



SIGFOX SBS-T3
PRODUCT MANUAL

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SIGFOX SBS-T3

ACCESS STATION

PRODUCT MANUAL

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CHANGES DESCRIPTION

Version	Description	Author	Date
1.1	Modification	L.Bordes	02/11/2016
1.2	Corrections content and form	A. Trombetta	14/11/2016
1.3	Update sbs datasheet	A. Trombetta	16/11/16
1.4	Modification BS name	A. Trombetta	22/11/16
1.5	Remove labels section	S. Barreiro	22/11/16
1.6	LNAC datasheet updated	A. Trombetta	05/12/16
1.7	LNAC names updated, addition of hot symbol, complete Canada warnings, correction of version	S. Barreiro	06/12/16
1.8	Addition of label	S. Barreiro	16/12/16
1.9	Update BS, LNA and antenna datasheet	A. Trombetta	16/01/17
2.0	Addition of grounding of LNAC	S. Barreiro	20/01/17
2.1	Completed Japan warning statement	A. Trombetta	02/02/17
2.2	Revome duplicate info with instal guide	A. Trombetta	16/02/17
2.3	LNAC datasheet update + reoulatory groups	A. Trombetta	31/03/17
2.4	Antenna datasheet + reoulatory groups+ power	A. Trombetta	11/05/17
2.5	Taiwan warning	A. Trombetta	11/07/17
2.6	Technical drawing and Lnac datasheet	A. Trombetta	05/09/17
2.7	South korea warning	A. Trombetta	16/10/17
2.8	Electrical consumption	A. Trombetta	21/11/17
2.9	Antenna and LNAC datasheet	A. Trombetta	21/12/17
3.0	Regulatory groups	A. Trombetta	01/02/18
3.1	Peru statement	A. Trombetta	21/11/18
3.2	Added Indonesia to regulatory groups	A. Trombetta	20/08/19
3.3	Change regulatory group table	A. Trombetta	28/08/19

ACRONYMS

Acronym	Description
ETH	Ethernet
LNA	Low Noise Amplifier
LANC	Low Noise Amplifier and Cavity filter
PVC	Polyvinyl Chloride
RF	Radio Frequency
SAT	Satellite
TAP	Transfox Access Point
VSWR	Voltage Standing Wave Ratio

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1. INSTALLATION RECOMMENDATIONS

1.1 Base Station synopsis

Sigfox base stations operate on reception on a specific frequency bandwidth used by sigfox terminals. They are also able if necessary to transmit information to do single or multi-cast back to these terminals.

The base stations include a complete system described in the following synopsis.

The antenna characteristics depend on the operating frequency band and specific site constraints (gain, height, etc.).

