Skoll Handbook

ALPSALPINE
Perfecting the Art of Electronics

Ver.	Date	BACKGROUND (Reason for change)	Description of change	Sections changed	Approver	Author
0.1	2022/02/xx	Create document		All		PL

REVISION HISTORY

Abbreviation/Term	Definition
BLE	Bluetooth/Bluetooth Low Energy
PCR	Pulse coherent radar
OTA	Over the air
ULD	Universal Load Device
IBC	Intermediate Bulk Container
GSE	Ground Support Equipment
PCB	Printed Circuit Board
IP	Ingress Protection Rating
DOF	Degrees of Freedom

DEFINITIONS AND ABBREVIATIONS

Contents

1 INTRODUCTION

"Skoll" is the name for a Pulse Coherent Radar Sensor BLE tag. This device has following capabilities:

- Distance/fill measurement (range: 0.06m – 7m)
- Object detection.
- Exterior temperature output (+/- 5C)
- Orientation detection (3 DOF)
- BLE 5 connectivity to Alps Alpine's Hati, Skalli, or other BLE gateway
- OTA Device Firmware Update
- Graphical User Interface demonstration app

Data can be sent to the cloud by three methods:

- Via BLE to an Alps Alpine / Sensolus tracker and visualized on the platform
- Via BLE to a gateway (e.g. Cassia X1000, X2000)
- Via mobile phone with a custom app

Skoll was developed by Alps Alpine North America. This product is especially designed for long lifetime. Depending on the use-case, the battery will meet a 5-year life minimum.

This document was created to have a condensed overview of Skoll's capabilities and specification.

1.1 Description

Skoll is a radar-based, Bluetooth Low Energy sensor tag that enables the user to track the fill level and object detection for the use cases below as an example. The module is a maintenance free industrial grade device, that can reach a lifetime up to +5 years, depending on the customer use case (i.e., daily amount of radar scans).

Fill detection use cases:

- IBC
- Water tanks.
- Grain silo.
- Waste bin.
- Recycling bin.
- Medical waste bin.
- Clothes bin.
- Flood/Snow level detection (municipal).

Object detection use cases:

- GSE: ULD load detection.
- Swap back trailer load detection.
- RTP load detection.
- Parking spot in a garage.

The radar operates using by emitting pulses at the speed of light, and the amplitudes of the received pulses tells us if there is an object.
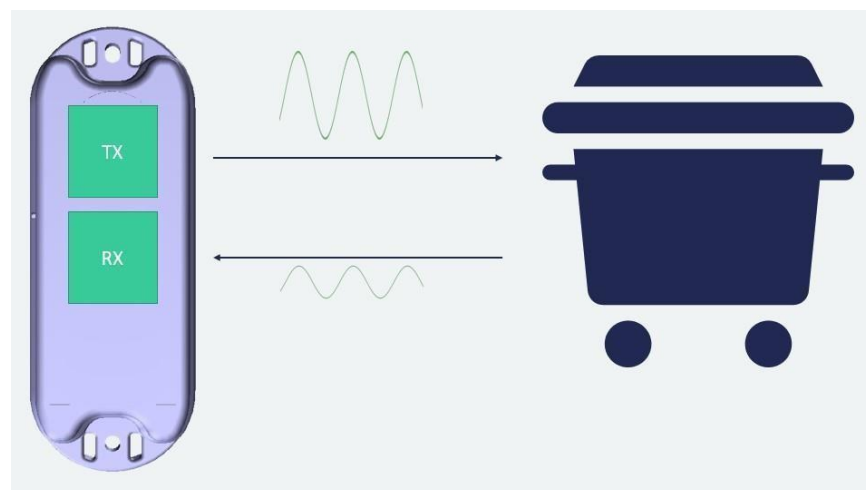

Figure 1: radar operates using by emitting pulses at the speed of light.

