IoT w Mikrotiku

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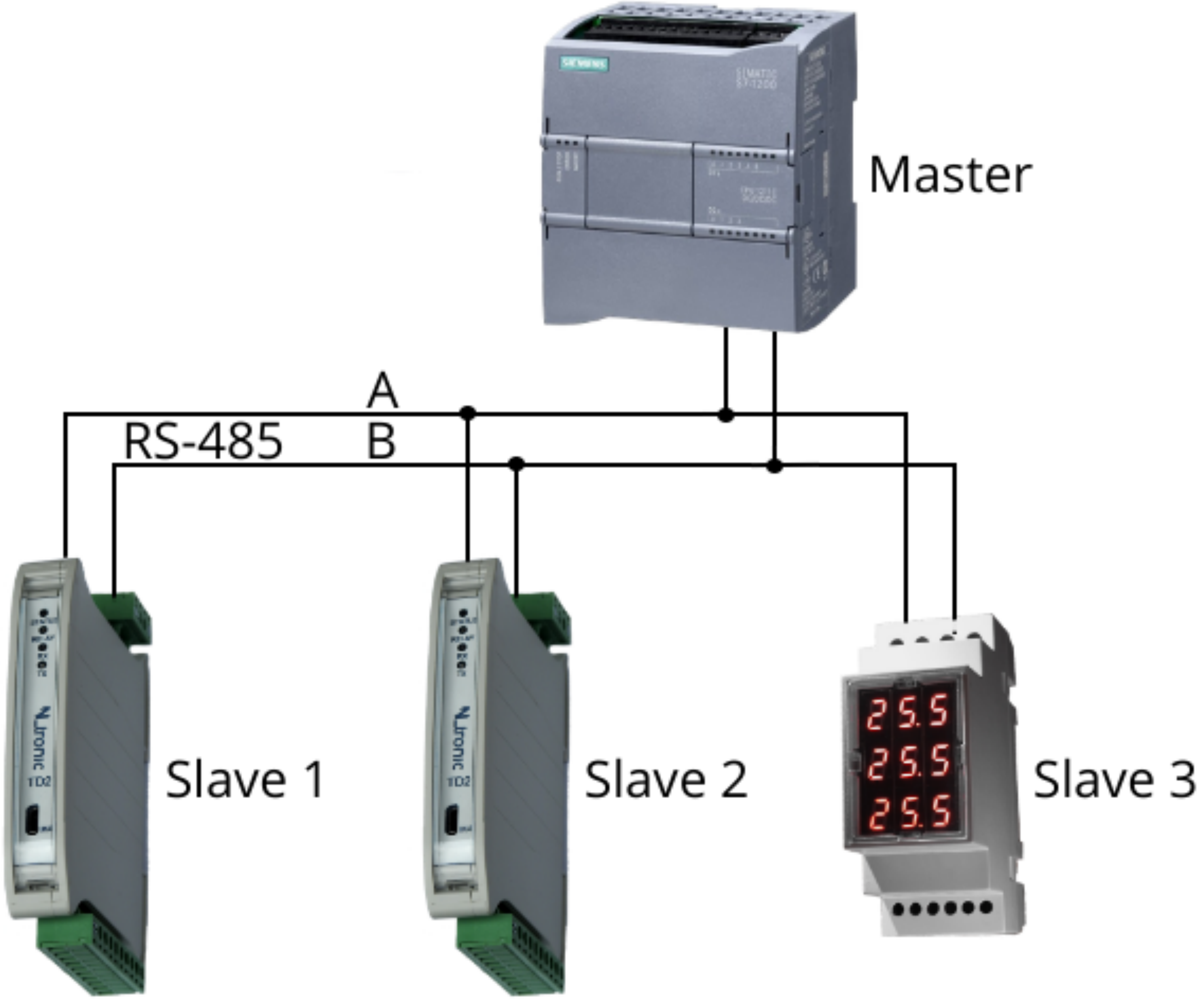
Rozkład jazdy

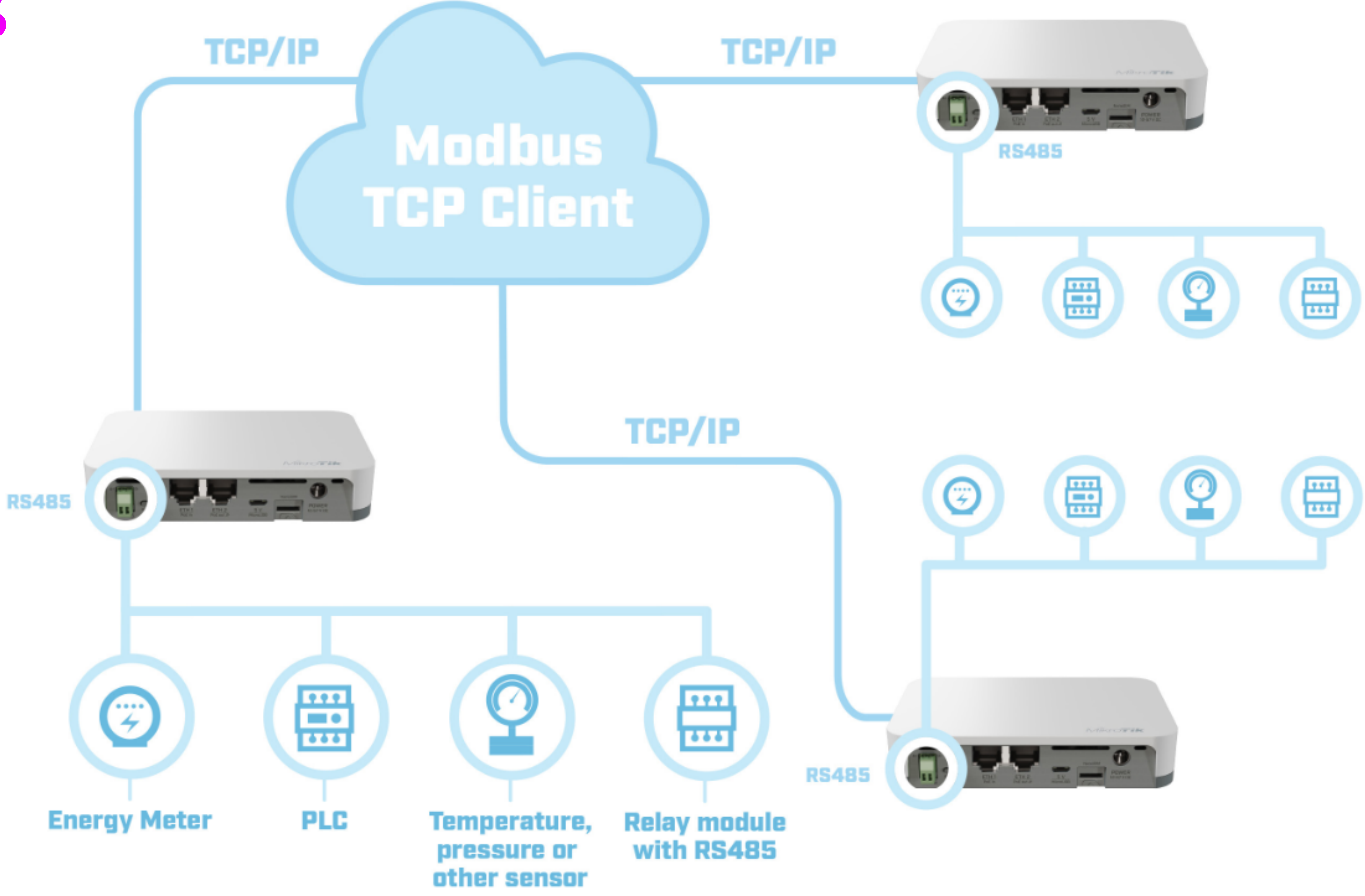
- Protokoły i technologie
- Zastosowanie LoRaWAN
- Hardware
- Konfiguracja NS pod Mietka

Modbus RS-485

- Standard przemysłowy
- Lata 70
- ASCII, RTU, TCP/IP



Modbus


TCP/IP
TCP/IP
Modbus
TCP Client
RS485
TCP/IP
RS485
RS485
Energy Meter
PLC
Temperature, pressure or other sensor
Relay module with RS485

Winbox - modbus

```
[admin@MikroTik] /iot modbus> print
         disabled: no
    hardware-port: modbus
         tcp-port: 502
          timeout: 1000ms
[admin@MikroTik] /iot modbus> read-holding-registers
append    do        interval  num-regs  port      slave-id  without-paging
as-value  duration  ip        once      reg-addr  timeout
[admin@MikroTik] /iot modbus>
[admin@MikroTik] /iot modbus>
```

