



# XM122 Connectivity Module Manual v1.1

## Abstract

The XM122 connectivity module is a reference module with optimized formfactor that can be used to support customer in their own design for commercial use, for evaluation and development purpose.

The XM122 connectivity module is built around the nRF52840 Bluetooth® 5 SoC (System on Chip) from Nordic Semiconductor and features an integrated antenna for Bluetooth connectivity.



*Figure 1. XM122 connectivity module Top view (left) and XM122 bottom view (right).*

# Table of Content

1	Revision History .....	4
2	Functional description .....	5
2.1	Overview .....	5
2.2	Product features.....	5
2.3	Block diagram.....	5
2.4	Module board connector and pin description .....	6
2.5	Not mounted battery connector support.....	7
2.6	MAC addresses.....	8
3	Interfaces .....	9
3.1	Module supply input .....	9
3.2	System functions.....	9
3.3	Serial interfaces .....	9
3.4	Digital I/O interfaces .....	9
3.5	Analog I/O interfaces.....	9
3.6	Module reset.....	9
3.7	Debug interface.....	9
4	Electrical specifications.....	10
4.1	Absolute maximum ratings .....	10
4.2	Recommended operating conditions .....	10
4.3	Power consumption summary .....	11
4.4	RF specification.....	12
5	Reference design description .....	13
5.1	Schematics & BOM .....	13
5.2	Component Placement Drawing.....	19
6	Mechanical specifications.....	21
7	Regulatory Approval (In progress) .....	23
7.1	FCC Approval (In progress) .....	23
7.1.1	FCC Regulatory Notes .....	23
7.2	Industry Canada Approval (In progress) .....	25
7.2.1	Regulatory Information Canada .....	25
8	Reference documents .....	27
9	Abbreviations.....	28
	Disclaimer .....	29

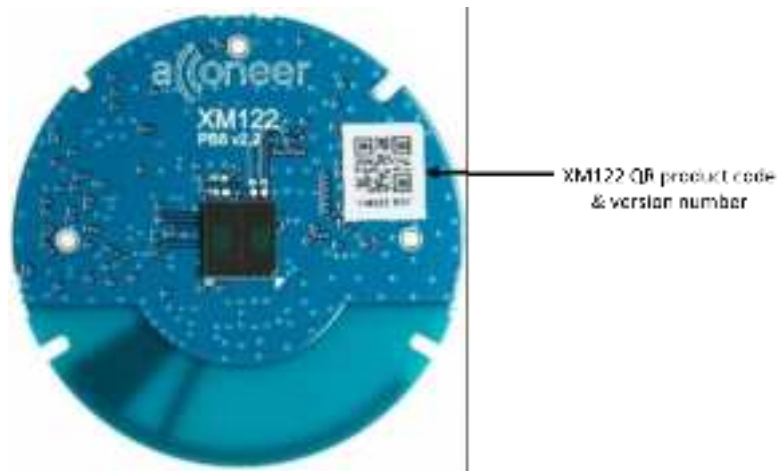
# 1 Revision History

Revision	Comment
V1.1	Released version

This document applies to the following product:

Product name	Part number
XM122 connectivity module	XM122

**XM122 connectivity module marking:**



## 2 Functional description

### 2.1 Overview

The XM122 connectivity module comes with Nordic nRF52840 SoC, see ref [1]. The Nordic nRF52840 supports Bluetooth 5/Bluetooth Mesh/Thread/Zigbee/ 802.15.4/ANT/2.4 GHz.

### 2.2 Product features

The XM122 is an IoT Connectivity module based on the Nordic nRF52840 SoC.

XM122 connectivity module features:

- The nRF52840 protocol stack support for Bluetooth 5, Bluetooth mesh, and is built around the 64 MHz ARM® Cortex™-M4 CPU with 256 KB SRAM and 1 MB Flash.
- Integrated 2.4 GHz micro strip IFA (inverted F antenna).
- Optimized circular form factor with a diameter of 33 mm.
- Wide single supply operating voltage range 2.0 V to 5.5 V.
- Operating temperature -40° to 85°C.
- External I/F support - SPI, UART, I2C, GPIO