1.2 Hardware content

Skoll's Hardware contains the following components:

- 1 PCB.
- 60GHZ radar IC.
- Bluetooth® Low Energy (BLE).
- Acceleration Sensor (with built in temperature readings).
- Magnetic Switch.
- Battery (non-replaceable*).
- QR Code ID.
- Plastic Enclosure, Industrial Strength.
- 2-sided adhesive backing.

Figure 2: Skoll Device.

*Warranty voided if device is opened.

2 OPERATION

2.1 System Modes

Power Off: default mode for shipment, activate with magnet operation seen below in Figure 1.

Normal Working Mode (Connectable): for normal working operations with a BLE connectable interface used for setup and configuration of module.

Normal Working Mode (Non-Connectable): for normal working operations with radar measurements operational and broadcasted via a Non-Connectable BLE advertisement.

2.1.1 Device Activation

Activate the device using a magnet. Magnet should have minimum gauss rating of 18 at 3cm away from the device. Tap magnet in circled area seen below in Figure 1 for activation.

Figure 3: Location of the magnet activation zone.

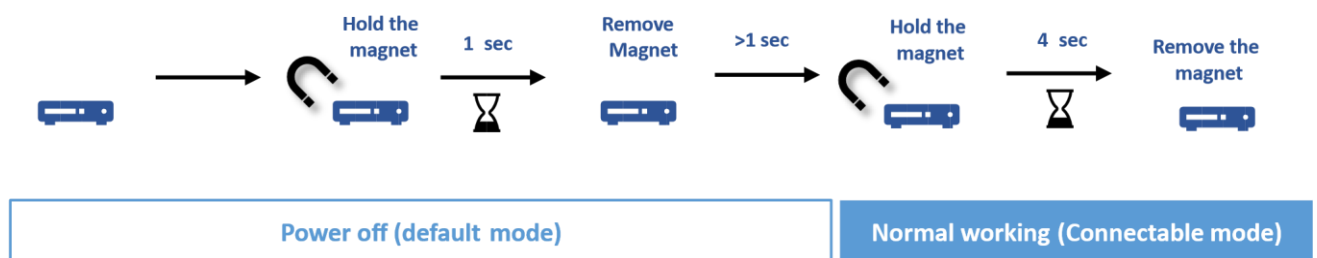*Figure 4: Magnet activation, Normal Working (Connectable Mode).*

2.2 System mode state machine (default)

After power on by default, module goes into normal working state, with BLE connectable. Remote device (or Alps Alpine Skoll mobile app) can initiate connection to module for configuration without physical access to the module. Security can be enabled to protect configuration change from unknown device.
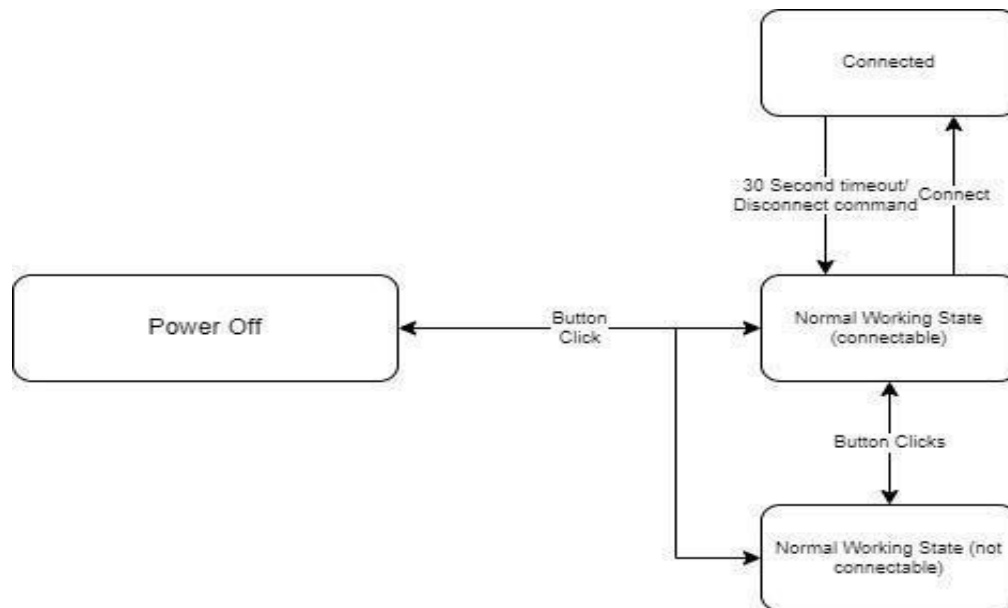
Figure 5: State diagram, activation modes/connect ability.

