

ENAMS – Ergebnisse und Weiterarbeit

Electrical Noise Area Measurement System

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Agenda



1. ENAMS Motivation
2. Spectra of typical Interferers
 1. VDSL
 2. PLC
 3. Photovoltaic Inverters
 4. Photovoltaic Optimizer
 5. LED - Lamps
3. What else can be seen with ENAMS
 1. Mögel Dellinger Effect
 2. Radio Wave Propagation
4. Outlook & Next Steps

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What is ENAMS ?



ENAMS is an noise field strength measurement system, i.e. an automatic receiving system distributed over Germany (and some European and non-European countries) for the detection of the interference level in the frequency range of 66 kHz - 31 MHz.

Why do we need ENAMS ?

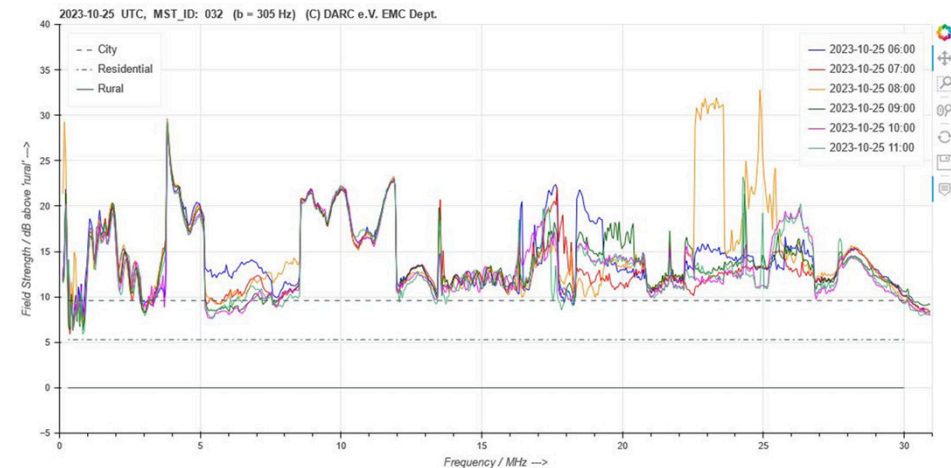
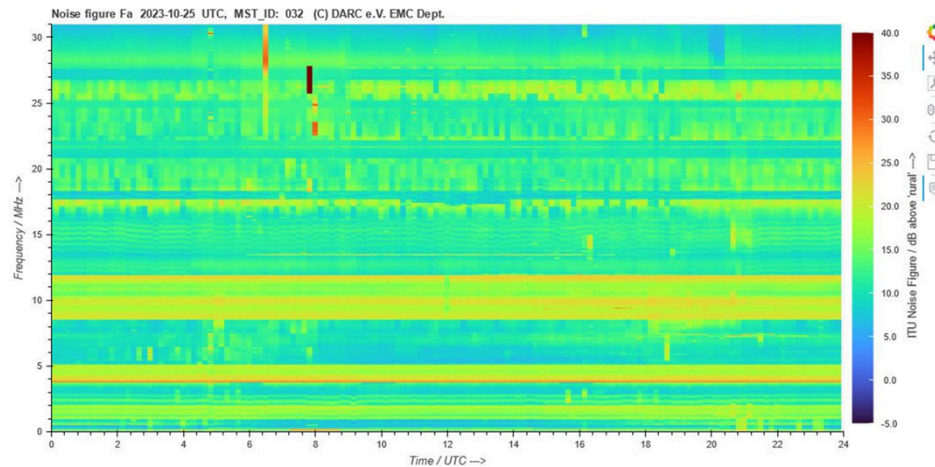
The ENAMS project was started by the DARC e.V., because the general noise measurements by the German Federal Network Agency (BNetzA) were no longer published after 2011 and the increase of the general noise level in the last years by the strong spreading of interfering electronics in residential and commercial areas is no longer documented. With ENAMS amateur radio is thus in a position to measure the noise level relevant to it and to bring it into the in the discussion about limit values. In some cases, unsuitable measurement systems and procedures, which leads to false results, were used. Therefore it is in the responsibility of amateur radio to present the correct measured values and noise situations.

