SIGFOX Mini base station Installation Guide

DISTRIBUTOR

APPROVED:

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Changes description

Version	Description	Author	Date
0.0	Draft	C.Cazeaux	13/01/2016
0.1	§3 Warning statements added	C.Cazeaux	30/03/2016
0.2	Addition of Antenna requirements	S. Barreiro	03/05/2016

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1 INSTALLATION SITE RECOMMENDATIONS

SIGFOX SMBS-T series are multiband, low profile, small factor base stations intended for extension of the SIGFOX base station family. These series are dedicated for quiet radio environments with limited performance for capacity and blocking resistance. This gives a complementary solution for the SIGFOX network based on macro cell SBS-T base stations. These series are intended for outdoor and indoor installation with aluminum chassis, suitable for antenna mast mounting, shelter cabinet mounting, rack mounting or desktop installation.

Regarding capacity performances, the SMBS-T is able to receive about 100 000 SIGFOX messages per day. **The installation site, and in particular the antenna elevation, shall be chosen so that the number of SIGFOX devices covered by the SMBS-T antenna is compliant with this capacity**.

The choice of the installation site is of the highest importance for proper operation of the station. Hereafter are the minimum distances from other radio transmitters in order to ensure proper operation. If the most severe constraints cannot be met, it is still possible to install a filter cavity in front of the mini station to avoid noise injection in the operating band. This will lead to a loss of sensitivity from 1 to 2 dB, depending on the filter.

If a cellular, or broadcast antenna is installed too closed to the SMBS-T antenna after the installation of the SMBS-T, the consequence will be a significant increase of the noise floor and a significant decrease of the number of messages received by the base station. A first corrective action should be to set the internal LNA of the SMBS-T in bypass mode. The consequence is a loss of sensitivity of 10dB (more in band edges). If there are still too many lost messages, the installation of a cavity filter will be necessary.

The following recommendations are available whatever the operating band of the mini station: from 865 to 870MHz and from 902 to 928MHz.
Whatever the type of installation (indoor or outdoor), the mini base station must be installed so that its RF connector must not receive more than -20dBm signals from 0 to 821MHz and from 925MHz to 2.5GHz.

In terms of distance from potential aggressors it means:
For indoor installation: The mini base station must be installed at a minimum distance of 10 meters from any fixed radio device (such as WiFi access points for example).

For outdoor installation without cavity filter:
Co-hosting with cellular or broadcast antennas is **forbidden.**
Regarding site location versus other emitter sites, the minimum distances to respect in a horizontal plane line of sight are:

Distance from a broadcaster of 100KW (FM or digital TV DBV-T)	4000m
Distance from the front of a distant cellular antenna of 2KW (typically in wide area)	500m
Distance from the front of a distant cellular antenna of 150W (typically in urban area)	150 m

Outdoor installation with a cavity filter from those allowed by SIGFOX (Elythe or Matech):
Co-hosting with cellular antennas is allowed provided that the SIGFOX antenna is located in the vertical axis of the cellular antenna at a minimum distance of 2 meters.
Regarding site location versus other emitter sites, the minimum distances to respect in an horizontal plane line of sight are:

Distance from a broadcaster of 100KW (FM or digital TV DBV-T)	500m
Distance from the front of a distant cellular antenna of 2KW (typically in wide area)	50m
Distance from the front of a distant cellular antenna of 150W (typically in urban area)	30 m

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2 SPECIFICATIONS

RADIO INTERFACE CHARACTERISTICS	
Standard	SIGFOX UNB bidirectional protocol
Operating bands	SRD 868 (865 – 870 MHz) or ISM 902 (902 – 928 MHz) (software configurable)
Monitored spectrum	192kHz
Radio Mode	Access Point
Receiver Sensitivity	-142dBm @ 100bps; -134dBm @600bps
Transmit Power	Up to 1 Watt, configurable remotely according to country regulations
Antenna Connector	Type N Female
INTERFACES	
Ethernet	1x10/100BaseT (RJ45) – POE+ type
USB	2xUSB2.0 ports (for cellular connectivity backhaul and monitoring. Type A jack
Maintenance port	USB Type B jack (only for maintenance)
POWER SUPPLY	
Power Consumption	17W typical, 25W max peak (in transmit mode)
Power supply	POE+ (Power Over Ethernet +) compliant IEEE 802.3at
MECHANICAL & ENVIRONMENTAL	
Product dimensions	160x180x58 mm indoor version. 240x180x58 mm with connectivity cover
Product weight	Ca 2kg (4 lbs)
Operating temperature	-40 to +70°C
Storage temperature	-45°C to +85°C
Protection	IP65 with connectivity cover
Casing material	Aluminum
COMPLIANCE	
Compliance	CE (EMC EN 301 489, radio EN 300 220, safety EN60950-1) FCC Part 15C equipment class

