

BOX860-WiFi 802.11b/g/n Interactive Toy

Data Sheet

BOX860
WiFi Interactive Toy

Revision History

Revision	Revision date	Description
PA1	2015-05-04	First Draft
PA2		
PA3	2015-08-26	Added radio restrictions, battery box label, updated flammability class
A	2015-12-09	Release A

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1 INTRODUCTION

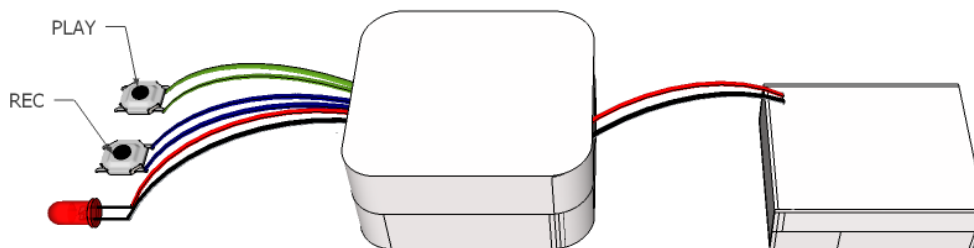
1.1 Overview

BOX860 is one of the end nodes of an easy to use messaging system based on WLAN. The other end is a smartphone APP. The BOX860 is intended to be placed inside a toy.

The simple user interface consists of two tactile switches and a LED. The switches controls the recording and playback of messages and the LED signals the presence of a new message.

BOX860 has a built in Access Point capability to enable quick and easy configuration into the end users network.

This data sheet pertains to hardware revision R2A and later of the BOX860.



1.2 Key Features

- WLAN 802.11 b/g/n radio modem for 2.4GHz ISM band.
- Data Rates: 1, 2, 5.5, 6, 7.2, 9, 11, 12, 14.4, 18, 21.7, 24, 28.9, 36, 43.3, 48, 54, 57.8, 65 Mbps
- Modulation: QPSK, 16QAM, 64QAM DBPSK, DQPSK, CCK, OFDM with BPSK
- Open WEP, WPA/WPA2 encryption
- Operates in station or access point mode
- Low power consumption
- Built in speaker and microphone
- Simple configuration and control via smartphone App
- Single Supply Voltage by 3xAA batteries in separate enclosure
- RoHS Compliant
- Integrated antenna

