SEMTECH

Healthy Home Sensor IAQ

Reference Manual

TBHV110-915
TBHV110-868

Model Name: TBHV110

Table of Contents

1. Description

The Healthy Home Indoor Air Quality sensor utilizes LoRaWAN connectivity to communicate the Temperature, Relative Humidity and Volatile Organic Compound levels of the surrounding environment. The intended use is to place the sensor within a room to determine if the air quality, temperature, and humidity are ideal.

2. Specifications

2.1 Mechanical

2.1.1 Sensor

Length x Width x Height	50mm x 20mm x 50mm
Weight	30g without battery 40g with battery
Sensor	• Temperature & Relative Humidity • Indoor Air Quality

2.2 Environmental

Temperature	0°C to +50°C
IP Rating	IP 40 equivalent

2.3 Radio

Frequency	• 863–870MHz for EU • 902–928MHz for North America
Tx Power	US: +19dBm EU: +17dBm
Rx Sensitivity	-135dBm
Antenna Gain	-2dBi Peak, -5dBi Avg

2.4 Certifications and Conformity

FCC ID: 2AMUGTBSP100
IC: 22980-TBSP100
CE
ROHS REACH

2.5 Power

Source	3.6V 1⁄2 AA Li-SOCl2 1200mAh battery
Maximum Voltage	3.6V
Minimum Voltage	3.1V
Current	135mA maximum/ 100uA minimum

2.6 User Interface

LEDs	One blue LED

2.7 Additional Features

Battery Monitoring

3. Operation

3.1 Transport Mode

Sensors are shipped with a plastic battery insulating pull tab that must be removed before the operation.

3.2 Default Operation

During default operation, the device will send an environmental status message to the network once there is a sufficient delta in the environmental conditions or 5 minutes of inactivity. The precise trigger values can be found in 4.1.1.

4. Messages

LoRaWAN Packets for this device use port 103.

4.1 Status

4.1.1 Triggers

Packet Triggers: 5-minute inactivity, ±2°C delta(environment temp), ±5 %RH Delta, ±25 IAQ Index Delta. The device will scan the environment every 5 minutes.

4.1.2 Payload

Port	103
Payload Length	11 bytes

Bytes	0	1	2	3	4	5	6	7	8	9	10
Field	Status	Battery	Temp. (PCB)	RH	CO_2		VOC		IAQ		Temp. (environment)

4.1.2 Payload (continue)

Status	**Sensors status**	
	Bits [0]	1 – Trigger Event, 0 – Keep-Alive
	Bits [2:1]	RFU
	Bits[3]	1 – Temperature and humidity sensor, 0 – IAQ Sensor
	Bits[4]	1 - Temperature status is changed (2℃ delta)
	Bits[5]	1 - RH status is changed (5% RH deltas)
	Bits[6]	1 - IAQ status is changed (25 IAQ index)
	Bits[7]	RFU
Battery	**Battery level**	
	Bits [3:0]	unsigned value v, range 1 – 14; battery voltage in V = (25 + v) ÷ 10.
	Bits [7:4]	RFU
Board Temp	**Temperature as measured by on-board NTC**	
	Bits [6:0]	unsigned value т, range 0 – 127; temperature in °C = т - 32.
	Bit [7]	RFU measurement range -32 to 95°C
RH	**Relative humidity as measured by digital sensor**	
	Bits [6:0]	unsigned value in %, range 0-100.
	Bit [7]	RFU
eCO_2	**CO2 equivalent estimate**	
	Bits [15:0]	Estimation of the CO2 level in ppm. The sensor does not directly measure CO2 ，but derives this from the average correlation between VOCs and CO2 in human's exhaled breath.

VOC

Breath VOC concentration estimate

Bits [15:0] Conversion into breath-VOC equivalents in ppm concentration.
The scaling is derived from lab tests with the b-VOC gas mixture described in Table 5.

Ref:
BME680 – Datasheet V1.3
Page 10 Table 5
(July 2019)

Table 5: bVOC mixture with Nitrogen as carrier gas

Molar fraction	Compound	Production tolerance	Certified accuracy
5 ppm	Ethane	20 %	5 %
10 ppm	Isoprene /2-methyl-1,3 Butadiene	20 %	5 %
10 ppm	Ethanol	20 %	5 %
50 ppm	Acetone	20 %	5 %
15 ppm	Carbon Monoxide	10 %	2 %

IAQ

Indoor-air-quality value as measured by digital sensor

Bit [15:0] unsigned value range 0 – 500.

