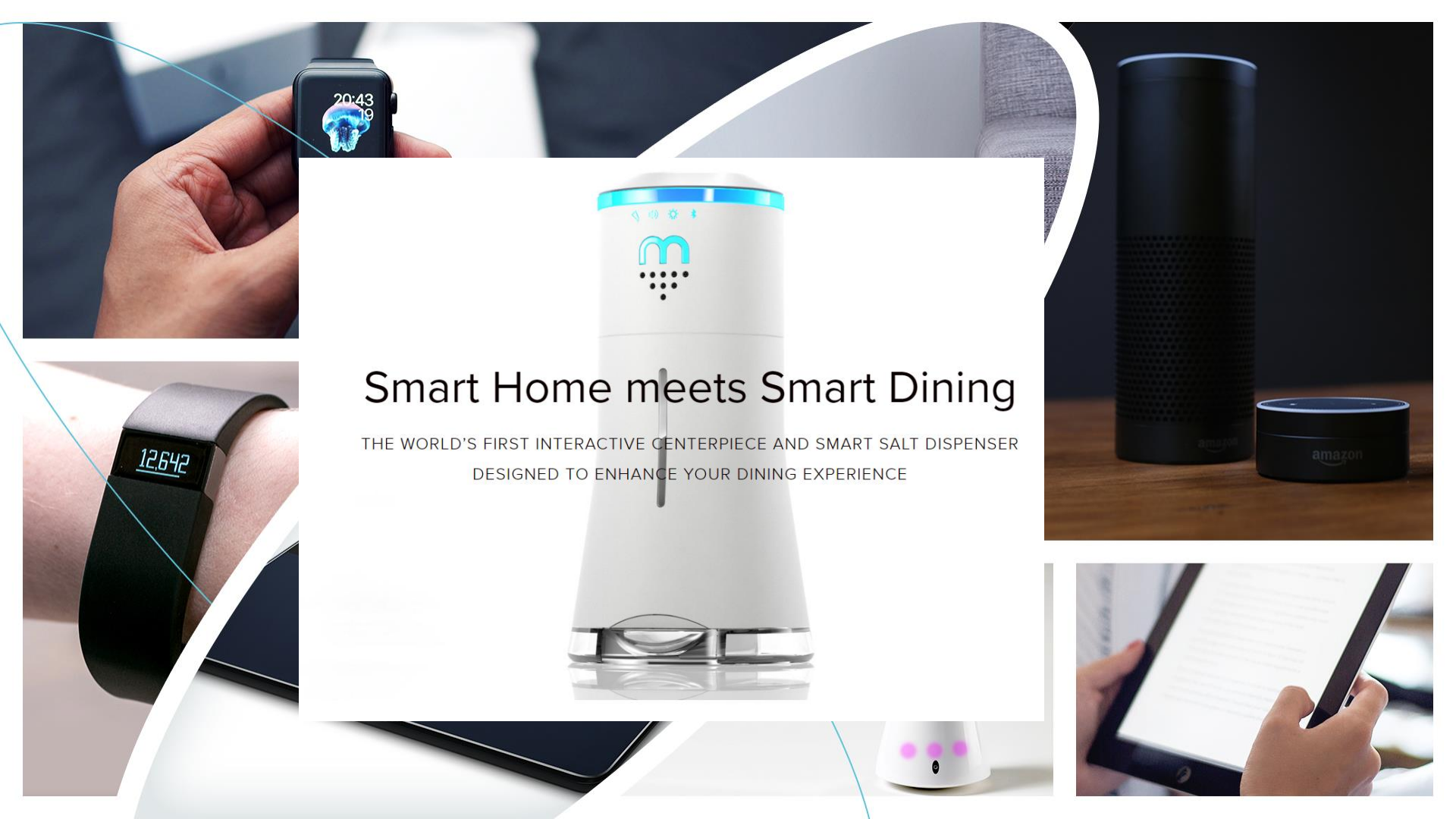
Getting started with Sigfox

Aurelien Lequertier
@aureleq


sigfox
IOT & Sigfox
overview


20:43
19
12,642
128.0
NOKIA
amazon



Smart Home meets Smart Dining

THE WORLD'S FIRST INTERACTIVE CENTERPIECE AND SMART SALT DISPENSER
DESIGNED TO ENHANCE YOUR DINING EXPERIENCE

Sigfox: Global LPWA network

Low power,
to provide autonomy

Global,
to be used everywhere

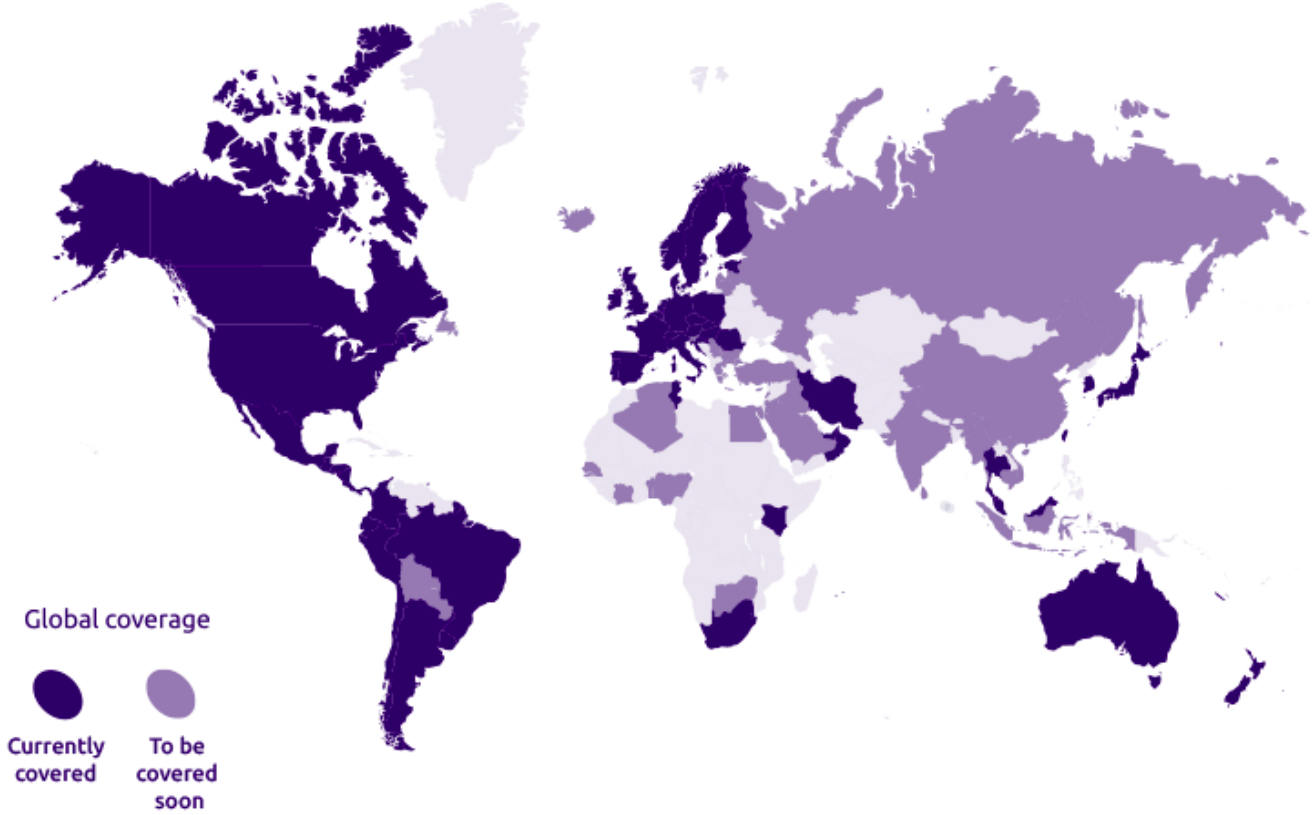
Low cost,
to address everything

Easy to use,
and adopted quickly

sigfox

We’ve got you covered!

