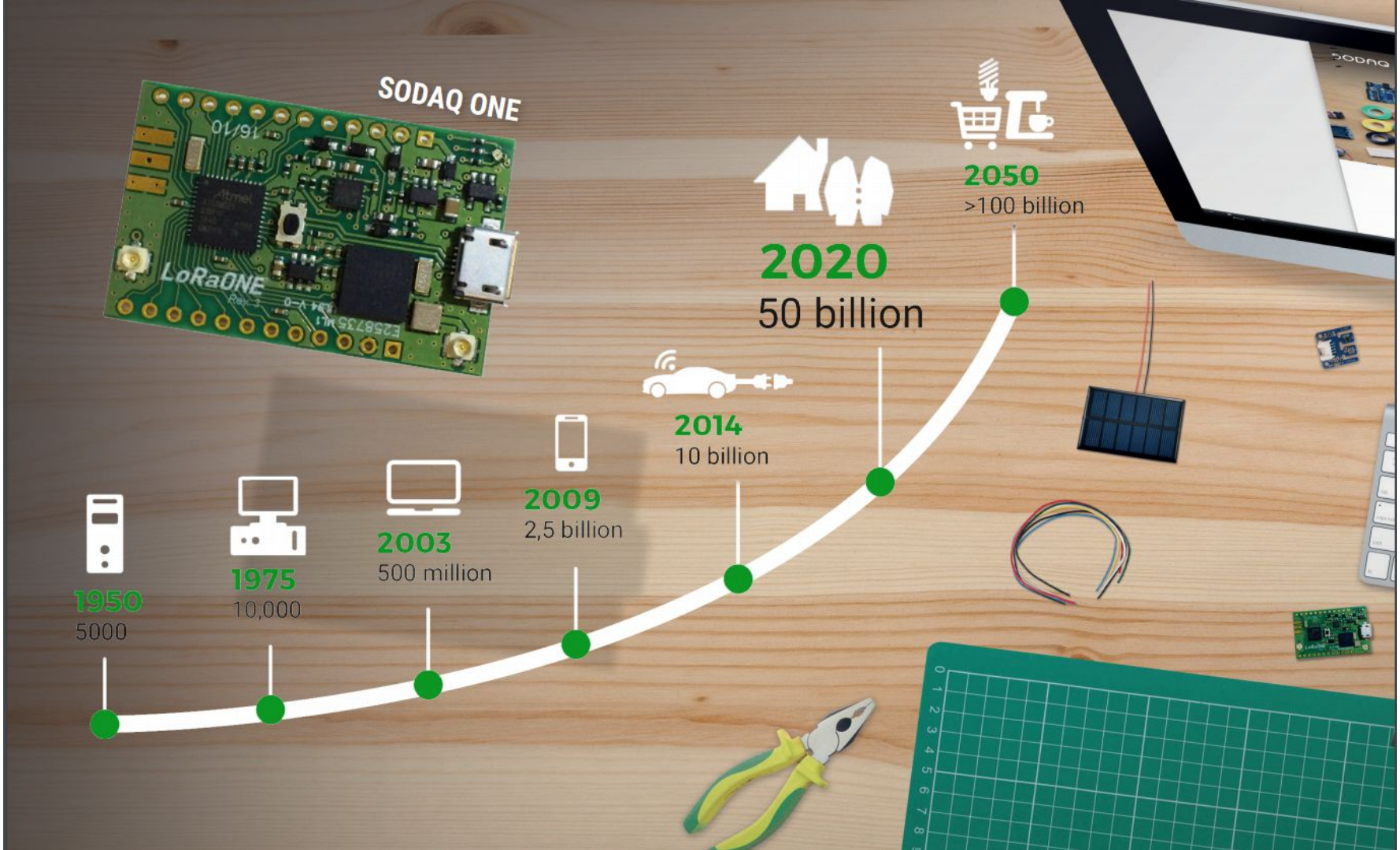
SODAQ

Jan Willem Smeenk


SODAQ ONE
LoRaONE
1950
5000
1975
10,000
2003
500 million
2009
2,5 billion
2014
10 billion
2020
50 billion
2050
>100 billion

# LPWAN started with Sigfox

- First LPWAN network
- Unlicensed spectrum
  - 868 MHz Europe
  - 902 MHz USA
- Ultra Narrow Band
- 12 bytes data payload
- 140 messages per day
- Simplex, one way traffic

