

# SC-LE01 OEM BLE Sensor Beacon System



The SC-LE01 is a fully integrated, ultra-low power BLE sensor with Temperature, Humidity and other sensors. Customizable for a myriad of applications, it enables quick deployment of sensor systems connected to Bluetooth Smart (BLE) enabled Gateways and Smartphones



## 1. Overview and Features

- Customizable OEM Sensor Platform
- Multi-Protocol 2.4GHz Radio with Bluetooth 5.0 Support
- FCC, IC, CE Certifications
- Ultra-low power consumption
- Temperature and Humidity Sensor
- Vibration and Motion Sensor
- Ambient Pressure Sensor
- Magnetic Switch Sensor
- Button and LED
- -20 dBm to +4 dBm Output Power
- User-Replaceable CR2045 Coin Cell Battery
- Mountable via adhesive and/or screws
- Based on Nordic Semiconductor's nRF52832 BLE SoC
- Ready to deploy firmware with Over-The-Air Update Capability
- Fully Configurable device
- Dimensions: 42 x 60 x 16mm
- Temperature Range: -40° to +85°C

## Applications

- Cold Chain Monitoring
- Environmental Monitoring and Sensing
- Beacons – iBeacon and EddyStone
- Industry 4.0
- Vibration Monitoring
- Bluetooth Low Energy Sensors
- Home Automation and Control

## 2. Ordering

The following orderable part numbers can be used to order devices.

Ordering Number	Status <sup>(1)</sup>	Description
SC-LE01-LE-1-RB	Active	SC-LE01 System with all sensors, individually packaged, 3M Adhesive Backing
SC-LE01-LE-1-BC	Active	SC-LE01 Beacon system, individually packaged, 3M Adhesive Backing

(1) Marketing Status

**PREVIEW:** Product is announced but not yet in full production. Samples may be available

**ACTIVE:** Product is in full production and is recommended for deployment

Sample devices and further information may be obtained directly from Argenox by contacting [sales@argenox.com](mailto:sales@argenox.com)

Information regarding design, integration, and customization can be obtained directly on the [SC-LE01 Platform Page](#)

## 3. OEM Customization

The SC-LE01 is designed to allow for customization as required end vendor for deployment, speeding time-to-market. Among the features that can be modified and customized:

- Label and Vendor Information
- Plastic Design and Color
- Custom Firmware and Features
- Custom Factory Configuration
- Custom Sensors
- Custom Packaging

For more information regarding customization, please contact [sales@argenox.com](mailto:sales@argenox.com) with your requirements.

## 4. Sensor System Summary

Protocols	
Protocols Supported <sup>(1)</sup>	Bluetooth LE, ANT, Gazelle, Proprietary 2.4GHz
Bluetooth Support	Single Mode Bluetooth v5.0 – backwards compatible
Bluetooth Roles	Peripheral and Central Roles (Concurrently), Observer, Broadcaster (Beacon)
LE Connection Support	20 concurrent Central connections, 1 as Peripheral
Bluetooth Beacon Support	iBeacons, Eddystone, Custom Beacons
Apple HomeKit Support <sup>(3)</sup>	Custom option
6LoWPAN and IPv6 Support	Supported in HW
Bluetooth Mesh Support	Yes

- (1) Bluetooth Low Energy v5.0 is currently supported by the firmware, with backwards compatibility to Bluetooth 4.2, Bluetooth 4.1 and Bluetooth 4.0. Other protocols are supported by hardware and may be used.
- (2) Bluetooth v5.0 Support is available in hardware and requires firmware with support. Bluetooth v5.0 features limited to 2Mbps PHY
- (3) Further information on MFI is available upon request by MFI licensees. Contact Argenox for information.

