Hati Combo Handbook

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REVISION HISTORY

Ver.	Date	BACKGROUND (Reason for change)	Description of change	Sections changed	Approver	Author
0.1	2025/04/04	Create document	Initial creation	n/a		**T.Kiefer**
0.2	2025/05/27	Add HATI COMBO 200g	Add 200g device to tree and description			**D.O'Shea**

REFERENCES

No.	Document	Description	Version
	AlpsAlpine Connect platform	www.alpsalpineconnect.sensolus.com	

DEFINITIONS AND ABBREVIATIONS

Abbreviation/Term	Definition
BT	Bluetooth
DL	Downlink
D.I.	Data Integrity
UL	Uplink
OTM	On-The-Move
GUI	Graphical User Interface
NB-IoT	Narrowband Internet of Things
LTE-M	Long Term Evolution for Machines

RELATED DOCUMENTS

Document	Version

TABLE OF CONTENTS

1. INTRODUCTION

"Hati Combo" is the name for a High-End Asset Tracker. This device has following capabilities:

- GPS Tracking
- WiFi Scanning
- Wifi transmission (optional)
- Communication Network Positioning
- NB-IoT Network Communication
- LTE-M Network Communication
- Long Battery Lifetime
- BLE Bluetooth® Low Energy
- Beacon detection
- Shock detection
- Data Integrity
- Orientation detection
- External sensors supported (i.e. temperature, humidity, distance, etc.)
- Firmware Update Over-The-Air (FOTA)
- End-2-End Encryption
- Graphical User Interface / Statistics via AlpsAlpine Connect Platform

Hati Combo is co-developed by AlpsAlpine Europe and Sensolus. This product is especially designed for achieving long lifetime. Depending on the Use-Case, it's running up to 8 years. Patented TRUMI motion detection algorithm is integrated to support long lifetime. Hati Combo supports different communication network technologies, thus being NB-IoT as well as LTE-M. Based on the availability of each network, Hati Combo will decide by its own, which technology is used for sending messages. Due to its capability of supporting both, NB-IoT and LTE-M, Hati Combo is especially designed for international and even intercontinental Use-Cases.

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

1.1. Description

Hati Combo is an asset tracking device that enables the user to track the different locations of a moving asset, such as containers, carriers, trailers, trollies, heavy tools, etc. It's an industrial grade device that is maintenance-free and can reach a life-time up to 8 years, depending on the customer Use-Case (amount of messages/position updates, reception conditions, etc.).
Based on a sophisticated motion algorithm, Hati Combo is capable to send the relevant GPS location of the asset location or - as a fallback - Wifi BSSIDs address. The GPS / WiFi location message will be transmitted via NB-IoT or LTE-M network. Both can be active simultaneously.

The core competence of the Hati is its motion algorithm, which allows sending messages only when motion event occurs. In different words, as long as the asset does not move, it will enter some kind of a power saving mode. Even if there is no motion detected, Hati Combo can send a periodic position update once a day (configurable). Detecting motion happens when certain thresholds, such as speed and distance are exceeded (configurable). Once this occurs, the device waits until motion stops, then transmits the corresponding GPS data. Data transmission is done via NB-IoT network or LTE-M network, depending on the availability on site; no transmission through Wifi. Motion algorithm parameters and others can be configured through AlpsAlpine Connect platform, in an end-user friendly GUI.

1.2. HATI Combo Family Variants

As mentioned, HATI Combo is co-developed with partner company Sensolus. Sensolus will market HATI Combo with their own brand called Track. The Track device is identical to the HATI Combo device, the HATI Combo being the parent.
Also, both Sensolus, ALPS Alpine and their customers have seen the need to create a family of products covering the scenarios where:

1) Varying colors covering the situation to make the device more visible in certain locations, more discrete in other locations, and to distinguish the role of the device.
2) Varying power by options:
   a. Battery powered devices; these will primarily be attached to smaller mobile assets such as trolleys.
   b. Battery plus external power via mains AC wall adapter; these devices will be installed on walls in convenient locations to act as anchors/gateways for other BLE devices. These gateways will relay messages from BLE only devices to the cloud services.
   c. Battery plus external power via a vehicle's power train; these devices will primarily be used on haulage trucks with containers, carriers, trailers, etc.

The BOM of the "Battery plus External Mains AC Wall Adapter" is the primary BOM, the "Battery plus External Power via Vehicle Power Train" BOM is the identical to the primary BOM. The "Battery Powered Device" has a reduced BOM, i.e. it does not include the DC/DC components and external connector of the primary BOM:

1) Primary BOM
   a. "Battery plus External Mains AC Wall Adapter" device
   b. "Battery plus External Power via Vehicle Power Train" device
2) Reduced BOM:
   a. "Battery" only powered device
3) HATI COMBO 200g device has one BOM difference in that it uses a 200g shock sensor rather than the standard 16g shock sensor.

