Inpixon Swarm Chirp V3 Dev Board User Guide

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1.0	2020-10-28	• First Release	MBOR
1.1	2021-03-04	• Corrections on power consumption	MBOR
1.2	2021-04-07	• Corrections on USART connections	MBOR
1.3	2021-08-10	• Additions and adaptions for certification	MBOR
1.4	2022-04-04	• Added ISED exposure considerations in sect. 9.2 • Changed schematic with new BPF • New format	MBOR
1.5	2022-06-02	• Added new section 9.10 Host Product Labelling Requirements	MBOR

Contents

1. Introduction

The Inpixon Swarm Chirp V3 Dev Board is a CE, FCC and ISED certified tool to develop, test and debug software based on Inpixon's Swarm Chirp V3 module. Several connectors and test points help to measure particular parameters, such as RF output power or current consumption.

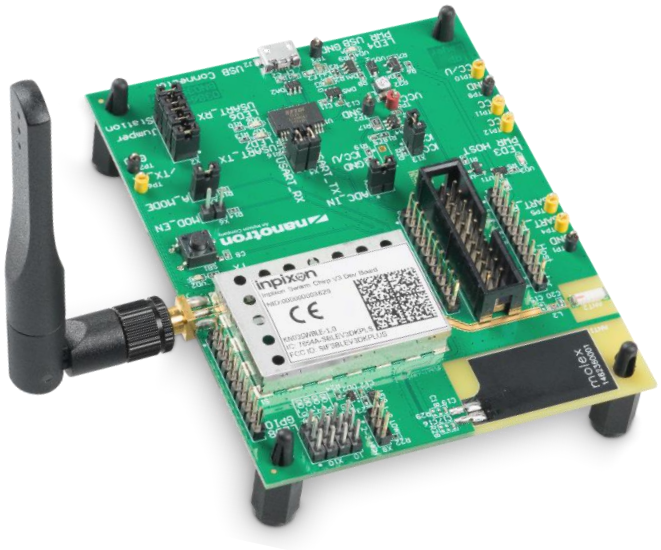

Figure 1-1: Inpixon Swarm Chirp V3 Dev Board

2. Technical Data

User and debugging interface 1..... Inpixon Swarm Chirp V3 USART, 500 bps to 1 Mbps, default 115.2kbps
User and debugging interface 2..... USB, converted to USART by FTDI chip, 115.2kbps

Radiated TX output power.....max. +20 dBm / 100 mW [1]
Supply voltage via host connector.....+3.1 V...+5.5 V
Power consumption over host connector (@ 3.3 V)..... max. 250 mA
Maximum supply voltage ripple when supplied via host connector ..... 30 mVpp
Supply via micro-USB .....standard 5 V USB power supply
Power consumption over USB ..... max. 200 mA

Operating temperature.....-30°C to +85°C
Dimensions (L x W x H).....80 mm x 100 mm x 22 mm
Weight.....46 grams

1. Only with supplied antenna PSKN3-24/55S. Other antennas connected to the SMA connector will infringe any certification

Note: All technical data related to the Inpixon Swarm Chirp V3 module can be found in the Inpixon Swarm Chirp V3 Technical Reference [1]

