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Subject: Noise Measurement Campaign

Committee: C7

Summary:

At the September-2017 IARU Region-1 2017 General Conference (Landshut, Germany), NRRL presented Paper LA17_C7_05, 'Background noise measurement campaign'. That paper proposed a noise measurement campaign, where individual members of the Member Societies can measure noise, and report the results in an easy way without elaborate test equipment. The proposal was approved by Recommendation LA17_C7_Rec_02.

This paper reports on the progress made on the Background Noise Measurement Campaign since the IARU Region 1 General Conference in 2017.

1) Introduction / Background

Recommendation LA17_C7_Rec_02 from the IARU Region 1 General Conference in 2017 was as follows:

To start a simple noise measuring campaign amongst Region 1 Member Societies. Hence, enabling IARU to be able to have an independent opinion on the noise situation in the bands and the trends over time. A data collection and processing system will be developed. The input data will be provided by the members.

The noise measuring campaign mentioned here will include the following points:

- *Collection of information from existing measurement projects*
- *Understanding and examining the different methods used*
- *Finding ways of aligning methodology to be able to compare results*
- *Financial support will be needed*

To appoint Brendan Minish, EI6IZ, as chairman of the Noise Measuring Campaign Sub-Working Group.

The EMCC (C7) to send a liaison statement to IARU Regions 2 and 3 including the following:

- 1) *Information on what Region 1 is planning and referring to any noise measurement recommendations that may be approved by the Final Plenary.*
- 2) *A request for input from Region 2 and Region 3 on any relevant activities*
- 3) *An invitation to collaborate on a world-wide noise measuring project*

2) Review of Existing Measurement Projects

Information had been collected about noise measurement campaigns that started before September 2017. The idea of a noise measurement campaign was suggested in 2008, when the IARU Region 1 General Conference made Recommendation CT08_C4_Rec_05(2). This proposed setting up a scientifically valid long-term assessment of the noise floor on Amateur Bands below 30 MHz with the intent to raise complaint over general loss of spectrum effectiveness for the Amateur Service.

In the UK, the RSGB started a noise measurement campaign in August 2013, which ran for five years. This used an active dipole antenna with an SDR receiver and stored results in a database. After completion of the project, an article was published in 'Radio Communication', the journal of RSGB [1].

In The Netherlands, VERON members conducted a man-made noise measurement campaign to gain insight into actual man-made noise levels today. This involved measuring the number of RFI signals at 54 radio amateur stations in various types of environment. The campaign had a focus on manmade broadband noise from local sources and RFI.

Further work is currently being done by members of the IARU C7 Noise Measuring Campaign Sub-Working Group to analyse the results of the RSGB and VERON noise measurement campaigns and to relate these to other noise measuring campaigns.

3) Progress in 2018

An email list was set up for discussions and work on the noise measurement campaign. The list was open both to members of IARU EMCC (C7) and also to individual members of national societies from all regions who are interested in being involved.

An email was sent to members of the Noise Measuring Campaign Sub-Working Group that asked the following questions:

- 1) *Have you a prototype or working system for making automated measurements in development?*
- 2) *Can the system under development distinguish between noise and regular band activity?*
- 3) *Can the system under development produce (subject to calibration etc.) measurements that can be compared to the methods used in ITU-R P372-13?*
- 4) *Have you a proposed solution for antenna calibration?*
- 5) *Have you a proposed solution for the back end data storage and collection?*
- 6) *What areas of the project would you most like assistance with?*

Responses included the following national activities:

Germany: In 2018, DARC started work on a German Measuring Network called ENAMS (Electrical Noise Area Monitoring System) with Jörg DL2NI as the antenna specialist. The antenna is an active HF antenna for use as a noise measurement antenna and also as a receiving antenna. It covers from below 100 kHz to 30 MHz with a flat response and it is usable up to 50 MHz. It is used with an SDR type of receiver where power density measurement, demodulation (QP) etc. are implemented in software. The antenna and receiver are calibrated and the measurements can be compared to the methods used in ITU-R P372-13 after taking account of the antenna factor. Further information in German was presented at the Münchner Amateurfunktagung 2018 [3].

The DARC team is working on a system for automated measurements. Initial results indicate that their measurement system can distinguish between noise and regular band activity and they can even identify different types of modulation. The DARC team have plans for the back-end data storage and collection but these need to be finalised. They expect to generate 'raw' data up to 1 Terabyte per year. They would like assistance with data evaluation and presentation.

Netherlands: A VERON member had an automated measurement system running from 2005 to 2016 using Rohde & Schwarz ESH2 receivers. To distinguish between noise and regular band activity, the 20% method was used in the post processing software, as mentioned in ITU-R Report SM.2055. Antenna calibration of an active tuned rod antenna has been done using the two antenna method with a calibrated antenna and a signal source with an antenna.

Portugal: Some REP members are making manual measurements at the moment but should be in a position when the time comes, to compare automated systems with manual measurements. Antenna calibration is by comparing with a certified calibrated R&S or other set. For back end data storage and collection, it has been suggested that a secure IARU server should be used with access passwords for National EMC Coordinators.

South Africa: A SARL project to monitor increases in the HF Noise Floor had already started in September 2017 and Hans van de Groenendaal ZS6AKV presented a paper to the IARU 2017 General Conference, Ref. LA17_C7_10.

To get as many amateurs as possible involved in the project, the SARL project does not focus on a calibrated antenna at this stage. The interim objective is to monitor the RF noise level in each station's local area and compare results over a period of time. The SARL project has a low cost of entry using a Raspberry Pi computer and a RTL-SDR based HF receiver. The software is on Github and the developers are keen to have others join in by using and developing the code.

UK: Work by RSGB members of the Noise Measuring Campaign Sub-Working Group includes design of a calibration source for calibrating an amateur antenna system to relate measured output to RF field strength. A simple and repeatable loop made of coaxial cable for use as a reference antenna is also being designed and calibrated using a TEM Cell. The relationship between measurements made with a horizontal dipole, vertical monopole and a loop antenna is also being studied.

Proposal:

This paper shows that significant progress is being made by members of the Noise Measuring Campaign Sub-Working Group. It is proposed that:

- The Noise Measuring Campaign should continue and that the Noise Measuring Campaign Sub-Working Group should seek to enlist the help in areas where further assistance is required, such as back-end data storage and collection and Web front-end systems.

Financial Implications:

Some Computing Server resources will be required in future, for central storage of data from the noise measuring campaign.

References

- [1] T. W. H. Fockens ; A. P. M. Zwamborn ; F. Leferink. "Measurement Methodology and Results of Measurements of the Man-Made Noise Floor on HF in The Netherlands," *IEEE Transactions on Electromagnetic Compatibility* (Not yet published as of Jan-2019, but available to IEEE Xplore subscribers as an Early Access Article)
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- [2] G. Williams G4FKH, "Noise Measurement Campaign – Project Completion", *Radio Communication*, January 2018, Vol. 94, No. 1, pp 86-87
- [3] Jörg Logemann DL2NI, "Kalibrierfähige aktive Kurzwellen-Antenne für Empfangs- und Feld-Stärkemessung," *Münchner Amateurfunktagung 2018*, <https://www.youtube.com/watch?v=vFYVpJ9FPZ8> (siehe auch cqDL 3/17 und 2/18)

ITU References

- Recommendation re 'Radio Noise' - <https://www.itu.int/rec/R-REC-P.372>
- Report ITU-R SM.2055 'Radio noise measurements', <https://www.itu.int/pub/R-REP-SM.2055-2006>