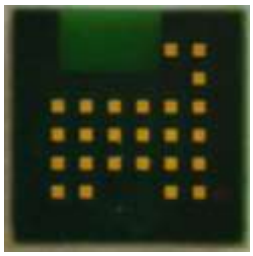
ALPW-BLEM103

Bluetooth® Smart HCI Module



FEATURES

- Ready-to-use *Bluetooth®* v4.0 Low Energy Smart HCI Module
- Low power consumption
- Host connectivity : SPI or UART
- LGA-25 footprint for easy integration
- Radio characteristics
  - TX Power : 3dBm to -18dBm
  - RX Sensitivity : -80dBm
  - Typical free-space range : 20m
- RF Output for external antenna connection
- Dimensions : 12 x 12 x 2.2 mm
- *Bluetooth®* SIG, CE, FCC and IC qualified

DESCRIPTION

The ALPW-BLEM103 HCI module is a single-mode *Bluetooth®* Low Energy compliant HCI module targeting low-power and low duty-cycle applications.

The ALPW-BLEM103 has a flexible hardware architecture and enables the use of *Bluetooth®* Low Energy with any host microcontroller running the ALPWISE *Bluetooth®* Low Energy Protocol stack.

Together with the ALPWISE Bluetooth Low Energy Software Development Kit, it enables easy application development and fast time-to-market.

APPLICATIONS

The ALPW-BLEM003 facilitates the integration of cost-effective and low power consumption wireless technologies for a wide range of application segments, thanks to a continuously updated and qualified list of services and profiles.

- Medical Devices
- Mobile Accessories
- Sport and Fitness
- Entertainment Devices
- Wireless Sensors
- Consumer Electronics
- Monitoring and Control
- Industrial
- Building Automation

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1 Product Description

The ALPW-BLEM103 HCI *Bluetooth*® Low Energy module embeds a low-power radio controller. The module can be accessed through UART/SPI interface by any host microcontroller running the ALPWISE *Bluetooth*® Low Energy protocol stack.

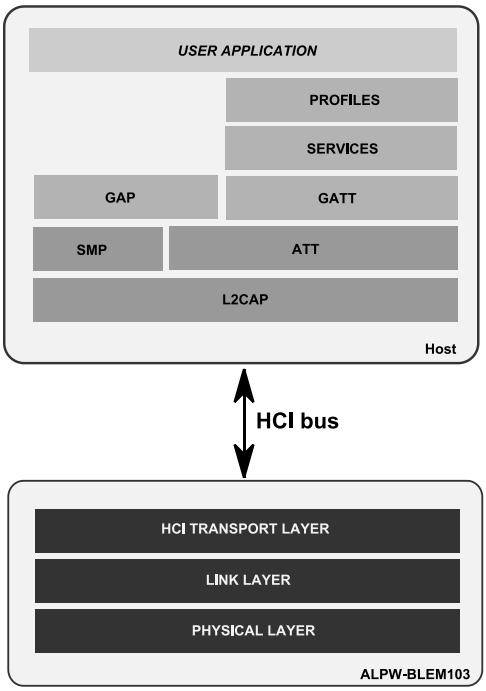

Figure1.: Simplified *Bluetooth*® Low Energy Stack

The user has the possibility to select the serial interface (UART or SPI) by pulling the SEL pin the right way (refer to chapter 2.1 for more information).

1.1 Functional Block Diagram

Below is a functional block diagram:

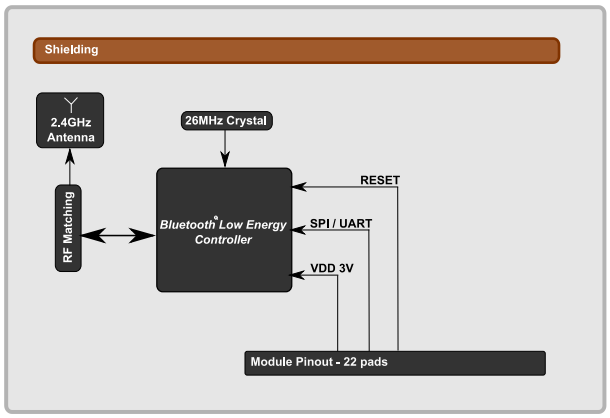

Figure2.: Block diagram

Below is a typical application diagram, showing how to easily design your own applications around the ALPW-BLEM103.

