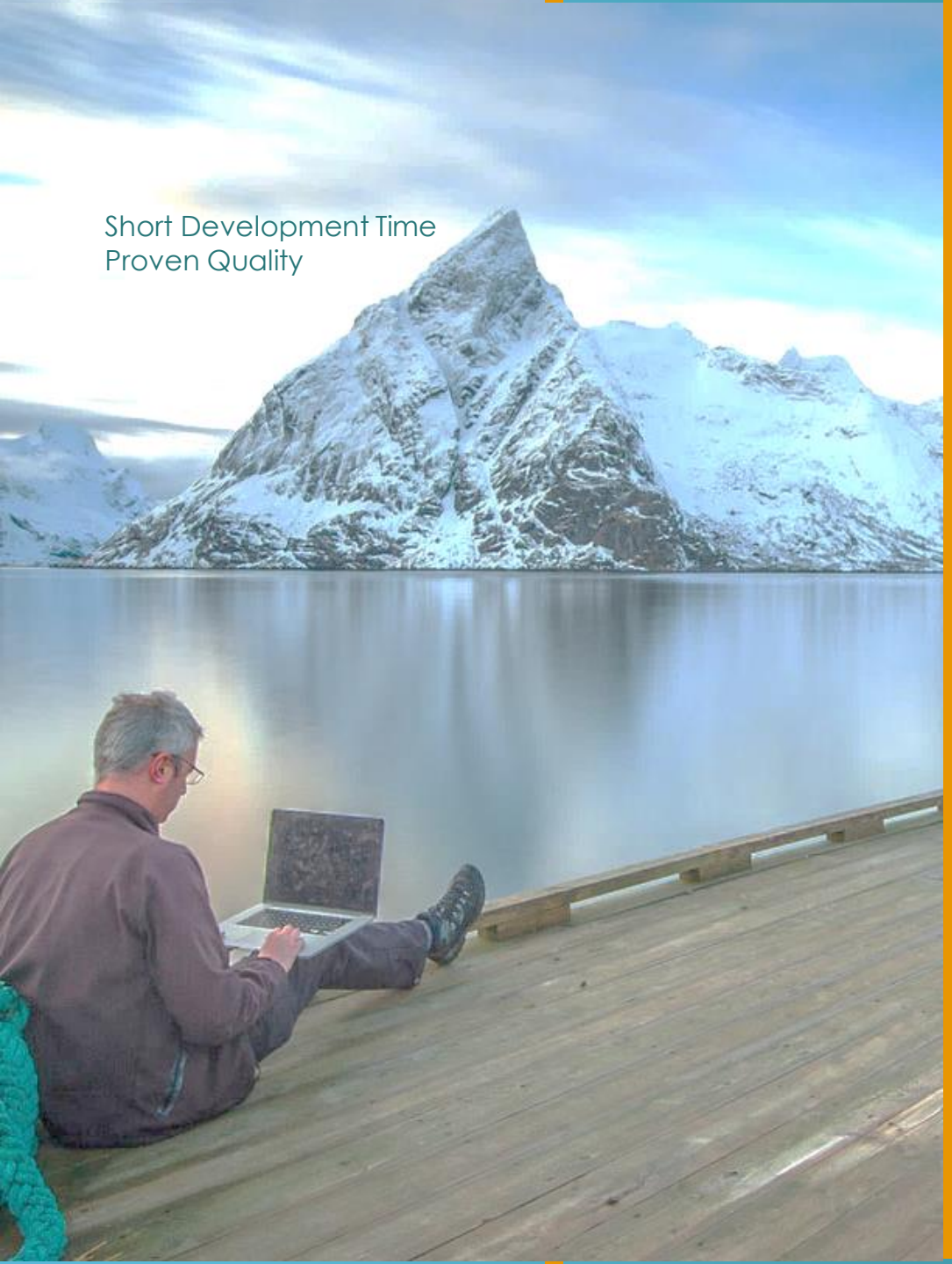

Radiocrafts
Embedded Wireless Solutions

Presentation will start shortly….