# and then LoRa

- Same unlicensed spectrum as SigFox
- Spread spectrum
- 51 bytes payload
- ~ 300 messages per day upload
- ~ 30 messages per day download
- 154 dB link budget

# And now 4G:  LTE-M and NB-IoT

- Regulated (Licensed) spectrum
  - no duty cycle limits
- Extreme good coverage
- Deep indoor penetration
  - NB-IoT 164 dB link budget
  - LTE-M 156 dB link budget
- 100 messages of 500 bytes/day
  - approx. €1 - € 2 per month

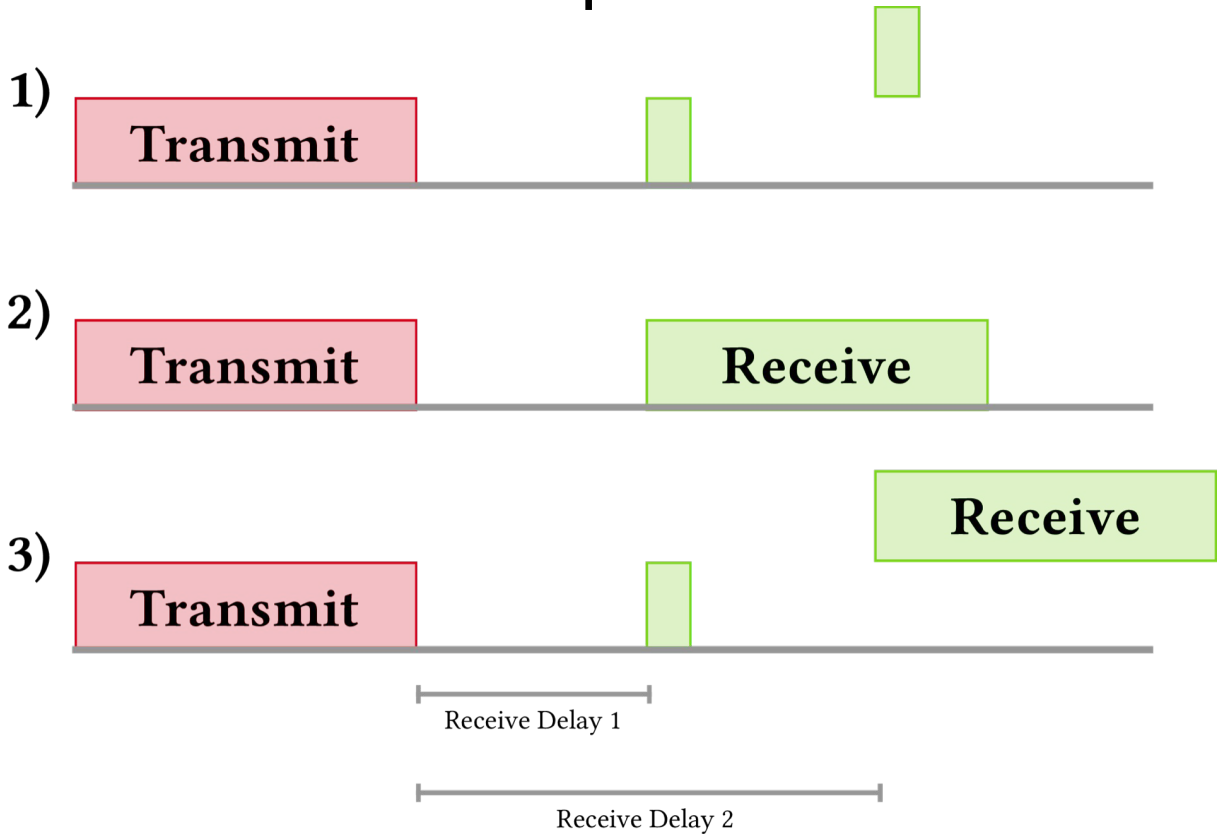
# Now what are the differences?