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Interferences caused by VDSL (Dresden #32)



HM049_2023-10-25

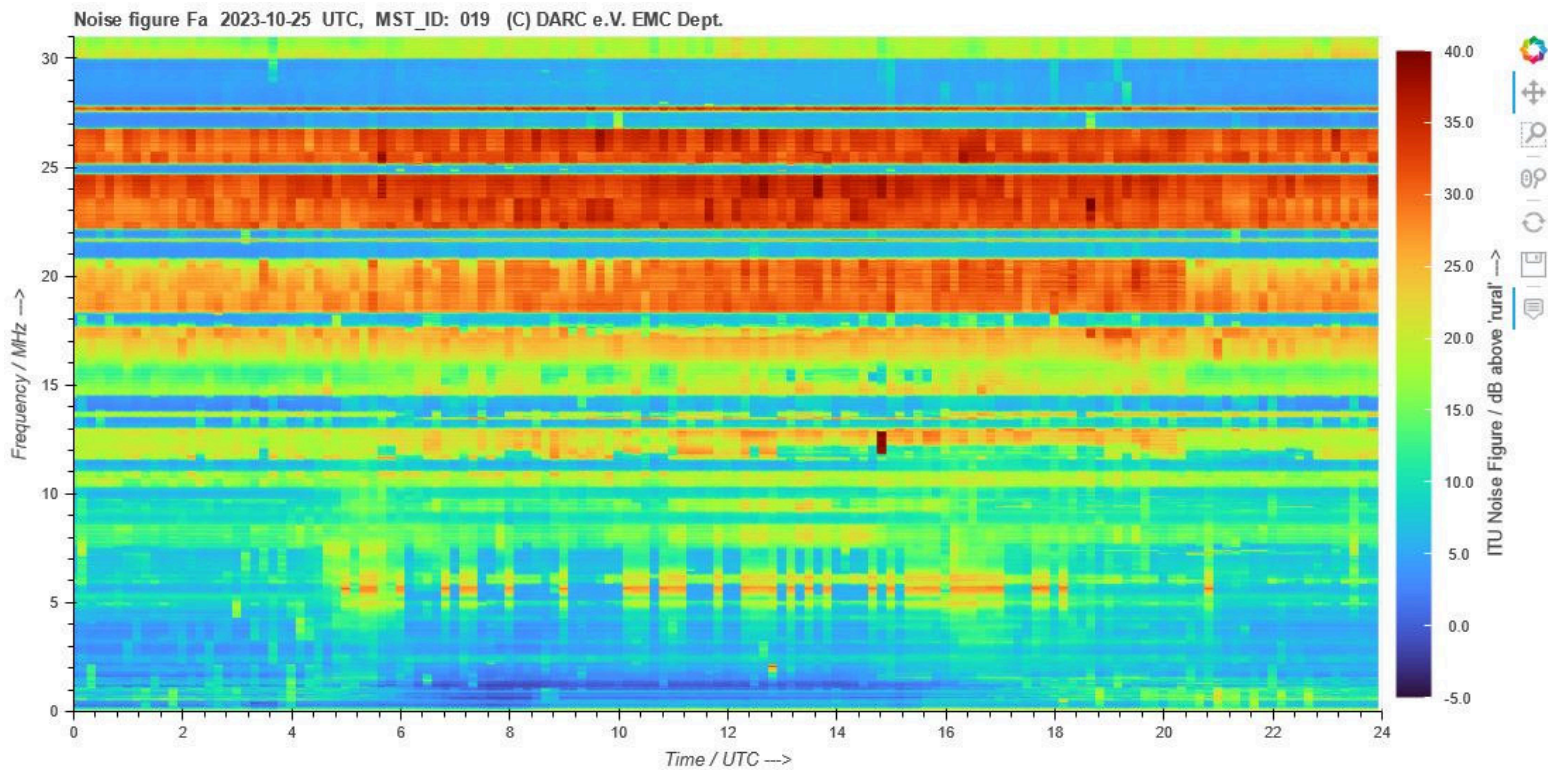
NFN63049_2023-10-25, 12:00 Uhr – 17:00 Uhr