"All LPWAN sensor data creates actionable insight

How much data can be lost before the insight loses its value?"

MIOTY
April, 2020

MIOTY

April 2020

- Ørjan Nottveit, R&D Director

House-keeping

- The webinar today is scheduled for 30 minutes with a 10-15 minutes Q&A afterwards.
- Post your questions in the chat window during the webinar, and we will answer the best we can in the Q&A session.
- We will post a recorded version of the webinar on our website after it's over, in case you want to go back and see it again.

Agenda

- Yet another LPWAN standard – why do we need that?
- MIOTY basics
- Benefits
- Use cases
- MIOTY Alliance
- Radiocrafts' offering

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Yet another LPWAN "standard"

- There exist several LPWAN solution in the market today (LoRAWAN, Sigfox ++)
- Challenges with existing solutions
  - QoS – Reliability
    - LPWAN by nature do not want to support downlink (acknowledgement)
  - Scalability
  - LPWAN's is not really suited for battery operation
  - Not open standards

MIOTY Basics

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MIOTY vs ETSI TS 103 357

- MIOTY is compliant to ETSI Technical Specification 103 357
  - The specification outline 3 different long range mode.
  - MIOTY implements TS-UNB (Telegram splitting ultra narrow band)
- TS 103 357

  → Ultra low power mode (ULP) 2380 Sym/s (Mandatory)

  → Extended Range mode (ER) 397 Sym/s (optional)

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MIOTY Physical layer

- Support for 868 MHz band in Europe and 915 MHz band in US
- (G)MSK with coherent demodulation
- Symbol rate 2380 Sym/s (on RF)
- Link budget Uplink = 153 dBm (14 dBm output power/-139 dBm sensitivity)
- Link budget Downlink = 157dBm (27 dBm output power/-129 dBm sensitivity)
- Telegram splitting
- Data whitening
- Interleaving
- 10 to 245 bytes in uplink packets
- **FEC (1/3) convolution code (up to 50 % of bits can be lost)**

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MIOTY MAC

- Both unidirectional and bidirectional supports
- Downlink is scheduled 6.9 seconds after last uplink burst
- Security
  - Both Encryption and authentication
  - AES 128 counter mode + CMAC(32 bits)
  - Packet counter(24 bits)

