

Diurnal periodicity in CMLs

Sagi Alon¹, Jonatan Ostrometzky¹, Hagit Messer¹

¹ School of Electrical and Computer Engineering

1. Introduction

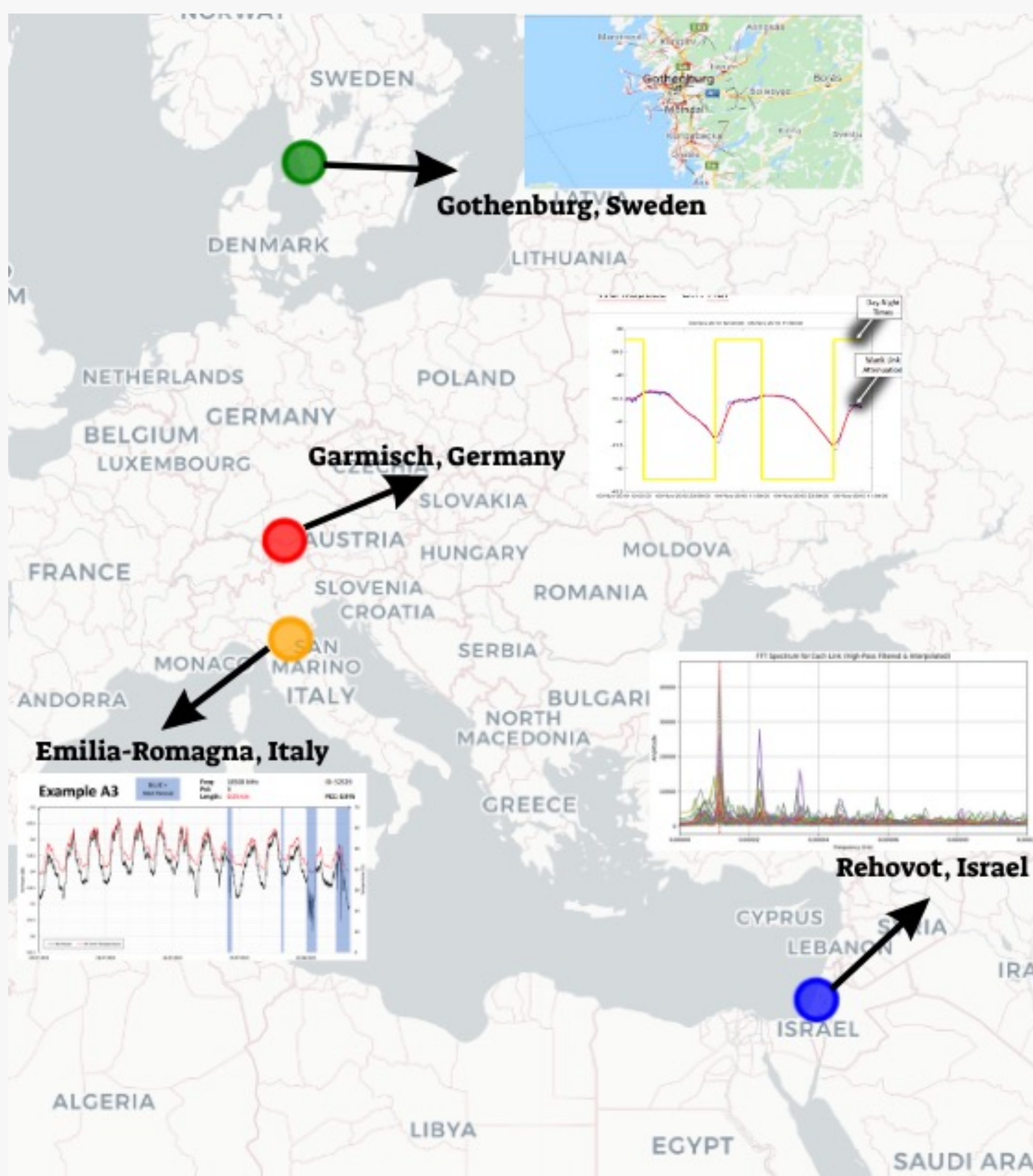
This work explores the phenomenon of periodicity (usually at 24-hour periods) in the received signal level observed in Commercial Microwave Links.

We will present an overview based on several observations from different locations around the world (mainly in Germany, Israel, Sweden, and Italy) and from different sources (cellular backhaul commercial microwave links and smart-city wireless network of mm-wave links) which are collecting data with different characteristics (e.g. sampling methods like instantaneous and min/max samples at different sampling rates, using different quantization levels).

