Ref : TN_RF_006 V1.0

TECHNICAL NOTE

Wireless sensor network association process

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Contents

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For general contact, technical support, to report documentation errors and to order manuals, contact ***BeanAir Technical Support Center*** (BTSC) at:
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2. VISUAL SYMBOLS DEFINITION

Visual	*Definition*
	***Caution or Warning** – 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.*
	***Danger** – This information MUST be followed if not you may damage the equipment permanently or bodily injury may occur.*
	***Tip or Information** – Provides advice and suggestions that may be useful when installing BeanAir Wireless Sensor Networks.*

3. ACRONYMS AND ABBREVIATIONS

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. AIM OF THE DOCUMENT

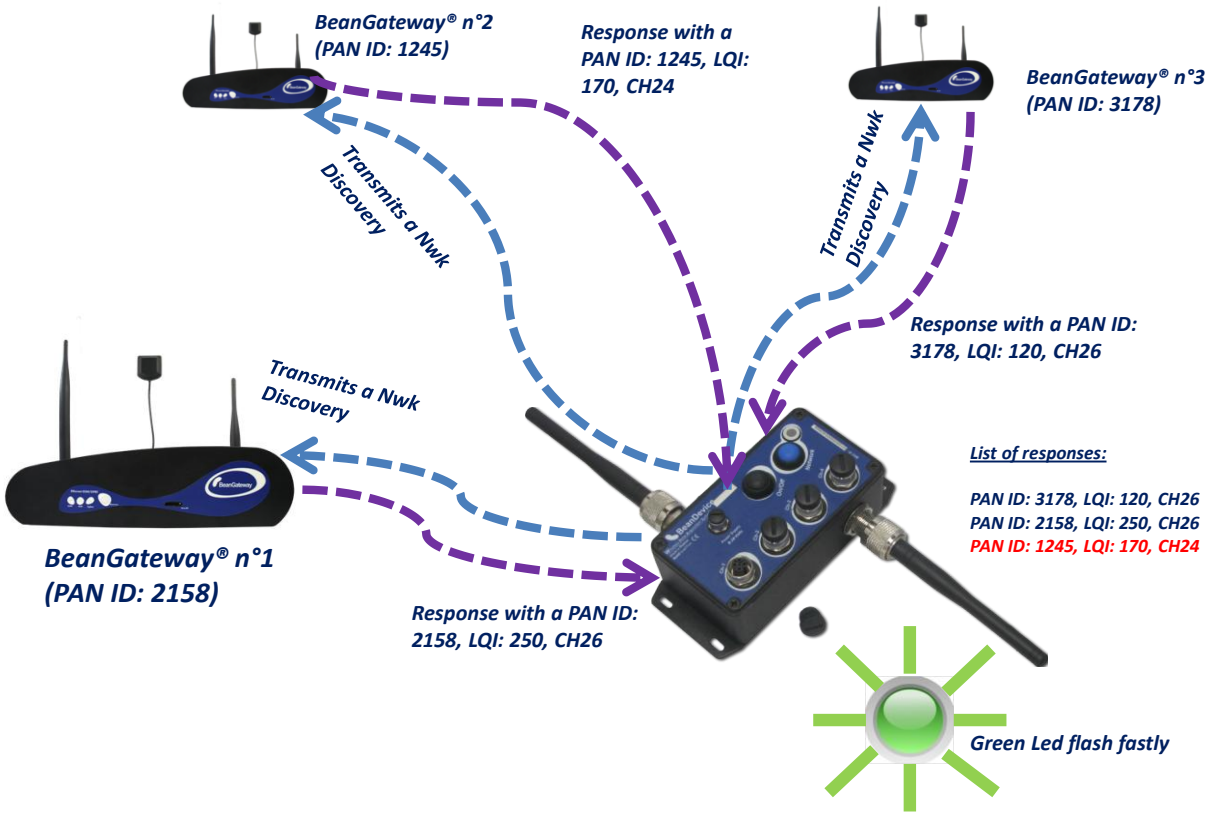
This document is intended to provide a description of how a WSN is build step by step.

5. WSN ASSOCIATION PROCESS

The various network components (BeanGateway®, BeanDevice®, BeanScape®) have been previously installed and configured. To initialize the WSN, refer to the BeanGateway® & BeanScape®.