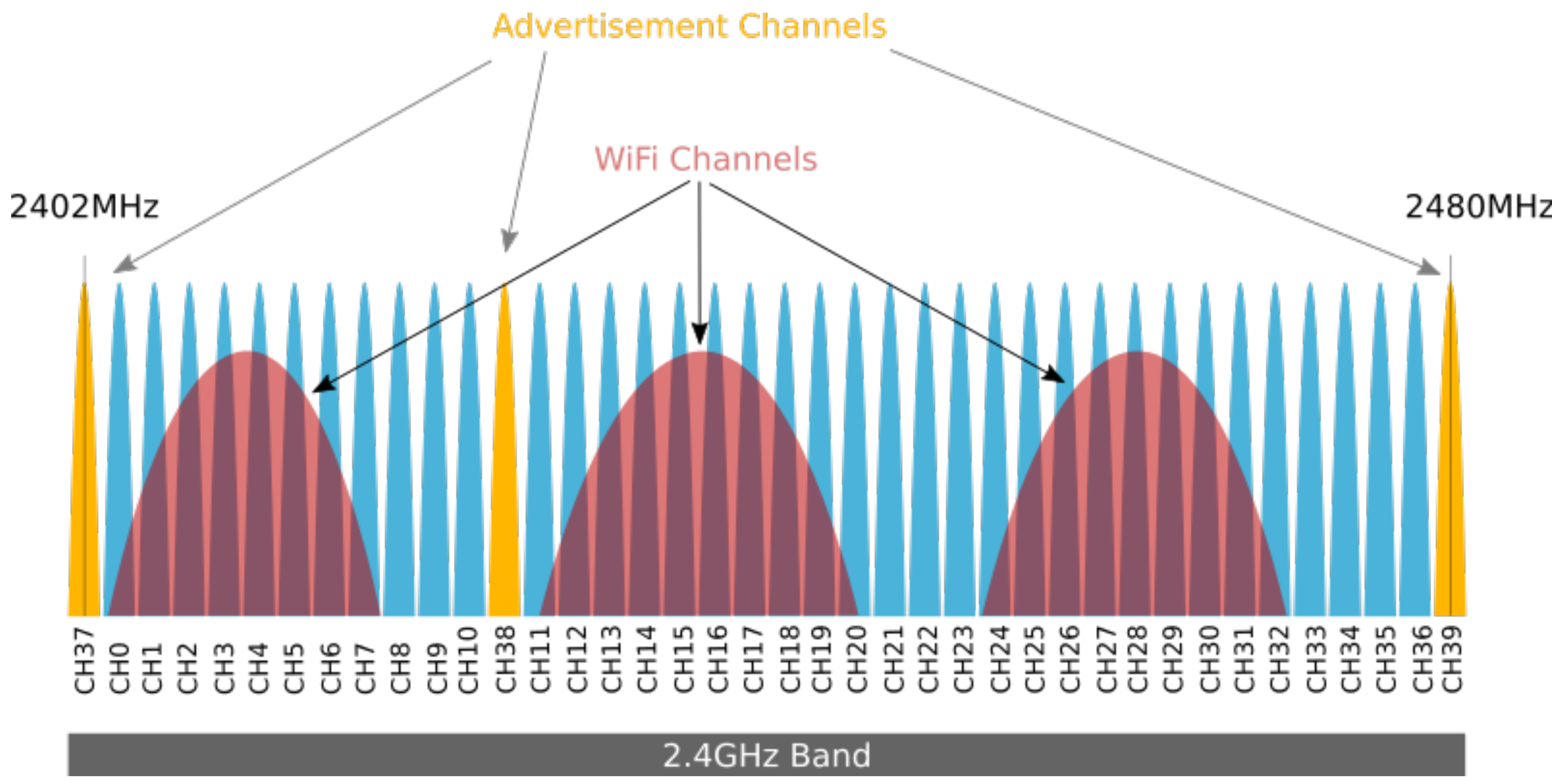
Bluetooth
BLE Advertising

iBeacon

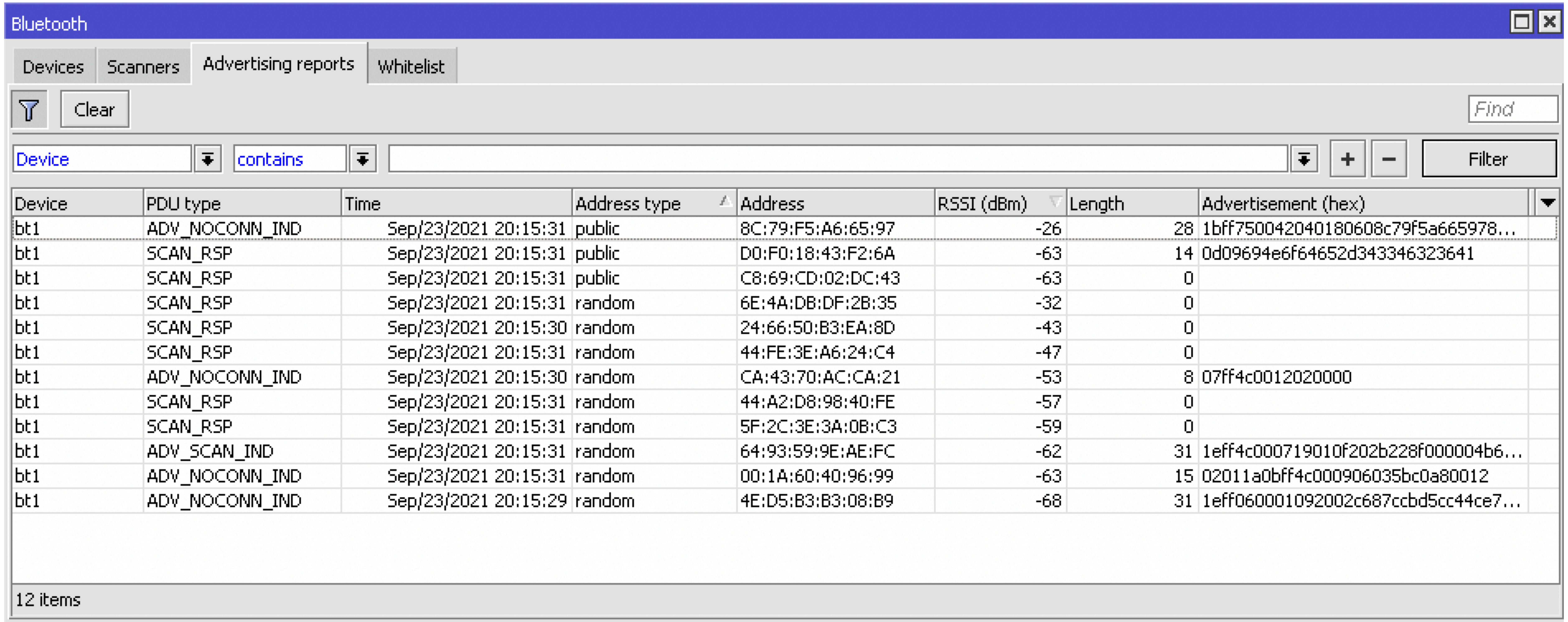
EddyStone

Ramki:

- ADV_IND
- ADV_NOCONN_IND
- ADV_SCAN_IND
- SCAN_REQ
- SCAN_RSP
- ADV_DIRECT_IND

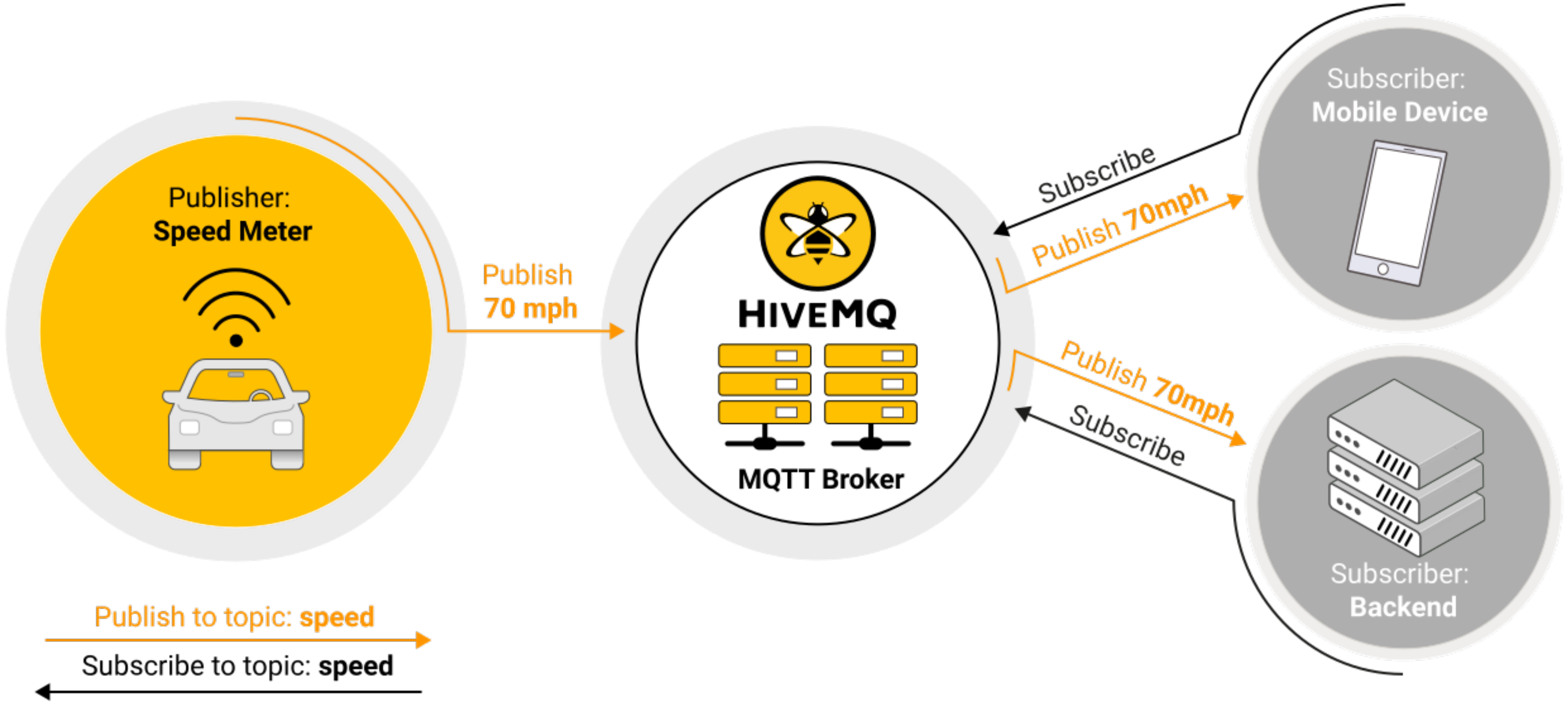


Winbox - bluetooth

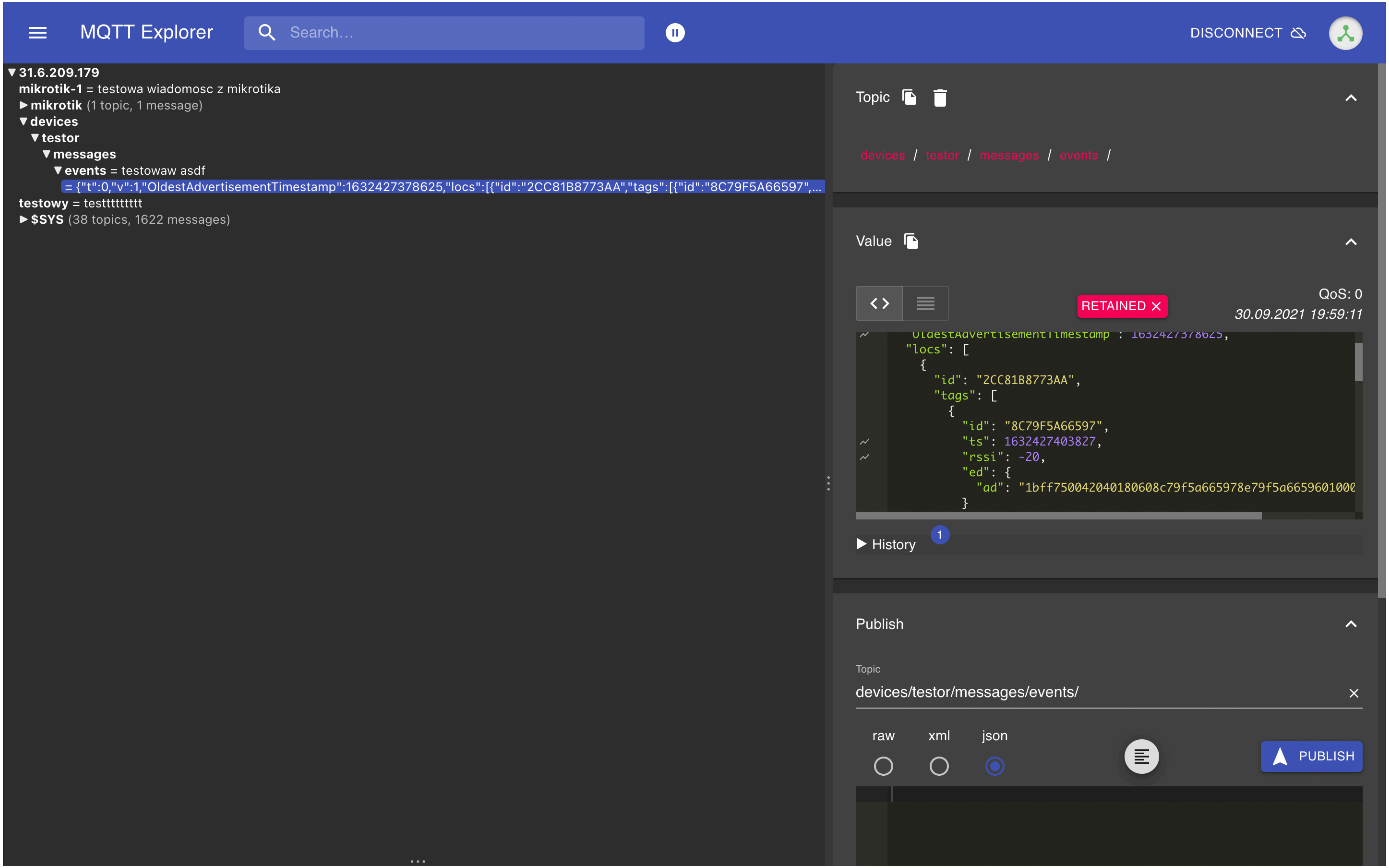


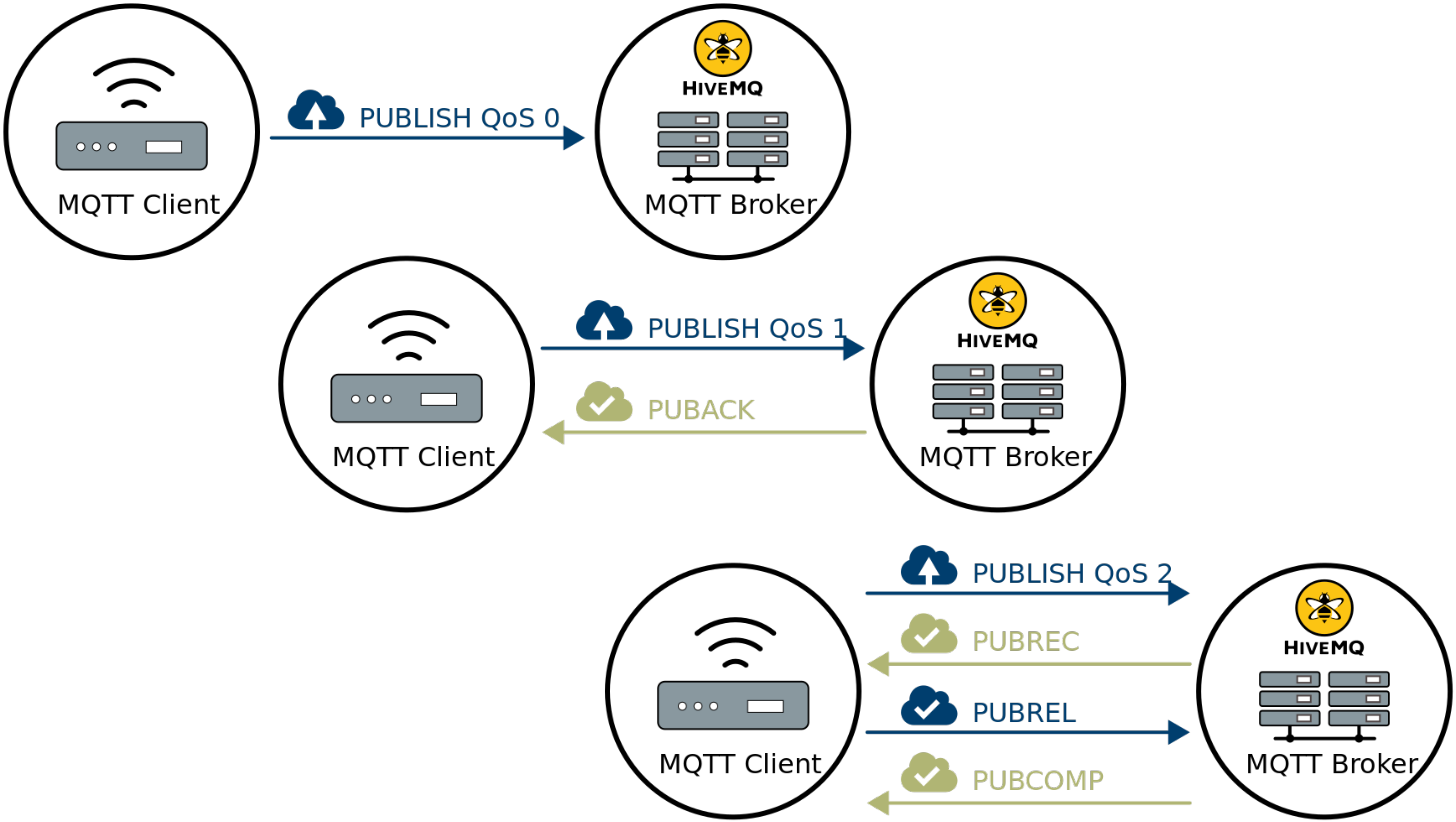
Device	PDU type	Time	Address type	Address	RSSI (dBm)	Length	Advertisement (hex)
bt1	ADV_NOCONN_IND	Sep/23/2021 20:15:31	public	8C:79:F5:A6:65:97	-26	28	1bff750042040180608c79f5a665978...
bt1	SCAN_RSP	Sep/23/2021 20:15:31	public	D0:F0:18:43:F2:6A	-63	14	0d09694e6f64652d343346323641
bt1	SCAN_RSP	Sep/23/2021 20:15:31	public	C8:69:CD:02:DC:43	-63	0	
bt1	SCAN_RSP	Sep/23/2021 20:15:31	random	6E:4A:DB:DF:2B:35	-32	0	
bt1	SCAN_RSP	Sep/23/2021 20:15:30	random	24:66:50:B3:EA:8D	-43	0	
bt1	SCAN_RSP	Sep/23/2021 20:15:31	random	44:FE:3E:A6:24:C4	-47	0	
bt1	ADV_NOCONN_IND	Sep/23/2021 20:15:30	random	CA:43:70:AC:CA:21	-53	8	07ff4c0012020000
bt1	SCAN_RSP	Sep/23/2021 20:15:31	random	44:A2:D8:98:40:FE	-57	0	
bt1	SCAN_RSP	Sep/23/2021 20:15:31	random	5F:2C:3E:3A:0B:C3	-59	0	
bt1	ADV_SCAN_IND	Sep/23/2021 20:15:31	random	64:93:59:9E:AE:FC	-62	31	1eff4c000719010f202b228f000004b6...
bt1	ADV_NOCONN_IND	Sep/23/2021 20:15:31	random	00:1A:60:40:96:99	-63	15	02011a0bff4c000906035bc0a80012
bt1	ADV_NOCONN_IND	Sep/23/2021 20:15:29	random	4E:D5:B3:B3:08:B9	-68	31	1eff060001092002c687ccbd5cc44ce7...