SigFox and LoRa are stateless

Device broadcasts a message which is received by a gateway

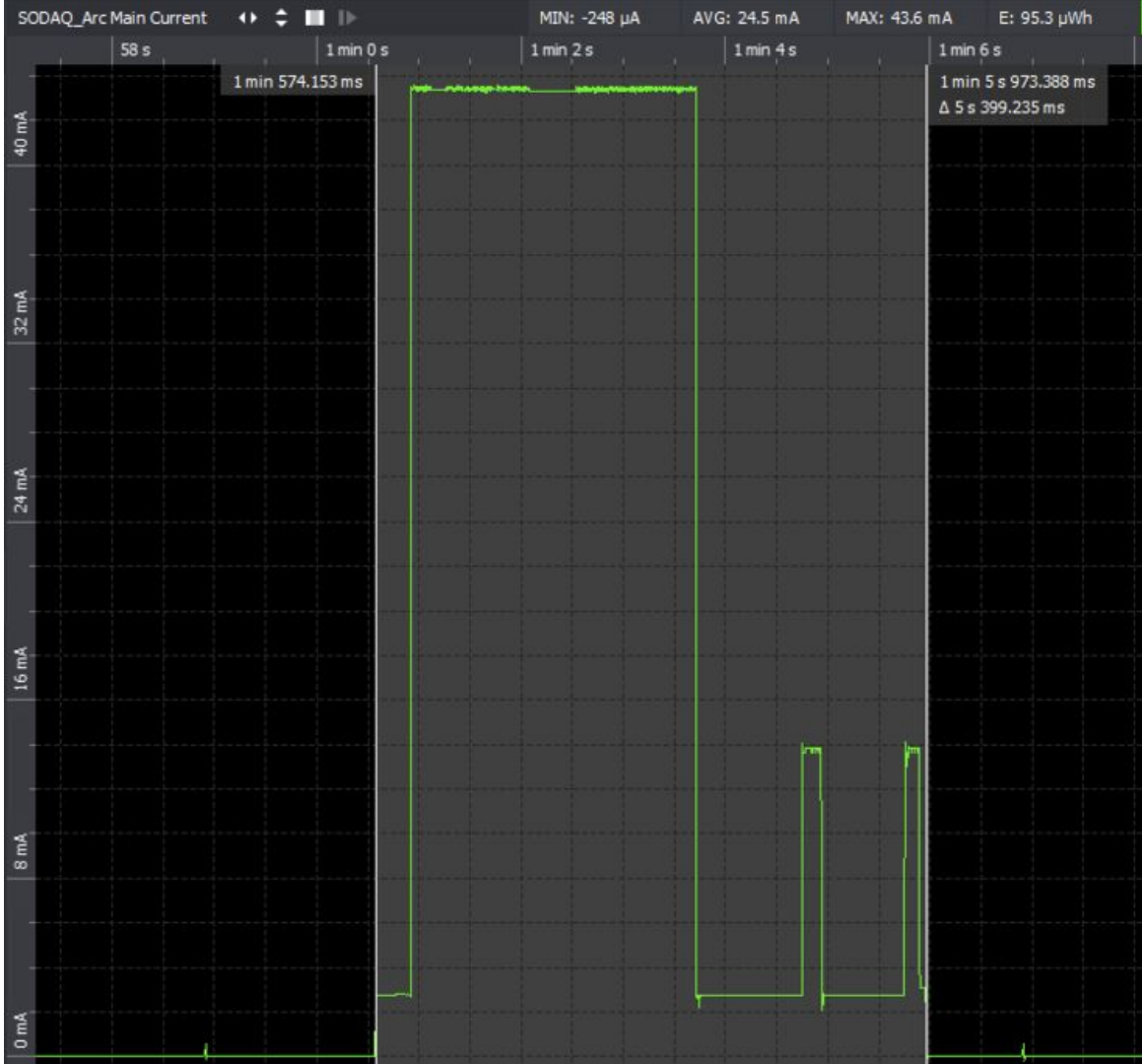
or not….