3. Block Diagram

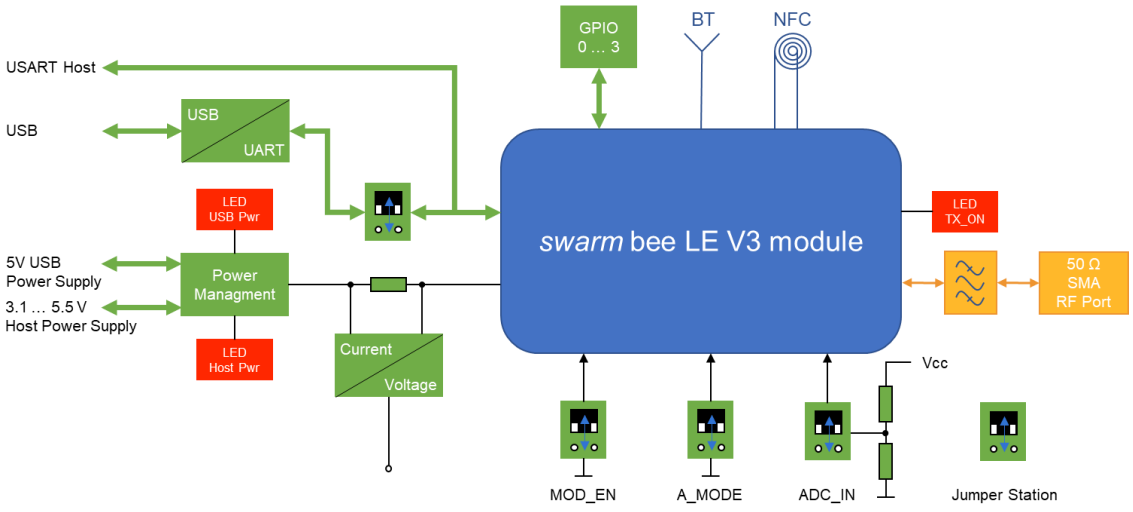

Figure 3-1: Block diagram of Inpixon Swarm Chirp V3 Dev Board

4. Connector Configuration

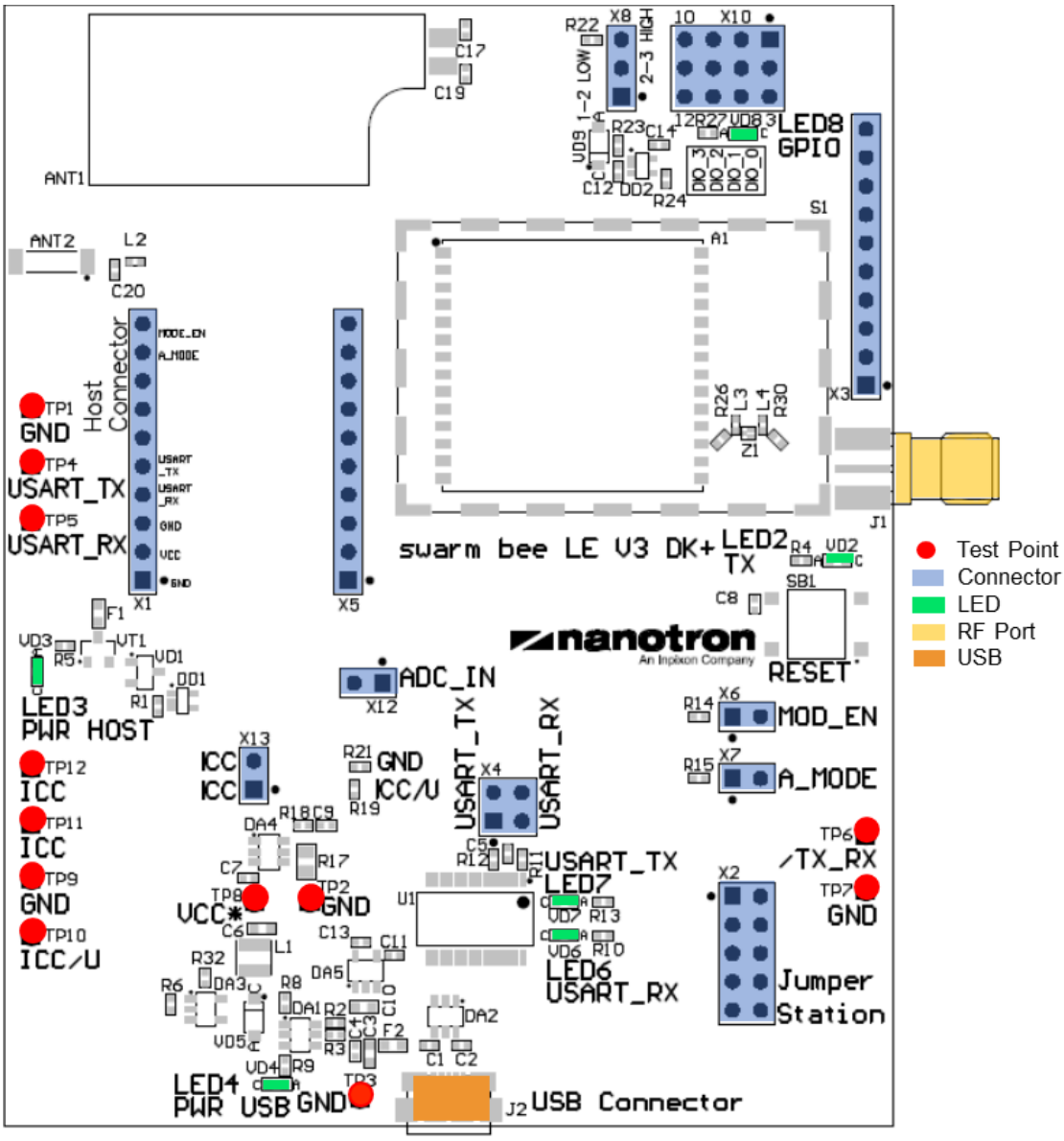

Figure 4-1: Inpixon Swarm Chirp V3 Dev Board, assembly and connector configuration

Note: ANT1 and ANT2 are for future use

Table 4-1: Inpixon Swarm Chirp V3 Dev Board connector configuration

Connector No.	Description	Type	Default State
J1	RF port	SMA type, 50 Ohm impedance	Open
J2	USB	micro-USB	Open
X1	Host connector	Pin connector, 10 poles	Open
X2	Jumper station	Pin connector, 2 x 5 poles	Spare jumpers
X3	*swarm* bee LE pin header	Pin connector, 10 poles	Open
X4	USB to Serial bridge	Pin connector, 2 x 2 poles, jumper	Closed
X5	*swarm* bee LE pin header	Pin connector, 10 poles	Open
X6	Enable *swarm* bee LE module	Pin connector, 2 poles, jumper	Open
X7	Enable autonomous mode	Pin connector, 2 poles, jumper	Closed
X8	Pull-up or pull-down bridge	Pin connector, 3 poles, jumper	Open
X10	GPIO Jumper Matrix	Pin connector, 3 x 4 poles, jumper	Open
X11	Reserved	Connector, 10 poles	Reserved
X12	ADC input for measuring supply voltage	Pin connector, 2 poles, jumper	Closed
X13	Measurement of current profile	Pin connector, 2 poles, jumper	Closed

4.1. Connector Description

All electrical parameters except those explicitly stated in this document refer to the ones specified in the Inpixon Swarm Chirp V3 Technical Reference [1].

4.1.1. Connector J1

J1 is a SMA connector with 50 Ohm impedance. It is terminated directly to the RF port of the Inpixon Swarm Chirp V3 module. The output power is calibrated that the radiated power at the provided antenna is close to but never exceeds +20 dBm.

Note: When using another antenna and to be in accordance with CE, FCC and ISED it is required to adapt the emitted power by the gain of the antenna by using the STXP API command. The procedure is explained in section 9.8.

4.1.2. Connector J2

J2 is a standard micro-USB-B connector to connect the Inpixon Swarm Chirp V3 Dev Board to a host PC (data and power) or a USB power pack or supply.

4.1.3. Connector X1

The Host Connector serves to connect the serial interface of a host controller to the Inpixon Swarm Chirp V3. It can also be used as alternative power supply instead of the USB one. When supplied via pin 2 it takes precedence to the USB power supply. The A_MODE and MOD_EN can also be controlled over this connector.

Table 4-2: X1 connector pin assignment

Pin No.	Description	Type	Module Pin	Comments
1	Ground			
2	Vcc	Supply voltage		+3.1V...+5.5V
3	Ground			
4	USART_RX	Input: Serial receiving line	19	If connected to a host remove jumpers on X4. See Figure 4-2
5	USART_TX	Output: Serial transmission line	12	
6	Not connected			
7	Not connected			
8	Not connected			
9	A_MODE	Input: Autonomous (high) or host-controlled mode (low)	9	Default high
10	MOD_EN	Input: Module enabled (high) or disable (low)	11	Default high

Note: All levels except Vcc and MODE_EN refer to 2.6 V. MOD_EN refers to Vcc. In any case refer to the Inpixon Swarm Chirp V3 Technical Reference [1].

