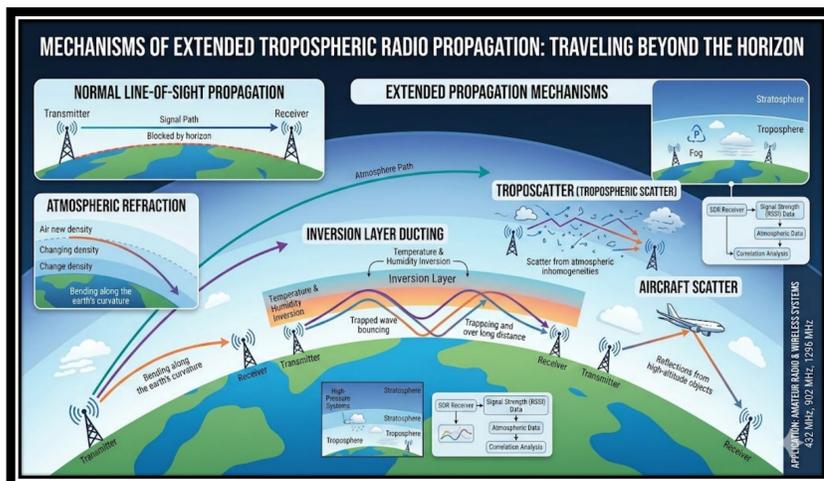
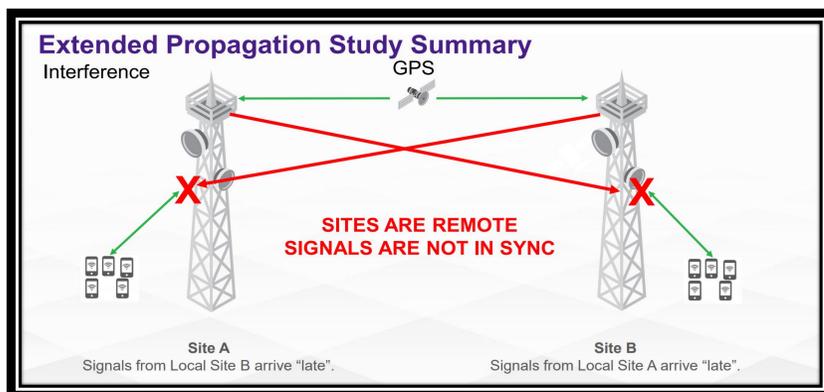


Starting a Low-Cost SDR Beacon Receiver Project for Studying Extended Tropospheric Propagation on 144/432/902/1296 MHz

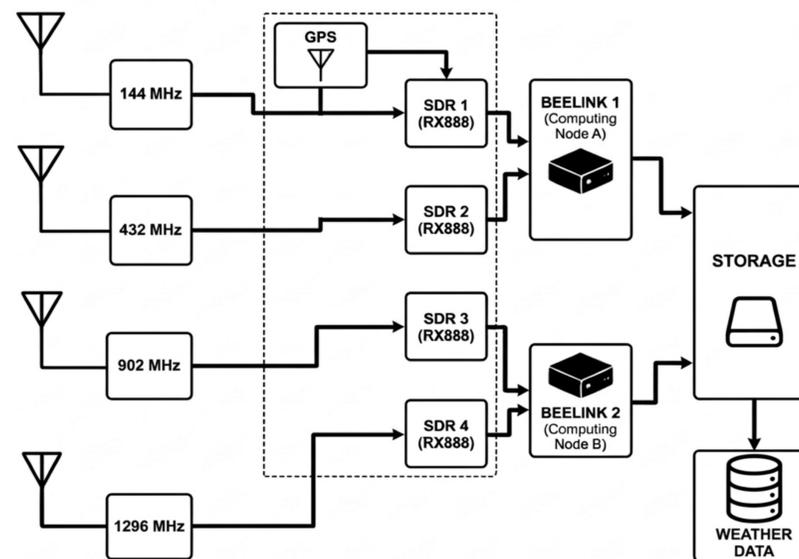
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Abstract

In this project, we will build and test a low cost SDR-based receive system to study extended tropospheric propagation on 144 MHz, 432 MHz, 902 MHz, and 1296 MHz, with the primary goal of understanding how radio signals travel far beyond normal line of sight. This can be caused by atmospheric or other tropospheric conditions such as refraction, inversion layer ducting, tropospheric scatter, and aircraft scatter. These extended propagation events are important not only for amateur radio operators who monitor weak signals, but also for synchronized wireless systems where late arriving signals can create interference or affect timing.



SYSTEM ARCHITECTURE



Method

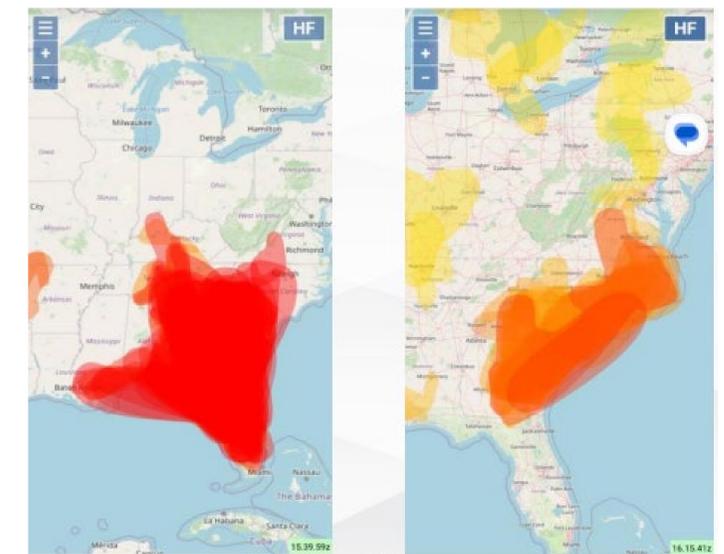
- 1) Deploy:
 - A receiving station using an RTL SDR class device
 - A low-noise preamplifier
 - Band appropriate antennas
- 2) Monitor known beacons and signals of opportunity
- 3) Collect time stamped RSSI values, CW and WSJT mode to decode results including WSPR, FT8, and Q65
- 4) Concurrently, gather atmospheric data on 15 to 60 minute intervals along/near propagation path
- 5) Compare signal behavior against weather patterns such as fog, temperature inversions, humidity changes, or pressure gradients

Since this is the first year and this project is just now starting, the primary focus of the project is on building a stable receive chain, confirming consistent beacon reception, and creating a data pipeline, that supports long-term propagation studies.

When we have stable data, we plan to analyze the signatures of extended propagation events and explore which atmospheric features are most responsible for them, and later we plan to attempt an initial machine learning model to predict "event vs. no event."

Applications

The end goal of this project is to create an AI algorithm based in large datasets in order to forecast signal propagation under specific atmospheric, tropospheric, and topographic circumstances for the cellular wireless industry, particularly in 5G. Additional applications exist in the military, reducing communication interception rates and improving communications clarity between allied forces. This research will also carry significant advantages for reducing interference in VHF/UHF radio.



References

- [1] <https://vhf.dxview.org/>

Acknowledgements

The project is a new collaboration between the University of Scranton, HamSCI, VIAVI Solutions, and the Texas A&M MTT-S student group. We also plan to create simple documentation and deployment guides so students, clubs, and under resourced schools can reproduce this low-cost system and join the research effort over time.