Inpixon Asset Tag User Guide

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Document Information

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Document History

Rev	Date	Change	Changed By
1.0	2021-03-09	Initial version	MBOR
1.1	2021-05-10	Pictures adapted to the new housing formfactor	MBOR
1.2	2021-05-26	Includes Asset Tag blink protocol and step by step COTA instructions	MBOR
1.3	2022-06-09	New format, new pictures	MBOR
1.4	2022-08-24	Corrected typo in the hex field of the last example section 5.2.2	MBOR
1.5	2023-04-06	Additions and adaptions for certification	CGUE
1.6	2023-07-05	Added ISED PMN and Exposure statement	GWIL
1.7	2023-09-05	Changed paragraph 5.1mobile condition and RF Exposure	CGUE

Contents

1. Scope

The scope of this document is to guide the owner through the mounting of the Inpixon Asset Tag on an asset, to activate it and if necessary how to re-configure parameters in the case the default ones don't fit to the use case.

2. Installation

Care should be taken when mounting the Inpixon Asset Tag. It should be fixed on a plane surface with a good visibility to the RTLS anchors. Obstacles like armored concrete or bulky metallic objects may divert or reflect the RF signals resulting in less accurate location computations.

2.1. Tape mounting

The Inpixon Asset Tag is provided with a double-sided adhesive removable tape. The surface where the tag has to be applied must be clean and dry. Remove the protective foil and press the tag for a couple of seconds to the surface.

To remove the tag stretch slowly the adhesive tape until the tag is released.

2.2. Screw mounting

Use two screws with a diameter of 3 mm.

3. Activation

The Inpixon Asset Tag is activated via a short finger press on the activation button as depicted in Figure 3-1 and stays active for the complete battery lifetime after this procedure. It cannot be switched-off.

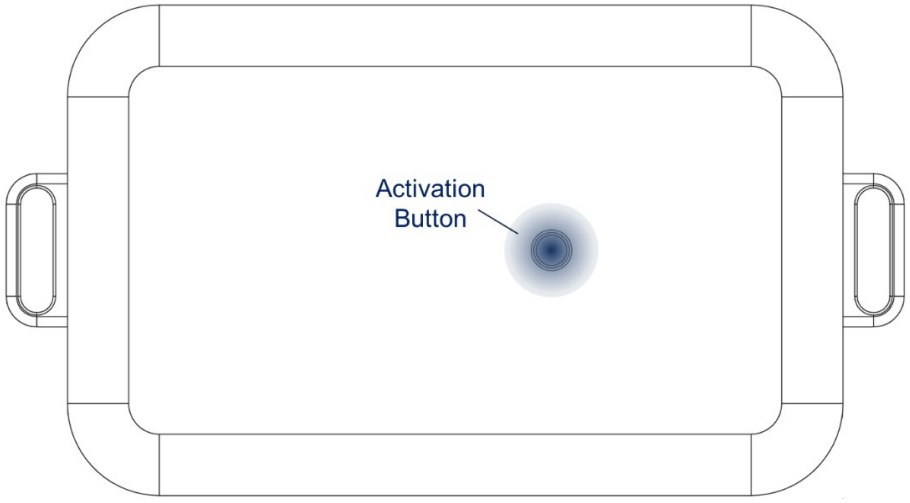
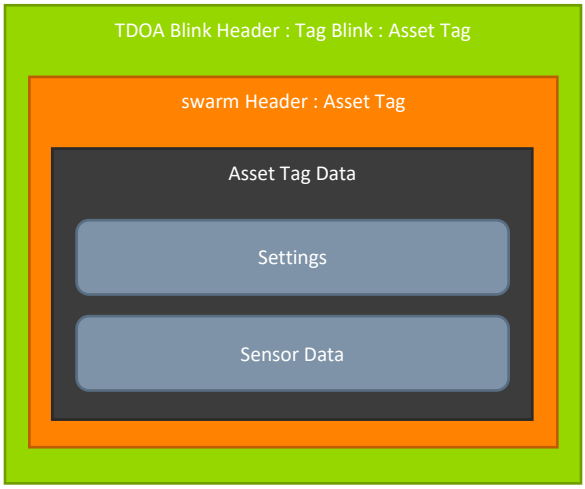


Figure 3-1 Inpixon Asset Tag activation

4. Inpixon Asset Tag Blink Protocol

4.1. Overview



An overview of the complete asset tag blink packet is shown in the image above.

