Introduction

This document aims to help users estimate the battery consumption of WS2 devices, considering three types of available technology: SigFox, Wi-Fi and Cellular. Each of these technologies has unique communication and consumption characteristics, and understanding how they differ is critical to optimizing device performance.
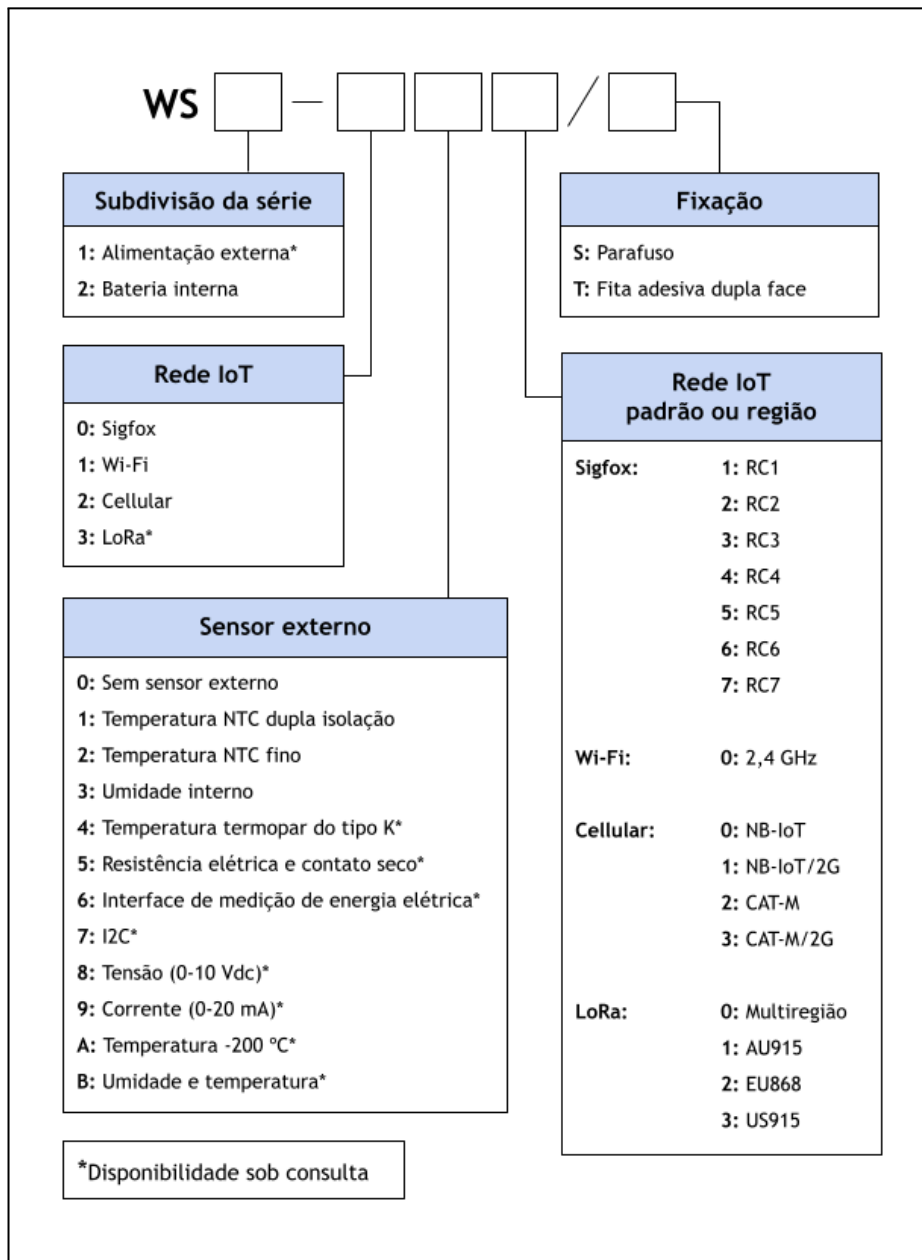
Looking at device settings, we present four main inputs for estimating battery consumption:

- **Messages per day**: Number of messages sent daily, considering different types of message, such as logs, events and location.