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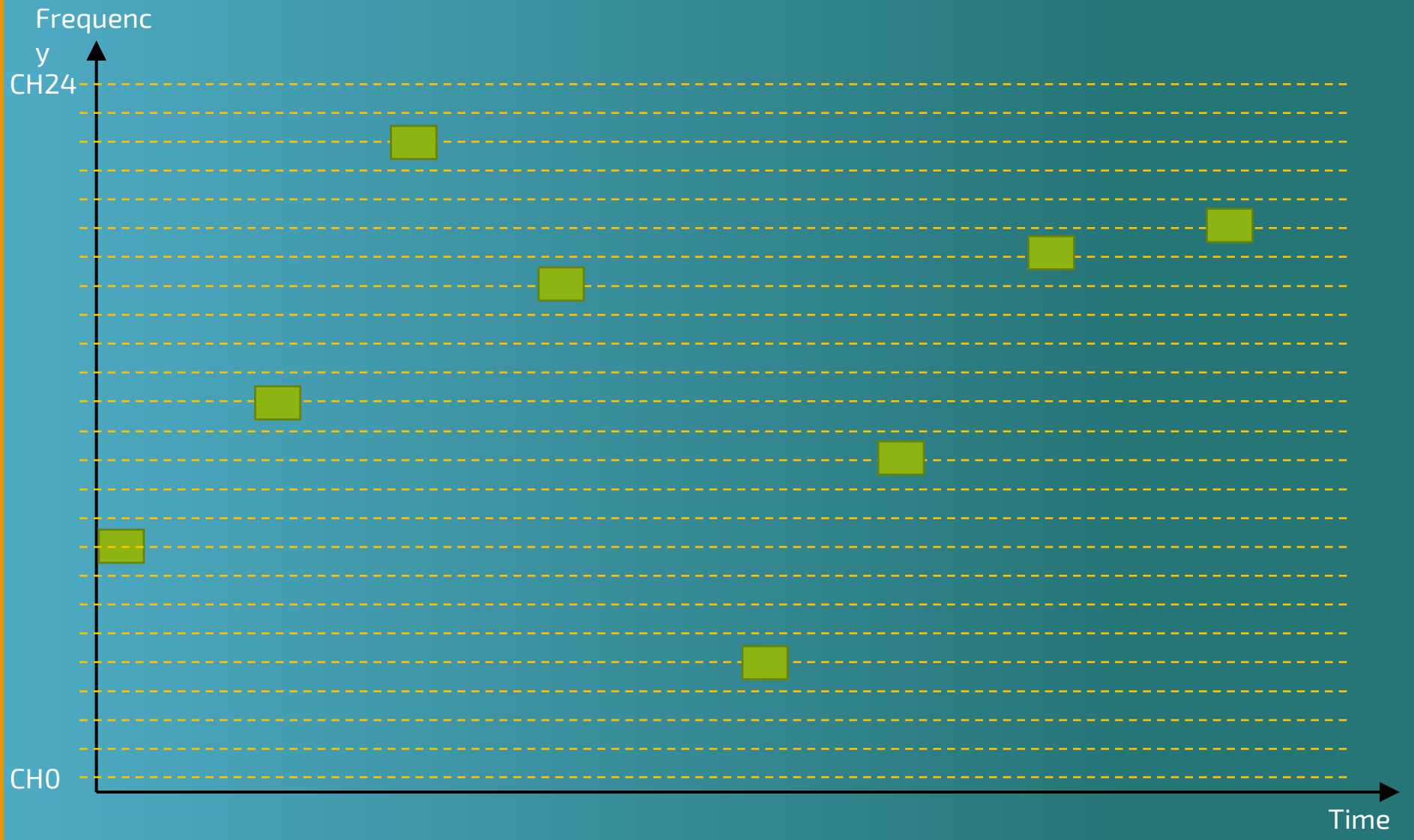
Telegram splitting



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Telegram splitting

- Uplink transmission
  - Each packet is divided in in chunks of 24 bits(3 bytes) sent in each burst
  - Each burst 15,12 ms long
  - Minimum of 24 burst
  - Each burst sent on one of 24 channels
  - Each channel 2.4 kHz wide (total channel width = 100kHz)
  - Channel raster 2.4 kHz
  - Time between burst pseudorandom 130-265 ms
    - Total transmission minimum 3.6 second
    - Actual transmit on minimum 363 ms (10 byte application data)

MIOTY Benefits

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Increase Scalability

- One of the main challenges with LPWAN is that when it rolled out in large volume/high density the network start to interfere with itself
- All sensors send data asynchronous.
- 1000 nodes sending data every 10 minutes generate 144000 messages per day.
- If each message is 500 ms are placed ideally after each other this will take 20 hours.
  - But in reality, they will collide a lot of the time