2 HARDWARE ARCHITECTURE

2.1 Block Diagram

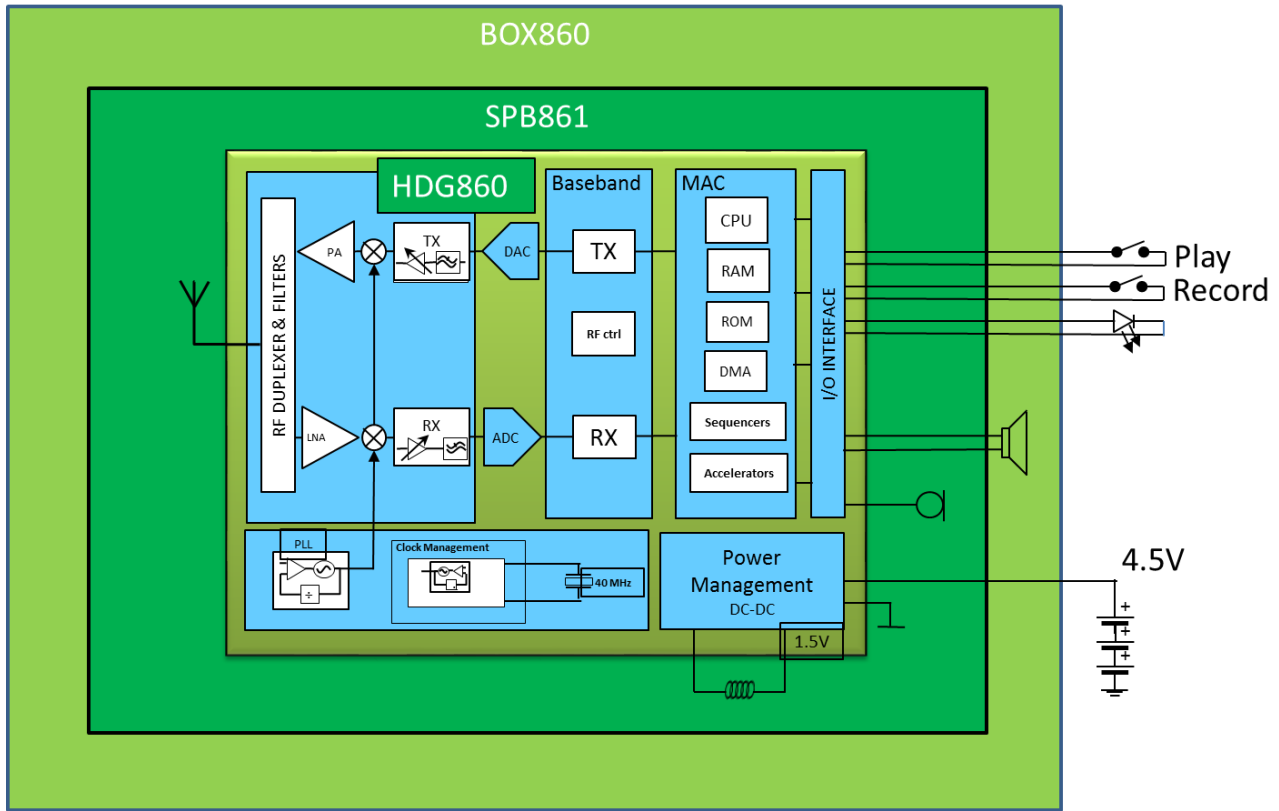


Figure 2-1 Block Diagram:

2.2 Order information

Order number	Description	MOQ
BOX860	BOX860 with battery case and wiring	100

Table 2.1: Ordering Information

3 ELECTRICAL DATA

3.1 Absolute maximum ratings

Rating	Min	Max	Unit
Supply voltage	-0.3	4.5	V
Input RF level		10	dBm
Storage temperature	0	+50	°C

Table 3.1: Absolute maximum ratings. Exceeding any of the maximum ratings, even briefly lead to deterioration in performance or even destruction. Values indicates condition applied one at the time.

3.2 Electro Static Discharge (ESD)

BOX860 withstands ESD voltages up to 2000V HBM (Human Body Model) according to JESD22-A114 and up to 300 V CDV (Charged Device Model) according to JESD22-A115.

3.3 Recommended operating conditions

Symbol		Min	Typ.	Max	Unit
VCC	Supply Voltage	3.0		4.5	V
T _{OP}	Operating temperature	0		50	°C
	Indoor use or corresponding temperature and humidity conditions				

Table 3.2: Recommended operating conditions

3.4 Power Consumption

If no other conditions are started does VDD=3.6V, T_{amb} = 25°C apply.

Mode	Conditions	Min	Typ.	Max	Unit
Peak current	All modes			300	mA
TX [802.11b]	CCK 11Mbps		205	230	mA
TX [802.11g]	OFDM 54 Mbps		165	200	mA
TX [802.11n]	OFDM 65 Mbps		140	170	mA
RX [802.11b]	Max sensitivity		53	59	mA
RX [802.11g]	Max sensitivity		56	64	mA
RX [802.11n]	Max sensitivity		56	64	mA
Record	WiFi Associated		58		mA
Playback	WiFi Associated		70		mA
Idle	Between check for messages		0.2		mA

Table 3.3: Current consumption in different modes.

Notes:

- 1) WLAN in power save mode listening to access point beacons.

3.5 RF Performance

Conditions: VBAT= 3.6V, Tamb= 25°C Spectrum Mask and BER according to IEEE 802.11b/g/n specification.