2.3 Device deactivation

The device can be placed into its "deactivated" mode by utilizing the magnetic switch located on the side of the module. By performing the pattern "short" -> "short" -> "long" the module will be placed into the "deactivated" mode and the module will stop performing normal BLE and measurement operations. The module can be placed back into its normal operation modes after deactivation.

"Deactivation" is not intended for regular use and is instead intended to be utilized if the Skoll module gets put out of service for a longer than normal time.

2.4 Accelerometer modes

The Skoll device is equipped with an accelerometer which, when enabled, allows it to perform different operations depending on the orientation of the device. This allows the Skoll device to operate in use cases where a lid mounted device might not want to perform a distance measurement when the lid is open. Depending on the measurement application, this functionality can be enabled or disabled.

Lid position vs scan "on" time

Figure 6: Lid position vs Scan "on" Time.

3 MATERIAL

Radar cross section (RCS) is a measure of how detectable an object is by radar. A larger RCS value indicates a that an object is more easily detected by radar. A few different factors make up the RCS of an object. As a rule of thumb, the larger an object, the higher its RCS is. Materials with high reflectivity rate will produce strong signals (solids and liquids). Use case test results may require an offset to account for radar penetration into the materials with less reflectivity.

Table 1 Relative permittivity of common materials

Material	Real(ε) at 60 GHz	γ with air boundary
ABS plastic	2.48	0.049
Mobile phone glass	6.9	0.02
Plaster	2.7	0.059
Concrete	4	0.11
Wood	2.4	0.046
Textile	2	0.029
Metal	–	1
Human skin	8	0.22
Water	11.1	0.28
Air	1	0

Figure 7: Relative Humidity of Common Materials - source Acconeer.

Source: https://docs.acconeer.com/en/latest/sensor_introduction.html

4 ALPS ALPINE SKOLL APP (OPTIONAL)

An app is provided for demonstration purposes, which is available through TestFlight® (downloadable from the Apple App Store®). Apple id needs to be provided to Alps Alpine and invite will be sent to user for access to application.

Figure 8: App "Skoll Demo".

- Add device by QR scan of device label.

- Set radar scan interval (30s – 3600s) *

- BLE advertisement interval (1s – 10) * - Data reported:

    o Distance o Rate of change from last measurement

    Temperature o Orientation o Geolocation (using

    phone) o Last seen (time) o Battery level

- Quick User guide provided separately.

*Changing interval rates will have effects on battery life. (30s Radar Interval = <120day battery life)
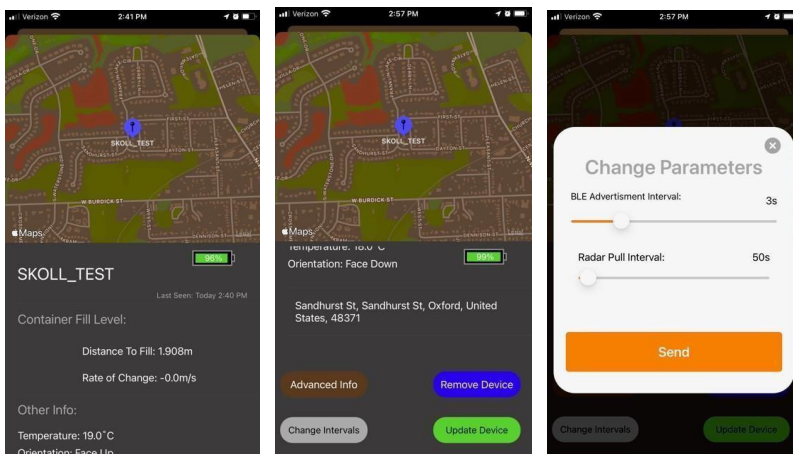

Figure 9: App with map view.