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3 WARNING STATEMENTS

3.1 FCC warning statement

This device complies with Part 15 of the FCC Rules and with Industry Canada licence-exempt RSS standard(s).

- Operation is subject to the following two conditions:
  (1) this device may not cause harmful interference, and
  (2) this device must accept any interference received, including interference that may cause undesired operation.
- Changes or modifications made to this equipment not expressly approved by (manufacturer name) may void the FCC authorization to operate this equipment.
- This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. End users must follow the specific operating instructions for satisfying RF exposure compliance. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.
- This equipment should be installed and operated with minimum distance of 20 cm between the radiator and your body.

- This equipment must be professionally installed. The installer is responsible for ensuring that the proper antenna is employed so that the limits in part 15 are not exceeded.

- Only the antennas approved by SIGFOX must be used. The antennas may not be modified. The antenna must not be co-located or operating in conjunction with any other antenna or transmitter. No additional antenna must be used.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

3.2 IC warning statement

"Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada.
To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.
This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions:

(1) this device may not cause interference, and
(2) this device must accept any interference, including interference that may cause undesired operation of the device."

This equipment should be installed and operated with minimum distance of 20 cm between the radiator and your body.

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Conformément à la règlementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inferieur) approuvé pour l'émetteur par Industrie Canada.
Dans le but de réduire les risques de brouillage radioélectrique a l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.
Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

(1) l'appareil ne doit pas produire de brouillage, et
(2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement

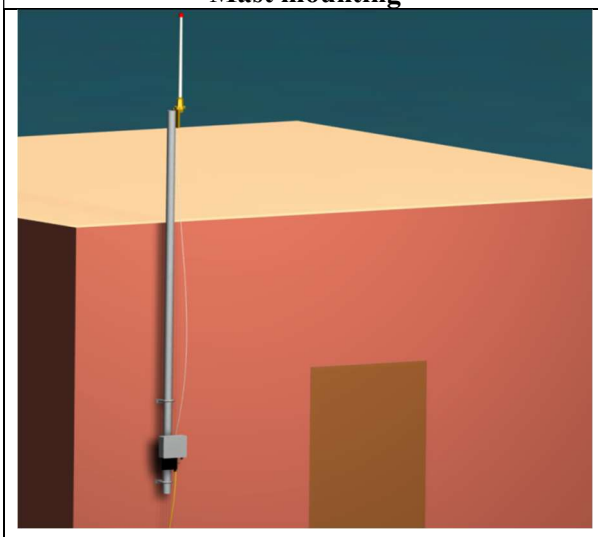
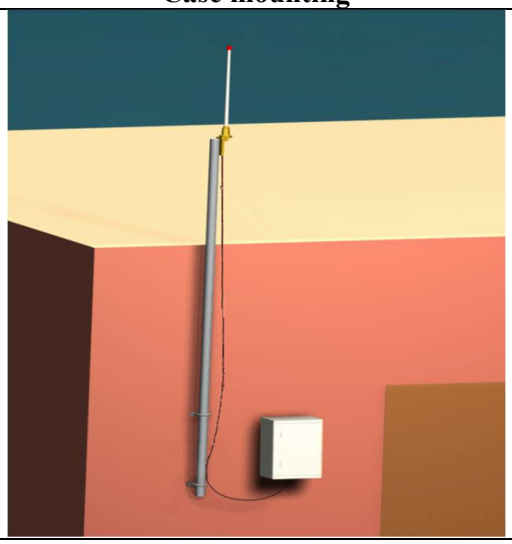
Cet équipement est conforme aux limites d'exposition aux rayonnements IC établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 20 cm de distance entre la source de rayonnement et votre corps.