# LoRa communication concept



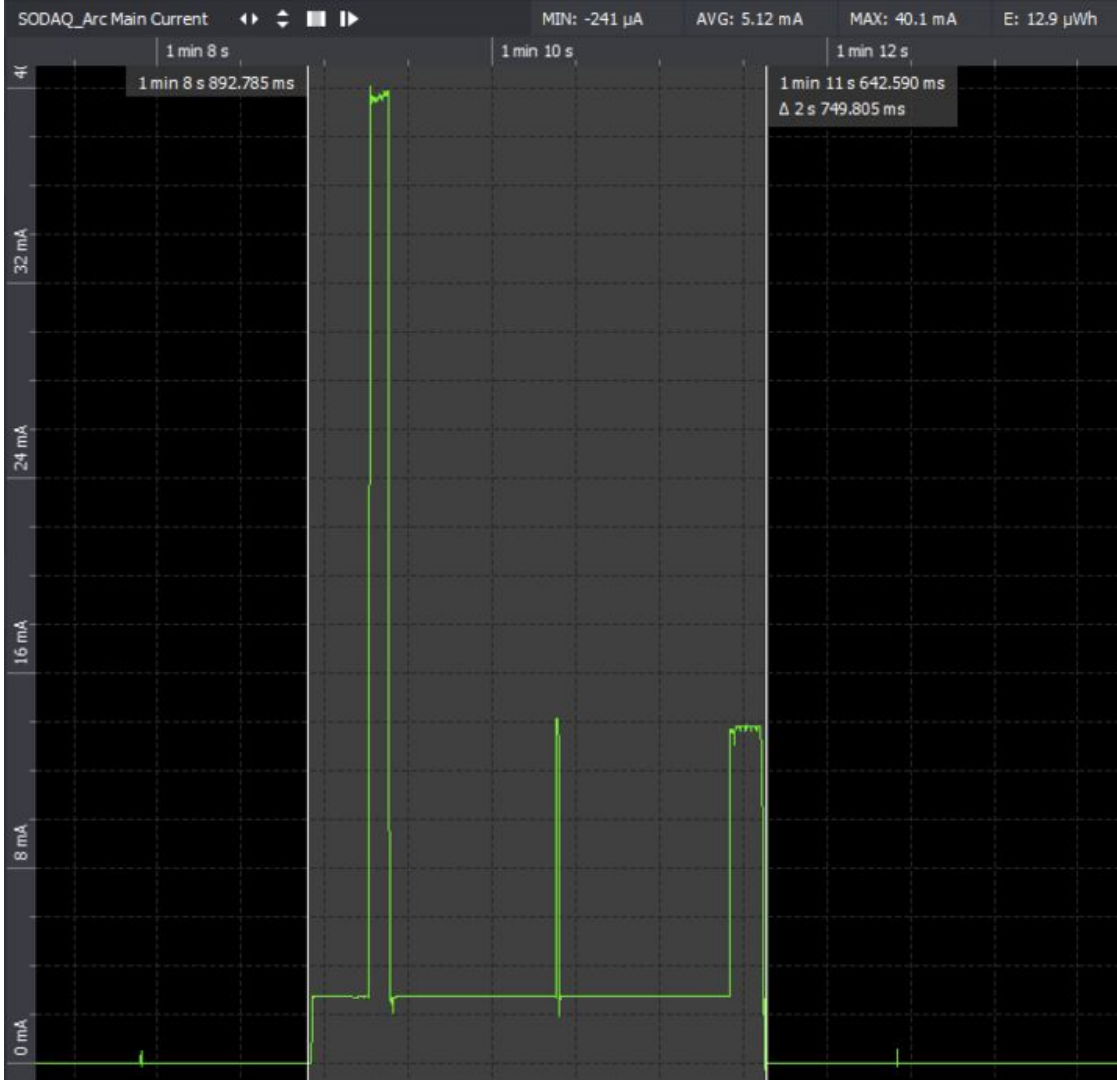
# LoRa

- fixed duration
- fixed power usage
- SF 12
  - 5.4 seconds
  - 95µWh
  - max 43mA



# LoRa

- SF 7
  - 2.7 seconds
  - 13 µWh



| | | |
|---|---|---|
| SF7 | | |
| messages per hour | 4 | |
| power per message | 13 | µWh |
| time on air | 3 | seconds |
| microcontroller power when active | 15 | mW |
| microcontroller when sleeping | 15 | µW |
| Total power per hour | 79.5 | µWh |
| | | |
| | | |
| SF12 | | |
| messages per hour | 4 | |
| power per message | 95 | µWh |
| time on air | 5.4 | seconds |
| microcontroller power when active | 15 | mW |
| microcontroller when sleeping | 15 | µW |
| Total power per hour | 417.5 | µWh |