All multi-byte fields in the asset tag blink protocol are sent in hexadecimal little endian format, that is the least significant byte is sent first and the most significant byte is sent last. For example, if the blink interval in the TDOA blink header below were set to 10 seconds. This would be represented by the value 0x**80000A**, where the most significant bit being set means that the value is in seconds (0x800000) and the remaining value is the time (0x00000A). This is sent in the packet as shown below.

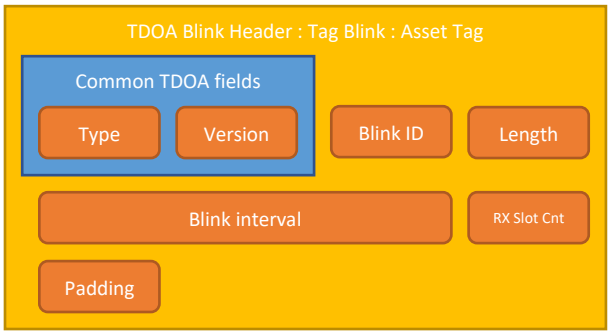
```
<TDOA Blink Header(swarm header(Asset Tag Data))>

<Type> <Version> <Blink ID> <Length> <Blink interval> <Rx Slot Cnt> <Padding> (s_header)

s_header: <swarm header(AssetTag Data(<Settings> <Sensor Data>))>

0220D7250A00800000064201D010B010A0000E803008813001E020E2B0015001A003400E2033C711300
```

4.2. TDOA Blink header



The TDOA Blink header for the asset tag has the same fields and alignment as the swarm TDOA Blink header (Type: MSG_BLINK_TAG, Version: PROTO_VERSION_D).
The blink interval differs as the asset tag needs to be able to represent much longer intervals of time as the swarm.
The blue section is common across all TDOA headers.

Field	Size	Description
Type	1 byte	MSG_BLINK_TAG (0x02)
Version	1 byte	PROTO_VERSION_ASSETTAG (0x20)
Blink ID	1 byte	The number of the packet incremented from 0 with each packet sent.
Length	1 byte	Length of packet in bytes excluding the length field and previous fields
Blink interval	3 byte	The time between blinks being sent. This value is in seconds if the most significant bit is set otherwise it is in ms.
RX Slot Cnt	1 byte	A receive window is available immediately after a packet is sent when this value is 0. This field is typically a count down to 0. This value is always 0 for the asset tag.
Padding	1 byte	Single padding byte for alignment to the NNT 2 format [2].

Example of a full Inpixon Asset Tag blink message

<Type> **<Version>** **<Blink ID>** **<Length>** **<Blink interval>** **<Rx Slot Cnt>** **<Padding>** <s_header>

<s_header>: <swarm header(AssetTag Data(<Settings> <Sensor Data>))>
See sections 4.3 and following

02 20 D7 25 0A 00 80 00 00 64201D010B010A0000E803008813001E020E2B0015001A003400E2033C711300

4.3. swarm header

The blue section is common across various swarm headers.

Field	Size	Description
Type	1 byte	SWARM_TYPE_ASSETTAG (0x64)
Version	1 byte	SWARM_VERSION_1 (0x20)
Length	1 byte	Length of payload in bytes (excluding the length field and previous fields).

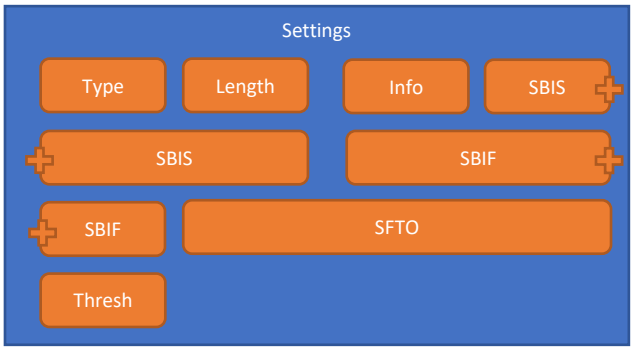
4.3.1. Asset tag data general format

All asset tag data is encoded in type-length-value format. Both the type and length fields are single byte integers. The value in the length field determines the number of bytes in the value field. Strings are not NULL terminated as the length of the string is known.

```
<TDOA Blink Header(swarm header(AssetTag Data(<Settings> <Sensor Data>))>

0220D7250A00800000642001D010B010A0000E803008813001E020E2B0015001A003400E2033C711300
```