- **Scans Wi-Fi per day**: Number of Wi-Fi scans performed in a day, essential for location estimation.

- **Parameterization request and ADD**: Messages sent to request the device parameterization on dots platform and the use of the ADD to guarantee the secure sending of data.

- **Accelerometer data rate**: Setting the accelerometer to different frequencies, which will influence the sensitivity of the device to detect motion.

The following instructions describe how to find the value of all 4 inputs according to the device's parameterization and use case.

Technology

To identify your device technology, you need to check the table below:

WS ☐ – ☐ ☐ ☐ / ☐

Subdivisão da série

1: Alimentação externa*
2: Bateria interna

Fixação

S: Parafuso
T: Fita adesiva dupla face

Rede IoT

0: Sigfox
1: Wi-Fi
2: Cellular
3: LoRa*

**Rede IoT
padrão ou região**

Sigfox:	1: RC1
	2: RC2
	3: RC3
	4: RC4
	5: RC5
	6: RC6
	7: RC7
Wi-Fi:	0: 2,4 GHz
Cellular:	0: NB-IoT
	1: NB-IoT/2G
	2: CAT-M
	3: CAT-M/2G
LoRa:	0: Multiregião
	1: AU915
	2: EU868
	3: US915

Sensor externo

0: Sem sensor externo
1: Temperatura NTC dupla isolação
2: Temperatura NTC fino
3: Umidade interno
4: Temperatura termopar do tipo K*
5: Resistência elétrica e contato seco*
6: Interface de medição de energia elétrica*
7: I2C*
8: Tensão (0-10 Vdc)*
9: Corrente (0-20 mA)*
A: Temperatura -200 ºC*
B: Umidade e temperatura*

*Disponibilidade sob consulta

Here are some examples of WACS to use as a reference:

- WS2-001: means it operates on battery, has Sigfox communication, does not have an external sensor, and is in zone RC1;
- WS2-120: means it operates on battery, has Wi-Fi communication, a slim temperature sensor, and operates in the 2.4GHz range;
- WS2-212: means it operates on battery, has cellular communication, a thick temperature sensor, and uses CAT-M as the data transmission protocol.

Each type of device has a different consumption. Therefore, in the technology tab you can choose the type of device technology you want to measure.

Document code: AN-0002-Battery Consumption Estimation-EN-R04

AYGA		
TECHNOLOGY		Cellular ▾
MESSAGES PER DAY		24
SCANS WI-FI PER DAY		0
PARAMETRIZATION REQUEST AND ADD		4
ACCELEROMETER DATA RATE (Hz)		Disabled ▾
BATTERY CONSUMPTION	DAYS	328,69
	MONTHS	10,81
	YEARS	0,90

Messages per day

One important factor that impacts battery lifetime is the number of messages sent per day. WS2 devices send three different types of messages:

- Log
- Event messages
- Location

To calculate the number of messages sent with a log period, it is important to know the type of log in the feature that you are using:

Log

Logs: are periodic records made by a WS2 device that are monitored by a platform called dots, including measurements such as temperature, humidity and other variables. These registers can be configured according to the specific needs of the customer.

Log period: The log period is the time interval in which the device takes measurements of temperature, humidity or other variables. For example, if the log period is set to 10 minutes, the device will take a measurement every 10 minutes.

Log message: When the device is configured with a log period of 10 minutes, it collects data and takes measurements over 10 consecutive periods. After these 10 periods, the dots platform will send a message based on these measurements.