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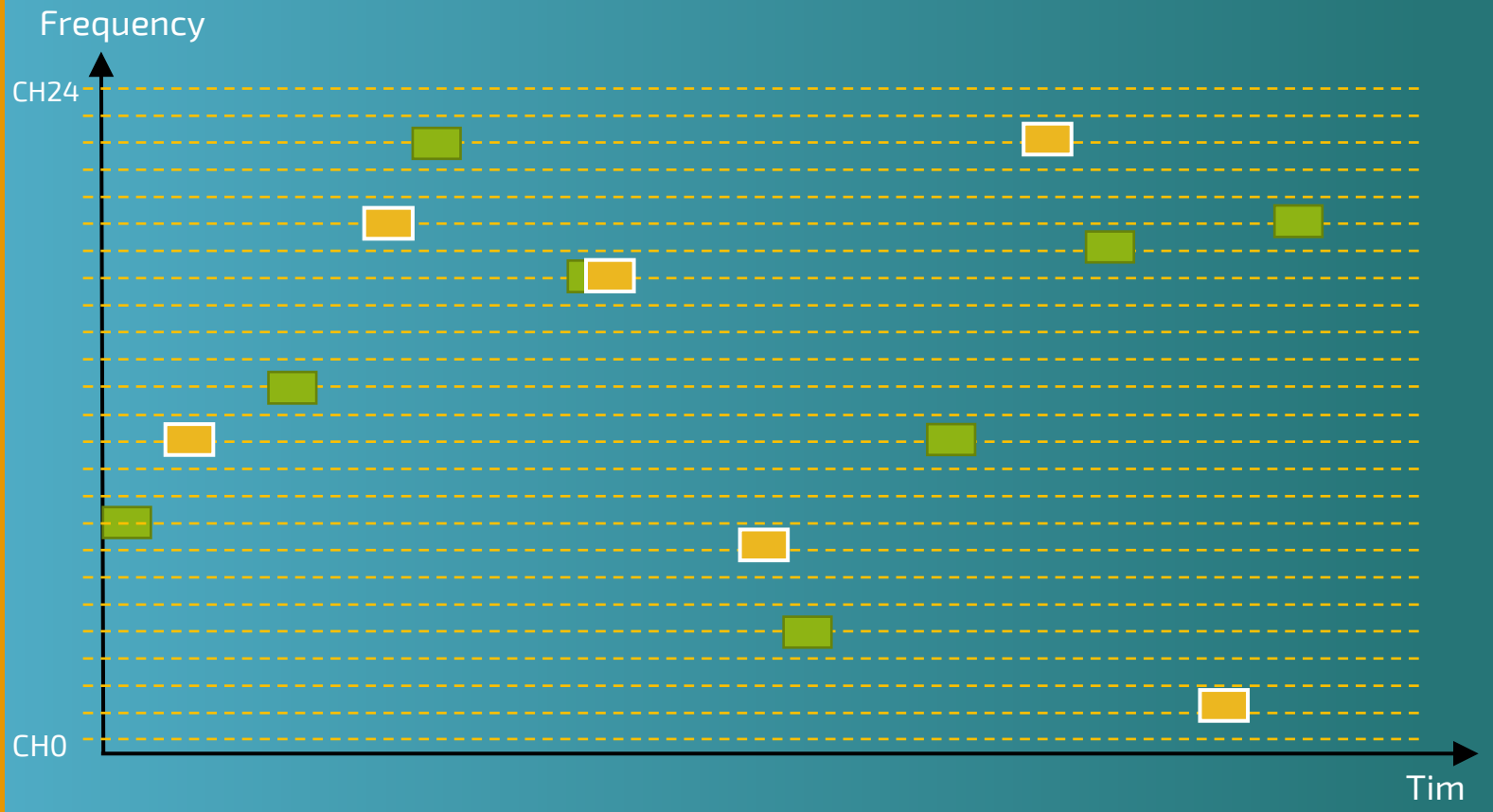
Increase Scalability

- Several incoming packets can coexist at the same time
- 1.5 million packet per 100 kHz at 1 gateway



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"All LPWAN sensor data creates actionable insight

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Increase QoS - Reliability

- In all wireless networks some packet will eventually get lost
- But having a packet success rate of 99.9% or 99% or 90% will influence the value of wireless system
- Normally QoS is accomplished with acknowledge/retransmission
- The noise level in the license free bands are constantly increasing
- Study have shown that in high density networks, Chirp Spread spectrum has a packet error rate of 10 % before TS-UNB losses one packet.

