



FFI Forsvarets
forskningsinstitutt

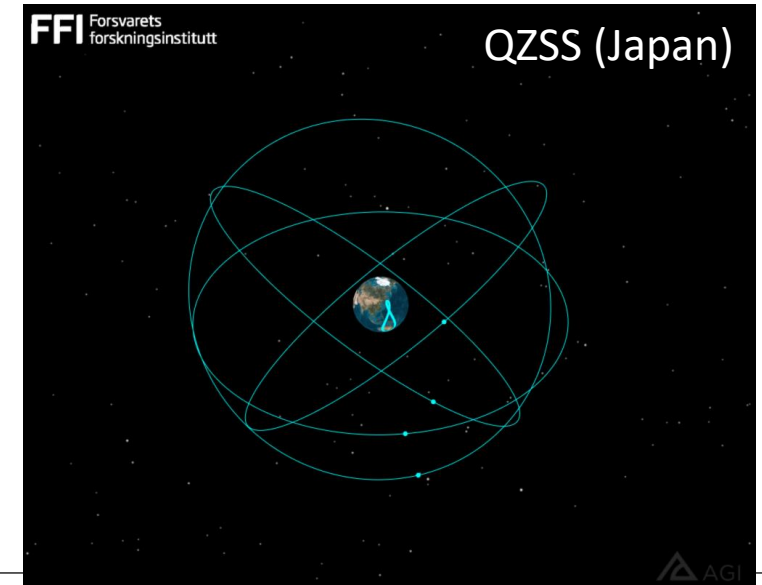
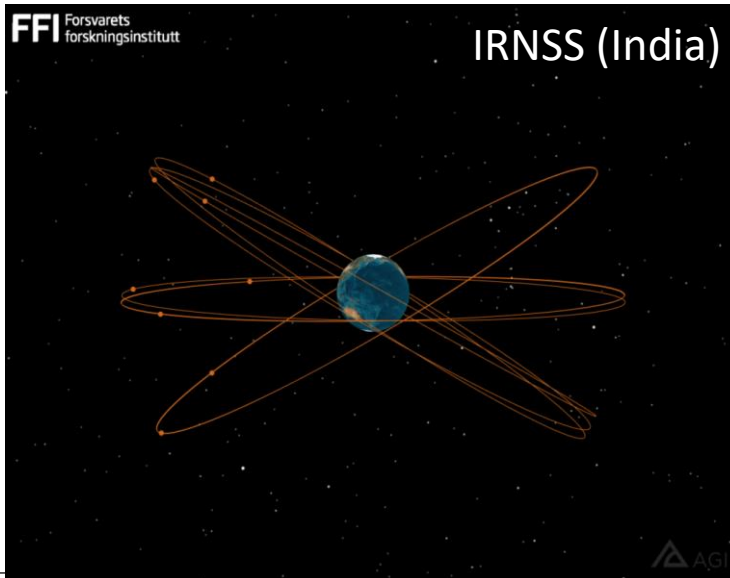
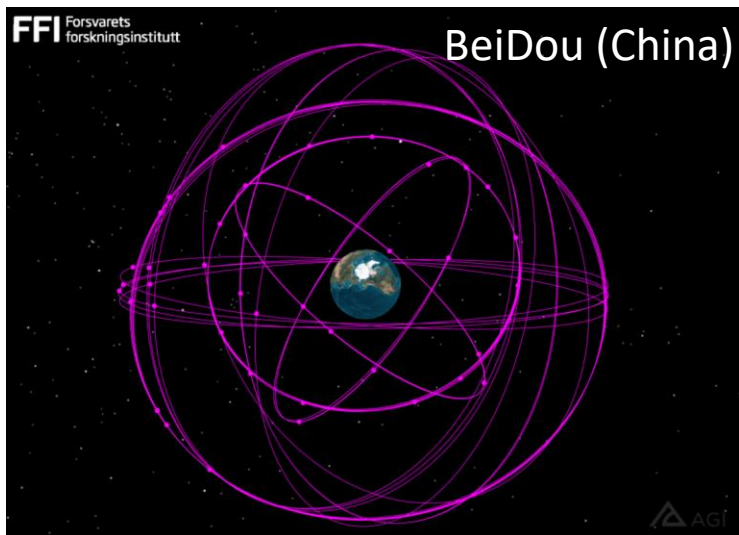