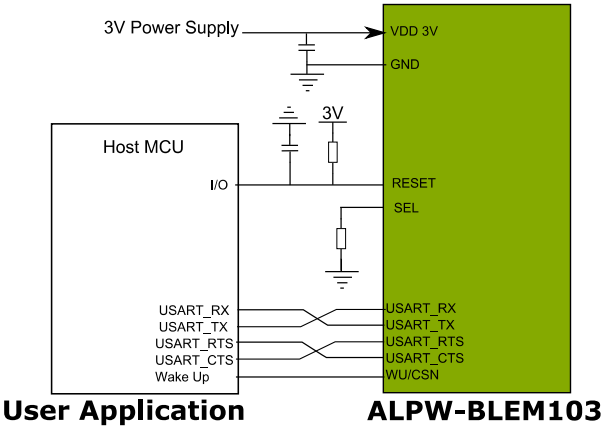

Figure3.: UART typical application

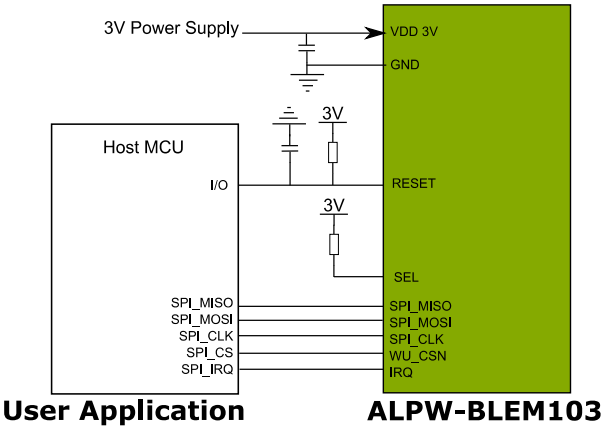

Figure4.: SPI typical application

2 Detailed Description

2.1 Module Pin Description

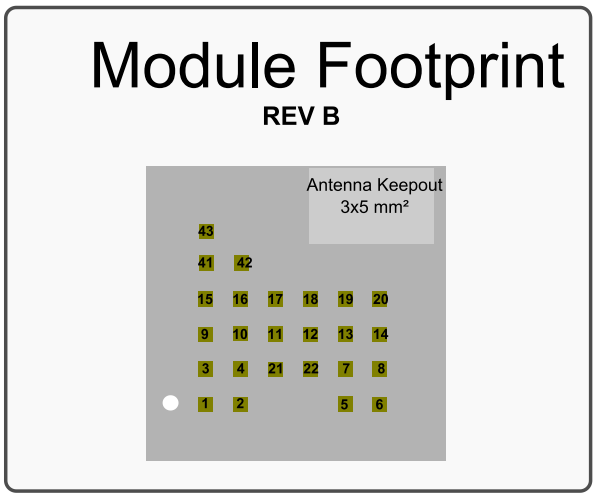

Figure5.: Module pin numbering (Top View)

LGA25pin	Signal Name	Description
1	GND	Ground
2	NC	
3	NC	
4	NC	
5	UART_RTS	USART bus Request to send or data IRQ
6	UART_CTS/SPI SCK	USART Clear to Send or SPI clock line
7	WU/CSn	Wake-up / SPI Chip Select
8	VDD 3,3V	3.3V supply to the module.
9	GND	Ground
10	NC	-
11	UART_TX / SPI_MISO	USART bus transmit / SPI Slave data output
12	NC	-
13	NC	-
14	GND	Ground
15	RESET	Reset pin Internally Pulled down
16	UART_RX / SPI_MOSI	UART bus receive / SPI Slave data input
17	SEL	Interface Selection USART / SPI 0 : UART 1 : SPI
18	NC	-
19	NC	-
20	NC	-
21	GND	Ground
22	GND	Ground
41	GND	Ground
42	RF	RF output
43	GND	Ground

2.2 Power Supply

The module is designed to operate within a 2.7V to 3.3V voltage range. User should ensure a proper filtering of its power supply: a ferrite bead, connected to a shunt capacitor to the ground (10uF typically) is a good practice.

