Car to Car (C2C)

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CIMB — CENTRO DE INVESTIGACIÓN EN MICROSISTEMAS Y BIODISEÑO

IEEE

A.D.M.A.S. — Advanced Driver Monitoring for Assistance System

General Objective

Test two different communication protocols (ZigBee and 802.11p), in real and simulated scenarios to determine the feasibility and efficiency of each one in Vehicle to Vehicle (V2V) communication and Vehicle to Infrastructure (V2X)

Specific Objectives

1. Implement transmission and reception of packets in both protocols.
2. Achieve V2V and/or V2X communication in real and simulated scenarios.
3. Analyze the behavior of both protocols in similar environments.
4. Define a real and simulated scenario for communication testing.

Methods

The ZigBee protocol was tested in real scenarios, while the 802.11p protocol was tested in a simulated manner using a software called Omnet. To test both, a specific route was proposed to analyze the signals behavior and functionality of each protocol for V2V and V2X applications

Hardware (Real scenario)

For real tests, three *Xbee 900 S3B* devices, two vehicles, two laptop computers and two smartphones with a GPS Logger were used. A Xbee 900 S3B was installed on the rear of each vehicle, connected to the computer to collect data. Also, the remaining Xbee was strategically placed in the highest point possible of CEDETEC in a spot were this device could have the most line of sight possible towards Anillo Periférico Avenue. Once placed, 9 tests were ran along the route shown next. This test was done to test V2V and V2X communication.


Software (Simulated scenario)