MQTT



Publisher:
Speed Meter
Publish
70 mph
HIVEMQ
MQTT Broker
Subscribe
Publish 70mph
Subscriber:
Mobile Device
Publish 70mph
Subscribe
Subscriber:
Backend
Publish to topic: speed
Subscribe to topic: speed

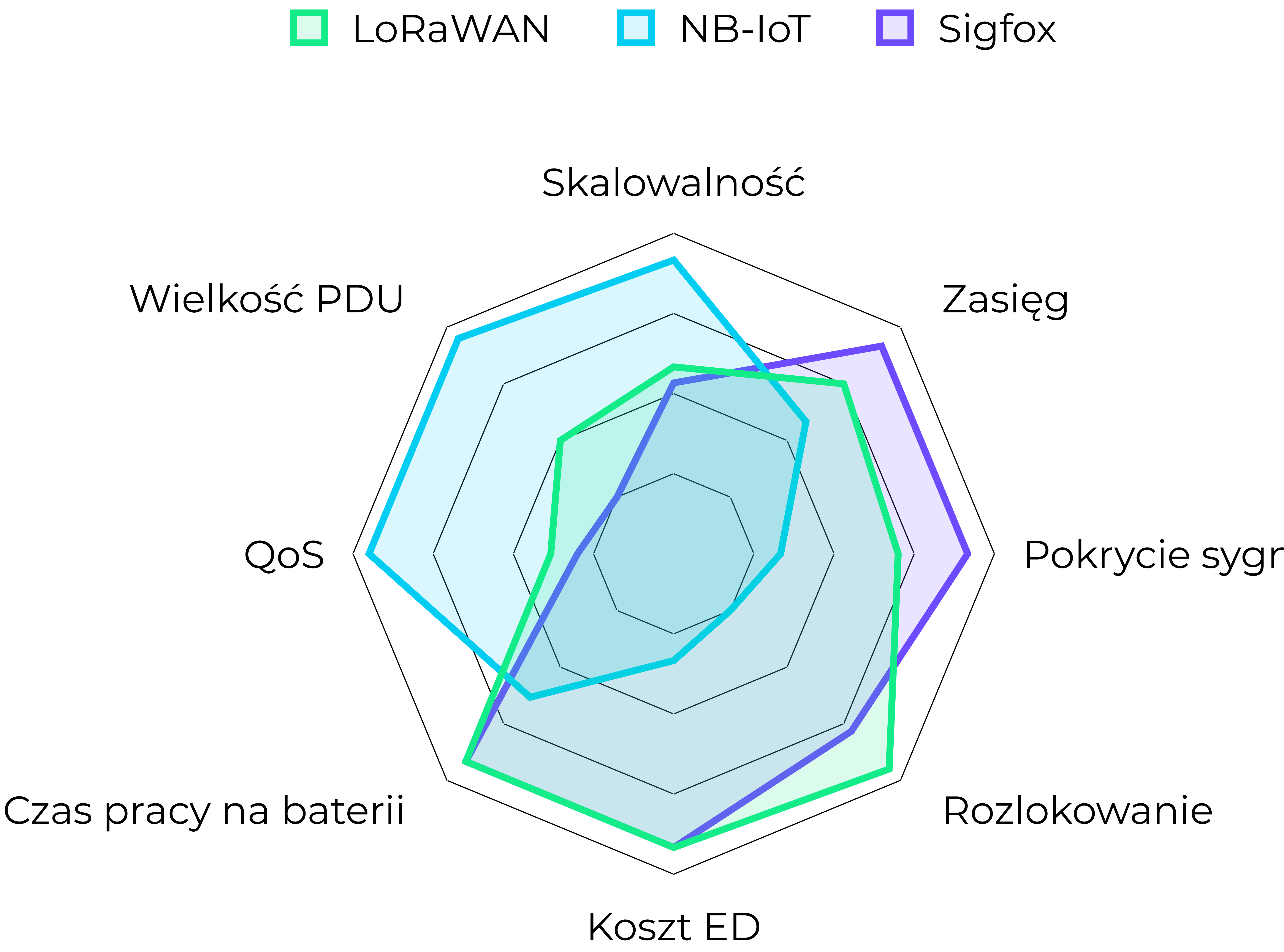

MQTT Explorer
Search…
DISCONNECT
▼31.6.209.179
mikrotik-1 = testowa wiadomosc z mikrotika
▶ mikrotik (1 topic, 1 message)
▼devices
▼testor
▼messages
▼events = testowaw asdf
= {"t":0,"v":1,"OldestAdvertisementTimestamp":1632427378625,"locs":[{"id":"2CC81B8773AA","tags":[{"id":"8C79F5A66597",...
testowy = testtttttttt
▶ $SYS (38 topics, 1622 messages)
Topic
devices / testor / messages / events /
Value
RETAINED
QoS: 0
30.09.2021 19:59:11
"locs": [
{
"id": "2CC81B8773AA",
"tags": [
{
"id": "8C79F5A66597",
"ts": 1632427403827,
"rssi": -20,
"ed": {
"ad": "1bff750042040180608c79f5a665978e79f5a6659601000
}
History
1
Publish
Topic
devices/testor/messages/events/
raw
xml
json
PUBLISH



HIVEMQ
MQTT Client
PUBLISH QoS 0
MQTT Broker
MQTT Client
PUBLISH QoS 1
PUBACK
HIVEMQ
MQTT Broker
MQTT Client
PUBLISH QoS 2
PUBREC
PUBREL
PUBCOMP
HIVEMQ
MQTT Broker

