Inpixon nanoANQ Chirp V3 User Guide

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Document History

Rev	Date	Change	Changed By
1.0	2021-01-29	First released version	MBOR
1.1	2021-12-03	Housing and mechanics information added	MBOR
1.2	2022-03-16	New format	MBOR
1.3	2022-06-17	Second released version	MBOR
1.4	2023-04-06	Additions and adaptions for certification	CGUE
1.5	2023-07-05	ISED PMN declaration and RF Exposure Statement	GWIL
1.6	2023-09-05	Updated chapter	CGUE

Contents

1. Introduction

The worldwide commercially deployed nanoANQ-series expands by the new and re-engineered Inpixon nanoANQ Chirp V3. The Real-time location system (RTLS) anchor is ready for industrial-scale tracking use cases. A highly robust product, IP65 compliant and extreme operating temperature range. Nanotron's integrated Chirp RF-technology unlocks unparalleled long ranges of 300 - 500 m for in- and outdoor tracking.

The Inpixon nanoANQ Chirp V3 creates and collects reliably high precision location information and communicates sensor and context data and stays fully synchronized with the whole RTLS network. Remaining backwards compatible to previous anchors the footprint has been reduced and allows to expand existing installations with ease.
The RTLS anchor is available with an IP65 industrial housing or as a PCB to be integrated into your own housing and design.

Through its Ethernet port, the anchor utilizes IP-based data and management protocols and features a built-in DHCP client. Thus, it can be configured remotely through its API [1] over the network. In addition, this port serves as recommended power source via PoE (Power over Ethernet). Alternatively, it can be powered by the micro-USB port.

Easy to install and maintain, the anchor is remotely configurable via standard TCP/IP connection. The anchor has an adjustable power amplifier (-17 to +20 dBm for extended range and different antenna options).

The Inpixon nanoANQ Chirp V3 includes the housing while the Inpixon nanoANQ Chirp PCB V3 variant is the assembled PCB only. They include both a chip antenna for each channel and share the same characteristics if not otherwise stated.