### 2.3 Block diagram

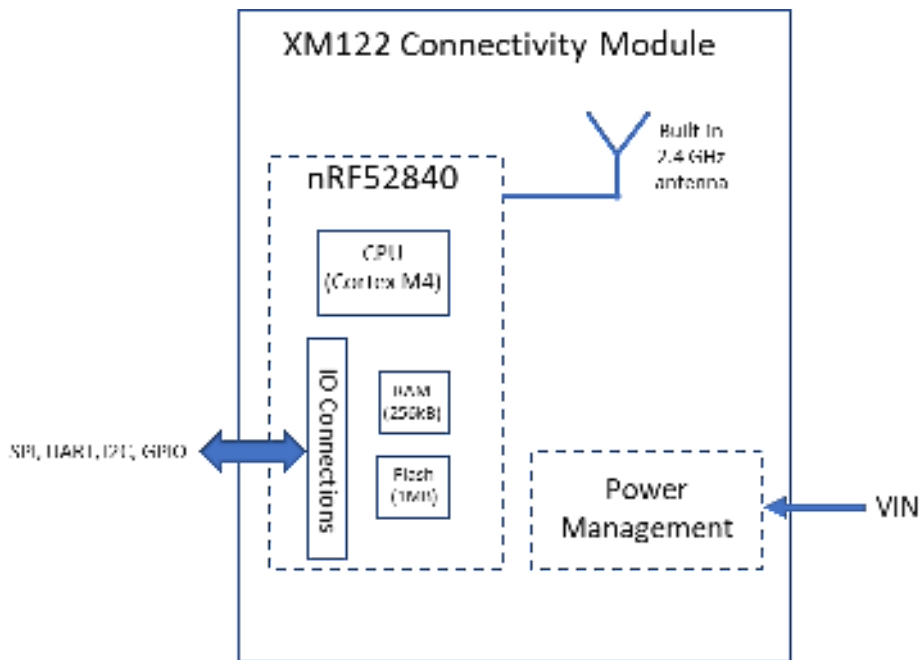


Figure 2.1. XM122 Connectivity module block diagram.

The XM122 connectivity module block diagram shows the nRF52840 microcontroller. The module provides a pin connector where the MCU external I/F are accessible including single voltage supply.

## 2.4 Module board connector and pin description

The board to board connector provides the external interface to the module. Figure 2.2 shows the connector footprint and Table 2.1 describes each signal.

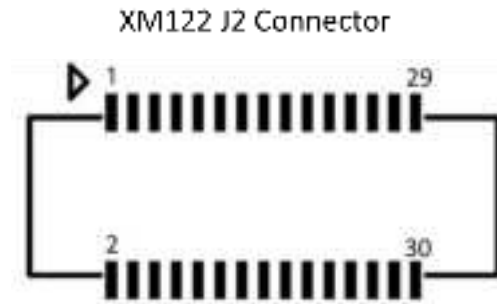


Figure 2.2. XM122 connectivity module J2 connector footprint.

Pin Number	Signal	Description	nRF52840* pin
1	GPIO		P0.23
2	GND	Ground	-
3	GND	Ground	-
4	VIN	2.0-5.5 V external power supply. Pin 4 and Pin 6 are interconnected.	-
5	GPIO		P0.21
6	VIN	2.0-5.5 V external power supply. Pin 4 and Pin 6 are interconnected.	-
7	GND	Ground	-
8	GND	Ground	-
9	GPIO		P0.24
10	GPIO	Configurable as Analog Input.	P0.04
11	GND	Ground	-
12	GPIO	Configurable as JTAG Trace signal.	P0.11 TRACEDATA2
13	GPIO		P0.22
14	GPIO	Configurable as JTAG Trace signal.	P0.12 TRACEDATA1
15	GND	Ground	-
16	VDD	Regulated 1.8 V output voltage.	-
17	GPIO		P0.06
18	GPIO, nRESET	nRF52840 reset pin.	P0.18 nRESET
19	GPIO		P0.16

20	SWDIO	SWD interface for flash and debug.	SWDIO
21	GND	Ground	-
22	GPIO, SWO	SWD interface for flash and debug. Configurable as JTAG Trace signal.	P1.00 TRACEDATA0
23	GPIO	Configurable as JTAG Trace signal.	P0.07 TRACECLK
24	GND	Ground	-
25	GPIO	Configurable as JTAG Trace signal.	P1.09 TRACEDATA3
26	SWDCLK	SWD interface for flash and debug.	SWDCLK
27	GPIO		P0.20
28	GND	Ground	-
29	GPIO		P0.19
30	GPIO, DFU	Device Firmware Upgrade. Set low during reset to enter bootloader mode. Could also be used as miscellaneous GPIO.	P0.25