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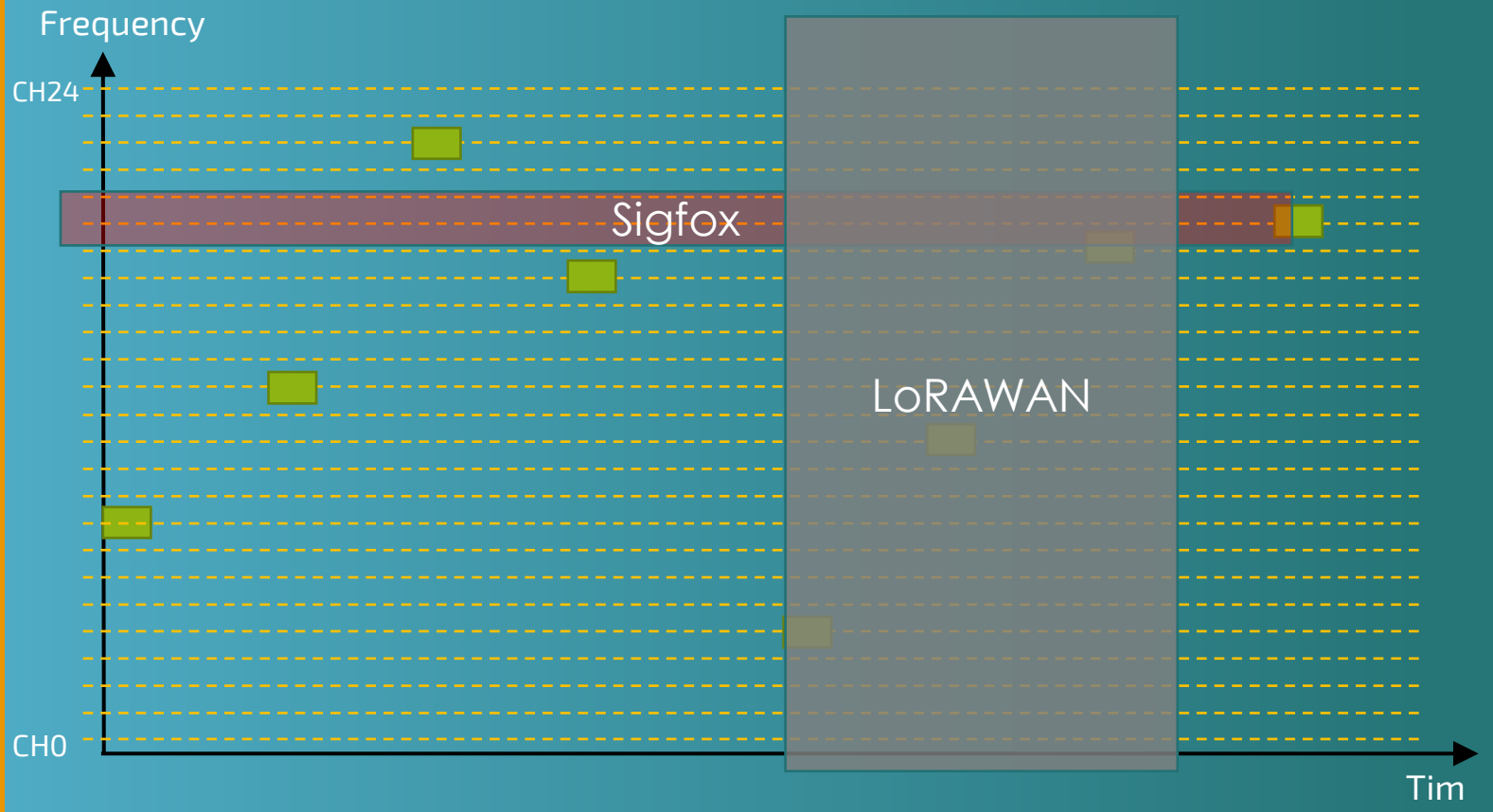
Increase Reliability

- Robust toward different type of interferer
  - Random
  - Narrowband(Sigfox)
  - Wideband(LoRAWAN)