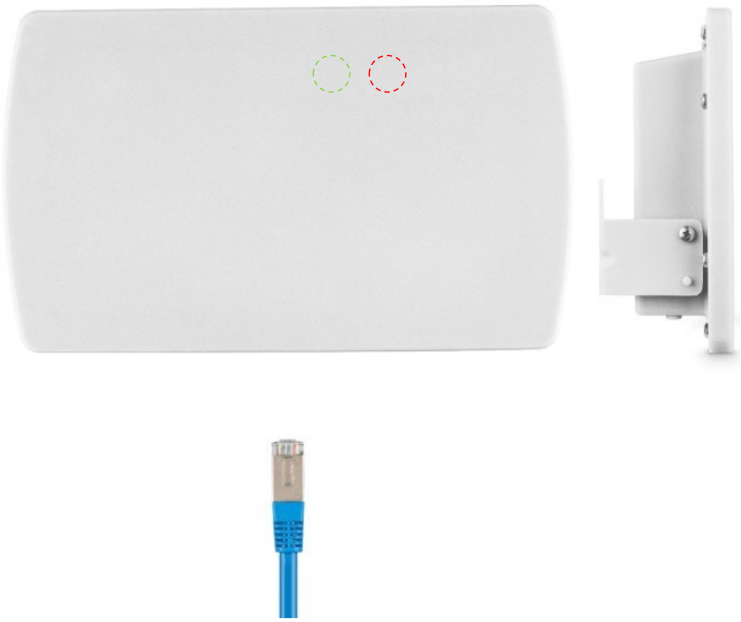


Figure 1-1: The Inpixon nanoANQ Chirp V3

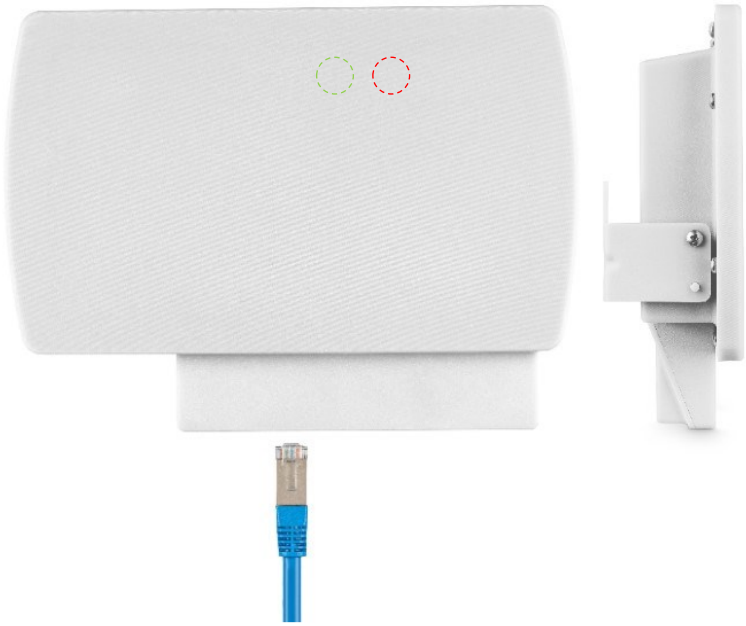


Figure 1-2: Inpixon nanoANQ Chirp V3

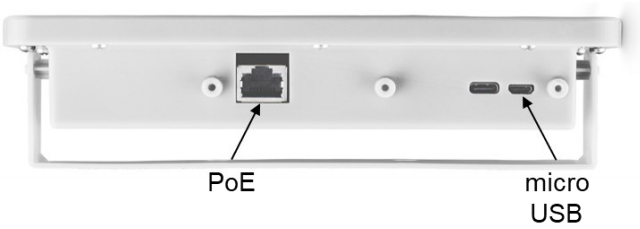


Figure 1-3: External Interfaces of the Inpixon nanoANQ Chirp V3

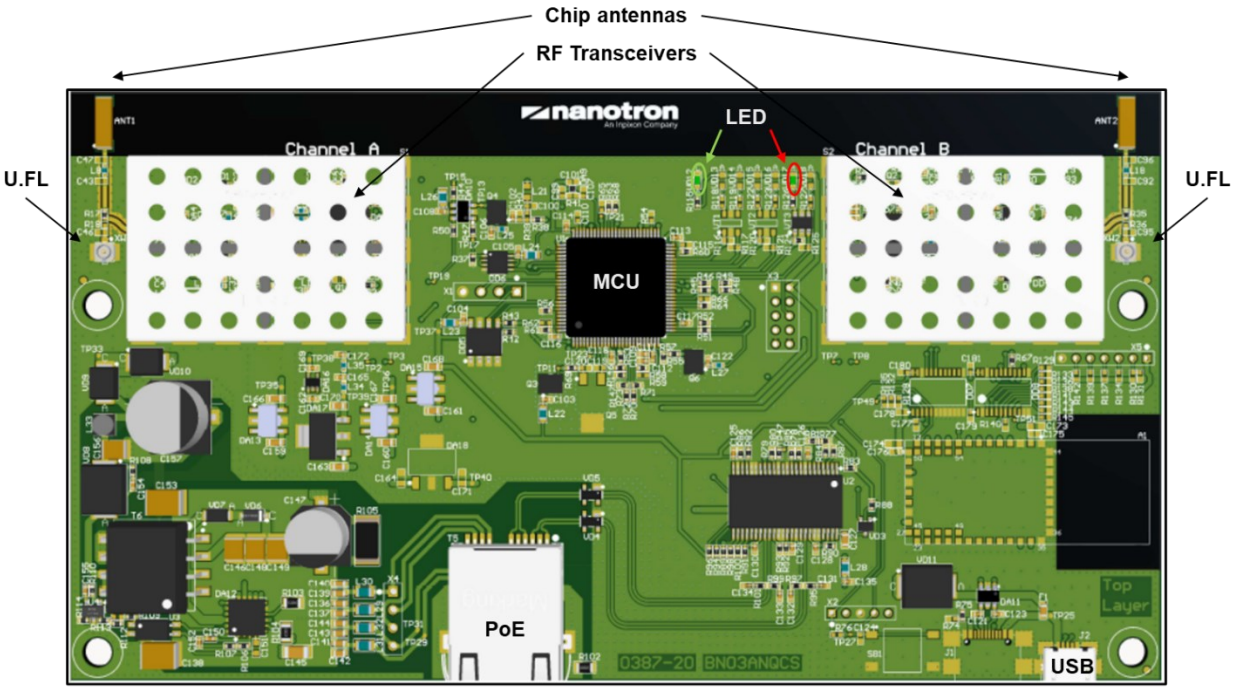


Figure 1-4: Position of key elements

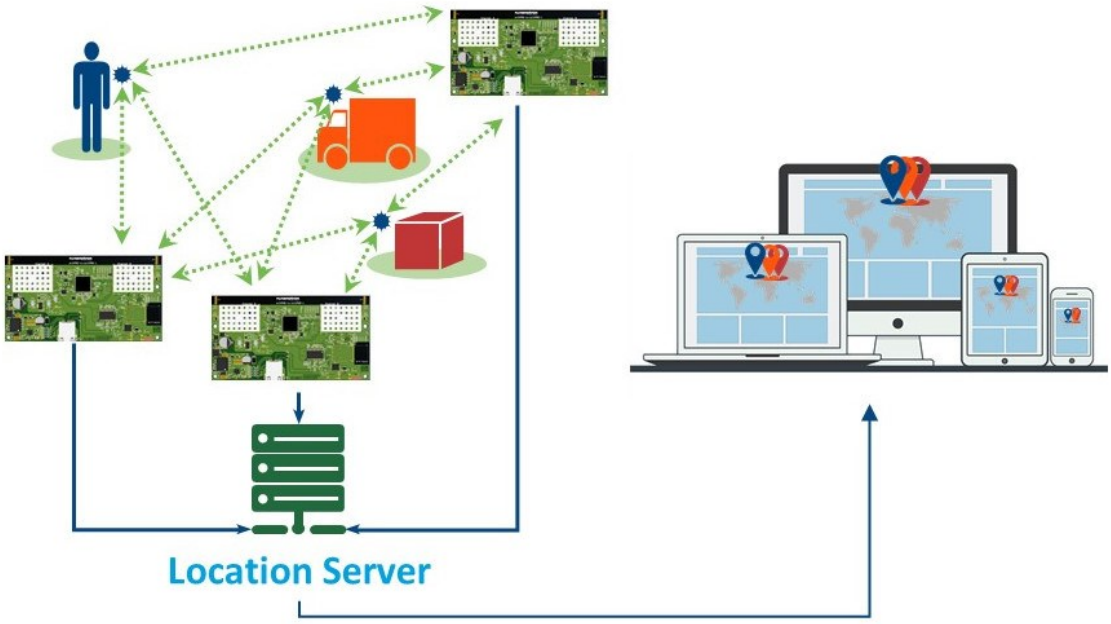


Figure 1-5: Typical RTLS topology

2. Features

Frequency range ..... ISM-band 2.4 GHz, 2.400 ... 2.4835 GHz

Modulation..... Chirp Spread Spectrum (CSS)

Signal detection rate..... up to 900 blinks per second

ToA capture accuracy .....< 1 ns*

Number of RF channels..... 2

RF output power (radiated) ..... configurable -17 to +20 dBm

RF sensitivity ..... -88 dBm typ., 80 MHz mode, 1Mbps

RF interface .....2 internal chip antennas

Data interface:..... Ethernet 10BaseT/100BaseTX

Supply voltages: ..... +48 V Power over Ethernet (recommended),
..... +5 V USB

Power consumption: .....Power over Ethernet: 5 W max.
.....Classified as PD Class2 according to IEEE 802.3af (3.84 W... 6.49 W)
.....USB 1000 mA max **

Connectors:..... 1 x RJ45 Ethernet with PoE
.....1 x micro USB Type B

Operating temperature.....-40°C to +85 °C

Dimensions ..... See section 4

Weight with housing without IP65 gasket .....255 g
Weight with housing with IP65 gasket .....365 g
..... without mounting options

Weight PCBA .....57 g

* Typical achieved RTLS accuracy 1 m at 90%, 1-hour static, 10m distance, RSSI -65 dBm
** Requires a power device able to deliver 1 A and a cable not longer than 1 m