2.3 Reset

The module reset input is directly connected to the pinout, and internally pulled down.

To ensure a proper reset of the radio controller, the reset signal should remain high for at least 1ms.

3 Device operating requirements

3.1 Absolute Maximum Ratings

The absolute maximum ratings listed below have not been tested, and correspond to the main components specifications. Stresses beyond those limits may cause permanent damage to the module.

Sym	Description	Value	Unit
V_{DD}	Supply Voltage	-0.2 to 3.8	V
V_{IN}	Input Voltage on any pin	0.2 to 4.0	V
ΔV_{SS}	Voltage difference between ground pins	Max 10	mV
V_{RFIN}	Input RMS Voltage on RF pin	Max 2.1	V

3.2 Recommended operating conditions

Sym	Description	Value	Unit
V_{DD}	Supply Voltage	2.7 to 3.3	V
T_{OPNom}	Operational Temperature Range	-20 to +55°C	°C
I_{Max}	Maximum Input Current	20	mA

3.3 Power Consumption

3.3.1 Static current consumption

T= 25°C

Sym	Description	Value	Unit
I_{RX}	RX peak Current	25	mA
I_{TX}	TX peak Current	26	mA
I_{Idle}	Idle Mode Current	294	µA
I_{Sleep}	Sleep Mode Current	24	µA
$I_{Deep-Sleep}$	Deep Sleep Mode Current	13	µA

3.4 Electrical Characteristics

3.4.1 Digital interface Characteristics

Sym	Description	Value	Unit
$UART_{BR}$	UART Baud Rate	Max 1843.2	kBd/s
SPI_{BR}	SPI Bit rate	Max 5000	kBd/s

3.4.2 RF General Characteristics

Sym	Description	Value	Unit
F	Operating RF band	2.4-2.483	GHz
DR	On-air data rate	1	Mb/s
Ch	Channel spacing	2	MHz
Receiver			
Z_{in}	Input Impedance	50	Ω
S_{in}	Sensitivity	-80	dBm
$P_{in\ max}$	Maximum input power	-5	dBm
Transmitter			
P_{RF}	Output RF Power	-18 to +3	dBm
D_m	Typical Range	20	m

The typical range highly depends on the module integration and the environment characteristics. In free-space conditions, use the following graph to determine the average path losses:

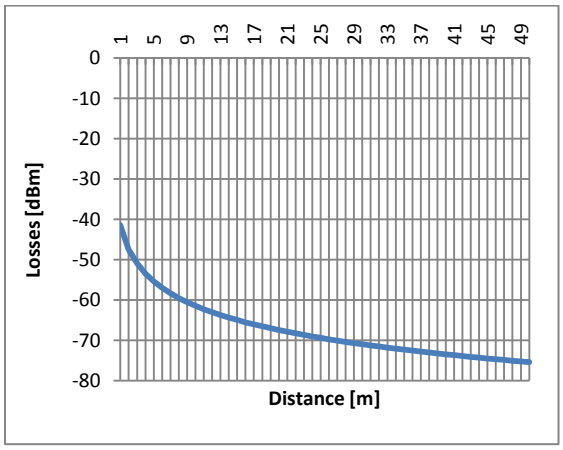

Figure6.: Free-Space Losses

4 Soldering recommendations

To avoid damaging the module components, the following reflow profile should be observed.