- Noise floor on city level
- Upload sections of VDSL 2 at 3.8 – 5.2 MHz and 8 MHz – 12 MHz clearly visible
- No notches visible in the heatmap nor in the noise spectra

Interferenzen durch PLC



Interferer PLC Burgau #19



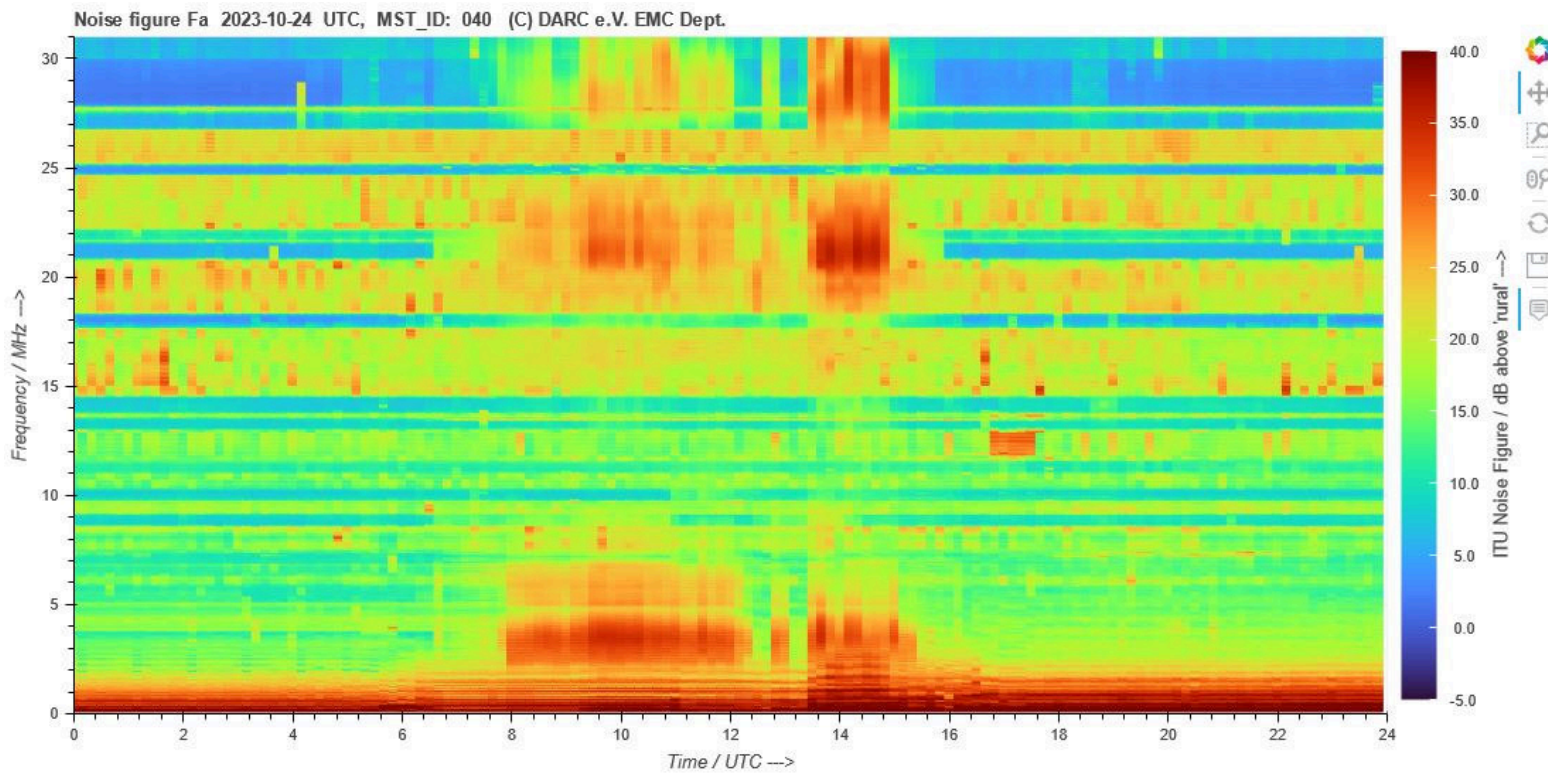
HM019_2023-10-25

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Interferenzen durch Photovoltaik