We will try to check how atmospheric factors (e.g., weather) as well as hardware characteristics might play a role in these signal fluctuations, relating to previously reported studies.

2. motivation

Preliminary results suggest that fluctuations during the daily cycle can reach a few decibels at a number of locations, regardless of whether or not precipitation is present.



Despite the correlation with a number of daily phenomena such as temperature, air pressure, and absolute humidity, the exact causes are still not fully understood, as correlation does not mean causation.

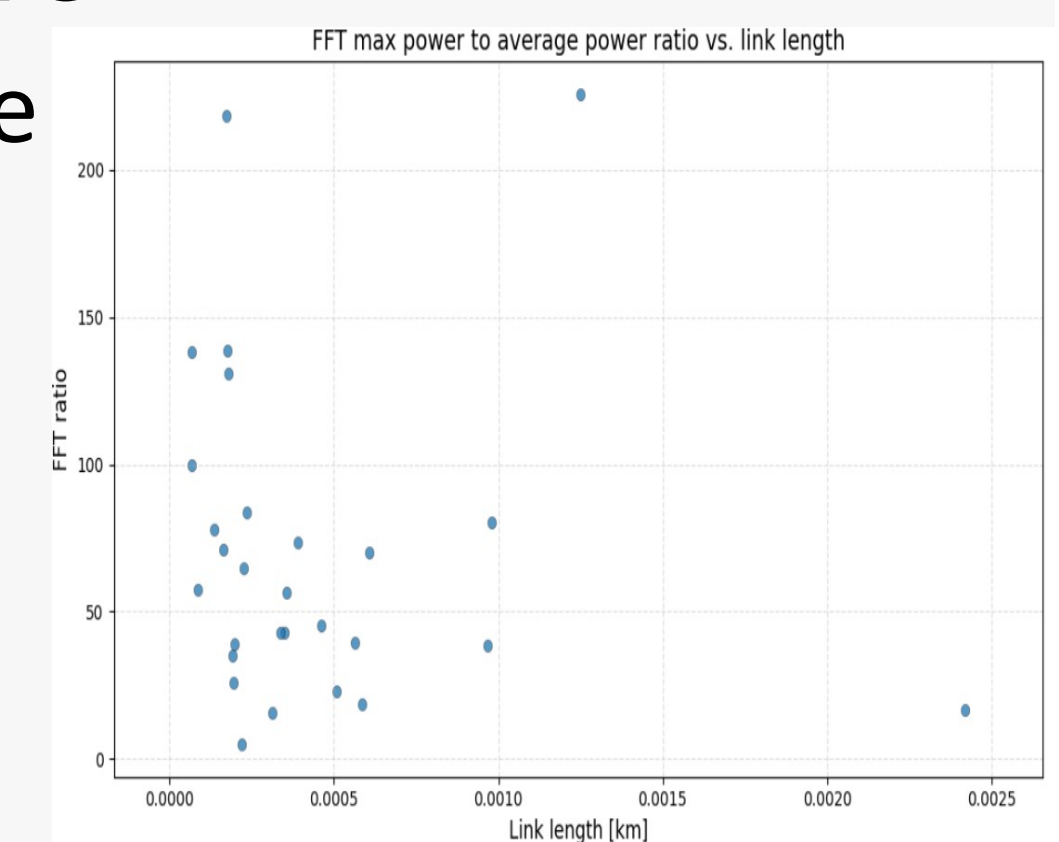
3. Data Diversity

| geographic region | number of links | frequency range [GHz] | link length range [km] | time period |
|-----------------------|-----------------|-----------------------|------------------------|---|
| Rehovot, Israel | 65 | 74-375 | 0.066-1.25 | 01/01/2019-31/12/2019 |
| Yatir, Israel | 2 | 18.792, 19.095 | 9.94, 10.31 | 15/06/2011-22/06/2011 |
| Emilia Romagna, Italy | 4 | 10.5 | 0.05, 0.19, 1.24, 1.81 | 20/07/2021-04/08/2021 |
| Guthenberg, Sweden | 729 | 7.46-38.68 | 0.14-15.23 | 01/06/2015-01/09/2015 & 01/01/2017-31/12/2017 |
| Garmisch, Germany | 1 | 13.3 | 4 | 18/06/2010-03/07/2013 |

4. Previous work

Initially, it was suggested that the link's length may affect the periodicity and its coherence. As can be seen in the plot shows that such a relation isn't significant.