The device colors in the following diagram describe the HATI Combo Variants:

1) WHITE: The predominantly primary device color marketed by both Sensolus and ALPS Alpine. This will account for most of production.
2) BLUE: One device only, planned for anchor/gateway stations.
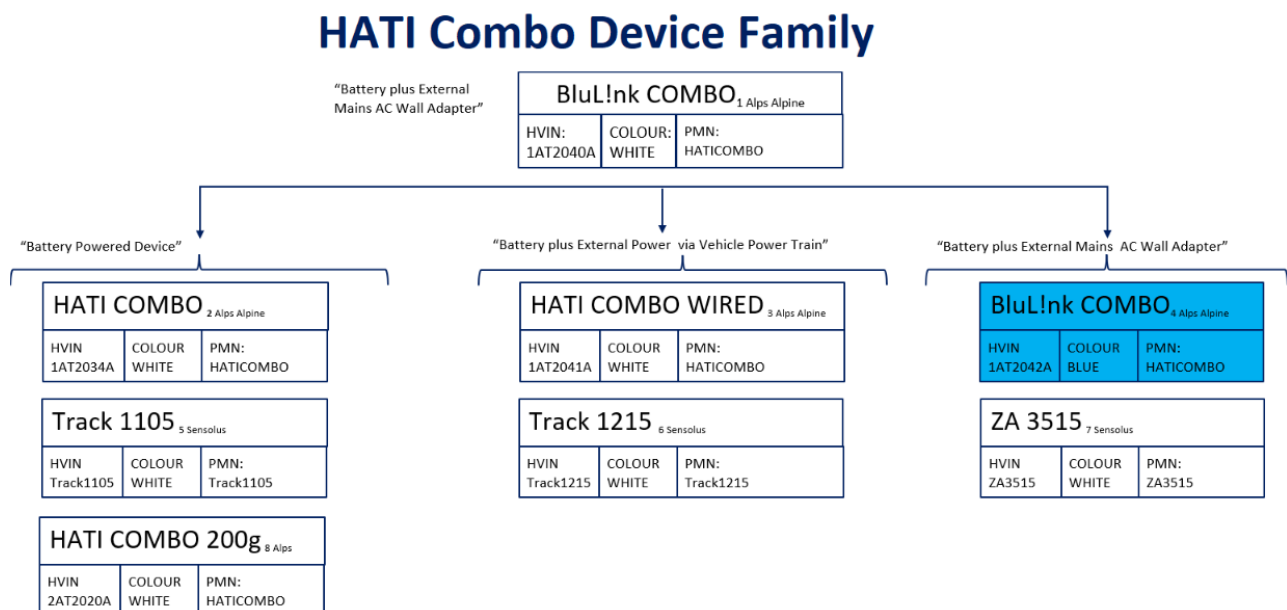
Figure 1: HATI Combo Device Family

1.3. Hardware content

Hati's Hardware basically contains following components

- 1 PCB
- GPS Receiver
- WiFi Transceiver (Tx optional)
- Combined NB-IoT / LTE-M Transceiver
- SIM Card, Type MFF2
- Bluetooth® Low Energy (BLE)
- Acceleration Sensors
- Temperature Sensor
- Magnetic Switch
- LED
- Battery (replaceable*)
- Housing, Industrial Strength

2. OPERATION

2.1. Device Activation

The device offers possibility to activate it by magnet.