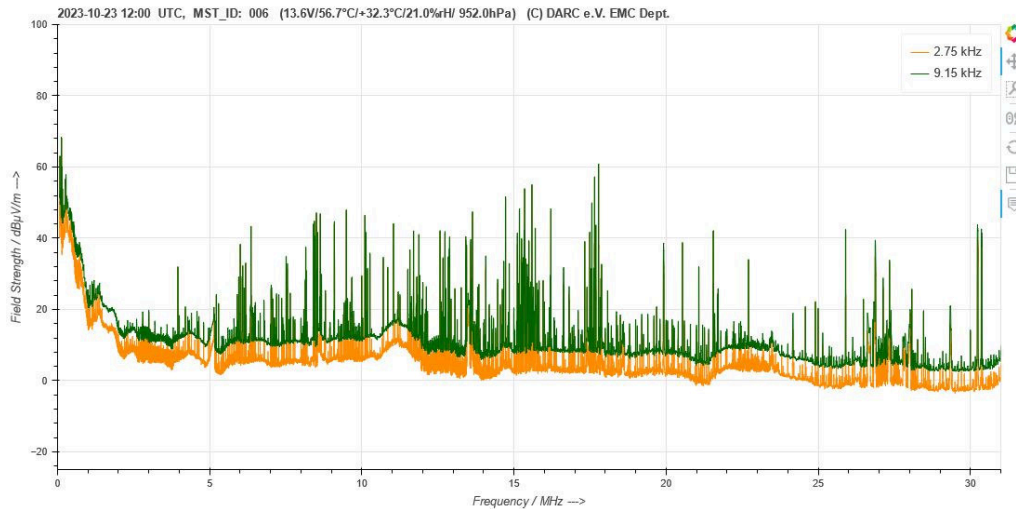
Interferer PV installation Bonn #40



HM040_2023-10-24

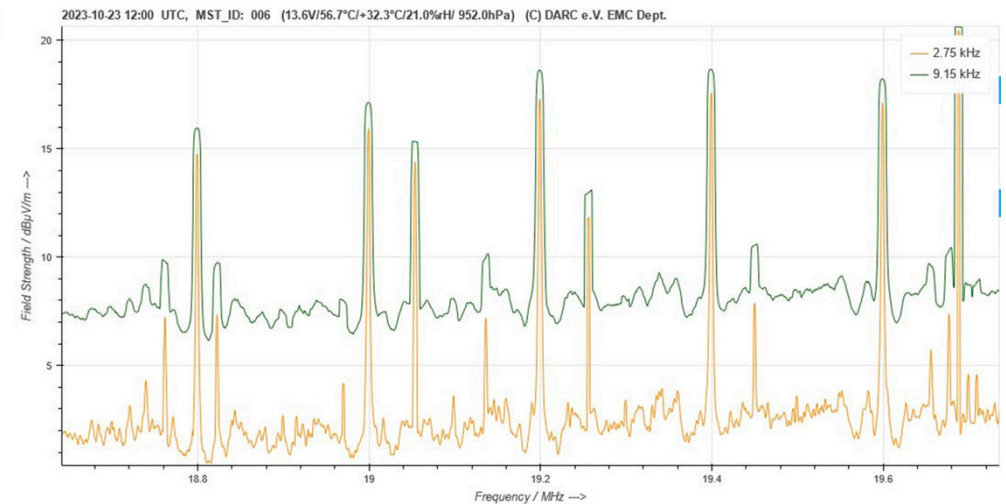
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Solar Optimizer (Weissenhorn #06)



S006_2023-10-23

- Harmonics can be seen in large sections of the spectrum
- Peaks show up at every 200kHz
- Sometimes these peaks are “smeared” out due to variation of the base frequency