4.1 Alps Alpine Skoll app (OPTIONAL)

Profiles can be used to apply multiple configurations at once. This is the best way to update parameters as it removes the ambiguity of sending individual commands. Profiles are sent via the ALPS mobile application and are selected before adding the device. The steps to add a device using a profile are as follows:

1. Download the profiles to the Skoll app → Profiles folder.

2. If the device is already added remove it from the App by going to the devices page and clicking "remove device"

3. Once the device is removed, from the settings tab, select add new device.

4. From the list of profiles select the profile that you wish to apply to the device

5. After selecting the profile scan the QR code for the device

6. Once the device is added a green checkmark will appear

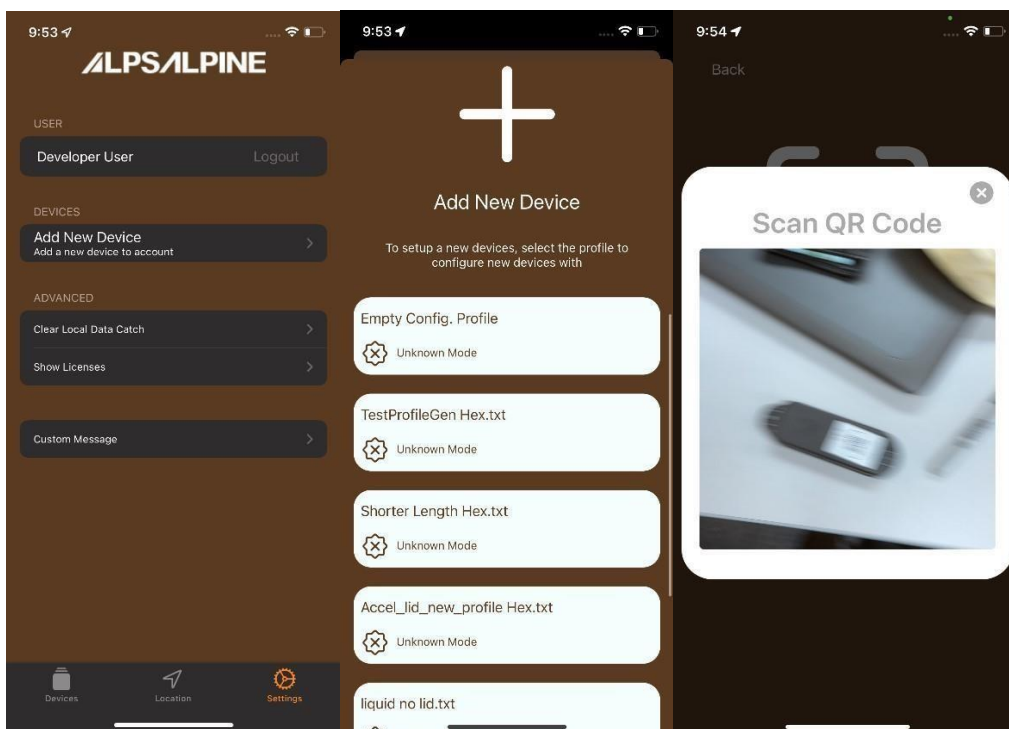7. If the device fails to add, close the app from the task manager and restart it and repeat from step 4.

Figure 10: Adding new device via App.

5 CUSTOMER FRONT-END "SENSOLUS PLATFORM" (OPTIONAL)

Sensolus is offering a Front-End / Web interface called Sensolus Platform, when connected to any Sensolus/Alps Alpine gateway device (SNT3, Track1100, Hati, Skalli)
https://stickntrack.sensolus.com/

This Front-End offers multiple functionalities.
- PCR data in GUI
- Localisation info.
- Statistics.
- Device History data.
- Details of received messages.
- Geo-Zones.
- Alarms.