First Step:
Network Discovery

- The BeanDevice® sends beacon requests to be detected by one or more Beangateway®, which then send out a beacon in response
- This response contains the following informations : PAN ID (Personal Area Network ID) , LQI Value & Radio channel ;

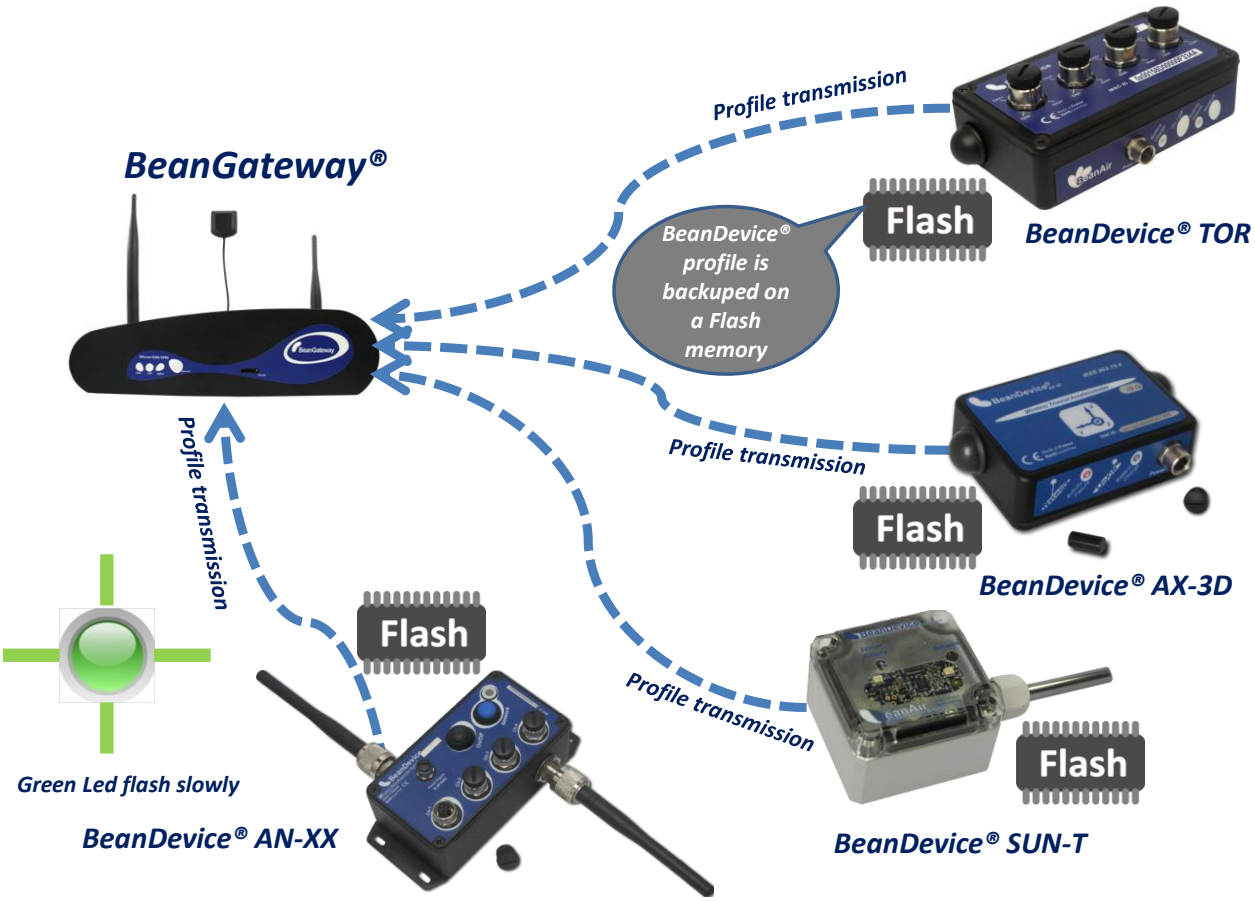


Second Step: ***Association with a BeanGateway®***

- The BeanDevice® choose to be associated with the BeanGateway® offering the best LQI value ;
- The BeanGateway allocate a Network address (16 bits) to the BeanDevice