2.1.1. Magnet activation

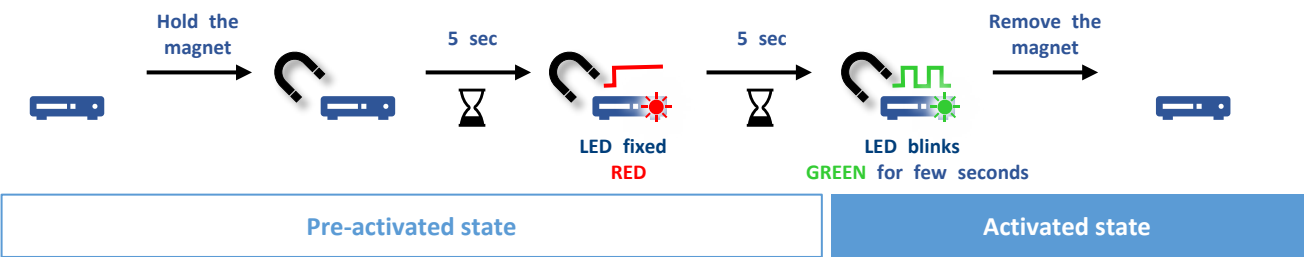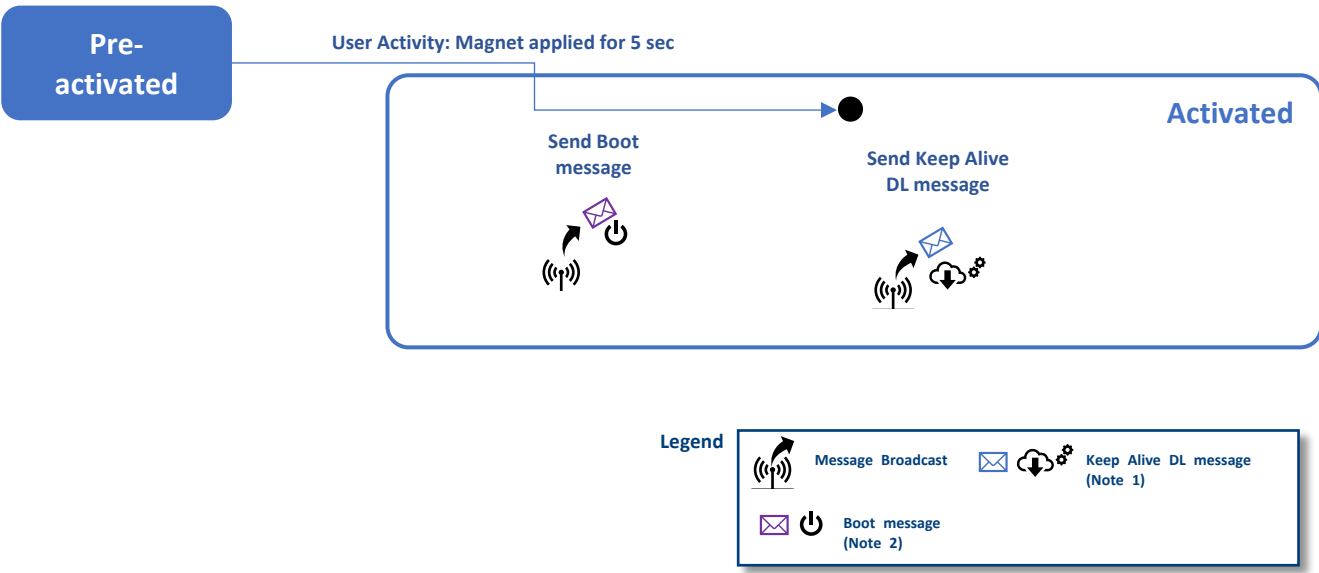**Figure 1 – Hati Combo location of the indicator for magnet switch (detector)**

Figure 2 – Magnet activation, continuously hold magnet for >=5sec

2.1.2. Activation state machine

Notes:

1. Keep alive DL message – is not a location message, uplink part contains various status information: uptime, consumed energy etc. Also, it will ask for new tracker configuration.

2. Boot message - Sent after activation or after rebooting in the activated state. It is not sent in a pre-activated state (even if reboot happens).

Figure 5 – State diagram in an activation context

2.2. Device Deactivation

The device cannot be deactivated manually. The only way to deactivate is by Downlink command (only AlpsAlpine Support member can do) . However, deactivating a device is not recommended, as you will lose possibility to remote control the device for maintenance. Instead, change configuration to non-frequent position updates.

2.3. Magnet capabilities

Magnet can be used for activation, ref. to previous chapters. Yet, it can also be used to perform following actions:

- Get device status

- Force a request for a new configuration

Any magnet is fine. No special one required.

2.3.1. Get device status

To get the device status, just hold the magnet for less than 5 seconds. The LED will indicate accordingly, indicating the current state of the device.
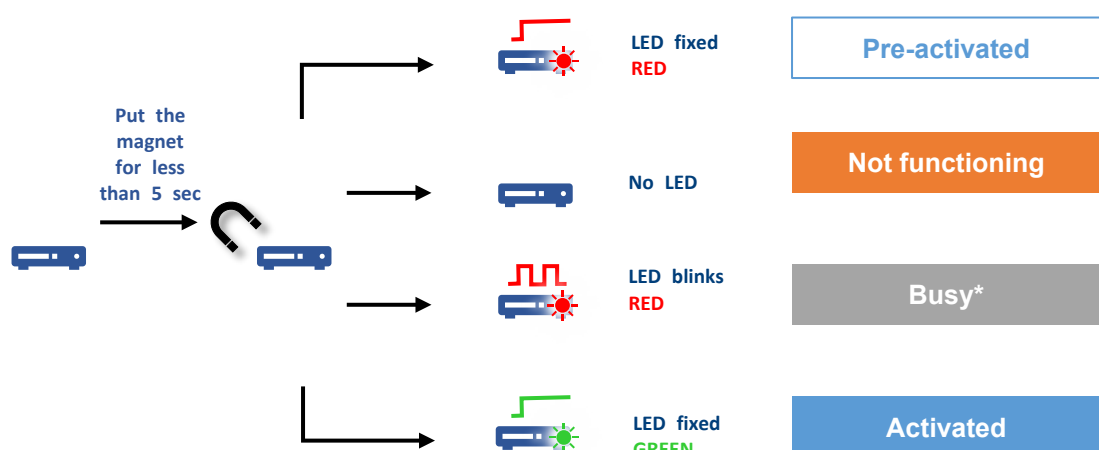
Figure 6 – Status determination of device