Mechanical Specifications	
Width	41.31 mm
Length	59.31 mm
Height	16.6 mm <sup>(1)</sup>
Weight	37g <sup>(2)</sup>

- (1) Including 3M Adhesive backing
- (2) Including CR2450 battery and 3M adhesive backing

Radio RF Specifications	
Frequency	2.360GHz – 2.500GHz (ISM Band)
Modulation	250kbps, GFSK 1Mbps, GFSK 2Mbps
Output TX Power	+4 dBm
Receive Sensitivity	-96 dBm BLE
Antenna	Onboard Ceramic Chip

Regulatory and Environmental Certifications <sup>(1) (2)</sup>	
FCC	Modular Certification FCC ID: SQG-BL652
Bluetooth SIG	BT-SIG QDID: 87158, Declaration ID: D031950
ETSI	TBD
Industry Canada (IC)	3147A-BL652
CE	TBD

- (1) Argenox may provide further certification for Japan, Korea, Australia/New Zealand and other regions upon request. Contact Argenox for information.
- (2) Please see section 013 for detailed certification information and requirements.

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## 5. Document Revision History

Revision	Date	Notes
0.2	8/03/2018	Preliminary Release
1.0	1/15/2019	Major Updates for Public Release

## 6. System Block Diagram

The SC-LE01 is a complete sensor system including advanced sensors, Bluetooth and multi-protocol radio containing a high-performance Cortex-M4F CPU as well as sensors that allow it to provide intelligent sensor data for a variety of applications while maintaining an extremely low power profile.

Leveraging the SC-LE01 in your system enables you to go to deploy faster with a proven set of low power sensors. The following diagram shows the main system components:

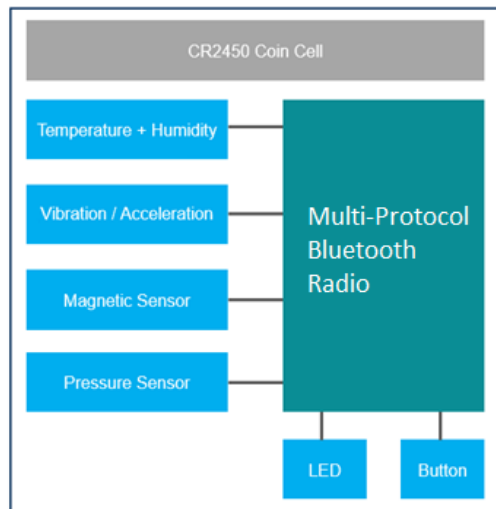


Figure 1 - SC-LE01 BLE System Block Diagram

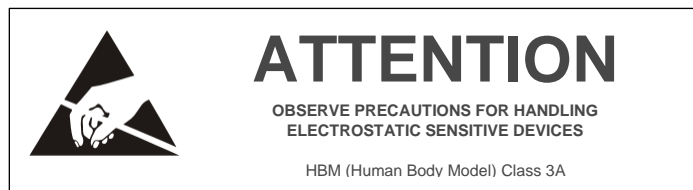
## 7. Specifications

### 7.1 Absolute Maximum Ratings

Parameter	Min	Max	Unit
Supply Voltage <sup>1</sup>	-0.3	3.9	V
Storage Temperature Range <sup>3</sup>	-40	125	°C
RF Signal Input Level	-	10	dBm
$V_{I/O}$ , $V_{DD} \leq 3.6$ V	-0.3	$V_{DD} + 0.3$ V	V
$V_{I/O}$ , $V_{DD} > 3.6$ V	-0.3	3.9V	V
Moisture Sensitivity Level (MSL)		2	
ESD Human Body Model <sup>4</sup>		4000	V
ESD Charged Device Model <sup>4</sup>		750	V

Table 1 - Device Absolute Maximum Ratings

- (1) All voltage values are specified with respect to ground, unless otherwise noted.
- (2) Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (3) Storage in extreme temperatures may degrade the part
- (4) Exposure to Electrostatic Discharge may damage the device permanently. External ESD protection may be required in certain applications.



### 7.2 Recommended Operating Conditions

The SCLE-01 runs from a standard CR2450 Coin Cell battery. These batteries have a nominal voltage of 3V.