Sigfox is already available in over 60 countries and regions and aims to cover 100% of the globe in the next few years...



sigfox

LIVE

Container tracking

Problem solved

track sea-freight containers in real-time

Solution

Axible & Argon Consulting offer an end-to-end tracking solution.
It notifies Michelin whenever the signal reaches the earth and give insights on the container's position. This information is key for lean production.

Benefits

- Cross country tracking without high roaming fees
- Foreseen transportation lead time
- Lean production & reduced stock
- Alerts in case of delay
- Visibility of service for customers

Video link

Home Alarm System

LIVE

Challenge

Alarms are traditionally connected through GSM to central system and burglar intrusion can be facilitated by GSM jammers. There is a need for effective backup connectivity to ensure more robust alarm transmissions.

Solution

Sigfox has upgraded Securitas Direct's alarm systems to provide a back-up connectivity in case jamming is detected.

The upgrade was possible over the air as a Sub-GHz chip was already inside.

Benefits

- Robustness of solution is a commercial differentiator
- Continuity of service
- Soft deployment via over the air update - no HW swap. No user impact
- Network available to handle millions of devices

Alternative partners for this application

SMACT MCS 360

sigfox

Maturix Concrete Monitoring
by Sensohive (DK)

sensohive

Challenge

Improve drying time of cast concrete and optimize factory production

Solution

Sensohive has made a sensor with external antenna that is put in the wet concrete and monitors the curing process. The solution consists of:

- ✓ Wireless temperature and moist sensors
- ✓ Live curing reports reports
- ✓ Notification when concrete is done hardening
- ✓ IP68 casing

Benefits

- 21 % increase in factory capacity
- 17% reduction in claims from customers
- 23% reduction in production waste
- More control points (quality system)
- Better staff utilization and reduction in energy consumption

sigfox

What we do in the IoT value chain

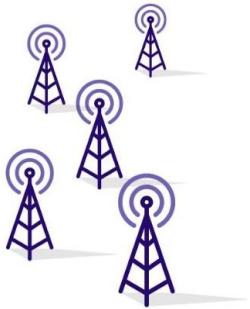
Objects

Embed a Sigfox compatible chip or module

Transmitted through its radio protocol on the **public spectrum**

0 to 140 12-Byte messages per day per device

Global network



High capacity network

SIGFOX cloud

Identification & authentication integrity

Big Data analytics platforms

Data storage & intelligence

Customer IT

Partners with specific applications for verticals

SMALL MESSAGES

to answer the cost & autonomy constraints of remote objects

Payload size examples

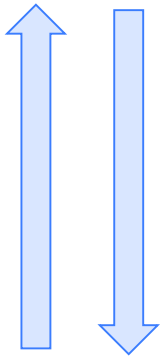
- ❑ 6 bytes: GPS coordinates
- ❑ 2 bytes: temperature reporting
- ❑ 1 byte: speed reporting
- ❑ 1 byte: object state reporting
- ❑ 0 byte: heartbeat (demonstrate when an object is alive)

UPLINK
12-Byte payload

- Sensor data
- Event status
- GPS fix
- Application data

DOWNLINK
8-Byte payload

- Action / actuator trigger
- Device management
- Application parameter setting



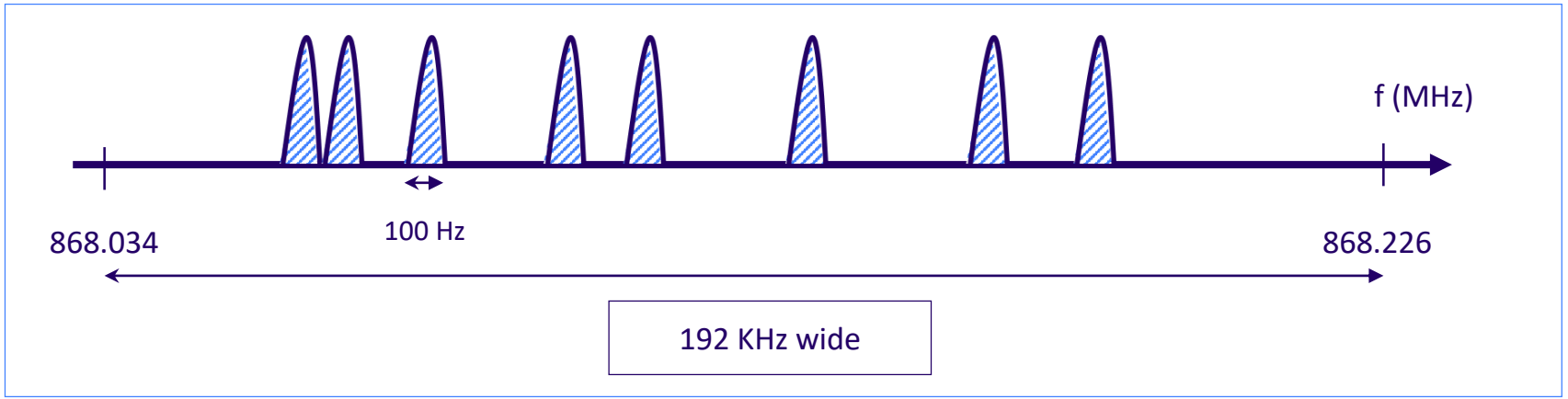
1 % duty cycle for Objects
Up to 6 messages/hour

10 % duty cycle for Base Stations
4 guaranteed downlink msg/day

sigfox

ULTRA NARROW BAND

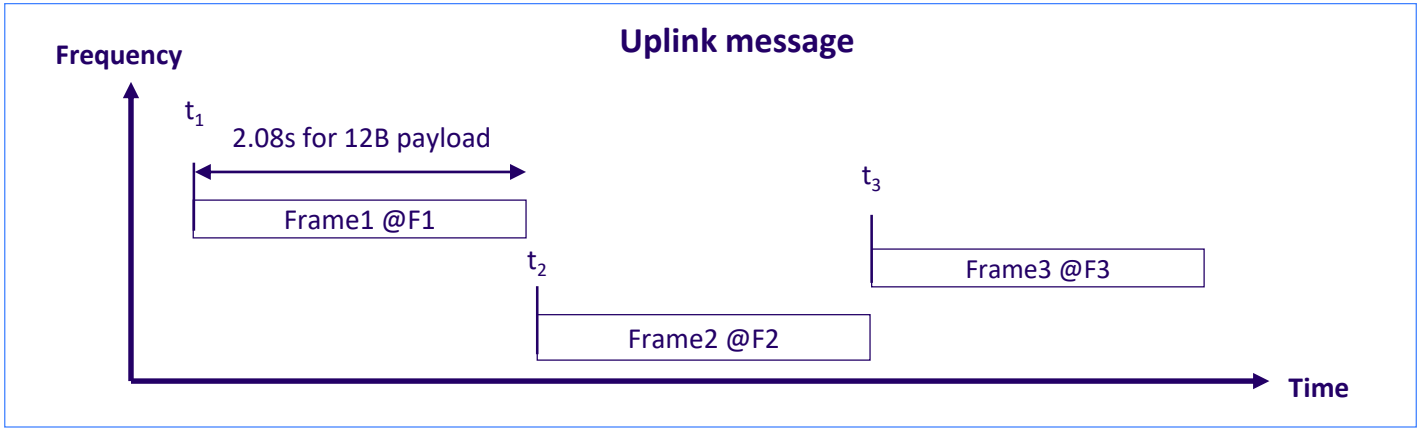
- Currently spreads on a 200KHz part of the spectrum
- High spectrum efficiency 1bit/s = 1Hz of bandwidth
- Each message is ~100Hz wide



