

for the ARRL Board of Directors Meeting
January 19 and 20, 2024

Submitted by Carl Luetzelschwab K9LA
Chair, ARRL EMC Committee
Director, Central Division



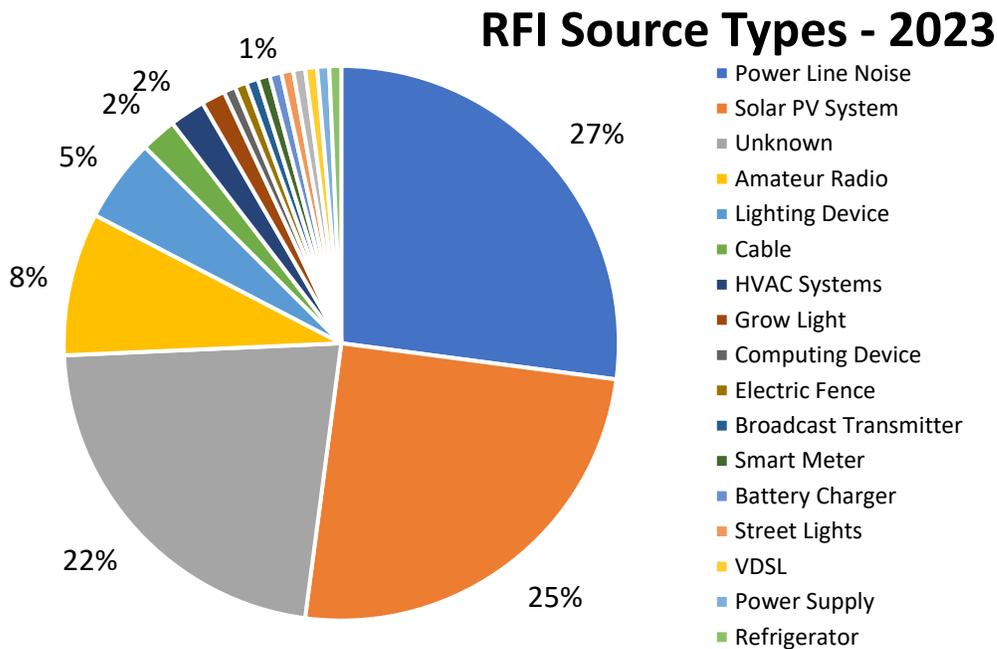
Meetings

EMC Committee meetings were held on March 30, on May 31 and on September 27 of 2023. The next meeting is tentatively scheduled for February 2024.

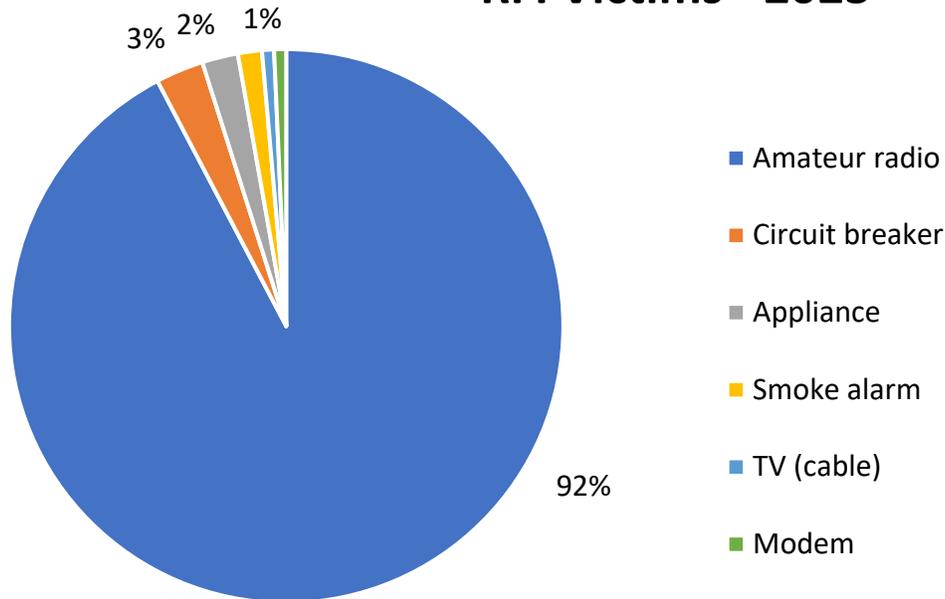
ARRL Lab Efforts – by Steve Anderson W1EMI

RFI Report (1/2/2024)

Following are the 2023 intake statistics for cases:



RFI Victims - 2023



Highlights from above:

- 1) Power lines and solar PV (photovoltaic) systems continue to be the top contributors to the RFI cases coming through ARRL, followed by unknown sources which eventually wind up in a category (generally devices of some sort).
- 2) As with previous reports, over 90% of the cases that come to ARRL are from some source interfering with an amateur radio, not RFI from an amateur radio.
- 3) In general, RFI from an amateur radio shows up in the amateur's own home (e.g., tripping a circuit breaker, interfering with an appliance or smoke alarm, etc.).