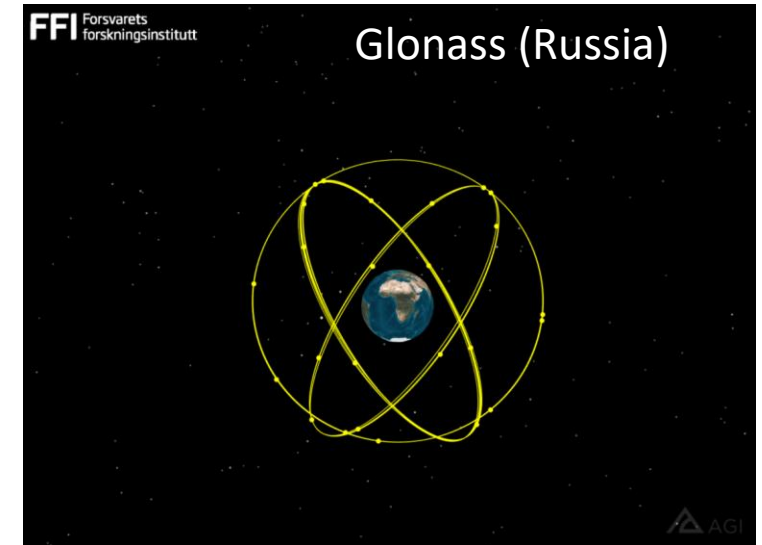
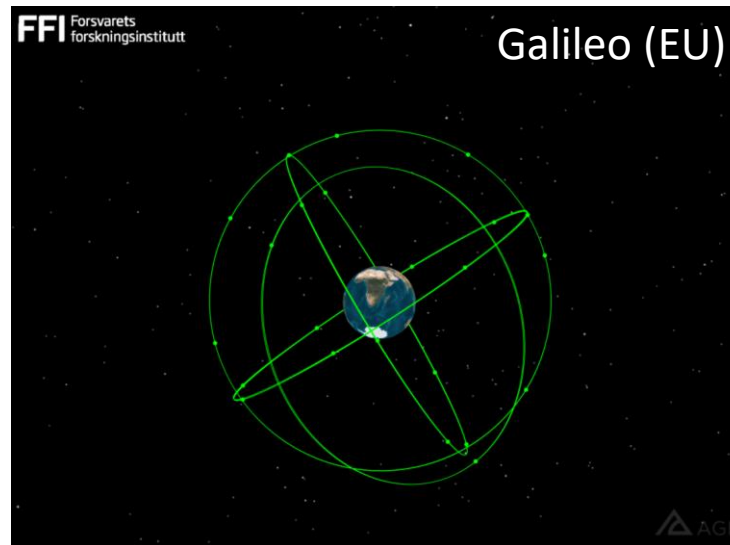
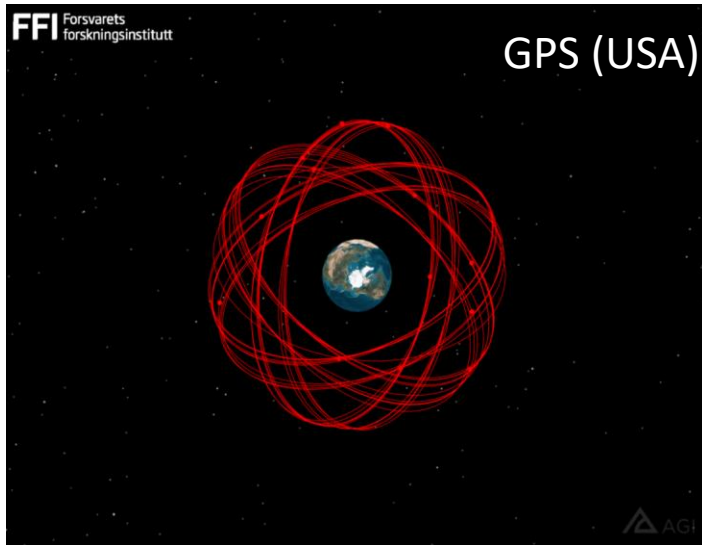
Master's Thesis with FFI