In the graph, the FFT ratio indicates the ratio of the power at the peak over the average power

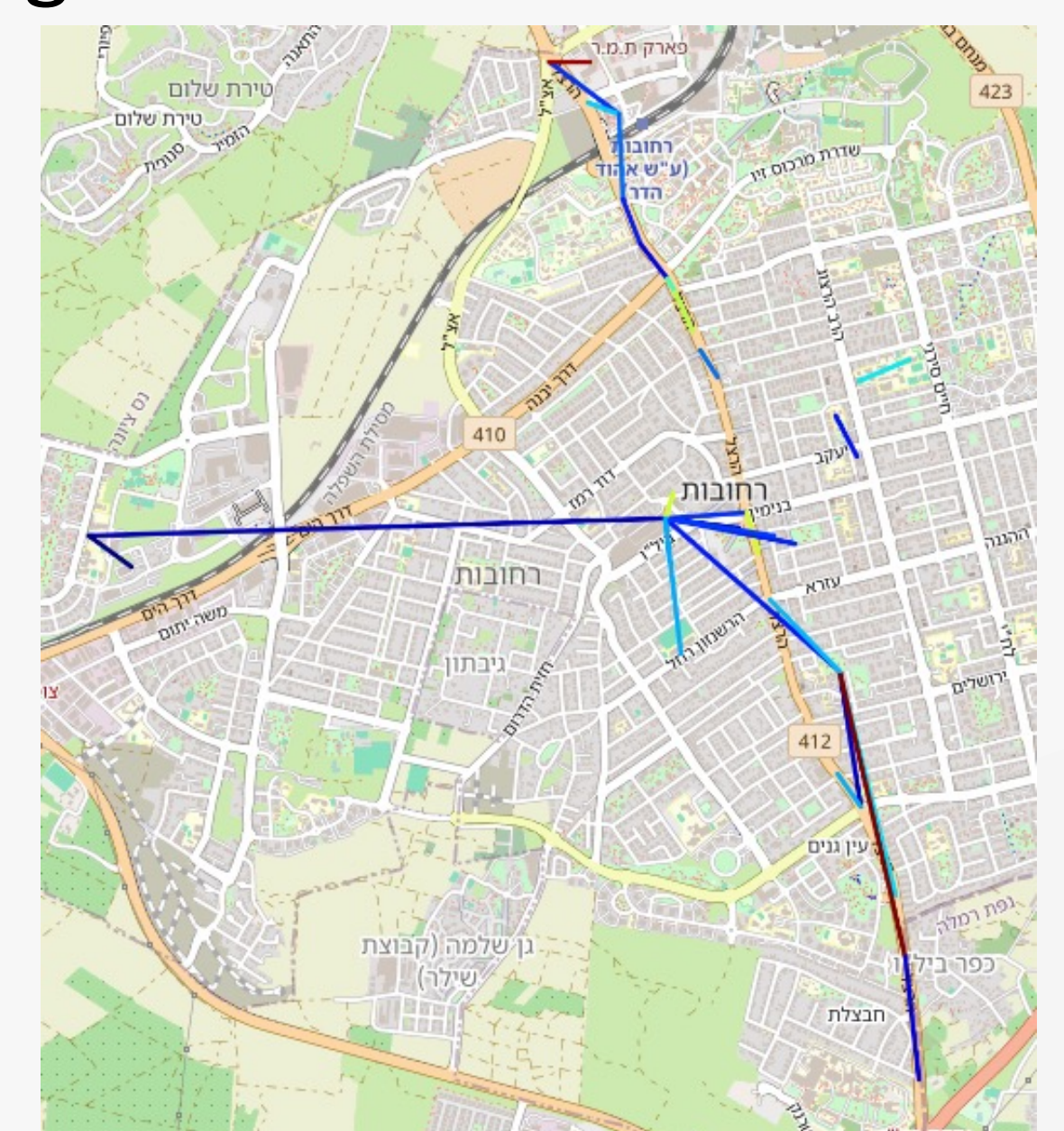


5. Suggested approach

Due to the fact that current model-based approaches have yet to find the underlying cause that is behind this phenomenon,

we are trying to check whether a data-based approach will shed more light on this unresolved question.

The suggested method relies on dimension reduction, where many parameters are being analyzed and refined in order to find a concrete representation that considers all their attributes.



References

- [1] M. Hadar, J. Ostrometzky, and H. Messer, Parameter estimation of in-city frontal rainfall propagation, in ICASSP 2020-2020 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), pp. 4910±4914, IEEE, 2020.