Document code: AN-0002-Battery Consumption Estimation-EN-R04
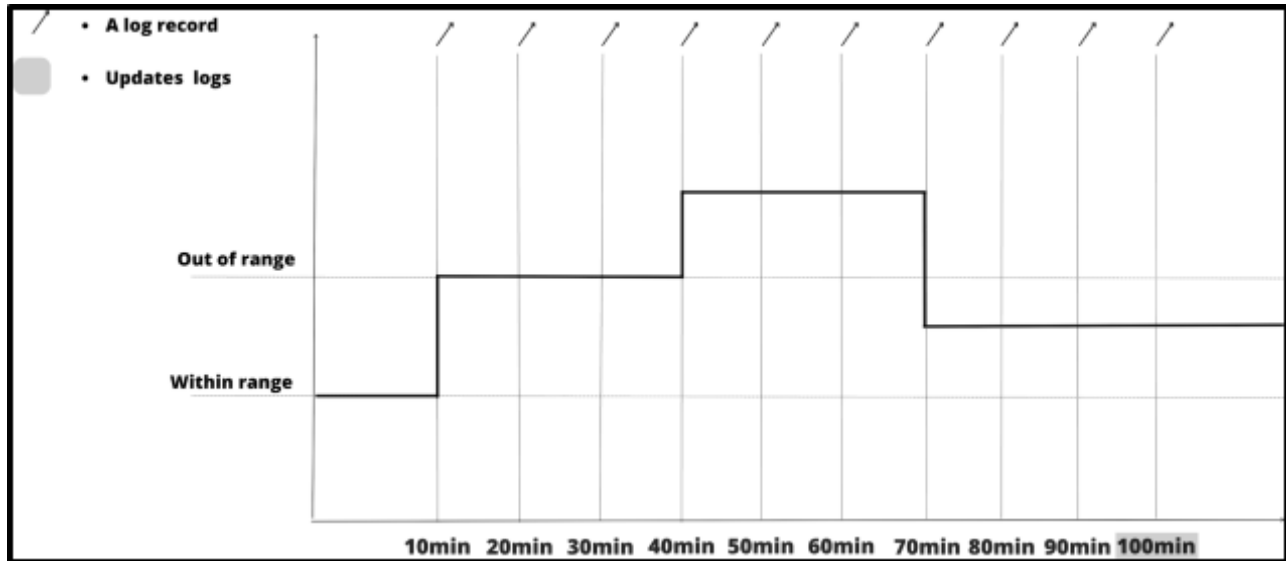
SigFox

- **Configuration:**
    - Temperature log period: 10 minutes
- **Calculation:**
    - 10 minutes x 10 periods: 100 minutes (That is, the log period is 10 minutes, that is, every 10 log records, the dots platform will send a message).
    - 100 minutes: 1,66 hours
    - 24h÷1,66 hours : 14,45 messages per day
    - 14,45 messages per day is the number that will be used in the calculation of battery estimation.