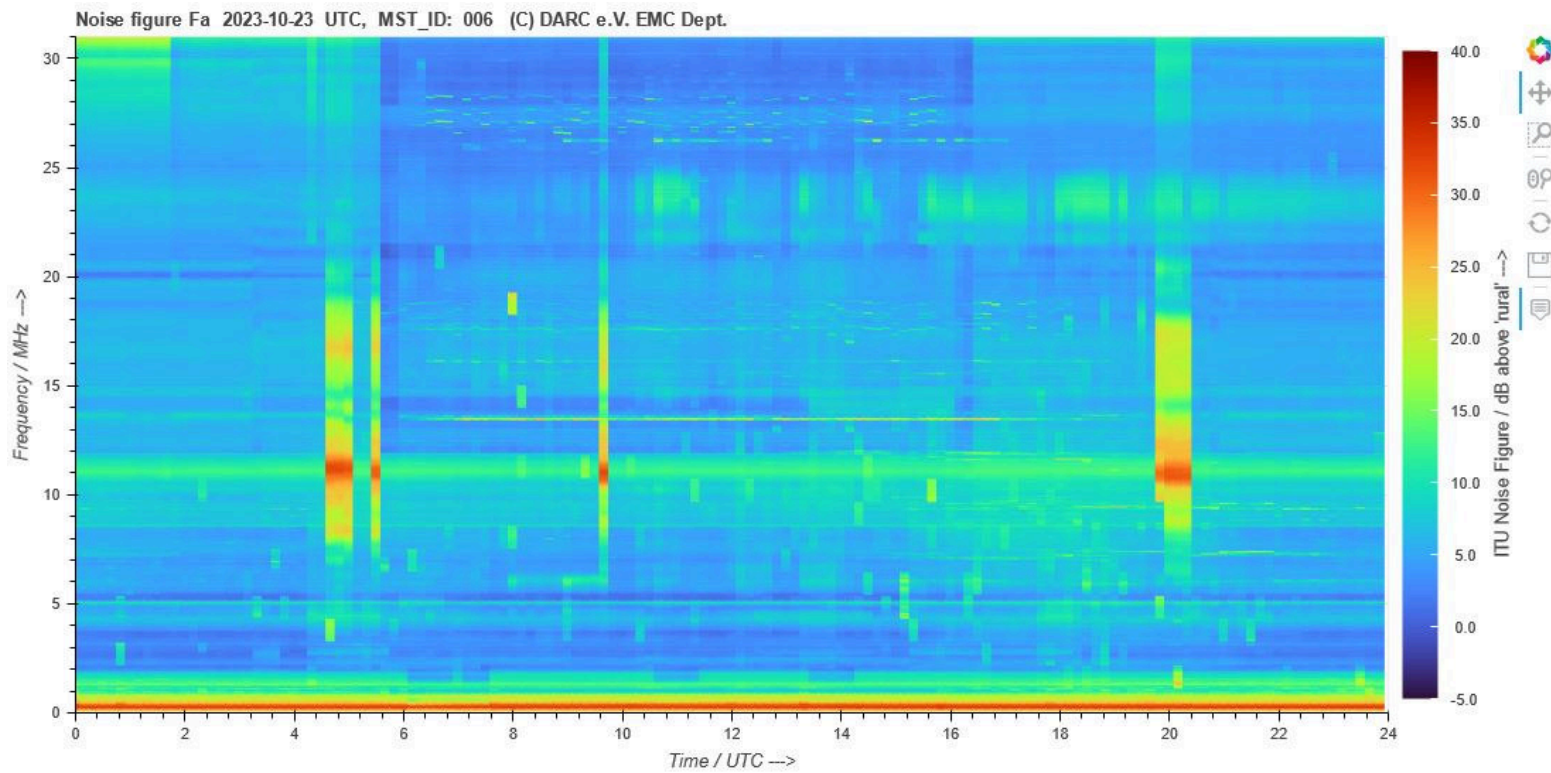


S006_2023-10-23

Interferenzen durch LEDs



Interferer LED street lamp



HM006_2023-10-23

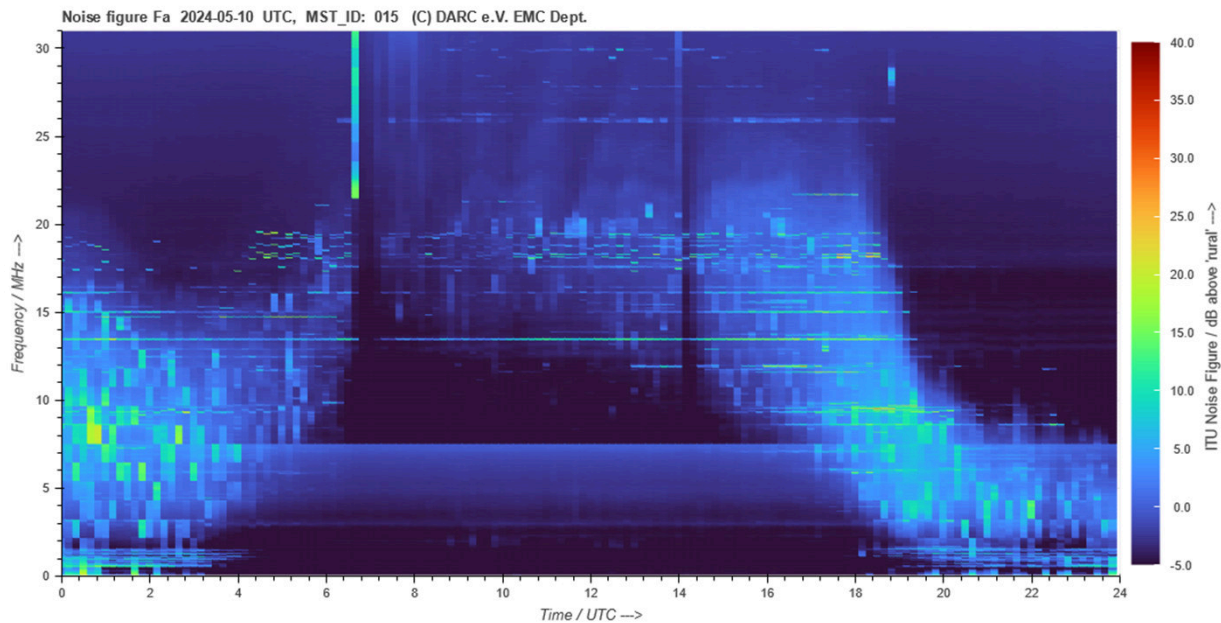
DL6SES, Klaus Eichel, DG8AL, Andreas Lock, HAM Radio 2024, 28.-30. Juni 2024

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Mögel Dellinger Effect (Landshut #15)

