



**TECHNICAL NOTE**

***BeanDevice® Power Mode Management & Ultra-Low Power Strategy***





Rethinking sensing technology

Document version : 1.0

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BeanDevice® power management

## DOCUMENT

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## 1. TECHNICAL SUPPORT

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For general contact, technical support, to report documentation errors and to order manuals, contact **BeanAir Technical Support Center** (BTSC) at:  
[tech-support@beanair.com](mailto:tech-support@beanair.com)

For detailed information about where you can buy the BeanAir equipment/software or for recommendations on accessories and components visit:




[www.beanair.com](http://www.beanair.com)

To register for product news and announcements or for product questions contact BeanAir's Technical Support Center (BTSC).

Our aim is to make this user manual as helpful as possible. Please keep us informed of your comments and suggestions for improvements. BeanAir appreciates feedback from the users.

## 2. VISUAL SYMBOLS DEFINITION

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<i>Visual</i>	<i>Definition</i>
	<p><u>Caution or Warning</u> – Alerts the user with important information about BeanAir wireless sensor networks (WSN), if this information is not followed, the equipment /software may fail or malfunction.</p>
	<p><u>Danger</u> – This information <b>MUST</b> be followed if not you may damage the equipment permanently or bodily injury may occur.</p>
	<p><u>Tip or Information</u> – Provides advice and suggestions that may be useful when installing BeanAir Wireless Sensor Networks.</p>

### 3. ACRONYMS AND ABBREVIATIONS

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AES	Advanced Encryption Standard
CCA	Clear Channel Assessment
CSMA/CA	Carrier Sense Multiple Access/Collision Avoidance
GTS	Guaranteed Time-Slot
kSps	Kilo samples per second
LLC	Logical Link Control
LQI	Link quality indicator
LDCDA	Low duty cycle data acquisition
MAC	Media Access Control
PAN	Personal Area Network
PER	Packet error rate
RF	Radio Frequency
SD	Secure Digital
WSN	Wireless sensor Network

## 4. RELATED DOCUMENTS

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In addition to this User manual, please consult the application notes & technical notes:

### 4.1 APPLICATIONS NOTES

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<i>Nom du document</i>	<i>Produits concernés</i>	<i>Description</i>
<b><i>AN_RF_007 : Beanair_WSN_Deployment“</i></b>	All BeanAir products	Wireless sensor networks deployment guidelines
<b><i>AN_RF_006 – „How to extend your wireless range“</i></b>	All BeanAir products	A guideline very useful for extending your wireless range
<b><i>AN_RF_005 Ver 1.0- BeanGateway® &amp; Data Terminal Equipment Interface</i></b>	BeanGateway®	DTE interface Architecture on the BeanGateway®
<b><i>AN_RF_004 V1.0-1. Coexistence And Interferences@2.4GHz</i></b>	All BeanAir products	Coexistence & interferences of different RF technologies in the 2.4 GHz frequencies band.
<b><i>AN_RF_003 V1.1 IEEE 802.15.4 2.4 GHz Vs 868 MHz (English)</i></b>	All BeanAir products	Comparison between 868 MHz frequency band and a 2.4 GHz frequency band.

## 4.2 TECHNICAL NOTES

<i>Document name</i>	<i>Concerned products</i>	<i>Description</i>
<b><i>TN_RF_010 – « BeanDevice® Power Management »</i></b>	All the BeanDevice®	This technical note describes the sleep & active power mode on the BeanDevice®.
<b><i>TN_RF_009 – « BeanGateway® management on LAN infrastructure »</i></b>	BeanGateway®	BeanGateway® integration on a LAN infrastructure
<b><i>TN_RF_008 – “Data acquisition modes available on the BeanDevice®”</i></b>	All the BeanDevice®	Data acquisition modes available on the BeanDevice®
<b><i>TN_RF_007 – “BeanDevice® DataLogger User Guide ”</i></b>	All the BeanDevice®	This document presents the DataLogger feature on the BeanDevice®
<b><i>TN_RF_006 – “BeanDevice® wireless network association”</i></b>	All the BeanDevice®	Description of the BeanDevice® network association
<b><i>TN_RF_005 – “Pulse counter &amp; binary data acquisition on the BeanDevice® SUN-BN”</i></b>	BeanDevice® SUN-BN	This document presents Pulse counter (ex: energy metering application) and binary data acquisition features on the BeanDevice® SUN-BN.
<b><i>TN_RF_004 - Ambient Light sensor technical specifications</i></b>	BeanDevice® SUN-XX (Ecosensor)	Technical description of the Ambient light sensor available on the BeanDevice® SUN-XX products
<b><i>RF_TN_003 V1.0- Wireless Network capacity</i></b>	All the products	Network capacity characterization of Beanair Wireless Sensor Networks
<b><i>RF_TN_002 V1.0 - Current consumption in active &amp; sleep mode</i></b>	BeanDevice®	Current consumption estimation of the BeanDevice® in active and sleeping mode
<b><i>RF_TN_001 V1.0- Wireless range benchmarking</i></b>	BeanDevice®	Wireless range benchmarking of the BeanDevice®



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BeanDevice® power management

## 5. AIM OF THE DOCUMENT

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The aim of this document is to provide a description of the power management on the BeanDevice®.