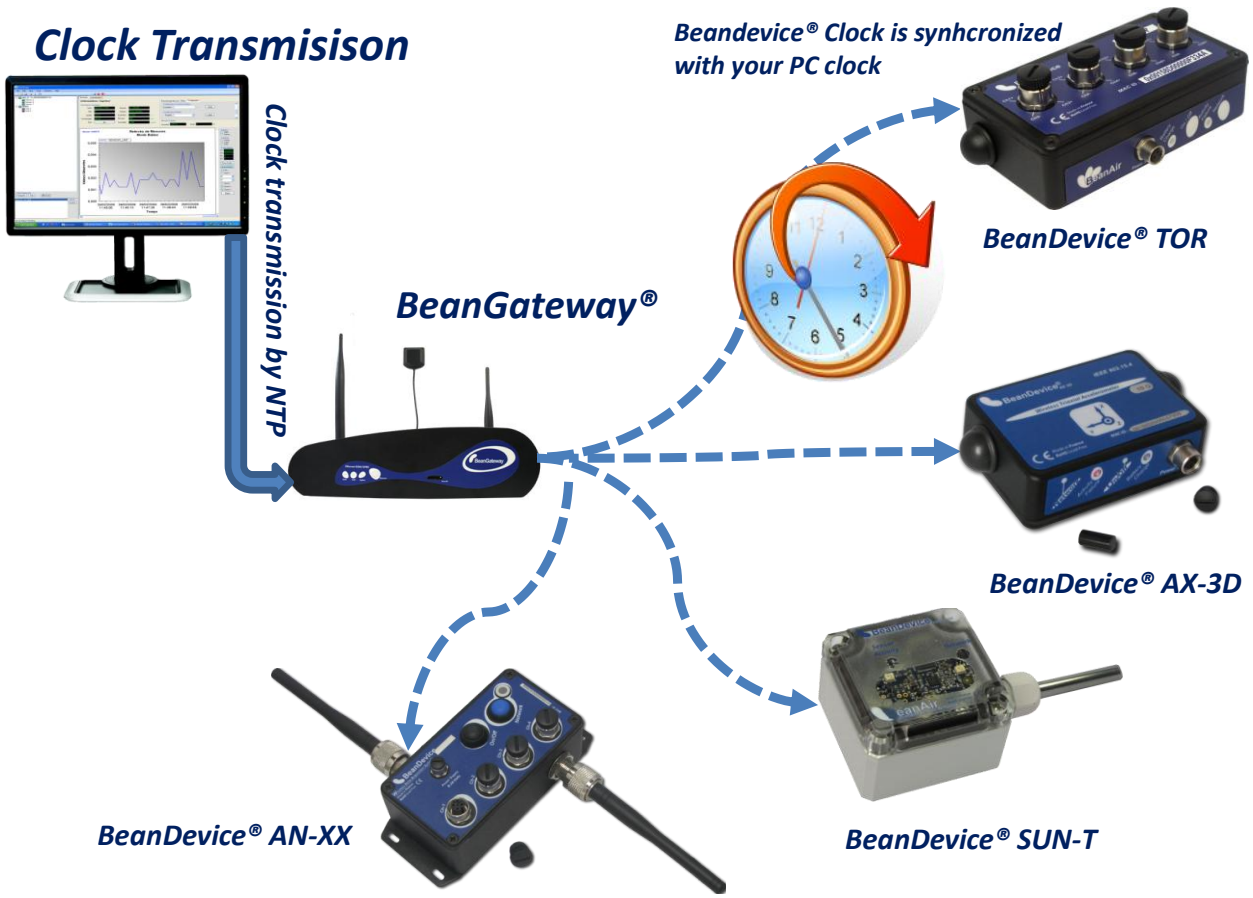
Third Step: Profile transmission

- Each BeanDevice® is recognized by its profile, which is backuped on a flash memory
- The BeanDevice® starts transmitting its profile to the BeanGateway®: MAC ID, Last Data acquisition mode, Sensors calibration, RF Power.....