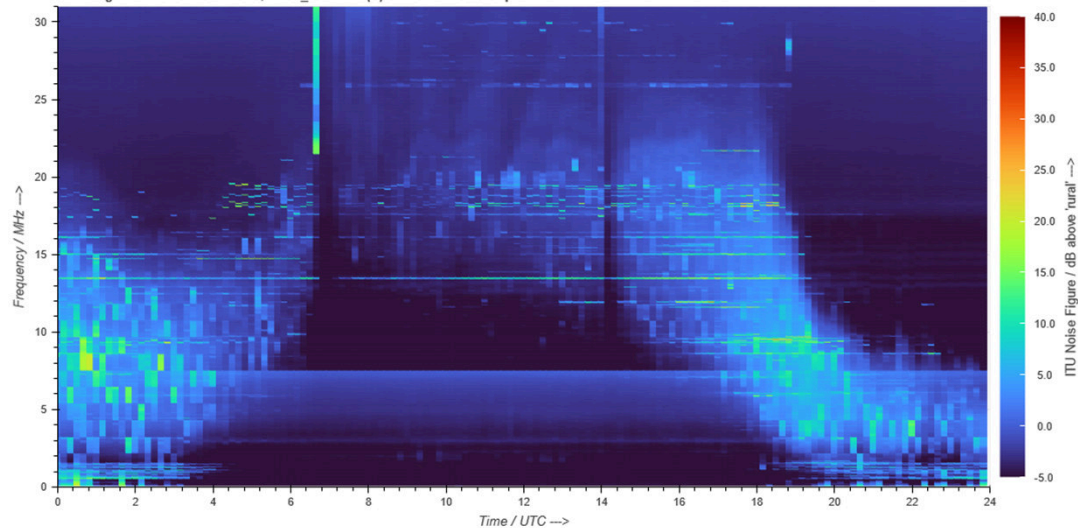


- At 8:00 UTC and 14:00 UTC on June 10th 2024 a drop out of complete RF shortwave propagation can be seen due to strong solar CME activity
- The first drop out is preceded by an intense radio burst
- Back ground noise on rural level and even below
- Light blue area shows distant noise sources
- Ionospheric attenuation suppresses distant noise during the day, MUF is indirectly visible
- Distant lightnings can be seen as „pixels“

Radio Wave Propagation (Example)

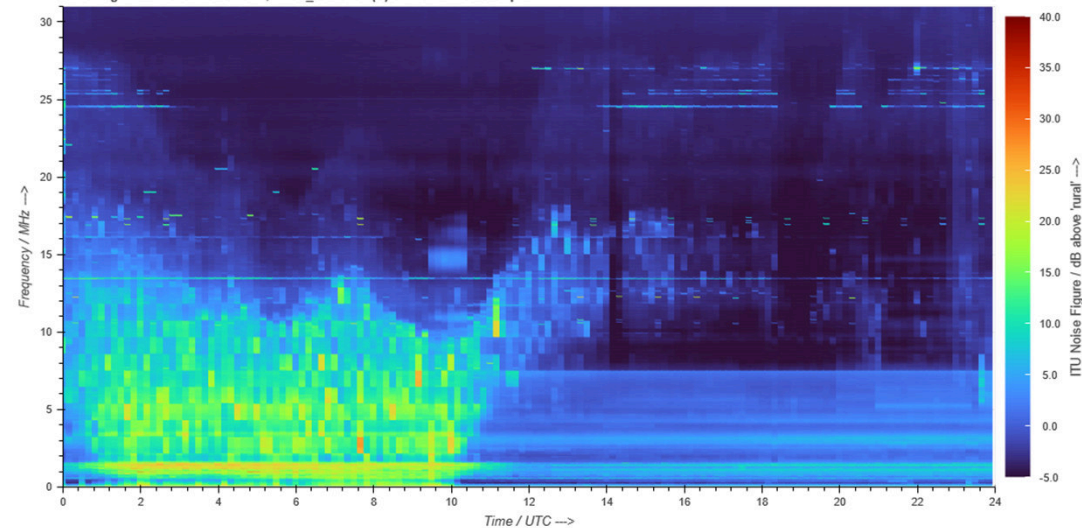


Noise figure Fa 2024-05-10 UTC, MST_ID: 015 (C) DARC e.V. EMC Dept.



HM015_2024-05-10 Landshut

Noise figure Fa 2024-05-10 UTC, MST_ID: 202 (C) DARC e.V. EMC Dept.



HM202_2024-05-10 Virginia Beach USA

- At 14:00 UTC drop outs of the RF radio wave propagation can be seen in Europe (Landshut #15) as well as in the US (Virginia Beach #202). Northern hemisphere was in a position where solar CME could affect both locations.
- Even further drop outs seem to have happened later which could not be detected in Europe
- In the data of the New Zealand station no CME impact was visible

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Summary



1. ENAMS has proven useful and supports with its data the protection of HAM Radio frequencies
2. The noise level between 66kHz and 31MHz has increased over the years compared to values given in ITU P.372,
 - Especially below 10 MHz there is a significant increase due to electronic devices
 - Above 10 MHz the noise figures in the HAM radio bands are still close to the ITU P.372 values
 - Above 10 MHz HAM radio bands are clearly visible as notches in the spectra and in some city locations the noise level is even on residential level
3. Different types of interferers are identified
 - VDSL, PLC
 - Photovoltaic equipment, especially “balcony” solar power stations
 - LED lamps, many types of inverters
 - ... and the list will be continued
4. ENAMS can also make radio wave propagation effects visible, i.e. Mögel-Dellinger, ...