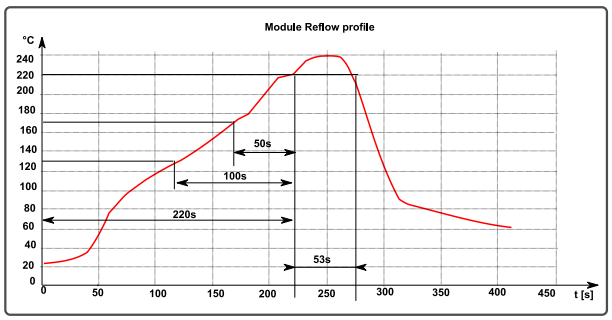

Figure7.: Recommended reflow profile

5 Product Dimensions

5.1 External Dimensions

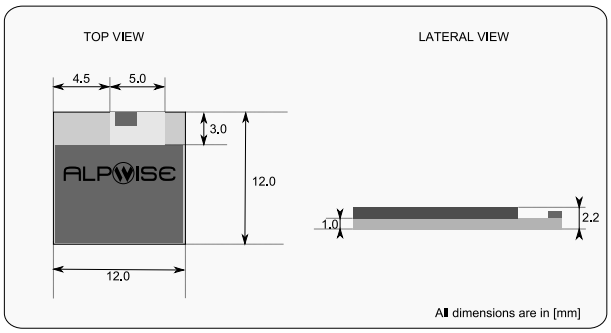

Figure8.: Product dimensions

5.2 Footprint

The module footprint dimensions are detailed below.

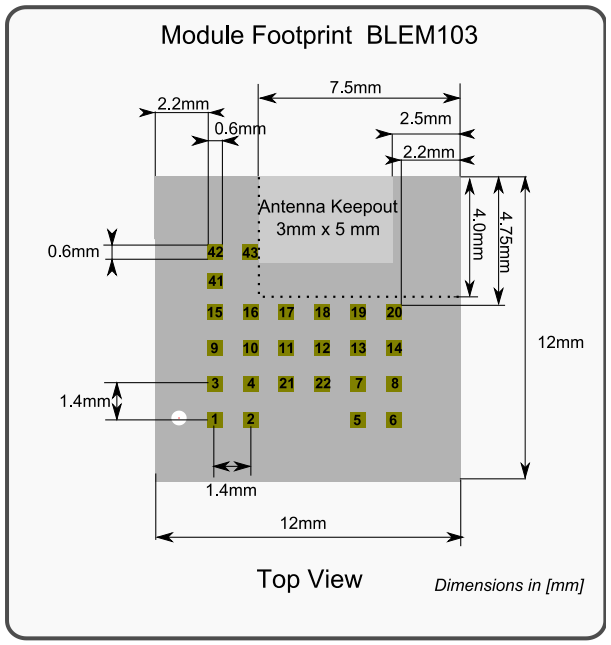

Figure9.: Product footprint

5.3 Top Side marking

The picture below shows the typical product printed codes:

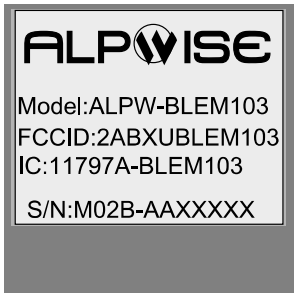

Figure10.: Product top-side marking

S/N	M02	B	-	AA	XXXXX
	Module Id	HW Rev.		Manufacturing Lot Id	Serial Number

6 Recommended Layout

When implementing the module on a custom PCB, the antenna clearance zone must be respected by all means:

- No ground on any layer
- No copper tracks, via, on any layer of the pcb.

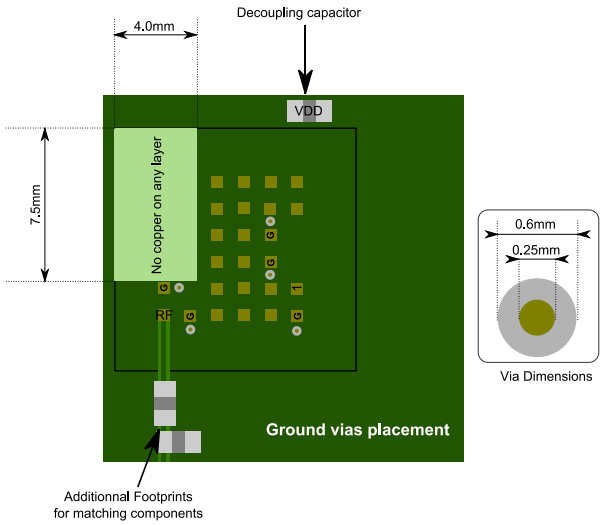

Figure11.: Recommended end-application PCB integration

The output RF power, achievable range, harmonic level directly depends on the integration of the module. The antenna clearance zone must be respected by all means, excluding copper on any layer of the pcb.