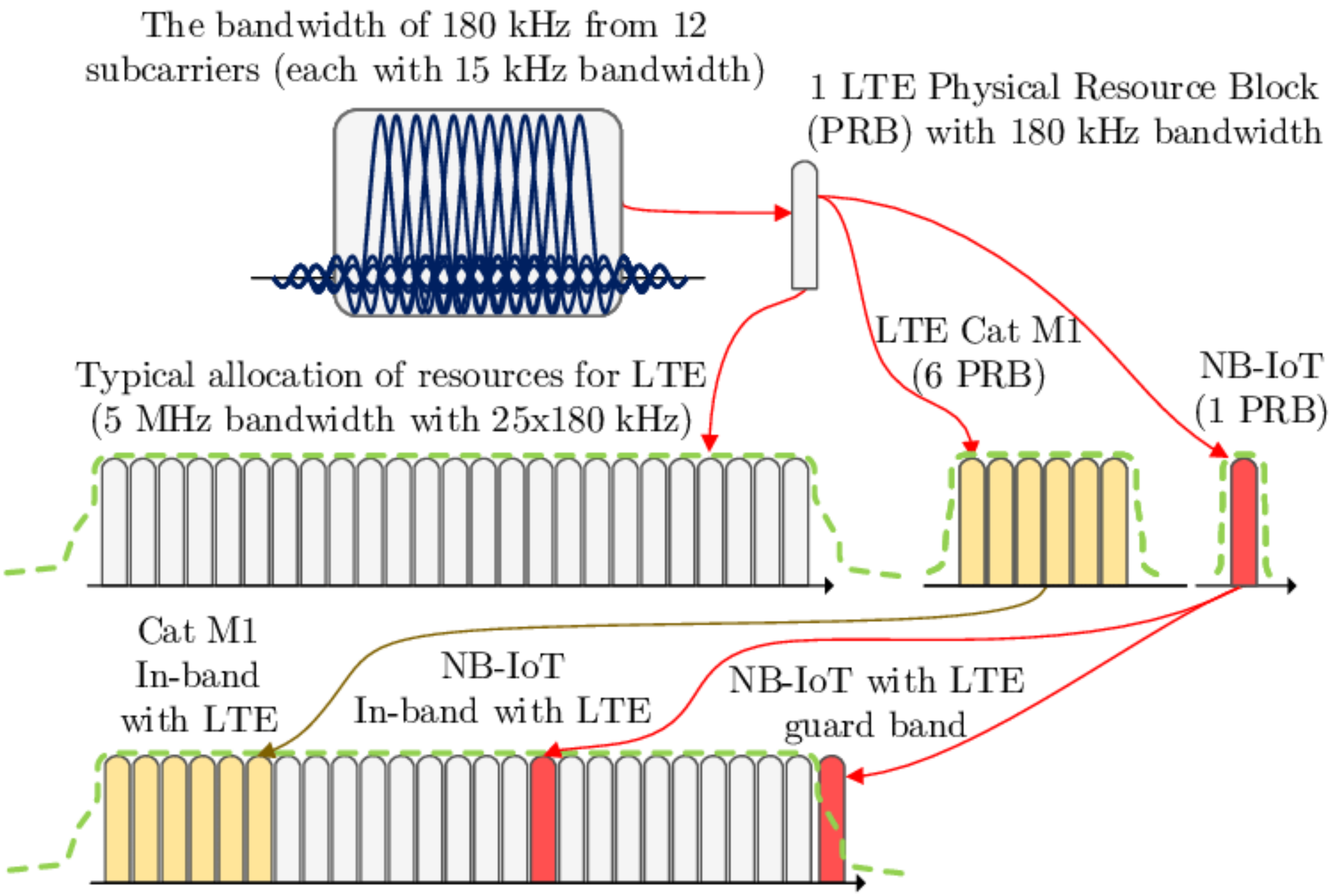
LPWAN

- NB-IoT
- LTE-Cat. M
- Sigfox
- LoRaWAN



LTE Cat. M
NB-IoT
Sigfox

LTE Cat. M
NB-IoT
Sigfox

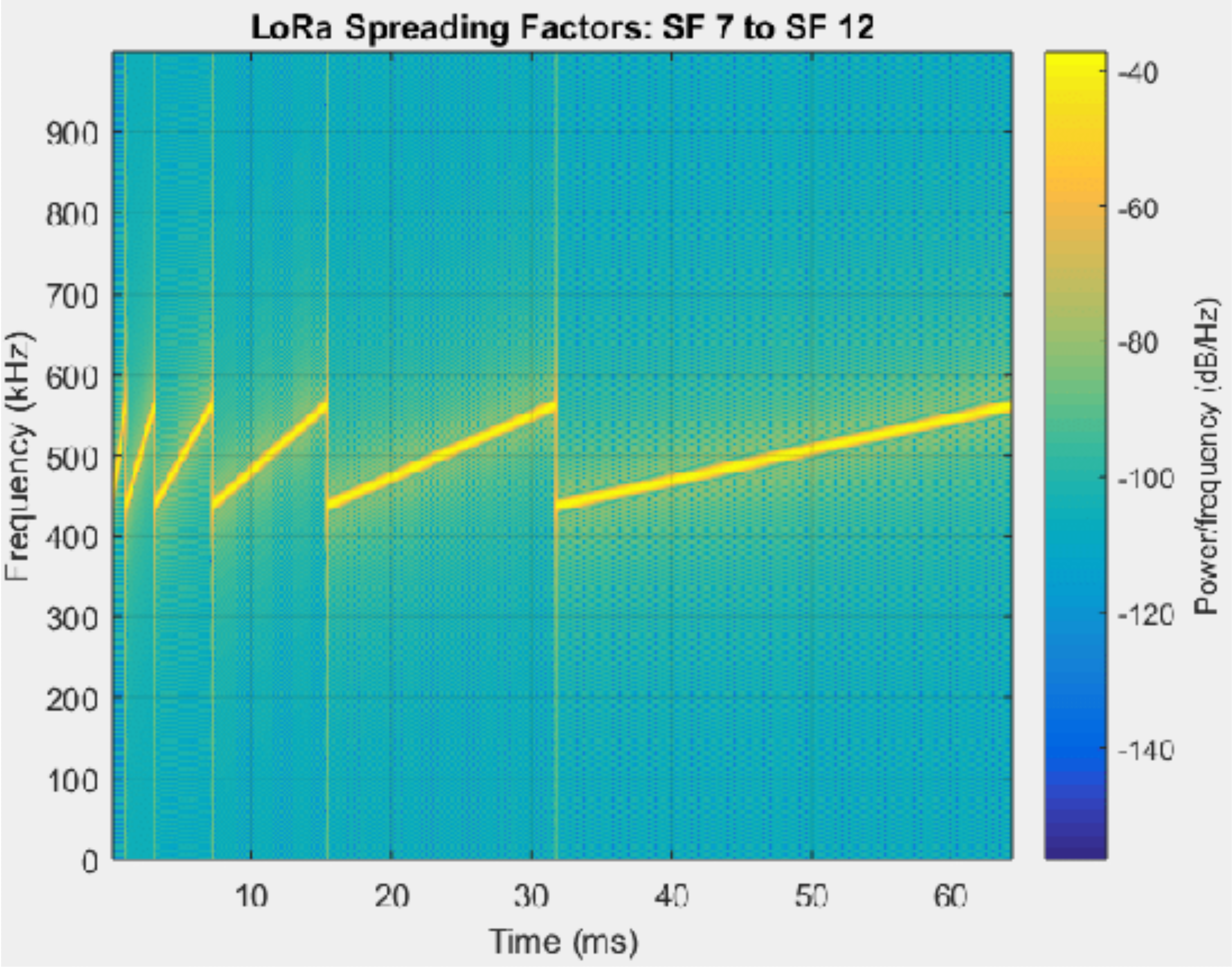


The bandwidth of 180 kHz from 12 subcarriers (each with 15 kHz bandwidth)
1 LTE Physical Resource Block (PRB) with 180 kHz bandwidth
LTE Cat M1 (6 PRB)
NB-IoT (1 PRB)
Typical allocation of resources for LTE (5 MHz bandwidth with 25x180 kHz)
Cat M1 In-band with LTE
NB-IoT In-band with LTE
NB-IoT with LTE guard band