3. Functional Description

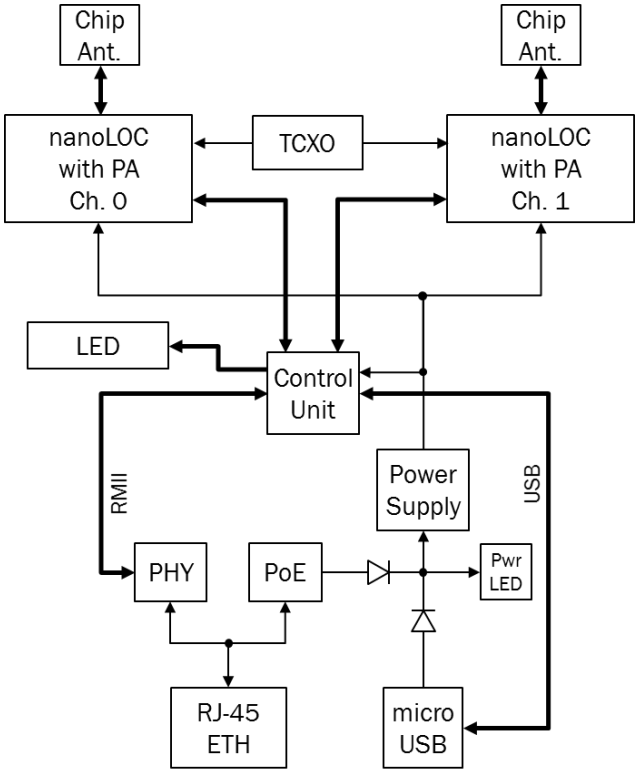


Figure 3-1: Block diagram of the Inpixon nanoANQ Chirp V3

3.1. Principle

The core locating unit consists of two independent RF channels and the control unit. It captures incoming chirp spread spectrum (CSS) tag broadcasts also called blinks and determines their time of arrival (ToA).

3.2. Control Unit

The control unit is composed of a micro controller which manages the two RF channels, the ethernet communication and the status LED. It collects the timestamps of blinking tags on each channel as well as the signal strengths and their node IDs to form a blink message which is sent to the location server nanoLES.

3.3. Status LEDs

Two LEDs display the operational status of the anchor. The green LED when on, signals the presence of a power source. The red one blinks during start-up and is switched-off once the operation is normal. The position of the LEDs is shown in Figure 1-4.

3.4. Power Supply and Clock Sources

The Inpixon nanoANQ Chirp V3 can be operated via two alternative power supply sources either via the recommended PoE (Power over Ethernet) or optionally via USB. All required supply voltages are derived internally from the power supply unit. All clocks are generated on board. The USB power supply must be able to deliver at least 1 A at 5 Volts and a cable not longer than 1 m to operate properly.

3.5. Interfaces and API

The Inpixon nanoANQ Chirp V3 has the required firmware to operate in Nanotron's RTLS network and IoT platform. The firmware can be updated via the ethernet interface using the pre-flashed anchor firmware bootloader. For detailed information on how to upgrade the Inpixon nanoANQ Chirp V3 firmware see the nanoANQ user guide [1]. Moreover, each anchor can be configured and managed via an API called anchor management interface. Also, a bi-directional communication from/to the tags is possible though the backchannel. See also section 3.8. and 4.

3.5.1. RF interface

The RF interface for channel 0 and channel 1 consists of a chip antenna each, radiating an output power of up to +20 dBm. The RF output power can be adjusted via the API [1]. In Figure 3-2 the TX output power Pout is shown as a function of TXPWR value (0...63) according to measurements at room temperature (25 °C). The tolerance is ± 2 dBm.