## 6. ULTRA LOW POWER DESIGN

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Having developed BeanAir products based on the IEEE 802.15.4 protocol, BeanAir went a step further in “Co-designing” hardware and software. This was done by manufacturing hardware with low current leakage on hardware analog blocks and software integrated with the Ultra-low power technology. Similarly, BeanAir incorporated ultra-low power IC hardware for digital blocks. Ultimately, BeanAir was able to achieve an Ultra-low power design without compromising on the performance.

### Ultra-Low Power Design

Analog components  
with low current  
leakage

Ultra Low Power IC  
Hardware

Wireless sensors  
with several level of  
sleeping mode

## 7. POWER MANAGEMENT OVERVIEW

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Three different types of power management are available on the BeanDevice®:

- "Sleep" power mode ;
- "Active" power mode;
- "Sleep with network listening" power mode;

### "Active" power mode

- **Advantages:** The OTAC parameter is fastly performed by the BeanDevice®
- **Constraint(s):** high power consumption

### "Sleep" power mode

- **Advantages:** Ultra low power consumption (several micro-amperes)
- **Constraints:** impossible to remotely configure the BeanDevice® when the sleep power mode is active

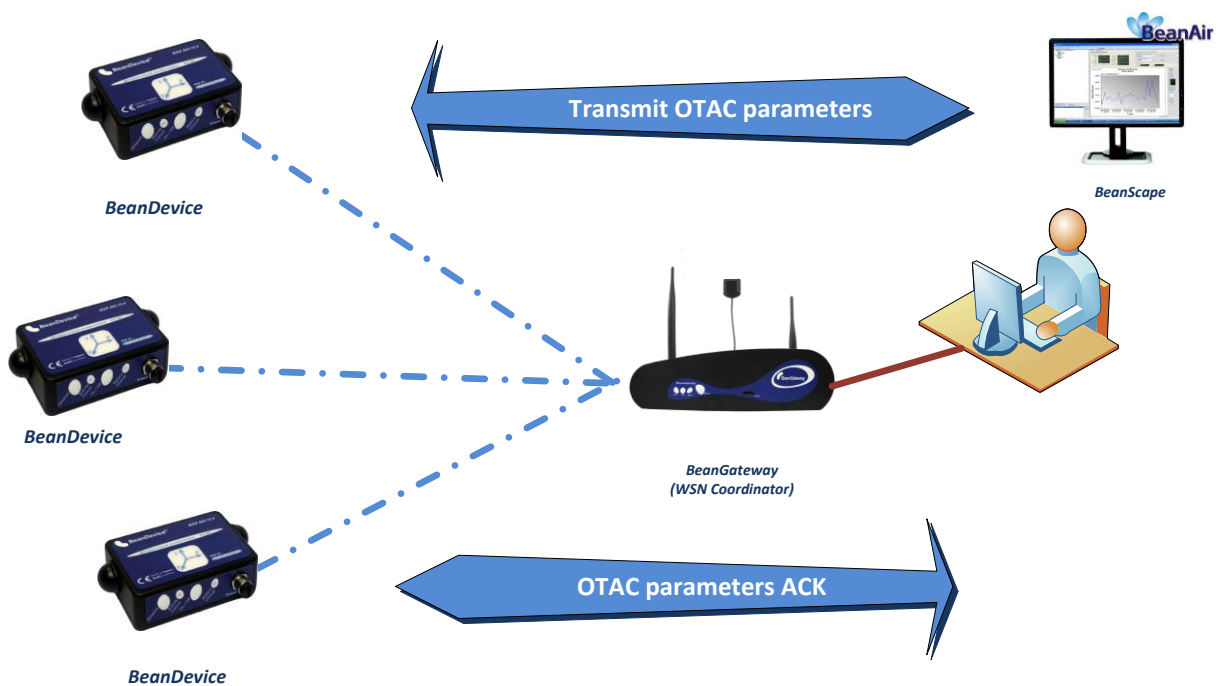
### "Sleep with network listening" power mode

- **Advantages:** low power consumption, you can remotely configure the BeanDevice®
- **Constraints:** The BeanDevice® cannot be configured instantly, it depends on the Network Listening duty cycle specified by the user.