Global Navigation Satellite Systems - GNSS

Tor Atle Solend

Anders Rødningsby

Global Navigation Satellite Systems (GNSS)



GNSS:

GPS

GALILEO

GLONASS

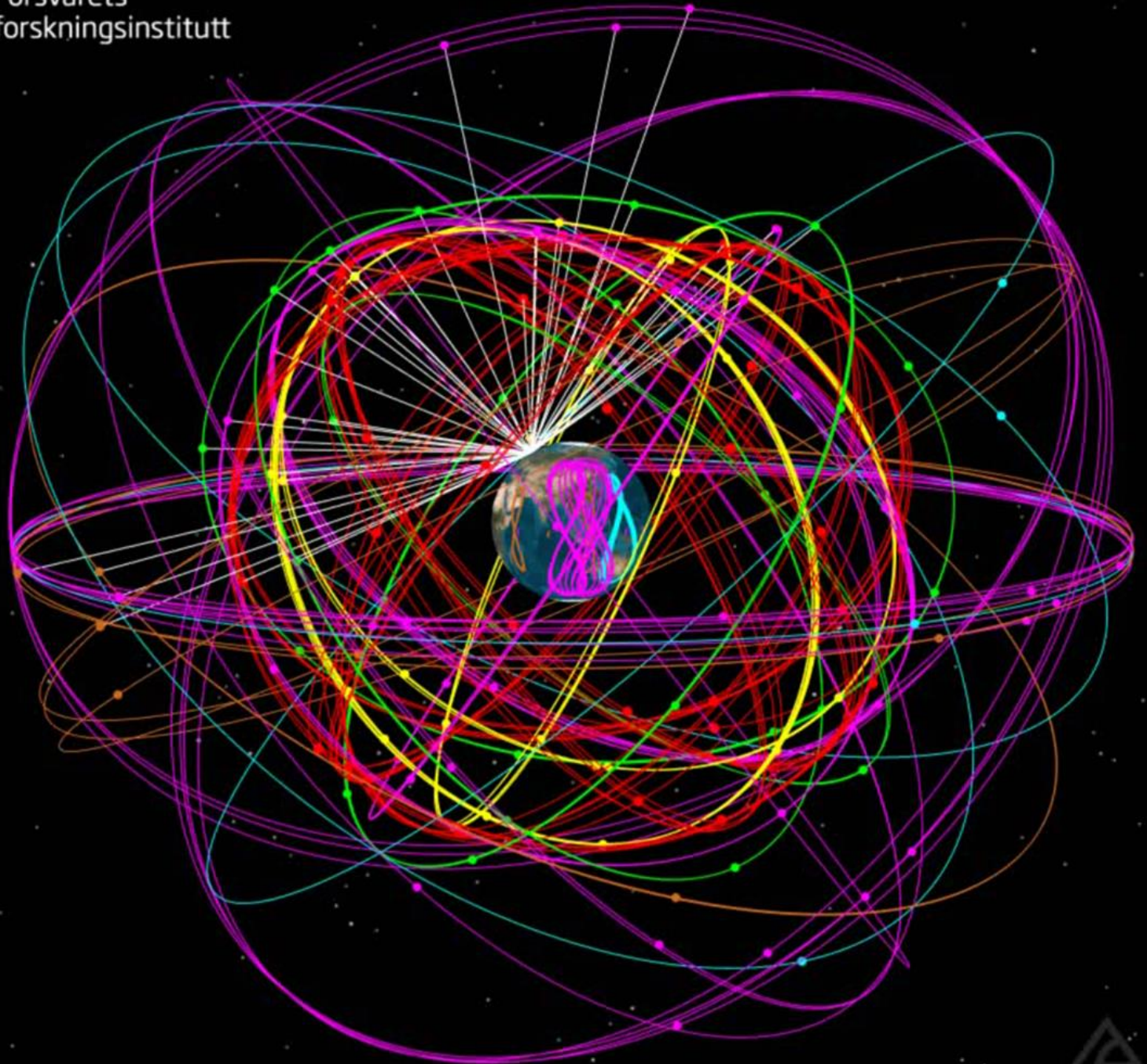
BEIDOU

RNSS:

BEIDOU*

QZSS

IRNSS



10.03.2022 00:00

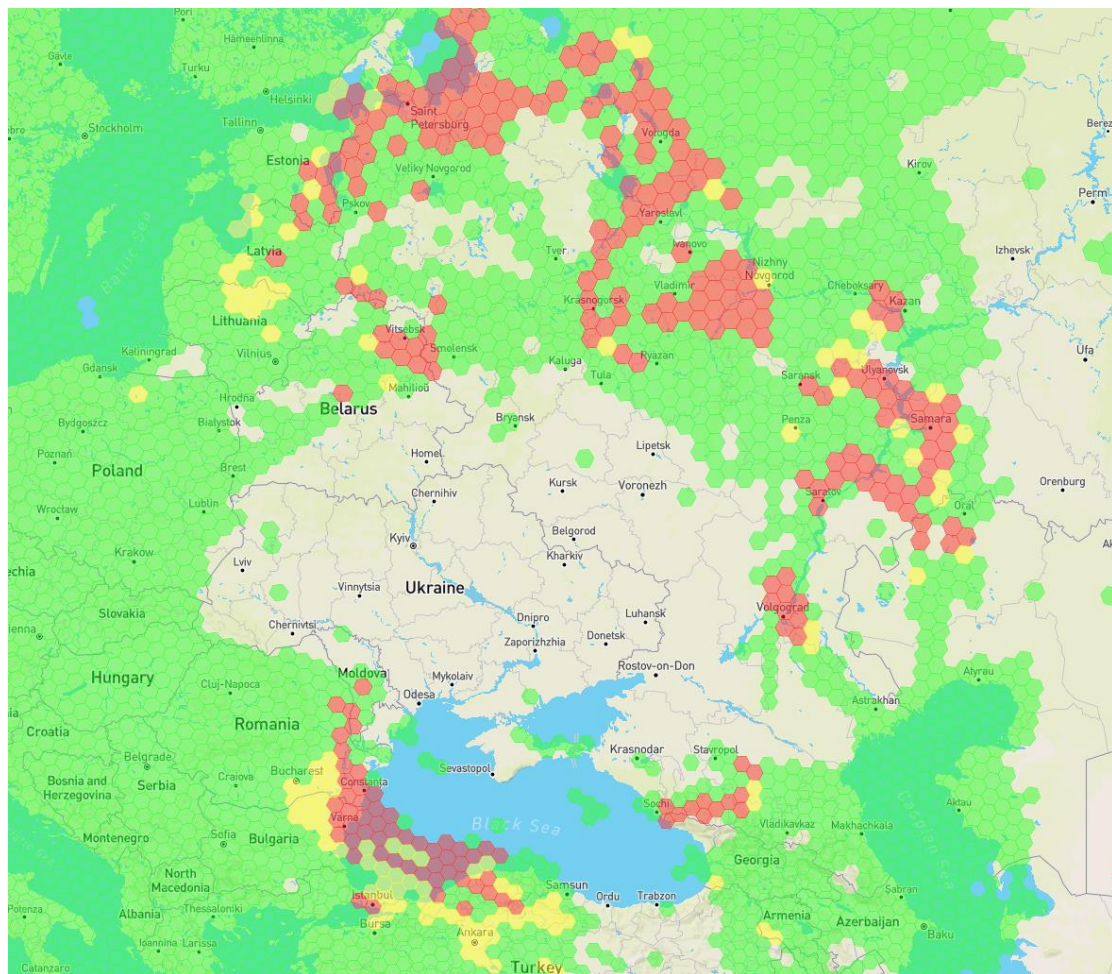