Indoor air quality (IAQ) classification

IAQ Index	Air Quality	Impact (long-term exposure)	Suggested action
0 – 50	Excellent	Pure air; best for well-being	No measures needed
51 – 100	Good	No irritation or impact on well-being	No measures needed
101 – 150	Lightly polluted	Reduction of well-being possible	Ventilation suggested
151 – 200	Moderately polluted	More significant irritation possible	Increase ventilation with clean air
201 – 250[9]	Heavily polluted	Exposition might lead to effects like headache depending on type of VOCs	optimize ventilation
251 – 350	Severely polluted	More severe health issue possible if harmful VOC present	Contamination should be identified if level is reached even w/o presence of people; maximize ventilation & reduce attendance
> 351	Extremely polluted	Headaches, additional neurotoxic effects possible	Contamination needs to be identified; avoid presence in room and maximize ventilation

Ref:
BME680 – Datasheet V1.3
Page 9 Table 4.
(July 2019)

Environment Temp

Temperature as measured by digital sensor

Bits [6:0] unsigned value T, range 0 – 127;
temperature in °C = T - 32.

Bit [7] RFU

measurement range -32 to 85°C

5. Battery

5.1 Replacement

Use ER14250 or equivalent.
Remove the upper cap and replace the battery.

5.2 Cautions

CAUTION: Disposal of a battery (or battery pack) into a fire or a hot oven, or mechanically crushing or cutting of a battery (or battery pack) can result in an EXPLOSION!

Leaving a battery (or battery pack) in an extremely high temperature surrounding environment that can result in an EXPLOSION or leakage of flammable liquid or gas.

A battery (or battery pack) subjected to extremely low air pressure may also result in an EXPLOSION or leakage of flammable liquid or gas.

Discard used batteries according to the manufacturer's instructions.

CAUTION: The unit is provided with a battery-powered circuit.

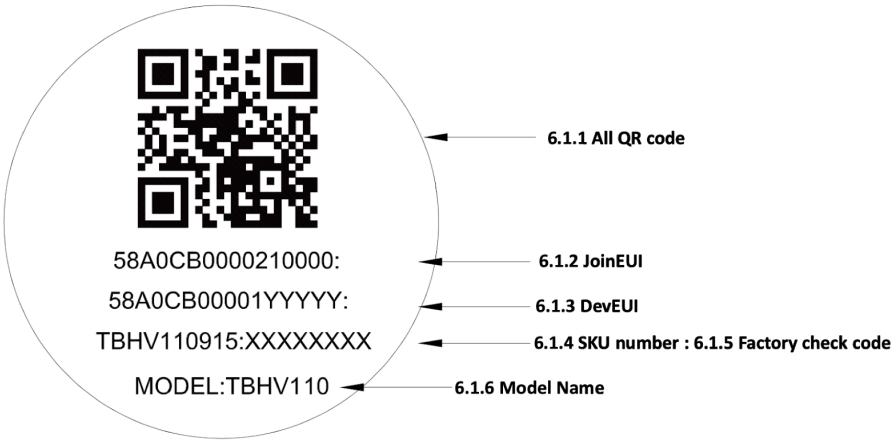
There is a danger of explosion if the battery is incorrectly replaced.

Replace only with the same or equivalent type recommended by the manufacturer. Discard used batteries according to the manufacturer’s instructions.

Risk of Explosion if Battery is replaced by an Incorrect Type. Dispose of Used Batteries According to the Instructions.

6. Label format information

6.1 Round label



6.1.1 All QR code

URN:LWDP:58A0CB0000210000:58A0CBFFFFFEFFFF:TBMS100915:4D4483B1.

The total maximum resulting character sentence is 72 alphanumeric characters long.

6.1.2 JoinEUI

900MHz: 58A0CB0000210000. (US/AU/AS923/BR)

800MHz: 58A0CB0001500000. (EU/IN/RU)

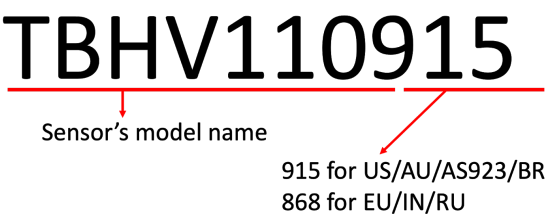
Uses a hexadecimal representation resulting in 16 characters.

6.1.3 DevEUI

58A0CBFFFFFEFFFF.

Uses a hexadecimal representation resulting in 16 characters.

6.1.4 SKU number



Non-reserved characters(except ":" and space) with a maximum length of 20 characters.

6.1.5 Factory check code

4D4483B1.

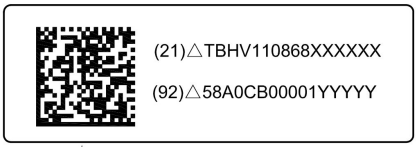
Checksum of the factory production line.

6.1.6 Model Name

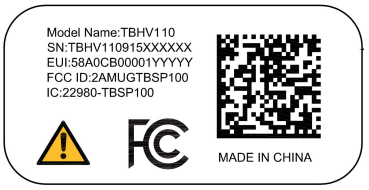
MODEL:TBHV110.