sigfox

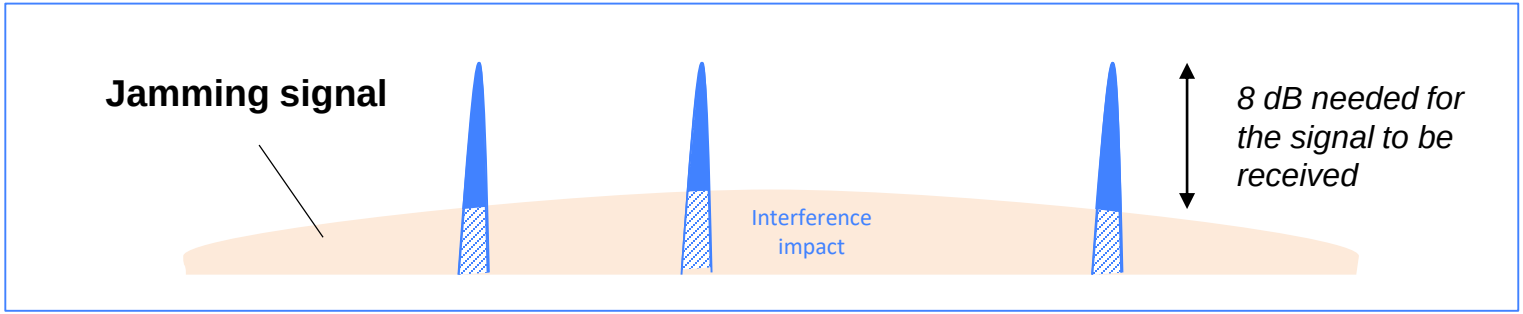
RANDOM ACCESS

- Unsynchronized transmission between the network and the device
- The device transfers a small amount of energy on a random frequency with no protocol overhead (frequency hopping)
- SIGFOX Base stations permanently listen to the spectrum and interpret received UNB signals
- The same frame is sent 3 times enabling time and frequency diversity



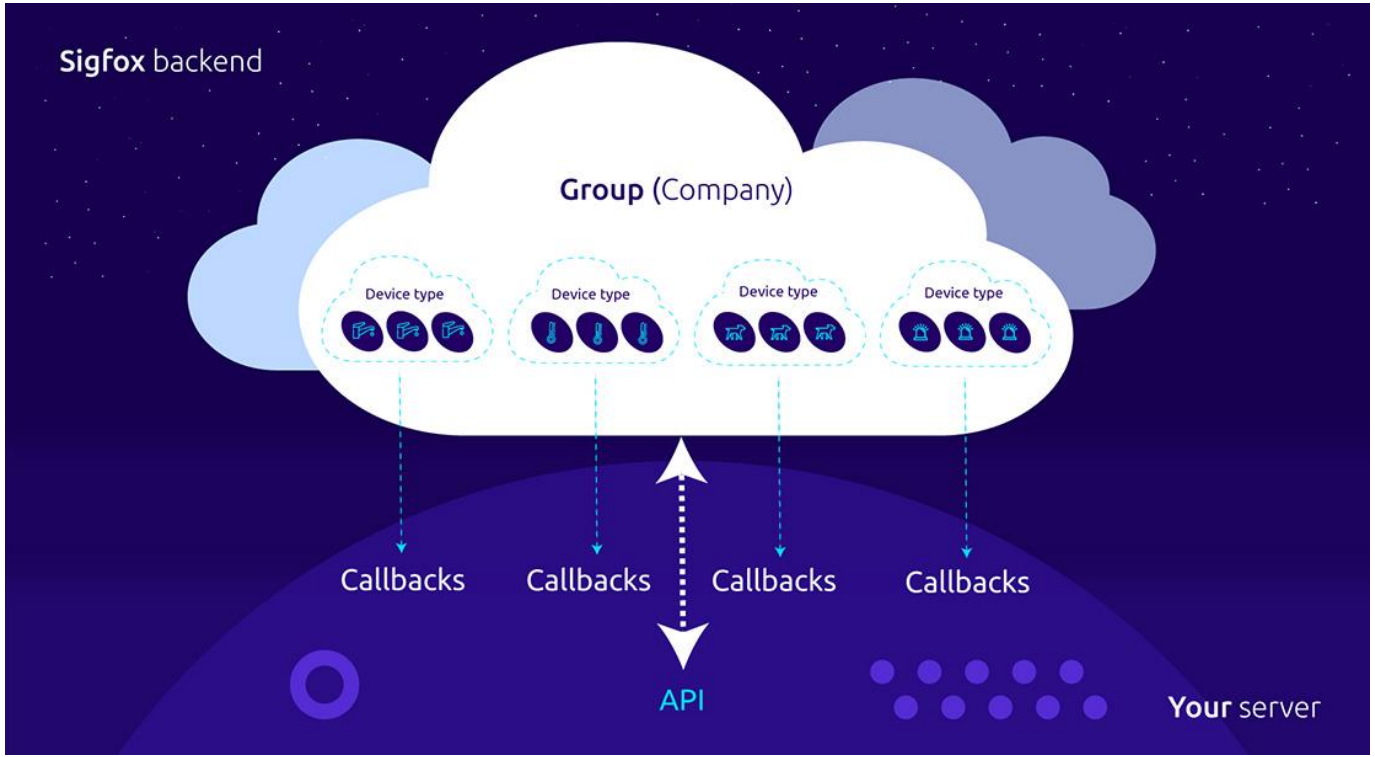
HIGH RESILIENCE TO INTERFERERS
robust to operate in the public ism band

Anti-jamming capabilities due to UNB intrinsic ruggedness coupled with spatial diversity of the base stations (+20dB)



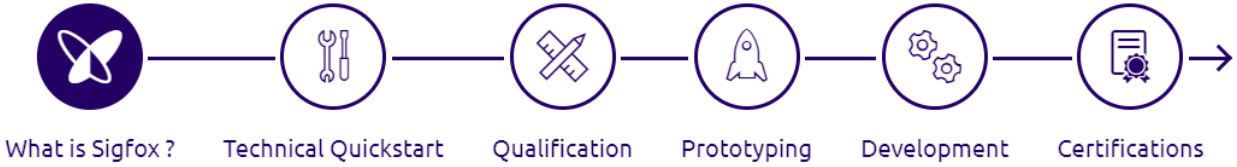
For the same technical reasons as above, UNB is extremely robust in an environment with other spread spectrum signals. However, Spread spectrum networks are affected by UNB signals. **Ultra Narrow Band is therefore the best choice to operate in the public ISM band**