USART settings are: 115.2 Kbps, 1 start bit, 8 data bits, 1 stop bit, no parity, no flow control

4.1.4. Connector X2

The Jumper Station is a storage area that serves to park spare jumpers. It has no electrical nor logical function.

4.1.5. Connector X3

Table 4-3: X3 connector pin assignment

Pin No.	Description	Type	Module Pin	Comments
1	Ground			
2	ADC_IN	Input: Measures the voltage referred to 2.6 V	21	2.6 V max.
3	DIO_0	Input or Output. Can be used for wake-up and interrupt source	22	If connected to an external device remove jumpers on X10. See Figure 4-3
4	DIO_1	Input or Output. Can be used as interrupt source	23	
5	DIO_2	Input or Output. Can be used as interrupt source	24	

Pin No.	Description	Type	Module Pin	Comments
6	DIO_3	Input or Output. Can be used as interrupt source	25	
7	USART_TX	Output: Serial transmission line	12	If connected to a host remove jumpers on X4. See Figure 4-2
8	USART_RX	Input: Serial receiving line	19	
9	TX_ON	Transmitter on (min. on time 50 ms)	26	
10	DIV_COEX	Can be used for co-existence purposes with external BT or Wi-Fi systems	27	

Note: All levels refer to 2.6 V. In any case refer to the Inpixon Swarm Chirp V3 Technical Reference [1]

4.1.6. Connector X4

The USB to Serial bridge serves to connect or disconnect the USB to serial converter to the USART lines. The jumpers shall be removed if a serial interface is connected to the Host connector X1. See Figure 4-2.

Table 4-4: X4 connector pin assignment

Pin No.	Description	Type	Module Pin	Comments
1-2	USART_TX	Output: Serial transmission line	12	If closed do not connect to X1 or X3
3-4	USART_RX	Input: Serial receiving line	19	

USART settings are: 115.2 Kbps, 1 start bit, 8 data bits, 1 stop bit, no parity, no flow control

Note: All levels refer to 2.6 V. In any case refer to the Inpixon Swarm Chirp V3 Technical Reference [1].

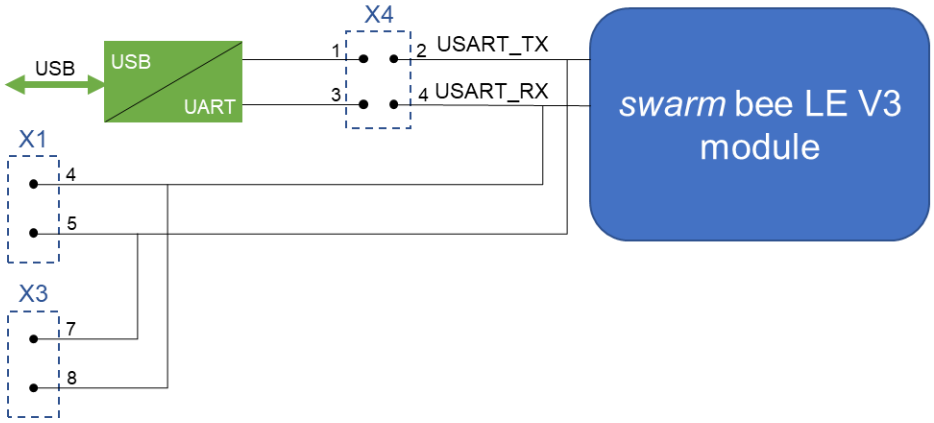

Figure 4-2: USART connectors

4.1.7. Connector X5

Table 4-5: X5 connector pin assignment

Pin No.	Description	Type	Module Pin	Comments
1	Ground			
2	\TX_RX	Output: RX (high), TX (low)	15	Transceiver direction
3	Reserved		-	Do not use
4	+2V6	µController voltage. Can be used for level shifters	13	
5	MOD_EN	Input: Module enabled (high) or disable (low)	11	
6	\NRST	Input: Resets µController, active (low)	10	
7	A_MODE	Input: Autonomous (high) or host-controlled mode (low)	9	
8	VIN	Output: Supply voltage of Inpixon Swarm Chirp V3 module	7	

Pin No.	Description	Type	Module Pin	Comments
9	Reserved		-	Do not use
10	Reserved		-	Do not use

Note: All levels refer to 2.6 V. In any case refer to the Inpixon Swarm Chirp V3 Technical Reference [1].

4.1.8. Connector X6

Is a jumper bridge which enables or disables the Inpixon Swarm Chirp V3 module.

Table 4-6: X6 connector pin assignment

Pin No.	Description	Type	Module Pin	Comments
1-2	MOD_EN	Jumper	11	Closed: disabled, Open: enabled

Note: MOD_EN level refers to Vcc. In any case refer to the Inpixon Swarm Chirp V3 Technical Reference [1].

4.1.9. Connector X7

Is a jumper bridge which sets the Inpixon Swarm Chirp V3 module into autonomous or host-controlled mode.

Table 4-7: X7 connector pin assignment

Pin No.	Description	Type	Module Pin	Comments
1-2	A_MODE	Jumper	9	Closed: host controlled Open: autonomous mode

Note: All levels refer to 2.6 V. In any case refer to the Inpixon Swarm Chirp V3 Technical Reference [1].

4.1.10. Connector X8

The pull-up or pull-down bridge serves in conjunction with jumper matrix X10 to determine the logical level of the GPIOs if configured as input. See Figure 4-3.

Table 4-8: X8 connector pin assignment

Pin No.	Description	Type	Module Pin	Comments
1-2	Pull-up	+2.6V	13	Logic high
2-3	Pull-down	Ground		Logic low

4.1.11. Connector X10

This jumper matrix can be used to either set a GPIO pin to logical high or low if configured as input or to display the state of a GPIO through a LED when configured as output. Figure 4-3 shows the principle. The RC element 1K/47µF composes an elementary debouncing circuit.