Lag 1

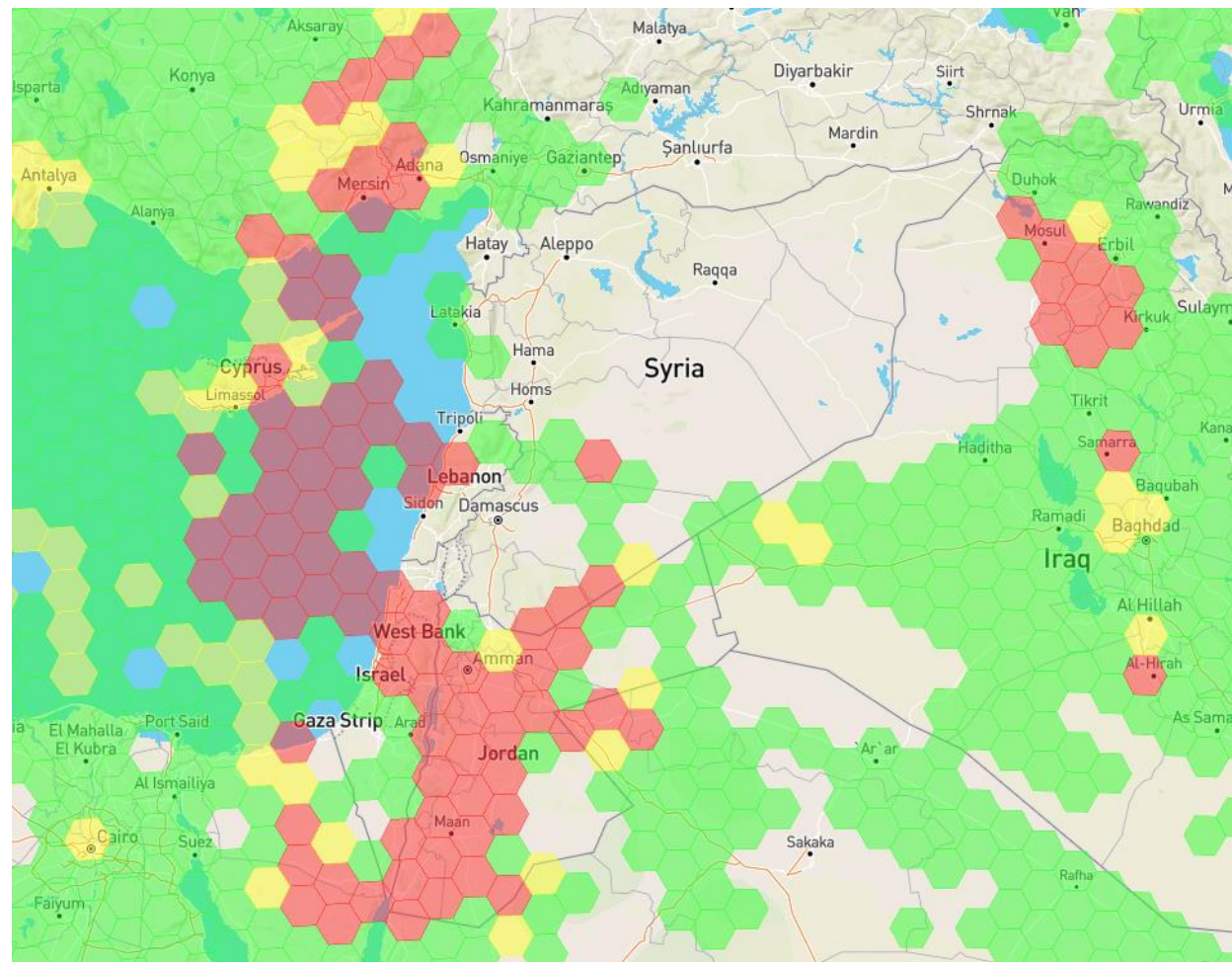
■ Høyde (m) (Sum)