The user must deliver a low-noise power supply to the module, without AC ripple voltage. Noisy supply voltages must have a filtering circuit (serial ferrite bead connected to a shunt capacitor to ground).

The placement of the ground vias is very important. Ground tracks length must be as short as possible to avoid parasitic inductance. A four-layer PCB is the insurance of a low-impedance ground plane: see the example layout above.

7 Resources

7.1 Related Documents

ALPWISE *Bluetooth*® Low Energy Software Development Kit
Bluetooth® SIG Specification

7.2 Software Resource

ALPWISE is providing a complete SDK supporting *Bluetooth*® Low Energy protocol stack and a complete list of profiles. The *Bluetooth*® Low Energy SDK is available for a wide range of microcontroller core. Please contact our sales support to get the right information and find the best solution for your application.

7.3 Hardware Resource

T
he ALPW-BLEM103 is embedded on the ALPW-BLEDVKCM3 Development kit, designed to ensure an easy evaluation of our product, and an easy development of your application.

The kit provides a main board with the ALPW-BLEM103 module mounted on it, connected to a Cortex-M3 microcontroller (1MB Flash size, 72MHz). The kit provides all be connection to build your application.

Furthermore, for sensor application, the ALPW-DVBBLE *Bluetooth*® Low Energy Development board can be connected to the kit. The board integrates an accelerometer, temperature sensor, LEDs and switches to ease sensor application development.
For more information about our product line, please contact our sales support.

8 Certifications

8.1 Bluetooth SIG

Certification pending.

8.2 FCC and IC

The ALPW-BLEM103 is certified compliant with the FCC CFR 47 Part 15, Subpart B and C, and RSS-210 Issue 8.
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.
Any changes or modifications not expressly approved by ALPWISE could void the user's authority to operate the equipment.
FCC RF Radiation Exposure Statement:

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 meets both portable and mobile limits as demonstrated in the RF Exposure Analysis. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter except in accordance with FCC multi-transmitter product procedures.
IC Statements:
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.
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.

OEM Responsibilities to comply with FCC and Industry Canada Regulations

The ALPW-BLEM103 module has been certified for integration into products by OEM integrators under the following condition:

- The transmitter module must not be co-located or operating in conjunction with any other antenna or transmitter except in accordance with FCC multi-transmitter product procedures.

As long as the two conditions above is met, further transmitter testing will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

IMPORTANT NOTE : In the event that these conditions can not be met (for certain configurations or co-location with another transmitter), then the FCC and Industry Canada authorizations are no longer considered valid and the FCC ID and IC Certification Number can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC and Industry Canada authorization.

End Product Labeling

The ALPW-BLEM103 module is labeled with its own FCC ID and IC Certification Number. If the FCC ID and IC Certification Number are not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. In that case, the final end product must be labeled in a visible area with the following:

"Contains FCC ID: 2ABXUBLEM103"

"Contains IC: 11797A-BLEM103"

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module or change RF related parameters in the user manual of the end product.

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 instruction, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If the equipment does cause harmful interference to radio or television reception which can be determined by turning the equipment off and on, the user is encourage to try to correct interference by one or more of the following measures:

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

8.2.1 FCC et IC

Déclaration d'IC:

Ce dispositif est conforme aux normes RSS exemptes de licence d'Industrie Canada. Son fonctionnement est assujetti aux deux conditions suivantes : (1) ce dispositif ne doit pas provoquer de perturbation et (2) ce dispositif doit accepter toute perturbation, y compris les perturbations qui peuvent entraîner un fonctionnement non désiré du dispositif. Selon les réglementations d'Industrie Canada, cet émetteur radio ne doit fonctionner qu'avec une antenne d'une typologie spécifique et d'un gain maximum (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Pour réduire les éventuelles perturbations radioélectriques nuisibles à d'autres utilisateurs, le type d'antenne et son gain doivent être choisis de manière à ce que la puissance isotrope rayonnée équivalente (P.I.R.E.) n'excède pas les valeurs nécessaires pour obtenir une communication convenable.