Letters

In support of our casework, we have written 48 ARRL letters/notices to operators of noisy equipment, 13 FCC letters, and 6 second FCC letters that went out during 2023.

Power Line Cases

Highlights are as follows:

- ARRL continues to maintain and develop productive relationships with power companies – some examples are PG&E, Dominion, Georgia Power, AEP. This allows us, in many circumstances, to forego the ARRL letter to a CEO, and go directly to a contact who has control over RFI investigators, or go directly to an RFI investigator.
- This year, we were able to perform some field work related to power line cases, including the following:

- Worked with a ham in NY to identify noise sources along a very busy roadway, then met the utility company and worked with them to repair the noise sources. This was the end of a long case in which the utility and the ham were at odds;
- Also worked with two other hams to identify noise sources for utility companies in NY, one resulted in resolution, the other had to go to the FCC due to a lack of response from the utility, but later was resolved by the utility based at least in part on ARRL findings in the field.
- Recommended equipment and training to several utilities – one was a utility commission that has three hams on its RFI team, but they could not locate all the noise sources causing the RFI. Mike Martin from RFI Services provided training to the utility, and located the noise sources. This also resolved a longstanding case where the utility and the ham were at odds.
- Jeff, W4DD, worked with a ham in Georgia to locate noise sources and get them reported to the power company – Jeff has the ability (through an RFI mapping program) to identify noise sources. He also has the knowledge and expertise to locate specific components on poles, which is very helpful in these cases. See page 7.

Solar PV Systems

Over the course of 2023, we continued to see a significant number of solar cases. Here are the highlights for this year:

- SolarEdge (SE) is rolling out a new optimizer which has been reported by SE to be a significant improvement from an RFI standpoint. As SE cases appear to be slowing, this may well be the reason, but we have no easy way to confirm this.
- This year, Steve has seen an increase in Generac and Enphase cases, which is somewhat concerning.
 - We continue to have a good relationship with Generac (as far as the ability to send them cases and get them in the pipeline for RFI mitigation).
 - I have a new contact with Enphase (a field engineer who is also a ham), and he seems to be responsive although the few cases I have sent him are taking some time to get resolved.
- We had one concerning issue with an installer, Trinity Solar, that proposed billing a ham for labor involved with installing SolarEdge RFI mitigation, to the tune of about \$1100, for a neighbor's PV system. We balked and actually had to get FCC involved before they agreed to do the work without cost to the ham.
- We've had two new PV vendors show up with RFI issues (Hoymiles and APsystems). The APsystems cases appear to be getting resolved, the disposition of the Hoymiles cases is unknown at this time.
- A "best practice" example, and some good news: Generac has started the practice of turning systems off upon identification of RFI problems, which provides immediate relief to hams (especially good for hams who are neighbors of someone with a noisy system). They need to seek permission from the system owner to do this, and sometimes need to compromise (e.g., allow the system to be turned on during a power outage). I would note, it's arguable whether Part 15 requires this, but it is a practice that would be good to

see happen more widely – it takes the pressure off of everyone while they implement an RFI solution.

Notable Device Cases not meeting FCC Part 15 emission limits

We have had several cases where we have had issues with device manufacturers this year. The following are of note:

- 1) [Progressive Dynamics](#) – they make a charger/converter unit for RV's. The unit (we believe the charger portion) is so noisy it can be picked up by the ham's mobile 2.5 blocks from the camper. They were unresponsive to the degree where we had to have FCC get involved, and now we are about a year out from when the case came in, and the issue is still unresolved and with their EMC company.

- 2) [Trimlight](#) – These lights are customizable color LED house lights, and incorporate (at least) a power supply and controller (Chinese made). They appear to have an FCC certification, but like many solar PV systems, the issue is less about conducted emissions and more about radiated emissions in the HF bands (where there are no radiated emission limits). It's another case where FCC had to get involved before the company began to take things seriously. During the course of the case, the company stated, in part, "so we have 5 engineers in Asia working on this with their local FCC testing facilities trying to solve the problem that exists worldwide to all IC-RGB LED systems. Even their engineers state that the entire industry doesn't meet the criteria for FCC and all of these type of controllers fail the testing."