6 FIRMWARE UPDATE (OPTIONAL)

The Skoll device is capable of over the air updates for future improvement/bug fixes. This operation is available to be performed using the Alps Alpine "Skoll Demo" mobile application update device feature.

Figure 11: App "Skoll Demo".

Note: A firmware update must be queued, by operator, to have related button available, within App.

7 BATTERY LIFE CALCULATOR

This document is provided separately and can determine the expected battery life based on the selected configurable settings. Specific use case requests will be reviewed.

8 TECHNICAL SPECIFICATION

Dimension [mm] (L x W x H):   131 x 44 x 21

Weight [g]:   68

Housing Material: PBT/PC UV Stable
Operating Temperature [°C]: -20 till +65
Battery Lifetime: Up to 5+ years

Certifications: CE, FCC, IC, NOM, Bluetooth Sig
Protection Class: IP69 / IK8
Maximum relative humidity: 95 %
Accelerometer: +/-2g max range, +/-16g orientation, built in temp +/- 5C
Battery: Non-replaceable, non-chargeable
                           (Li-SoCl2, 2xER14335M parallel connected cells)
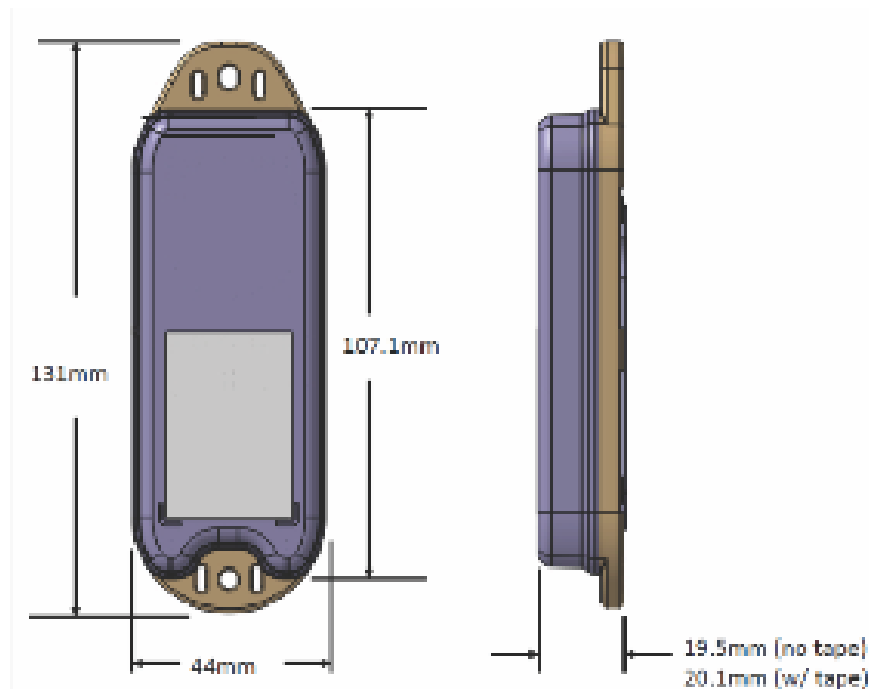Mounting Method: Rivets, Screws, Zip-ties, Double side adhesive

Figure 12: Dimensions of Skoll Device.