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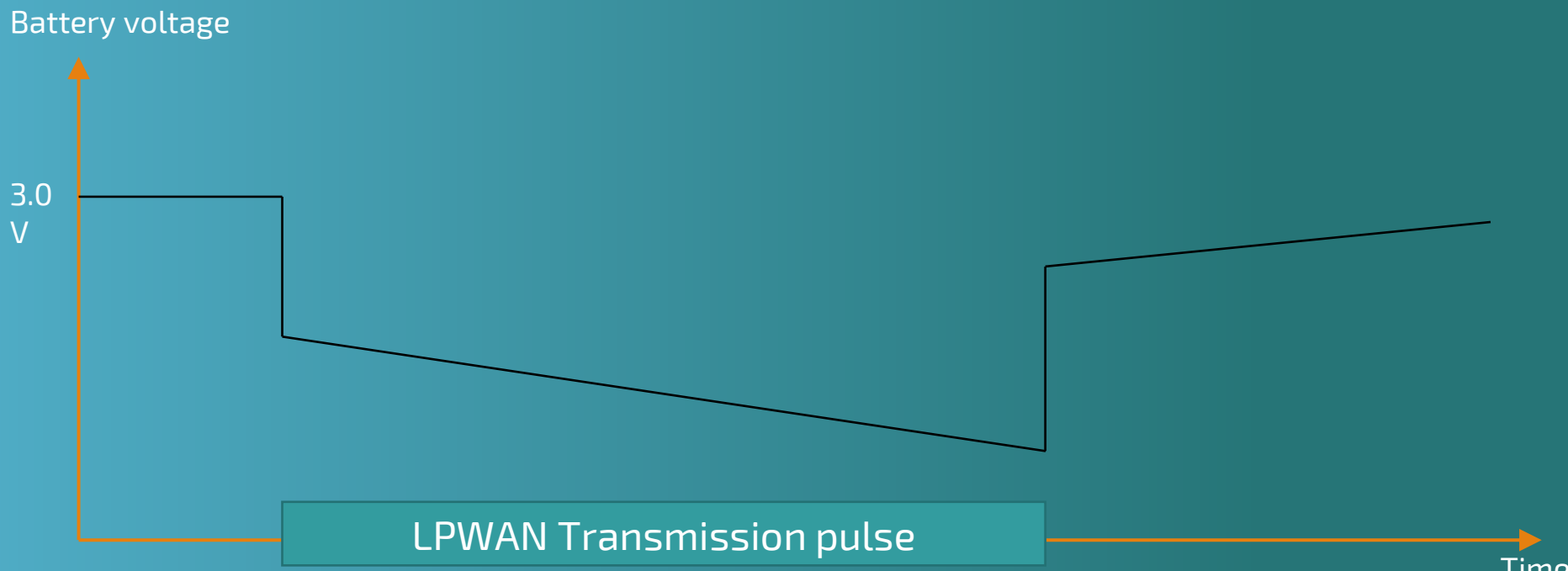
Battery friendly

- LPWAN is not really battery friendly compared to short range wireless
- The current x time product is high and this is tough on the battery



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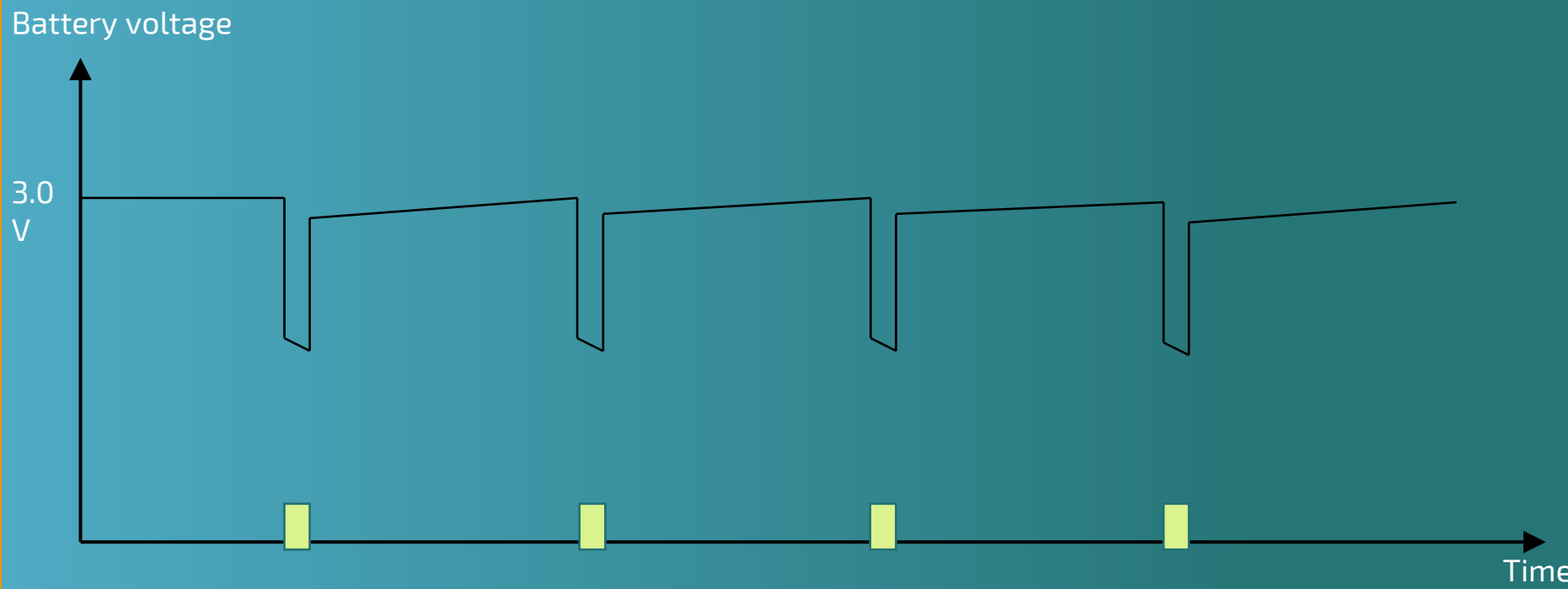
Battery friendly