In the 802.11p protocol simulation, similar parameters to those of the hardware tests were stablished to have the less distortion possible. 10 tests were ran along the same route shown previously.
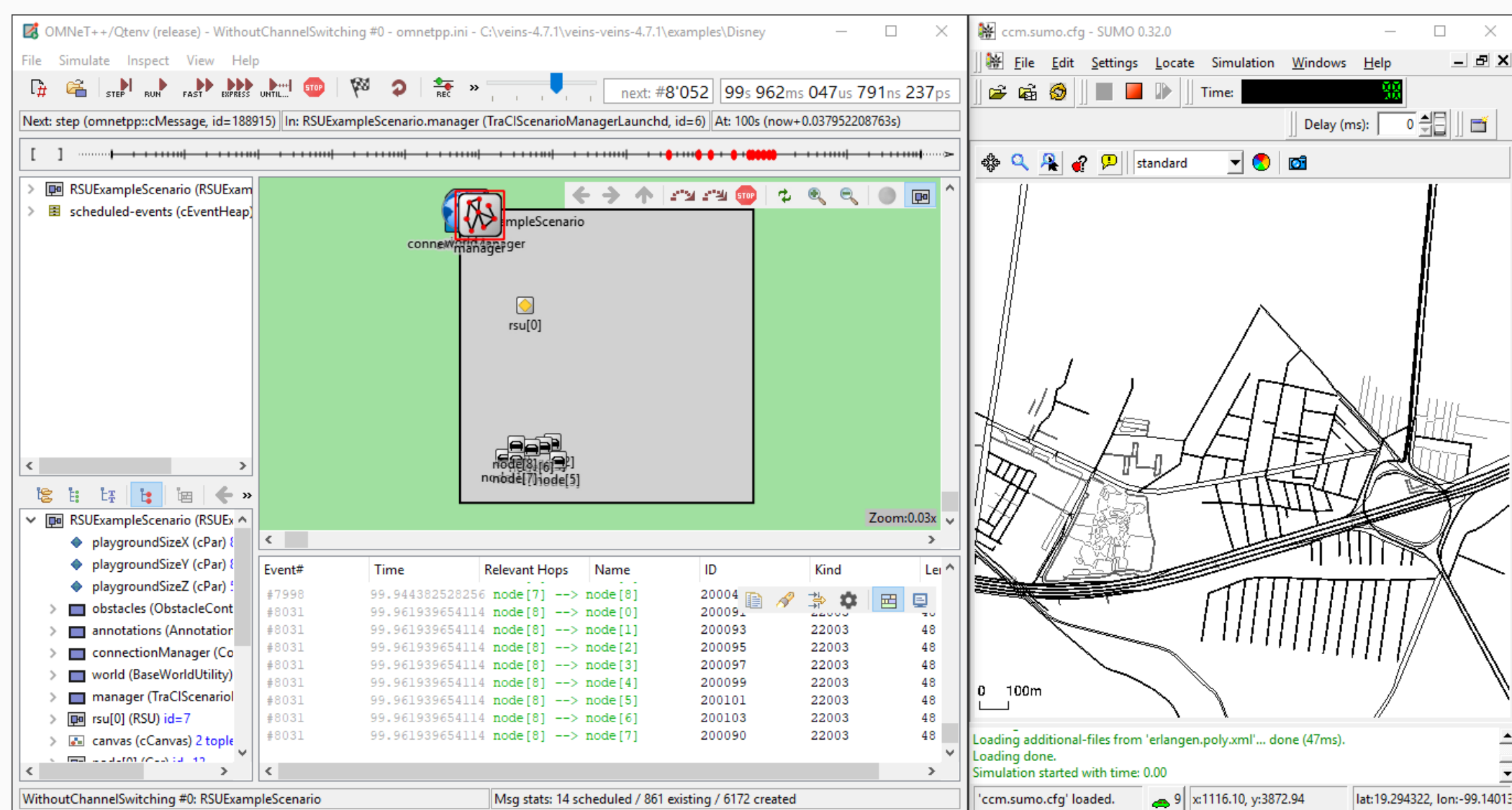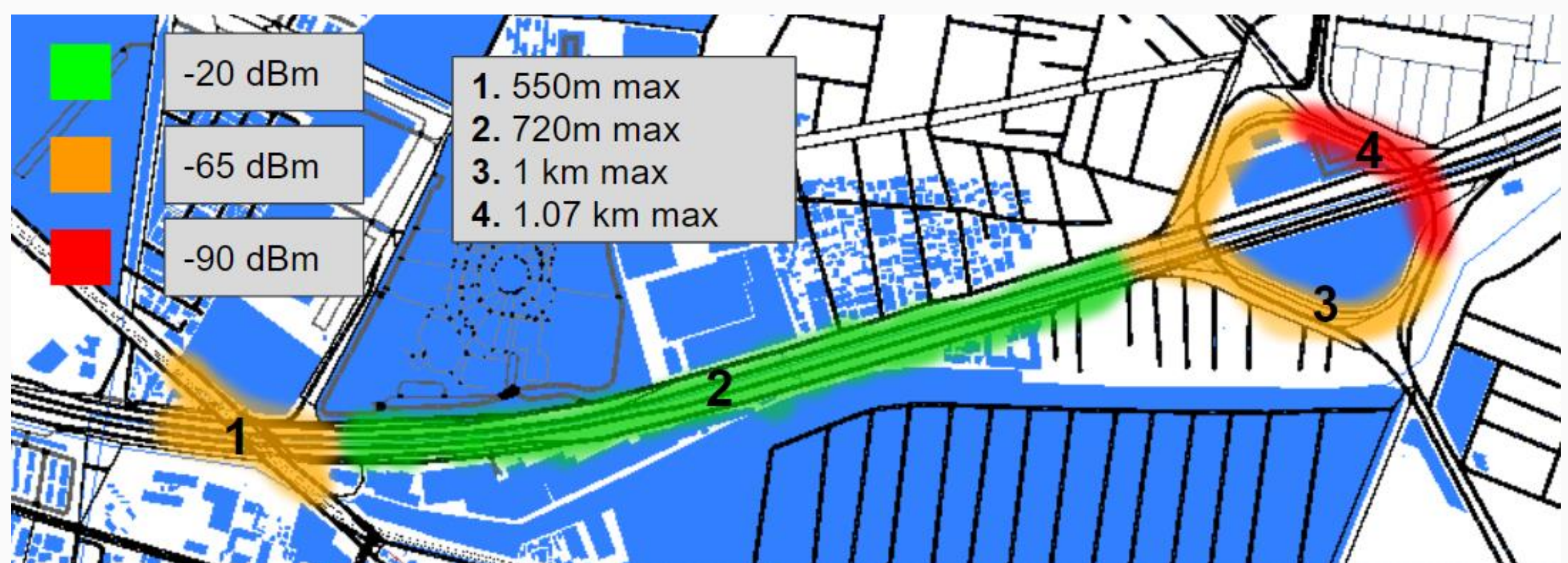

