are needed in this situation.

Second Half 2014 Year Total RFI-Case Statistics:

New RFI Cases – 149
New electrical power-line cases – 28

- ARRL Letters sent – 12
- FCC 1st Letters submitted – 10 (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 – 3

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.

Vice director and EMC Committee Chairman Kermit Carlson has been performing follow-up on the status of a majority the 74 open cases of power line noise that had been previously referred to the FCC. The purpose of this inquiry was to determine the status of harmful interference from Power Line Noise for cases that had been reported in the past 5 years but for which the League had an unknown remediation status.
Those cases which are the subject of ongoing FCC investigations and cases where the complainant(s) is known to be problematic or unreasonable were not subject to review.

Fourteen of the 74 cases were closed as a result of the inquiry with the complainant that led to the determination the harmful interference issue had been resolved and that no follow-up is necessary. There were 4 cases where the amateur had moved or become inactive. In 5 cases inquiry was made by email and telephone with no response and in three cases there was no accurate email address in either the ARRL or QRZ.com database and no accurate phone number could be found.

Out of the 41 unresolved cases identified by the follow-up effort three have been selected for presentation to the Commission for further action beyond the 2nd letter by Laura Smith. In all three cases no action by the Utility has been performed and the harmful interference has continued for more than 3 years. It has been decided that in order to insure that these are in fact cases of harmful interference from Power-Line Noise, it was determined that reliable trained and knowledgeable members of the EMC Committee should conduct a survey of the case with noise signature equipment prior to presentation to the Commission. The ARRL laboratory Radar Engineers has been sent to California for the first of these three field investigation, follow-up surveys of a five-year-old PLN case in New Mexico is planned for later Winter-2015.

It is the intent to present these three cases to the Enforcement Bureau with a request for significant action once it has been proven to the satisfaction of the ARRL EMC Engineer

Mike Gruber, W1MG, Laboratory Manager Ed Hare, W1RFI, and to the EMC Committee Chair that the source of the harmful interference is indeed power line noise caused by the power utility. In advancing these harmful interference cases we need to absolutely insure that the root cause of the harmful interference has been correctly identified as PLN.

Here is an update on two RFI cases that Vice director Carlson was able to personally investigate:

- Mr. Carlson investigated a power line noise case in Chicago, Illinois involving two amateurs who suspected that municipal lighting was to blame for a case of harmful interference. Using DF loops and noise signature methods, the source was located in Commonwealth Edison power line distribution system and not the municipal lighting street lighting system. It was fortunate that that the City of Chicago was helpful in the investigation. This remains an active complaint and no remediation effort by Commonwealth Edison has resulted.

- An additional case was briefly investigated while at the Dayton Hamvention by Messer's Carlson and Gruber. Located in nearby Tipp City, it was first reported to ARRL over ten years ago in July of 2004. Since then, Mr. Gruber sent the municipal utility an ARRL Letter, and the FCC also sent a letter was sent in June 2013. The ARRL investigation took place on the morning of May 17, 2014.

  Using signature analysis, the ARRL confirmed that the reported interference is consistent with power line noise, which the utility had previously denied in a letter to the FCC. They were further able to investigate two general locations within walking distance of Mr. Peura's residence. Although unable to complete the investigation due to inclement weather, Mr. Carlson conclusively located one source on the edge of a park. Messer's Carlson and Gruber were unable to locate additional power line noise sources due to rain.

  As a result of this investigation, Mr. Gruber filed for FCC follow-up with Laura Smith on June 13, 2014. The utility then hired Mike Martin of RFI Services to find the problems, and the problem now appears fixed.

Smart Grid & EMC Standardization Efforts

Mr. Ramie is continuing work in these four areas:

1) Update to IEEE-1613.1(2013) - The Scope for the new version of IEEE-1613.1(2013) has been approved by the Substations Committee. There was so much support within the IEEE Power & Energy Society for expanding the Scope of this Standard to include virtually everything a utility buys that, with a slight change in the title of the document, another Subcommittee agreed to join as a co-sponsor. Now, everyone wants to take credit for the new document called "IEEE Standard Environmental and Testing

Requirements for Intelligent Electronic Devices Installed in Transmission and Distribution Facilities." Our original sponsor was the Substations Committee, with the Transmission & Distribution Committee as co-sponsor. We've just added the Power Systems Relaying Committee by including IEDs in the title per their suggestion. This ARRL-funded work has given the utilities just what they wanted; a harmonized immunity testing Standard for equipment they must buy that gets them a wider selection of better quality products from which to choose. The manufacturers never opposed us since they already meet these requirements from selling their products in the EU previously (as shown in their advertising). The IED makers don't have a Standard to use until now. Everybody wins! The hams get Smart Grid utility equipment (that might be installed nearby) with designed-in immunity to their emanations in HF.