Parameter	Conditions	Min	Typical	Max	Units
Frequency range	ETSI ¹	2412		2484	MHz
	FCC ¹	2412		2462	
Supported Channels	ETSI ¹	Ch.1 (2412 MHz)		Ch. 13 (2472 MHz)	
	FCC ¹	Ch.1 (2412 MHz)		Ch. 11 (2462 MHz)	
Transmitter performance ¹					
Output power	CCK 1 Mbit/s	+15	+16	+17	dBm
Output power	CCK 11 Mbit/s	+15	+16	+17	dBm
Output power	OFDM 6 Mbit/s	+13	+14	+15	dBm
Output power	OFDM 54Mbit/s	+13	+14	+15	dBm
Output power	HT20 MSC0-MSC6	+10	+11	+12	dBm
Receiver performance 11b/g, T _{amb} = 25°C					
Receiver sensitivity	DSSS 1Mbit/s		-94	-87	dBm
Receiver sensitivity	DSSS 2Mbit/s		-91	-85	dBm
Receiver sensitivity	CCK 5.5Mbit/s		-89	-84	dBm
Receiver sensitivity	CCK 11Mbit/s		-86	-81	dBm
Receiver sensitivity	BPSK 6Mbit/s		-89	-84	dBm
Receiver sensitivity	BPSK 9Mbit/s		-88	-83	dBm
Receiver sensitivity	QPSK 12Mbit/s		-86	-81	dBm
Receiver sensitivity	QPSK 18Mbit/s		-84	-79	dBm
Receiver sensitivity	16QAM 1/2 24Mbit/s		-82	-76	dBm
Receiver sensitivity	16QAM 3/4 36Mbit/s		-79	-72	dBm
Receiver sensitivity	64QAM 2/3 48Mbit/s		-74	-68	dBm
Receiver sensitivity	64QAM 3/4 54Mbit/s		-72	-67	dBm
Receiver performance 11n, T _{amb} = 25°C					
Receiver sensitivity	OFDM/BPSK 7.2Mbit/s		-90	-83	dBm
Receiver sensitivity	OFDM/BPSK 14.4Mbit/s		-88	-80	dBm

Receiver sensitivity	OFDM/BPSK 21.7Mbit/s		-86	-78	dBm
Receiver sensitivity	OFDM/16-QAM 28.9Mbit/s		-83	-75	dBm
Receiver sensitivity	OFDM/16-QAM 43.4Mbit/s		-79	-71	dBm
Receiver sensitivity	OFDM/64-QAM 57.8Mbit/s		-72	-67	dBm
Receiver sensitivity	OFDM/64-QAM 65Mbit/s		-70	-66	dBm

Table 3.4: RF performance.

- 1) BOX860 products sold for final use in North America has the Operations Region set to FCC in the OTP memory. This limits the use of frequencies to those allowed in FCC Part15 and backs down the TX power at the band edges.
- 2) TX output power varies with temperature as shown in Figure 3-1