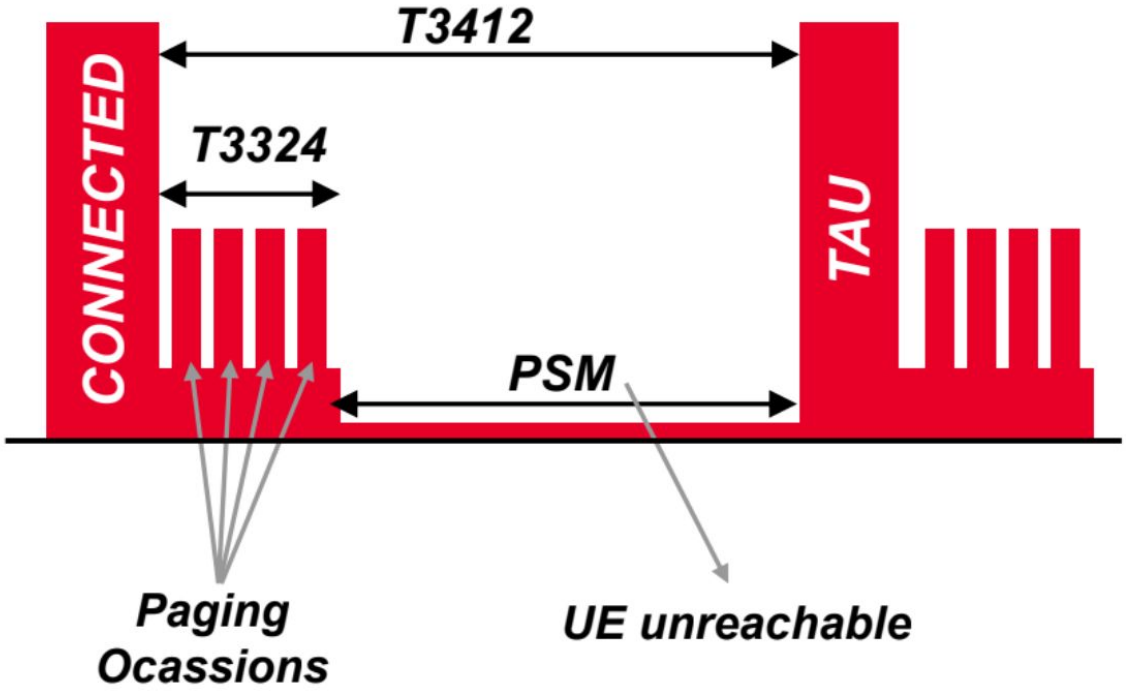
# SAFT LS14500

- 2600 mAh
- ~ 8000 mWh
- SF-7
  - 100.000 hours
  - 11 years
- SF-12
  - 20.000 hours
  - 2.2 years

# LoRa

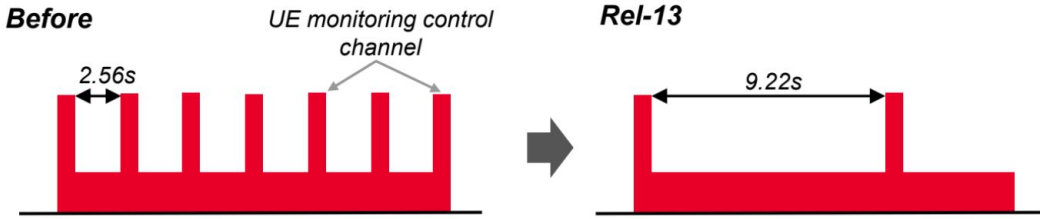
- Very low power consumption possible
- Try using lowest SF
  - Geolocation requires higher SF (11?)
- Ideal for private networks
- Message delivery not guaranteed
- Place gateways close to devices to solve this

