

GOALS

Through EXpLoRa, we aim to analyze the performance of LoRa products under realistic conditions:

- NITOS city-wide LoRa experimentation platform
 - 13 LoRa devices scattered in a city scale environment
- varying channel conditions
 - range of ~35 dB
 - LOS/ NLOS
 - interference
- NITOS link quality evaluation framework

CHALLENGES

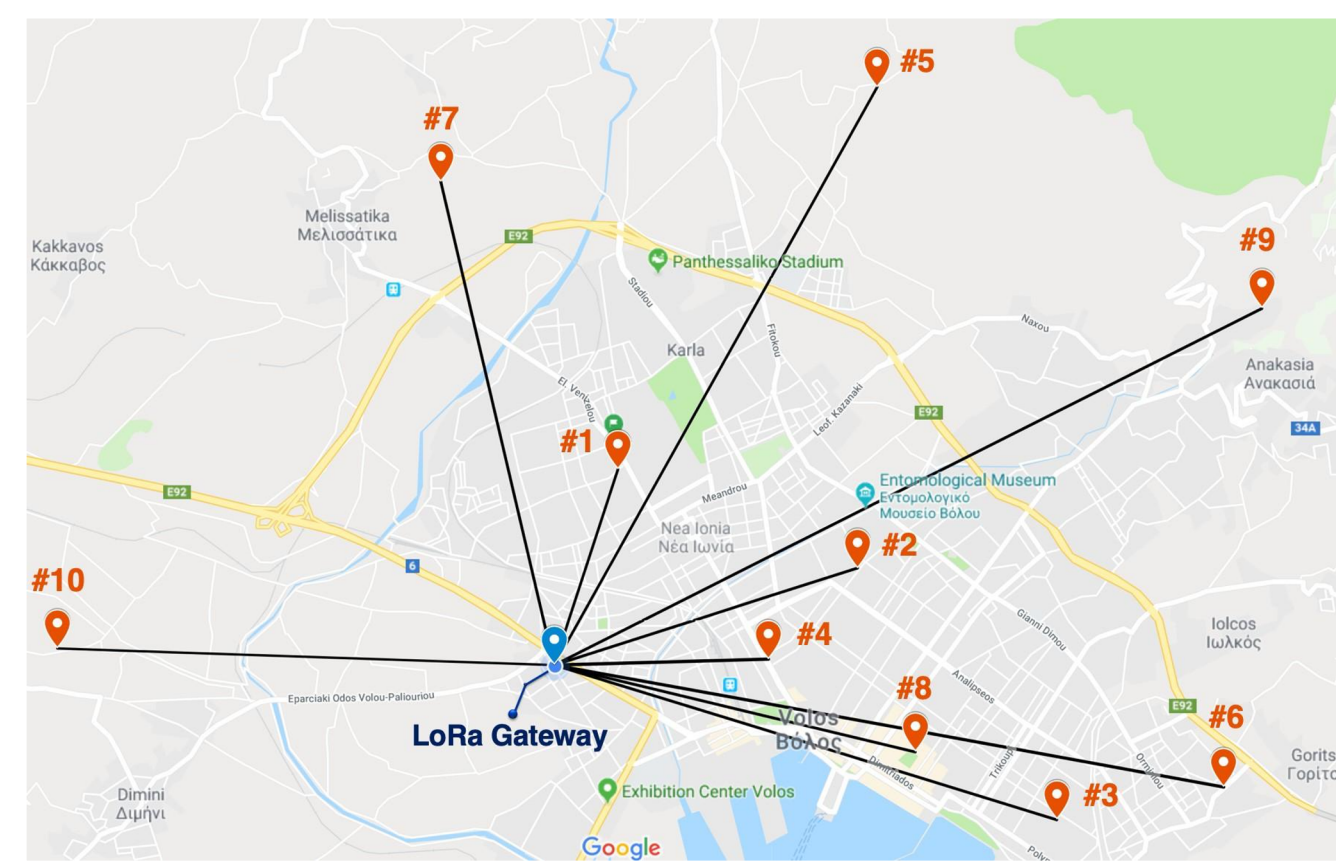
LoRa performance under key configurations has not been investigated in detail:

- high obstruction density, such as cities with tall buildings and NLOS conditions
- congested and rich interference conditions
 - multiple collocated nodes
 - overlapping LoRa transmissions
- representative application scenarios
 - energy metering within buildings

DEMO SETUP

LoRa devices

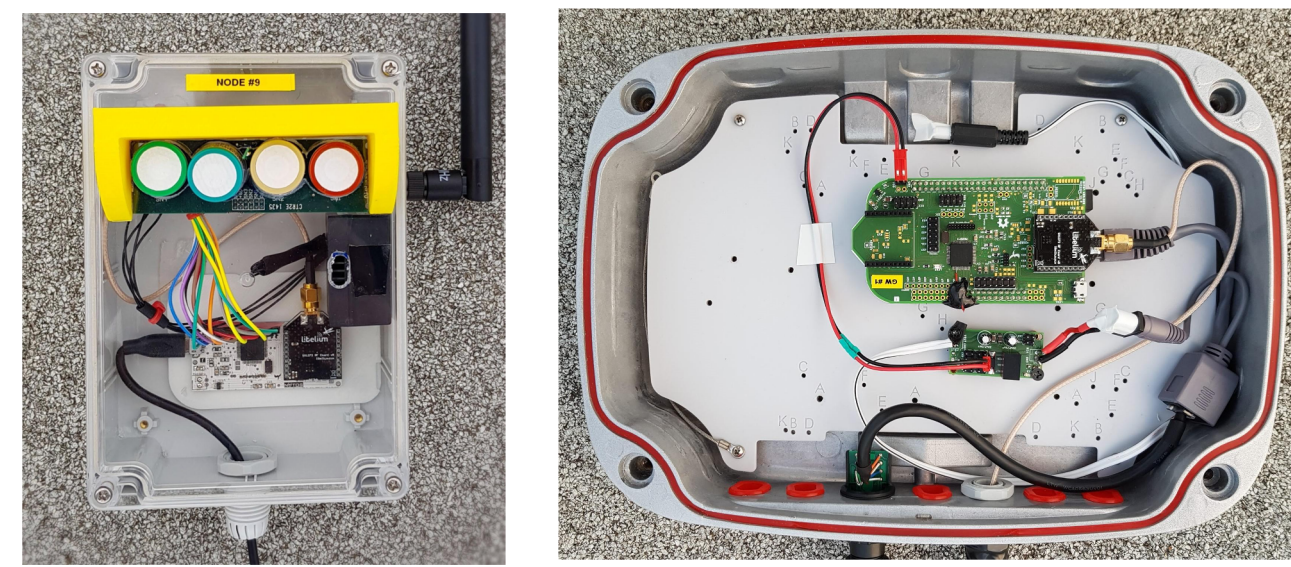
- 10 NITOS LoRa end nodes
- 2 Libelium LoRa Waspnotes
- 1 NITOS LoRa GW
- 1 NITOS LoRa Monitor



NITOS LoRa testbed topology

LoRa Experimental Settings

- 10 LoRa Transmission modes
 - BW, SF, Data Rate
- 8 channels (862.5 - 868 MHz)
- 3 TX Power levels
 - 0,7,14 dBm
- Varying payload (10-250B) NITOS LoRa end node and GW



RESULTS

Performance Analysis

- >100K LoRa packets
- RSSI range -102 to -137dBm

Key parameters

- Duty Cycle (Monitor node)
- PDR per node and TX power
- PDR per TX Mode
- PDR vs RSSI