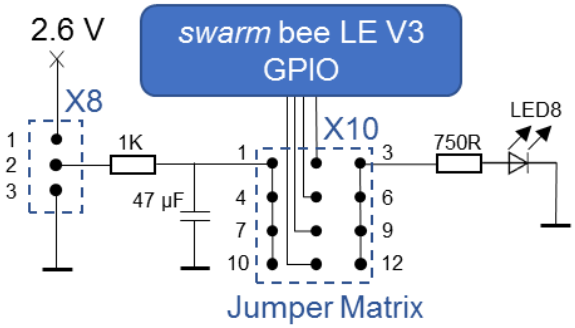

Figure 4-3: Jumper matrix with pull-up and pull-down jumper

How to configure each GPIO is explained in detail in the *swarm* bee API3.0 User Guide [2] sect 5.6.11 and followings.

Note: For a proper debouncing, always connect the jumper as input on X10 first and then change the polarity on X8. Otherwise, an unpredictable behavior will occur.

4.1.12. Connector X11

Reserved and for future use.

4.1.13. Connector X12

When the jumper is closed, the input voltage of the Inpixon Swarm Chirp V3 module can be measured by the µController with the corresponding API 3.0 commands GBAT [2]. If a voltage is injected at pin 2 of X3 leave the connector open.

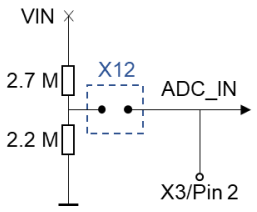

Figure 4-4: Voltage divider

4.1.14. Connector X13

This jumper bridge when opened allows to connect a current measuring device, like an Ampere meter, in series to the main power supply of the Inpixon Swarm Chirp V3 module VIN. It measures the sum of all currents consumed by the module.

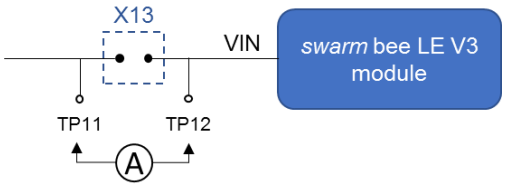

Figure 4-5: Current measurement

5. Test Points

The Inpixon Swarm Chirp V3 Dev Board provides test points for measurements. The test points are suited to connect oscilloscope or multimeter probes.

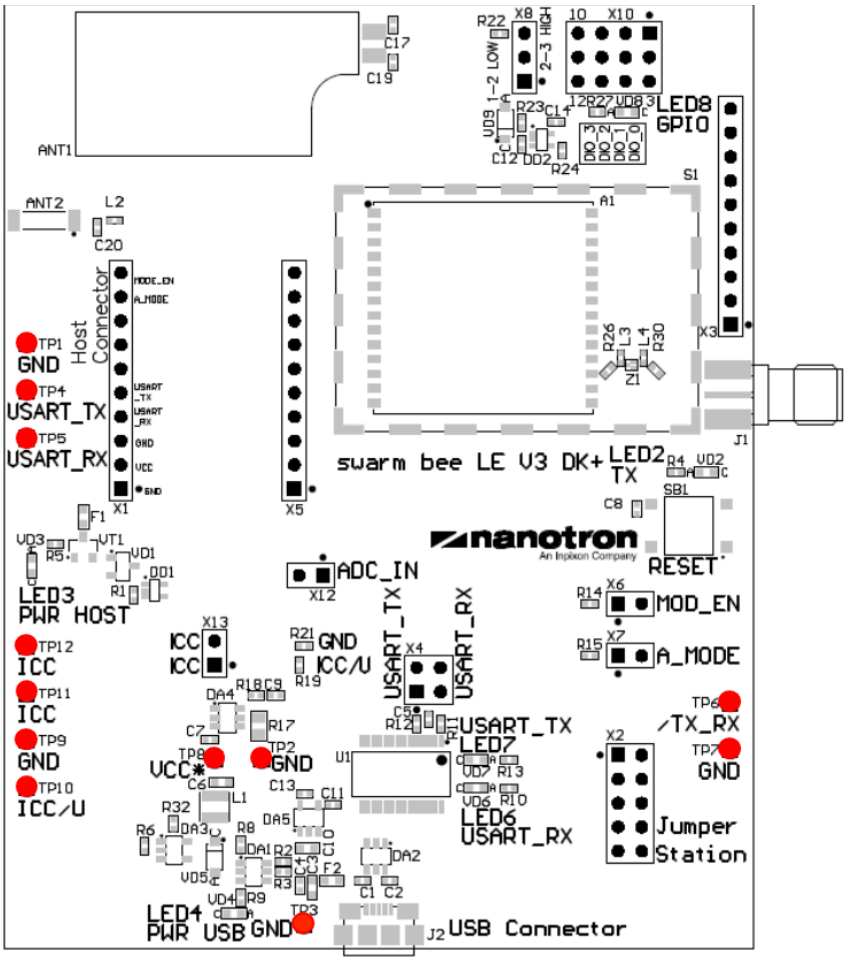

Figure 5-1: Test points position

Table 5-1: Test points pin assignment

TP No.	Description	Function	Comments
TP1	GND	Ground	
TP2	GND	Ground	
TP3	GND	Ground	
TP4	USART_TX	Output: Serial transmission line	
TP5	USART_RX	Input: Serial receiving line	

TP No.	Description	Function	Comments
TP6	/TX_RX	Hardware TX indicator	TX = low, RX (2.65 V) = high (nanoLOC)
TP7	GND	Ground	
TP8	VCC*	Supply voltage	Supply voltage of the *swarm* bee LE module applied either on X1 pin2 or on USB
TP9	GND	Ground	
TP10	ICC/U	Supply current converted to voltage	Supply current is converted to a voltage, ratio is 1:10 (100mA/1V), see sect. 5.1
TP11	ICC	Current measurement	Same function as X13, see chap. 4.1.14
TP12	ICC	Current measurement	Same function as X13, see chap. 4.1.14

5.1. Test point TP10 Current Measurement

On test point 10 (TP10) the supply current of the *swarm* bee LE module is converted to an equivalent voltage. The ratio between the supply current and the equivalent voltage is 100mA/1V. This means, the current of the different operating states of the Inpixon Swarm Chirp V3 module like the TX current and the RX current, can be measured at this point. With an oscilloscope, a current profile can be measured over the time, which allows to optimize the power consumption of the module to the needs in relation to the configurable parameters via the API [2]. Figure 5-2 shows the current consumption of the Inpixon Swarm Chirp V3 module at different operating states.

