

# EE-420R

## Electronic Shelf Label 4,2”

The EE-420R is a black/white/red E-ink based electronic shelf label with a screen size of 4.2” and with 802.15.4 based wireless communication.

## Specifications manual



All information subject to change without notice.

## Document History

<b>Model Number:</b>	EE-420R	<b>Specification Number:</b>
<b>Edition:</b>	4.0	<b>Original Spec Number:</b>
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## Limited Warranty and Disclaimers

Please read this manual carefully before installing or using this product.

## Serial Number

A serial number appears on all Opticon products. This official registration number is directly related to the device purchased. Do not remove the serial number from your Opticon device. Removing the serial number voids the warranty.

## Warranty

Unless otherwise agreed in a written contract, all Opticon products are warranted against defects in materials and workmanship for two years after purchase. Opticon will repair or, at its option, replace products that are defective in materials or workmanship with proper use during the warranty period. Opticon is not liable for damages caused by modifications made by a customer. In such cases, standard repair charges will apply. If a product is returned under warranty and no defect is found, standard repair charges will apply. Opticon assumes no liability for any direct, indirect, consequential or incidental damages arising out of use or inability to use both the hardware and software, even if Opticon has been informed about the possibility of such damages.

## Packaging

The packing materials are recyclable. We recommend that you save all packing material to use should you need to transport your product or send it for service. Damage caused by improper packaging during shipment is not covered by the warranty.

## Trademarks

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## Revision History

Product Name : EE-293 Specifications manual

Revision	Date	Page	Section	Description of Changes
1.0	17/07/2017	-	-	Initial release
2.0	21/09/2017			Changed to new layout
3.0	07/08/2023	10		Updated radio spec
4.0	06/02/2024	18		Update mechanical drawing

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## 1. Abstract

This manual provides specifications for the EE-420R electronic shelf label (hereafter referred to as “ESL”).

## 2. Overview

The EE-420R is an Electronics Shelf Label with a 2.4GHz radio for data communication. The product has a 3-color E-ink based e-paper display with black, white and red pixels. This product uses Direct Sequence Spread Spectrum RF technology that allows for an ultra-low power consumption combined with a reduced sensitivity to background noise. That means less interference by other radios that operate in the 2.4GHz band. The radio protocol that is used is based on the IEEE 802.15.4 standard that specifies the physical layer and media access control for low-rate wireless personal area networks. The protocol is entirely implemented, except for some small changes that have all to do with the connection protocol to a base station. When the base station is not available the EE-420R switches to a non-802.15.4 standard to lower the power. That is especially meaningful when the EE-420R is not being used for a prolonged period of time (e.g. during shipping)

The EE-420R is intended to be operated in combination with a base station such as the EBS-40 which can control a large number of EE-420R and other types of ESL of the same family such as EE-202 and EE-750.