When **ADD is enabled**, one **SigFox** message is sent every 6 periods (instead of the usual 10), also, we can estimate the number of messages lost that will be sent through ADD.
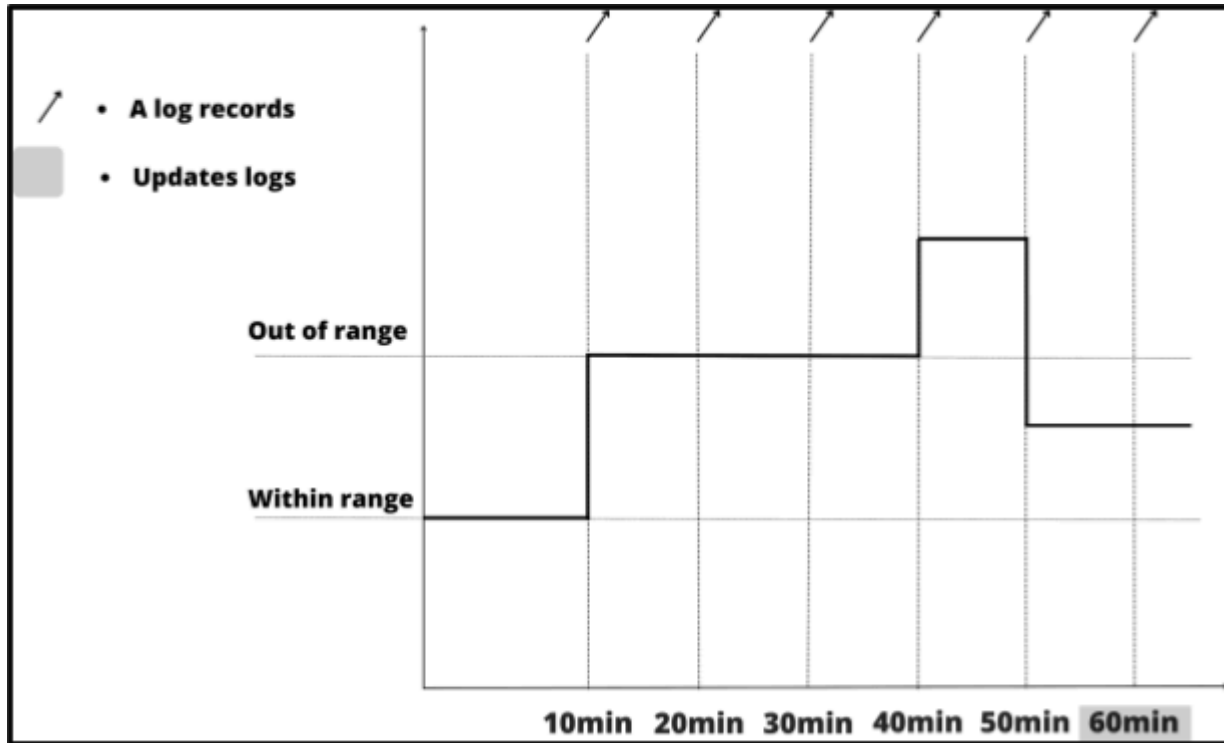
Example:

- **Configuration:**

  - Temperature log period: 10 minutes

- **Calculation of the temperature log if ADD is enabled:**

  - 10 minutes x 6 periods: 60 minutes

  - 60 minutes: 1 hours

  - 24h÷1 hours : 24 messages per day

Cellular and Wi-Fi

The device types for **Cellular** and **Wi-Fi**, in its most recent versions it has ADD automatically enabled. Therefore, a period of 6 logs.

Example:

- **Configuration:**

  - Temperature log period: 10 minutes

- **Calculation:**

  - 10 minutes x 6 periods: 60 minutes

    60 minutes: 1 hour

  - 24h÷1 hours : 24 messages per day

- **Configuration:**

  - Temperature log period: 15 minute

- **Calculation:**

- 15 minutes x 6 periods: 90 minutes

- 90 minutes: 1,5 hours

- 24h÷1,5 hours : 16 messages per day

Event

Event: events only happen when there is some value out of specified parameters thus the value of messages is relative and must be estimated according to your device expected behavior.

- Events of temperature

Temperature events occur when the device goes outside the acceptable range of values configured for the device. There are some settings in the system:

- TED - Temperature event delay
- TE   - Temperature event
- TTD - Time to disable temperature event
- TTE - Time to enable temperature event

When the device leaves the temperature range, it sends a message from a TED (Temperature Event Delay), which can be configured by the "dots". After the device has exceeded the TED time, it will send the first event message, advising that the device has already exceeded this delay time. Following this initial delay, it will send TE (Temperature Event) messages periodically at predefined intervals set in the "dots" settings. This TE will be disabled when the total sum of time spent measuring reaches the configured value for TTD (Time to Disable Temperature Event), which is the disabling of event messages. Once the device is disabled, it will no longer send event messages. The TTE (Time to Enable Temperature Event) is used so that when the device returns to its acceptable range, it will need some time to re-enable the events. If, by chance, it returns to its temperature range and then leaves the range again for a shorter time configured in the TTE in the 'dots', it will continue without event message submissions. If it stays longer in the acceptable range, greater than the TTE, it will re-enable the event messages.