4.4. Settings



Field	Size	Description
Type	1 byte	AT_TYPE_SETTINGS (0x01)
Length	1 byte	Length of settings data to follow
Info	1 byte	Information flags. Ref. to sect. 4.4.1
SBIS	3 bytes	Slow blink interval in seconds
SBIF	3 bytes	Fast blink interval in ms
SFTO	3 bytes	This is the duration of time that the asset tag will be in fast blink mode before returning to slow blink mode. This is in ms
Thres	1 byte	Accelerometer threshold

<TDOA Blink Header(swarm header(**AssetTag Data(<Settings>** <Sensor Data>))>

0220D7250A0080000064201D**010B010A0000E80300881300 1E**020E2B0015001A003400E2033C711300

4.4.1. Info flags

2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
Air Settings Res							U

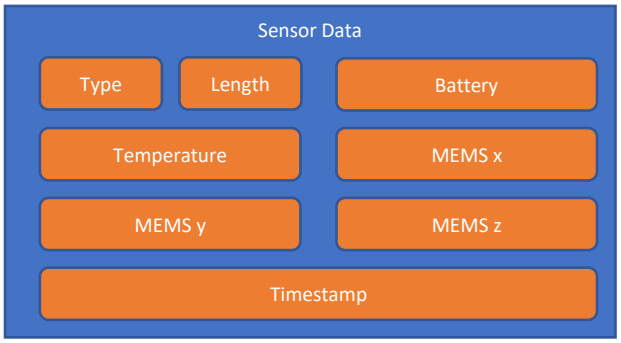
Field	LSB	Size (bits)	Description
U	0	1	Blink interval units. Indicates that the current interval is in seconds (SBIS) if this bit is set otherwise ms (SBIF).
Air Settings Res	1	7	Results of the validity checks from the last received AIR command. 0 indicates success.

4.4.1.1. Air Settings Results

A value of 1 means the validity check for that setting failed. Settings are only changed if all validity checks pass.

Field	Bit offset	Description
SBIS	0	Slow blink interval check
SBIF	1	Fast blink interval check
SFTO	2	SBIF timeout
SFEC	3	FEC check
SDAM	4	Communication mode check
SSYC	5	Syncword index check
SMTH	6	MEMS threshold

4.5. Sensor data



Field	Size	Description
Type	1 byte	AT_TYPE_SENSORS (0x02)
Length	1 byte	Length of settings data to follow
Battery	2 byte	Battery voltage [dV]
Temperature	2 bytes	Temperature [°C]
MEMS x	2 bytes	Acceleration in x axis [mg]
MEMS y	2 bytes	Acceleration in y axis [mg]
MEMS z	2 byte	Acceleration in z axis [mg]
Timestamp	4 byte	Timestamp of current data [ms] Relative to activation. Rollover after ca. 49 days

```
<TDOA Blink Header(swarm header(AssetTag Data(<Settings> <Sensor Data>))>

0220D7250A0080000064201D010B010A0000E803008813001E020E2B0015001A003400E2033C711300
```

Important note: It is up to the user to check the battery voltage. If the voltage drops below 3.6 V the functionality cannot be guaranteed. Even if it seems to be operational far below. Appropriate measures have to be taken like replacing the tag

.

5. Configuration Over The Air (COTA)

The Inpixon Asset Tag is normally intended to be used with its default parameters. Those have been chosen to fit for the most use cases. However, if for certain applications specific parameters need to be changed, it can be done over the air. Two methods can be used, via the swarm bee API using a swarm bee based device like a DK+ board or by using the backchannel capability of an anchor.

Note: Changing any parameter of the Inpixon Asset Tag will change the lifetime of the battery. In this case Nanotron Technologies GmbH cannot be made liable for a shorter lifetime of the tag. Nor Nanotron Technologies GmbH will accept any claims.