PLATFORM INTEGRATION



Sigfox device journey

Build



- Evolutive online platform to support device makers and solution providers at every stage of their journey
- Centralized document resource center
- Support for device development & tooling
- Simplify certification process

sigfox

Hardware

- Sigfox is not a hardware vendor
- Components sourcing from multiple partners

Modules extract

Module Cluster	*Module Maker*	*Reference*	*Extra-Connectivity*
Multi-connectivity ***Combo***	Wisol	WSSFM20Rx	GPS, BT, WIFI, Acc
	Telecom Design	TD 1204, TD 1205	GPS, Acc, Antenna
	Innocomm	SN20-1x	BT, GPS, WiFi, Acc
	PyCom	S01 (SIPY) 14dBm / 22dBm	BT, WIFI
Dual-Mode	muRata	LPWA	Lora/Sigfox dual-mode
Sigfox w/ ***Secure Element***	Jorgin	WS2119-A0	BT, Secure Element
Sigfox only ***with SDK***	SMK	WF923	
	Radiocraft	RC1682-SIG / RC1692HP-SIG	
	M2COMM	UPLYNX RC1 / RC2/4	
	Telecom Design	TD 1207, TD 1508	
	Telit	LE51-868 S	
	Liteon		
	muRata		
Sigfox only *AT Modem,* ***no SDK***	Innocomm	SN10-1x	
	Wisol	WSSFM10Rx	
	Telecom Design	TD 1207R	

sigfox

Radio zones

- RC1: Europe, MEA

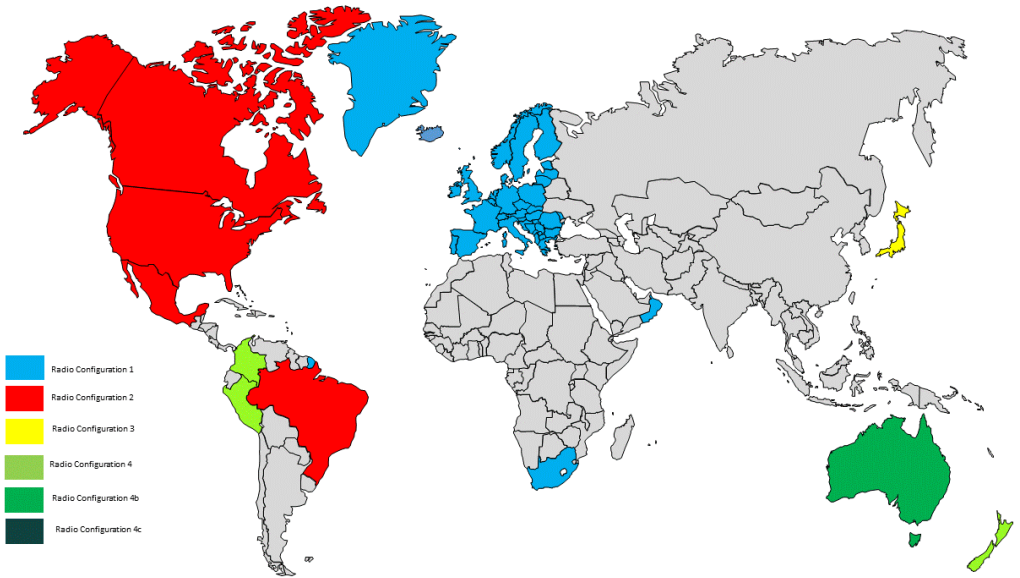
  868 MHz, +14 dBm
- RC2: North America, Brazil

  902 MHz, +23 dBm
- RC3: Japan

  923 MHz, +14 dBm, LBT
- RC4: South America

  920 MHz, +23 dBm
- RC5: Korea

  923 MHz, +23 dBm



Sigfox Monarch: Inter-zone mobility

sigfox

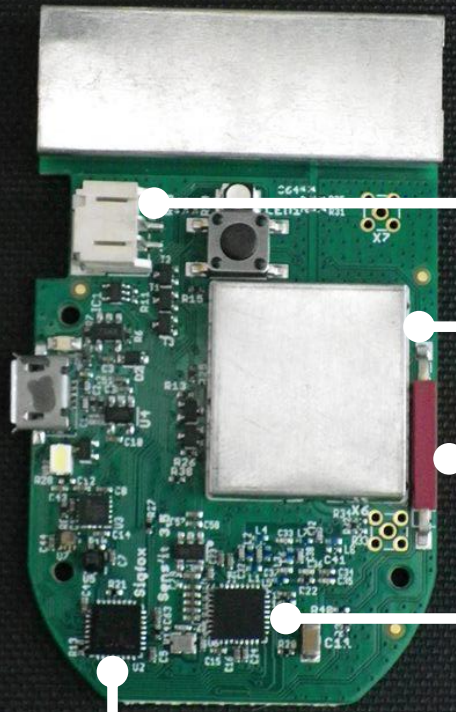
Inside the Sens’it

Most of devices have the same components

- Casing
- Battery
- Sensors
- Microcontroller
- Sigfox Modem
- Antenna

sigfox

Sens’it



Antenna

Battery connector

Radio components

Magnet

Transceiver (CC1125)

MCU (STM 32)

sigfox

Let’s play !

Useful Resources

- **Build** : http://build.sigfox.com
- **Board info:** https://www.arduino.cc/en/Main.ArduinoBoardMKRFox1200
- **Sigfox Ask Forum**: http://ask.sigfox.com
- **Slack:** http://sigfoxbuilders.herokuapp.com

About the MKRFOX Arduino+Sigfox starter kit

Overview

Product released spring 2017

Full sigfox service included

Cortex M0 MCU

Sigfox chipset : Atmel/Microchip ATA8520

Atmel/Microchip ATA8520

Compatible with Sigfox RC1 (Europe + S.Africa)

Addressed using SPI

Datasheet: http://atmel.com

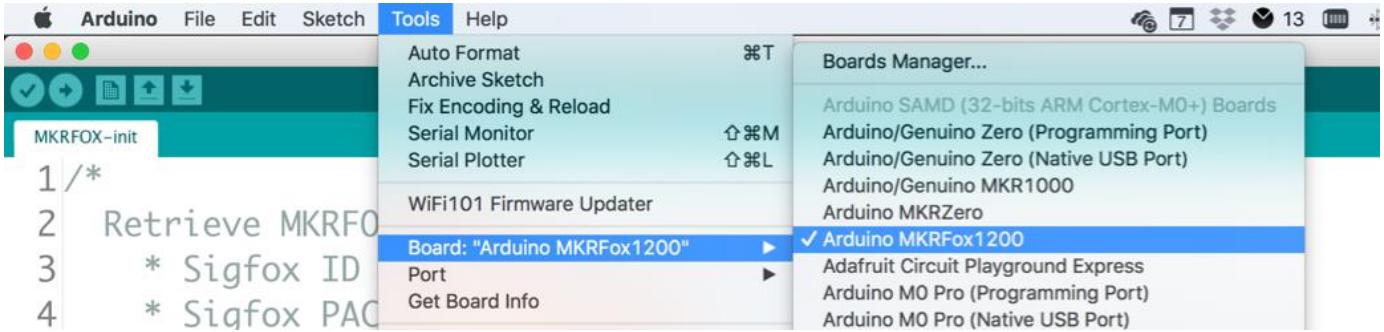
sigfox

Setup the Arduino IDE

Select your board using the Tools > Port menu

Set the board as *Arduino MKRFOX1200*

If board not present, add it using *Boards Manager* => search for MKRFox and install Arduino SAMD boards

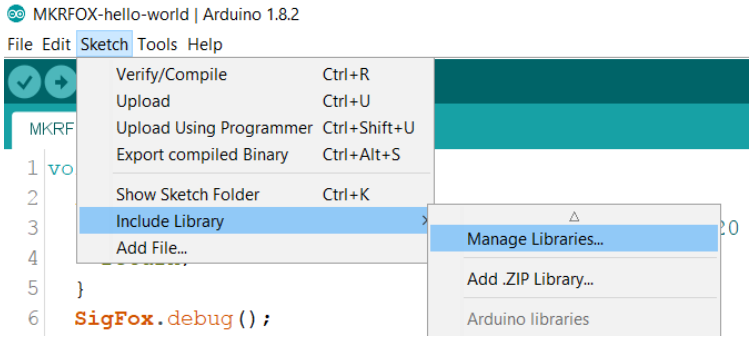


sigfox

Setup the Arduino IDE

Install the following libraries (Sketch => Include Library => Manage Libraries)

- Arduino Sigfox for MKRFox1200
- Arduino Low Power
- RTCZero



sigfox

Download Example Sketches & Slides

https://github.com/sigfox/mkrfox-workshop

Download zip or “git clone”

sigfox

Retrieve your board information

(Connect antenna and remove foam from the board)

Open the MKRFOX-Init.ino sketch

Check that MKRFox1200 board is selected (Tools -> Board)

Check that COM port is correctly detecting the board (Tools -> Port)

sigfox

Upload to your board & open the monitor

Can’t see the COM port?