Example

- **Configuration**
    - Temperature event delay: 15 min
    - Temperature event: 5 min
    - Time to disable temperature event: 30 min
    - Time to enable temperature event: 20 min

Document code: AN-0002-Battery Consumption Estimation-EN-R04

- **Situation**

  - Device left the temperature range 00:20 to 00:35. It generated the first event respecting the delay time (15 minutes).

  - At 00:35, the device generated the first event, indicating that the TED was exceeded.

  - From that moment on, the device started to record messages every 5 minutes (TE) 4 - Messages continued to be sent until they accounted for 30 minutes (TTD).

  - Note that the device returned to the acceptable range for a time shorter than the TTE (20 min) and therefore did not send event messages during this period.

  - After returning to the acceptable range, the device stayed in the range from 00:30 to 00:50, a time longer than the TTE (20 minutes), which re-enabled the sending of event messages.
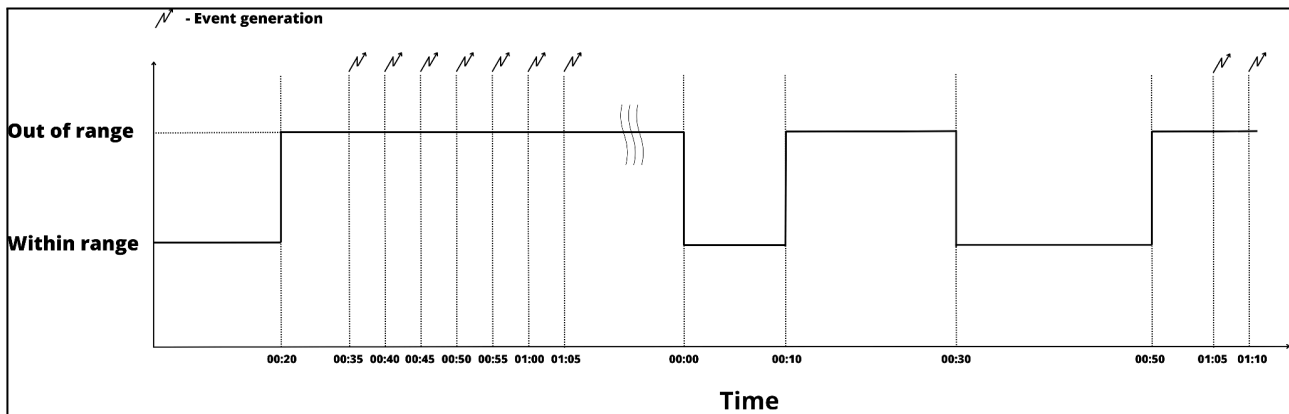
In the graph, it simulates an event condition, where there is a device within the range and later outside the ranges of acceptable values, causing the device to generate events.

Certainly, there can be various types of events, including:

- Double tap event

- Low battery event

- Device offline event

Each of these events can have its own specific behavior and configurations, similar to the temperature event described above earlier. The device can send messages to the and notifications related to these events based on the specified parameters and settings for each type of event.

Document code: AN-0002-Battery Consumption Estimation-EN-R04

Localization

SigFox

WS2 sends the number of location messages according to the chosen period and the Number of Macs/ RSSI that are being used. It is possible to visualize the influence of these factors according to the following table:

Number of MACs	Messages
2 MACs	1
2 MACs + RSSI	2
4 MACs	2
4 MACs + RSSI	3

Example 1:

- **Configuration:**
    - Location: Every 30 minutes
    - Number of MACs: 4 MACs
    - Increased location with RSSI: Enabled
- **Calculation:**
    - 4 MACS + RSSI: 3 messages per period (30 min)
    - 24h÷0,5h: 48 periods
    - 48x3 messages per period: 144 messages per day
    - Total: 144 messages per day

Example 2:

- **Configuration:**
    - Location: Every 1 hour
    - Number of MACs: 4 MACs
    - Increased location with RSSI: Enabled
- **Calculation:**
    - 4 MACS + RSSI: 3 messages per period (1 hour)
    - 24h÷1h: 24 periods
    - 24x3 messages per period: 72 messages per day
    - Total: 72 messages per day

Example 3:

- **Configuration:**

- ○ Location: Every 2 hours

    - ○ Number of MACs: 2 MACs

    - ○ Increased location with RSSI: Enabled

- **Calculation:**

    - ○ 2 MACS + RSSI: 2 messages per period (2 hours)

    - ○ 24h÷2h: 12 periods

    - ○ 12x2 messages per period: 24 messages per day

    - ○ Total: 24 messages per day

Wi-Fi and Cellular

In **Wi-Fi** and **Cellular** devices it is irrelevant to the number of messages. In other words, the device can send a message regardless of whether they are configured for 2 MACs or 4 MACs plus RSSI (Received Signal Strength Indicator).

Number of MACs	Messages
2 MACs	1
2 MACs + RSSI	1
4 MACs	1
4 MACs + RSSI	1

Example 1:

- **Configuration:**

    - ○ Location: Every 30 minutes

    - ○ Number of MACs: 4 MACs

    - ○ Increased location with RSSI: Enabled

- **Calculation:**

    - ○ 4 MACS + RSSI: 1 messages per period (30 min)

    - ○ 24h÷0,5h: 48 periods

    - ○ 48x1 messages per period: 48 messages per day

    - ○ Total: 48 messages per day

Example 2:

- **Configuration:**

    - ○ Location: Every 1 hour

    - ○ Number of MACs: 4 MACs

    - ○ Increased location with RSSI: Enabled

- **Calculation:**
    - 4 MACS + RSSI: 1 messages per period (1 hour)
    - 24h÷1h: 24 periods
    - 24x1 messages per period: 24 messages per day
    - Total: 24 messages per day

Example 3:

- **Configuration:**
    - Location: Every 2 hours
    - Number of MACs: 2 MACs
    - Increased location with RSSI: Enabled
- **Calculation:**
    - 2 MACS + RSSI: 1 messages per period (2 hours)
    - 24h÷2h: 12 periods
    - 12x1 messages per period: 12 messages per day
    - Total: 12 messages per day

> ℹ️ NOTE: The same rules apply to location on motion, but this feature is enabled only when the device is on motion.

Scans Wi-Fi

Wi-Fi scans are important for estimating the location of WS2 devices. A Wi-Fi scan occurs when the device looks for a local network to update its location. The number of Wi-Fi scans performed per day is directly related to the chosen location period.

Location estimation is based on the number of Scans wi-fi made by WACS, so to calculate the number of Scans wi-fi use the period defined in Location.

To calculate the number of Wi-Fi scans per day, follow the steps below.

For example:

- Period: 6 hours
- 24÷6: 4 scans per day

For example:

- Period: 3 hours
- 24÷3: 8 scans per day

For example:

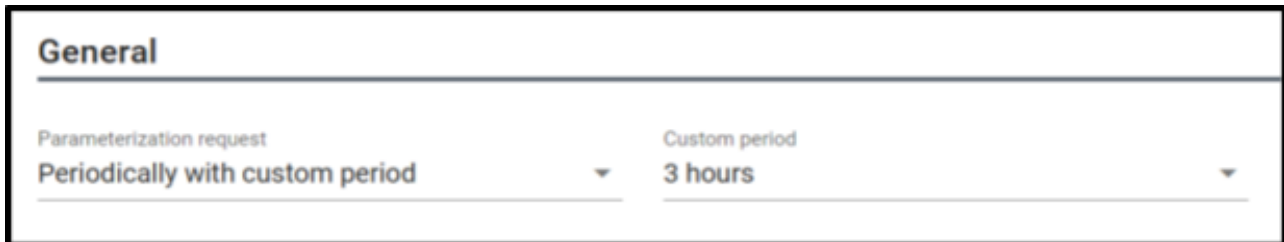Period: 30 min = 0,5 hours
- 24÷0,5: 48 scans per day