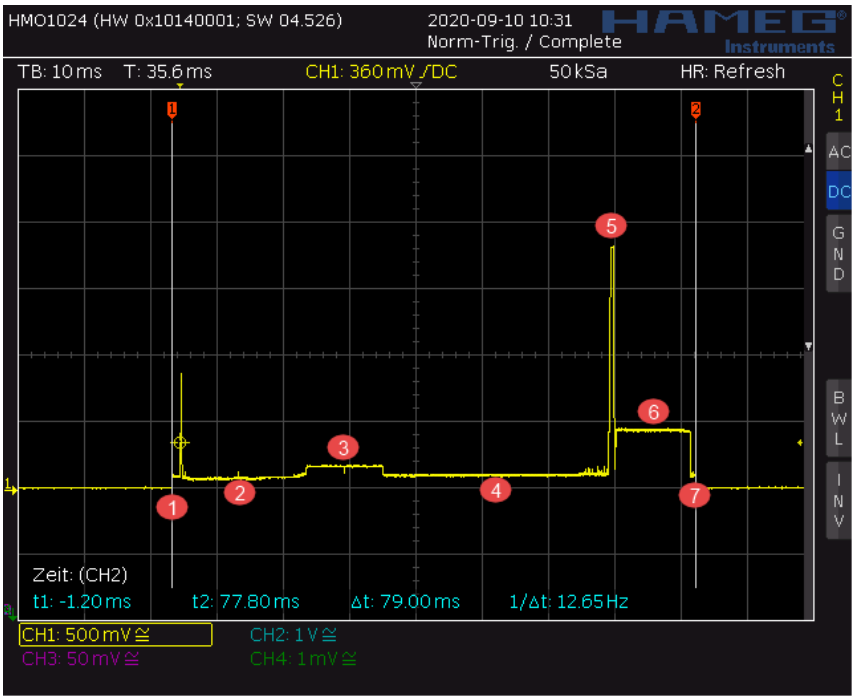

Figure 5-2: Screenshot of a typical *swarm* bee LE module current profile

Table 5-2: Description of operating modes shown in Figure 5-2

State	Description
1	Wakeup after nap mode
2	Switching on the DC/DC converter for supplying the RF power amplifier and nanoLOC Initialization of nanoLOC
3	Frequency calibration of nanoLOC
4	Initialization of the MEMS sensor
5	Transmitting Broadcast ID
6	Receiving Window
7	Shut down to nap mode

6. LEDs

Several LEDs have been placed to display the status of particular functions.

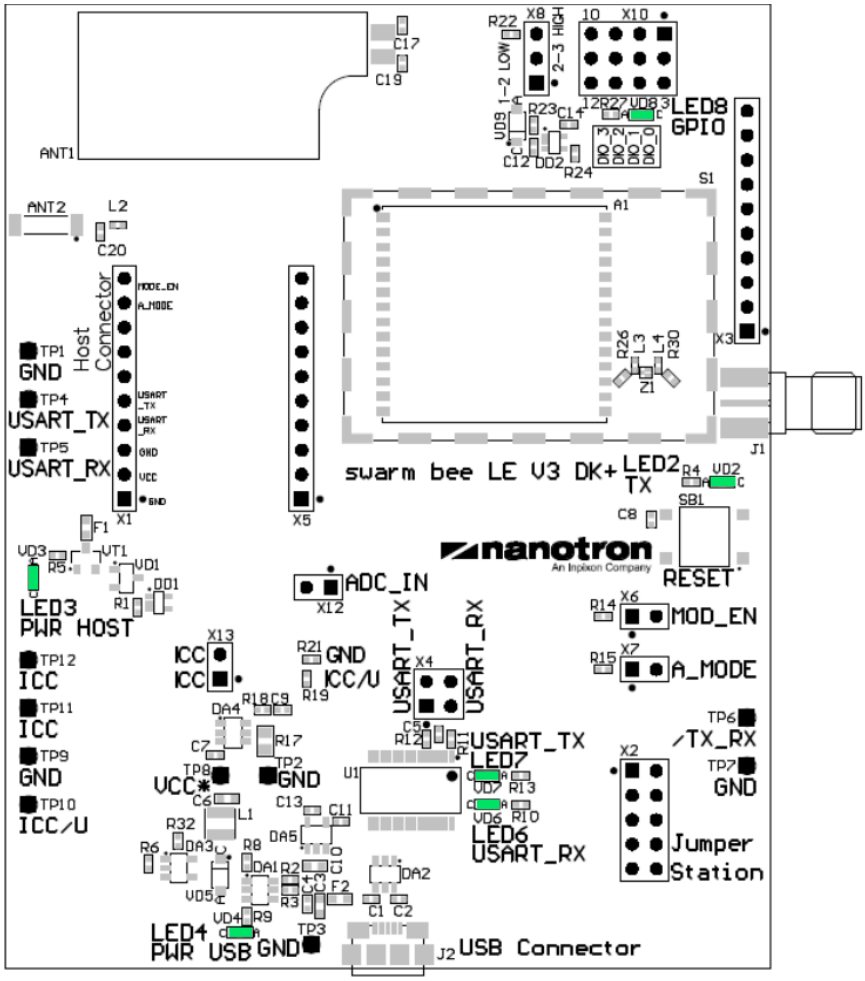

Figure 6-1: LEDs position

Table 6-1: LEDs assignment

TP No.	Description	Function	Comments
LED2	TX_ON	On: RF transmission	Luminescence 50 ms
LED3	PWR Host	External Power connected	PWR Host takes precedence on PWR USB
LED4	PWR USB	USB Power connected	
LED6	USART_RX	Status of serial RX line	
LED7	USART_TX	Status of serial TX line	
LED8	GPIO	If connected to jumper matrix status of the connected GPIO	High: On / Low: Off