Source: NKOM

Jamming activity elsewhere



gpsjam.org 30.10.2023



gpsjam.org 31.10.2023

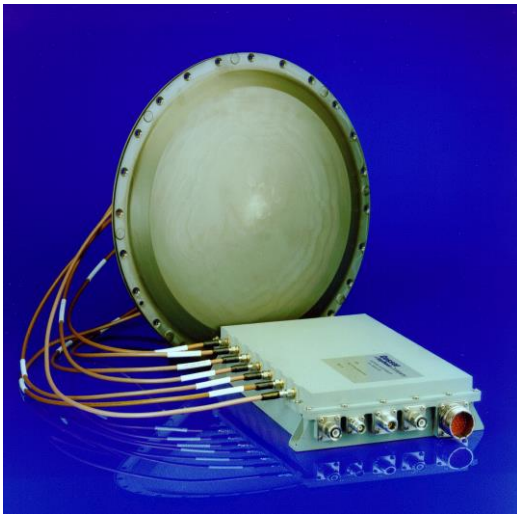
Why is GNSS vulnerable?



20000 km

Anti-jam antenna simulator

- Analyze and understand how anti-jam antennas work
- Compare different nulling algorithms
- Develop an anti-jam antenna simulator

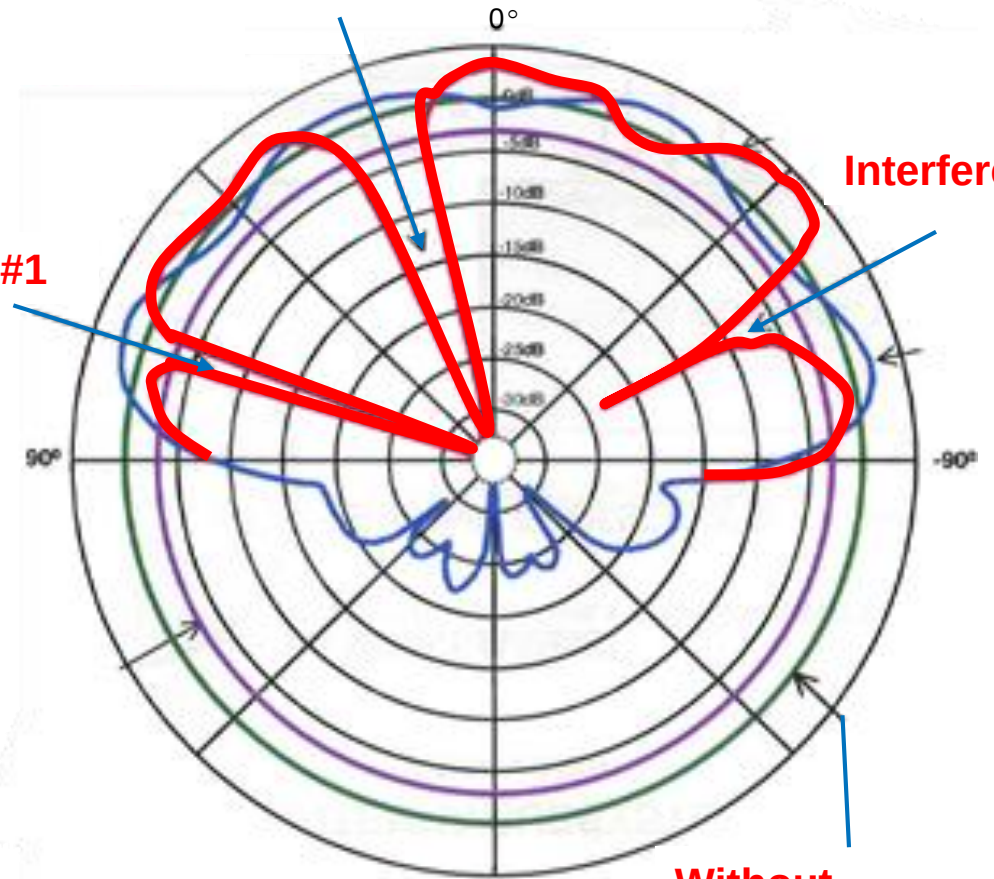


Security clearance may be needed!