## 8. POWER MANAGEMENT DESCRIPTION

### 8.1 « ACTIVE » POWER MODE

In active power mode, the BeanDevice® is active everytime. The radio link between the BeanDevice® and the BeanGateway® is always conserved.



If your BeanDevice® is set to **“Active”** power mode, your battery may drain quickly. If you want to extend your battery autonomy, you must configure your BeanDevice® in **“sleep”** power mode or **“sleep with network listening”** power mode.

In active mode, your Beandevicé® is always active; it will receive instantly your OTAC command.

## 8.2 “SLEEP” POWER MODE

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### 8.2.1 Principle of function

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In “sleep” power mode, you cannot send an OTAC command to the BeanDevice®, the device is sleep almost the time.

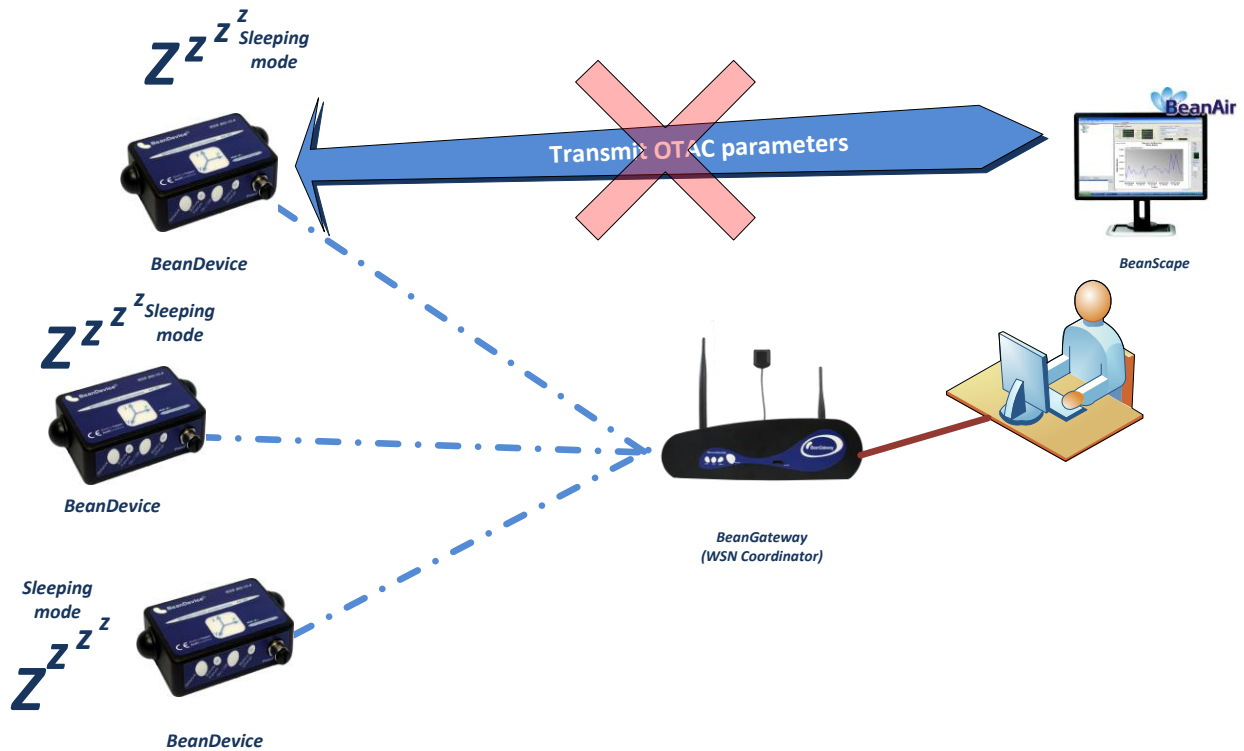
***If your BeanDevice® is configured with “Sleep” power mode, it will operate as follow:***

- In “Streaming” or “Streaming Packet” data acquisition mode, the BeanDevice® goes to sleep based on the already set data sampling duration.
- For other types of data acquisition mode, the BeanDevice® goes to sleep after sending its measurement

As the BeanDevice® switches to sleep, the power consumption is extremely low in micro amps.