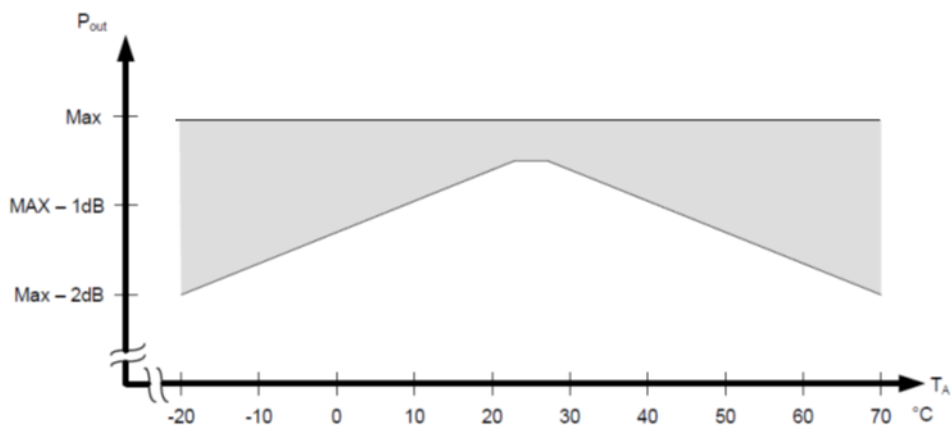


Figure 3-1: Pout vs ambient temperature

- 3) TX Output power varies with temperature as shown in Figure 3-2

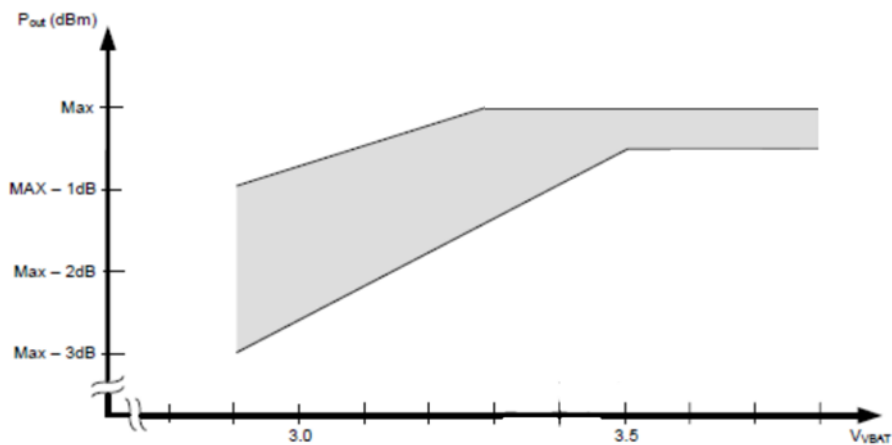


Figure 3-2: Output Power vs. VCC voltage

3.5.1 Batteries

The BOX860 is designed to use 3x1.5V size-AA/LR6 alkaline batteries as voltage supply. Other types of batteries may affect the function and in worst case cause damage to the electronics.

4 Interfaces

4.1 Tactile switches

The BOX860 has two tactile switches. The switches are mounted on two 350mm wires, signal and ground, and creates a short to ground when pressed.

The switches are to be placed so that the end user can access them easily, for example in the paws of a stuffed toy animal.

The PLAY switch is to be placed in the right paw of the toy.

The REC switch is to be placed in the left paw of the toy.

4.2 LED

The BOX860 has a single red LED. It is mounted on 350mm long wires to allow it to be placed at a visible location on the toy.

4.3 Speaker

The BOX860 has a 2" speaker mounted inside the main enclosure.

4.4 Microphone

The microphone is mounted on the PCB.



5 Mechanical

5.1 Main enclosure

The main enclosure host the circuit board and speaker, its dimensions is shown in Figure 5-1