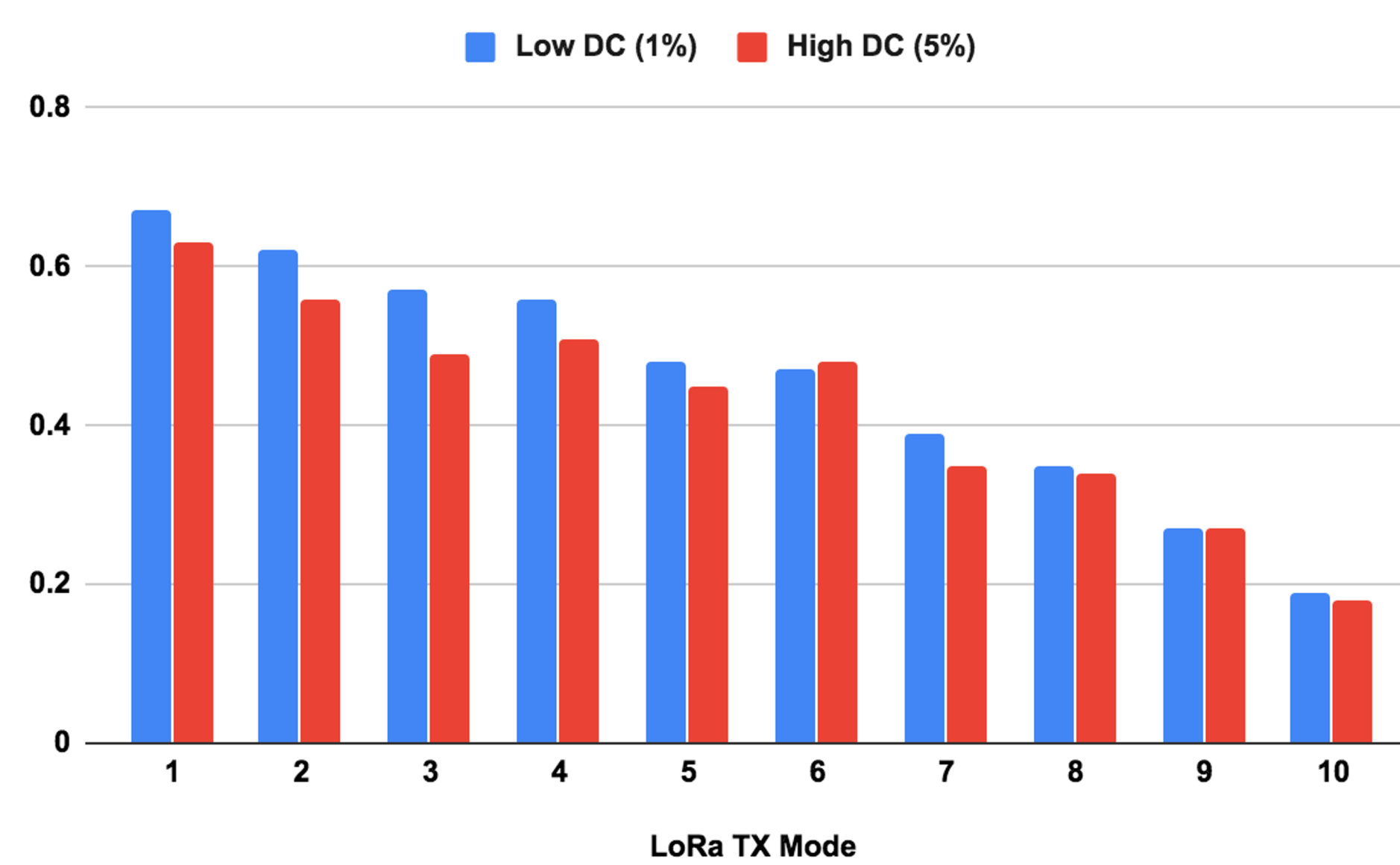
Web dashboard

MORE RESULTS

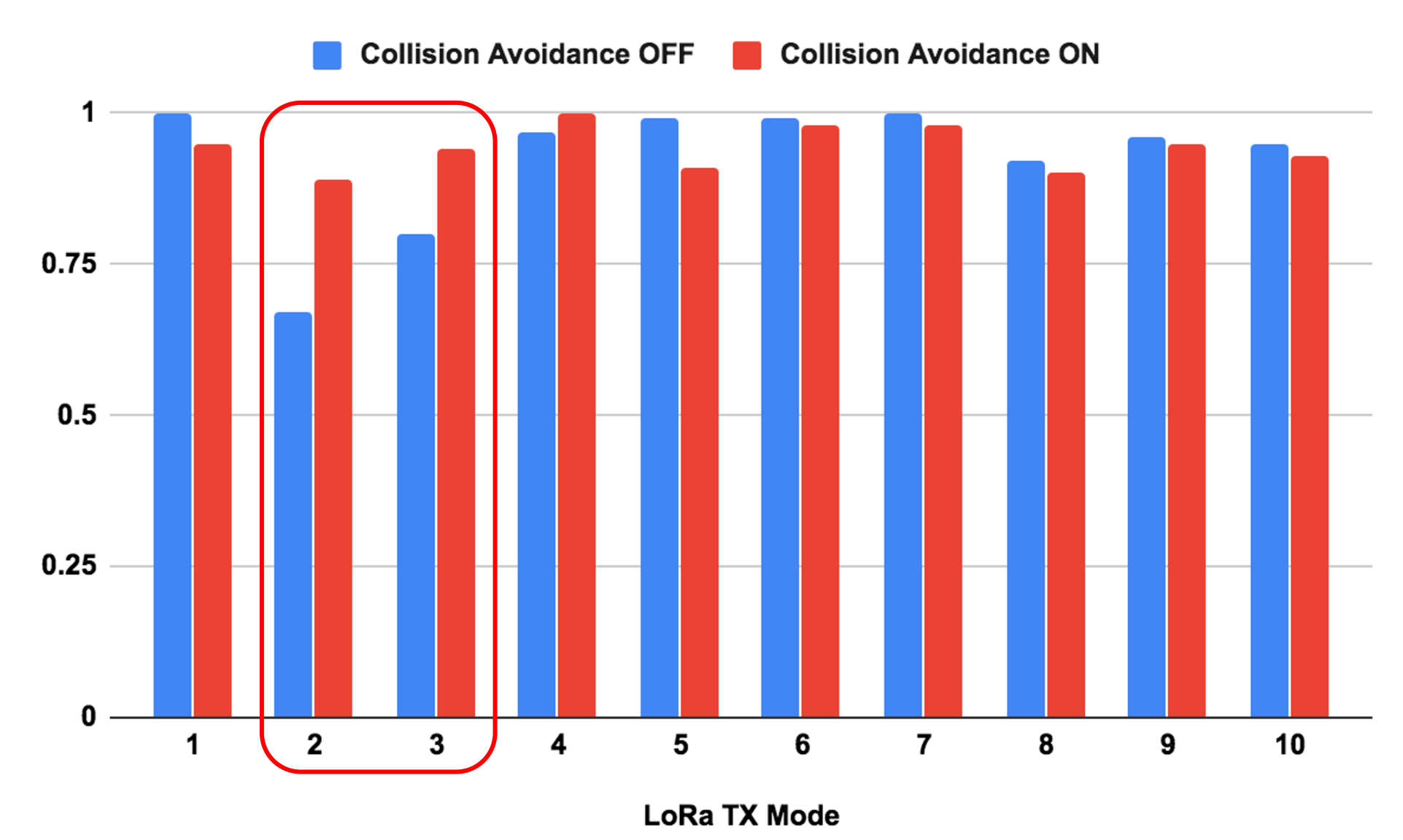
LoRa sensitivity

Transmission Mode	Experimental Sensitivity (dBm)	Protocol Sensitivity (dBm)
1	-134	-137
2	-132	-135
3	-131	-133
4	-129	-129
5	-131	-130
6	-128	-128
7	-126	-128
8	-123	-122
9	-120	-119
10	-116	-116

PDR vs channel utilization



PDR vs interference



CONCLUSIONS

- LoRa can support city-scale monitoring applications:
 - sufficient PDR even at low RSSI conditions (-137 dBm)
 - minimal channel interference across different SFs

In domX SME, we have to systematically characterize the potential of LoRa to cover the company's needs

Need to experiment under typical energy metering setups:

- representative payload and metering intervals
 - communication across multiple floors
 - intra and inter building LoRa links
 - LoRa-based power metering equipment

POST MORTEM

Stage 2 experiment

- Extended experimental settings
 - CA, multi-hop LoRa, LoRa concentrator for GW
- NITOS isolated indoor testbed
 - controlled interference experiments
- NITOS office testbed
 - typical energy metering setup

Experiment with LoRa Energy Metering Prototype