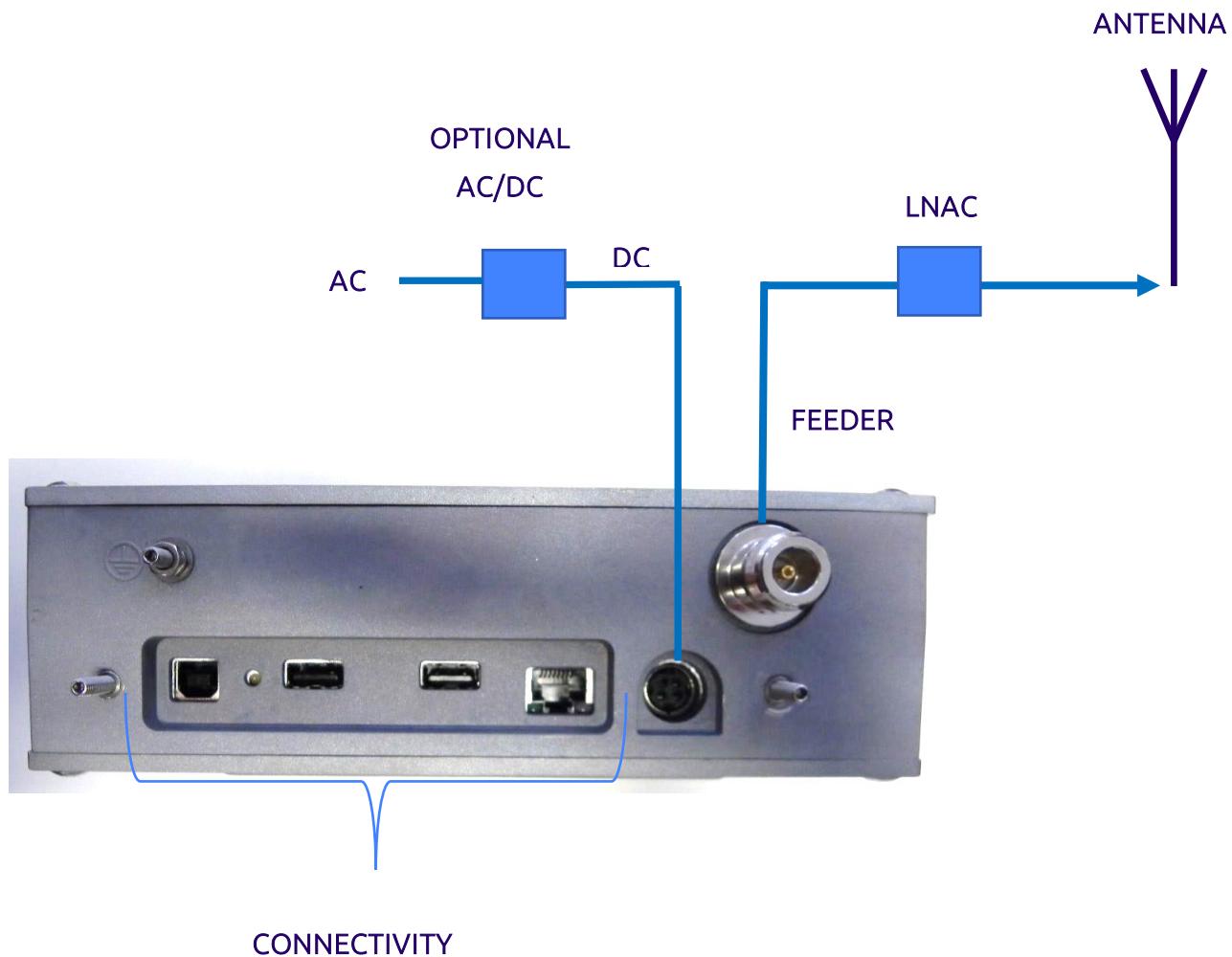
Sigfox will provide the transceiver unit called Sigfox Base Station transceiver (SBS-T) version 3 and the corresponding antenna low noise switch/amplifier (LNAC or LNA). This component integrates a low noise amplifier in reception mode and a switch that bypasses this stage in transmission mode.

This device characteristic depends also on operating frequency bands applicable in the region.

Sigfox Base Station transceiver (SBS-T) version 3 series are ultra-wide range, high linearity transceivers units and feature first class performance radio and innovative software defined processing, for use in Ultra Narrow Band Machine-To-Machine wireless communication systems.

Base Station transceiver (SBS-T) version 3 can have a pre-set receiver frequency depending on the radio regulation applicable in the region. This choice is made by a specific software configuration.

1.2 Installation synopsis





1.3 Installation site recommendations

This base station has been developed to be installed in indoor or outdoor with sealing cover (with exception of South Korea -outdoor only- see warning §2.6).

It must be used with a Low Noise Amplifier and Cavity filter (LNAC) or LNA.

Make sure to follow the installation guidelines and Base Station commissioning to avoid damage, especially maximum cable losses equal or below 6dB.

The datasheets of LNACs are in annex 2.

2. WARNING STATEMENTS / KEY RISKS

2.1 FCC Warning statement

This device complies with Part 15 of the FCC Rules and with Industry Canada license-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 antennas provided by Sigfox must be used. The antenna 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.

2.2 Canada 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 isotropic radiated power (e.i.r.p.) is not more than that necessary for successful communication.

This device complies with Industry Canada license-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.



Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada.

Dans le but de réduire les risques de brouillage radioélectrique à 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.

This radio transmitter SBS-T3-902 has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Only an omnidirectional antenna with a gain of 5dBi or less can be used.