2) SGIP2: - The Smart Grid Interoperability Panel uses their EMI Issues Working Group to address EM interference issues to / from utility equipment. They have decided to publish an "Application Note" on using the upcoming version of IEEE-1613.1(2015) as it's the biggest action in smart grid EMC right now. The new version of this 2013 Smart Grid Network Communications Equipment EMC Standard is being expanded in Scope and Title to include all Intelligent Electronic Devices, which will cover virtually everything a utility might buy with a microprocessor in it (whether it communicates or not). The Application Note will help manufacturers apply the document to the immunity testing of their type of products by offering examples and explanations not contained in the Standard (but written by the same people who wrote the Standard).

3) Public Speaking about EMC Standards Harmonization - There will be a smart grid EMC session at the IEEE - EMC show in March where we'll have a chance to teach about these Standards. I will act as liaison from P&E back to the EMC Society as before to keep the EMC Society informed of our progress. There's still some mistrust from the Bad Old Days of BPL, (when the P&E Society wrote their own EMC Standard without consideration of EMC Society views) but things are getting better after the publication of IEEE-1613.1 late last year. We're trying to make peace here so things can get done. Presentations on this topic have been given three times this year (Portland, Pomona, Milpitas) and will probably be given six more times in 2015.

4) Support the ARRL Lab - there's one interference investigation coming up in Pleasant Hill on a powerline noise complaint. Video recording of the lab presentations, and others, was conducted during the Centennial last summer. Edited MP4 files were provided for posting.

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.

Mr. Hare reports that at this point, broadband-over-power-line (BPL) technology is still not posing a significant threat to US Amateur Radio. US access-BPL deployments have proven to be a financial and technical failure and have been dismantled. There is still some in-building BPL product being manufactured and sold, but in compliance with international standards on BPL, none of these products use the Amateur bands, with the exception of 60 meters. In-building BPL does pose some threat to the reception of international HF broadcast signals. ARRL has not received reports of harmful interference involving in-building or access-BPL devices.

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

DSL, U-Verse & Home Phone Networking Alliance

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

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 2nd half of 2014 and compared to the first half of 2014 and the previous four years:

Category of Case Reported to ARRL Lab/EMC Engineer	2010	2011	2012	2013	2014-1	2014-2
BPL	3	0	0	0	0	0
Unknown Unintentional Radiators	57	78	66	68	44	37
CABLE TV	8	7	3	4	0	4
Satellite TV				2	1	2
Computing Devices and Modems	4	7	3	5	5	1
Power Line Noise	90	65	53	52	23	28
Plasma TV Receivers	10	14	5	3	4	1
Other Broadcast Receivers	7	0	4	4	1	3
Other Receivers	8	3	1	1	3	1
Other Transmitters	2	9	2	2	2	2
Broadcast Transmitters	3	4	6	6	1	1
Lighting Devices	15	13	4	10	6	9
Confirmed & Suspect Grow Lights[4]	---	---	---	2	8	8
Fence Systems	4	2	0	3	0	3
Battery Chargers / Power Supplies	1	1	3	4	2	3
Wheelchair	1	1	0	0	0	0
Water Pump Systems	3	2	1	2	1	1
HVAC Systems	11	6	3	10	3	3
Alarm Systems including detectors	6	0	4	2	1	3
Other Appliances	3	8	7	7	2	2
GFIC / AFCI	1	1	5	7	8	17
AUTOMOBILE Systems	4	3	2	7	0	1
Manufacturing and Retail Generated Noise	1	0	0	1	1	1
AT&T U-Verse Systems	10	8	8	3	2	2
PV Systems	---	---	---	2	0	1
Doorbell Transformers	---	---	---	2	1	2
Other			36	16	3	13

[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 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 Vice Chair of Subcommittee 5, Immunity. Mr. Hare also leads the C63® committee's Task Force on testing below 30 MHz, which has completed writing a section of an intentional emitter measurement standard that correctly and scientifically extrapolates field strength measurements below 30 MHz. This material was incorporated into the ANSI C63.10 standard on the measurement of unlicensed intentional emitters (transmitters). At the end of 2014, the C63.10 standard was adopted by the FCC, incorporated by reference into its rules. This establishes a reasonable distance extrapolation method for unlicensed intentional emitters. ARRL expects to continue its work in the standards arena, to continue to ensure that information about the needs of Amateur Radio is considered as future major industry standards are developed.

Mr. Ramie serves as the C63® Secretary and as a member of Subcommittee 5 and the Below 30 MHz Task Group. 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, 2014, on the on the IEEE EMC Society Board of Directors.

Related to committee work, Mr. Hare also maintains informal contact with a number of industry groups, including HomePlug and the HomeGrid Forum (in-building BPL industry groups), 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;

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

The Future of EMC and Amateur Radio:

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

ARRL's information about RFI can be read at:

www.arrl.org/radio-frequency-interference-rfi.