Parametrization request and ADD

What is a Parameterization Request? The parameterization request checks whether or not there is any change in the dots platform settings, and then executes the parameterization. You can determine how many hours this parameterization will take place.
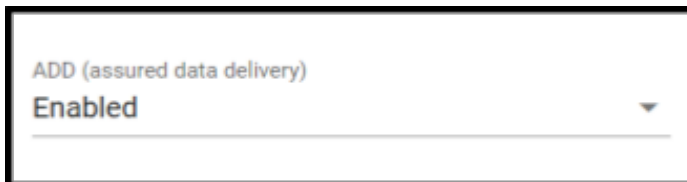

What is an ADD? The ADD is the guarantee of sent messages, enabling the data recovery feature for records.

This parametrization is used only for devices SigFox when a config can be enabled and disabled. **The latest versions of these Wi-Fi and Cellular devices have the functionality already enabled in the firmware version.**

Device SigFox

Example:

- **Configuration:**
  - Custom period: 6 hours
  - ADD: Enabled
  - Parametrization request: Enabled
- **Calculation**
  - ADD messages per day: 24h÷6 hours: 4 messages per day
  - Parametrization request per day: 24÷6: 4 messages per day
  - PARAMETRIZATION REQUEST AND ADD = ADD messages per day + Parametrization request per day
  - PARAMETRIZATION REQUEST AND ADD = 4 ADD messages per day + 4 Parametrization request per day
  - PARAMETRIZATION REQUEST AND ADD = 8 messages per day

Document code: AN-0002-Battery Consumption Estimation-EN-R04

Devices Wi-Fi and Cellular

Wi-Fi and **Cellular** devices have the option to enable and disabled add in their settings, you can use the example above by enabling and disabling it. The examples below serve as examples for both **Wi-fi** and **Cellular**.

The latest versions of **Wi-Fi** and **Cellular** have this functionality enabled automatically.

Example:

- **Configuration:**
  - Custom period: 6 hours
  - ADD: Enabled (enabled automatically)
  - Parametrization request: Enabled
- **Calculation**
  - ADD messages per day: 24h÷6 hours: 4 messages per day
  - Parametrization request per day: 24÷6: 4 messages per day

PARAMETRIZATION REQUEST AND ADD = 8 messages per day

Example:

- **Configuration:**
  - Custom period: 3 hours
  - ADD: Enabled (enabled automatically)
  - Parametrization request: Enabled
- **Calculation**
  - ADD messages per day: 24h÷3 hours: 8 messages per day
  - Parametrization request per day: 24÷3: 8 messages per day

PARAMETRIZATION REQUEST AND ADD = 16 messages per day

> 🛈 NOTE: Parametrization request and ADD are independent of each other despite using the same custom period.

Accelerometer

ACCELEROMETER DATA RATE (Hz)	Disabled ▾

There are 4 accelerometer options, which would be: Disabled, 12.5 Hz, 50 Hz and 200 Hz. The accelerometer basically serves to increase the sensitivity frequency to detect the state of movement. That is, the lower the frequency, the lower the sensitivity to the "touch", the higher

the frequency, the greater the sensitivity of the touch, and the higher the frequency, the greater the consumption.

Battery estimation

After calculating the number of messages and scan wi-fi, choose the accelerometer data rate (according to the instructions in the tooltips available in Ayga dots), and fill the data in the table available in the document annex.

Related articles

The following Technical Characteristics document has detailed instructions for all the features described in this announcement.

They are all available in: Suporte | AYGA

Code	Name	Language
UM-WACS	Manual do WACS	PORTUGUÊS

Any Doubts?

Visit the Ayga website for more information: https://www.ayga.com.br/suporte

Contact us via:

- +55 51 2160-7180
- support@ayga.com.br