2.3 Japan warning statement

Japanese Radio Law and Japanese Telecommunications Business Law Compliance.

This device is granted pursuant to the Japanese Radio Law (電波法) and the Japanese Telecommunications Business Law (電気通信事業法)

This device should not be modified (otherwise the granted designation number will become invalid).

This equipment is intended for installation in a restricted access location.



2.4 Mexico warning statement

'La operación de este equipo está sujeta a las siguientes dos condiciones:

- (1) es posible que este equipo o dispositivo no cause interferencia perjudicial y
- (2) este equipo o dispositivo debe aceptar cualquier interferencia, incluyendo la que pueda causar su operación no deseada'.

Este equipo ha sido diseñado para operar con las antenas que enseguida se enlistan y para una ganancia máxima de antena de 5 dBi. El uso con este equipo de antenas no incluidas en esta lista o que tengan una ganancia mayor que 5 dBi quedan prohibidas. La impedancia requerida de la antena es de 50 ohms.

2.5 Peru warning statement

En Perú, este equipo diseñado para la banda de 902 – 928 MHz, debe ser configurado para operar solo en la banda 916 – 928 MHz con una PIRE de hasta 4 W (36 dBm) y sujeto a las Condiciones de Operación que establezca el MTC.

2.6 South Korea warning statement

The station is allowed for outdoor use only and Fixed Point-to-multipoint devices

2.7 Taiwan NCC warning statement

Warnings

Measures for the management of low power electric radiant equipment.

Companies, firms or users are not allowed to change the frequency, increase the power or change the original design features and functions.

The use of low-power RF equipment shall not affect the safety of flights and interfere with legitimate communications. When interference is found, it shall be discontinued immediately and shall be used when there is no interference.



A legal communication in the preceding paragraph means that a low-power radio frequency electrical machinery specified in a telecommunications law shall be subject to interference from licit communications or industrial, scientific and medical radioactive radiological equipment.

警語

低功率電波輻性電機管理辦法

第十二條經型式認證合格之低功率射頻電機,非經許可,公司,商號或 使用者均不得擅自變更頻率,加大功率或變更原設計之特性及功能。

第十四條低功率射頻電機之使用不得影響飛航影響安全及干擾合法 通信,經發現有干擾現象時,應立即停用,並改善至無干擾時方得繼續 使用。

前項合法通信,指一電信法規定作業之無線電通信低功率射頻電機需 忍受合法通信或工業,科學及醫療用電波輻射性電機設備之干擾。 »

2.8 Symbols

The station casing can reach high temperatures. Hot surfaces to keep from touching are marked with the symbol:



2.9 Battery

CAUTION: There is a risk of explosion if the battery is replaced by an incorrect type battery.
Dispose of used batteries according to the instructions.

3. BILL OF MATERIAL

3.1 Base station Datasheet

	SBS-T3-868	SBS-T3-902
RADIO CHARACTERISTICS		
Standard	SigFox Ultra Narrow Band Protocol for M2M and IoT	
Max range of operating frequencies supported *	865 to 870 MHz	902 to 928 MHz
Receiver Sensitivity	Typical -142dBm @ 100bps	Typical -134dBm @ 600bps
Data Rate and Modulation	100 bps D-BPSK (UL) 600 bps GFSK (DL)	100 and 600 bps D-BPSK (UL) and 600 GFSK (DL)
Max Transmit Power supported *	39 dBm in conducted mode *	
Pre-amplifier/filter	NF 3.5dB G≥20dB / rejection 30 dB @ +/-10 MHz	
Antenna Connector	Type N Female	
INTERFACES		
Ethernet	1 x RJ45 (10/100BaseT)	
USB port	2 x USB 2.0 female type A (for secondary cellular backhauling)	
Maintenance port	USB 2.0 female type B (for maintenance only)	
POWER		
Power Consumption	30W typical (Rx mode), 60W max peak (in Tx mode) in 12V DC source, with Ethernet as primary connection	
Input power	10.5 to 14V DC / 6A max	
Input plug	Power DIN 4 pin with lock type	
MECHANICAL AND ENVIRONMENTAL		
Product dimensions	200 x 150 x 70 mm (7.9 x 5.9 x 2.7 in)	
Product weight	2.15kg (4.74 lb)	
Operating temperature	-20°C to +55°C	
Storage temperature	-40°C to +85°C	
Robustness	MTBF 160 000 hours	
Protection	IP65 (with cabinet or sealing cover)	
Casing material	Coated Aluminum	
COMPLIANCE		
Safety	EN 60950-1, IEC 60950-1	EN 60950-22, IEC60950-22
Radio	EN 300 220-2 ; EN 300 220-1	FCC part 15.247 ; ARIB STD-T108
EMC	EN 301 489-3 ; EN 301 489-1	FCC Part 15 B FCC 15.207 and FCC 15.209