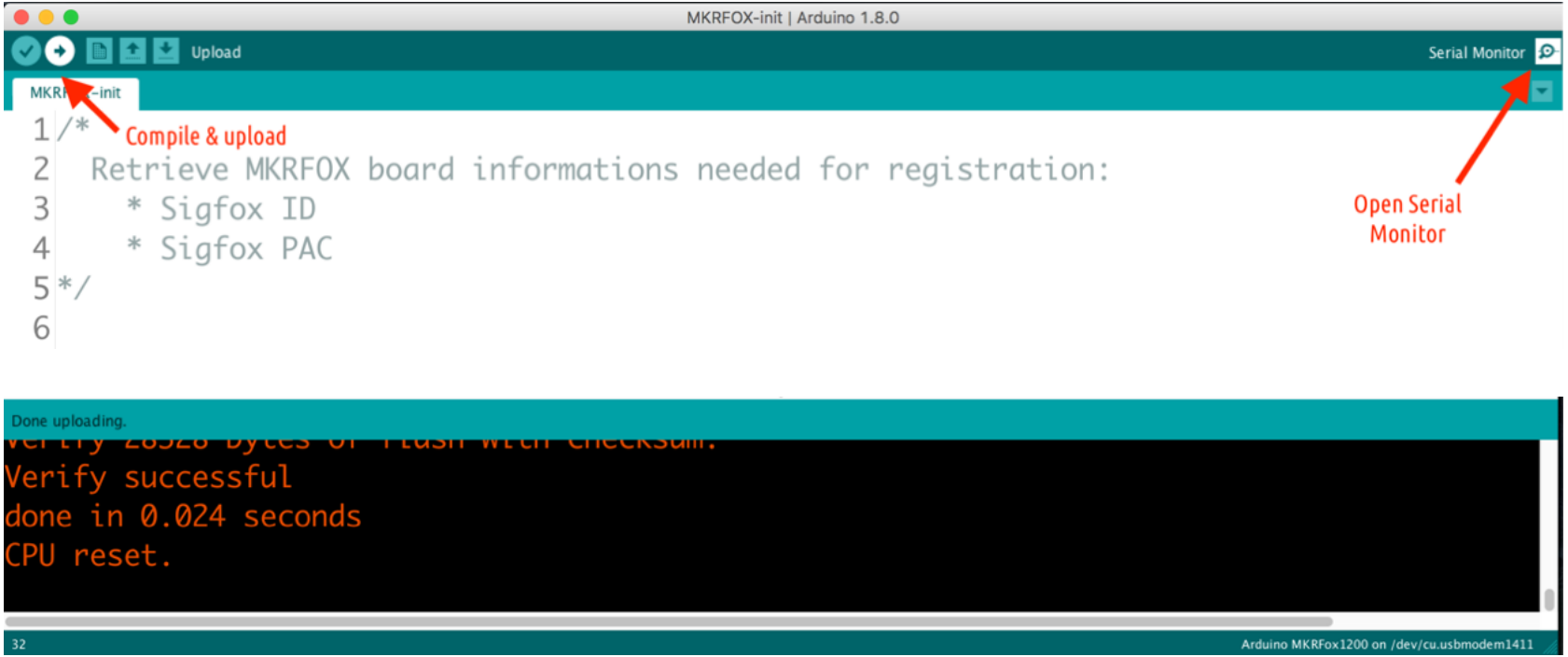
Check your cable supports data transfer

Put board in bootloader mode (required when LowPower library has been loaded) ➔ quick double press reset button

sigfox

Upload to your board & open the monitor

Select COM port attached to MKRFox1200 then upload



Online onboarding

http://buy.sigfox.com/activate

ID/PAC: Retrieved before

Company Name: needs to be unique

Email: double check the spelling!

(account is created before receiving email confirmation..)

sigfox


sigfox
Hello World

Hello World

Open MKRFOX-hello-world.ino and upload this new sketch (COM port might have changed)

```
#include <SigFox.h>
void setup() {
  SigFox.begin();
  short valA = 7700;
  float valB = 654.32;
  SigFox.beginPacket();
  SigFox.write(valA);
  //SigFox.write(valB);
  SigFox.endPacket();
}
void loop(){}
```

sigfox

Message received ?

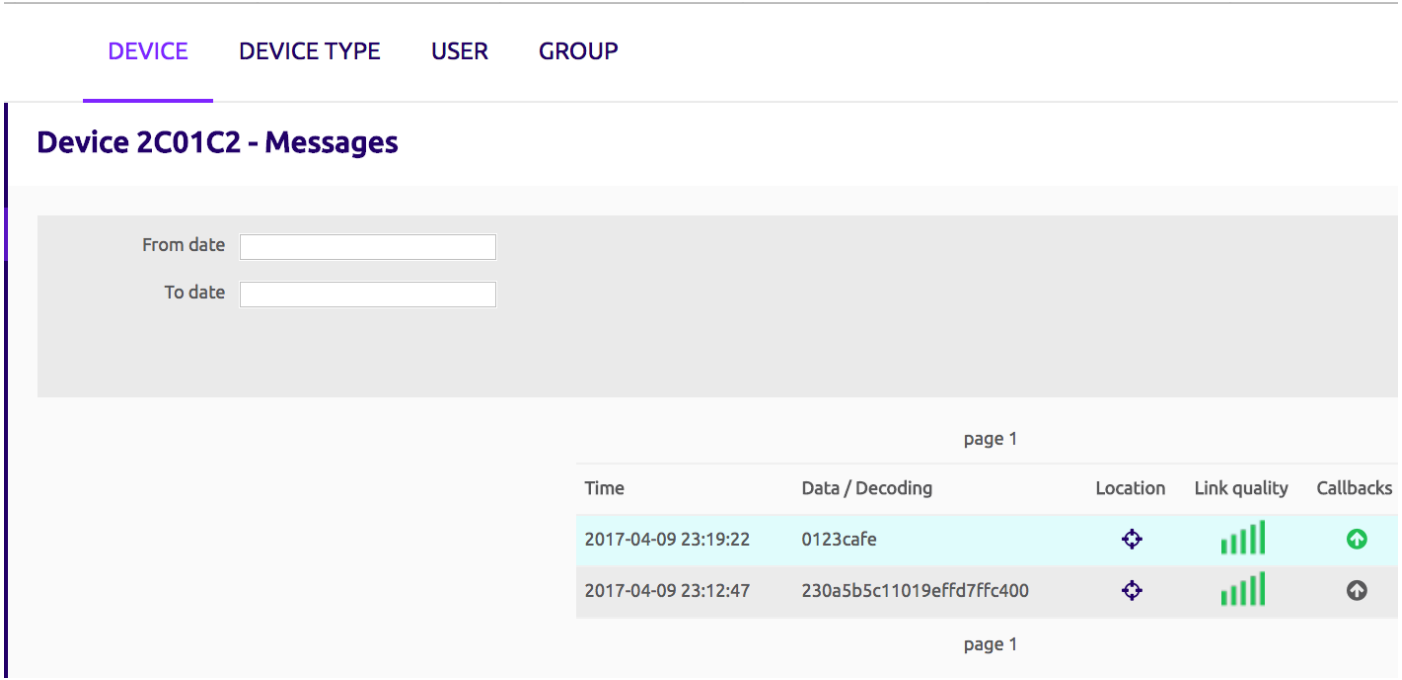
http://backend.sigfox.com (check your e-mails to get credentials)