The following conditions are recommended for the operation of the device:

Parameter	Symbol	Min	Typical	Max	Unit
Operating Supply Voltage	$V_{CC}$	1.9V	3.0	3.6	V
Operating Temperature Range	$T_{Op}$	-40	25	+85	°C
Power Supply Rise Time <sup>1</sup>	$T_{R\_VDD}$	-	-	60	ms

Table 2 – Device Recommended Operating Conditions

- (1) If operated outside of this range, the reset circuitry may not function properly.

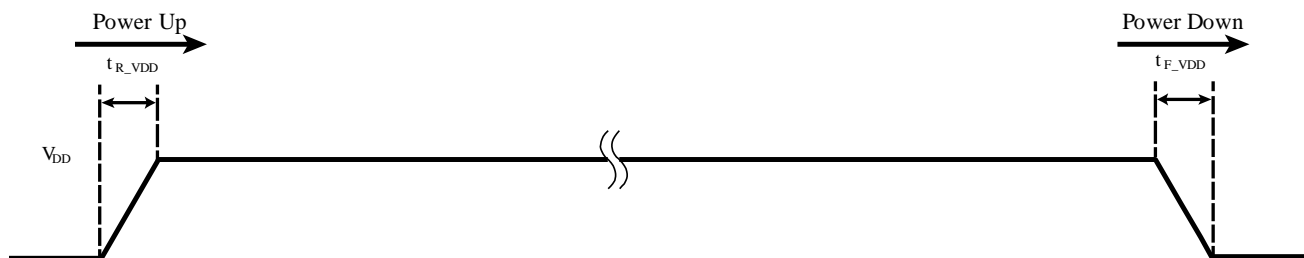


Figure 2 - Power Supply Timing Diagram

## 7.3 Battery Operation

Standard CR2450 batteries can operate at a range of -30°C to 60°C. However, operating at the temperature extremes will reduce the battery's effective capacity and operational lifetime. This is especially true at temperatures of 0°C (32°F) and below. At 0°C, the battery may experience a reduction of approximately 30% in its effective capacity.

Should your device require prolonged operation in low temperature, please contact

## 7.4 Power Consumption

For latest power consumption figures, please refer to the power consumption figures provided with the firmware release notes.

## 7.5 Radio Specifications

Over operating free-air temperature range (unless otherwise noted)

Parameter <sup>(1)</sup>	Min	Typical	Max	Unit
Frequency Range	2402	-	2480	MHz
Channel Spacing	-	2	-	MHz
Output Power <sup>(2)</sup>	-20	-	+4	dBm
Receiver Sensitivity - BLE			-96	dBm
Data Rate <sup>(3)</sup>		1Mbps, 2Mbps		-
RSSI Range	-90	-	-20	dBm
RSSI Resolution		1		dB

Table 3 - Radio Specifications

- (1) Further specifications of the Radio are available at the nRF52832 Objective Datasheet.
- (2) Transmit Output Power is specified by design.
- (3) 1Mbps and 2Mbps are the only modulations available for Bluetooth LE. 250kbps used in proprietary mode.