4 BILL OF MATERIAL

4.1 Outdoor installation types

The SMBS-T base station can be installed:

- mounted on the mast: mast mounting plate needed
- Inside a cabinet together with the ADSL or SAT modem: DIN rail plate needed

Mast mounting	Case mounting
	

- **Antenna and feeder**

Component	Description	Index	Supplier	Quantity
Antenna	Omnidirectional antenna	1	SIGFOX	1
Antenna mounting support	Steel bracket between existing support and antenna.	-	DISTRIBUTOR	1
coaxial cable	LMR400 or ½" coaxial cable	3	DISTRIBUTOR	10m max Depends on site configuration
Connector	Nmale feeder connector	-	DISTRIBUTOR	2

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- **Base station**

Component	Description	Index	Supplier	Quantity
SMBS-T	Mini Station	-	SIGFOX	1
Mounting accessories	Mast mounting plate or Din rail plate		SIGFOX	1

- **Internet connection**

Component	Description	Index	Supplier	Quantity
Modem	ADSL modem or SAT modem + power cable	-	DISTRIBUTOR	1
Ethernet cable POE	Ethernet cable category 6 or 6a	5	DISTRIBUTOR	Depends on site configuration
Connector	RJ45 connector for Ethernet cable		DISTRIBUTOR	2
USB 3G key	3G key. Must be agreed by SIGFOX.	-	SIGFOX/DISTRIBUTOR	1
	Activated M2M SIM card	-	DISTRIBUTOR	1
POE injector	POE Injector + power cable supply	4	SIGFOX	1

4.2 Indoor installation types

The SMBS-T base station can be installed:

- on a horizontal surface such as a table or a shelf: no mounted accessory needed
- wall mounted on a DIN rail or inside a cabinet: DIN rail plated needed
- Racked in a bay: 2U front panel needed

- **Antenna**

Component	Description	Index	Supplier	Quantity
Antenna	Omnidirectional antenna	1	SIGFOX	1
Connector	Adapter N male to SMA fem	-	DISTRIBUTOR	2

- **Base station**

Component	Description	Index	Supplier	Quantity
SMBS-T	Mini Station	-	SIGFOX	1
Accessories	None or din rail plate or 2U front panel		SIGFOX	1

- **Internet connection**

Component	Description	Index	Supplier	Quantity
Modem	ADSL modem or SAT modem + power cable	-	DISTRIBUTOR	1
Ethernet cable POE	Ethernet cable category 6 or 6a	5	DISTRIBUTOR	Depends on site configuration
Connector	RJ45 connector for Ethernet cable		DISTRIBUTOR	2

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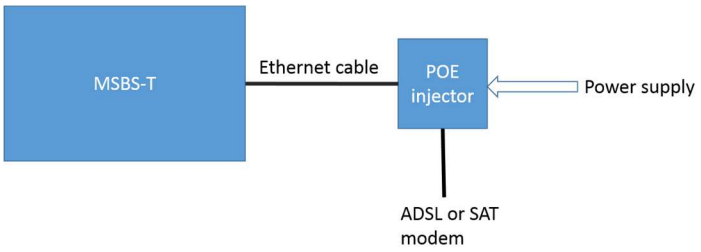
USB 3G key (if 3G coverage	3G key	-	SIGFOX	1
	Activated M2M SIM card	-	DISTRIBUTOR	1
POE injector	POE Injector + power cable supply	4	SIGFOX	1