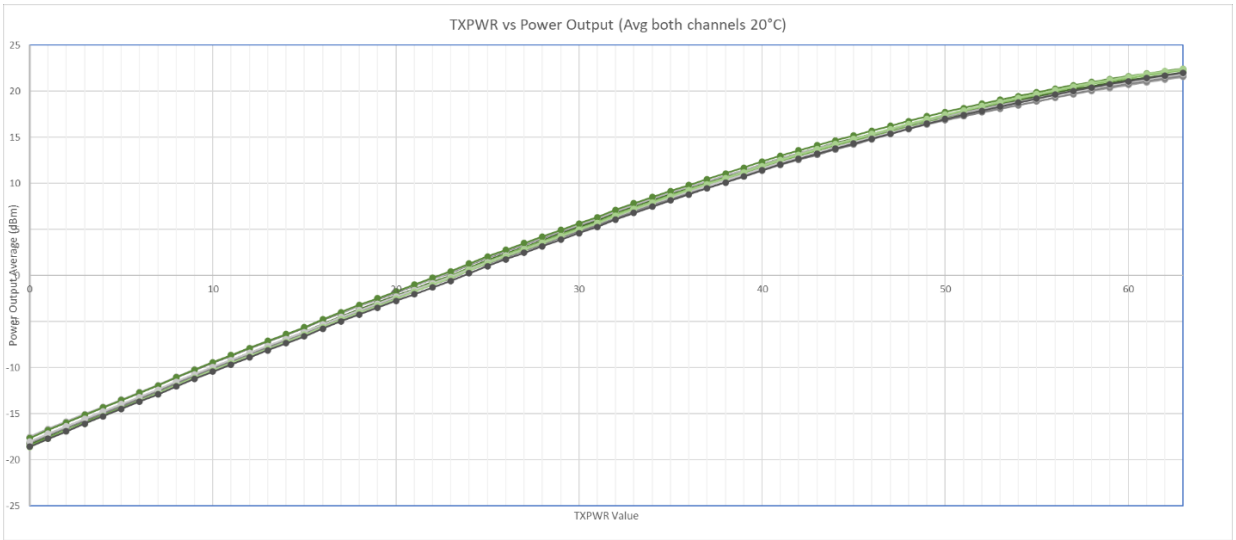


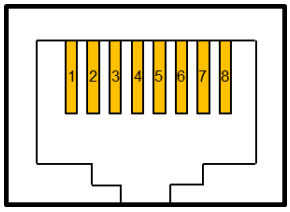
Figure 3-2: Typical RF Pout as a function of TXPWR

3.5.2. Ethernet interface

The Inpixon nanoANQ Chirp V3 provides an Ethernet 10BaseT/100BaseTX interface via a standard RJ-45 connector. The default setting uses DHCP to assign an IP address to the anchor which can optionally be set to static. It also provides a power source Power over Ethernet (PoE) 48 V, PD Class2 according to IEEE 802.3af (3.84 W to 6.49 W).

Table 3-1: RJ-45 signals, pin description

Pin No.	Pin Name	Pin Description
1	TX +	Data
2	TX -	Data
3	RX +	Data
4	VDC +	PoE
5	VDC +	PoE
6	RX -	Data
7	VDC -	PoE
8	VDC -	PoE

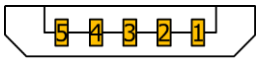


3.5.3. USB interface

The anchor includes an USB 2.0 full speed interface for **maintenance** purposes **only**. It provides an alternative 5 V power supply source when PoE is not available. Therefore, it has a micro-USB type B connector. Except optional external protection circuits against surge and lightning, the USB interface needs no additional components.

Table 3-2: micro-USB signals, pin description

Pin No.	Pin Name	Pin type	Pin Description
1	USB_OTG_FS_VBUS	I	USB Bus voltage
2	USB_OTG_FS_DM	I/O	USB differential serial data line
3	USB_OTG_FS_DP	I/O	USB differential serial data line
4	USB_OTG_FS_ID	I	USB connector identification
5	GND	-	circuit ground



3.6. Virtual Anchor Synchronization

The Inpixon nanoANQ Chirp V3 supports Nanotron's patented virtual anchor synchronization. Therefore, periodic blinks (pacer blinks) are transmitted between the anchors. Those are reported to the location server nanoLES which estimates the time differences between the anchors. This knowledge is used to compensate clock deviations against the common time base. This allows to synchronize the received tag blinks (timestamps) which is part of our TDOA (Time Difference Of Arrival) localization solution. Detection of Location Broadcasts

Two Chirp modes are supported by the Inpixon nanoANQ Chirp V3. 80 MHz with 1 µs symbol length (80/1) and 80 MHz with 4 µs symbol length (80/4). 1 µs symbols require only one fourth of the airtime of 4 µs symbols. In contrast, the 80/4 mode provides a 6 dB better link budget which may increase the operational range up to the double (LOS). Hence, 80/1 is recommended for high tag densities while 80/4 can be used to maximize the anchor-to-tag range.