## 8. Mechanical Specifications

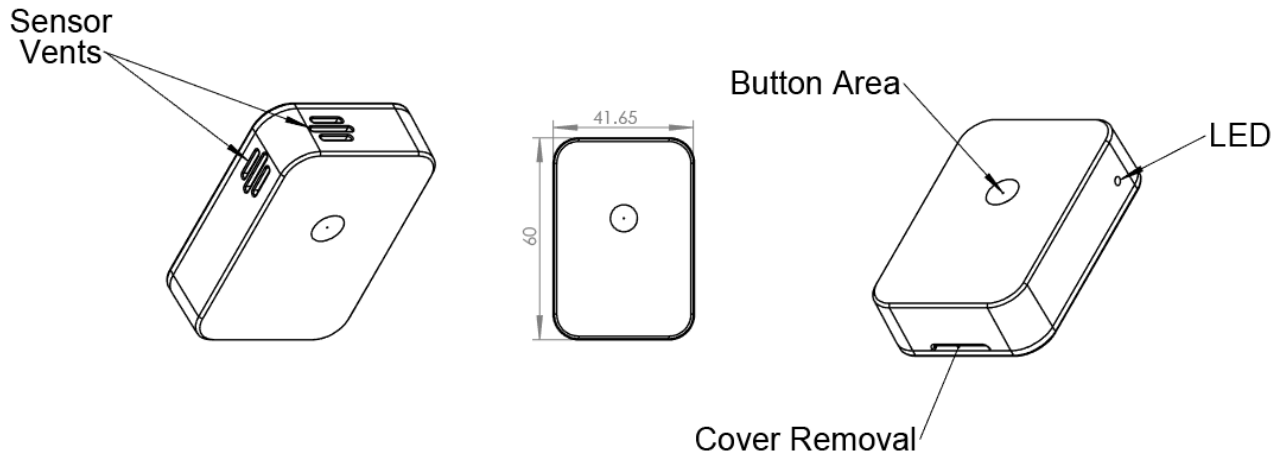


Figure 3 - SC-LE01 Device Mechanicals

Note: All dimensions are in mm unless otherwise specified

The device has two sensor vents which should be placed as close as possible to air and to the environment to be measured, if the sensors are used. The device includes a button area dimple which allows the user to press. In addition, an LED is provided to facilitate user interaction. It is usually off to reduce power consumption.

The device is by default white in color to allow for easy blending with walls, but Argenox can provide other colors upon request.

### 8.1 Battery Replacement

The SCLE-01 uses a standard CR2450 battery with nominal 3.0V and approximately 620mAh capacity. The following batteries have been tested and are known to be compatible:

Manufacturer	Battery Part #
Panasonic BSG	CR2450
FDK	CR2450
Energizer	CR2450

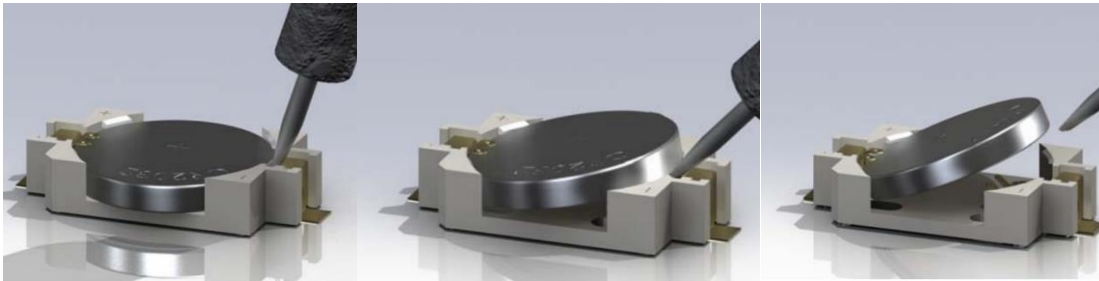
Other manufacturers provide similar CR2450 batteries that will be reliably. Our testing of hundreds of thousands of batteries have shown Panasonic batteries have superior reliability with extremely low failure rates, less than 2 per 200,000 batteries.

The battery is located underneath the top cover which can be removed by gently prying the bottom of the device to separate the top cover from the rest of the device.



## 8.2 Removing the Battery

The battery is best removed by gently prying it with a flat head screwdriver or similar tool:

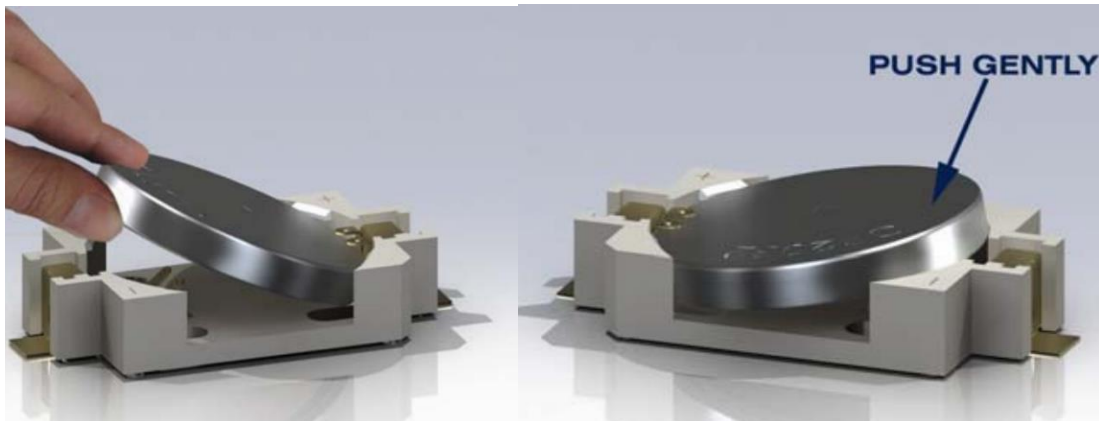


## 8.3 Inserting a new Battery

The battery should be carefully removed by prying on its left side.

To insert a new battery, slide the battery to the right under the gold fingers of the battery holder, so that the battery is at a 45-degree angle. Finally, push the battery using a finger on the protruding side to complete the installation.

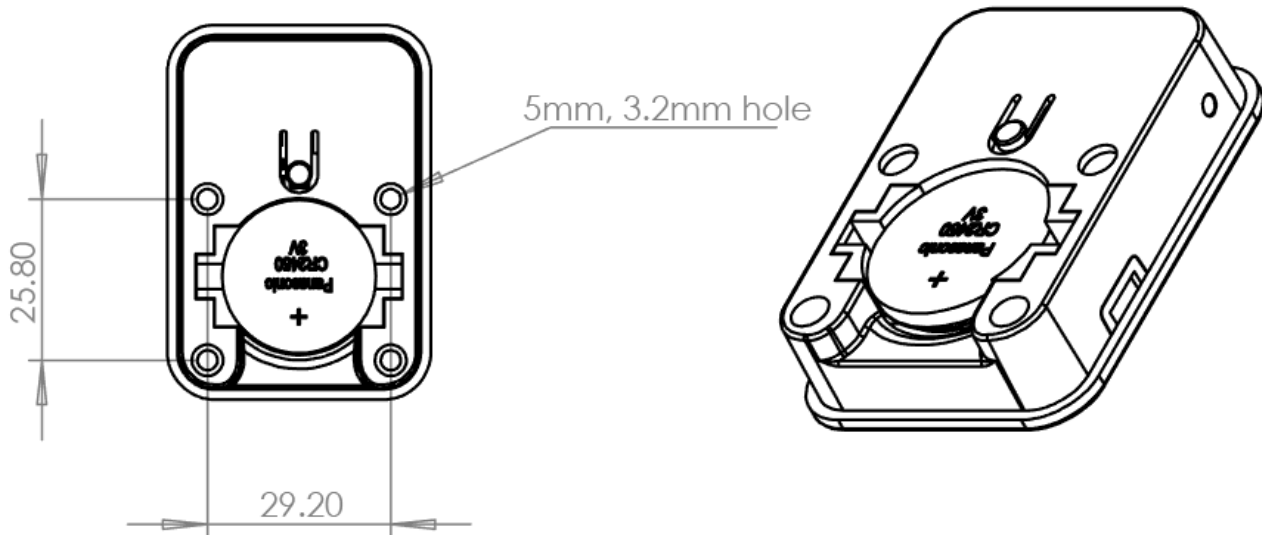
The following images show the process of inserting a quickly and easily:



Care must be taken to ensure the fingers of the battery positive contact (top) are not bent by the battery during installation.

## 8.4 Device Mounting

To facilitate mounting the SCLE-01 in the end use application, the SCLE-01 comes with a custom double-sided 3M adhesive tape. This allows quick mounting of the device on smooth surfaces. In addition to mounting the device using a 3M adhesive tape, it is possible to mount the device using mounting screws under cover to screw the system to wood and wall. The cover may be removed by gently prying the cover from the base of the device. The screw pattern is shown in the figure below.