## 3. Physical Features

### 3.1. Dimensions

(WxHxD): 100.0 x 92.4 x 15.5 mm

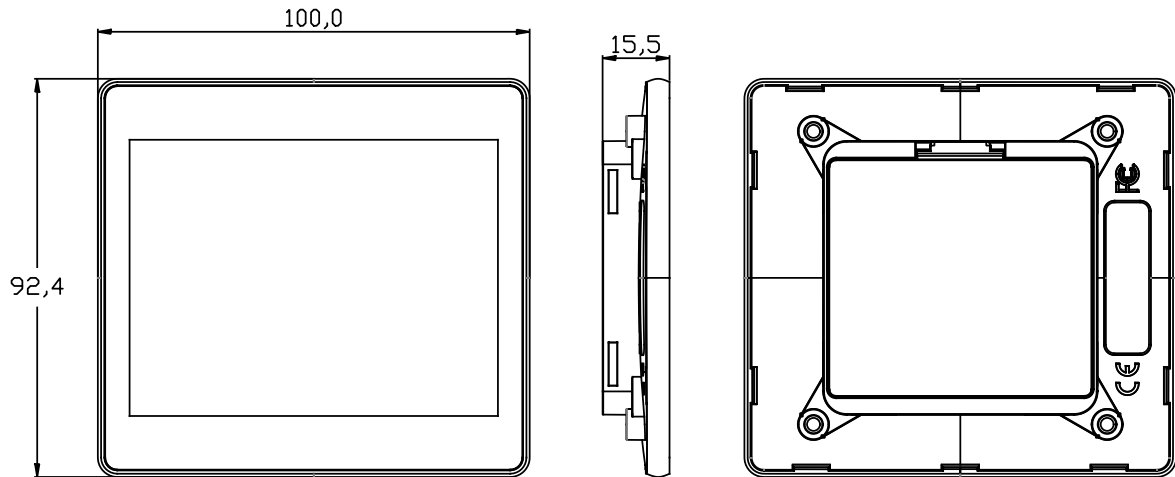


Figure 1: Dimensions

### 3.2. Weight

100 g (including batteries) TBD

## 4. Environmental Specifications

### 4.1. Operating Temperature and Humidity

Temperature: 0 to 40° C

Humidity: 30% to 70% RH

**Warning:** Make sure to use the EE-420R under the recommended (green) combinations of temperature and humidity and never use it under the orange marked conditions.

Recommended temp./humidity		Relative Humidity (%)												
		20	25	30	35	40	45	50	55	60	65	70	75	80
Temp.	0													
	5													
	10													
	15													
	20													
	25													
	30													
	35													
	40													
	45													
	50													
	55													
	60													

### 4.2. Storage Temperature and Humidity

Temperature: -20 to 40° C

Humidity: 30% to 70% RH

### 4.3. Static Electricity

Air discharge: ± 8 kV MAX (No malfunction)

Contact discharge: ± 4 kV MAX (No malfunction)



## 5. Controls

Items	Specifications		Remarks
CPU	Type	8-bit	
	ROM	256KB	
	RAM	8 KB	
	Clock frequency	32 MHz	
LCD	Active area	W 84.8 x H 63.6 mm	
	Number of dots	W 400 x H 300	
	Dot pitch	0.21 x 0.21 (107dpi)	mm
Radio	Modulation	DSSS	
	Frequency	2405 + 5(C-11) MHz Channel 11-26	Channels 27~28 are available on request. <sup>2</sup>
	Baud rate	250 Kbits / second	

<sup>1</sup>Channels 1~10 are reserved for sub-GHz frequencies, which are not supported by the EBS-50.

<sup>2</sup>Local regulations may not allow the use of these channels.

## 6. Electrical Specifications

### 6.1. Power and battery

Parameter	Typ	Unit	Remarks
Operating voltage	3.0	V	2x Alkaline AAA size battery
Battery life	5	Years	Reference: Panasonic LR03XWA 2 updates per day
Sleep current	<1	μA	When the transmitter and receiver are idle
Poll rate	>5	Per sec.	See below

The ESL is in sleep mode almost the entire time. The device wakes up at regular intervals (called the poll time) and it then transmits a poll request to the base station. When the base station has no data to send, it just acknowledges the poll after which the ESL immediately goes back to sleep. The poll rate is configurable and is set to 20 seconds by default. A higher poll rate will decrease the power consumption but will increase the response time.

The power is supplied to the EE-420R by two replaceable Alkaline AAA size batteries (not included). The typical operation time on a set of batteries is 5 years when using quality alkaline batteries, based on a poll rate of 20 and on average two display updates per day.

### 6.2. Radio Specifications

Parameter	Min	Typ	Max	Unit	Remarks
Receiver sensitivity		-97	-89	dBm	Over the entire temp. and operating voltage range
Nominal output power	0.9		1.1	dBm	
Frequency	2405		2405 + 5(C-11)	MHz	Over the entire temp. and operating voltage range
Transfer rate		250Kbit/s			
RSSI range		100		dB	Signal strength indication that can be reported to the base station

### 6.3. Radio Protocol

Modified 802.15.4 (Physical layer and Media Access Control layer).

#### 6.3.1. The physical layer

The physical layer (PHY) provides the data transmission service, as well as the interface to the physical layer management entity, which offers access to every layer management function and maintains a database of information on related personal area networks. Thus, the PHY manages the physical RF transceiver and performs channel selection and energy and signal management functions. It operates on the above mentioned frequency band. The PHY layer is 100% compliant and is based on direct sequence spread spectrum (DSSS) technique with a transfer rate of 250 kbit/s.

### **6.3.2. The medium access control layer**

The medium access control (MAC) layer enables the transmission of MAC frames through the use of the physical channel. Besides the data service, it offers a management interface and itself manages access to the physical channel. It also controls frame validation, guarantees time slots and handles node associations. Finally, it offers hook points for secure services. The EE-420R does not make use of the optional network beaconing, instead it used a polling mechanism to increase power efficiency. Some changes are made to the standard to allow for more efficient data frames and better power efficiency, especially when nodes are not connected to a base station.