(*) Note: The maximum frequency range and power setting will vary by channel and according to country regulations. Refer to the regulatory table in annex 3 for more details.

3.2 LNAC choice

The LNAC can provide only RX rejection or RX and TX. In some countries TX rejection is mandatory to comply with out of band emissions and a specific LNAC must be used. These regulatory obligations are described below.



New Zealand and Japan:

In New Zealand and Japan this base station must be installed with LNAC-922-TX described in annex 2.

3.3 Antenna and feeder

3.3.1 Antenna

This Base station was certified with an Omnidirectional Antenna with a Gain of 5dBi.

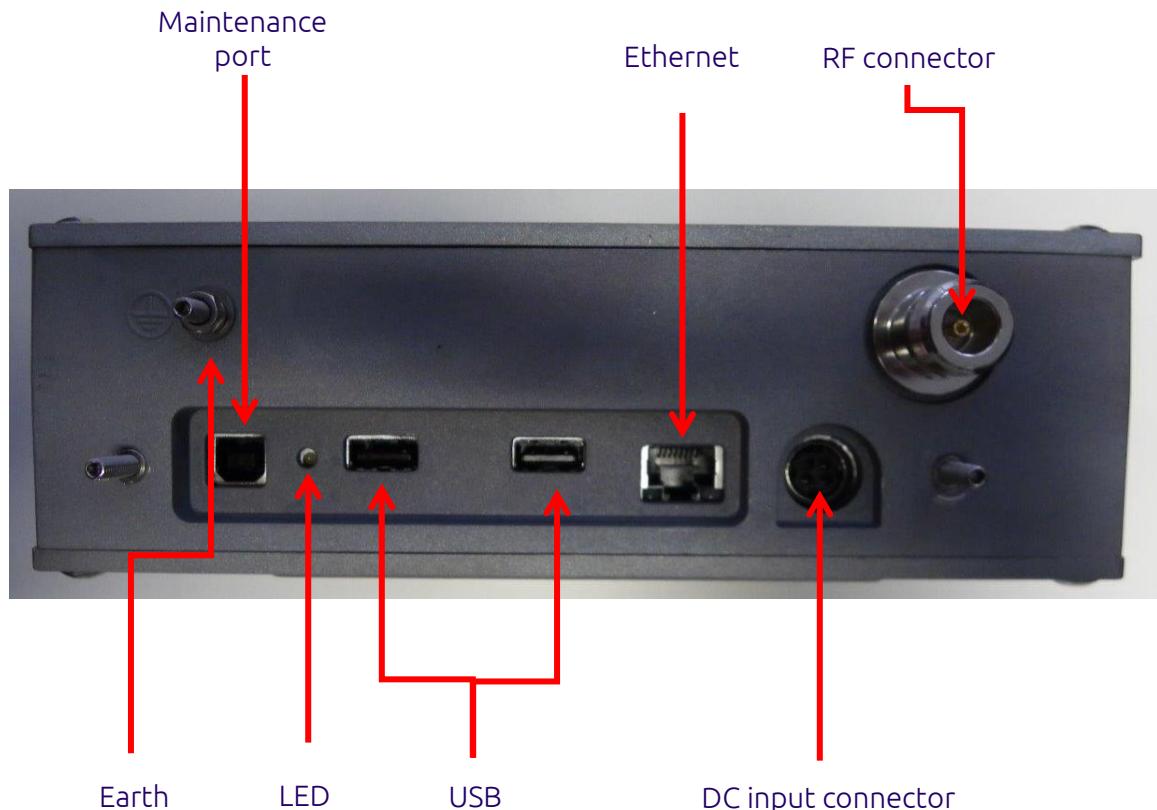


See annex 1 for specifications.