Having said the above, it appears the company is making progress, although the RFI continues as of the time of this report. We have received new certifications for the lights/controllers, and the testing process appears to be more realistic now. However, final testing has yet to be completed and implemented near the complainants' stations.

LED lighting and grow lights continue to be an issue for amateur radio operators as well. Lastly, with respect to noisy devices, we have inquired with Mike Rhodes (FCC OET) about reporting of noisy devices and have investigated use of FCC's Consumer Complaints Portal for this purpose. It appears this will be a good starting point, as it gives us the ability to include ARRL observations, test data, interference reports, etc. in a submittal. We will look for a case to get this process going, a strong case that would clearly be actionable by FCC.

IEEE and ANSC C63

With Ed Hare's retirement in April, Steve Anderson continues our participation on the IEEE EMC Society, and in the standards development work Ed was engaged in. Steve also has been working with the IEEE hams group, which is considering formation of either a Technical Community or an Affinity Group within IEEE. A couple dozen hams have been meeting fairly regularly from this group.

With respect to ANSC C63, where ARRL has an organizational membership, Kermit Carlson is the Primary representative and Steve Anderson is the Alternate. Steve attended the most recent meeting in Palo Alto, and Kermit and Steve work together to form ARRL positions on any votes

that may be required. In addition to Main Committee work, there are numerous subcommittees that member organizations can be involved in. The one most relevant to RFI work is the subcommittee on immunity. There has also been discussion of formation of a working group to revise standard 63.29 (concerning testing of lighting products for compliance with FCC Part 15), so we will likely be involved with that group.

Also see page 11.

National Association of Broadcasters AM Improvement Workgroup

Steve Anderson continues our participation in this group, which is working to improve AM radio through technological improvements, noise studies and other actions. ARRL has largely been involved in noise characterization work, due to our work with the amateur radio community concerning RFI issues.

RFI Presentations/Materials

In 2023, the Lab conducted several presentations concerning our RFI program, and revised handout materials highlighting this important member benefit.

Areas of Work

Illegal Transmitters – by Carl Luetzelschwab K9LA

- Involves technical performance (spurious emissions) and marketing tactics (Amazon, Walmart and eBay are the big sellers)
- Sold without requiring Amateur Radio license
 - And they operate on more than Amateur Radio frequencies
- Extensive report written by Ed W1RFI
 - Former ARRL Lab Manager (now retired)
- Summary synopsis for the FCC written by K9LA
- Doesn't appear to be going anywhere at the moment
- We get blamed for interference by “ham radio operators”

Part 15 Devices Not Meeting Limits – by Carl Luetzelschwab K9LA, also see page 4.

- Part 15 sets limitations on the amount of electromagnetic interference allowed from digital and electronic devices
 - LED lighting, switch-mode power supplies, chargers, etc
- The ARRL Lab is seeing more and more Part 15 devices that don't meet the emission standards
- Steve W1EMI at HQ has been working with the new FCC OET Director
 - OET is the Office of Engineering and Technology

- Goal is to set up a system with OET similar to the system with Laura Smith (Special Counsel, Spectrum Enforcement Division, Enforcement Bureau) that addresses harmful interference

HF Trading – by Carl Luetzelschwab K9LA

- Time is money - financial institutions want to use HF to make trades faster
- Part 5 (Experimental Radio Service) licenses issued to perform tests at sites in the following areas – Seattle, Chicago and New York
- Shortwave Modernization Coalition petitioned the FCC on April 28, 2023 with changes to Part 90 (Private Land Mobile Radio Services)
 - 20 KW, digital waveform with 50 KHz bandwidth, relatively easy spectral mask
- Almost 900 comments and replies to comments
 - We have screen-shots of waveforms
 - Are they still transmitting if their Part 5 license expired?
- Our FCC Counsel (K3ZJ) says an NPRM is not imminent
 - Competing proposals and ideas are percolating

National Spectrum Strategy – by Carl Luetzelschwab K9LA

- The White House released its “National Spectrum Strategy” document in mid November
 - Drafted by the National Telecommunications and Information Administration (NTIA) with FCC and the White House Office of Science and Technology help
- Two areas identified to address the spectrum decision-making process
 - Increase innovation and spectrum sharing
 - Need for expanded STEM education and spectrum expertise
- Only Amateur Band affected is 3.300-3.450 GHz (part of 3.100-3.450)
 - Identified for immediate study
 - Amateur operations will be required to cease in this spectrum if/when re-allocated for commercial purposes

WRC-23 – by Carl Luetzelschwab K9LA

- World Radiocommunication Conference 2023
- Continued coexistence of the secondary amateur and amateur-satellite allocation with the primary radio-navigation satellite service in the 1240 - 1300 MHz band
- 40 - 50 MHz radar sounders largely limited to the polar area
- 231.5 - 252 GHz continues our secondary 241 - 248 GHz allocation
 - Primary allocation of 248 - 250 GHz is unaffected
- Agendas set for WRC-27 and WRC-31
 - Note that WRC-31 includes WPT-EV – might be too late
 - Nothing on HF Trading

WPT-EV (Wireless Power Transfer – Electric Vehicles) – by Carl Luetzelschwab K9LA

- The demo of a WPT-EV system in Detroit was to occur in mid 2022.