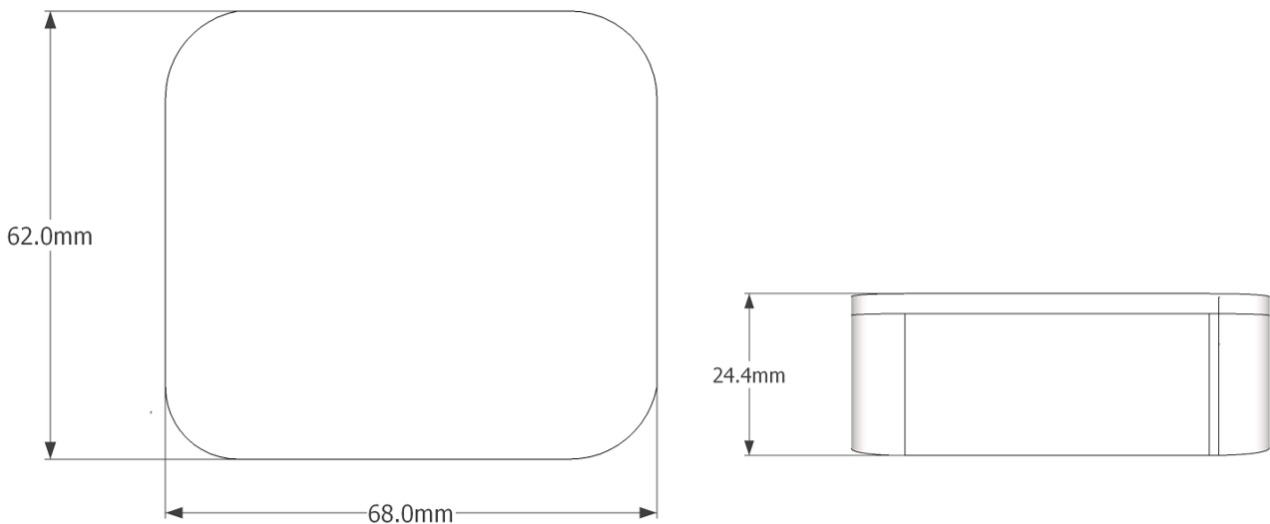


Figure 5-1: Main enclosure dimensions

The main enclosure is latched with two screws.

The main enclosure is made of polyethylene with flammability class V-2.

5.2 Battery box

The battery box holds three AA/LR6 size batteries and is permanently connected to the main enclosure with two 200mm wires.

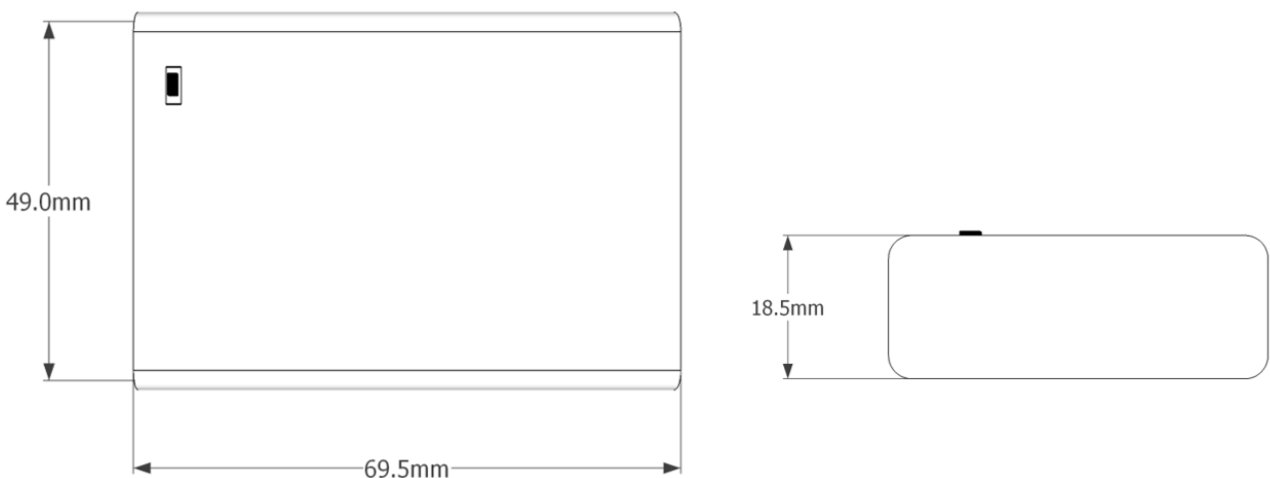


Figure 5-2: Battery Box dimensions

The Battery Box has an on/off switch located on the top side upper left corner. The battery compartment is latched by a screw.

The Battery Box is made of polyethylene with flammability class V-2

5.3 Tactile switches

The two tactile switches are of the same type. Two wires of 350mm connects the switch to the PCB.