3.3.2 Feeder

For outdoor antenna installation, the type of coaxial cable will depend of site configuration (distance from the antenna). It is fixed on the RF connector.

4. ELECTRICAL CONNECTION

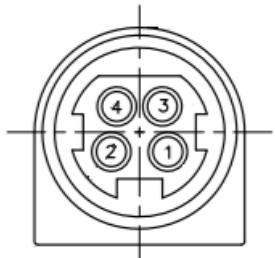


4.1 Power connection

The base station must be connected to a power point with electrical protection according to standards. The base station can operate with DC supply voltage (limits 10.5 to 14.0 V) or with AC to DC adapter.



Figure: power supply input (power DIN 4-pin connector)



Power	Pin Out
V- (Earth)	1,3, shield
V+ (+12VDC)	2,4

In case the Base station is connected to mains by its electrical cable, the electrical plug must be easily reachable in order to remove the cable. In case the electrical plug is not easily reachable it is mandatory to have a circuit breaker system easily accessible for any technician in order to switch off completely the installation.

4.2 Earthing

Earthing all components is extremely important. The reasons are:

- Protection against lightning strikes;
- Evacuation of static electricity in the cables and equipment.

Base station earth point is marked with following symbol:



Base Station



LNAC

In order to protect the station and the LNAC, they must be earthed with a G/Y 6mm² wire (or AWG9).

4.3 LED Status

- blinking green: boot sequence (this is a transitional state)
- blinking orange: connection to the CRA
- fixed orange: no VPN connection
- fixed red: no radio or radio error
- blinking red: power unit default
- fixed green with blinking orange: operational state (the blinking orange frequency is related to the amount of traffic sent to the backend, the more data being sent, the faster it blinks)

5. 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 connectors oxidation and also protect against steam, salt and dust.

The sealing cover or cabinet insures the waterproofness of the base station itself when installed outdoor. The gasket must be correctly positioned in the groove of the cover





The sealing cover must be screwed on the front panel of the station.

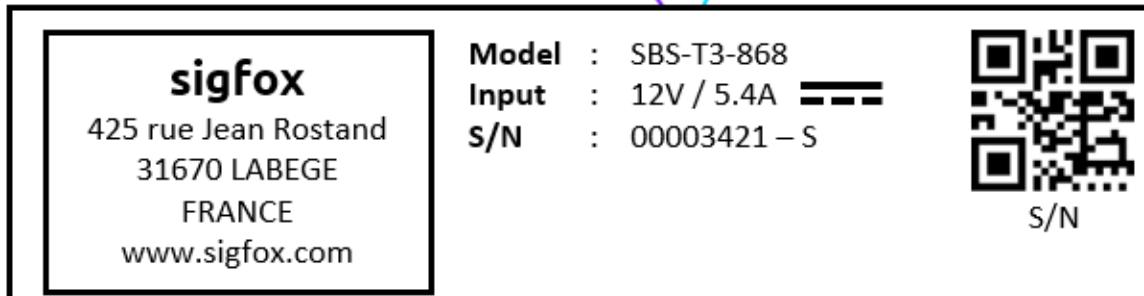


The station must be screwed on the top of the cabinet.

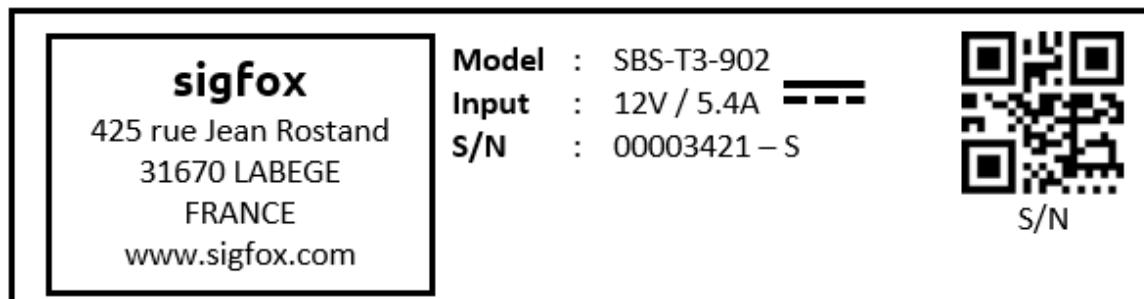
6. LABEL

Following elements will appear in SBS-T3 label:

SBS-T3-868



SBS-T3-902



The complete label will be defined with countries basis, taking into account the certification requirements.