***Once you enable “Sleep” power mode, it will not be possible to remotely configure the BeanDevice®***



## 8.3 SLEEP WITH NETWORK LISTENING POWER MODE

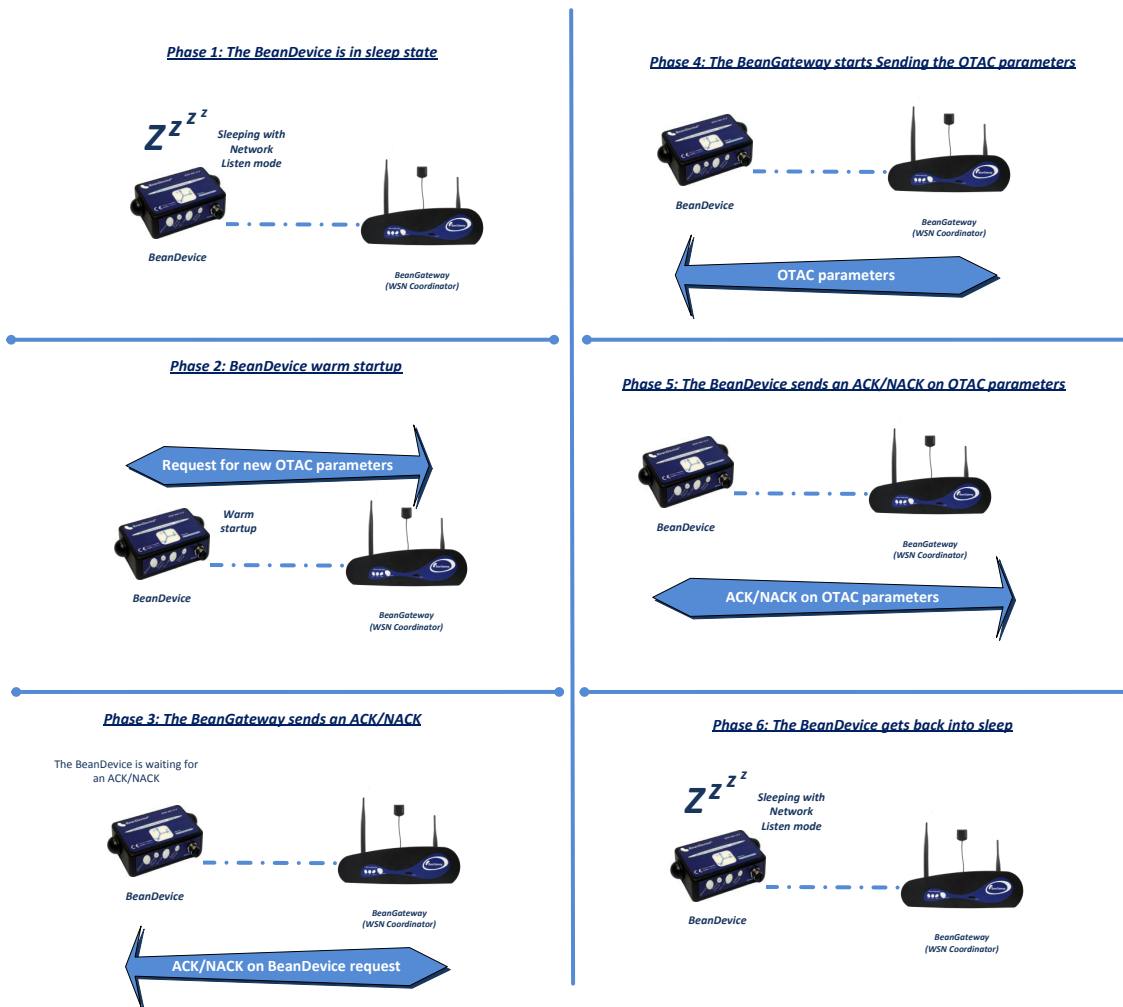
### 8.3.1 Principle of function

When the BeanDevice® operates in “sleep with network listening power mode”, it sends periodically a request (called listening cycle) to the BeanGateway® for an OTAC parameter.

The user can easily configure the listening cycle depending on the data acquisition low duty cycle.

In sleep with network listening, it is possible to remotely transmit an OTAC configuration to your BeanDevice® without sacrificing its ultra-low power consumption.

The following diagram shows the operation of the sleep with network listening:



**Example 1 :** If the Data Acquisition Low Duty Cycle set to 20 seconds and the coefficient network listening round is set at 5, every 100s then the BeanDevice® sends a request to the BeanGateway® to know if any Over the Air Configuration (OTAC) is available.



**If this power mode is configured on your BeanDevice®, OTAC command cannot be updated in real time. If OTAC command must take effect instantly, it will be advisable to run your BeanDevice® in “active” power mode.**

## 9. OTAC (OVER-THE-AIR CONFIGURATION) PROCESS

OTAC (Over-the-air configuration) concerns all the configuration parameters which are transmitted by radio to the BeanDevice®. These parameters are generated by the BeanScope® supervision software.