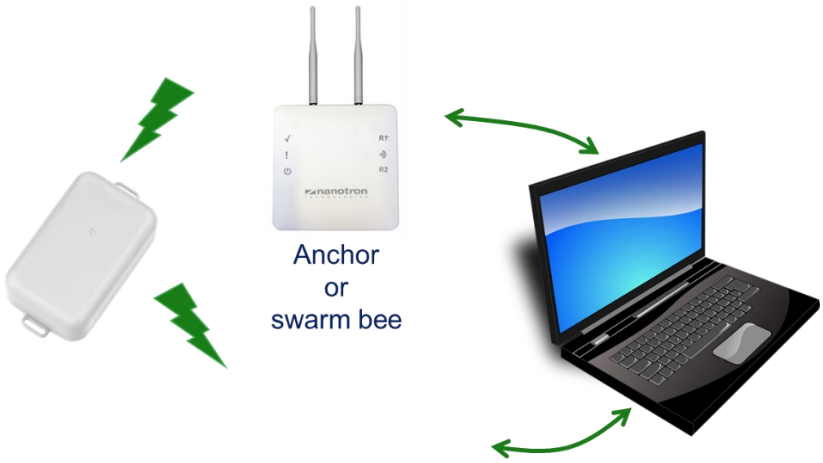


Figure 5-1 Configuration architecture

5.1. COTA via the swarm bee API

The section below explains the format and command to be used over the air by using either a *swarm* bee module or a *swarm* bee DK+ board. Both are using the UART to convey the command and parameters.

Example: Connect the DK+ via the USB interface to a terminal emulation such as PuTTY or Tera Term.
The settings are:

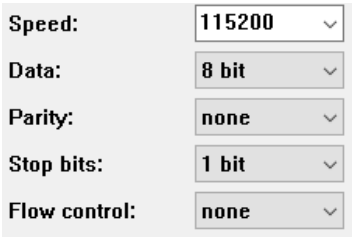
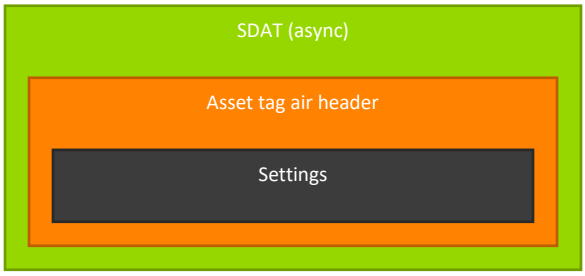


Figure 5-2 Settings for a DK+ Board

5.1.1. Settings Air Command

Asset tag settings can be changed by issuing an air command from a swarm device. Only a single asset tag air command is available. Thus, one command for all asset tag settings which means that all parameters have to be provided even if they remain the same.

5.1.2. Overview



The air command is sent by issuing a swarm API SDAT command in asynchronous mode. The SDAT payload contains the asset tag air command header followed by the settings data.

5.1.3. SDAT

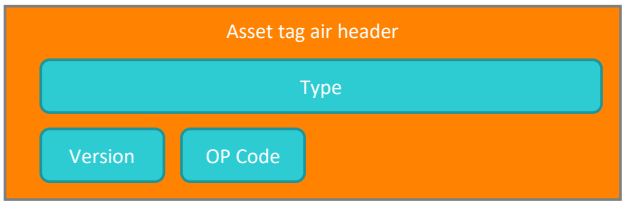
SDAT shall be set to asynchronous mode (option=**1**) and a suitably long timeout based on the current SBIF value as explained below. The asynchronous mode means that the transmitter waits within the timeout period for a blink from the Inpixon Asset Tag to transmit the SDAT. The detailed description of the SDAT including acknowledgment and error messages is described in section 5.3.3 of the swarm API 3.0 [1].

The following example in each section show how to build step by step a full SDAT including asset header and settings on the basis of the default values as described below. For proper settings change the parameter values accordingly.

Example

```
sdat 1 <NodeID> <Len of payload> <Asset tag header(Settings)> <TimeOut>
```

5.1.4. Asset tag air header



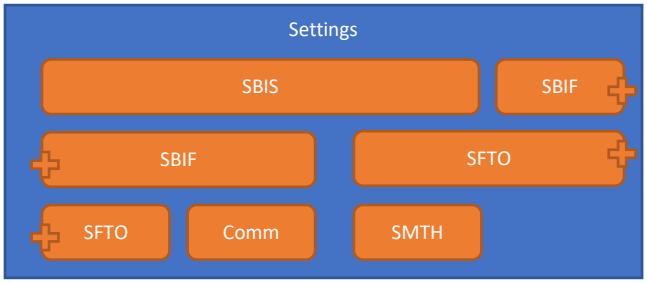
Field	Size	Description
Type	4 bytes	Asset tag air type (0x08205554)
Version	1 byte	Protocol version (0x01)
OP Code	1 byte	AIR_OPCODE_SETTINGS (0x00)

Example

```
sdat 1 <NodeID> <6 + Len of Settings> <082055540100(Settings)> <TimeOut>
```

5.2. Settings

As mentioned above, all parameters are changed in a single command. All parameter fields, even if they remain the same, have to be provided as stated in this section.