The 8 digits of the serial number is the ID of the Base station.

ANNEXES

Annex 1: antenna specification

Antenna array RO8605NF

ELECTRICAL SPECIFICATIONS	
Antenna type	Collinear dipole array
Frequency	860-930 MHz
Nominal Impedance	50 Ω
VSWR	2:1
Gain	5 dBi
Efficiency	65 % Min
HPBW H-Plane	360 °
HPBW E-Plane	22 °
Polarization	Vertical
ESD Protection	DC Grounded
Power withstanding	50 W
Connector type	N-Female



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MECHANICAL SPECIFICATIONS

Plastic Radome	Pultruded Fiberglass
Color	White
Ingress Protection	IP67
Weight, Antenna + Mounting Hardware	506 g
Wind-loading	300 kph (186.4 mph)
Antenna Length	812.4 mm
Overall Length with Bracket	916.3 mm

ENVIRONMENTAL SPECIFICATIONS

Operating temperature	-40 to +85° C
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Annex 2: LNACs datasheet

LNAC	LNAC-868	LNAC-868-TX	LNAC-902	LNAC-921	LNAC-921-TX	LNAC-922-TX
Frequency Range	867MHz ~870MHz	867MHz ~870MHz	902MHz ~ 928MHz	911MHz ~ 928MHz	919MHz ~ 925MHz	919MHz ~ 925MHz
LNA Electrical Specification						
Central frequency	868.13MHz	868.13MHz	902.2MHz	920.8MHz	920.8MHz	920.8MHz
Gain +21.5dB ±1dB Typ / ±1.5dB Max						
total NF ($\pm 100\text{kHz}$) Max	4.0dB	4.5dB	4.0dB	5.0dB	5.0dB	4.0dB
Typical	3.7dB	4.0dB	3.7dB	4.5dB	4.3dB	3.5dB
Maximum Input Level Out Band: +35dBm Max @ Peak +35dBm Max @ Average						
In Band: +15dBm Max @ Peak +15dBm Max @ Average						
CAVITY FILTER Electrical Specification						
Central Frequency	868.13MHz	867MHz	902.2MHz	921.5MHz	921.5MHz	921.55MHz
3dB Bandwidth	6MHz	6MHz	6MHz	4MHz	4MHz	6MHz
Maximum Insertion Loss	1.0dB @ 868.13MHz	1.0dB @ 868MHz	1.0dB @ 902.2MHz	2.0dB @ 921.5MHz	2.0dB @ 920.8MHz	1.0dB @ 920.8MHz
Rejection (Min)	55dBc @ 500MHz ~ 816MHz 25dBc @ 850MHz 50dBc @ 916MHz ~ 1500MHz	55dBc @ 500MHz ~ 816MHz 25dBc @ 850MHz 35dBc @ 872MHz 55dBc @ 916MHz ~ 1500MHz	55dBc @ 500MHz ~ 895MHz 50dBc @ 920MHz ~ 1500MHz	53dBc @ 500MHz ~ 910MHz 55dBc @ 916MHz 60dBc @ 927MHz 53dBc @ 935MHz ~ 1500MHz	53dBc @ 500MHz ~ 910MHz 55dBc @ 916MHz 60dBc @ 927MHz 53dBc @ 935MHz ~ 1500MHz	40dBc @ 500MHz ~ 894MHz 30dBc @ 894MHz ~ 916.5MHz 30dBc @ 928MHz ~ 950MHz 45dBc @ 950MHz ~ 1500MHz
TX mode						
VSWR, all ports (Typ)	1.3:1					
Insertion loss (Typ)	2.3dB	3.7dB	2.3dB	2.3dB	4.3dB	3.3dB