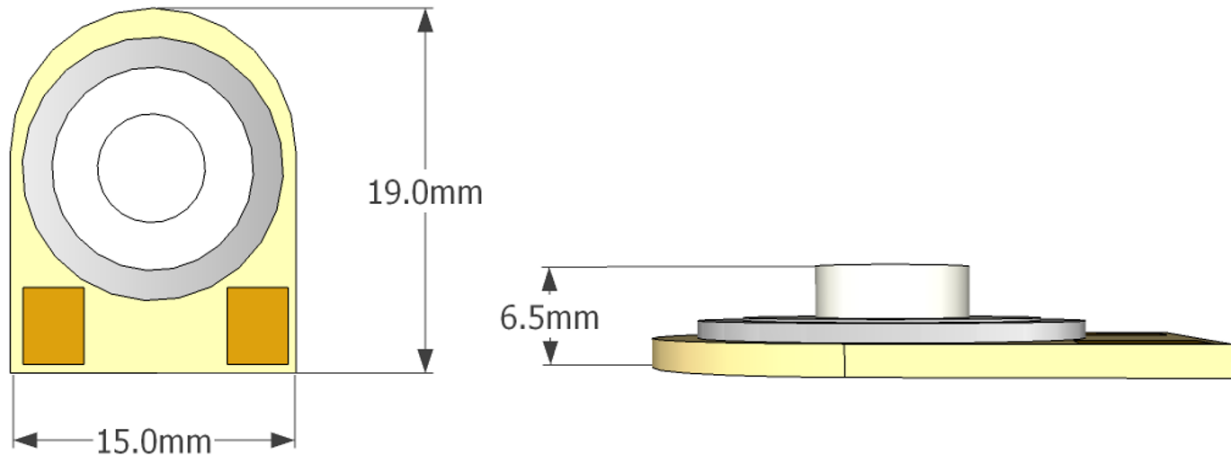


Figure 5-3: Tactile switch dimensions

6 APPLICATION INFORMATION

6.1 Power Supply

BOX860 should be powered by 4.5V by three alkaline AA/LR& size batteries. The 1.5V batteries are inserted in series in the Battery Box to generate the 4.5V.

6.2 Power on/off

The BOX860 is turned on by sliding the switch in the Battery BOX to its "ON" position and turned off by sliding the switch into its "OFF" position.

6.3 Configuration

When the BOX860 has no configuration it starts in Access Point mode with the SSID:TOY-xx-yy-zz where xx-yy-zz are the last six digits of the MAC address. A Smart Phone with the corresponding APP can then associate to the BOX860 and configure it to the network to use and "pair" itself with the BOX860.

6.4 Record

After configuration messages to the APP can be recorded by pressing the REC switch. When the REC switch is pressed once the LED starts blinking and the message is recorded until the REC switch is pressed again or the max message length is reached. Once the message is recorded it is sent to the server for forwarding to the APP. In local mode the message is delivered to the APP directly.

6.5 Playback

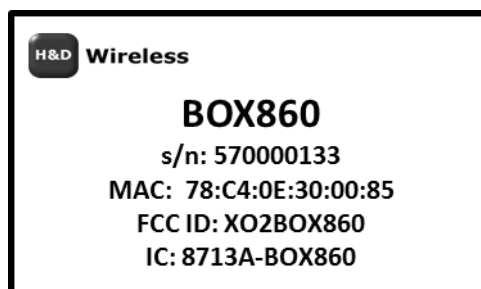
When the BOX860 receives a message the LED will start to blink. To listen to the message the PLAY switch is pressed. After a message has been recorded it can be listen to by pressing the PLAY switch.

6.6 Environmental statement

The BOX860 is designed and manufactured to comply with the RoHS and Green directives.

6.7 Markings on the BOX860

The label is imprinted with the FCC ID and serial number. See example below:



6.8 Markings on the Battery Box

As the battery box normally is the easy accessible part of the system the data is also available on the battery box label.

Use only alkaline batteries
Caution: Risk of explosion if battery is replaced by an incorrect type. Dispose of used batteries according to the instructions

7 STANDARDS COMPLIANCE

7.1 IEEE/IETF

Standard	Notes
802.11b	Rates: 1, 2, 5.5, 11 Mbps
802.11d	International (country-to-country) roaming extensions
802.11g	Rates: 6, 9, 12, 18, 24, 36, 48, 54 Mbps
802.11i	Enhanced security
802.11j	Extensions for Japan
802.11n	Rates: 7.2, 14.4, 21.7, 28.9, 43.3, 57.8, 65

Table 7.1: Applicable IEEE standards

7.2 WiFi Alliance

Specification	Notes
WiFi 802.11n STA	
WPS2.0	

Table 7.2: Applicable WiFi Alliance standards

7.1 Regulatory

Country	Approval authority	Regulatory	Frequency band
USA	FCC	FCC ID: XO2BOX860	2.412 GHz -2.462 GHz
Canada	IC	IC: 8713A-BOX860	2.412 GHz -2.462 GHz
Europe	Self Certification	ETSI	2.412 GHz -2.4835 GHz

Table 7.3: Regulatory standards

7.1.1 FCC (United States of America)

This equipment complies with Part 15 of the FCC rules and regulations.