# NB-IoT and LTE-M concept



# eDRX

## CONNECTED eDRX



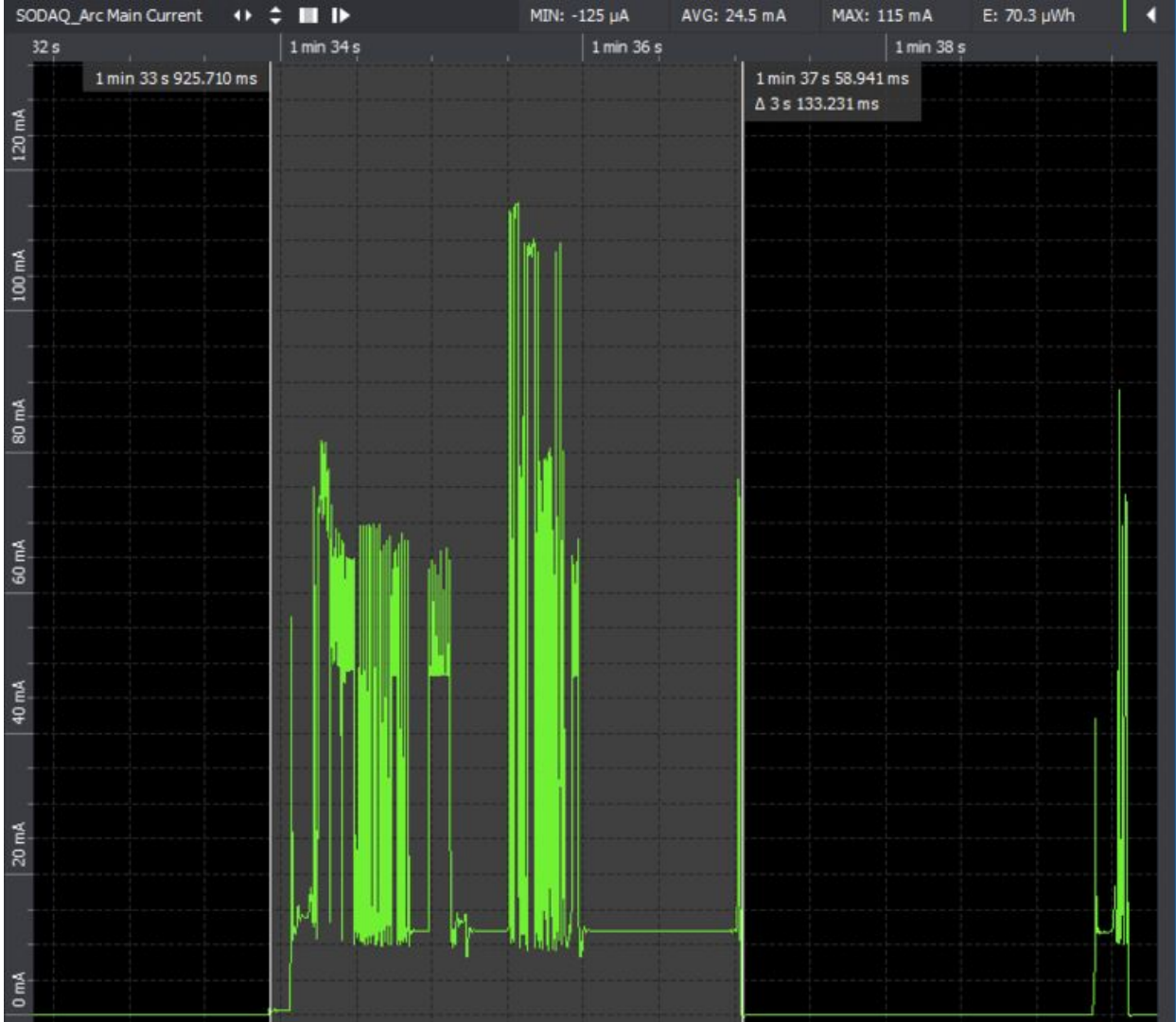

- DRX cycles extended from 2.56 seconds:
  - To 9.22 seconds in NB-IoT

## IDLE eDRX

- New Paging Time Window which allows longer paging cycles:
  - 3 hours in NB-IoT

# NB-IoT

- Send UDP datagram
  - 3.1 seconds
  - 70 µWh
  - max 115mA
- Only when signal is good!
- Additional power needed for:
  - establishing session
  - (e)DRX