As a note of personal thanks, I would like to recognize the contributions of the members of EMC Committee in their ongoing effort to protect the amateur radio service from interference. I especially owe a great debt of gratitude to Mr. Hare, W1RFI; Mr. Ramie, KI6LGY and Mr. Gruber, W1MG; for their authorship of material for this report.

Respectfully Submitted,

Kermit A Carlson W9XA
EMC Committee Chairman
ViceDirector Central Division

Appendix 1A

Web: www.arrl.org/news/arrl-to-fcc-grow-light-ballast-causes-hf-interference-violates-rules

ARRL to FCC: "Grow Light" Ballast Causes HF Interference, Violates Rules

03/14/2014

The ARRL has formally **complained** to the FCC, contending that a "grow light" ballast being widely marketed and sold is responsible for severe interference to the MF and HF bands. The League urged Commission action to halt sales of the Lumatek LK-1000 electronic ballast and to recall devices already on store shelves or in the hands of consumers. In a March 12 letter to the Commission's Enforcement Bureau and its Office of Engineering and Technology, ARRL General Counsel Chris Imlay, W3KD, said the ARRL's own laboratory testing revealed that the Lumatek device exhibited excessive conducted emissions, in violation of the FCC's rules.

"ARRL has received numerous complaints from Amateur Radio operators of significant noise in the medium and high frequency bands between 1.8 MHz and 30 MHz from 'grow lights' and other RF lighting devices generally," Imlay told the Commission. "The level of conducted emissions from this device is so high that, as a practical matter, one RF ballast operated in a residential environment would create preclusive interference to Amateur Radio HF communications throughout entire neighborhoods." An extensive ***Conducted Emissions Test Report*** detailing the ARRL Lab's test results was attached to the League's correspondence.

"[T]he *Report* concludes from the conducted emissions tests that the six highest emissions from the device in the HF band vastly exceed the quasi-peak limit specified in Section 18.307(c) of the Rules," Imlay related. The ARRL further pointed out that, while a FCC sticker has been affixed to the device, it lacked FCC compliance information. FCC Part 18 rules require RF lighting devices to provide an advisory statement with the device, notifying users that it could interfere with radio equipment operating between 0.45 MHz and 30 MHz.

The League noted that the device is imported into the US and marketed and sold by Sears, where ARRL purchased its test sample, as well as by Amazon.com and other retail outlets.

"ARRL respectfully requests that your office take the appropriate action with respect to this device without delay," Imlay's letter concluded. Copies of the correspondence were sent to the importer.

In separate correspondence to FCC Commissioner Ajit Pai, seeking his review of the complaint, Imlay said the Lumatek unit was "typical in terms of its performance, and many other types of 'grow lights' are being imported, marketed, sold and deployed now." One of Pai's main interests is the revitalization of the AM Broadcast Band, where noise can be an impediment to reception. "It is not at all an exaggeration that even one of these electronic ballasts operated in a residential neighborhood makes any AM Broadcast reception impossible," Imlay asserted. The League included a copy of its test report with the letter to Commissioner Pai.

"Marked increases in the noise floor at MF and HF, year-over-year, are well-known to active Amateur Radio licensees, and it is devices such as the Lumatek LK-1000 and its progeny that are major contributors to this noise pollution," Imlay added.

Appendix 1B

Web: www.arrl.org/attachments/view/News/74152

March 12, 2014

Via E-mail and U.S. Mail
john.poutasse@fcc.gov
rashmi.doshi@fcc.gov

Mr. John Poutasse, Acting Chief Spectrum Enforcement Division Enforcement Bureau
Federal Communications Commission
445-12th Street, S.W.
Washington, D.C. 20554

Dr. Rashmi Doshi,
Chief Laboratory
Division

Office of Engineering and Technology
Federal Communications Commission
7435 Oakland Mills Rd,
Columbia MD 21046-1609

Re: Violations of Part 18 Regulations; Lumatek LK-1000 RF Dual Voltage HPS-MH Dial A Watt Dimmable, 1000W-750W-600W Lighting Device (Electronic Ballast); Conducted Emission Limit, Labeling and Marketing Violations.

Dear Mr. Poutasse and Dr. Doshi:

This office represents ARRL, the national association for Amateur Radio, formally known as the American Radio Relay League, Incorporated. The purpose of this letter is to request on behalf of ARRL that the Commission investigate and commence an enforcement proceeding in order to halt immediately the marketing and retail sale of an RF lighting device in the United States known as the Lumatek LK-100 Electronic Ballast. This device is intended for agricultural/horticultural deployment and is known as a "grow light." The device has been thoroughly tested by ARRL's laboratory and has been found to grossly exceed the Conducted Emission limits set forth in Section 18.307(c) of the Commission's Rules. As well, the device is also being marketed and sold in violation of, at least, Section 18.213 of the Commission's Rules.