### **6.3.3. Security**

The 802.15.4 standard 128-bit AES encryption is supported. A secure method for key management is implemented as well. The encryption is optional though and can be configured via the base station. By default, the radio traffic is unencrypted.

7. Labeling

7.1. Product label

The product label is affixed to the ESL as shown below.



Figure 2: product label

The barcode shows the product serial number.

The 'B' is followed by 10 hexadecimal digits. These correspond to the MAC address of the unit.

Material: Base + laminate protection against wear.

Base: PP film, thickness 80µm, backing with glue.

Laminate: PET film, clear, thickness 50µm.

The dimensions of the product label are as follows:

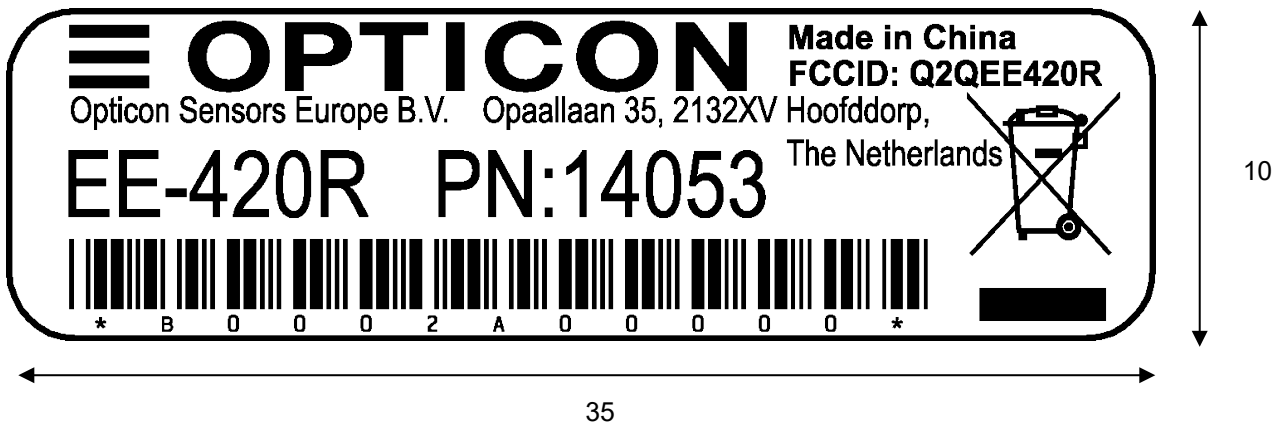










Figure 3: product label dimensions

## 7.2. Shipment box label

The shipment box label is meant to show the number of labels in a box and their serial numbers. Also information about the software versions and the order number is added. The labels are 150mm\*95mm and are made from plain paper with adhesive backing. For more information, please check ShipmentBoxLabel\_spec\_rev1

<b>OPTICON</b>		C/No 001 Made in China
Product:	EE-420R	
PO:	 *12813*	
Spec#:	 *OF1EE420R.01*	
Article US: code	 *_*	
EU:	 *14053*	SN (from)  *B0002A00001*
QTY:	 *160*	SN (to)  *B0002A000A0*
<div style="border: 1px solid black; padding: 5px;">           Missing Serial Numbers           <div style="float: right;">QTY: 0</div> <div style="clear: both;"></div> <div style="margin-top: 10px;">1</div> <div style="margin-top: 10px;">2</div> </div>		
Shipping date: 05-09-2017		
Software: Boot: IAYV0084 OS: IREV0084		 Opticon Sensors Europe B.V.

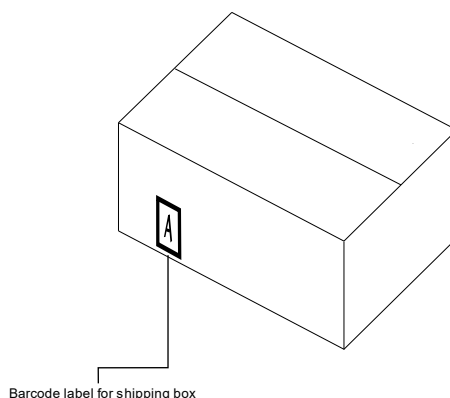


Figure 4: shipment box label

## 8. Accessories

Accessories, for instance for mounting, may be optionally available. Please contact Opticon for information.

