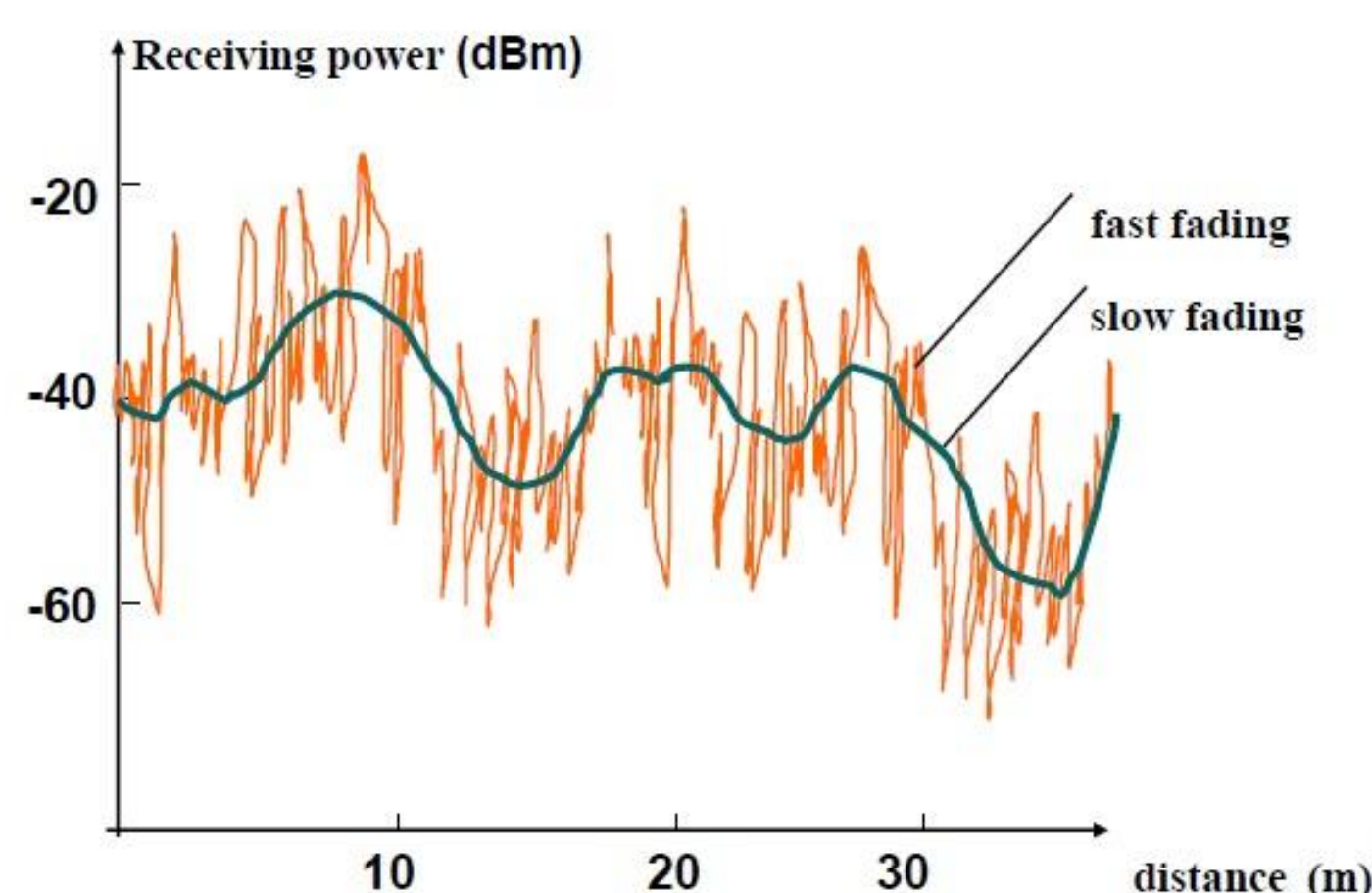


Background

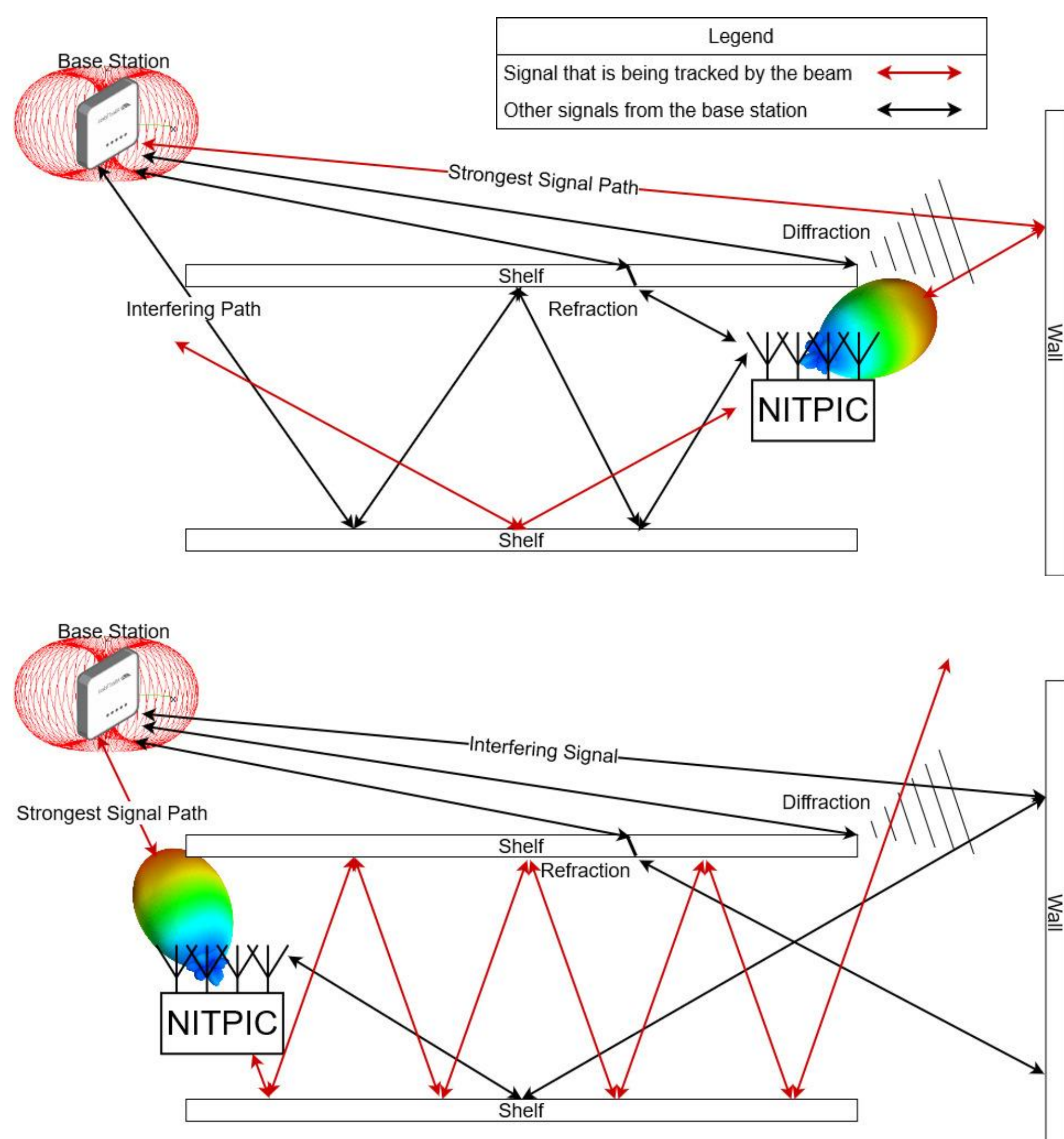
- Signals can reflect, refract, and diffract, which changes their phase and amplitude
- Some environments create much more of these interferences
- When 2 signals of opposite phase interact, they cancel completely
 - This can cause signal "dead zones"
- Fast Fading and Slow Fading interference is a result of these destructive interferences



"Teletopix.org," TELETOPIX.ORG, 23-Apr-2020. [Online]. Available: <https://teletopix.org/signal-fading/>