* Reasons for Busy state:

- Device is within first 60 seconds after (re-)boot

Note: On a reboot, it will blink green, for a short time (16 blinks, 4sec). Same for activation by Magnet.

2.3.2. Force a request for a new configuration

In default settings, device will ask for new DL settings every 23hrs (configurable). To avoid such waiting time, it's possible to manually trigger the DL request on device side. You'll need a magnet to do so.

Following graphic explains procedure of forcing DL request on device side.
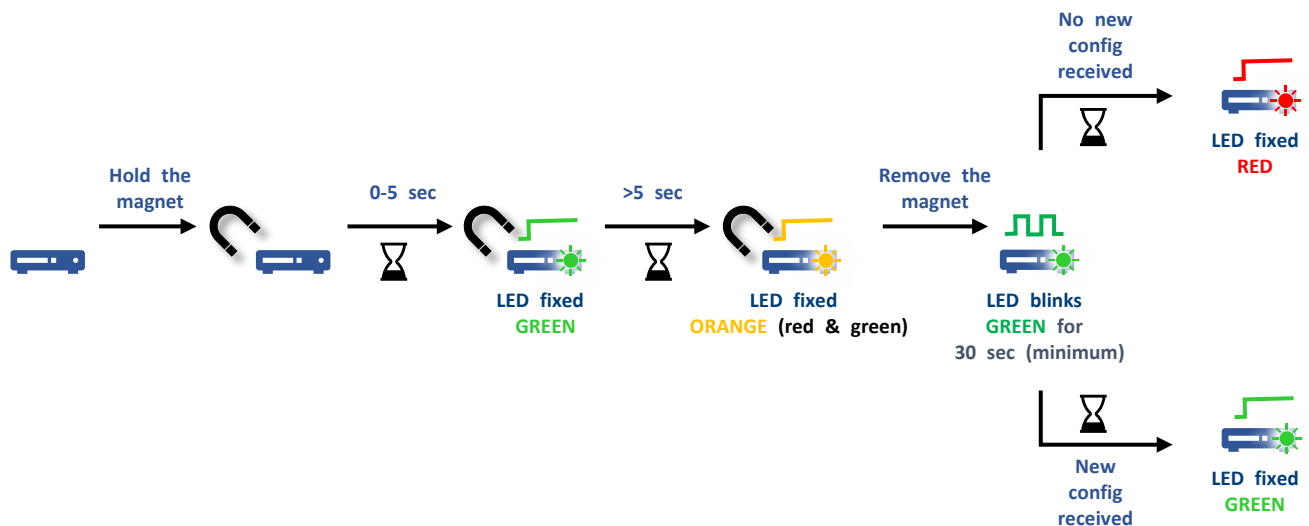
Figure 7 – Force new configuration download by Magnet (device already activated)

Note: There is no possibility to force a DL request from platform side.

2.4. Movement Detection

Hati Combo devices are equipped with advanced technologies to detect movement of the device. The type of movement detection depends on the configuration of the device. Hati Combo is supporting various kinds of movement detection, for different Use-Cases. AAEU support team will take care of proper configuration, according to customer's Use-Case.