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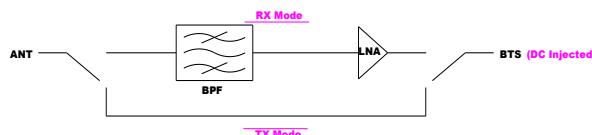
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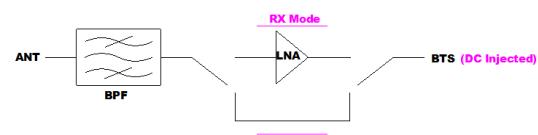
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Environmental Specification	
Operating Temperature Range	-40°C to +85°C
Storage Temperature Range	-45°C to +125°C
Relative Humidity	100%
Weather Protection	IP-65
Bias voltage on coaxial output	should be between 7 and 14 VDC with ESD protection as per standard IEC61000-4-5, and susceptibility test to surges
Switching between Rx/Tx mode	controlled by the bias voltage value on the coaxial output
AC coupling on the antenna side (input):	no DC should reach the antenna, ESD
Marking	ROHS compliant
Mechanical Specification	
Dimension	116 x 116 x 78 mm
Weight	Around 1.6Kg
RF Connectors	N Female Connectors
Finish	White color Spray coating
Mounting Brackets	Included (vertical or horizontal), for pole

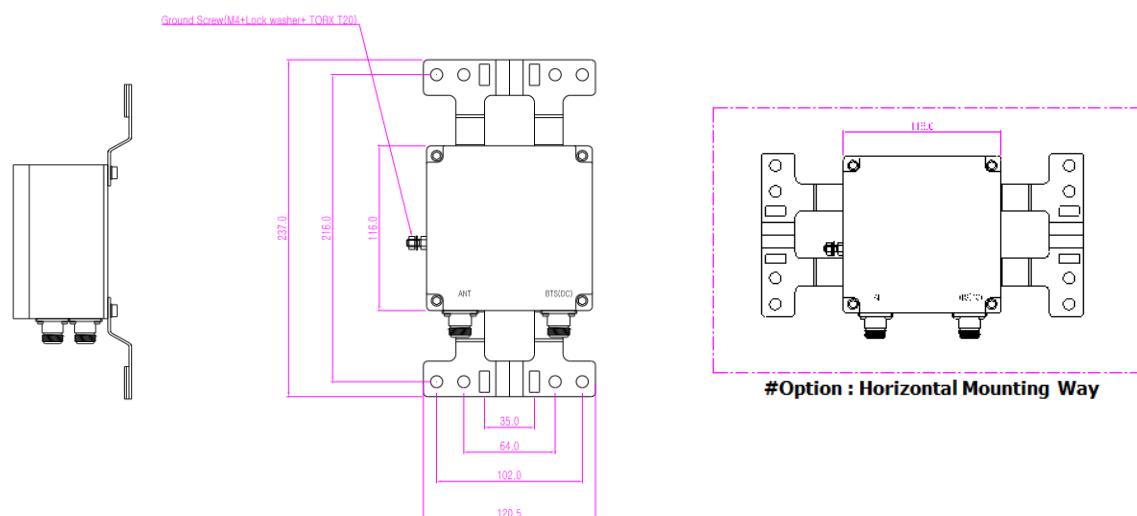
BLOCK DIAGRAM (RX filtering only)

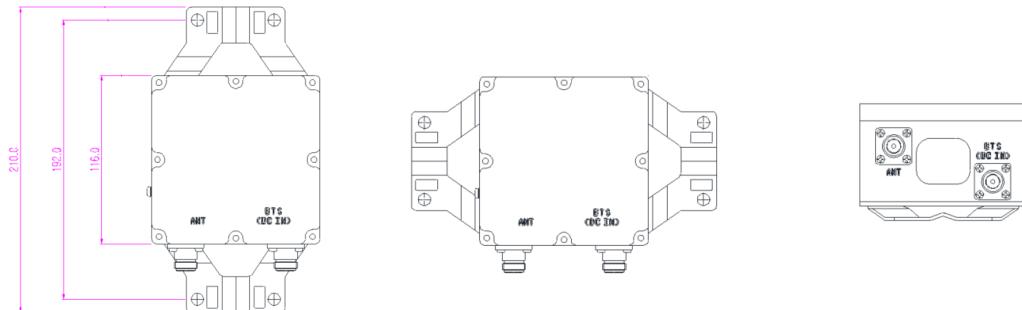


BLOCK DIAGRAM for TX models (RX and TX filtering)