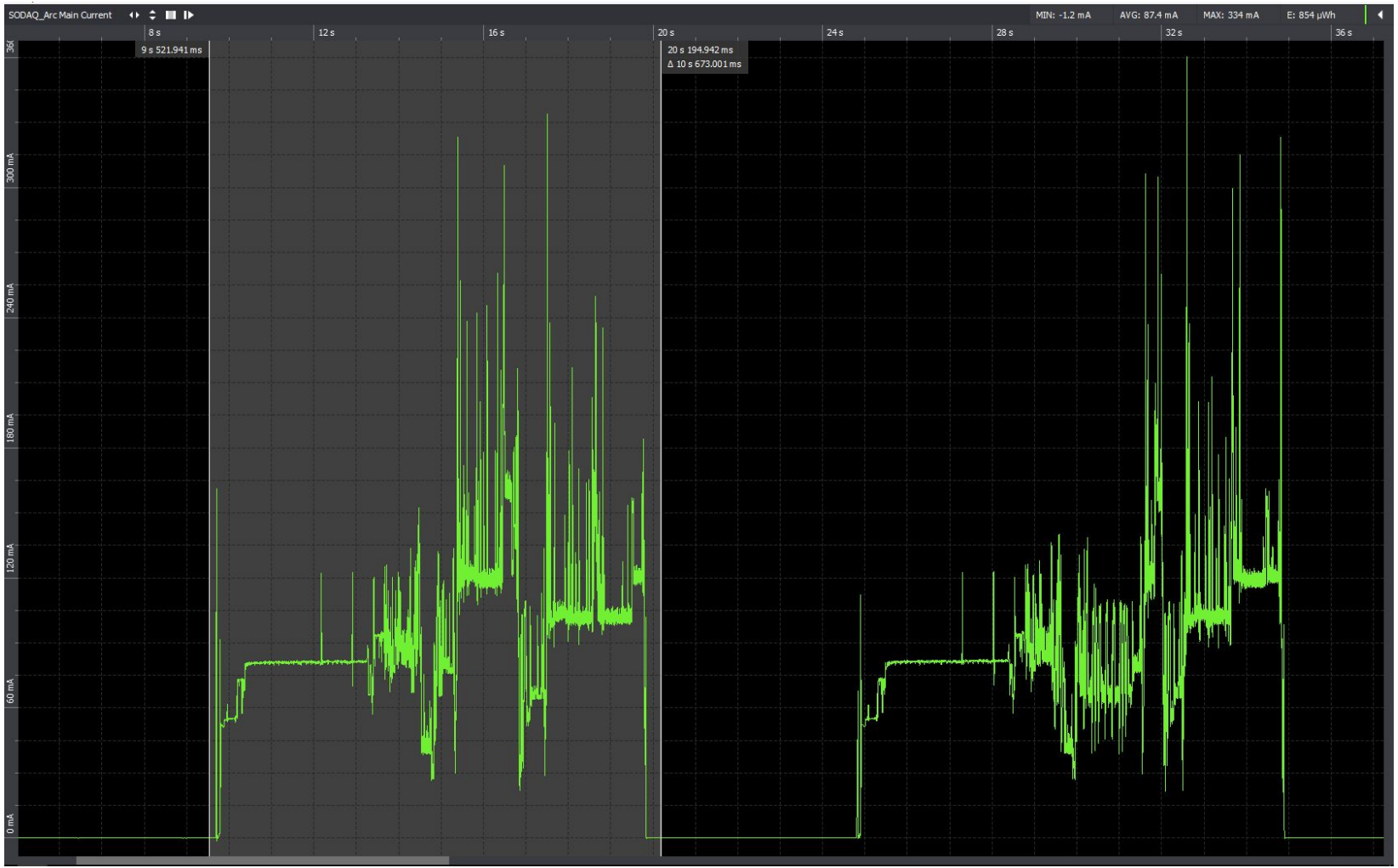


# LoRa and NB-IoT compared

- Under good signal conditions:
  - LoRa SF12 and NB-IoT have similar power consumption
- Under poor signal condition
  - LoRa messages don’t arrive
  - NB-IoT power consumption will be high and difficult to control
- LoRa is limited in data throughput
- NB-IoT has better link budget
- LoRa can be private network (cheap)
- NB-IoT commercial networks have much better coverage

# LTE-M

- alternative to NB-IoT
- ~ 156 dB MCL
- much higher data rates
- full TCP/IP support
- voice support (VoLTE)
- > 300mA peaks
- still under development
    - PSM not supported yet


SODAQ_Arc Main Current
MIN: -1.2 mA
AVG: 87.4 mA
MAX: 334 mA
E: 854 µWh
8 s
12 s
16 s
20 s
24 s
28 s
32 s
36 s
9 s 521.941 ms
20 s 194.942 ms
Δ 10 s 673.001 ms
360 mA
300 mA
240 mA
180 mA
120 mA
60 mA
0 mA

Questions?