Fourth Step: Clock Transmission

- The BeanGateway® broadcast its clock to each BeanDevice® during the association
- The BeanGateway® clock is updated by NTP (Net -Time protocol) when a connexion is established between the BeanScape® and the Beandevice®



The BeanDevice® starts transmiting its data acquisition.

6. OPERATIONAL FEATURES (FOR EXPERTS ONLY)

6.1 DEVICE ADDRESSING

Each device in an IEEE 802.15.4 network can have two types of address:

- ***IEEE (MAC) address***: This is a 64-bit address, allocated by the IEEE, which uniquely identifies the device no two devices in the world can have the same IEEE address. It is also sometimes called the extended address.
- ***Short address***: This 16-bit address identifies the node in the network and is local to that network (thus, two nodes on separate networks may have the same short address). The short address may be allocated by a BeanGateway® when a node joins a network.

The use of 16-bit short addresses rather than 64-bit IEEE addresses allows shorter packets and therefore optimizes use of network bandwidth. A short address may be requested by the device when it joins the network. If a device does not have a short address, it must be addressed using its IEEE address.

6.2 DATA FRAMES AND ACKNOWLEDGEMENTS

Communications in an IEEE 802.15.4 network are based on a system of data and MAC command frames, and optional acknowledgements. When a BeanDevice® sends a message to the BeanGateway®, it can return an acknowledge message – this simply confirms that it has received the original message and does not indicate that any action has been taken as a result of the message.

Acknowledgements are provided by the MAC sub-layer.

6.3 DATA TRANSFER

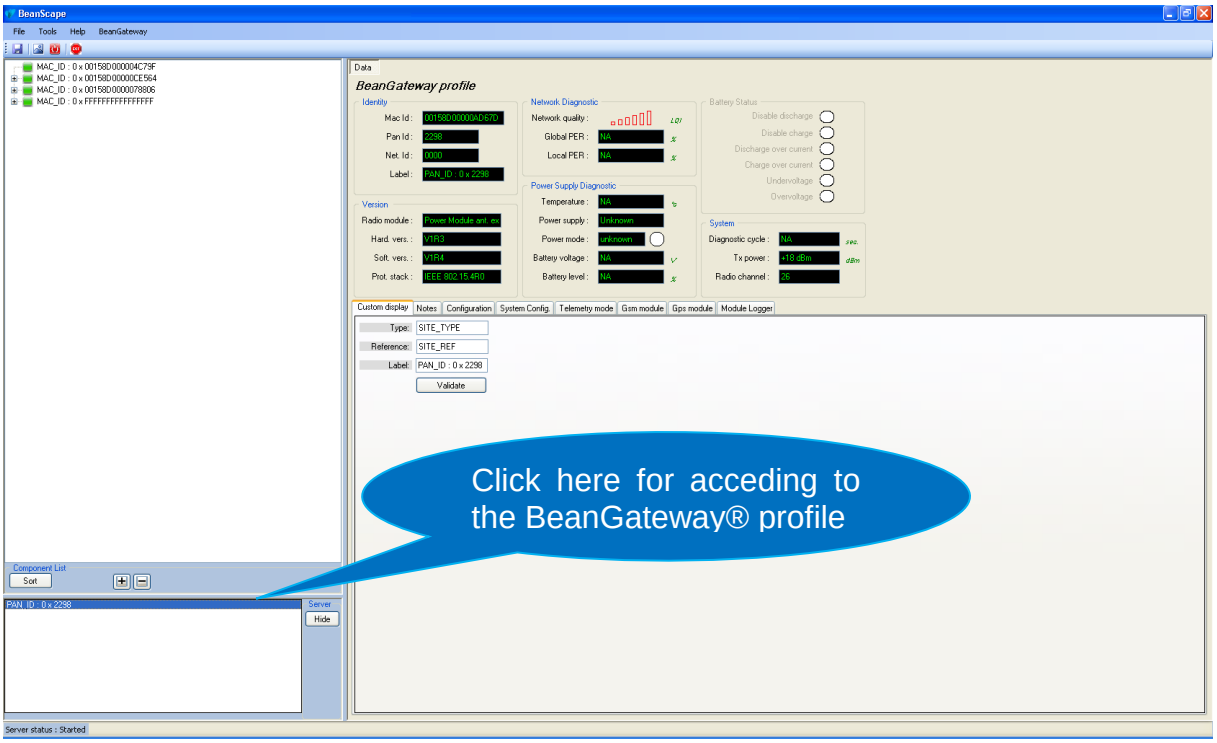
When transferring data from a node to another node where reception is likely to be guaranteed (for example, from a BeanDevice® to a BeanGateway®), it is usual to send a data frame directly (i.e. unsolicited).