5 CABLE ETHERNET POE

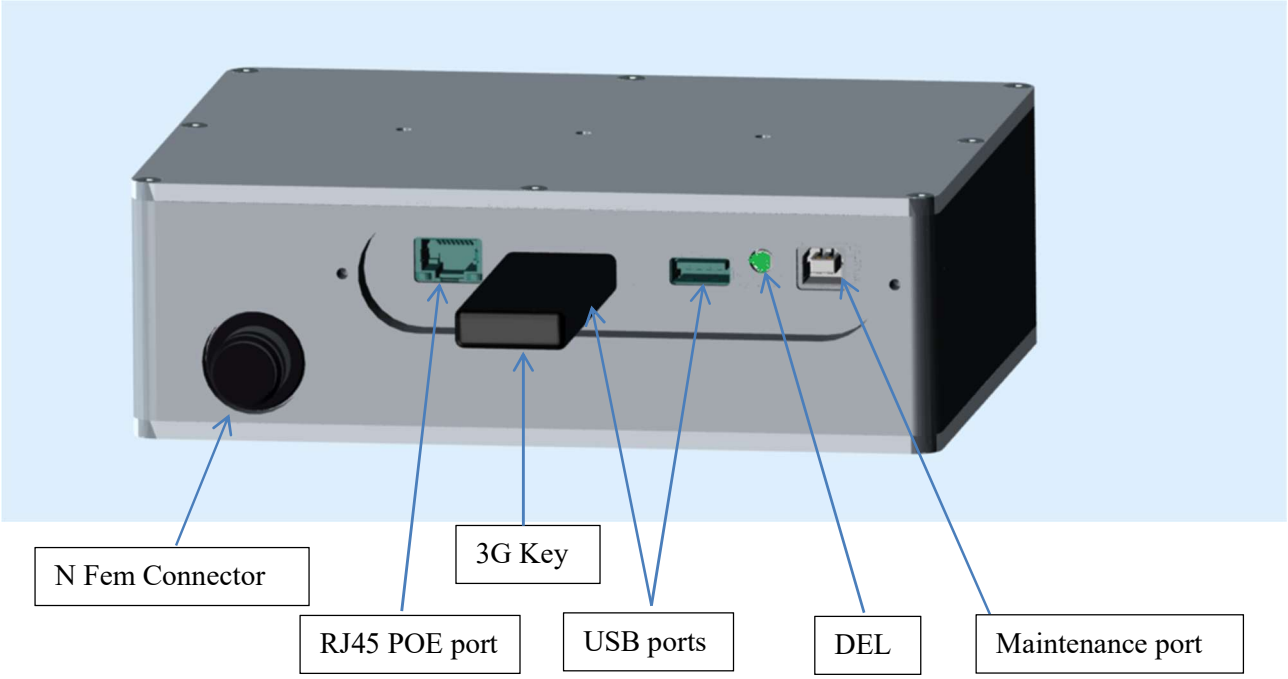
The Ethernet cable must be a category 6 or 6a. The maximum length of the cable depends on its gauge.

Gauge > AWG25: 100m maximum
Gauge = AWG26: 50m maximum
The shielding of the Ethernet cable should be SFTP or SSTP.

The Ethernet cable is connected to the mini base station from one side and to a POE injector at the other side. The modem (SAT or ADSL) is connected to the POE injector. The POE injector is connected to the power supply.



6 ELECTRICAL CONNECTION



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7 DEL STATUS

- Green flash => Boot sequence.
- Orange flash => Connection to the SIGFOX CRA for backbone access
- Orange light => Backbone configuration KO.
- Red Flash => Check POE tension
- Red light => Connection to the radio card
- Green light + orange flash according to Ethernet traffic => Operational

8 ANTENNA

This Base station was certified with an Omnidirectional Antenna with a Gain of 5dBi. **Only an omnidirectional antenna with a gain of 5dBi or less can be used.**

9 ANTENNA INSTALLATION (OUTDOOR CONFIGURATIONS)

Correct installation	Incorrect installation
	The antenna must be fixed at the end of the tube

- The mounting support diameter must be in the range of 40 to 50mm and be hot deep galvanized inside as well as outside
- The antenna must be fixed by nuts and jam nuts

Installation recommendation:

- Ensure the waterproofness (must be 100%) of the connector with a self-vulcanizing scotch-seal (rubber mastic tape) , then with and finally with 2 zip tie-wraps
- **The tightening of RF connectors must be made manually.**

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9.1 Coaxial cable measurement

This measure aims at checking the cable characteristics at 868MHz ETSI or 902MHz FCC and the quality of the installation.

- Type of measurements :
  - VSWR
  - Loss
  - Length

The main cable measures must not exceed the following:

- VSWR : < 1.2 or >21dB Return loss @ 868MHz or 902MHz
- Loss : < 2dB max @ 868MHz or 902MHz

Maximum cable length depending on cable type:

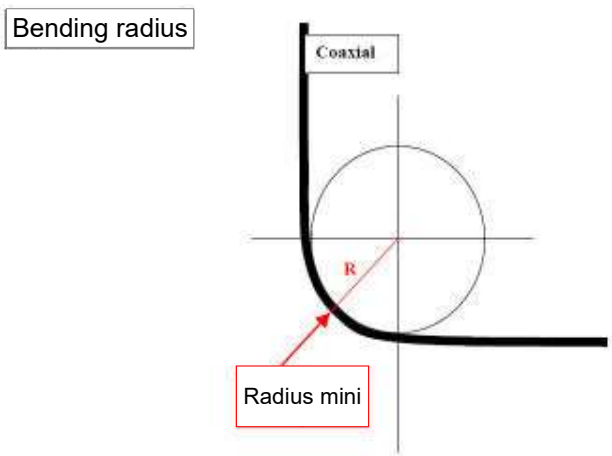
LMR 400 → max 14m
1/2" LDF4-50 → max 24m

The main cable measurement must be performed once it installed in the cable tray.

9.2 Coaxial bending radius

Static mode:

- LMR 400 → Radius mini 4cm
- 1/2" LDF4-50 → Radius mini 15cm



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9.3 Key risks

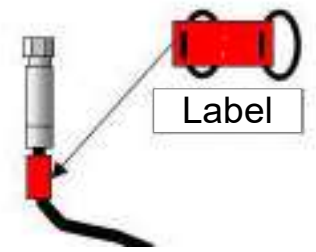
The list below gives the main hotspots during the antenna installation.

- Connector installation procedure must be strictly followed in order to avoid specific problems VSWR on cables and to maximize the efficiency and lifetime of connections.

- Specific attention must also be paid to ensure waterproofness and labeling.

9.4 Labeling

- Coaxial cable must be clearly marked closed to the base station with a label : SIGFOX – 868 (or 902)
- Tables, electrical circuit breakers must be clearly marked with a label : SIGFOX
- When connections are made and waterproofness has been made and checked, final labeling can be implemented. All labels must be easily legible.
- No hidden label in the cable tray.



10 MAST MOUNTING

In order to mount the mini base station on a mast (outdoor installation), you need to screw the mast mounting plate on bottom of the station. Take care to insert the assembly rods of the bracket before screwing the plate. Once the plate is screwed, you can insert the bracket on the rods, put the washers first and then the nuts to maintain the bracket.
Pay attention to screw the plate so that, once mounted on the mast, the RF connector and the connectivity cover are located on the underside of the station.

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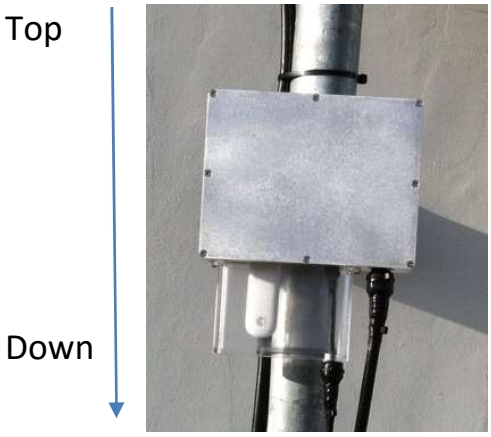
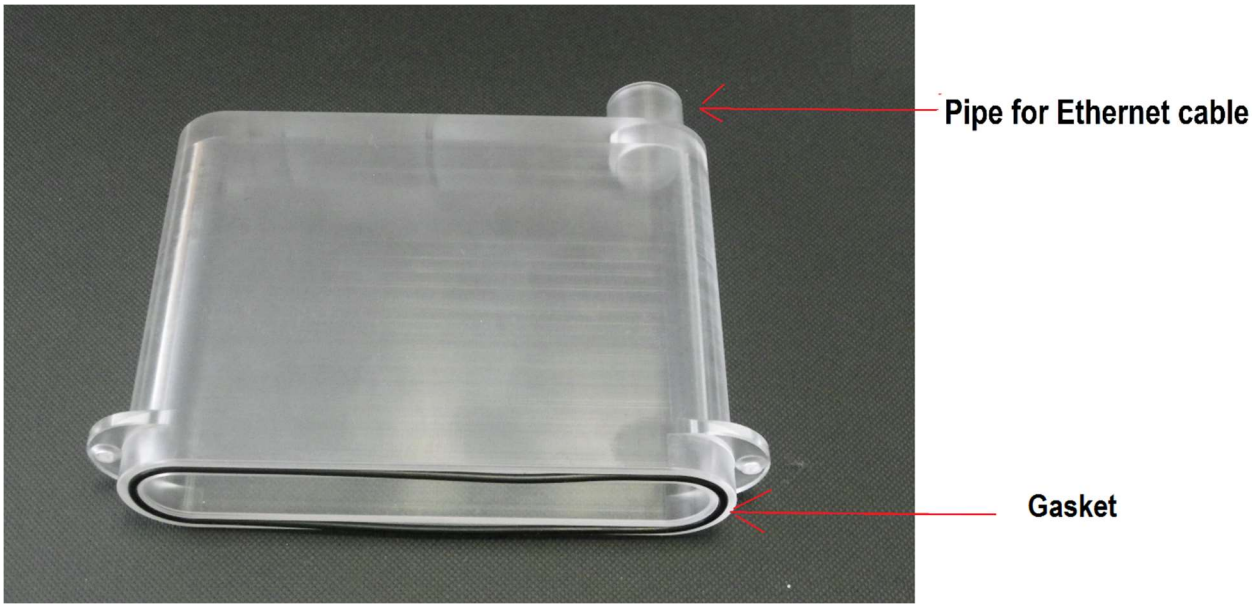