Interference #2

Interference #1

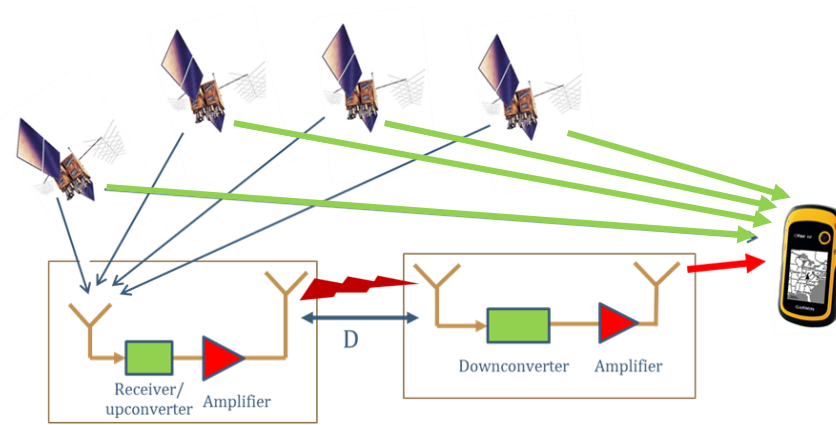
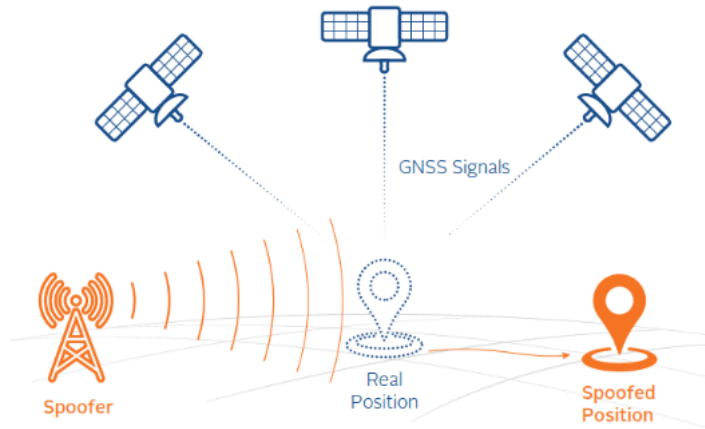
Interference #3



Without
interference

Spoofing – what is it and how does it work

Retransmit «true», or generate fake, satellite signals



GNSS-simulator



Software Defined Radio (SDR)

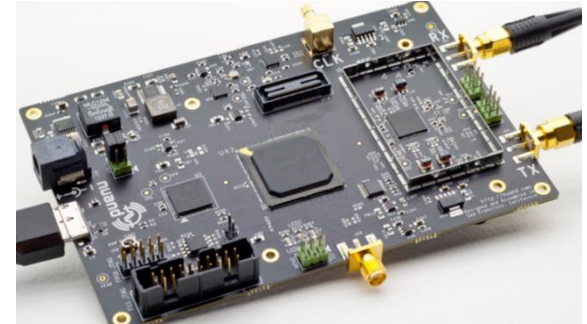


GNSS spoofer

- Build your own GNSS spoofer based on SDRs
→ and become an expert in Pokemon GO 😊
- Evaluate software available online
- Demonstrate enhanced functionality
- Can the spoofing signals be synchronized with real GNSS time

Security clearance may be needed!

Software Defined Radio (SDR)



If you find the topics interesting, do not hesitate to contact us 😊

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