Navigate to the *devices* menu in the top bar

Click on the ID of your device

Enter the *messages menu* from the left navigation column

Check device messages



sigfox

Callback setup

Device Type menu

Click on your *device type* name

Enter the *Callbacks* menu

Select *new default callback*

sigfox

INFORMATION
LOCATION
ASSOCIATED DEVICES
DEVICES BEING TRANSFERRED
STATISTICS
EVENT CONFIGURATION
CALLBACKS
BULK CREATIONS

Device type 'Thinxtra Solutions RCZ2 kit' - Information

Id: 58e4135d3c8789274562f9e5

Name: Thinxtra Solutions RCZ2 kit

Description: Auto created device type for EVK user : Nicolas Lesconnec

Keep alive: N/A

Group: Nicolas Lesconnec EVK

Payload display: None

Contract: Free eval board contract

Alert Email:

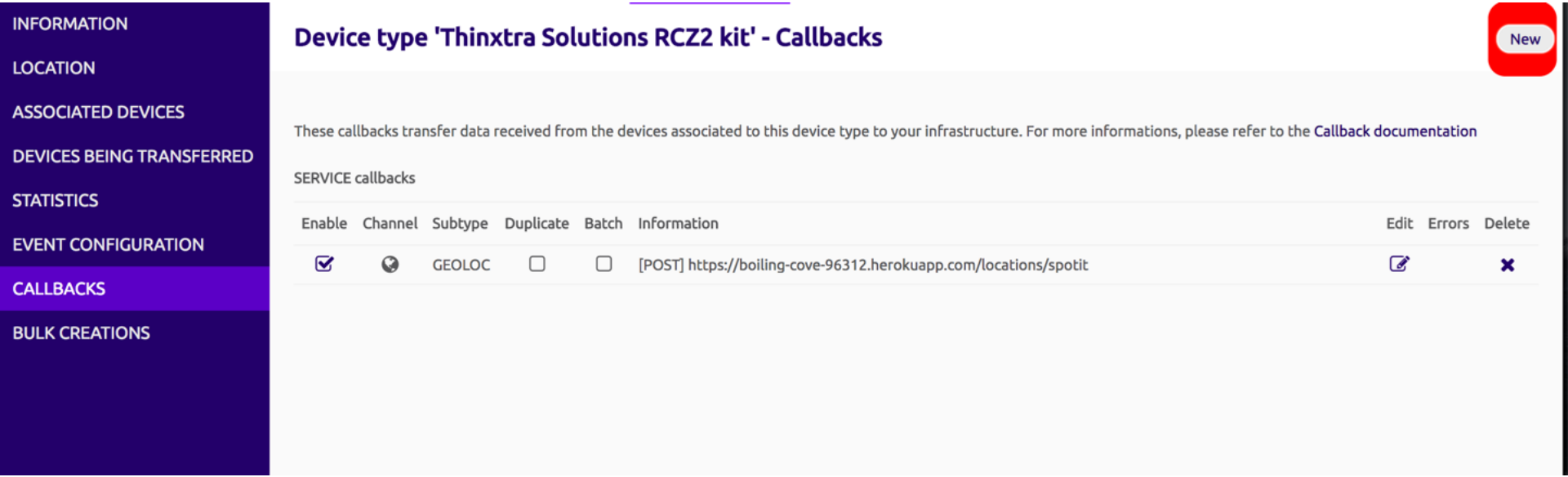
Downlink data hexa: {tapId}0000{rssi}

Creation date: 2017-04-04 23:42:53

Created by: Nicolas Lesconnec

Last edition date: 2017-04-04 23:43:11

Last edited by: Nicolas Lesconnec


INFORMATION
LOCATION
ASSOCIATED DEVICES
DEVICES BEING TRANSFERRED
STATISTICS
EVENT CONFIGURATION
CALLBACKS
BULK CREATIONS
Device type 'Thinxtra Solutions RCZ2 kit' - Callbacks
New
These callbacks transfer data received from the devices associated to this device type to your infrastructure. For more informations, please refer to the Callback documentation
SERVICE callbacks
Enable
Channel
Subtype
Duplicate
Batch
Information
Edit
Errors
Delete
GEOLOC
[POST] https://boiling-cove-96312.herokuapp.com/locations/spotit

sigfox

Device type 'Thinxtra Solutions RCZ2 kit' - New Callback

Create callbacks to connect Sigfox cloud to your server/platform.
A callback is a custom http request containing your device(s) data, along with other variables, sent to a given server/platform when the aforesaid device(s) message is received by Sigfox cloud.

Custom callback

Creates a new callback from **Sigfox cloud** to **your own server**. This is the "default" callback type.
You can create a full custom request (http method, content type, headers, etc).

AWS IoT

AWS IoT is a managed cloud platform that lets connected devices easily and securely interact with cloud applications and other devices. AWS IoT can support billions of devices and trillions of messages, and can process and route those messages to AWS endpoints and to other devices reliably and securely.

AWS Kinesis

Amazon Kinesis is a platform for streaming data on AWS, offering powerful services to make it easy to load and analyze streaming data, and also providing the ability for you to build custom streaming data applications for specialized needs.

Microsoft Azure™ Event hub

Event Hubs is an event processing service that provides event and telemetry ingress to the cloud at massive scale, with

Device type Thinxtra Solutions RCZ2 kit - Callback new

Callbacks

Type: DATA | UPLINK

Channel: EMAIL

Send duplicate: ☐

Custom payload config:

Recipient: nicolas.lesconnec@sigfox.com

Multiple emails allowed separated by comma, semicolon or new line

Subject syntax: Subject with device {device}
Message syntax: Message containing time {time}, key1 {var1}, key2 {var2}...
Available variables: device, time, duplicate, snr, station, data, avgSnr, lat, lng, rssi, seqNumber
Custom variables:

Subject: Device {device}

Message: Data received : {data}

Callback status

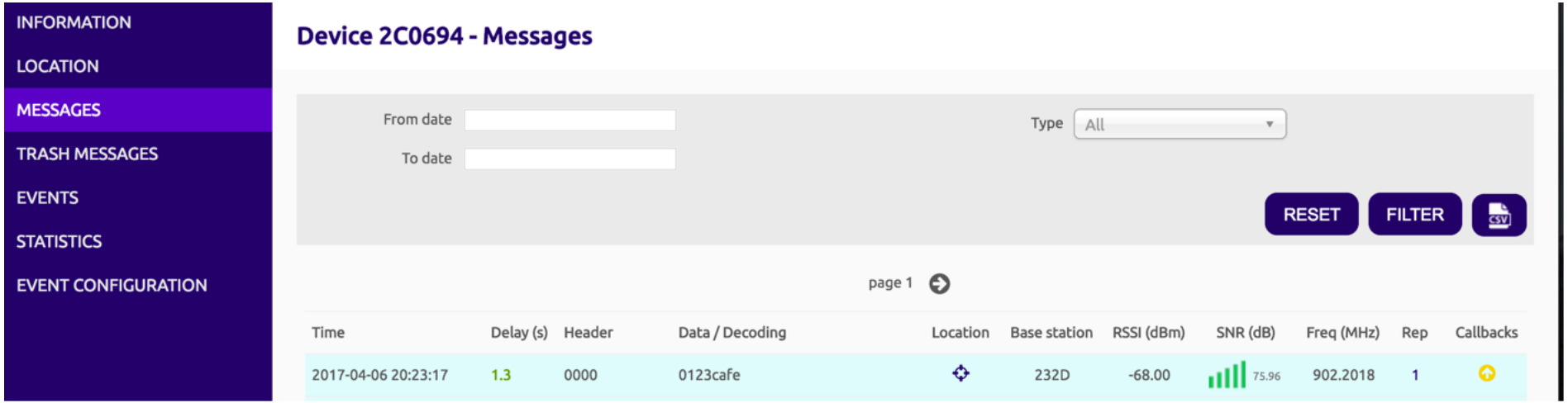
In the *Devices > Messages* panel, you have a indicator of the callback status (an arrow)

Black : in progress

Green : Callback OK

Red : Callback KO (at least one of the callbacks failed)

Click the arrow to display details.


INFORMATION
LOCATION
MESSAGES
TRASH MESSAGES
EVENTS
STATISTICS
EVENT CONFIGURATION
Device 2C0694 - Messages
From date
To date
Type
All
RESET
FILTER
CSV
page 1
Time
Delay (s)
Header
Data / Decoding
Location
Base station
RSSI (dBm)
SNR (dB)
Freq (MHz)
Rep
Callbacks
2017-04-06 20:23:17
1.3
0000
0123cafe
232D
-68.00
75.96
902.2018
1

sigfox


sigfox
Frame parsing

Sigfox payload display feature

Using a « simple » grammar, you can ask Sigfox to parse your incoming data

This is done at the device type level

sigfox

Device type 'Thinxtra Solutions RCZ2 kit' - Information

Disengage sequence number | Edit | Delete

Id: 58e4135d3c8789274562f9e5

Name: Thinxtra Solutions RCZ2 kit

Description: Auto created device type for EVK user : Nicolas Lesconnec

Keep alive: N/A

Group: Nicolas Lesconnec EVK

Payload display: None

Contract: Free eval board contract

Alert Email:

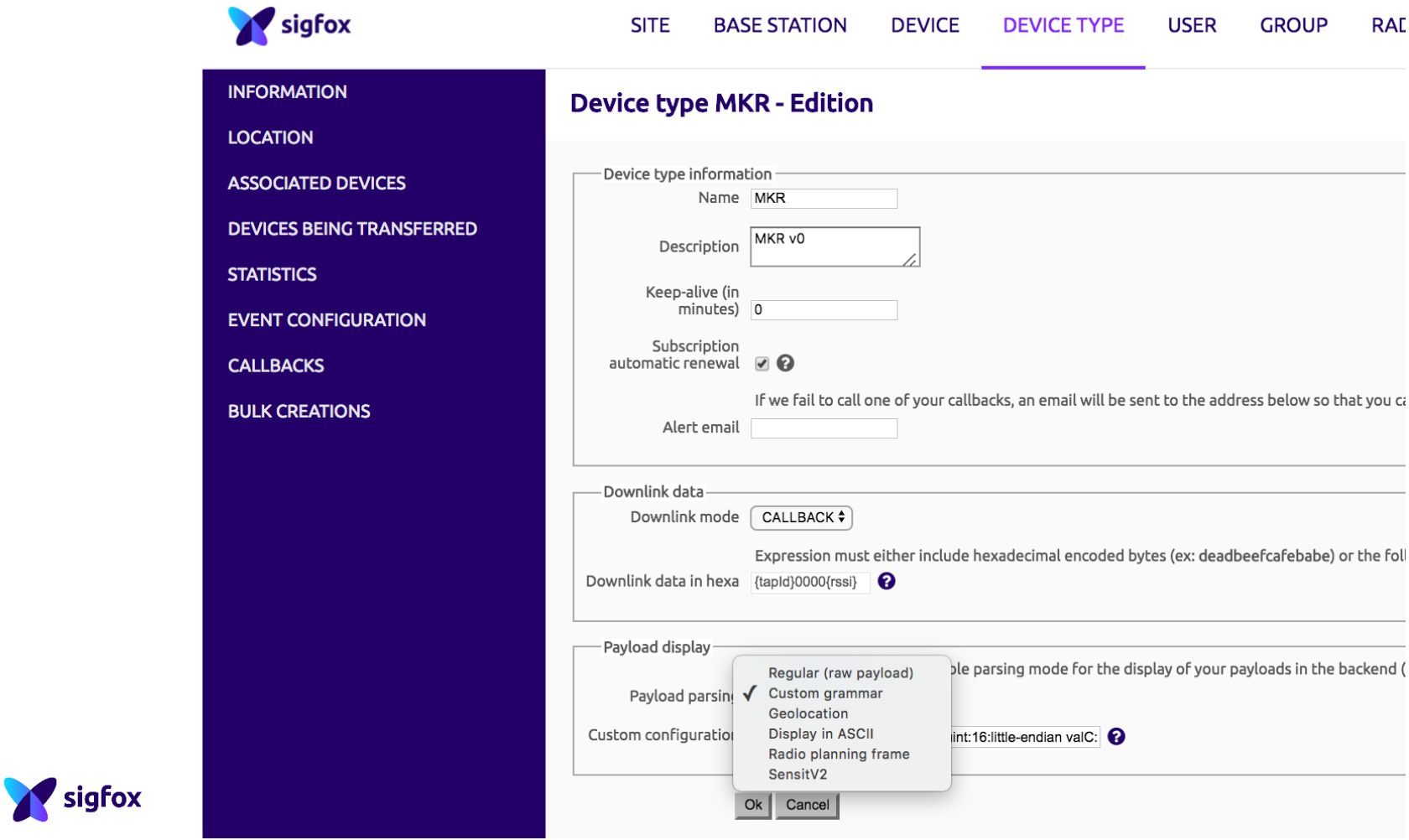
Downlink data hexa: {tapId}0000{rssi}

Creation date: 2017-04-04 23:42:53

Created by: Nicolas Lesconnec

Last edition date: 2017-04-04 23:43:11

Last edited by: Nicolas Lesconnec


sigfox
SITE
BASE STATION
DEVICE
DEVICE TYPE
USER
GROUP
RAD
INFORMATION
LOCATION
ASSOCIATED DEVICES
DEVICES BEING TRANSFERRED
STATISTICS
EVENT CONFIGURATION
CALLBACKS
BULK CREATIONS
Device type MKR - Edition
Device type information
Name
MKR
Description
MKR v0
Keep-alive (in minutes)
0
Subscription automatic renewal
If we fail to call one of your callbacks, an email will be sent to the address below so that you ca
Alert email
Downlink data
Downlink mode
CALLBACK
Expression must either include hexadecimal encoded bytes (ex: deadbeefcafebabe) or the foll
Downlink data in hexa
{tapId}0000{rssi}
Payload display
ble parsing mode for the display of your payloads in the backend (
Payload parsing
Regular (raw payload)
Custom grammar
Geolocation
Display in ASCII
Radio planning frame
SensitV2
Custom configuratio
int:16:little-endian valC:
Ok
Cancel
sigfox