The time of arrival (ToA) of tag broadcasts (blinks) are captured by the Inpixon nanoANQ Chirp V3 with a resolution better than 1 ns. The detection rate at 80/1 is more than 900 blinks per second. Radio waves travel over the air at 30 cm in 1 ns. Thus, ToAs from different anchors are used to calculate the time difference of arrival (TDoA). Several TDoAs results are then combined to estimate the tag's position.

3.7. RSSI Detection

Each RF channel receiver can estimate the received signal strength indicator (RSSI) with a tolerance of ± 6 dB of each captured tag. Both indicators are part of the blink message sent to nanoLES.

3.8. API

The Inpixon nanoANQ Chirp V3 has a powerful and versatile Application Interface (API). It is used to set-up, operate and maintain the anchors. Moreover, it is able via its backchannel to control and to exchange payload to and from the tags. How to use this API is explained in detail in the nanoANQ User Guide [1] and the nanoLES 3 User Guide [2].

For instance, the location engine nanoLES as well as the RTLS Toolbox 3 uses the API. The latter can be used during the deployment phase and to configure and maintain the system easily.

4. Dimensions

4.1. Housing

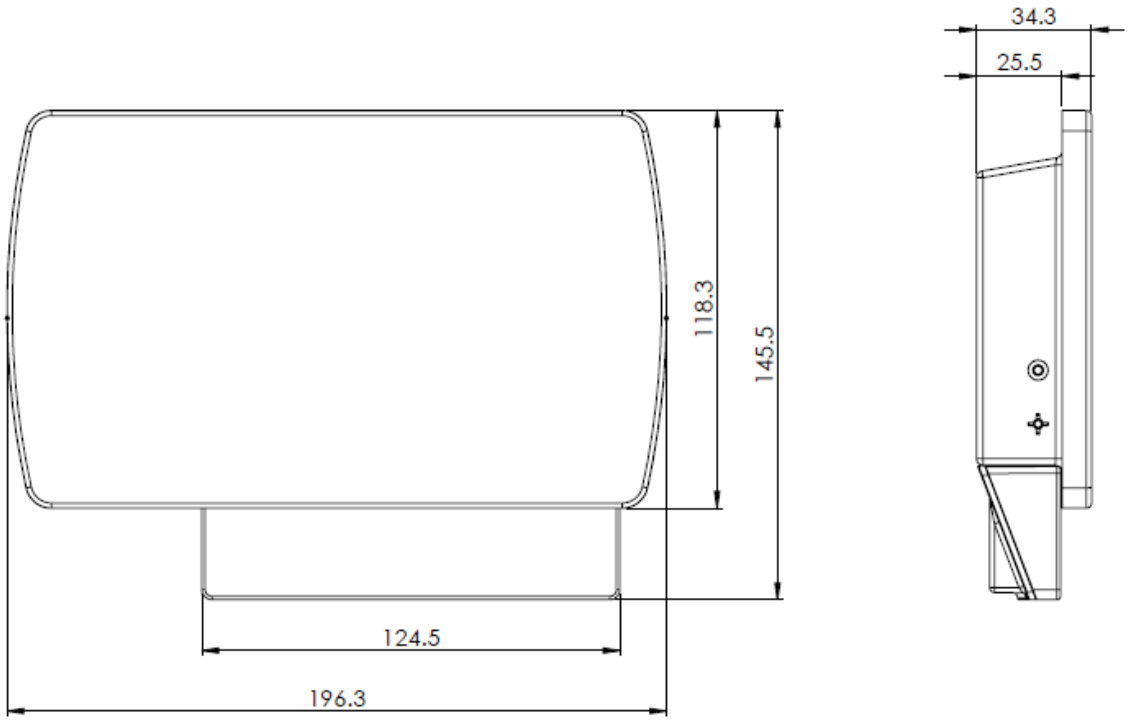


Figure 4-1: Dimensions of the housing

4.2. Circuit Board

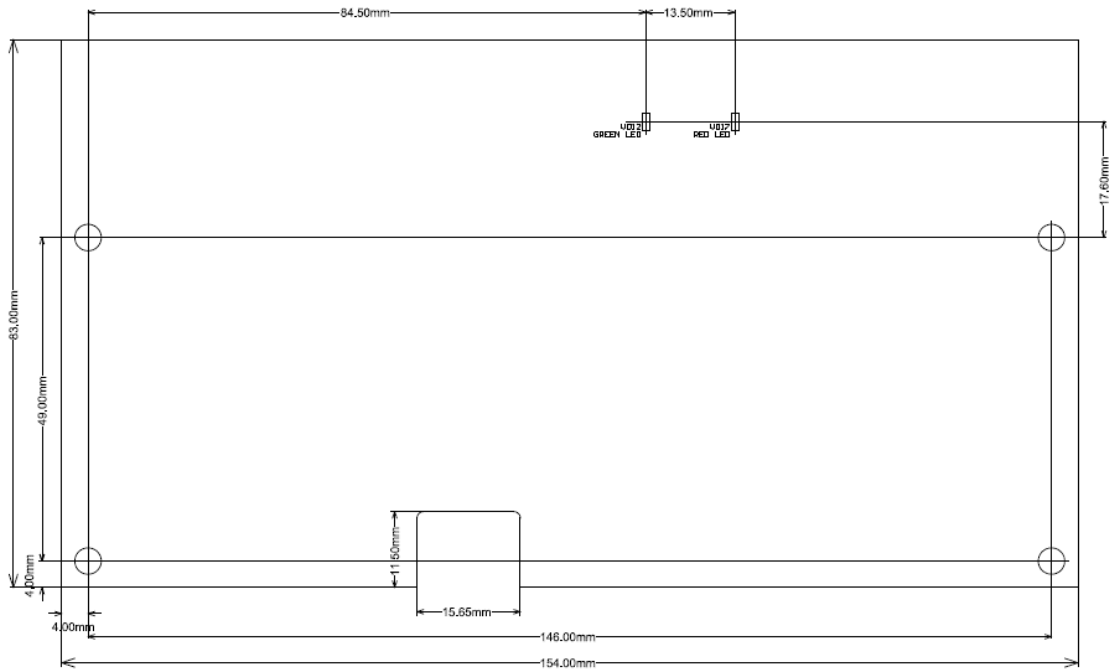


Figure 4-2: PCB dimensions

4.3. Mounting Options

Two options are delivered in the package, a wall mount bracket and a corner bracket as described below.