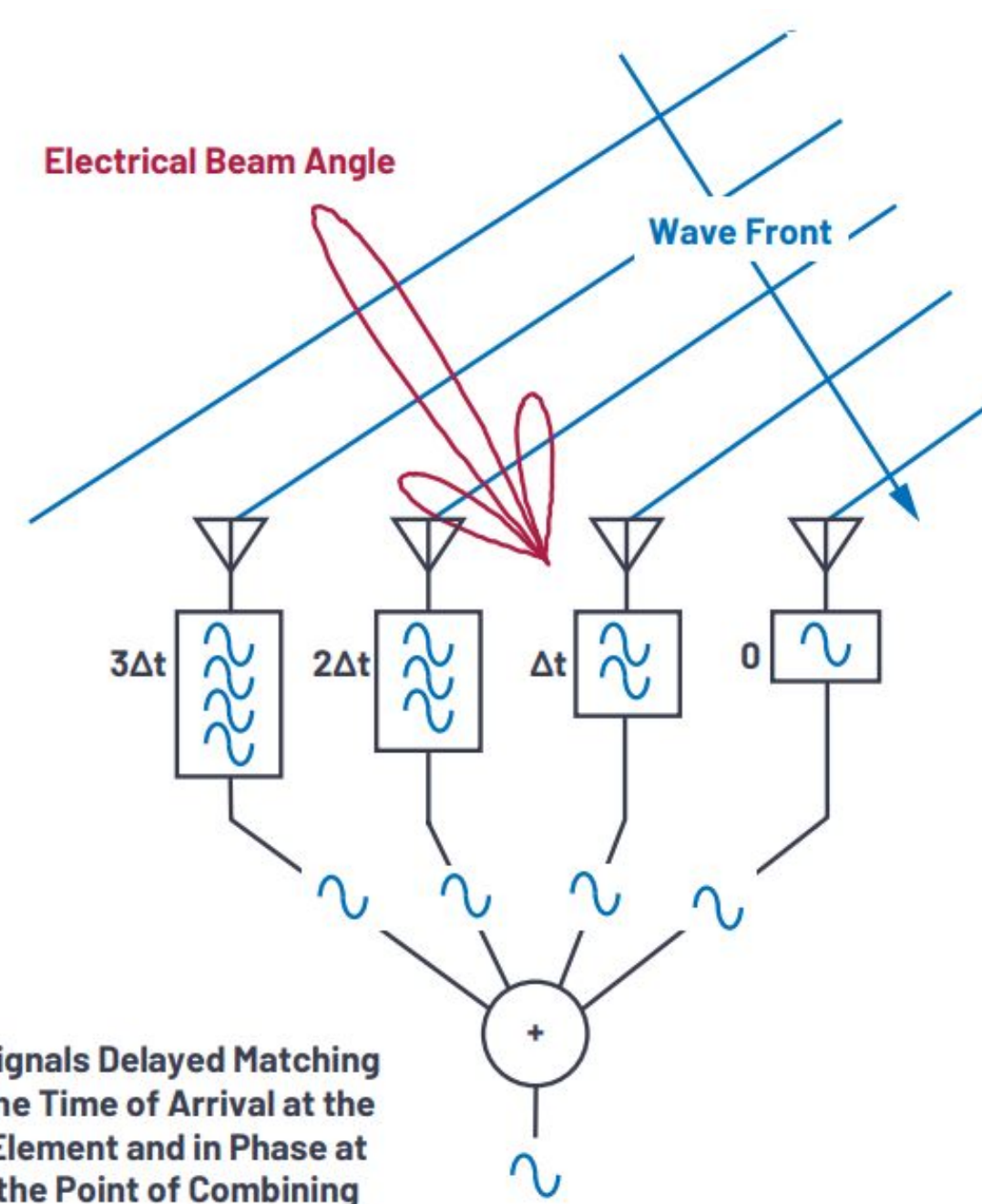
Signal Tracking

- In order to find the best pattern, we are changing the beam pattern and checking the power of the received signal
- Focusing in the direction of the strongest signal, and reducing the effect of destructive interference
- Unlike regular radar, beam pattern will still be able to monitor all directions such that signal is not dropped