7. Schematic

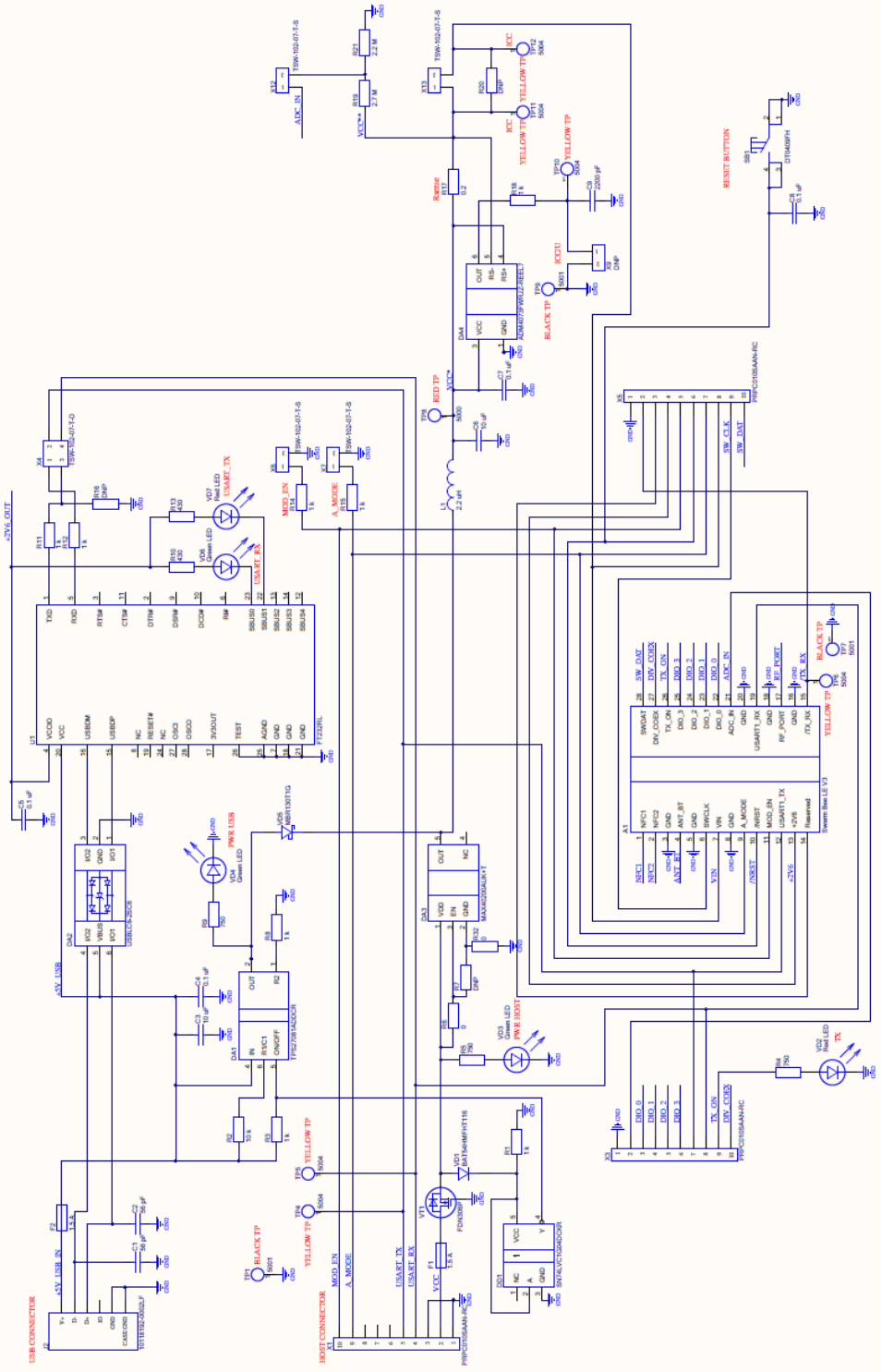

Figure 7-1: Inpixon Swarm Chirp V3 Dev Board schematic page 1/2

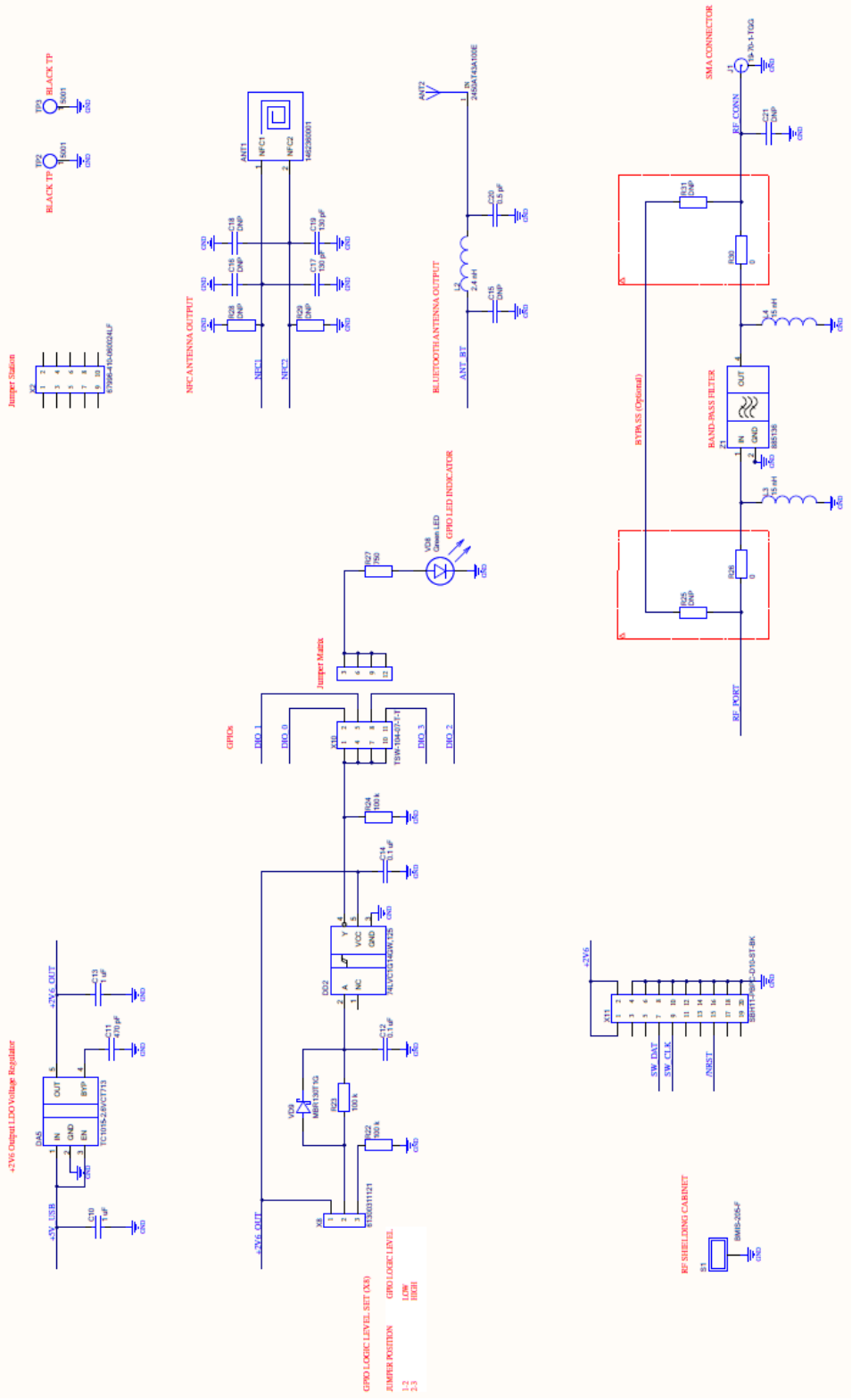

Figure 7-2: Inpixon Swarm Chirp V3 Dev Board schematic page 2/2

8. Dimensions

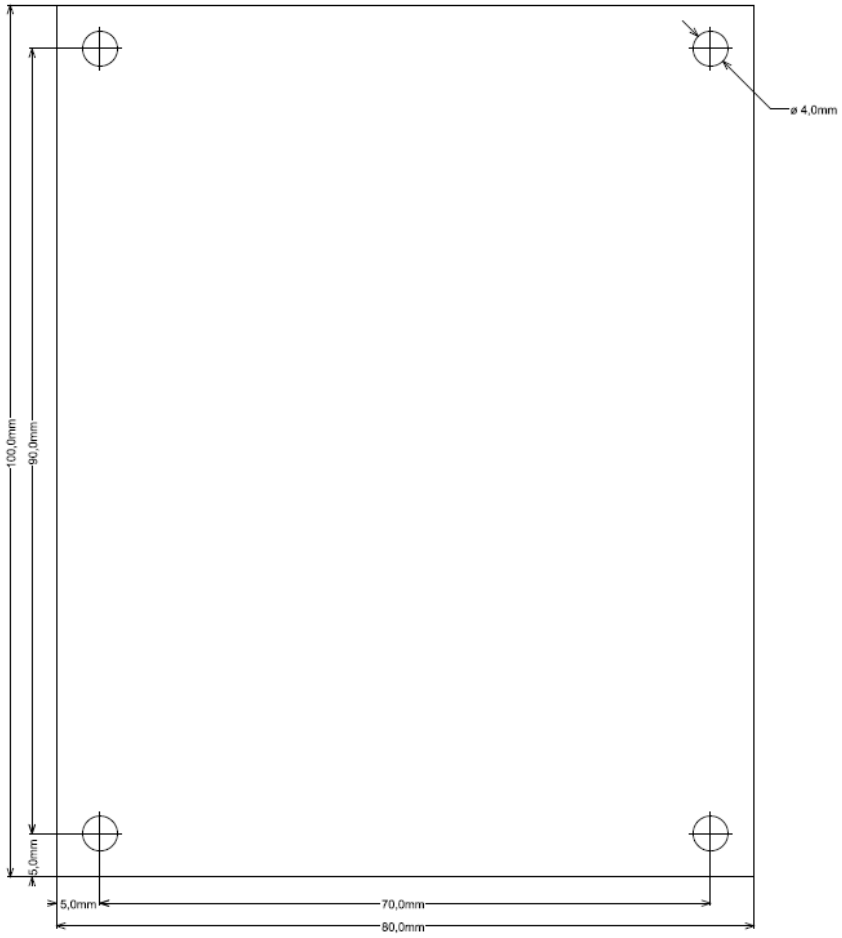

Figure 8-1: Dimensions of the Inpixon Swarm Chirp V3 Dev Board

9. Integration instructions for host product manufacturers according to KDB 996369 D03 OEM Manual v01

9.1. List of applicable FCC / ISED rules

FCC:	ISED:
47CFR-§15.212	RSS-100
47CFR-§ 15.203	RSS-102
47CFR-§ 15.247	RSS-247
47CFR-§ 15.249	RSS-GEN

9.2. Specific operational use conditions

Use case scenarios must conform to FCC 10.5/RF and ISED exposure considerations. In the case of this board, it must be at least 20 cm away from a human body.

9.3. Limited module procedures

Not applicable

9.4. Trace antenna designs

Not applicable. The supplied antenna (PSKN3-24/55S) is a dipole one.

9.5. RF exposure considerations

RF exposure requirements are fulfilled for mobile configuration. The installation of the module is restricted to mobile host devices what is clearly stated in the installation instruction of the user manual.
For portable applications, OEM integrators need their own SAR evaluation and thus an own FCC ID.

9.6. Antennas

Each swarm bee LE module is calibrated during production not to exceed +17 dBm at the RF port. However, if the host product manufacturer wants to take another antenna, he shall take the used antenna gain into consideration and adapt the radiated power so that his product does not exceed +20 dBm at the antenna. This shall be done as explained in section 9.8.