Fixed code, not including in QR code.

6.2 PE Bag & Back Label Label Barcode



PE Bag Label



Back Label

Definition of Back Label and PE Bag Barcode Label:

GS1 DataMatrix

- The GS1 Application Identifier (21) indicates that the GS1 Application Identifier data field contains a serial number.
- The GS1 Application Identifier (92) assigned to the company's internal information is DevEUI.

: Caution! For more information please refer to chapter 5.2 and chapter 10.

7. Important Product & Safety Instructions

For the most current and more detailed information about Tabs features and settings as well as safety instructions, please download the user manual for the products online at www.browan.com before the use of any Tabs products or services.

Certain sensors contain magnets. **Keep away from ALL Children!** Do not put in nose or mouth. Swallowed magnets can stick to intestines causing serious injury or death. Seek immediate medical attention if magnets are swallowed.

These products are not toys and contain small parts that can be dangerous to children under 3 years old. Do not allow children or pets to play with products.

Observe proper precautions when handling batteries. Batteries may leak or explode if improperly handled.

Observe the following precautions to avoid a sensor explosion or fire:

- Do not drop, disassemble, open, crush, bend, deform, puncture, shred, microwave, incinerate or paint the sensors, Hub or other hardware.
- Do not insert foreign objects into any opening on the sensors or Hub, such as the USB port.
- Do not use the hardware if it has been damaged—for example, if cracked, punctured or harmed by water. Disassembling or puncturing the battery (whether integrated or removable) can cause an explosion or fire.
- Do not dry the sensors or battery with an external heat source such as a microwave oven or hairdryer.

8. Warnings

- Do not place naked flame sources, such as lighted candles, on or near the equipment.
- The battery shall not be exposed to excessive heat such as sunshine, fire or the like.
- Do not dismantle, open or shred battery pack or cells.
- Do not expose batteries to heat or fire. Avoid storage in direct sunlight.
- Do not short-circuit the battery. Do not store batteries in a box or drawer where they may short-circuit each other or be short-circuited by other metal objects.
- Do not remove a battery from its original packaging until required for use.
- Do not subject batteries to mechanical shock.
- In the event of a battery leaking, do not allow the liquid to come in contact with the skin or eyes. If contact has been made, wash the affected area with copious amounts of water and seek medical advice.
- Do not use any charger other than that specifically provided for use with the equipment.
- Observe the plus (+) and minus (-) marks on the battery and equipment and ensure correct use.
- Do not use any which is not designed for use with the product.
- Do not mix cells of different manufacture, capacity, size or type within a device.
- Keep batteries out of the reach of children.
- Seek medical advice immediately if a battery has been swallowed.
- Always purchase the correct battery for the equipment.
- Keep batteries clean and dry.
- Wipe the battery terminals with a clean dry cloth if they become dirty.

9. Notices

- Avoid exposing your sensors or batteries to very cold or very hot temperatures. Low or high temperature conditions may temporarily shorten the battery life or cause the sensors to temporarily stop working.
- Take care in setting up the Hub Gateway and other hardware. Follow all installation instructions in the User Guide. Failure to do so may result in injury.
- Do not install hardware equipment while standing in water or with wet hands. Failure to do so can result in electric shock or death. Use caution when setting up all electronic equipment.
- When charging the sensors, do not handle the sensors with wet hands. Failure to observe this precaution could result in electric shock.
- PROP 65 WARNING: This product contains chemicals known to the State of California to cause cancer and birth defects or other reproductive harm
- Cleaning Tabs Products: Use a clean dry cloth or wipe to clean Tabs products. Do not use detergent or abrasive materials to clean the Tabs products, as this may damage the sensors.

10. Cautions

CAUTION: Disposal of a battery (or battery pack) into a fire or a hot oven, or mechanically crushing or cutting of a battery (or battery pack) can result in an **EXPLOSION!**
Leaving a battery (or battery pack) in an extremely high temperature surrounding environment that can result in an **EXPLOSION** or leakage of flammable liquid or gas.
A battery (or battery pack) subjected to extremely low air pressure may also result in an **EXPLOSION** or leakage of flammable liquid or gas.
Discard used batteries according to the manufacturer's instructions.

CAUTION: The unit is provided with a battery-powered circuit.
There is a danger of **EXPLOSION** if the battery is incorrectly replaced.
Replace only with the same or equivalent type recommended by the manufacturer. Discard used batteries according to the manufacturer's instructions.
Risk of **EXPLOSION** if Battery is replaced by an Incorrect Type. Dispose of Used Batteries According to the Instructions.