- MIOTY is much more kind on the battery
- The battery is exposed to shorter current pulses and have time to recover between pulses



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Other benefits

- Efficient coding give lower transmit time and save energy
  - An equvivalent LoRAWAN packet has 60 % longer transmit time

  (SF11, CR 4/5, 10 byte user data -> 577ms TX time)
- Open technical specification
  - Openness ensures quality and innovation
- No lock in of hardware. Already supported by 3 semiconductor vendors
- Support devices in high speed (up to 120 km/h)

MIOTY Use cases

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Use case - General

- Uplink dominated use cases
- Large number of device/High density of devices
- QoS important
- Project lifetime is long
- Battery operated

- Not good ideas
  - Intensive control application
  - Not latency < 6 seconds
  - Not sensor readings more often than every 30 second(europe)

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Use case - Metering

- Main traffic is meter data up → Uplink dominated use cases
- One device in each household → Large number of device/High density of devices
- Data used for invoicing → QoS important
- Typical 10-15 years project lifetime → Project lifetime is long
- Gas and water meter → Battery operated

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Other use case

- Smart city
- Smart Factory /Industry 4.0
- Building management
- Project lifetime is long
- Battery operated

mioty alliance

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- Launced at Embedded world
- Radiocrafts members since February 2020
- The MIOTY Alliance has a simple goal:

To enable the most accessible, robust and efficient Massive IoT connectivity solution on the market

- www.mioty-alliance.com

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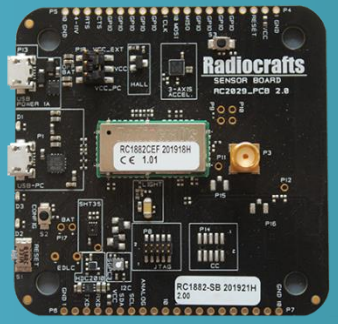
Radiocrafts offering

RC1882CEF-MIOTY1

- AT based command set
- Plan launch June

RC1882CEF-MIOTY2

- Embedded application running inside the module based on innovative and unique ICI application interface
- Plan launch Q3



Development kits

Based on industry leading semiconductors from Texas Instruments

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Summary

- Introducing MIOTY
- Why MIOTY
  - **Reliability**
  - **Scalbility**
  - Long range
  - Battery friendly
  - Openness (ETSI technical specification)
  - Many vendors of chips
  - Up to 120 km/h


Radiocrafts
Embedded Wireless Solutions
Short Development Time
Proven Quality

Q&A

Thank you for your attention!

Read more on MIOTY

https://radiocrafts.com/products/mioty-network/