The hole for the screw head is 5mm in diameter, while the hole for the screw body is 3.2mm.

## 9. User Interface

The SCLE-01 includes a user button on top of the device which can be found by pressing on the depression on the front, without requiring the removal of the cover. A Blue LED on the side provides feedback when button is pressed and on system boot-up.

For Button and LED behavior, please refer to the User's Guide for the firmware provided.

## 10. RF and Antenna

As the SC-LE01 is a fully integrated wireless device with an internal antenna, so it does not require any external connections. However, care must be taken in placing the device to ensure best performance and range is obtained.

Of primary concern is to place the unit away from metal and metallic objects, as these can limit and redirect the wireless signal. The unit should be placed far away from large metallic objects as far as practically possible.

The practical range obtain depends on the placement of the device, as well as the location and antenna of the Smartphone or Gateway device.

## 11. Firmware

The SC-LE01 device is shipped fully operational with Argenox standard firmware as follows:

Device	Firmware
Sensor	Sensor Firmware
Beacon	Argenox iBeacon and EddyStone

The sensor firmware allows quick configuration and sensing of Temperature, Humidity, Pressure, as well as detecting magnetic sensing and can work out of the box with Smartphones and Gateways.

Argenox's Beacon firmware allows completely custom iBeacon and Eddystone, including simultaneous and fully configurable timed beacons, allowing advanced location and tracking applications.

For more information regarding the firmware, please refer to the firmware User Guide applicable for that firmware as well as the release notes provided for the firmware release supported by the devices.

## 12. Sensors

The following sensors are available in the devices.

Sensor Type	Specifications <sup>(1)</sup>
Humidity and Temperature	± 3% RH, 0–80% RH ±0.4 °C –10 to 85 °C
Ambient Pressure	300 - 1100 hPa
Vibration / Acceleration	±2g/±4g/±8g/±16g 1 Hz to 5.3 kHz ODR <sup>(2)</sup>
Magnetic Switch	

Table 9 - Sensors

(1) All specification provided by manufacturer

(2) Actual Data Rate is limited by I2C interface and power consumption to approximately 400Hz

## 13. Programming and Debugging

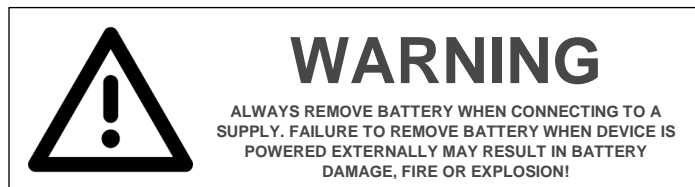
Although the device is provided with standard firmware and features, customers may develop and reprogram the units. Argenox can provide pre-programmed devices with firmware provided by customers.

Note: The debugging connection does not support ARM JTAG Trace functionality due to limited number of pins.

The battery may remain installed in the unit provided that the ARM JTAG does not attempt to provide power to the unit. A power supply be used instead of the battery during development, but the battery should be removed in that case.

Signal	Interface	Notes
SWDIO	Serial Wire Debug (SWD)	
SWCLK		
VTarget	Target Voltage Sense	Should not provide power
GND	Signal Ground	

Please contact Argenox for details regarding development setup and details.



## 14. Regulatory Certification

This product has the following regulatory certifications:

FCC ID: SQGBL652

IC:ID: 3147A-BL652

CE: TBD

The following sections describe the product certifications in more details. Several describe specific requirements that the product user / OEM integrator must meet in order to use the certifications. Failure to follow these requirements may result in failure to comply with regulations. If you have any questions regarding integrating the product in your system, please contact Argenox support.

## 14.1 Federal Communication Commission (FCC) Statement

### FCC Rules, Part 15.

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 or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment to 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

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.