11. Regulatory

CE FC	Hereby, Browan Communications Inc. declares that the radio equipment for Tabs products is in compliance with Directive 2014/53/EU. This device complies with Part 15 of the FCC Rules and RSS Standards of Industry Canada. 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.
	This symbol means that according to local laws and regulations your product should be disposed of separately from household waste. When this product reaches its end of life, take it to a collection point designated by local authorities. Some collection points accept products for free. The separate collection and recycling of your product at the time of disposal will help conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment.

11.1 Federal Communication Commission Interference Statement

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 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.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

This device complies with Part 15 of the FCC Rules. 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.

IMPORTANT NOTE:

Radiation Exposure Statement:

The product complies with the US portable RF exposure limit set forth for an uncontrolled environment and is safe for intended operation as described in this manual. The further RF exposure reduction can be achieved if the product can be kept as far as possible from the user body or set the device to lower output power if such a function is available.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

11.2 Industry Canada statement:

This device contains license-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's license-exempt RSS(s). Operation is subject to the following two conditions :

(1) This device may not cause interference
(2) This device must accept any interference, including interference that may cause undesired operation of the device

Cet appareil contient des émetteurs / récepteurs exempts de licence qui sont conformes au (x) RSS (s) exemptés de licence d'Innovation, Sciences et Développement économique Canada. L'opération est soumise aux deux conditions suivantes :

(1) Cet appareil ne doit pas causer d'interférences
(2) Cet appareil doit accepter toute interférence, y compris les interférences pouvant provoquer un fonctionnement indésirable de l'appareil

The product complies with the Canada portable RF exposure limit set forth for an uncontrolled environment and are safe for intended operation as described in this manual. The further RF exposure reduction can be achieved if the product can be kept as far as possible from the user body or set the device to lower output power if such a function is available.

This equipment should be installed and operated with minimum distance 0cm between the radiator & your body.

Déclaration d'exposition aux radiations :

Le produit est conforme aux limites d'exposition pour les appareils portables RF pour les Etats-Unis et le Canada établies pour un environnement non contrôlé. Le produit est sûr pour un fonctionnement tel que décrit dans ce manuel. La réduction aux expositions RF peut être augmentée si l'appareil peut être conservé aussi loin que possible du corps de l'utilisateur ou que le dispositif est réglé sur la puissance de sortie la plus faible si une telle fonction est disponible.

Cet équipement doit être installé et utilisé avec un minimum de 0 cm de distance entre le radiateur et votre corps.

Appendix. Configuration Downlink Command

Appx. 1 Configuration Command

Port	204

Appx. 1.1 Payload

Bytes	0	0~1
Field	Cmd	Config

Cmd	**Command**	1 byte
	Bit [7:0]	0x00 – Set keep alive value.(per unit:5min) default value : 1 => 1*5 min = 5 min value range : 1~216 (5min ~ 18hours) 0x01 – Set temperature delta. default value : 2(°C) value range : 0~100 0x02 – Set RH delta. default value : 5(%RH) value range : 0~100 0x03 - Set IAQ index delta. default value : 25 value range : 0~255
Config	**Configuration**	0~1 bytes

See the table as follows:

Cmd	Command Description	Config Length
0x00(1byte)	Get Sensor Configuration **(Only for unconfirmed downlink)**	0 bytes
0x00(1byte)	Set keep alive value.	1 byte
0x01(1byte)	Set temperature delta.	1byte
0x02(1byte)	Set RH delta.	1 byte
0x03(1byte)	Set IAQ index delta.	1 byte

Payload Content	Command content
	Ex: 000C || **0102 || 0205 ||** 0332 00 0C => Set keep alive value : 0x0C -> 12 (*5min) = 60 min **(per unit:5min)** 01 02 => Set temperature delta : 0x02 -> 2(°C) 02 05 => Set RH delta : 0x05 -> 5(%RH) 03 32 => Set IAQ index delta : 0x32 -> 50

Appx. 2 Response Content

(Only for unconfirmed downlink)

Port	204
Payload Length	8 bytes

Payload Content	Response content
	Ex: 000C01020205 0319 00 0C => Keep alive interval : 0x0C -> 12(*5 min) = 60 min (per unit : 5 min) 01 02 => Temperature delta : 0x02 -> 2(°C) 02 05 => RH delta : 0x05 -> 5(%RH) 03 19 => IAQ index delta : 0x19 -> 25

Appx. 3 Frame Count 0 Content

Payload Length	17 bytes
Payload Content	Frame count 0 content Ex: **01** **01** => command ID **06000000** => bootloader version : 0x00000006 (little-endian format) **00030000** => HW ID : 0x00000300 (little-endian format) **7ff1f102** => FW CRC : 0x02f1f17f (little-endian format) **e2d4f6ee** => PubKey ID : 0xeef6d4e2 (little-endian format)