



# Heltec LoRa 32 Range Limits

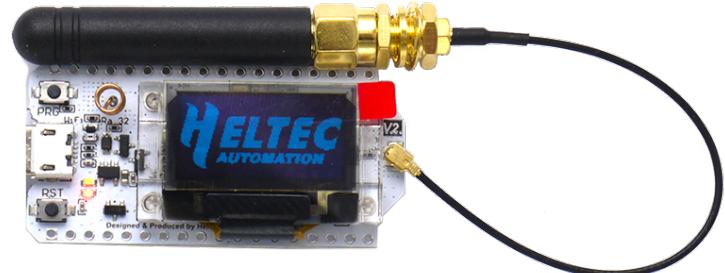
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# Introduction

The Heltec LoRa 32 is a versatile sensor board integrating LoRa communication for long-range wireless connectivity and various sensors for diverse IoT applications.

# Hypothesis

- What is the relationship between LoRa transmission range and environmental factors in varying terrains ?
  - Without obstacles
  - With obstacles
  - With metal ground



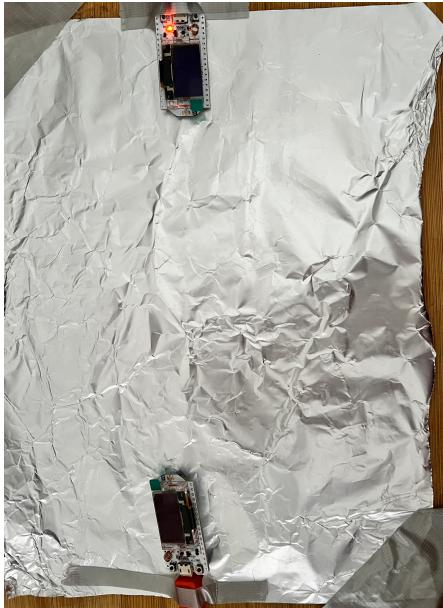
# Parameters

**Received Signal Strength Indicator (RSSI):** Measured in dBm, indicates the strength of the received signal. A higher RSSI value represents a stronger signal.

**Signal-to-Noise Ratio (SNR):** Measured in dB, indicates the ratio of the signal power to the noise floor. A higher SNR value represents a better signal quality.

$$FSPL = 20 \log_{10}(d) + 20 \log_{10}(f) + 20 \log_{10} \left( \frac{4\pi}{c} \right) - G_{Tx} - G_{Rx}$$

# Set-up & Experimental Environment



# Results

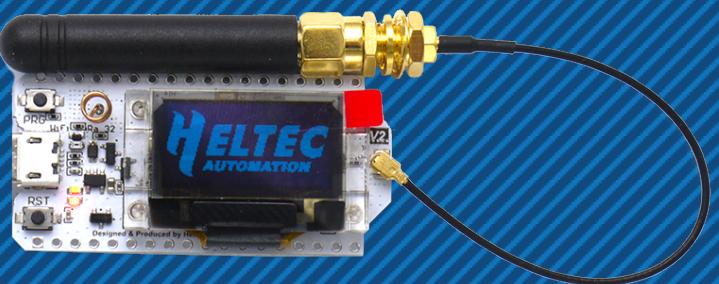
The results showcase the correlation between LoRa transmission range and environmental variables, indicating the impact of terrain and conditions on signal strength

**Note :** LoRa Heltec Antenna would enable to communicate for higher ranges

Setup	Max Range (Successful Com > 70% times)	RSSI	SNR
Theoretical Limits (Optional)	Upto 1 KM (idle conditions)	None	None
Without Obstacles (Open Space)	60cm to 120 cm	-125	-9
Without Obstacles (Closed Space)	60cm to 120 cm	-125	-9
Without Obstacles (Metal Ground)	30 cm - 80 cm	-112	-7
With Obstacles (Open Space)	27cm to 85 cm	-110	-5
With Obstacles (Closed Space)	35cm to 55cm	-105	-3
With Obstacles (Metal Ground)	30cm - 40 cm	-117	-8

# Conclusion

The project conclusively highlights the significance of terrain and environmental factors in determining LoRa's transmission range, emphasizing the need for adaptive strategies in IoT deployments





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# Thank You