Field	Size	Description	Default
SBIS	3 bytes	Slow blink interval in seconds [hex] (Range 0x1 – 0x01517F)	0x000E10 (3600)
SBIF	3 bytes	Fast blink interval in ms [hex] (Range 0x64 – 0x7FFFFF)	0x002710 (10000)
SFTO	3 bytes	Fast blink timeout after motion has stopped in ms [hex] (Range 0x64 – 0x7FFFFF)	0x00EA60 (60000)
Comms byte	1 byte	FEC, comms mode and syncword [hex]	Next table
SMTH	1 byte	MEMS threshold value [hex] (Range: 0 - 0x7f)	0x1E (30)

5.2.1. Comms byte

2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
0	a	b	b	c	c	c	c

Field	LSB	Size (bits)	Description	Default
a	6	1	FEC enabled if bit is set [hex]	0b0
b	4	2	SDAM [hex] Modes: 1 = 80/1 2 = 80/4	0b01
c	0	4	SSYC - syncword index. Range: 0 - 12 [hex]	0b0001
0,a,b,c		8	Comms byte	0b00010001 (0x11)

Example

```
sdat 1 <NodeID> <6+11> <082055540100000E1000271000EA60111E> <TimeOut>

NodeID: 0x00000052001A Len: 6+11 (dec) = 0x11 TimeOut: 65000 ms (dec)

sdat 1 00000052001A 11 082055540100000E1000271000EA60111E 65000
```

5.2.2. Example of Settings packets

Settings strings examples (spaces in the string are for readability only and must be omitted in the actual string):

Hexadecimal string	Description
000E10 002710 00EA60 11 1E	Default settings. SBIS = 3600 s (0x000E10), SBIF = 10 s (0x002710), SFTO = 60 s (0x00EA60), Comms byte = 17 (0x11) [SFEC = 0 (0x00), SDAM = 1 (0x01), SSYC = 1 (0x01)], SMTH = 30 (0x1E)
01517F 002710 00EA60 11 1E	Default settings, SBIS = 1 day – 1 s. SBIS = 1 day – 1 s (0x01517F), SBIF = 10 s (0x002710), SFTO = 60 s (0x00EA60), Comms byte = 17 (0x11) [SFEC = 0 (0x00), SDAM = 1 (0x01), SSYC = 1 (0x01)], SMTH = 30 (0x1E)

000E10 002710 00EA60 52 1E	Default settings, FEC enabled, Syncword index = 2. SBIS = 3600 seconds (0x000E10), SBIF = 10 s (0x002710), SFTO = 60 s (0x00EA60), Comms byte = 82 (0x52) [SFEC = 1 (0x01), SDAM = 1 (0x01), SSYC = 2 (0x02)], SMTH = 30 (0x1E)

5.3. COTA via anchor backchannel

The use of the backchannel is explained in the nanoLES 3 User Guide [2]. The parameter <data> is replaced by the content of SDAT as described above.

6. Disclaimer

6.1. FCC Disclaimer

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 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 into 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.

Any changes or modifications made to this device not expressly approved by the party responsible for compliance may void the authorization to operate the equipment.

6.2. ISED Statement

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

6.2.1. ISED Product Marketing Name Declaration

ISED certification requires that the Product Marketing Name (PMN) for the Inpixon AssetTAG is declared.

Product Marketing Name: ASSETG

6.3. RF Exposure Statement

This product operates under mobile condition and is exempt from RF Exposure evaluation under FCC and ISED RF exposure guidelines.

Distance between this device and human body or head must be higher than 20cm.

7. References

[1] swarm API 3.0 Doc Id. NA-13-0267-0003
[2] nanoLES 3 User Guide Doc. Id. NA-13-0243-0043

Life Support Policy

These 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. Inpixon (including its affiliates and subsidiaries) customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify for any damages resulting from such improper use or sale.

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