ARRL has received numerous complaints from amateur radio operators of significant noise in the Medium (MF) and High Frequency (HF) bands between 1.8 MHz and 30 MHz from "grow lights" and other RF lighting devices generally. In

response to these complaints, among other things, ARRL purchased the Lumatek LK1000 grow light at retail from Sears (i.e. Sears Holdings Corporation) through its web site. ARRL tested the device in its laboratory. The results of the tests made by ARRL are in the attached Conducted Emissions Test Report (the "Report"). ***On information and belief, other similar products exhibit the same excessive conducted emissions as does the LK1000***.

The Lumatek grow light has been imported by Hydrofarm Horticultural Products of Petaluma, CA (see, www.hydrofarm.com). In addition to Sears, the device is apparently available from Amazon and other retail sources including but not necessarily limited to those listed at page 1 of the Report.

As can be seen from the Report, ARRL tested the conducted emissions from this device according to the IEEE C63.4-2009 standard for Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment. At page 5, the Report concludes from the conducted emissions tests that the six highest emissions from the device in the HF band *vastly* exceed the Quasi-Peak limit specified in Section 18.307(c) of the Rules. For example, the Quasi-Peak limit in the bands between 3.0 and 30 MHz is 48 dBµV. The Lumatek device has a Quasi-Peak Interference Voltage at 6.4 MHz of 106 dBµV. At 21.2 MHz, the Quasi-Peak Interference Voltage is 64 dBµV. Appendix C of the attached Report shows that in both phase-to-ground and neutral-to-ground operating conditions, when operated at any of the four power settings of the device (i.e. 600 watts, 750 watts, 1,000 watts and "Super Lumens"), the conducted emissions limits are exceeded, sometimes by extreme margins, throughout the *entire* HF frequency range.

The level of conducted emissions from this device is so high that, as a practical matter, one RF ballast operated in a residential environment would create preclusive interference to Amateur radio HF communications throughout entire neighborhoods.

As discussed in Appendix B of the Report, there are, in addition to the blatantly excessive conducted emissions from this device, substantive marketing violations associated with this device. The Report indicates that there is a circular sticker on the bottom of the device, bearing the FCC logo as called for by Section 18.209(b) of the Rules for devices subject to Declarations of Conformity. However, there is no FCC compliance information anywhere in the documentation for the device, or in or on the box, or on the device itself. Marketing of the device therefore does not comply with, at least, Section 18.213(d) of the Commission's rules, which requires that RF lighting devices must provide an advisory statement, either on the packaging or with other user documentation, notifying the user that the operation of the device might cause interference to radio equipment operating between 0.45 MHz and 30 MHz. Variations of the language are permitted but presentation in a legible font or text style is required. No such notice is included with this device. Pursuant to Section 2.909 of the Commission's rules, the party responsible for FCC compliance with rules governing RF devices is, in the case of devices that are subject to a grant of equipment

authorization, the equipment authorization grantee. Or, in the case of a device subject to a grant of a Declaration of Conformity, the responsible party is the importer. In this case, because there is no apparent grantee of equipment authorization, but there is a label consistent with a claim that the device is subject to a Declaration of Conformity, the Commission should look to the importer of the device as the responsible party.

ARRL respectfully requests that all such devices be removed from retail sale and marketing immediately. Those devices that have been sold to consumers, or which are available for retail sale should be tracked and recalled immediately. To the extent that there are successor or similar products imported by Hydrofarm Horticultural Products of Petaluma, CA, those devices should be immediately tested by the Commission for compliance with conducted emission limitations. Finally, it is requested that the importer of this device be subjected to a forfeiture proceeding commensurate with the Commission's enforcement policies.

Given the foregoing, on behalf of the more than 710,000 licensed radio amateurs in the United States, who have a significant interest in avoiding interference from these noncompliant devices, ARRL respectfully requests that your office take the appropriate action with respect to this device without delay.

Should any additional information be called for, please contact either the undersigned, General Counsel for ARRL, or Mr. Mike Gruber of the ARRL's staff, whose contact information is listed on the attached Report. Thank you very much for your consideration of this request.

Sincerely,

Christopher D. Imlay

Christopher D. Imlay
General Counsel, ARRL

Attachment

Copies to:

Hydrofarm West
2249 S. McDowell Ext.
Petaluma, CA 94954

Sunlight Supply, Inc.
5408 N.E. 88th Street, Bldg. A
Vancouver, WA 98665

Sears Holdings Corporation
3333 Beverly Road
Hoffman Estates, IL 60179

SLS California
Livermore, CA
(Via Fax only: 925-454-1535)