LoRaWAN $\neq$ LoRa

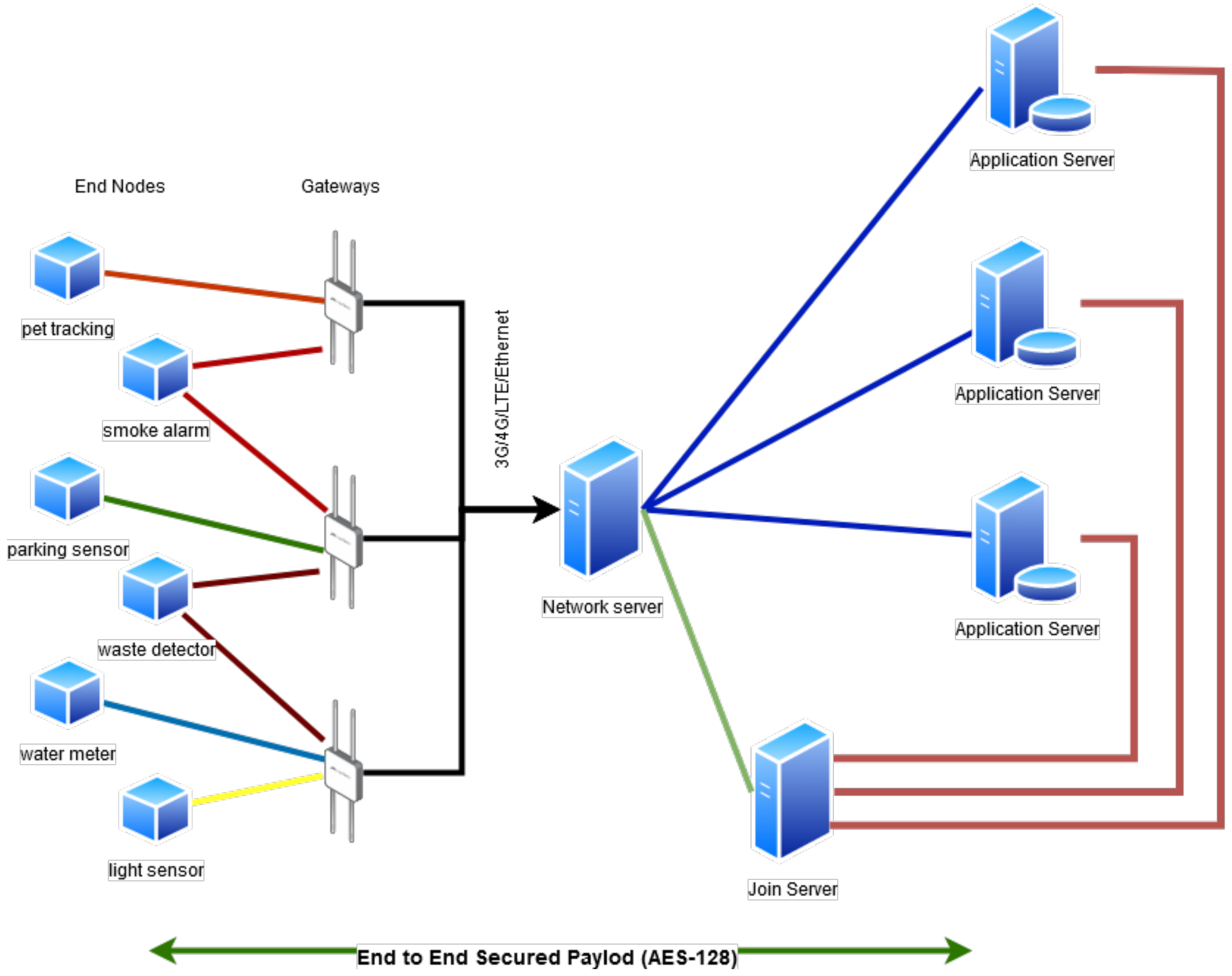
LoRa

- CSS
- SF - spread factor
- CR - code rate
- Właściciel Semtech



Co to LoRaWAN?

- Otwarty standard
- Wielu producentów
- Szyfrowanie E2E
- Bezpłatny przydział częstotliwości
- Łatwa i szybka rozbudowa



Pomiar przepływu
Nakładka radiowa na wodomierz

- Wodomierze
- Gazomierze
- Ciepłomierze
- Liczniki energii elektrycznej

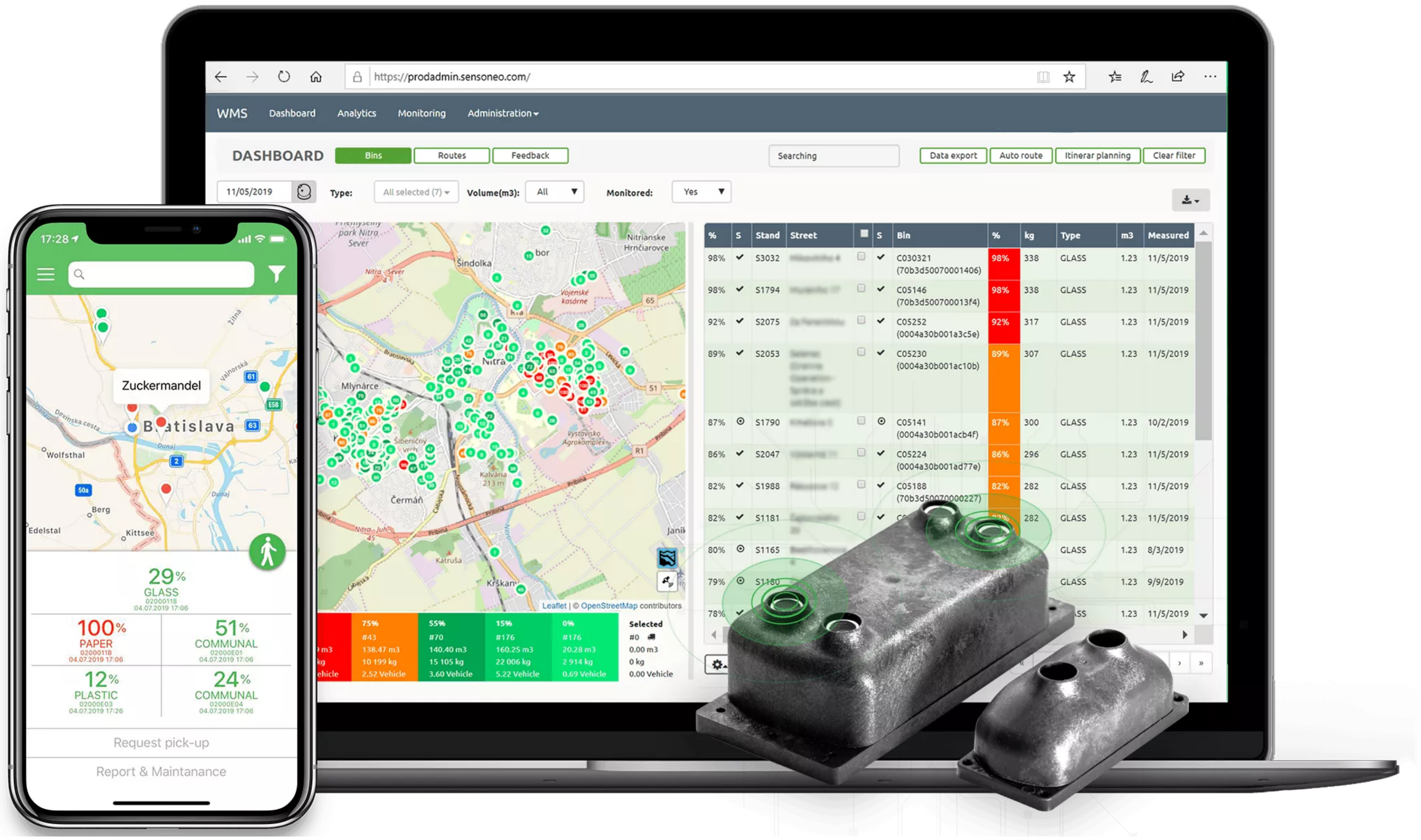
Sterowanie falownikami
LoRaWAN - RS485 Modbus

- Punkty poboru wody

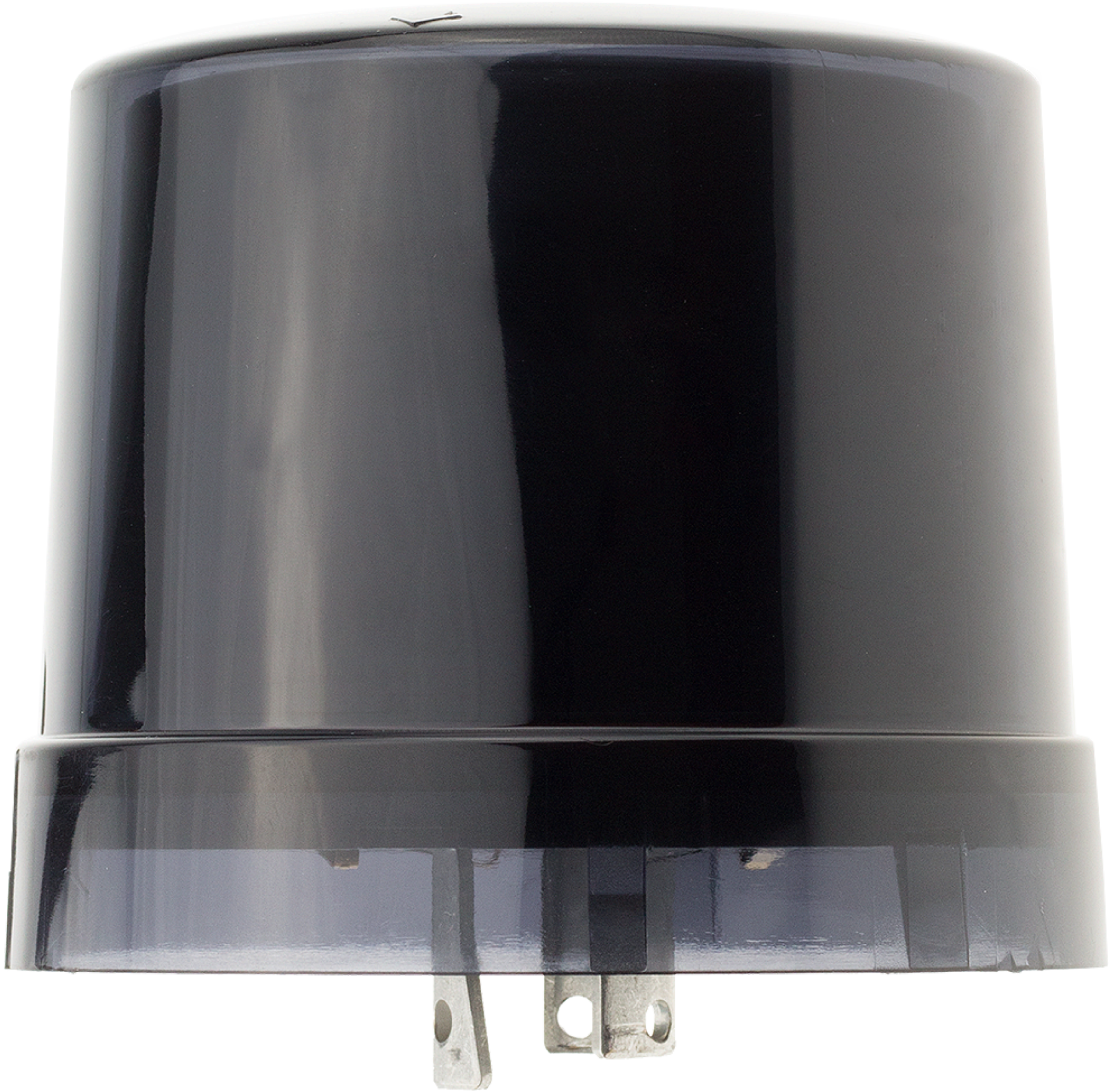
Czujniki parkingowe
Czujnik obecności pojazdu