OUTLINE DRAWING



With small brackets:

Annex 3: Regulatory groups

Radio access mode:

DC: Duty Cycle / FH: Frequency Hopping / LBT: Listen Before Talk

EMEA

Country	Regulatory group	Radio access mode	Operating band	Access Station Model and variant	Max output radiated power (EIRP)
E.U. countries					
BAHRAIN					
BENIN					
BOTSWANA					
BURUNDI					
ESWATINI					
GEORGIA					
IRAQ					
IRAN					
IVORY COAST					
KENYA					
MAURITIUS	E	DC 10%	869.4 – 869.65 MHz	SBS-T3-868	29 dBm
NIGERIA					
NORWAY					
OMAN					
SERBIA					
SOUTH AFRICA					
SWITZERLAND					
TUNISIA					
TURKEY					
UAE					
UGANDA					
ZAMBIA					



PRODUCT MANUAL

Americas

Country	Regulatory group	Radio access mode	Operating band	Access Station Model and variant	Max output radiated power (EIRP)
ARGENTINA	U	FH	902 – 928 MHz	SBS-T3-902	35 dBm
BRAZIL	B	FH	902-907.5 & 915-928 MHz	SBS-T3-902	35 dBm
CANADA	U	FH	902 – 928 MHz	SBS-T3-902	35 dBm
COLOMBIA	C	FH	915 – 928 MHz	SBS-T3-902	35 dBm
COSTA RICA	R	FH	920.5 – 928 MHz	SBS-T3-902	30 dBm
ECUADOR	Q	FH	915 – 928 MHz	SBS-T3-902	32 dBm
EL SALVADOR	L	FH	912 – 928 MHz	SBS-T3-902	35 dBm
HONDURAS	U	FH	902 – 928 MHz	SBS-T3-902	35 dBm
MEXICO	U	FH	902 – 928 MHz	SBS-T3-902	35 dBm
PANAMA	U	FH	902 – 928 MHz	SBS-T3-902	35 dBm
PERU	P	FH	916 – 928 MHz	SBS-T3-902	35 dBm
PUERTO RICO	U	FH	902 – 928 MHz	SBS-T3-902	35 dBm
URUGUAY	C	FH	915 – 928 MHz	SBS-T3-902	35 dBm
USA	U	FH	902 – 928 MHz	SBS-T3-902	35 dBm

APAC

Country	Regulatory group	Radio access mode	Operating band	Access Station Model and variant	Max output radiated power (EIRP)
AUSTRALIA	A	FH	915 – 928 MHz	SBS-T3-902	30 dBm
CAMBODIA	S	FH	920 – 925 MHz	SBS-T3-902	29 dBm
HONG KONG	H	FH	920 – 925 MHz	SBS-T3-902	35 dBm
INDIA	I	DC 10%	865 – 867 MHz	SBS-T3-868	35dBm
INDONESIA	O	DC 10%	920 – 923 MHz	SBS-T3-902	26 dBm
JAPAN	J	LBT	920.6 - 922.2 MHz	SBS-T3-902	27dBm
MALAYSIA	M	FH	919 – 923 MHz	SBS-T3-902	27dBm
MYANMAR	Y	FH	915 – 924 MHz	SBS-T3-902	29 dBm
NEW ZEALAND	N	FH	920 – 928 MHz	SBS-T3-902	35 dBm
SINGAPORE	S	FH	920 – 925 MHz	SBS-T3-902	29 dBm
SOUTH KOREA	K	LBT	920.8 - 923.4 MHz	SBS-T3-902	23dBm
TAIWAN	T	FH	920 – 925 MHz	SBS-T3-902	32 dBm
THAILAND	D	DC 10%	920 – 925 MHz	SBS-T3-902	36 dBm

Annex 4: SBS-T3 outline drawings