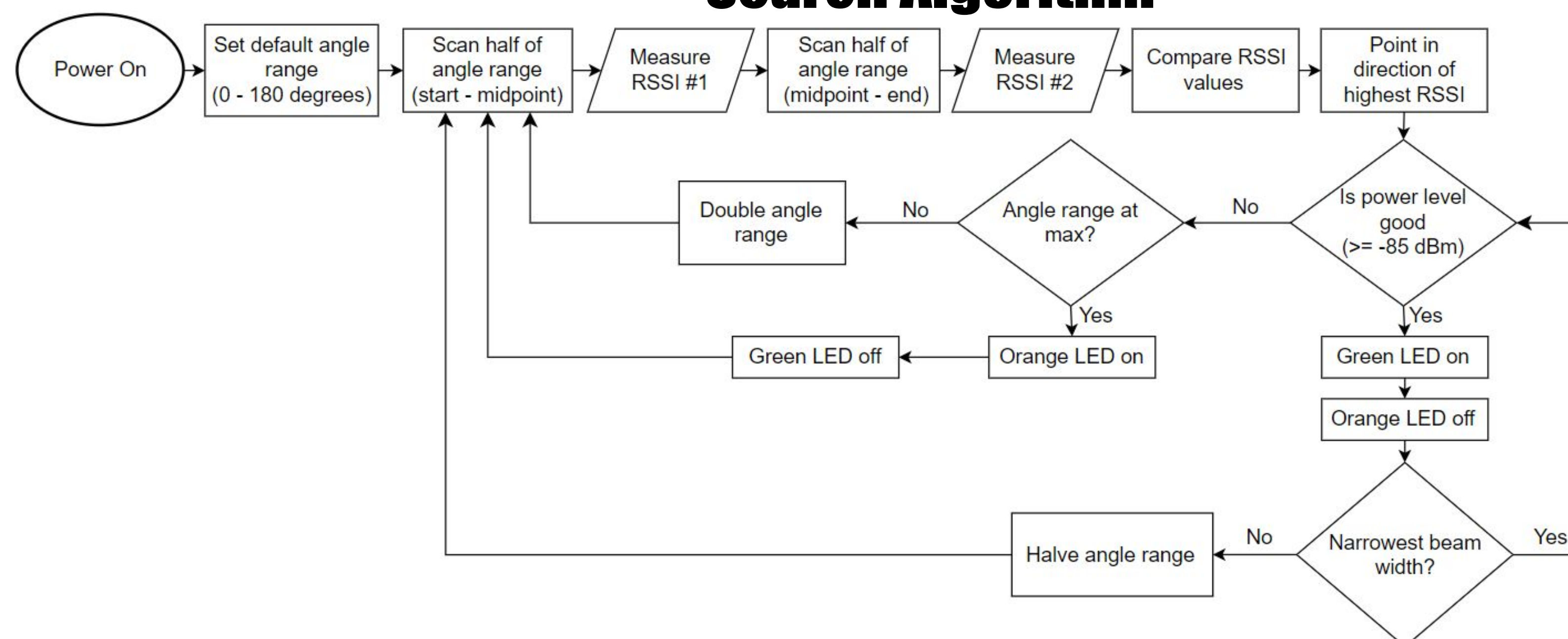
Why an Array

- A single omni-directional antenna cannot be directed, but an array of antennas can be
- Differences of phase and attenuation between antenna in an array "point" the pattern
- With a directed beam, we reduce the effects of fast fading and slow fading interference on the signal