This portable transmitter with its antenna complies with FCC/IC RF exposure limits for general population / uncontrolled exposure.

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

## 14.2 Industry Canada Statement

This device complies with Industry Canada's licence-exempt RSSs. 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.

This radio transmitter TBD has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Approved Antennas
On Module PCB Chip Antenna

Cet appareil est conforme aux normes d'exemption de licence RSS d'Industry Canada. Son fonctionnement est soumis aux deux conditions suivantes: (1) cet appareil ne doit pas causer d'interférence et (2) cet appareil doit accepter toute interférence, notamment les interférences qui peuvent affecter son fonctionnement.

Conformément aux réglementations d'Industry Canada, les émetteurs radio de cet appareil ne peuvent fonctionner qu'à l'aide d'une antenne dont le type et le gain maximal (ou minimal) pour ces émetteurs - transmetteurs sont approuvés par Industry Canada. Pour réduire le risque d'interférence éventuelle pour les autres utilisateurs, le type et le gain de l'antenne doivent être choisis de manière à ce que la puissance isotrope rayonnée équivalente (p.i.r.e.) minimale nécessaire à une bonne communication soit fournie.

Ce dispositif a été conçu pour fonctionner avec une antenne cellulaire ayant un gain maximal de 1 dBi. Une antenne à gain plus élevée est strictement interdite par les règlements d'Industry Canada. L'impédance d'antenne requise est de 50 ohms.

Antennes Acceptables
à bord d'antenne en céramique

## 14.3 FCC and IC Compliance

The device has been designed and certified to comply with FCC and Industry Canada regulations. In order to ensure the validity of both FCC and IC regulations, the device must not be co-located with other transmitters at a distance of less than 20cm between the transmitting antennas. If this condition is met, no further intentional radiator testing is required. The end user is still required to test the end product for compliance with other requirements related to unintentional radiator emissions such as digital device emissions.

If the requirement to separate antennas by at least 20cm cannot be met, the FCC and IC certifications are considered invalid and they cannot be used in the final product. The module integrator must then obtain the

proper FCC and Industry Canada certifications and take measures to comply with them such as avoiding two transmitters operating at the same time.

Le module a été conçu et certifié conforme aux règlements de la FCC et d'Industrie Canada, et d'être certifié pour l'intégration avec des produits OEM. Afin d'assurer la validité des deux règlements de la FCC et IC, les produit ne doivent pas être co-localisés avec d'autres émetteurs à une distance de moins de 20 cm entre les antennes d'émission. Si cette condition est remplie, aucun test de radiateur intentionnel supplémentaire est nécessaire. Le usair est toujours responsable de tester le produit final de la conformité avec d'autres exigences relatives aux émissions de radiateur non intentionnels tels que les émissions appareil numériques.

Si l'obligation de séparer les antennes d'au moins 20 cm ne peut être respectée, les certifications FCC et IC sont considérés comme non valides et ne peuvent pas être utilisés dans le produit final. Le module intégrateur doit alors obtenir les certifications appropriées de la FCC et d'Industrie Canada et de prendre des mesures pour se conformer avec eux comme éviter deux émetteurs fonctionnant en même temps.

## 14.4 Conformité Européenn - CE - Preliminary

This device has been tested to comply with CE regulation for use in the European Union.

The OEM integrator has the responsibility to ensure the compliance of the final product to EU CE standards and to obtain and keep on file a Declaration of Conformity as described in the Radio and Telecommunications Terminal Equipment (R&TTE) Directive.

The Declaration of Conformity (DOC) of the module is available on Argenox's Website [www.argenox.com](http://www.argenox.com)

## 14.5 OEM Labeling Requirements for FCC and IC

This device is labeled with an FCC ID and IC Certification Number affixed outside and visible to the end user. Regulatory bodies require the end product display a labeling with the proper identification. The label must be located on the outside in a visible area. Such markings may be done in a variety of methods and must contain the following:

“Contains Transmitter Module FCC ID: SQGBL652”

“Contains Transmitter Module IC: 3147A-BL652”

The 'CE' mark must be placed on the OEM product if it requires the use, please see section 14.4.