Network used

The network connection diagram, used by the hardware to complete the tests mentioned before, is shown below.
This devices were connected in a mesh topology, which allows every node used, to communicate with each other
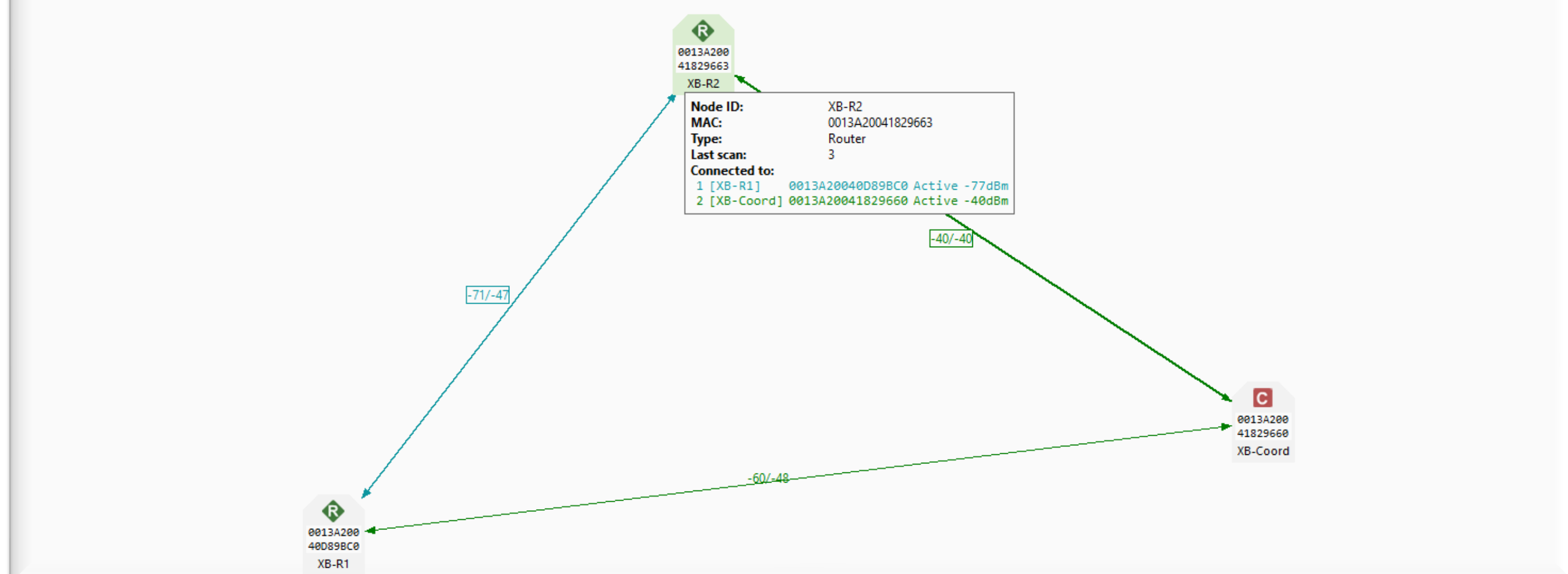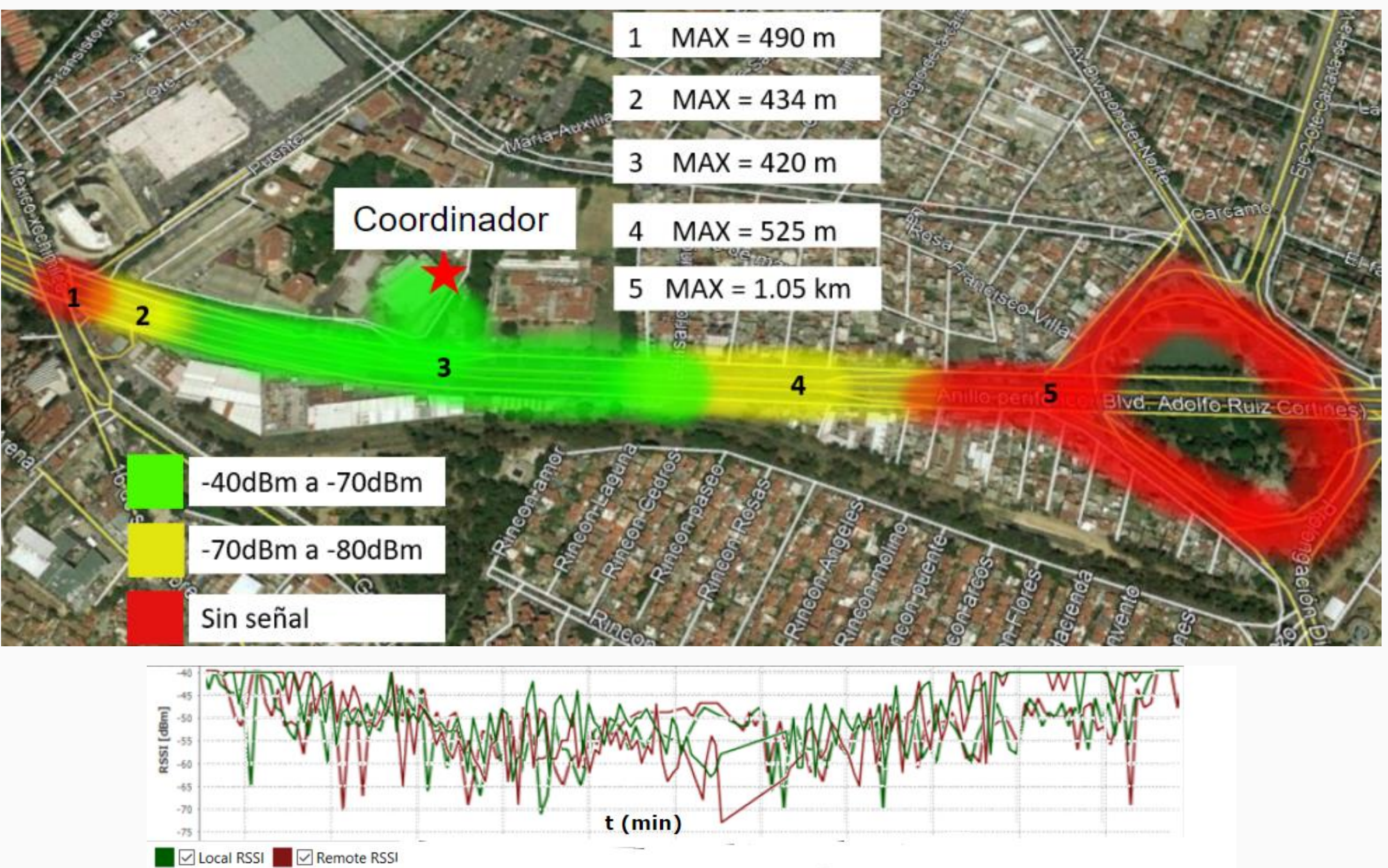