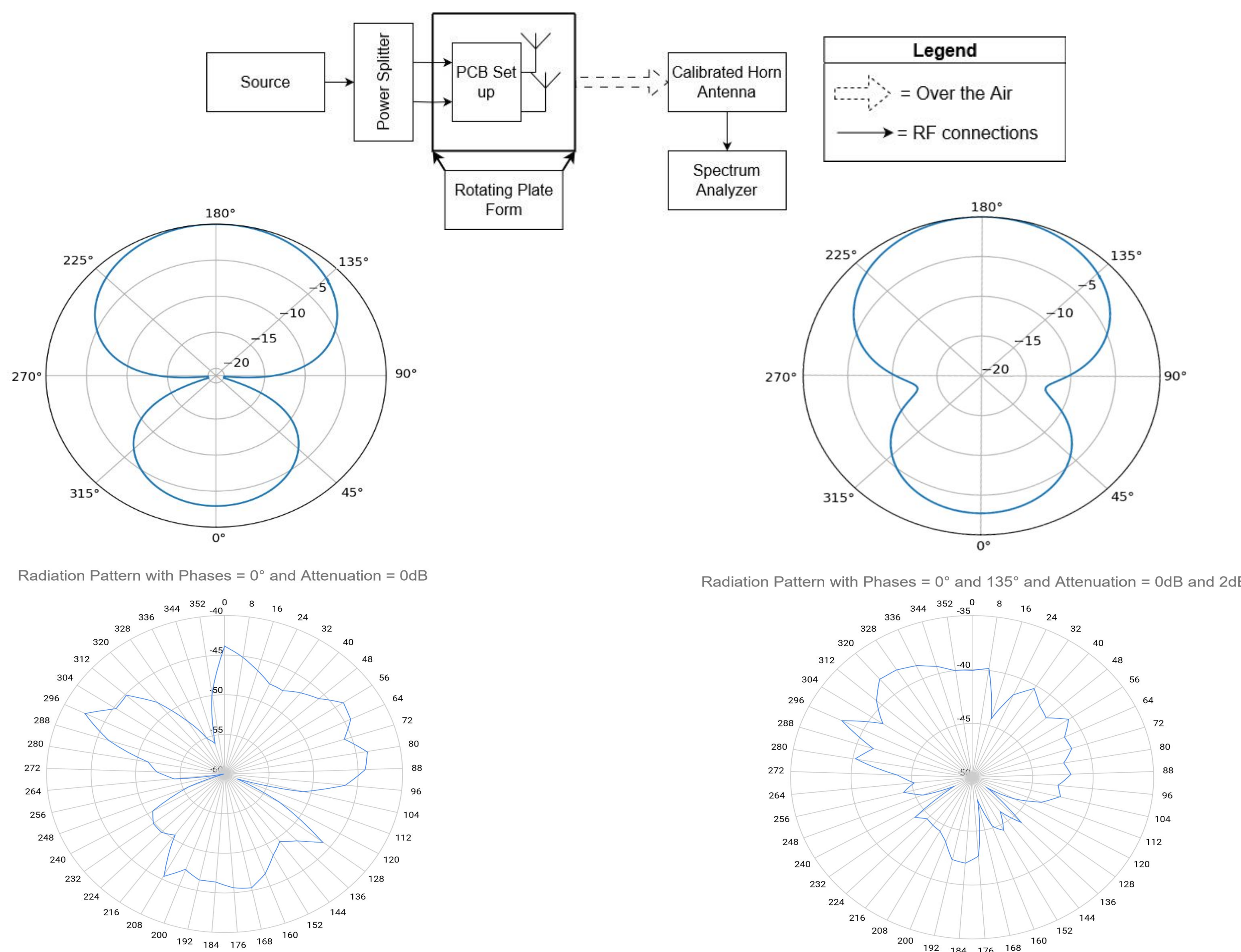


F.Gross, "Smart Antennas," in Smart Antennas with MATLAB®, 1st Edition, The McGraw-Hill Companies, Inc. 2005, pp-207-211

Search Algorithm

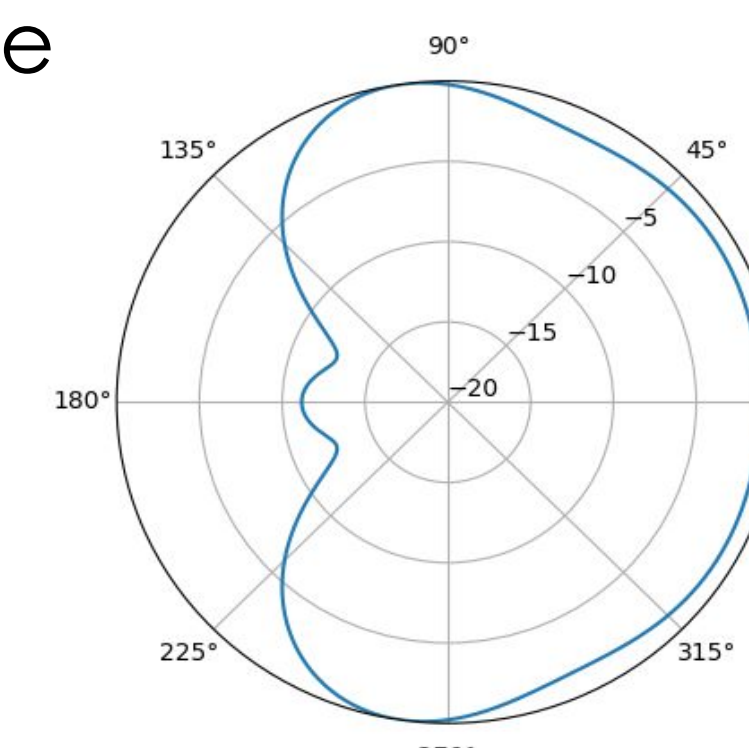


- The values of the radiation patterns were found through the use of a genetic algorithm