### BeanDevice® OTAC process is as following:

- Enter a new value in the field configuration
- Click on the button validate
- A new window occurs with the confirmation that the message was transmitted to the BeanGateway®
- The OTAC command is transmitted to the BeanGateway®
- The BeanGateway® confirms the good reception of the OTAC command

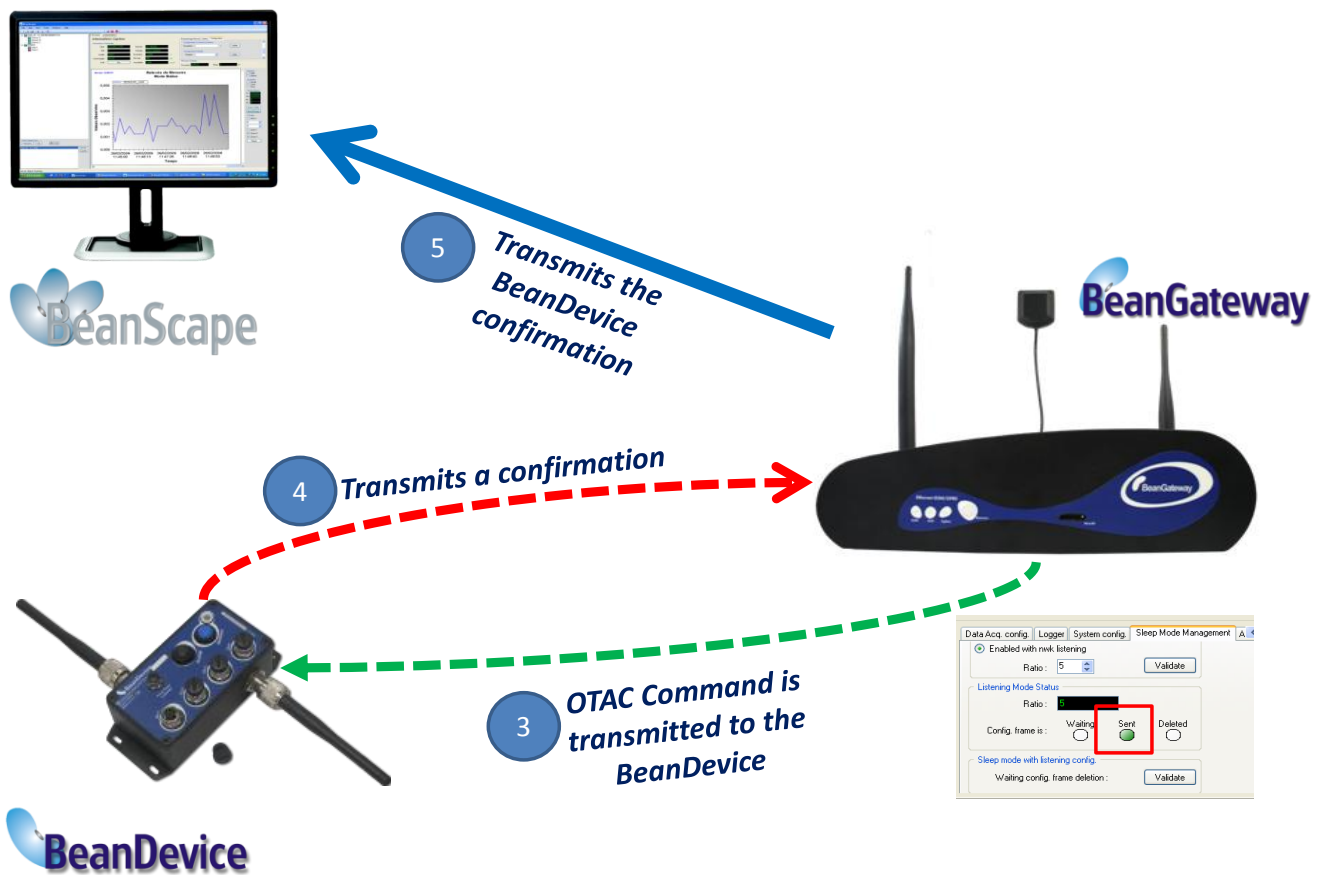


Depending on the power mode used by the BeanDevice®, the OTAC command is transmitted to the BeanDevice® in different way. The following section describes this process.