Parsing the Hello World sample

Modify the sketch to send 3 values in a same message

```
short valA = 7700;
 short valB = 128;
 float valC = 654.32;
 SigFox.beginPacket();
 SigFox.write(valA);
 SigFox.write(valB);
 SigFox.write(valC);
 SigFox.endPacket();
```

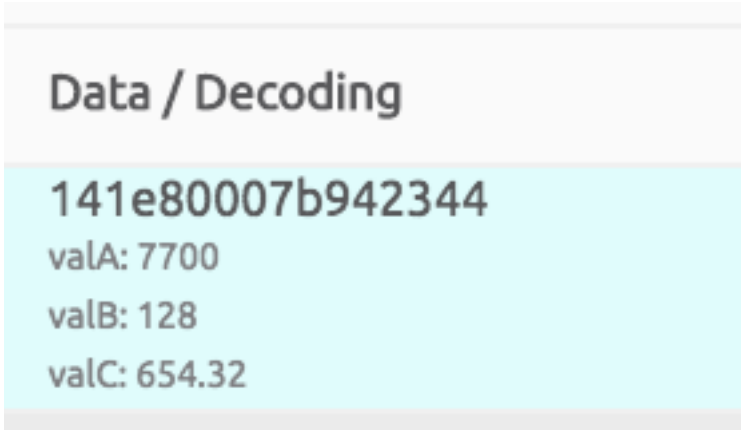
sigfox

Set a custom grammer

valA & valB are shorts : 16 bits

valC is a 32 bits float

```
valA::uint:16:little-endian valB::uint:16:little-endian valC::float:32:little-endian
```



sigfox

Downlink Callback

How does it work?

Downlink flag included in Sigfox message

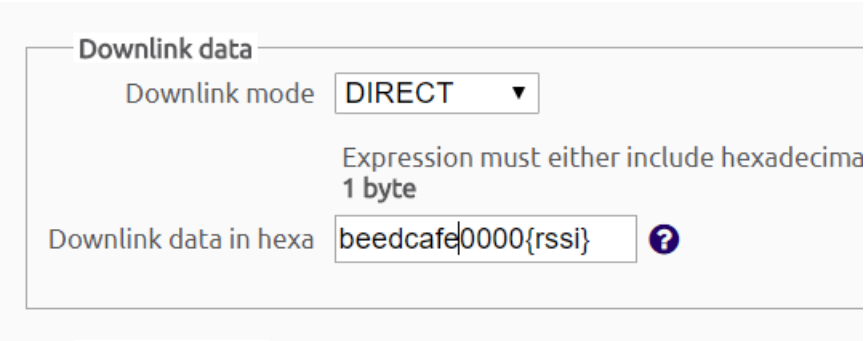
20 sec after first frame transmission, the module wakes up and waits for downlink response (25 sec window)

Downlink Callback setup

Automatic callback: *Device Type > Informations > Edit*

Set Downlink mode to *DIRECT*

Enter an 8 bytes value



sigfox

Device type 'Thinxtra Solutions RCZ2 kit' - Information

Disengage sequence number | Edit | Delete

Id: 58e4135d3c8789274562f9e5

Name: Thinxtra Solutions RCZ2 kit

Description: Auto created device type for EVK user : Nicolas Lesconnec

Keep alive: N/A

Group: Nicolas Lesconnec EVK

Payload display: None

Contract: Free eval board contract

Alert Email:

Downlink data hexa: {tapId}0000{rssi}

Creation date: 2017-04-04 23:42:53

Created by: Nicolas Lesconnec

Last edition date: 2017-04-04 23:43:11

Last edited by: Nicolas Lesconnec

Device type Thinxtra Solutions RCZ2 kit - Edition

Device type information

Name: Thinxtra Solutions RCZ2 I

Description: Auto created device type for EVK user : Nicolas

Keep-alive (in minutes): 0

If we fail to call one of your callbacks, an email will be sent to the address below so that you can take action to fix the problem.

Alert email:

Downlink data

Downlink mode: DIRECT / CALLBACK

Expression must either include hexadecimal encoded bytes (ex: deadbeefcafebabe) or the following variables: - {time} 4 bytes - {tapId} 4 bytes - {rssi} 2 bytes

Downlink data in hexa: {tapId}0000{rssi}

Payload display

Select below the most suitable parsing mode for the display of your payloads in the backend (mostly appropriate for debugging and development)

Payload parsing: Regular (raw payload)

Ok Cancel

Sample code

Simple change

`SigFox.endPacket();` to

`SigFox.endPacket(true);`

This will request a response from the network

sigfox

Handle the response

Open MKRFOX-downlink.ino and upload this new sketch

```
void loop(){
  while (SigFox.available()) {
      Serial.print("0x");
      Serial.println(SigFox.read(), HEX);
    }
 }
```

sigfox

Geolocation

Geoloc callback

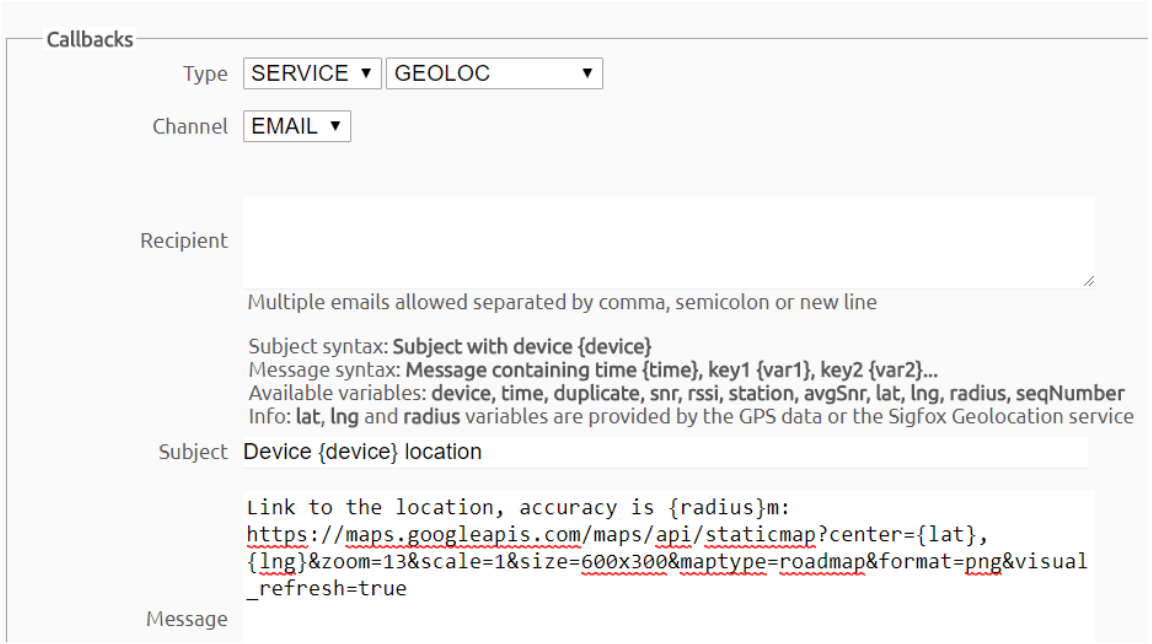
Simply create a SERVICE > GEOLOC callback, and receive latitude + longitude + accuracy

Geolocation Callback

Create a new Service > Geoloc callback

Use following URL to center the map:

https://maps.googleapis.com/maps/api/staticmap?center={lat},{lng}&zoom=13&scale=1&size=600x300&maptype=roadmap&format=png&visual_refresh=true



sigfox