## 9. Packaging Specifications

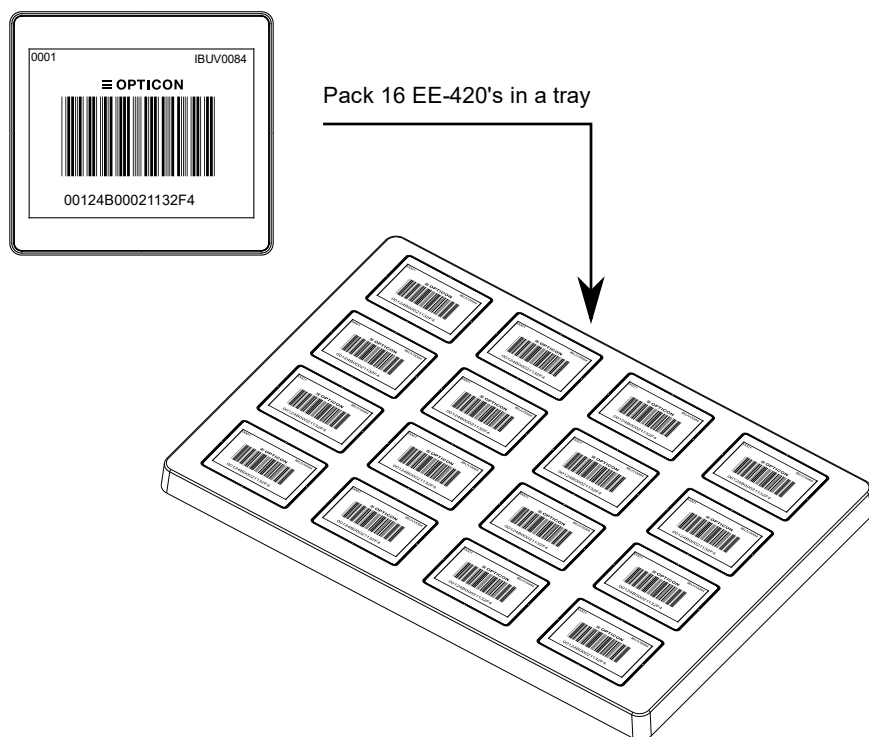


Figure 5: Packing step 1: Put 16 pcs EE-420R in a plastic tray

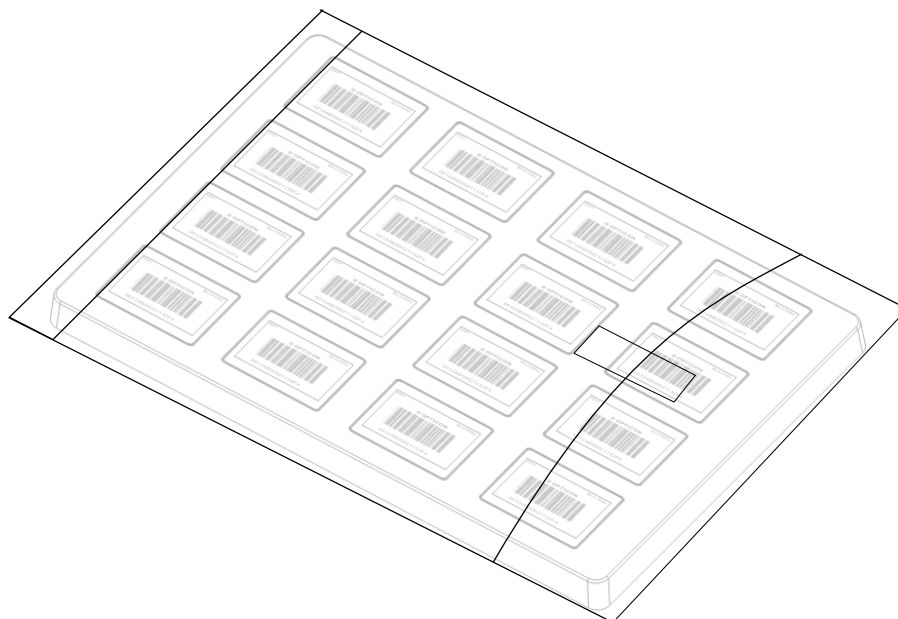


Figure 6: Packing step 2: Add two bags of silica and put a bag around the tray

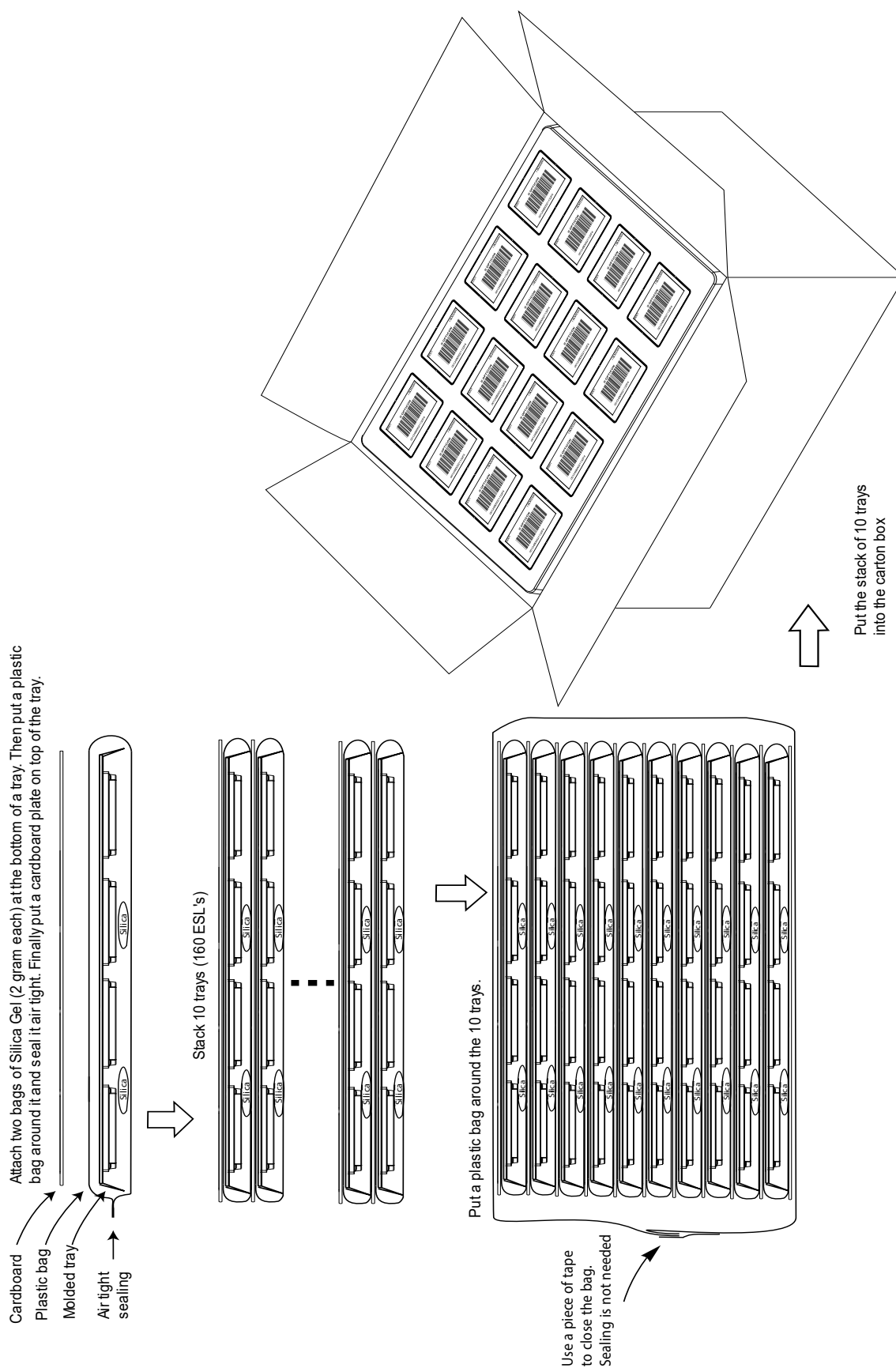


Figure 7: Packing step 3: Stack 10 trays (160 ESL's) and put this into a shipping box

## 10. Regulatory Compliance

### 10.1. Product Safety

IEC 60950-1:2005 2nd +Am 1:2009 + Am 2:2013

### 10.2. EMC

EN 55032: 2015 + AC:2016-07

EN 55024: 2010 + A1:2015

RED Directive 2014/53/EU

EN 301 489-1 v2.2.0

EN 301 489 -17 v3.2.0

FCC Part 15 Subpart C Class B

#### Federal Communications Commission Notices

This product 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.

#### Harmful Interference Notice

This product has been tested and complies with the specifications 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 according to 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 is found 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 or devices
- Connect the equipment to an outlet other than the receiver's
- Consult a dealer or an experienced radio/TV technician for assistance

Changes or modifications to this equipment that have not been approved by Ruckus Wireless may void the user's authority to operate this equipment.

