# KHF-VLF Emissions - What are they? 

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For the very first time, a strange spectral world of differently structured high-frequency waves has been opened up after filtering out the sferics above $\mathrm{f}=4 \mathrm{kHz}$. To the best of our knowledge, such signals have not been reported before Manninen et al. (2016) [1]. On a 1-hour spectrogram, these signals often resemble 'sticks' or 'wands'. Actually, they are mostly hiss bursts with durations of a few seconds. These high frequency VLF emissions were previously known as recently revealed emissions, but from now on we will use new term: KHF-VLF (Kannuslehto High-Frequency VLF).

These KHF-VLFs are not rare since from 2006 to 2015, they were observed during $60-90 \%$ of all campaign days. KHF-VLFs were also often detected during the winter campaigns in 2016-2019. It seems that during the years when solar activity was high (2013-2015) we observed KHF-VLFs very regularly: in winter 2014-2015 they were observed on 52 days out of 59 , and in winter 2015-2016 on 75 days out of 91 . However, to date there are no statistical studies on the occurrence and properties of these waves.

In this presentation, we will show our observations of KHF-VLF emissions during different years.


Figure 1. Two examples of KHF-VLF events. Non-typical emissions (KHF-VLF) are seen above 6 kHz .

## References

[1] J. Manninen, T. Turunen, N. Kleimenova, M. Rycroft, L. Gromova, and I. Sirviö (2016). Unusually high frequency natural VLF radio emissions observed during daytime in Northern Finland, Environ. Res. Lett., 11, 124006, https://doi.org/10.1088/1748-9326/11/12/124006.