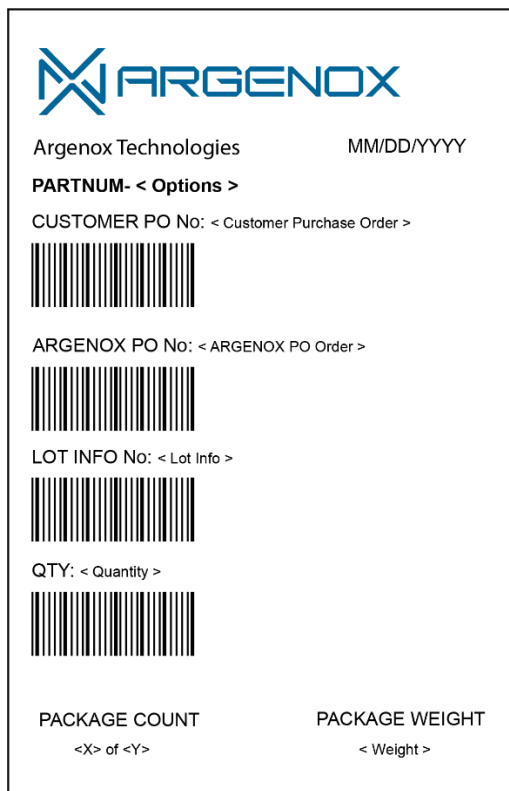
## 15. Packaging and Labeling

### 15.1 Individual Packaging

Each Product is provided in a plastic bag inside of an individual product box, containing the optional backing adhesive. Each packaging box contains 250 sensors.

### 15.2 Packaging Box Label Information

Each 250 units are packaged together in a box with the following label affixed.



## 16. Cautions

### 16.1 Integration Notes

- (1) It is critical to following the recommendations of this document to ensure the device meets the specifications.
- (2) This product should not be stressed mechanically after installation
- (3) Exposing the device to significant temperatures will result in degradation and decreased lifetime.
- (4) Keep this product away from other high frequency devices which may interfere with operation such as other transmitters and devices generating high frequencies
- (5) Avoid static electricity, ESD and high voltage from occurring during battery replacement or operation
- (6) Prolonged exposure to cold may result in added offset to temperature and humidity sensor

## 16.2 Installation

- (1) Do not block airflow to sensor vents as this will prevent accurate readings

## 16.3 Handling and Storage

- (1) Keep this product away from other high frequency devices which may interfere with operation such as other transmitters and devices generating high frequencies.
- (2) Do not expose the module to the following conditions:

Corrosive gasses such as Cl<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub>, SO<sub>2</sub>, or NO<sub>x</sub>  
Extreme heat or cold, humidity, or salty air  
Prolonged exposure to direct Sunlight  
Temperatures beyond those specified for storage

- (3) Do not apply mechanical stress
- (4) Avoid dropping or shocking the device
- (5) Avoid static electricity, ESD and high voltage as these may damage the device



## 16.4 Life Support Applications

Argenox's products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Argenox Technologies LLC for any damages resulting from such improper use or sale.

## 17. Documents and Resources

Please visit the SC-LE01 Platform page for the latest up to date documents and resources, or contact Argenox directly:

[SC-LE01 Platform Page](#)

## 17.1 Additional Customization

Argenox provides extensive customization, design and manufacturing services to ensure the perfect fit for your product. Our wide selection of devices and services allows developers to create any number of products. Should you need more information and assistance in integrating this device or developing your product, contact us at [sales@argenox.com](mailto:sales@argenox.com)

- Custom SCLE-01 Design including changes to sensors or capabilities
- Custom Firmware capabilities
- Custom Hardware design including Modules, RF and Antenna Design
- Bluetooth and Firmware Development
- Mobile Apps for iOS and Android
- Mechanical Design and Manufacturing

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Document Identifier: SC-LE01-DS-1.0

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