To fulfill FCC Certification requirements, an OEM manufacturer must comply with the following regulations:

The modular transmitter is labeled with its own FCC ID number, and, if the FCC ID is 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. This exterior label can use wording such as the following:

Example of label required for OEM product containing BOX860

Contains FCCID: X02BOX860
The enclosed device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (i) this device may not cause harmful interference and (ii) this device must accept any interference received, including interference that may cause undesired operation.

NOTE: Only the built in antenna is approved for used with BOX860.

IMPORTANT: This equipment 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 (FCC 15.19).

IMPORTANT: This device is approved as a portable device with respect to RF exposure compliance and when the BOX860 is installed in its final casing the BOX860 has to be placed so that the distance between the antenna and any body part of the end user is always greater than 27mm.

IMPORTANT: Modifications not expressly approved by this company could void the user's authority to operate this equipment (FCC section 15.21).

IMPORTANT: The transmitter module may not be co-located with any other transmitter or antenna.

IMPORTANT: The finished product is required to comply with all applicable FCC equipment authorizations regulations, requirements and equipment functions not associated with the transmitter module portion. Compliance for unintentional radiators (Part 15 Subpart B "Unintentional Radiators"), such as digital devices, computer peripherals, radio receivers, etc. has to be demonstrated.

7.1.2 IC (Canada)

Equipment is subject to certification under the applicable RSSs, shall be permanently labeled on each item, or as an inseparable combination. The label must contain the following information for full compliance:

Certification Number:	IC: 8713A-BOX860
Manufacturer's Name, Trade Name or Brand Name	H&D Wireless AB
Model Name:	BOX860

IMPORTANT: This equipment for which a certificate has been issued is not considered certified if it is not properly labeled. The information on the Canadian label can be combined with the manufacturer's other labeling requirements

IMPORTANT: 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: The transmitter module may not be co-located with any other transmitter or antenna.

IMPORTANT: 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 permitted for successful communication.

IMPORTANT: The installer of this radio equipment must ensure that the antenna is located or pointed such that it does not emit RF field in excess of Health Canada limits for the general population. Consult Safety Code 6, obtainable from Health Canada's website www.hc-sc.gc.ca/rpb.

7.1.3 ETSI (Europe)

The BOX860P module has been certified for use in European union countries according to ETSI EN 300 328 (Electromagnetic compatibility and Radio spectrum matters for equipment operating in the 2,4 GHz ISM band using spread spectrum modulation techniques). This standard is harmonized within the European Union and covering essential requirements under article 3.2 of the R&TTE-directive.

If the BOX860P module are incorporated into a product, the manufacturer must ensure compliance of the final end-user product to the European harmonized EMC and low voltage/safety standards. A declaration of conformity must be issued for the product including compliance references to these standards. Underlying the declaration of conformity a technical construction file (TCF), including all relevant test reports and technical documentation, must be issued and kept on file as described in Annex II of the R&TTE-directive.

Furthermore, the manufacturer must maintain a copy of the BOX860P module documentation and ensure the final product does not exceed the specified power ratings, antenna specifications, and/or installation requirements as specified in the user manual. If any of these specifications are exceeded in the final product, a complete re-test must be made in order to comply with all relevant standards as basis for CE-marking. A submission to notified body must be used only if deviations from standards have been found or if non-harmonized standards have been used.

8 Related Documents

9 Trademarks

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10 SALES OFFICES

Global Sales Office Sweden

H&D Wireless AB
H&D Wireless AB
Norgegatan 1
164 32 Kista
Sweden

E-mail: info@hd-wireless.se
Support: support@hd-wireless.se
Home page: www.hd-wireless.se

Local sales offices and representatives see www.hd-wireless.se