## 9.1 OTAC PROCESS IN “ACTIVE” POWER MODE

If the Power mode on your BeanDevice® is configured with “*Active mode*”:

- ✓ The OTAC parameter is transmitted instantly to the BeanDevice®
- ✓ The Beandevice® transmits a confirmation to the BeanGateway® which is already forwarded to the BeanScope®

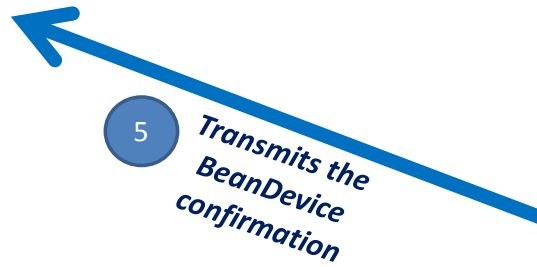


### 9.1.1 OTAC process in “sleep with network listening” power Mode

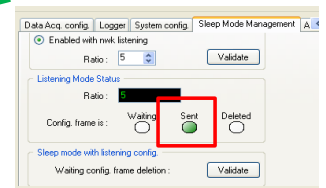
If the Power mode on your Beandevicé® is configured in “*Sleep with Network listening*”:

- ✓ The OTAC parameter is not transmitted instantly to the BeanDevice®, the BeanDevice® is sleep most of the time;
- ✓ When the BeanDevice® wakes up, it sends periodically a request to the BeanGateway® for an OTAC parameter;
- ✓ If an OTAC parameter is waiting on the BeanGateway®, it will be transmitted to the BeanDevice®;
- ✓ The Beandevicé® transmits a confirmation to the BeanGateway® which is already forwarded to the BeanGateway®;



BeanScape

BeanDevice wakes up

BeanDevice

### 9.1.2 OTAC Process in “Sleep” power mode

If the “sleep” power mode is activated on your Beandevic<sup>®</sup> and you wanted to remotely configure your Beandevic<sup>®</sup>, you have to follow these procedures:

#### Step 1

- Power Off your Beandevic<sup>®</sup>

#### Step 2

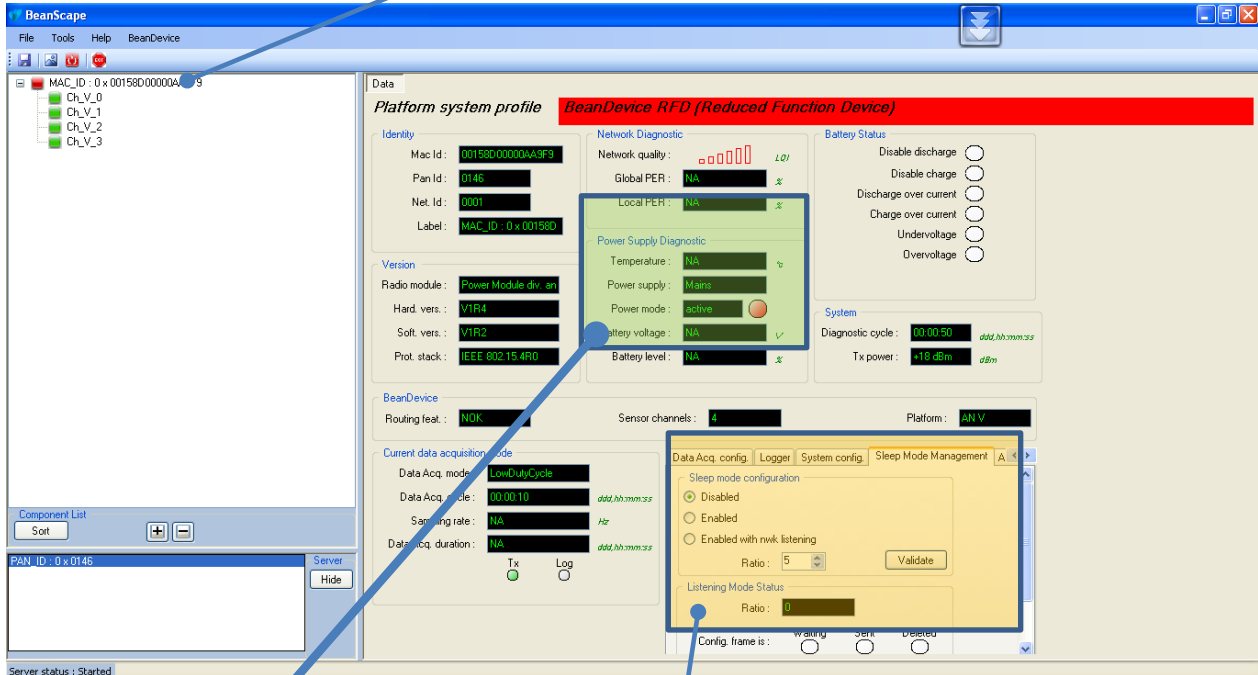
- Send an "offline" OTAC command to your Beandevic<sup>®</sup>
- The OTAC command is registered on your Beangateway<sup>®</sup> flash memory and waits for a request from the Beandevic<sup>®</sup>