The above data transfer methods are illustrated in the figure below:

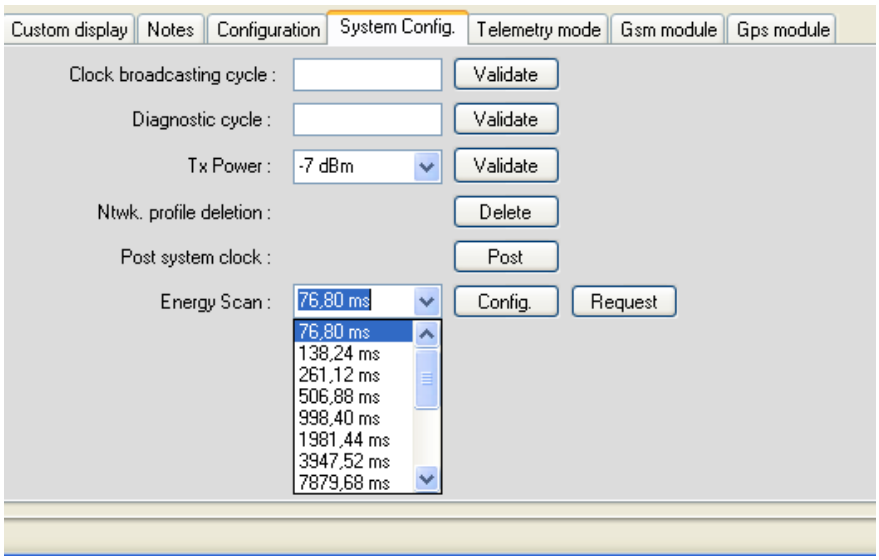
6.4 ENERGY SCAN FEATURE ON THE BEANGATEWAY®

The Energy Scan allows the user to know the network quality on each Radio channel. This operation allows the user to choose the appropriate RF channel on a site where the WSN is deployed. This value is 0 (excellent) to 255 (poor), and you can configure the scanning time means of each radio channel, by selecting the tab the scan time in ms and confirm it by pressing the "***Config***" button. A new energy scan is performed by clicking on "***Request***" button.

1. Launch the BeanScape
2. Go on BeanGateway® profile



3. Go on "System Config" Tag, choose the predefined Energy Scan Time value and click on config to validate the new value



4. by pressing the ***Request*** button will start scanning different radio channels.