2.4.1. Normal scenario (TRUMI®)

The patented motion detection algorithm TRUMI enables the user to track the location of moving assets, such as containers and trollies. The algorithm is capable of detecting high speed motion and tracking a long distance relocation, as opposed to minor moves within a warehouse. When a relevant motion event occurs, special messages are sent, allowing the user to locate the device. The user can control the behaviour via the intuitive speed and distance thresholds.
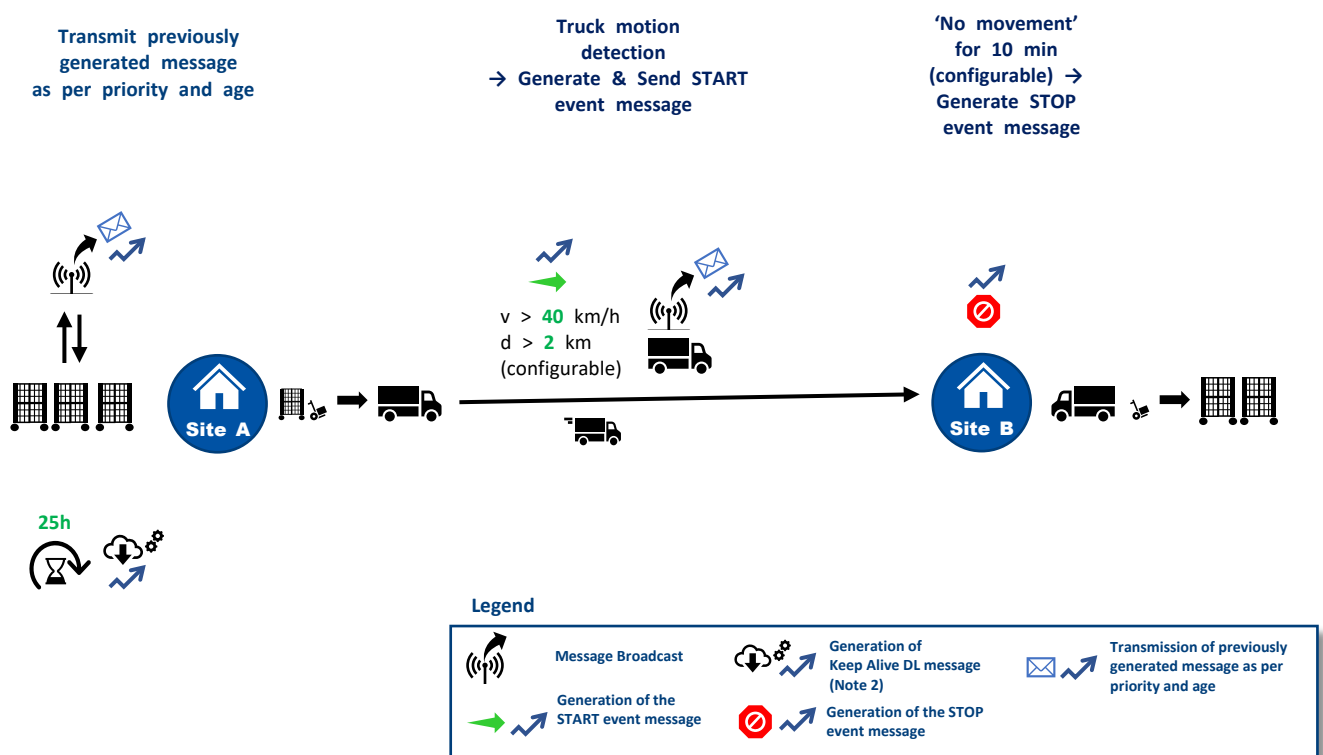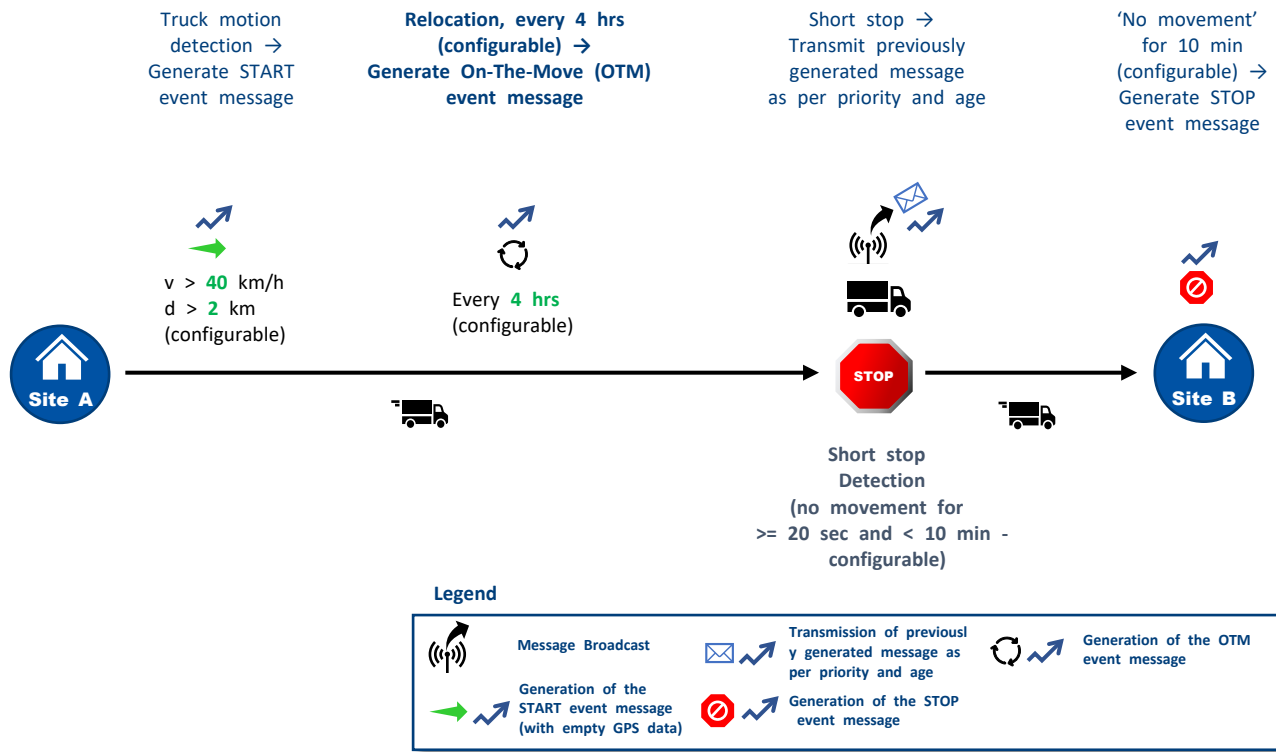