- Installation appears to have finally been finished in late November 2023
- Testing in Detroit is to begin in 2024
- We're reaching out to Detroit for the test dates and our involvement
- Steve W1EMI at HQ found that Utah State University has a test track
 - He sent an e-mail on 11/30/2023 to one of the project leads to understand their system
 - No response yet
- Purdue (West Lafayette) also appears to be working on this
 - K9LA plans to get in contact with them

RFI teams

All these efforts are towards the goal of having at least one RFI Team in every section.

From Rob Leiden K1UI

Jeff, W4DD, has created a Windows-based app that maps RFI from power lines as you drive along side of them. Rob has been experimenting with the software to develop some guidelines for its use by the RFI teams. Rob knows several others on the teams are doing the same thing. The ICOM 705 in each team has both the GPS and CI-V capability to support gathering the required data.

The process begins by installing the app, available on request, and creating a directory or folder to receive the data. The vehicle is then equipped with a Hamstick for 10-meters (Rob hasn't tried other bands but this is the one Jeff recommends) and a team ICOM 705 is connected via a micro-usb port on the 705 and a usb port on a laptop that has the ICOM drivers installed on it (available on the ICOM America website at <https://nediv.arrl.org/wp-content/uploads/2023/12/rfi-test-setup.jpg>). Rob installed several ferrites (available on Amazon) on the usb cable to suppress the usb port noise when in operation. If all is connected properly, starting the RFID software displays that the GPS and the CI-V S-meter reading from the ICOM 705 are recognized.

Rob tunes the ICOM 705 to 28.5 MHz in the AM mode. Start the data gathering process by providing a name for the file when requested. Start driving the test route at about 30 MPH paying attention to traffic so you don't become the lead car in a caravan. At this point Rob strongly recommends that you work with a partner so you can drive and not need to pay attention to the data being recorded. The faster you drive, the further apart the data points become so you can cover more territory but you may miss the detailed location of an RFI source. You can zoom in on a particular area of the map and examine it in Google Earth to gather more detail. If you are hunting a real source, you may want to repeat a run. It is helpful to have a spare laptop battery.

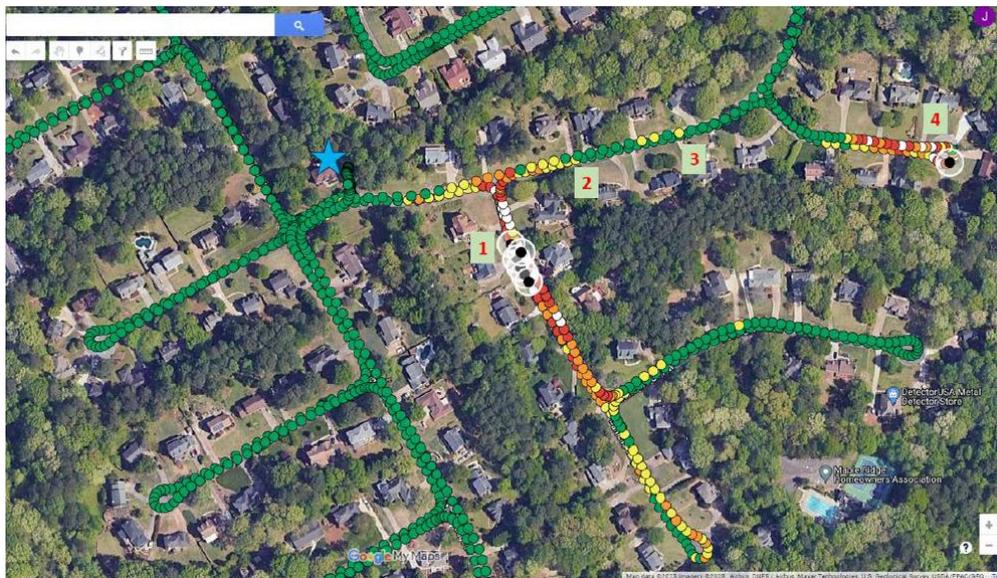
When you complete a run, connect to the internet and go to the GoogleMyMaps site. Upload the data file you created into a new map. Look at the data and use color (select style by S-meter reading) to single out the high noise data points, i.e. S1-S5 colored

green, S5-ST colored yellow, S8 and higher colored red. Rob used a slightly different set since he wanted a bit finer scale.