#### Step 3

- Power-on your Beandevic<sup>®</sup>
- During the initialisation process, it sends an OTAC request to the Beangateway<sup>®</sup>
- If an OTAC command is pending, it will be transmitted to the Beandevic<sup>®</sup>
- The Beandevic<sup>®</sup> sends an ACK if the OTAC is accepted, otherwise an NACK is send

## 10. POWER MODE MANAGEMENT FROM THE BEANSCAPE®

Select your BeanDevice®



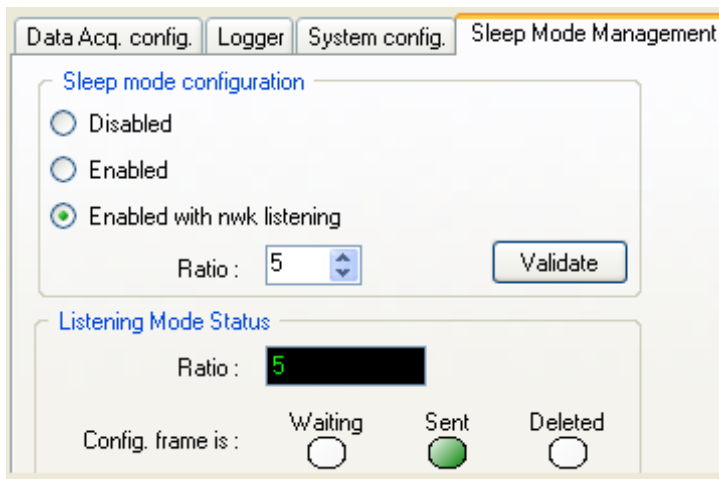
This frame displays the actual power mode status

Power mode configuration Tab

## 10.1 TAB : SLEEP MODE MANAGEMENT

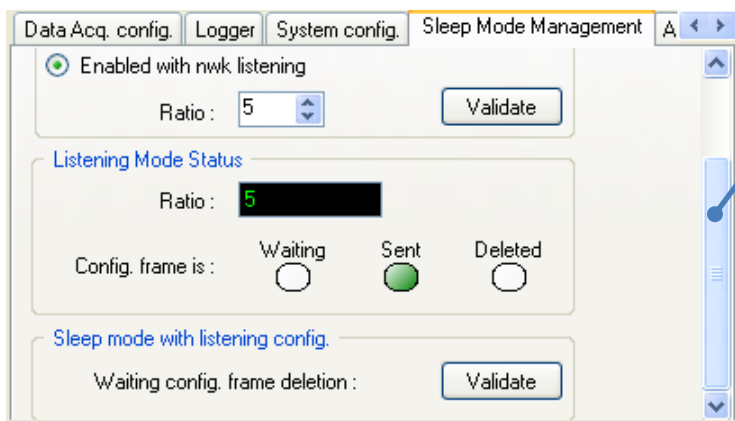
This Tab is composed of three frames:

- ✓ **Sleep mode configuration:** Configure the Power mode on your BeanDevice®
- ✓ **Listening Mode Status :** Describes the status of an OTAC (Over-the-air-Configuration)
- ✓ **Sleep mode with listening config. :** Configuration settings for Sleep mode with network listening



The screenshot shows the top portion of the 'Sleep Mode Management' tab. It includes three tabs: 'Data Acq. config.', 'Logger', and 'System config.', with 'Sleep Mode Management' being the active tab. The 'Sleep mode configuration' section has three radio buttons: 'Disabled', 'Enabled', and 'Enabled with nwk. listening' (which is selected). Below these is a 'Ratio' field set to '5' and a 'Validate' button. The 'Listening Mode Status' section shows a 'Ratio' field with the value '5' highlighted in black, and three radio buttons for 'Config. frame is': 'Waiting', 'Sent' (which is selected), and 'Deleted'.

Use the vertical scrollbar  
for displaying all the  
frames



This screenshot shows the bottom portion of the 'Sleep Mode Management' tab. It includes the 'Sleep mode with listening config.' section with a 'Waiting config. frame deletion' field and a 'Validate' button. A vertical scrollbar is visible on the right side of the window, and a blue callout bubble points to it with the text 'Use the vertical scrollbar for displaying all the frames'.