11 WATERPROOFNESS

Coaxial cable, connectors, and overall cables, performance and lifetime strongly depend on waterproofness level. The main purpose of ensuring waterproofness is to avoid the direct contact with water and thus prevent oxidation of the connectors and also protect against steam, salt and dust,

- The N connectors must be waterproofed self-vulcanizing scotch-seal (rubber mastic tape), then with and finally with 2 zip tie-wraps (at the top and at the bottom connector).

The connectivity cover insures the waterproofness of the mini base station itself. The gasket must be correctly positioned in the groove of the cover. Once the 3G Key is connected to the mini station and the Ethernet cable is passed through the pipe of the cover and connected to the mini station, the cover must be screwed on the front panel of the station.



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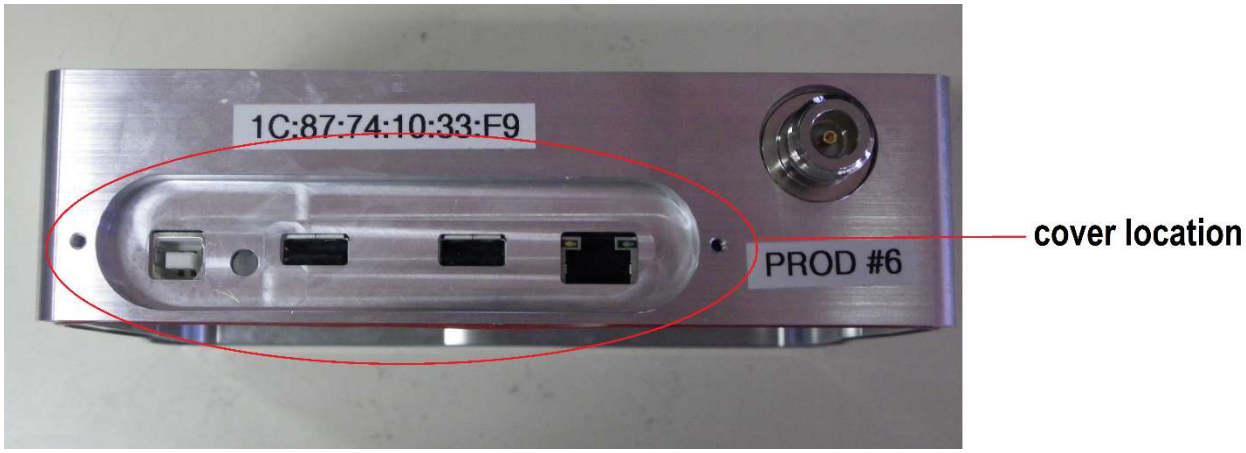

Then, the pipe for the Ethernet cable must be waterproofed with self-vulcanizing scotch-seal (rubber mastic tape).

12 EARTHING THE BASE STATION

In order to protect the station, it must be earthed with a G/Y 6mm^2 wire (or AWG9).