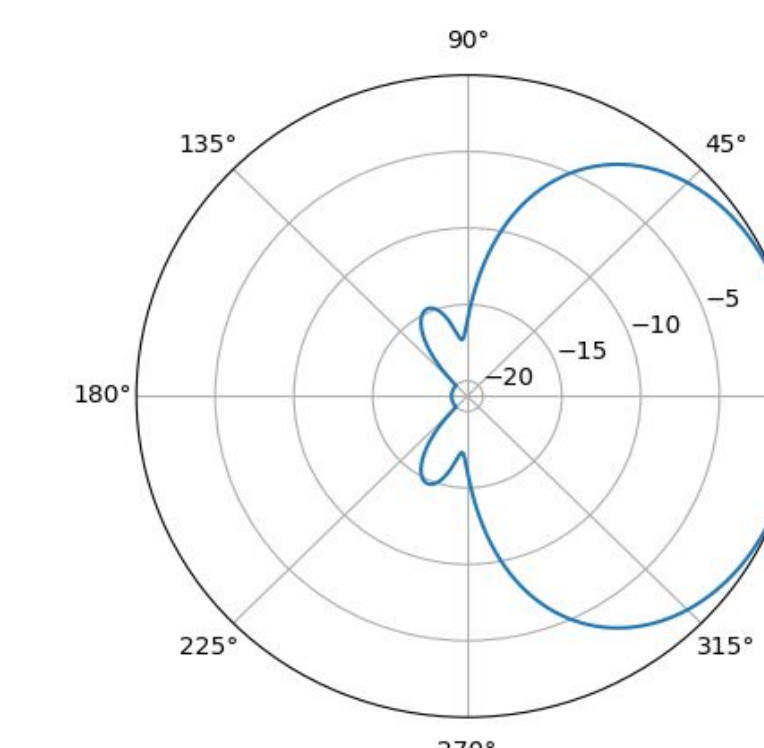


Beam Formation

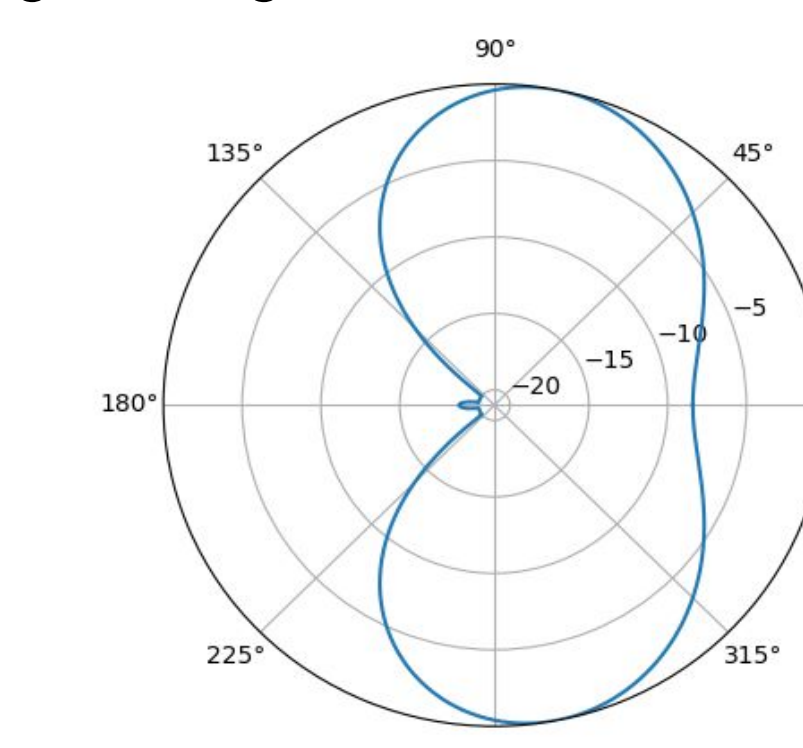
- Changing the attenuators and phase shifters "points" the beam
- Smallest beam is approx. 60 degrees for primary lobe