Once you've identified a problem location, the use of the team VHF/UHF log-periodic to find the specific pole and an acoustic dish (Rob uses an MFJ dish) to find the particular faulty component are the last steps.

Rob will refine this process with the teams' inputs as we go forward but his testing so far is very positive and Rob believes that Jeff, W4DD, has provided us with a valuable tool for finding powerline RFI.

Here's an example of a run.



From Gary Lopes WA6MEM

The LAX team addressed two noise issues during the last period with a write up of each noted below.

Case #1 – On Oct 18, 2023, Diana Feinberg, AI6DF, forwarded an e-mail to Gary Lopes WA6MEM from Marty Smith, WB6MRP, regarding a severe RFI problem (S9+ across all bands) at his residence. Gary ordered Chris Parker, AF6PX, Technical Specialist ARRL Los Angeles Section, to solve it.

Parker engaged Smith via e-mail and requested he start by ruling out his residence as the source of his severe RFI. Parker e-mailed Smith Parker's award-winning PowerPoint presentation, "RFI in the City" and asked him to read and follow the directions (with photos) in the presentation. Towards this end, one of the first tasks was to have Smith turn off the main circuit breaker to his residence to see if the RFI level decreased. Smith

e-mailed Parker: Oh, and to answer the question, the noise just seems to be spread around differently when the power is off. The S Meter still says S9, and the noise never stops.”

Based on this response, Parker asked Smith to take a handheld RX on AM mode, tuned to 121.5 MHz, with a factory rubber ducky antenna, and record S-unit readings while standing near a handful of suspect power line poles near Smith’s residence that Parker identified using Google Maps.

Smith responded that one pole was S8.

Based on the data above, Parker and Lopes scheduled a field service call to Smith’s residence at 8812 E Fairview, San Gabriel, CA 91775 on Oct 27, 2023.

Arriving onsite, Parker and Lopes drove the streets around Smith’s residence using an expanding search pattern with HF and VHF RX’s to identify power poles with PLN signatures. These poles were then further examined visually, photographed, and checked with a Radar Engineer Model 243, a UHF RX, a Fluke Acoustic Imager, and an Ultrasonic Pinpointer.



During this search, a detached ground terminal on a 16kV lightning arrester was discovered on pole number 4688718E, located at 8841 E. Fairview. The same day, Parker gave an Edison foreman (who happened to be in the neighborhood) the pole number, address, and photo of the defective arrester to file a trouble ticket for repair.



After more than an hour of surveying the area, and unable to find a source strong enough to generate S9 RFI at Smith's residence, Parker and Lopes finally arrived at Smith's residence. The first task was to verify that with the main circuit breaker OFF the RFI did not decrease as reported by Smith. However, when Parker turned the main circuit breaker off, Lopes reported the S9 noise dropped to S1 at 14 MHz. At this point, we knew the source was in the residence. Using deduction, it was determined the Lutron dimmers driving recessed LED ceiling lights in the kitchen and another room were the sources. Parker and Lopes recommended replacing the Lutron dimmers with another model or different brand, or replacing with a switch. Later that day, Parker e-mailed Smith a couple of resources: the website "RFI Contesting" (a group dedicated to identifying and solving RFI issues) and ARRL.

Marty sent the following e-mail:

Hello Gary and Chris

Well, my problems are finally all fixed!!! When you two came to my house in October, you quickly zeroed in on my noise problem which was primarily from my LED recessed lighting. The problem was that I had 36 of these devices in my home.

Out of those 36, three were perfectly OK. The other 33 were not. So ---- I replaced them.

First, I made a "tester" where I could put two LED's side-by-side: an old noisy one and a "candidate" LED purchased from an electrical supply store (not a big-box store). I had an SPDT switch that could switch instantly from one to the other. On the cord to my tester (about 20 feet long, I had a switch. So I could test "Device A" on, "Device A" off, "Device B" on and "Device B" off. I would listen to my receiver in the 80/40/20/15 and 10-meter bands.

I went to the electrical supply house and they gave me two high-end LED's -- one for "canned" service, and one "wafer" type. You use the wafer type when a stud is directly above the light. Both passed. So, I bought 16 canned units and 17 wafer units and tested them one-by-one prior to installation.