Results

In both cases, successful communication was achieved, transmitting and receiving packets correctly. Results from both protocols are shown next in heat maps, on which we can appreciate the adequate and non-adequate ranges to get good quality of transmission and reception of packets of each tested protocol.
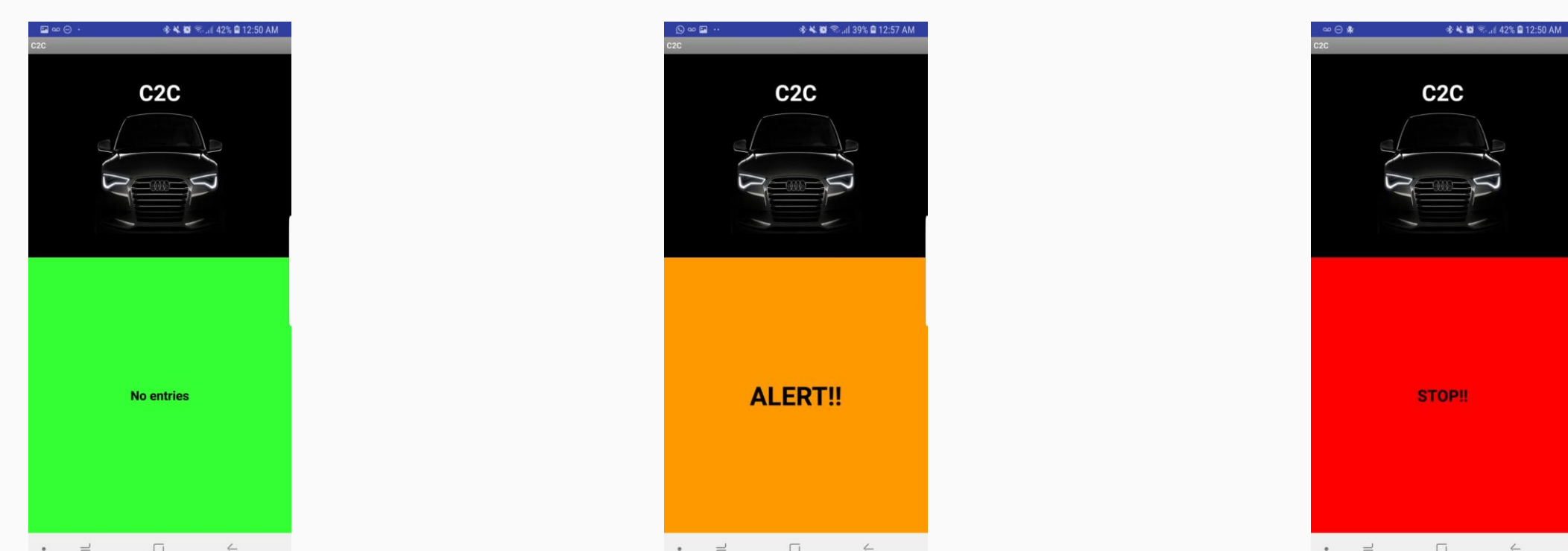
Simulated Tests