#### RF Exposure Information

This product complies with FCC radiation exposure limits set forth an uncontrolled environment.

### 10.3. WEEE

Waste of Electrical and Electronic Equipment Directive, 2012/19/EU.



The use of this symbol indicates that this product may not be treated as household waste. By ensuring this product is disposed of correctly, you will help prevent potential negative consequences for the environment and human health, which could otherwise be caused by inappropriate waste handling of this product. For more detailed information about recycling of this product, please contact your local city office, your household waste disposal service or the shop where you purchased this product.

### 10.4. RoHS

RoHS: The restriction of the use of certain hazardous substances in electrical and electronic equipment, 2011/65 EC



## 11. Safety

Handle this product carefully. Do not deliberately subject it to any of the following.

### 11.1. Shock

Do not throw or drop the ESL.

Do not place heavy objects on the ESL.

### 11.2. Temperature Conditions

Do not use the ESL at temperatures outside the specified range.

Do not pour boiling water on the ESL.

Do not throw the ESL into the fire.

Do not leave the ESL on the dashboard of a car.

### 11.3. Foreign Materials

Do not immerse the ESL in liquids.

Do not subject the ESL to chemicals.

### 11.4. Battery

Replace the battery when its lifetime has expired. The typical lifetime of a set of batteries is 5 years when using quality alkaline batteries. Treat the batteries as chemical waste and dispose of them according to local regulations.

**CAUTION**  
**RISK OF EXPLOSION IF BATTERY IS REPLACED**  
**BY AN INCORRECT TYPE.**  
**DISPOSE OF USED BATTERIES ACCORDING**  
**TO THE INSTRUCTIONS**

### 11.5. Disposal

When discarding the product, treat it as chemical waste and dispose of it according to local regulations.

### 11.6. Other

Do not disassemble this product, other than opening the battery compartment to exchange the batteries.

The ESL may be damaged by high voltage discharges.

## 12. Mechanical Drawing

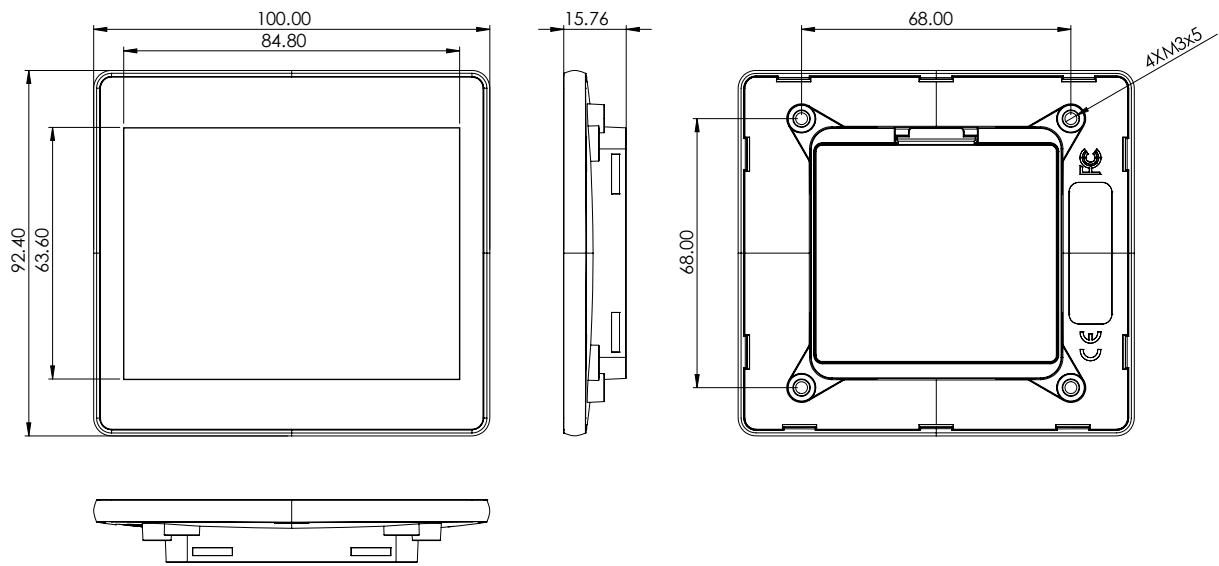


Figure 8: Mechanical drawing