9.7. Label and compliance information

The label complies to the FCC and ISED rules. The data matrix code contains the following information

KN03SWBLE-1.0	(HVIN, fixed code)
2021-07-29	(Production Date, variable date)
NID: 000000003829	(Node ID, sequenced no.)
FCC: SIFSBLEV3DKPLUS	(FCC ID, fixed code)
ISED: 7654A-SBLEV3DKPLS	(ISED ID, fixed code)

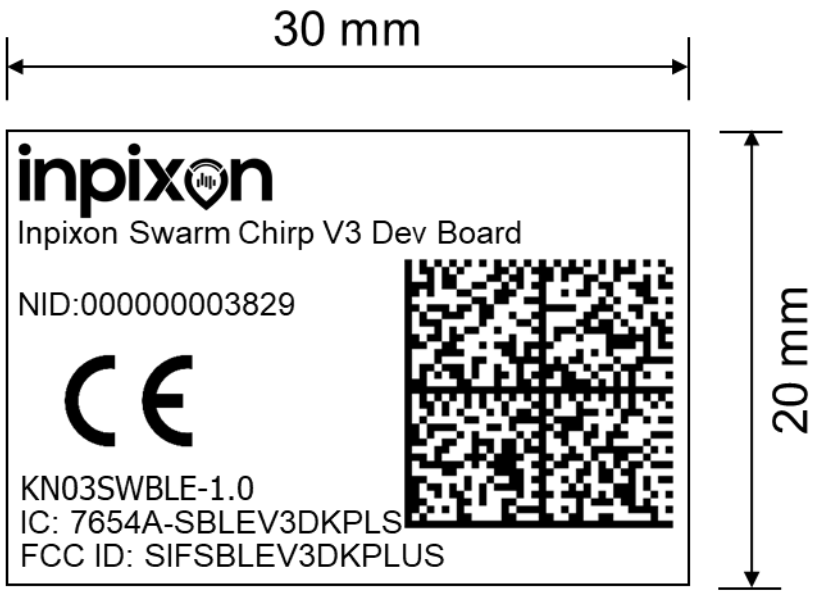

Figure 9-1: Label dimensions

9.8. Information on test modes and additional testing requirements

The final host product shall comply to the CE, FCC or ISED rules mentioned in section 9.1. For this, the host product manufacturer must adapt the TX output power so that the radiated power at the product antenna never exceeds +20 dBm. AN0521 [3] which can be requested at our support [4]. explains how to adapt the TX output power of the Inpixon Swarm Chirp V3 module accordingly. The setup requires a computer connected directly or indirectly to the swarm bee module USART to allow control of it via the API. The measurement shall be done in an anechoic chamber or in a space without multipath and unwanted external RF signals causing erroneous measurement of the host product under test.

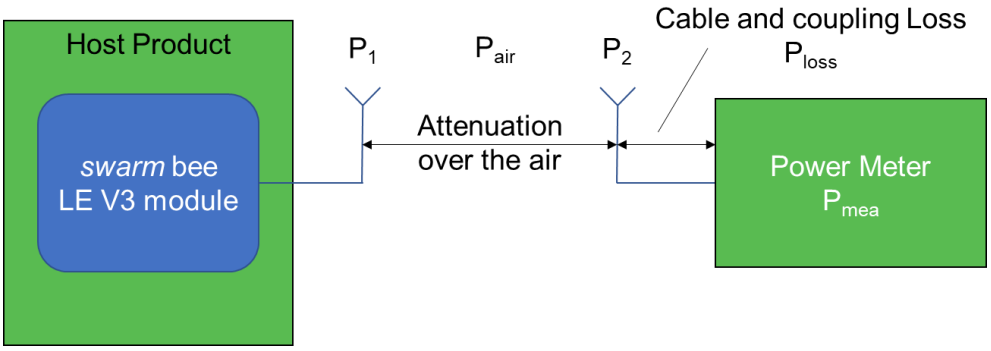

Figure 9-2: Test setup

Definitions:

P_1: Radiated power of the host product antenna
P_2: Gain of the receiving power meter antenna for the given RF band
P_{air}: Free space propagation loss
P_{loss}: Total attenuation caused by all cables and connectors
P_{meas}: Measured RF power from the power meter for the given frequency band

9.9. Additional testing, Part 15 Subpart B disclaimer

This Inpixon Swarm Chirp V3 Dev Boards comply to the FCC rules stated in section 9.1 and doesn't require additional testing according to part 15 subpart B. The host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification.

9.10. Host Product Labelling Requirements

9.10.1. FCC

The host product shall be properly labelled to identify the modules within the host product.

The FCC certification label of a module shall be clearly visible at all times when installed in the host product; otherwise, the host product must be labelled to display the FCC certification number for the module, preceded by the word "contains" or similar wording expressing the same meaning, as follows:

Contains FCC: SIFSBLEV3DKPLUS

9.10.2. ISED

The host product shall be properly labelled to identify the modules within the host product.

The ISED certification label of a module shall be clearly visible at all times when installed in the host product; otherwise, the host product must be labelled to display the ISED certification number for the module, preceded by the word "contains" or similar wording expressing the same meaning, as follows:

Contains IC: 7654A-SBLEV3DKPLS

10. Disclaimer

10.1. 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.

10.2. 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.

11. References

[1] swarm Chirp Technical Reference, Doc Id. NA-19-0382-0024
[2] Inpixon Swarm API 3.0, Doc Id. NA-13-0267-0003
[3] AN0521-Additional testing requirements for Inpixon Swarm Chirp V3 certification, Doc Id. APN-0382-0002
[4] support@inpixon.com

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.

About Inpixon

Inpixon® (Nasdaq: INPX) is the innovator of Indoor Intelligence™, delivering actionable insights for people, places and things. Combining the power of mapping, positioning and analytics, Inpixon helps to create smarter, safer, and more secure environments. Inpixon customers can take advantage of industry leading location awareness, RTLS, workplace and hybrid event solutions, analytics, sensor fusion and the IoT to create exceptional experiences and to do good with indoor data.

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This product complies to CE, FCC, ISED, WEEE, RoHS and REACH