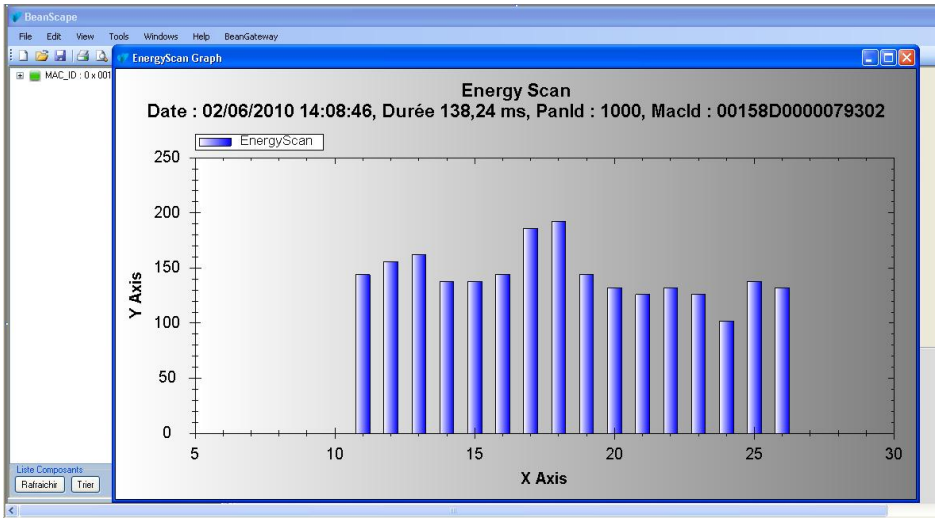


Table of Energy Scan values

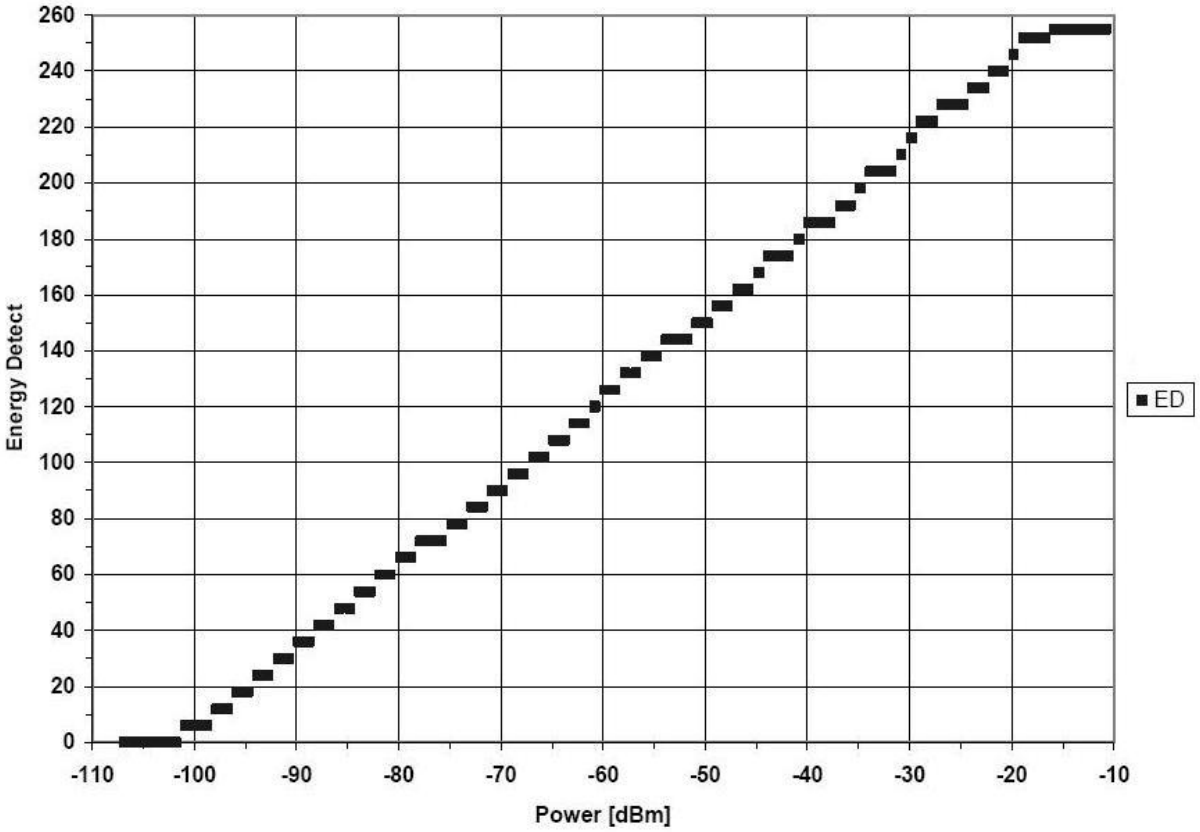


Table to convert the Energy Scan power in dBm

It is strongly recommended to perform an Energy Scan on a site before a major deployment of wireless sensor network.

7. TROUBLESHOOTING

If your BeanDevice® cannot join the WSN, check the following features:

- The BeanDevice® shares the same PAN ID than your BeanGateway®. If several BeanGateway® are present in the same area, be sure that there is no conflict of PAN ID;
- The RF Channel used on your BeanGateway® must offer the best quality link (for more informations read your BeanGateway® user manual);
- Check the wireless range between your BeanDevice® and your BeanGateway®, maybe the BeanDevice® is very far from your BeanGateway®;