9   MOUNTING POSITION

To mount the Skoll to the asset, rivets or screws must be inserted through the mounting holes of the device. Industrial double-sided tape is included as an alternative mounting solution (Note: Attaching surface must be cleaned when using this mounting method). There are arrows moulded into the back cover to indicate the radar side of the device. It is advised to place the Skoll such that the radar side is aimed at the measurement/object detection area. It is also critical that the Skoll is placed in such a way to avoid any hits/impacts from a forklift or any other type of vehicles. The module must also be placed parallel with the fill level. Additionally, make sure Skoll is not covered/surrounded by metal as this might cause bad reception of build-in antennas.
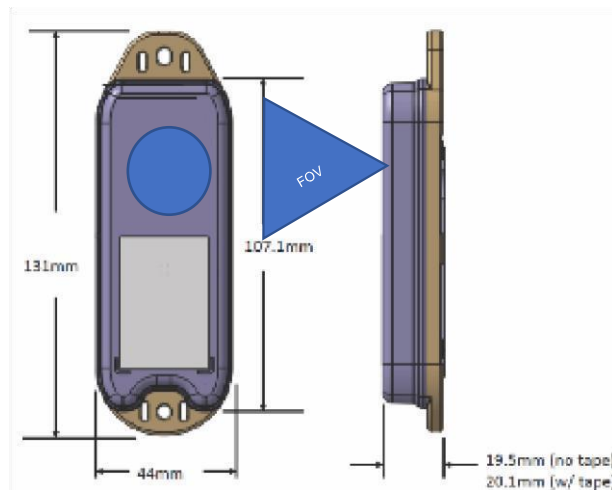
Figure 13Skoll field of view.

The Skoll field of view also changes depending on the orientation of the device, with a wider field of view along the width of the device.
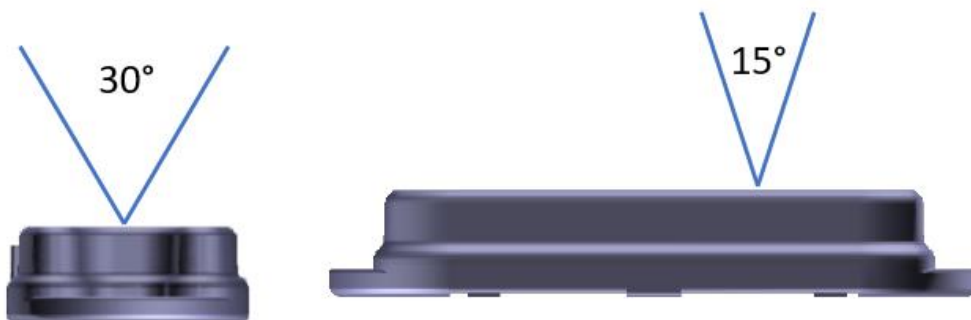

Figure 14: Skoll field of view.

10 ORIENTATION

The device orientation reading can be interpreted by the diagram [10-1] below.
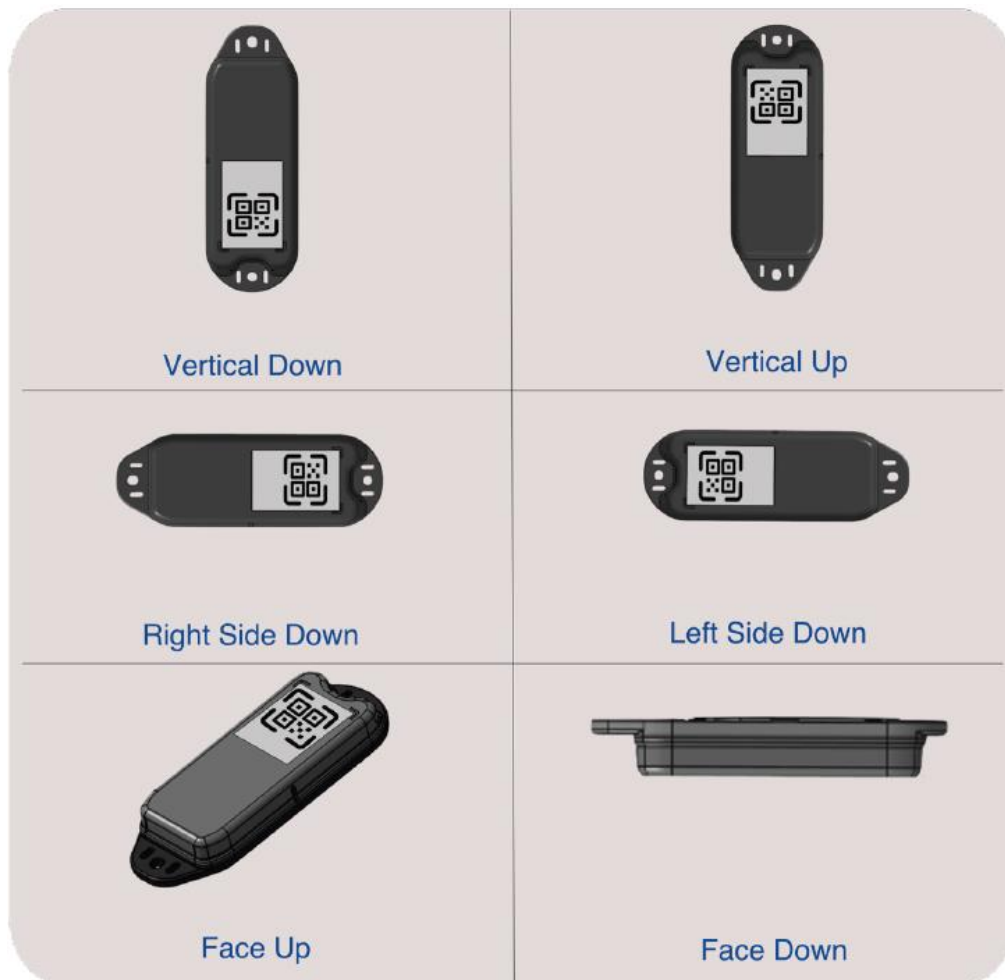
Figure 15: Skoll orientation of the device.