Notes

START message will always be a Location_Update message with empty GPS data (Long 0/Lat 0). Hence, start position need to be derived from previous STOP event. The AlpsAlpine Connect platform is handling this accordingly.

Figure 9 – Normal scenario of the movement transition

Copy restricted

2.4.2. Long drive scenario

Figure 10 – Long Drive scenario of the movement transition

Note: Using short intervals of OTM will decrease battery lifetime.

2.4.3. Keep-Alive / BIDIR

Keep alive message (BIDIR messages) contains most of the diagnostics information (Temp, Uptime, Battery status, etc). There is NO POSITION info included.

A BIDIR message equals a Keep-Alive message, but including DL request. By default, Hati Combo sends BIDIR messages every 23hrs. This interval is configurable (1hr – 48hr).

2.4.4. Startup behaviour on Boot event (i.e. BLE Reset)

On Startup, the device will send a Boot message, followed by a BIDIR message (So, Keep-Alive including DL request). Startup requires approx. 60 seconds. On first startup of the device, the tracker will usually receive updated configuration from the Alps Alpine Platform. In certain cases, this will automatically trigger a reboot after a few minutes, to apply new settings. This is an autonomous process that doesn't require any manual interaction by user.

2.4.5. Overseas Transport / Container Boat

There is no special mode for Overseas transport. In default configuration, the device will update its location based on the OTM interval OR periodic position update set by DL config. Note that there is usually no NB-IoT/LTE-M coverage on the high sea, so probably no live data available on Alps Alpine platform side. Yet, once the vessel has arrived in an area with NB-IoT/LTE-M coverage, all stored messages will be submitted and user will have position data available, of the asset's journey ("Data Integrity").

2.5.   Message queue

It is important to understand that Hati Combo has a prioritized message queue handling. Each message, that shall be send out, is added to general message queue as a first step. When message was successfully sent out, it is automatically moved to D.I. queue (if D.I. feature is enabled). If D.I. (Data Integrity) functionality is not enabled, message will be deleted from 1st queue, after sending.

Each message has a pre-defined priority (Urgent/High/Normal/Low) [even Boot messages]. Ref. to fig. 12. Based on the priorities, the messages within the queue are handled. Of course, urgent messages have highest Priority.

Size of internal message buffer can handle up to several hundreds of messages. Once it is full, the handling is first in, first out.
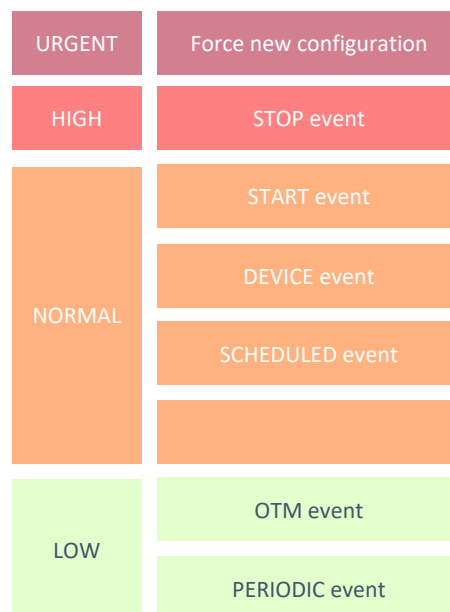
Figure 12 – Determining the priority of messages

2.6. Procedure for selecting geolocation data

Since the device's position can be determined by several location technologies (GPS, WiFi, Communication), a procedure is defined when and in which order a localization technology is used and which data will be sent through communication network.