- -20 dBm
- -65 dBm
- -90 dBm

1. 550m max
2. 720m max
3. 1 km max
4. 1.07 km max

Hardware Tests

1	MAX = 490 m
2	MAX = 434 m
3	MAX = 420 m
4	MAX = 525 m
5	MAX = 1.05 km

Coordinador

- -40dBm a -70dBm
- -70dBm a -80dBm
- Sin señal

Future Work

Upgrade the mobile app to receive notifications from the ones sent by the 802.11p or ZigBee devices

Ethical Dilemma

Privacy violation because of the access to users location at all times while the vehicle is turned on. That's why several security methods have been developed to ensure maximum security on V2V and V2X communication.
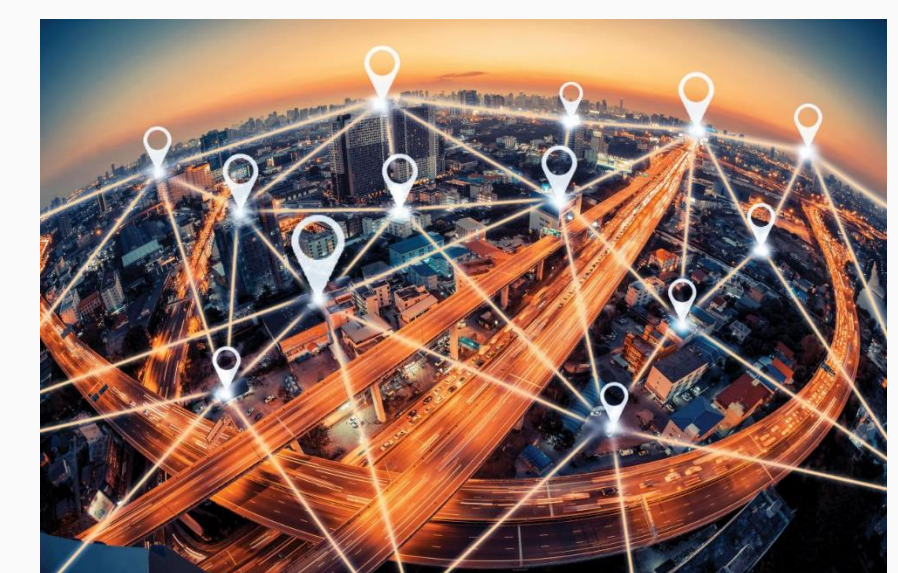
Conclusions

- V2v and V2X communication was achieved using Zigbee and 802.11p protocols in their respective environments (real and simulated).
- A space for different kinds of tests was defined.
- The real range of Zigbee devices was determined.
- The behavior of each protocol was analyzed (Transmission and Reception of Packets).
- 802.11p is designed for V2V and V2X communication
- Zigbee is focused to long range applications, but fixed ones.
- Zigbee is a multipurpose protocol, while 802.11p is a specific one.