I hired a handyman to do attic work and prepare things so installation could be done from below. That took about 4.5 hours. Then for another day and a half, I replaced all of them installing the canned types where I could. The candidates that performed well were:

1. Canned type -- Elite Field Selectable CCT Recessed Retrofit Downlight G3 REL437-700L-120-27K/30K/35K/40K/50K-90-W-WH
2. Wafer type -- Westgate LED Round Slim Recessed Light (No Housing Required) RSL4 Series RSL4-MCTS Dimmable

I also purchased Lutron Maestro LED+ MA-Pro dimmers to be sure, but at least in the living room, they weren't part of the problem in my case. I found it out by wiring around the dimmer while testing things out. Those dimmers cost twice the price of the Lutron Maestro LED+ dimmers sold at Home Depot. You can buy them either on line or at a local Electrical Supply House.

After this work was performed (except for the kitchen lights on 3.5 MHz) there was no difference, lights on or off. On the kitchen lights (same wafer type as in the living room) there was light noise at 3.5 MHz, but the wiring for the kitchen in the attic is about 3 feet away from my antenna.

I also purchased an MFJ-1026 Noise reducer and installed a 15m dipole noise antenna in my attic.

All this made my rig perform beautifully. If you have anyone who has an LED problem in the future, give them my number and I can help them with an approach that will very likely work.

Yes, there's lots of noise in the neighborhood compared to other places which I measured all over. But -- that noise is way secondary compared to the original LED's installed at my home. Your work on my behalf totally made the difference.

Once again, many thanks.
Marty Smith
WB6MRP

Case #2 – Doug Iversen, N6DJI, who lives in Spring Valley Lake, CA sent an email in November asking for support to reduce excessive noise he hears on the HF bands. His noise level was typical for power line and switching supplies and was particularly bad on the 20-meter band.

Gary provided Doug with the typical guidance of how to begin isolating the noise in his home before venturing out into his neighborhood. This was augmented by including the “Noise in the City” slide presentation which guides you through the equipment and steps necessary to locate noise sources. As a follow up, Doug did use the steps in the presentation and found that most of the noise was coming from his own home. Light dimmers, LED lighting, even his refrigerator, were all contributing to the problem. He is now busy finding ways to replace or filter his appliances.

Standards

From Kermit Carlson W9XA

Kermit remains the C63 (primary) Delegate and a member of IEEE P1897. There is one new Standard that is noteworthy to report to the Board – The Committee has voted to form a Balloting Committee to formalize a new standard; C63.9™/D21 “Standard for Laboratory Immunity Testing of Multimedia Equipment Exposed to RF Sources.”

From Ed Hare W1RFI

Ed has continued to serve on the IEEE P1897 Working Group on the resolution of power-line noise, but he has dropped all other IEEE and C63 activities. Steve W1EMI has stepped into both roles, although probably in a different way than Ed when Ed was active.

The P1897 standard completed the ballot process and is in the final stages of IEEE edit, to be available 1Q2024.

From Jerry Ramie KI6LGY

There were five electric utility EMC Standards that the League has supported over the past six years:

- 1) **IEEE-P1897** - Recommended Practice for Resolving Sparking Gap Noise Complaints - efforts are nearly complete, all comments addressed - Mike Gruber was the Chair.
- 2) **IEEE-P1613** - Draft Standard for Environmental and Testing Requirements for Devices with Communications Functions used with Electric Power Apparatus - Jerry Ramie was co-Vice Chair - efforts are nearly complete, parent committee comments addressed, should go to IEEE next month.

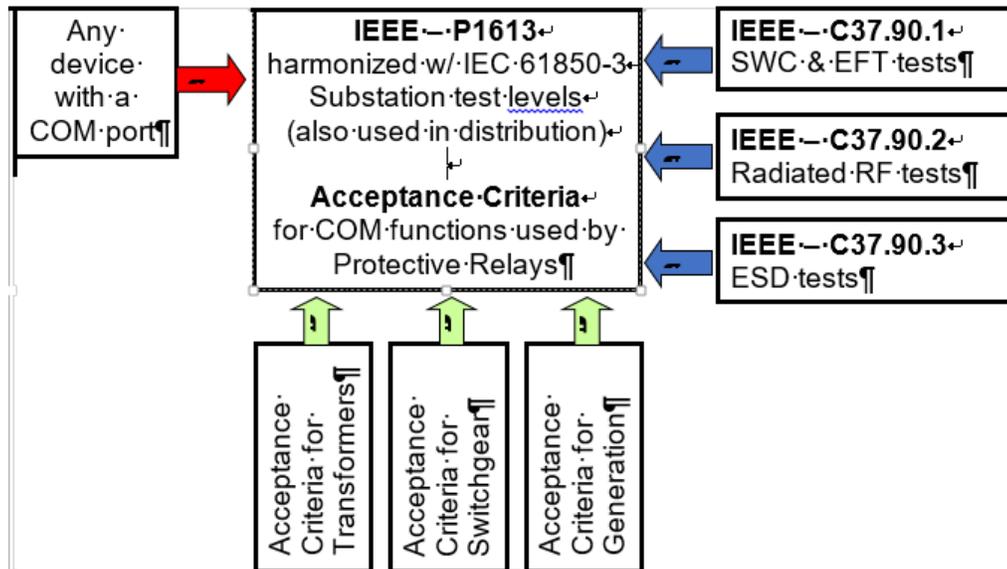
Background:

In September of 2018, Ed Hare (VP of Stds. of the EMC Society) and I attended the IEEE-P1613 meeting in Minneapolis. We compromised on the content of the upcoming P1613 document to address communications networking equipment only, but not protective relays. We accepted "half a loaf," hoping that since most utility control products had communications functions, that we could get controls manufacturers used to more complete testing for EMC immunity (resistance to outside interference) and could get their customers (utilities and systems integrators) to demand this testing.

Eight "new" tests were added to the P1613 draft: (taken from IEC requirements for the same equipment)

Surge (indirect lightning strike)	IEC 61000-4-5
Conducted RF Immunity (incl. HF)	IEC 61000-4-6
Power Freq. Magnetic Field	IEC 61000-4-8
Damped Oscillatory Mag. Field	IEC 61000-4-10
Mains Voltage (Common Mode)	IEC 61000-4-16
AC Voltage Dips/Interrupts	IEC 61000-4-11
DC Voltage Dips/Interrupts	IEC 61000-4-29
Damped Oscillatory Wave (SWC)	IEC 61000-4-18 (partial)

EMC testing in the Power & Energy Society is governed by function rather than by environment. Some common functions would include transformers, switchgear, generation plant, protective relays, etc. Most of these other functional committees (transformers, switchgear, generation) use IEEE-1613 and/or IEEE-C37.90.x tests as shown below with their own particular Acceptance Criteria (rules for judging if a product passed the tests):



The tests for protective relays would remain unchanged, only updated. (only require the C37.90.x tests) The status of the three C37.90.x Standards (covering four tests) are listed below:

- 3) **IEEE-PC37.90.1** - SWC (DOW) & EFT tests - undergoing a minor upgrade, should be complete in about a year. No remaining controversy. (added 100 kHz rep. rate for EFT tests)
- 4) **IEEE- PC37.90.2** - Radiated RF Fields (80 MHz - 6 GHz) - completed about a year ago. We got all that we asked for (expanded frequency range and higher test levels).

5) **IEEE-PC37.90.3** - Electrostatic Discharge - completed a couple of months ago, we got all that we asked for. (corrected diagrams, four complete test levels, front-panel USB port is now tested).

The current draft of P1613 contains the IEC equivalent Standards for these four tests (listed in the three Standards above). When the PC-37.90.1 draft is completed and adopted during the coming year, we will then re-visit the P1613 draft and remove the four IEC tests and replace them with the updated C37.90.x tests (probably by use of a corrigendum).

When P1613 is approved soon, we will be left in the ludicrous condition that the communications system is more completely tested for resistance to interference than the protective relays and other utility control products connected to it. This condition cannot stand the test of time. It is expected that customers will demand the new IEEE-1613 for the controls themselves, rather than just for the communications system. This will be when we get the other half of the "loaf!"

From Mike Gruber W1MG

Project IEEE P1897 - Recommended Practice for the Resolution of Power-Line Gap-Noise Reports has now been assigned to a RevCom agenda 29 Jan 2024. Mike Gruber has also completed uploading all text and figures to the IEEE. He will also continue to assist the IEEE editors as required during the final preparation of this document.

From Ghery Pettit N6TPT

CISPR SC I is working on updates to CISPR 32 (emissions from broadcast receivers, ITE and multimedia equipment) and CISPR 35 (immunity for the same).

We are working on an update to ANSI C63.4, and have been for a number of years. We should (fingers crossed) publish an updated version in 2024.