1. If the device can make a GPS fix, then a message with GPS data is generated.
2. (optional) If no GPS fix could be made, the device scans for Wi-Fi access points and sends BSSID data (fee for service provider is required, to resolve this data)
3. If Wi-Fi access points are not found (for example, outside the city), it uses smart technology to determine its location based on communication network
4. Also, Geo-Beacons can be used for positioning

The best sequence of positioning methodology depends on Customer Use-Case and is configurable through Alps Alpine Connect platform. Alps Alpine support member will assist to find best settings.

Note: GPS detection offers an Indoor detection. If there is insufficient GPS signal strength within certain timeframe, the device considers its condition as being indoors, and will scan for Wifi Accesspoints, instead (configurable).

2.7. Orientation Detection

Hati Combo device offers Orientation Detection feature. When activated (configurable), Hati Combo can detect a change in orientation. Once such a change is detected, it will send a message with date/time and position information (if necessary/configurable).

2.8. Shock Detection

Alps Alpine is introducing a new feature called shock detection.
When activated (configurable), Hati Combo will use internal acceleration sensor to detect and record shock events, such as
- Asset dropped
- Asset hit by vehicle (i.e. fork lifter)
- Etc.

In such cases, internal sensor will detect heavy shock and related event will be reported to AlpsAlpine Connect platform with related date/time info and position data. The type of shock (strength) is configurable and can be adjusted by AlpsAlpine member. Ask for support.

2.9. Wifi Client (optional)

In regular Use-Cases, Hati Combo operates autonomously, outside and completely separated from customer's Wifi network. (Only scanning AP's, not sending any messages through customer's Wifi). In rare cases, when there is no known network coverage, Hati Combo can be embedded in customer's Wifi network, to send all messages via Wifi, to AlpsAlpine Connect platform. This requires very specific settings and can only be done by AlpsAlpine support member. In general, for security reason (on both sides, AlpsAlpine and customer), this shall be avoided.

3. CUSTOMER FRONT-END "ALPSALPINE CONNECT"

AlpsAlpine is offering a Front-End / Webinterface called AlpsAlpine Connect.
https://alpsalpineconnect.sensolus.com/

This Front-End offers multiple functionality.
- Localisation info
- Statistics
- Convenient configuration of trackers
- Device History data
- Details of received messages (visible only for Alps Alpine Support Team, for diagnostic purpose)
- Battery Lifetime data
- Geo-Zones
- Alarms
- Dashboards
- Flows
- User Handling and related visibility of assets
- etc.

For details on AlpsAlpine Connect platform please contact Alps Alpine Support member

4. FIRMWARE UPDATE

The device supports Firmware Over-The-Air (FOTA) updates. Alps Alpine automatically pushes firmware updates to improve device performance without requiring end-user interaction. All historical data is preserved on the platform side.

Firmware updates only affect the device's application behaviour and do not modify the RF-radio stack of the WiFi-module, BLE-chip, cellular modem. These radios are configured through their designated APIs, and the device will never change modulation parameters or configure transmission power beyond initially certified levels.

End-users cannot manually trigger OTA updates. Only Alps Alpine support members can initiate updates remotely.

Updates may be necessary to provide optimal performance to customers.

Once an update is queued by Alps Alpine support, it starts automatically when environmental conditions are favourable (good network reception quality) and the device is stationary. Updates can take up to 2.5 hours depending on network conditions.

5. CONNECTION TO EXTERNAL SENSORS

BT Devices/Sensors can be linked/connected to Hati Combo tracker , through the AlpsAlpine Connect platform. Note that there is a list of supported devices. Means, when there is additional sensor that should be supported, a FW change might be required. Tracker acts as a gateway. Note that 1 tracker can handle up to 4 BT sensors.

Following sensors can be used (Example)

- Temp. Sensor

- Humidity Sensor

- Pressure Sensor

- Radar Sensor (i.e. distance detection)

- etc.

Alps Alpine Connect platform can be configured accordingly, so all sensor data is directly visible on platform. Contact your Alps Alpine support member, if adjustments are required.