11 PACKAGING / SHIPPING INFORMATION

- Standard box has 100 units.
- Box size [cm] (L x W x H): 29.5 x 3.95 x 22.4
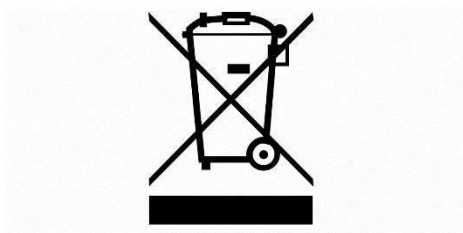- Total Weight: 8.40 Kg

Figure 16: WEEE Symbol.

12 DISPOSAL

Make sure you apply to the rules of disposal, existing within your country.

GER: Skoll device is registered at EAR (Elektro-Altgeräte Register) and has an WEEE number (Waste of Electrical and Electronic Equipment).

13 DISCLAIMER

We make every effort to ensure that the information and technical details in this handbook are accurate and complete. Nevertheless, this document is not a contractual agreement and cannot be used as a reference for any warranty claims.

Due to IP69 certification, warranty is lost if the device is opened.

14 REGULATIONS

Radiation Exposure Statement: The radiated output power of this device meets the limits of FCC/ISED Canada radio frequency exposure limits. This device should be operated with a minimum separation distance of 20 cm between the equipment and a person's body.

WARNING: Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment

NOTE: This product is not permitted for use on satellites or aircrafts.

Radio Equipment Statement: Operation is subject to the following two conditions:

The device may not cause harmful interference.

The device must accept any interference received, including interference that may cause undesired operation of the device.

FCC ID: 2AT4VSKOLL

IC: 26629-SKOLL

Contains FCC ID: 2AQ6KA1004

Contains IC: 24388-A111

HVIN: 1AD-MA00055

FCC USA

FCC ID: 2AT4VSKOLL, Contains FCC ID: 2AQ6KA1004

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.

Changes or modifications not expressly approved by the party responsible for compliance voids the user's authority to operate this equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

RF Exposure

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This device should be installed and operated with a minimum distance of 20 cm between the radiator and your body.

ISED Canada

IC: 26629-SKOLL, Contains IC: 24388-A111

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-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.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique 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;

2. L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

RF Exposure

This equipment complies with ISED Canada radiation exposure limits set forth for an uncontrolled environment. This device should be installed and operated with a minimum distance of 20 cm between the radiator and your body.

Cet équipement est conforme aux limites d'exposition aux rayonnements d'ISDE Canada établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec une distance minimale de 20 cm entre le radiateur et votre corps.