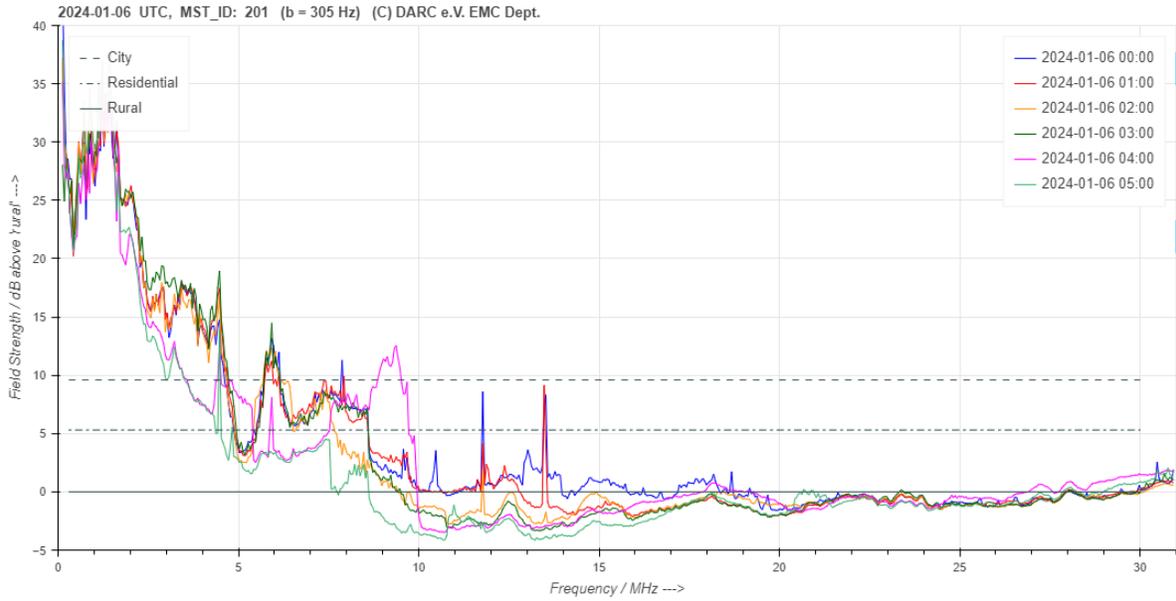
The same for C63.9 and C63.16. Working up updates and should publish updates in 2024.

IARU Region 1 EMC Committee

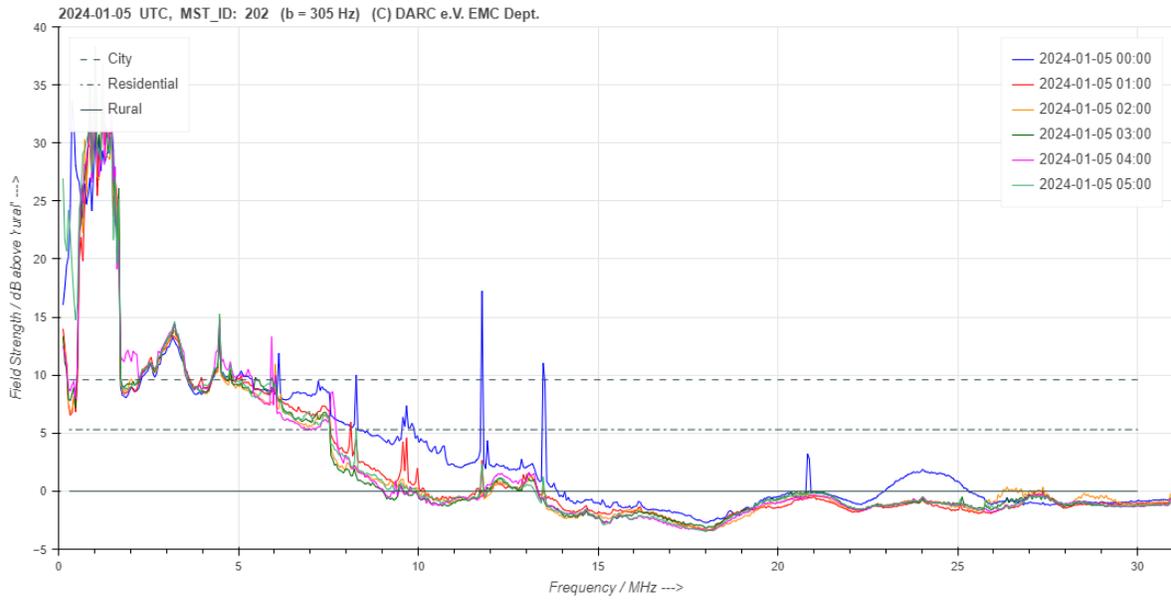
K9LA continues to attend the monthly IARU Region 1 EMC Committee meetings and the monthly IARU Region 1 NMC (Noise Measurement Campaign) meetings.

There are three ENAMS units operating in the US: at W1RFI's QTH, at K9LA's QTH and in Virginia. Here are sample results from each of these three sites.

W1RFI QTH – a quiet location



K9LA QTH – a quiet location



Virginia QTH – a rather noisy location