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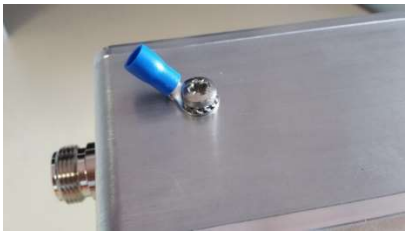
First you need to insert a grower washer or a lock washer and a grounding lug into a hexagon socket screw M4x10. And then you must screw it into the hole provided for this purpose on the side of the station. The correct tightening torque is of 2.2 N.m. If needed, you can bend the lug to ease the insertion of the wire.



13 CONNECTIVITY

13.1 Via ADSL (primary)

Please refer to your provider manual
The base station **only** accepts the dynamic host configuration protocol (DHCP) on the ETH interface

13.2 Via Satellite connexion (primary)

Please refer to your provider manual
The base station **only** accepts the dynamic host configuration protocol (DHCP) on the ETH interface

13.3 Via the 3G network (secondary)

The 3G key is connected directly to the front panel of the base station

The indicator (DEL) on the 3G key will blink for a few minutes and then should stop. At this point color must be blue or green. The blinking green or blue means: research network.

Blue → fixed connection to 3G networks (depends on the material)
Green → fixed connection to 2G networks (depends on the material)

14 BASE STATION « SWITCHING ON » PROCEDURE

- **How to switch the base station on:**

Switching occurs when the POE+ cable is powered and connected to the base station. Do it at the end of the installation.

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❖ **ADSL connectivity checks :**

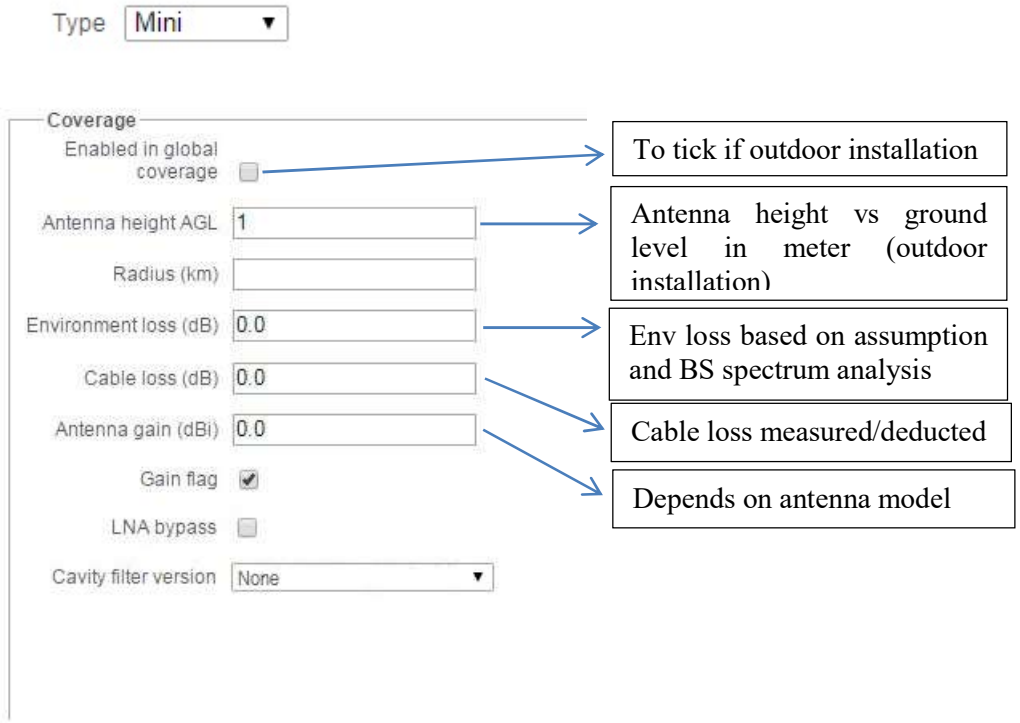
DSL and internet lights must be green (depends on the material)

❖ **RF Tests**

An RF transmitter (key App) has been shipped with the Equipment.
Press the transmitter button to switch it on, until the light becomes green. When it does get green stop moving and wait until the signal is received on the backend. Press again to switch the transmitter off.

15 SIGFOX BACKEND COMMISSIONING

The Type of the SMBS-T must be set to **Mini:**



Any identified radio obstacle (building, wall …) in SIGFOX antenna vicinity shall also be set accordingly to reflect field situation.

More detailed information are available in SIGFOX training documentation.

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