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Outlook – Next Steps 2024 ff



1. ENAMS 2.0:

IARU R1 requested more receiving stations. We work on an improved version of the ENAMS receiver – ENAMS 2.0, advanced features:

- Local storage of data up to 5 years, i.e. stations are now easily relocatable
- I/Q data are stored for up to one hour and can be retrieved
- Storage of raw and calibrated data
- More computing power:
 - measurement cycle could be reduced to 5 minutes (not tested yet)
 - Band width could be set to 157 Hz (not tested yet)
- Very high reliability for 24/7 operation

2. ENAMS Diagrams & Evaluations will be continued and extended by feature detectors

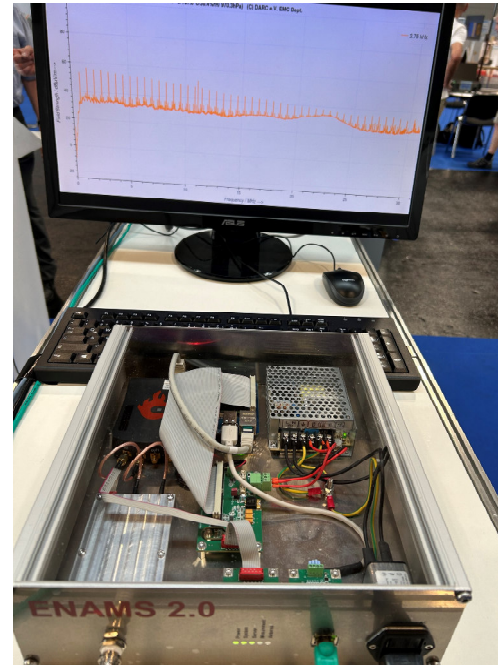
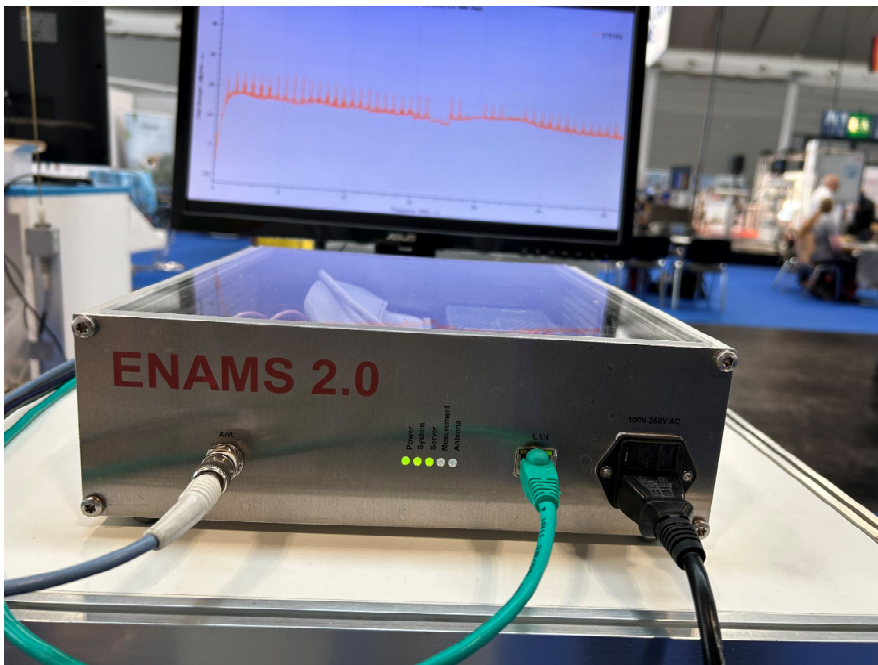
3. Third party assessment of system planned to get “quality” label, i.e. system has proven and “certified” measurement capability

Distriktsversammlung P | 22.09.2024 – ENAMS 2.0



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Distriktsversammlung P | 22.09.2024



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Vielen Dank für die Aufmerksamkeit !

Fragen