## 6. DEBUGGING

There are two possibilities of Debugging

- Device is sending some debug information by his own, in case of abnormal device operation.
- Via BT connection (BLE), it is possible to retrieve detailed debugging information. (Only for DEV purpose). Related App "Sensolus" need to be used. Within the App, you can find "BT Console" button. Note: Only possible with proper access rights

7. TECHNICAL SPECIFICATION

7.1. Hati Combo

Dimension [mm] (L x W x H)	130.4 x 72 x 35.5
Weight:	200g
Housing Material	PBT/PC
Operating Temperature [°C]	-20 to +60
Localization technology (accuracy)	GPS 5-25m
	Wifi 25-100m
	Bluetooth 5-30m
Battery Lifetime	Up to 8 years, highly depending on Use-Case
Certification	CE, FCC, GCF, PTCRB, BT SIG
Impact Protection Class	IK09
International Protection Class	IP69
Maximum relative humidity:	95 %
Battery	Replaceable 10.500 mAh, 3.6V, nominal 25°C (Li-SoCl$_2$, 3xER17505 cells)
Mounting Method	Rivets, Screws, Zip-ties, Double side adhesive tape
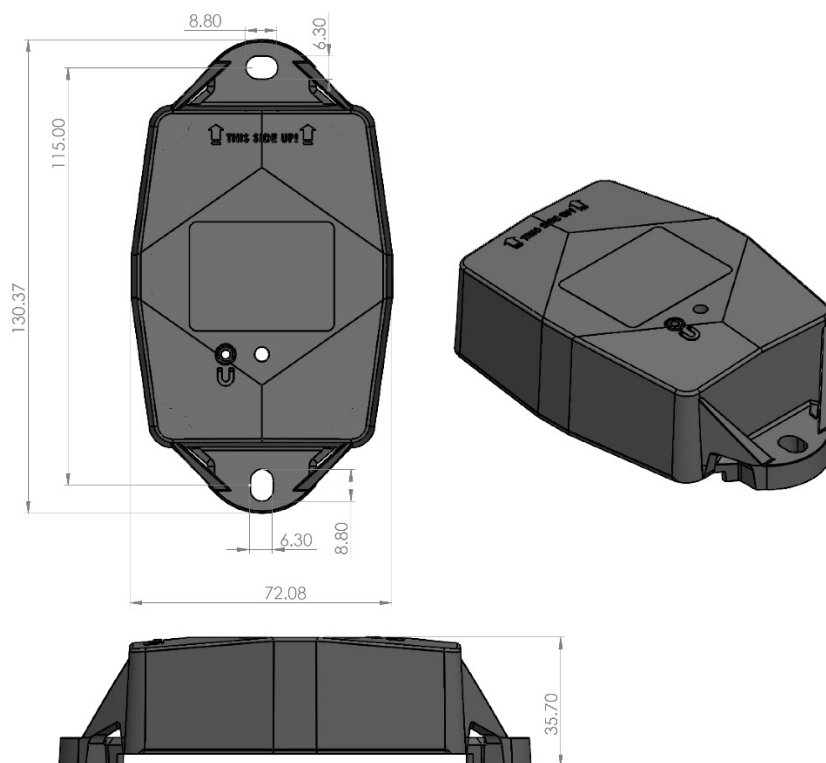
Figure 14 –Dimensions Hati Combo

8. MOUNTING POSITION

To mount the Hati Combo to the asset, 2 rivets or screws have to be insert through the two holes of the device on the sides. There are arrows on the device housing to indicate the best mounting orientation.
It is advised to place the Hati Combo on the top part of the asset, in order to avoid any hits/impacts from a forklift or any other type of vehicles. Additionally, make sure Hati Combo is not covered/surrounded by metal as this might cause bad reception of build-in antennas. In general, keep good sky view, for better GPS reception.
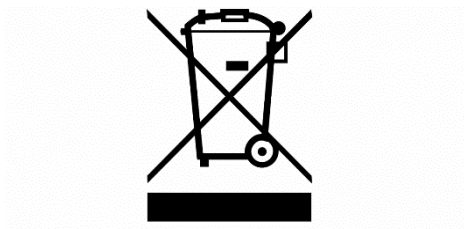Note: Hati Combo device shall be installed with arrows pointing up, see picture below.

9. PACKAGING / SHIPPING INFORMATION

▪ Standard box has 42 units
▪ Box size [cm] (L x W x H): 39,5 x 30 x 24
▪ Total Weight: 10 kg

10. DISPOSAL

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

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

11. 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. The network communication is highly dependent on NB-IoT/LTE-M coverage and many other environmental factors, therefore ALPS ALPINE is not liable to any monetary impacts due to lost messages.

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

12. 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
Radio Equipment Statement: Operation is subject to the following two conditions:
1.
The device may not cause harmful interference.
2.
The device must accept any interference received, including interference that may cause undesired operation of the device.
FCC ID: 2AT4V- HATICOMBO
IC: 26629- HATICOMBO
Contains FCC ID: 2ANPO00NRF9151
Contains IC: 24529-NRF9151
HVIN: 1AT2040A

FCC USA

FCC ID: 2AT4V-HATICOMBO, Contains FCC ID: 2ANPO00NRF9151. 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-HATICOMBO, Contains IC: 24529-NRF9151 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.