Pattern for 0 - 120 degree range

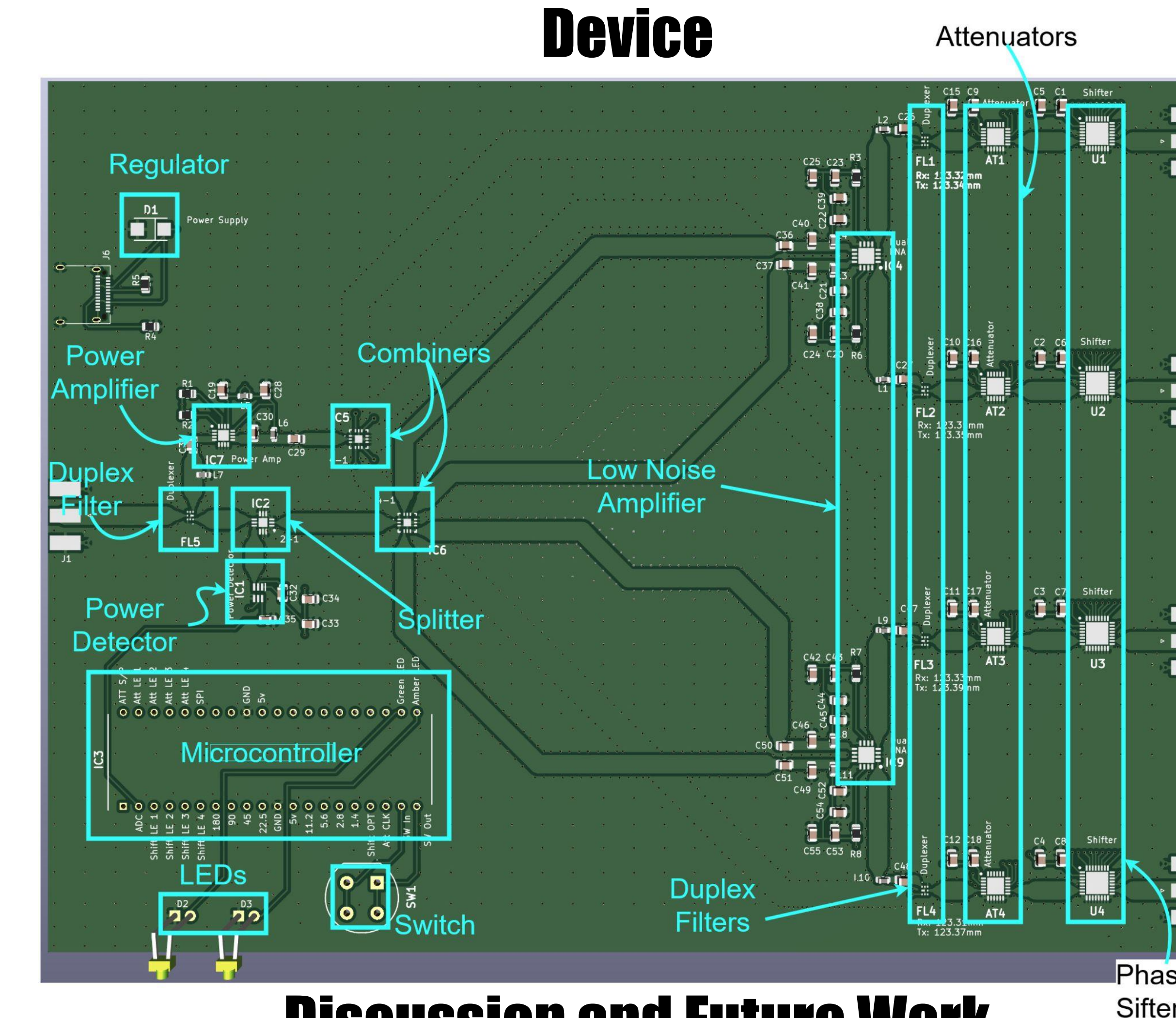


Pattern for 0 - 60 degree range



Pattern for 60 - 120 degree range

Device



Discussion and Future Work

- Making the device smaller for more ease of use.
- Make it possible for more rural and underprivileged communities to connect to LTE signals without having to build as many cell towers.
- First responders can still connect to LTE signal even in network congested areas.