Parameter	Description
<b>Sleep mode configuration</b>	<p><b>Disabled:</b> Sleep mode is disabled. The BeanDevice® operates in Active power mode.</p> <p><b>Enabled:</b> Sleep mode is enabled</p> <p><b>Enabled with nwk listening:</b> Sleep with network listening mode is enabled.</p> <p><b>Ratio:</b> Fix the Ratio of the listening cycle depending on the data acquisition low duty cycle.</p> <p><b>Example :</b> If the data acquisition is 30 seconds, the Listening cycle will be 150 seconds.</p>
<b>Listening mode status</b>	<p><b>Ratio:</b> displays the latest Ratio value</p> <p><b>Waiting:</b> This led is <b>green</b> if an OTAC (Over-the-Air configuration) frame is pending for a transmission to the BeanDevice®</p> <p><b>Sent:</b> This led is <b>green</b> if an OTAC (Over-the-Air configuration) frame is transmitted to the BeanDevice®.</p> <p><b>Deleted:</b> This led is <b>red</b> if a pending OTAC (Over-the-Air configuration) is deleted</p>
<b>Sleep mode with listening config</b>	By clicking on “validate”, the pending OTAC frame is deleted

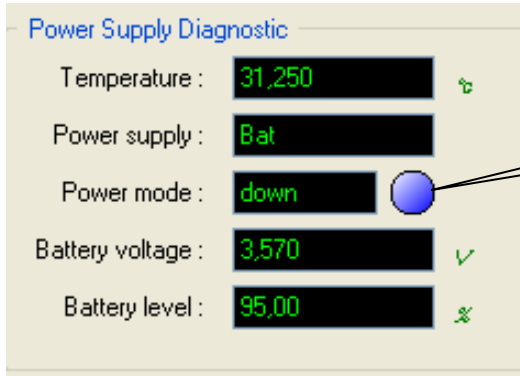


**Sleep mode is vital if you want to extend the battery life of your BeanDevice®. But it requires some precautionary principles: by activating sleep mode, the radio receiver of your BeanDevice® will also operate in sleep mode. Any OTAC parameters will then be possible. If you want to reconfigure your BeanDevice®, perform the following operations:**

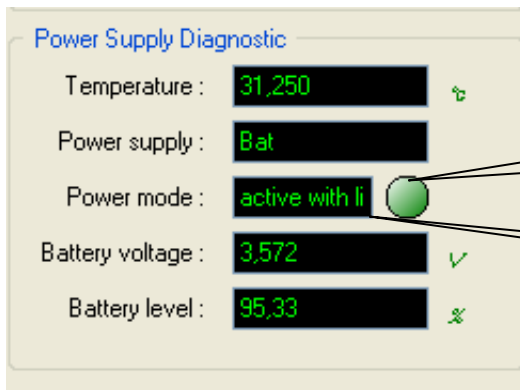
<b>Solution 1</b>	<b>Go to the section</b> “How to remotely configure your BeanDevice® if the “Sleep” power mode is selected?
<b>Solution 2</b> ( if a button Network is present on your BeanDevice® casing)	<b>Press the Network push button for more than 2s, you can reset to factory settings (default RF power is fixed at its maximum: 18 dBm).</b>

**To avoid unnecessary manual intervention, you should use sleep with network listening power mode.**

## 10.2 POWER MODE STATUS

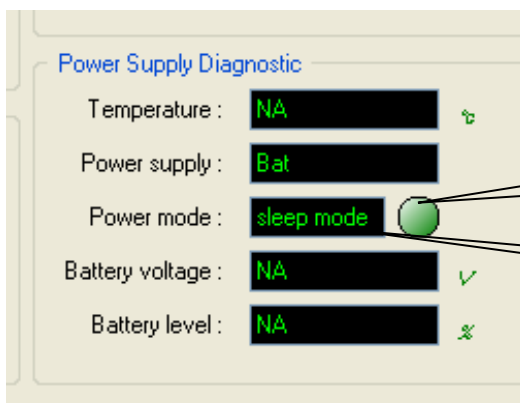


**BLUE LED:** The BeanDevice® is power off



**GREEN LED:** The BeanDevice® is in sleep with network Listening power mode

Sleep with network listening power mode is displayed



**GREEN LED:** The BeanDevice® is in active sleep power mode

Sleep power mode is displayed

Power Supply Diagnostic

Temperature :	31,250	⊗
Power supply :	Bat	
Power mode :	active	●
Battery voltage :	3,572	✓
Battery level :	95,33	⊗

**RED LED:** The BeanDevice® is in active power mode

Active mode is displayed