4.3.1. Wall mount bracket

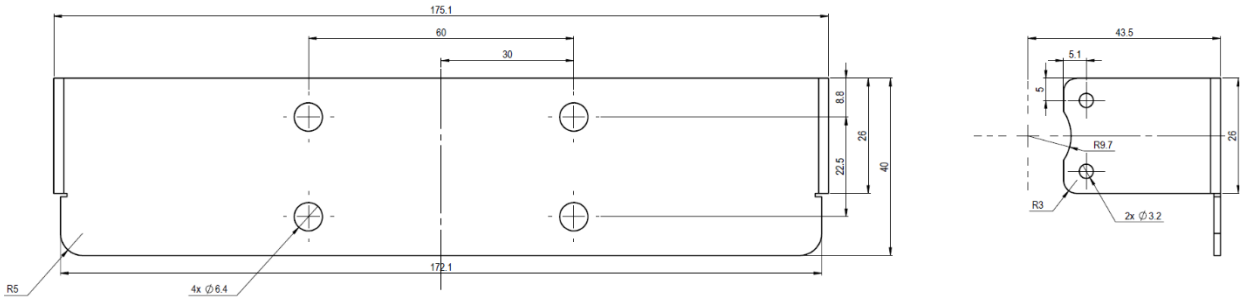


Figure 4-3 Wall mount bracket dimensions

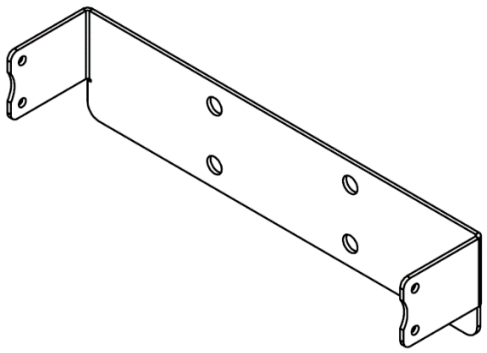


Figure 4-4 Wall mount bracket perspective

4.3.2. Corners Holder

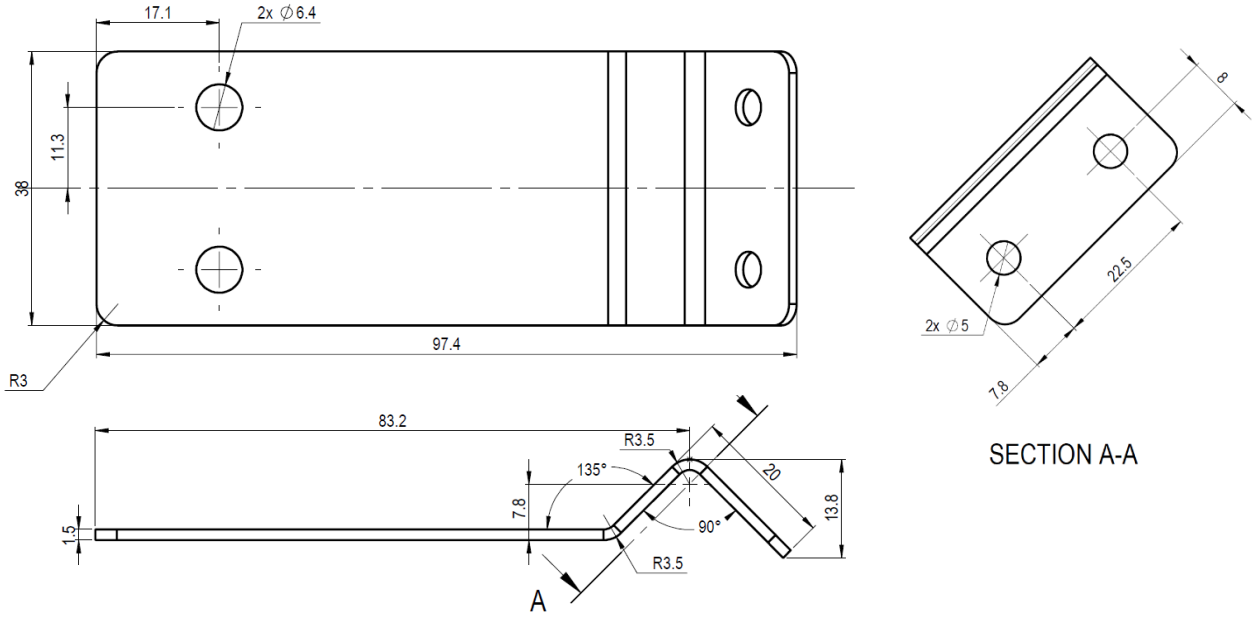


Figure 4-5 Wall mount corner bracket perspective

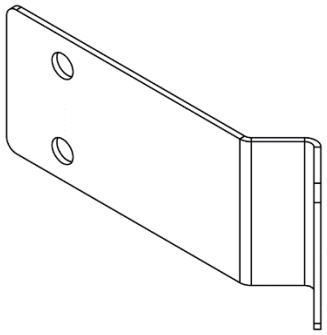


Figure 4-6 Wall mount corner bracket perspective

5. Disclaimer

5.1. 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.

5.2. 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.

5.2.1. ISED Product Marketing Name Declaration

ISED certification requires that the Product Marketing Name (PMN) for the Inpixon nanoANQ Chirp V3 is declared.

Product Marketing Name: 7654A-ANQ03C

5.3. 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.

6. References

[1] nanoANQ User Guide, Document ID: NA-13-0275-0025
[2] nanoLES 3 User Guide, Document 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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Sales Inquiries
Inpixon
nanotron Technologies GmbH
Alt-Moabit 60a
10555 Berlin, Germany

Europe/Asia/Africa: +49 (30) 399954-0
USA/Americas/Pacific: +1 (339) 999-2994
nanotronsales@inpixon.com
www.inpixon.com