Responsabilités des OEM quant à la conformité avec les réglementations de FCC et d'Industrie Canada

Le module ALPW- BLEM103 a été certifié pour entrer dans la fabrication de produits

exclusivement réalisés par des intégrateurs dans les conditions suivantes :

- Le module transmetteur ne doit pas être installé ou utilisé en concomitance avec une autre antenne ou un autre transmetteur.

Tant que ces deux conditions sont réunies, il n'est pas nécessaire de procéder à des tests supplémentaires sur le transmetteur. Cependant, l'intégrateur est responsable des tests effectués sur le produit final afin de se mettre en conformité avec d'éventuelles exigences complémentaires lorsque le module est installé (exemple : émissions provenant d'appareils numériques, exigences vis-à-vis de périphériques informatiques, etc.)

REMARQUE IMPORTANTE : En cas d'inobservance de ces conditions (en ce qui concerne certaines configurations ou l'emplacement du dispositif à proximité d'un autre émetteur), les autorisations de FCC et d'Industrie Canada ne seront plus considérées valables et l'identification de FCC et le numéro de certification d'IC ne pourront pas être utilisés sur le produit final. Dans ces cas, l'intégrateur OEM sera chargé d'évaluer à nouveau le produit final (y compris l'émetteur) et d'obtenir une autorisation indépendante de FCC et d'Industrie Canada.

Etiquetage du produit final :
« Contient identification FCC : 2ABXUBLEM103 »
« Contient IC : 11797A -BLEM103 »
Dans le guide d'utilisation du produit final, l'intégrateur OEM doit s'abstenir de fournir des informations à l'utilisateur final portant sur les procédures à suivre pour installer ou retirer ce module RF ou pour changer les paramètres RF.

8.3 CE

The ALPW-BLEM103 is certified compliant with the following standard:

SAFETY:

EN60950-1

EMF

EN 62311 (2008) : Limitation of human exposure to electromagnetic fields

RADIO

EN 300 328 v1.7.1 : Electromagnetic compatibility and Radio Spectrum Matters (ERM)

8.4 Installation notes

The product should be mechanically stressed when installed.

Reflow soldering is possible, according to the recommendations in chapter 5.

8.5 Usage conditions notes

This product has limited ESD protection. Take measures to protect the unit against static electricity, especially in dry atmosphere.

Follow the operating conditions regarding the power supply applied to the product.

This product is intended for general purpose and standard use in general electronic equipment. For applications in a particular environment, please contact the technical support.

All external circuits connected to our device shall be of SELV type (*Safety Extra Low Voltage*), and shall be qualified as *Limited Power Souces,* as defined in chapters 2.2 and 2.5 of IEC60950-1:2005+/A1:2010 and EN60950-1:2006+/A11:2009+/A1:2010+/A12:2011.

All power sources provided to our device shall be of SELV type (*Safety Extra Low Voltage*), and shall be qualified as *Limited Power Souces,* as defined in chapters 2.2 and 2.5 of IEC60950-1:2005+/A1:2010 and EN60950-1:2006+/A11:2009+/A1:2010+/A12:2011.

The antennas and antenna cables connected to our device shall always remain indoor, and in the same building as our device.

Do not wash the product.

8.6 Storage notes

In order to preserve the performance characteristics of the module, do not store the product in the following conditions:

- Storage in an environment where the temperature may be outside the 5°C to 35°C range
- Storage in an environment where the humidity may be outside the 45% to 85% range
- Storage of the product for more than 1 year after the date of delivery

8.7 Other Cautions

The datasheet document is copyrighted.

Do not use this product for other purposes than those listed.

9 ROHS Declaration

This product is manufactured following the restrictions of the 2002/95/CE European directive, based upon the information from our subcontractor.

10 Support

For any technical questions regarding usage of this BT module, please consider the following Email address:

alpwisesales@alpwise.com

11 Sales

For any commercial questions regarding access of this BT module, please consider the following Email address:

alpwisesales@alpwise.com

12 Contact information

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