- Tarnów
- Opole
- Katowice
- Płock
- Gdańsk
- Kraków
- Bielsko-Biała
- Toruń

Czujnik zapełnienia
Pojemnika na śmieci

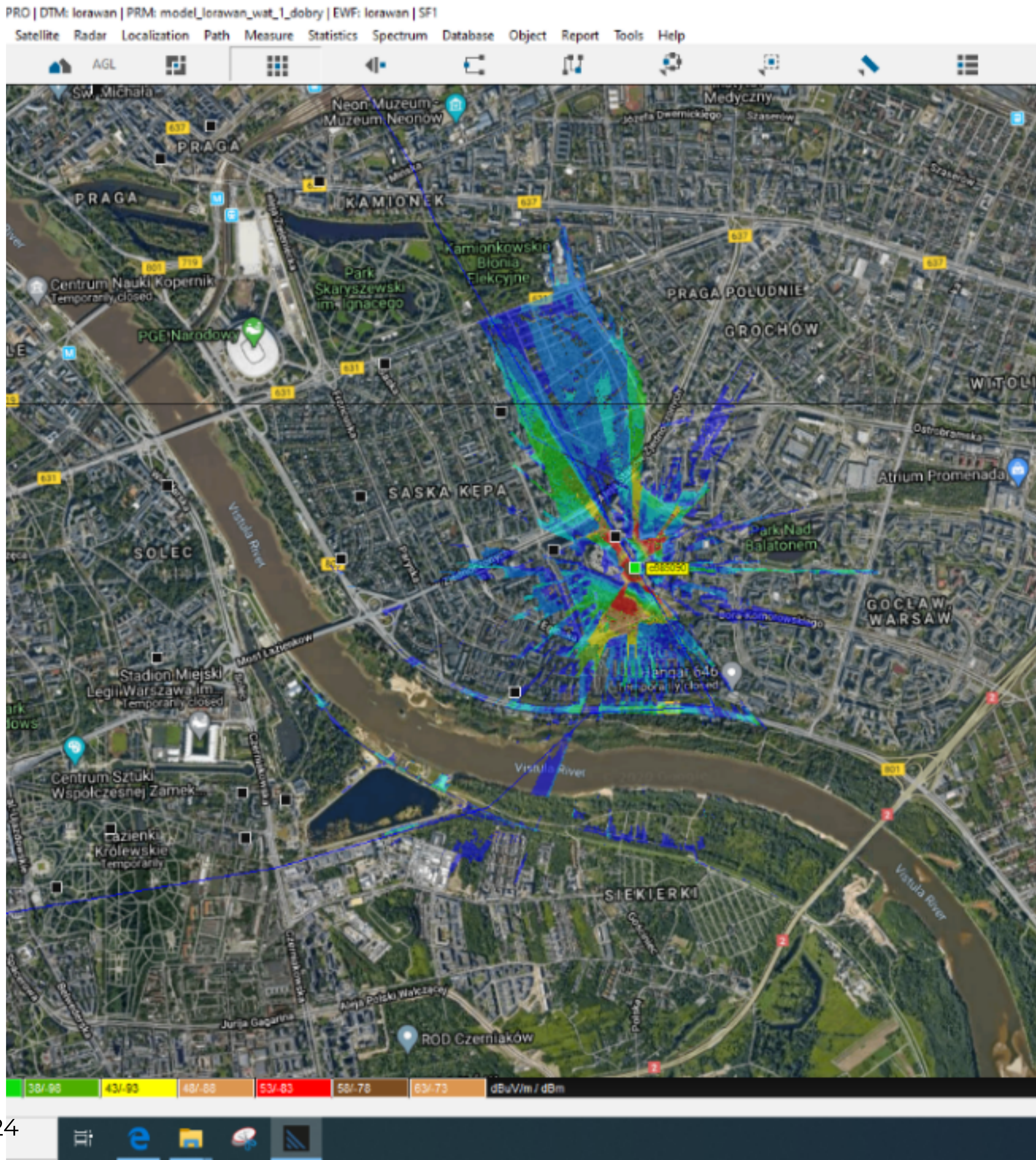


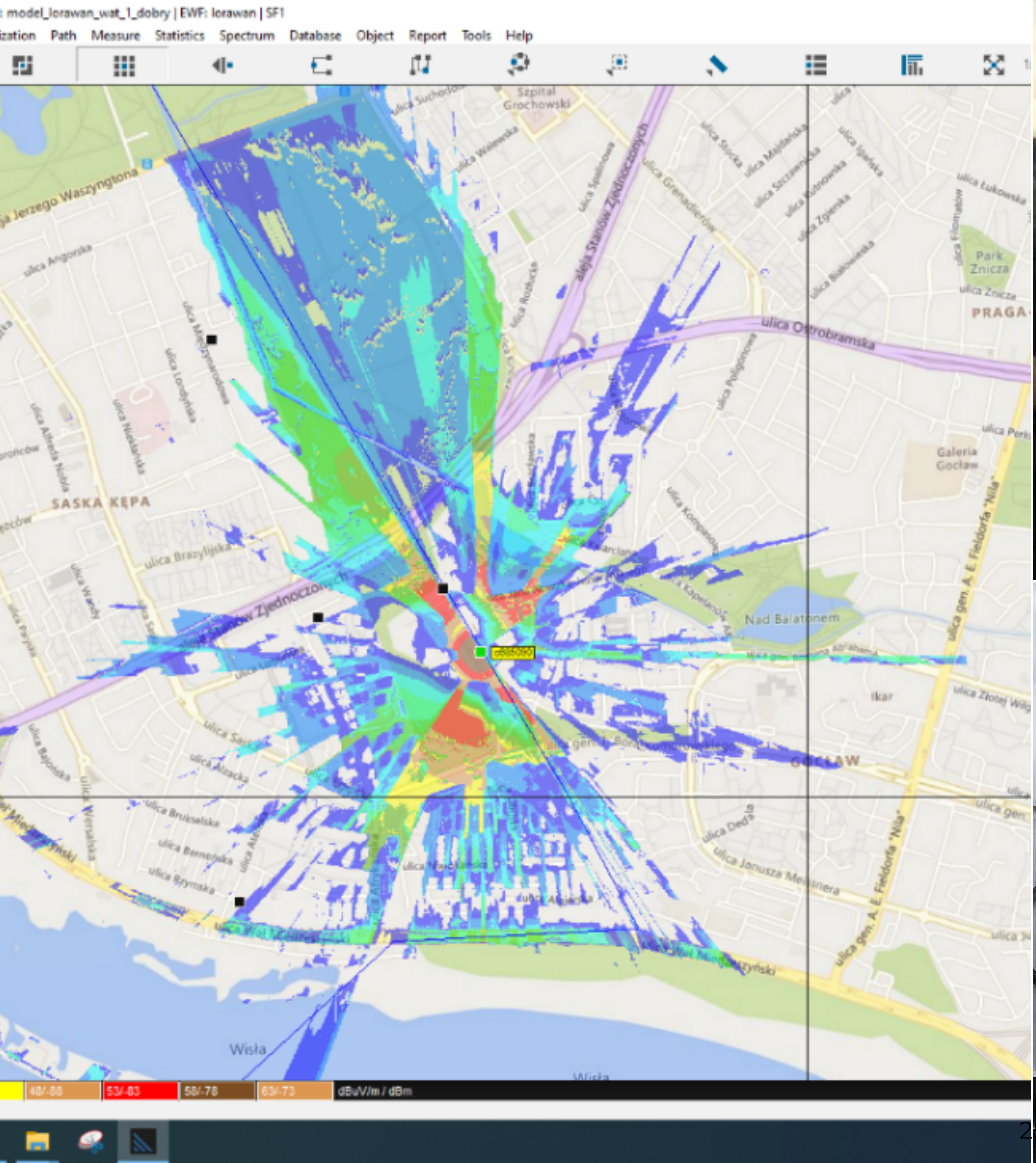
Sterowanie oświetleniem

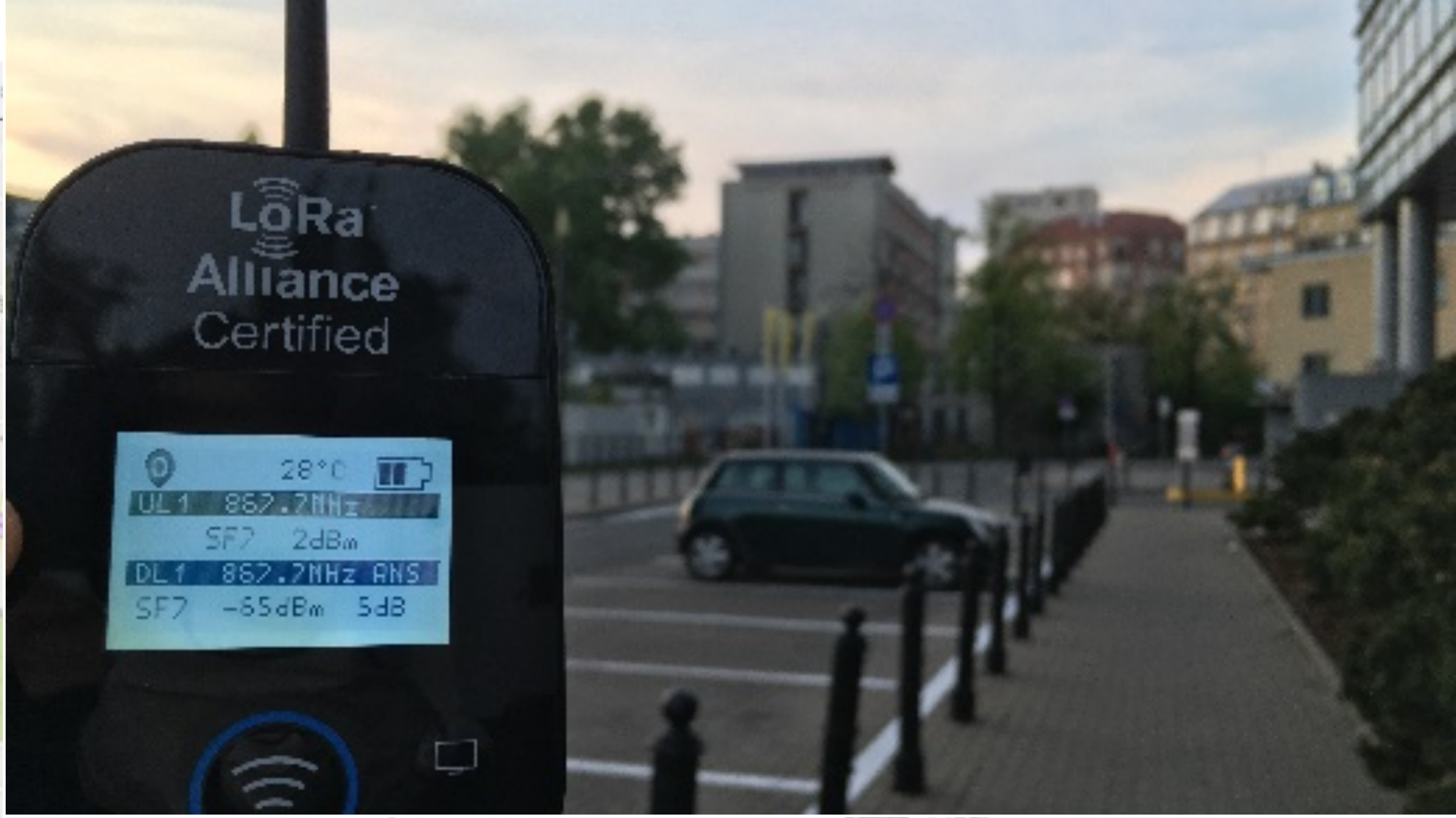


Mapowanie sieci

- Planowanie radiowe
- Mobilna stacja radiowa
- Wykonaniu pomiarów
- Analiza powykonawcza




model_lorawan_wat_1_dobry | EWF: lorawan | SF1
Path Measure Statistics Spectrum Database Object Report Tools Help
SASKA KĘPA
PRAGA
ulica Ostrobramska
Nad Balatonem
Galeria Gocław
Wisła
48/-88
53/-83
58/-78
63/-73
dBuV/m / dBm


LoRa
Alliance
Certified
28°C
UL 1 867.7MHz
SF7 2dBm
DL 1 867.7MHz ANS
SF7 -65dBm 5dB

Szczecinek

- Lokalizacja Szczecineckiego Tramwaju Wodnego

Warszawa

- Lokalizacja zwierząt
- Lokalizacja pojazdów
- Czujniki zapełnienia koszy
- Testy systemów parkingowych

Muszyna

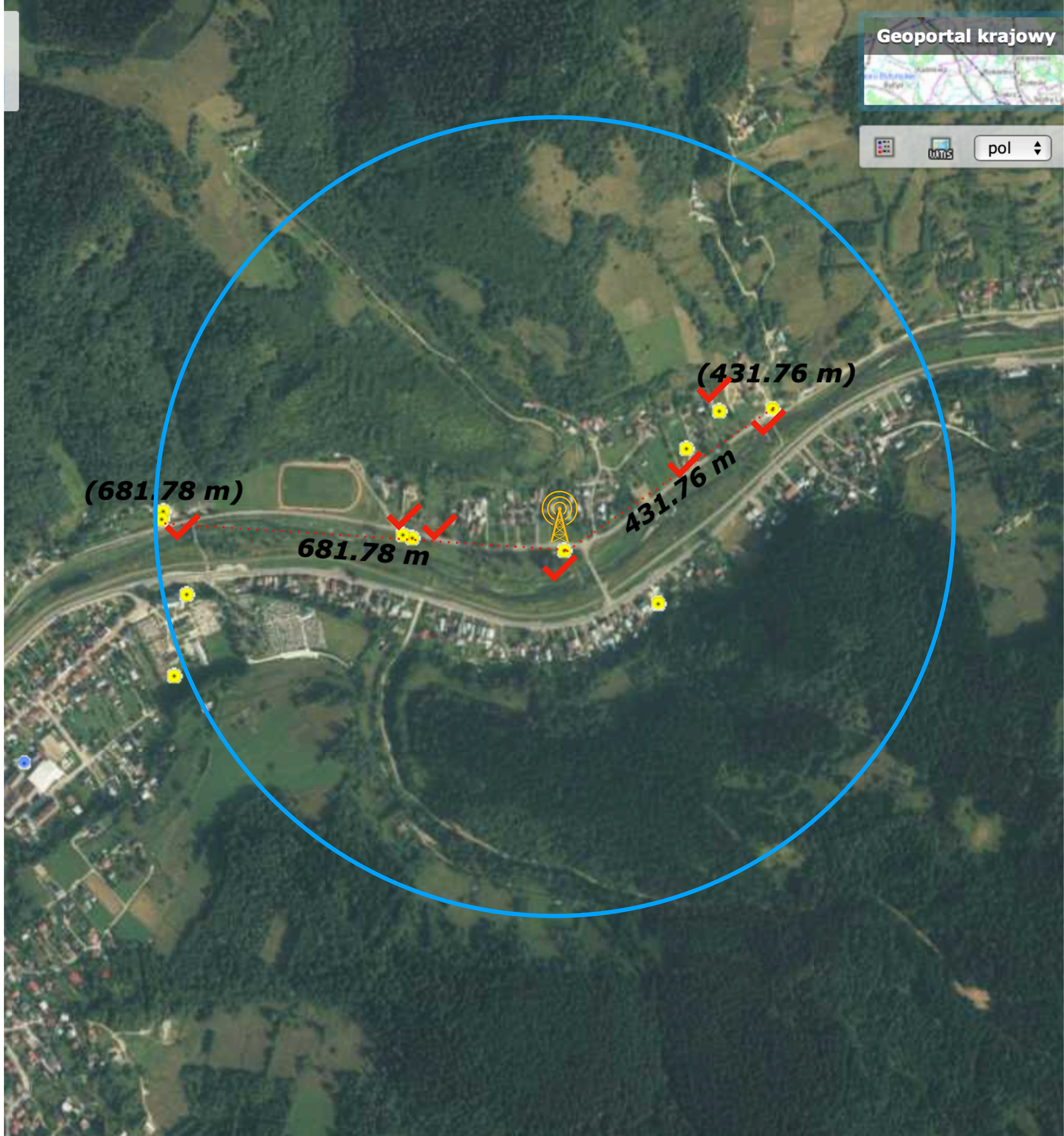
- Pomiar przepływu
- Systemy alarmowe
- Sterowanie falownikami
- Wysokość lista wody

Obsługiwane wodomierze

- Wehrle Modularis
- Bernhardt Modularis
- Maddalena CD SD PLUS EVO
- Maddalena VTZ
- Simens WFW30/WFK30 series
- Wasser- Geräte typu ECO

Zasięg gateway'a

~ 110 gospodarstw



Mapa pomiarowa

Mapa przedstawia lokalizację punktów pomiarowych wraz z ich statusem.

Hardware

KNOT

- MODBUS - RS485
- GPIO
- 3 x Zasilanie
- LTE cat M/ NB-IoT
- 2x ETH
- LoRaWAN
- AP
- Bluetooth
- GNSS
- PoE in / PoE out

LtAP LR8 LTE kit/ wAP LRx kit/ R11e-LRx

- LTE
- LoRaWAN
- GPS
- 3x SIM
- 3 we zasilania