*Table 2.1. J2 connector pinout.*

## 2.5 Not mounted battery connector support

Not mounted battery connector (Reference Designator J3) supported on XM122 connectivity module PCB. See chapter 5 schematics for further information. Example of compatible battery connectors:

- Vertical Amphenol 10114828-10102LF
- Horizontal Amphenol 10114828-10102LF
- Horizontal Molex 532617002

## 2.6 MAC addresses

The XM122 connectivity module comes with a Static Random Bluetooth Address provided by the Nordic nRF52840 SoC. This address is assigned randomly during manufacturing. This static address can be used for evaluation.



## 3 Interfaces

### 3.1 Module supply input

The XM122 connectivity module support external single power supply for battery power applications, see table 4.2 recommended operating conditions.

Note that supply voltage conditions (E.g. slew rate) need to be taken into consideration according to nRF52840 product specification & manual, ref [1].

### 3.2 System functions

Module RESET is supported by activating NRST pin (active low).

Module ERASE is used to reinitialize the MCU Flash content and some of its NVM (Non-Volatile Memory) bits to an erased state. See nRF52840 product specification & manual, ref [1] for further information.

### 3.3 Serial interfaces

The XM122 connectivity module nRF52840 GPIO pins can be configured to support up to two UART, up to four SPI master or three SPI slave and up to two I2C compatible 2-wire master/slave external serial interfaces. See table 2.1 for HW configuration. See also nRF52840 product specification & manual, ref [1] for further information.

### 3.4 Digital I/O interfaces

The XM122 connectivity module support General Purpose IOs (GPIOs), 16 GPIOs are available. The GPIO pins are configurable for different functions, only the debug and RESET pins are fixed to specific GPIOs. See table 2.1 for HW configuration. See also nRF52840 product specification & manual, ref [1] for further information.

### 3.5 Analog I/O interfaces

The XM122 connectivity module support one analog input (pin 10 on XM122 connector J2) and up to four individual PWM outputs which can be assigned to any of the GPIO pins. See table 2.1 for HW configuration.

### 3.6 Module reset

The XM122 connectivity module has an external reset option (Pin 18 on XM122 connector J2) that can be configured as a GPIO or RESET input.

### 3.7 Debug interface

The XM122 has 7 debug pins, SWDIO, SWDCLK and Trace signals. TRACE signals reuse GPIO pins. See table 2.1 for HW configuration.

## 4 Electrical specifications

### 4.1 Absolute maximum ratings

The below table shows the XM122 connectivity module absolute maximum ratings over operating temperature range, unless otherwise noted:

Parameter	Description	Min.	Max.	Unit
VIN	power supply	-0.3	6.0	V
I/O	Voltage on I/O pins	-0.3	2.1	V
T <sub>OP</sub>	Operating temperature range	-40	85	°C
T <sub>STG</sub>	High temperature storage		125	°C

*Table 4.1. Absolute maximum ratings.*

Stresses beyond those listed in table 4.1 may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these conditions or at any other conditions beyond those indicated under Recommended Operating Conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods of time may affect device reliability.

### 4.2 Recommended operating conditions

The below table shows the XM122 connectivity module recommended operating conditions:

Parameter	Min.	Typ.	Max.	Unit
VIN, operating power supply voltage <sup>1)</sup>	2.0		5.5	V
I/O operating range	0		1.8	V
Operating temperature <sup>1)</sup>	-40		85	°C

*Table 4.2. Recommended operating conditions.*

<sup>1)</sup> Minimum battery voltage depends on battery internal resistance and temperature.

### 4.3 Power consumption summary

See nRF52840 product specification and manual, ref [1].

## 4.4 RF specification

The XM122 connectivity module support Bluetooth v5 including BLE, mesh, long range and advertising extensions.

The below table shows the XM122 connectivity module Bluetooth radio performance:

Parameter	Min.	Typ.	Max.	Unit
Frequency (40 channels)	2.4		2.48	GHz
Data rate		2		Mbps
Total radiated power (TRP)		5.5		dBm
Conducted RX sensitivity (BLE)		-97		dBm
Conducted RX sensitivity (Long range)		-101		dBm
Conducted total link budget		-109		dBm

*Table 4.5. XM122 connectivity module Bluetooth radio performance.*

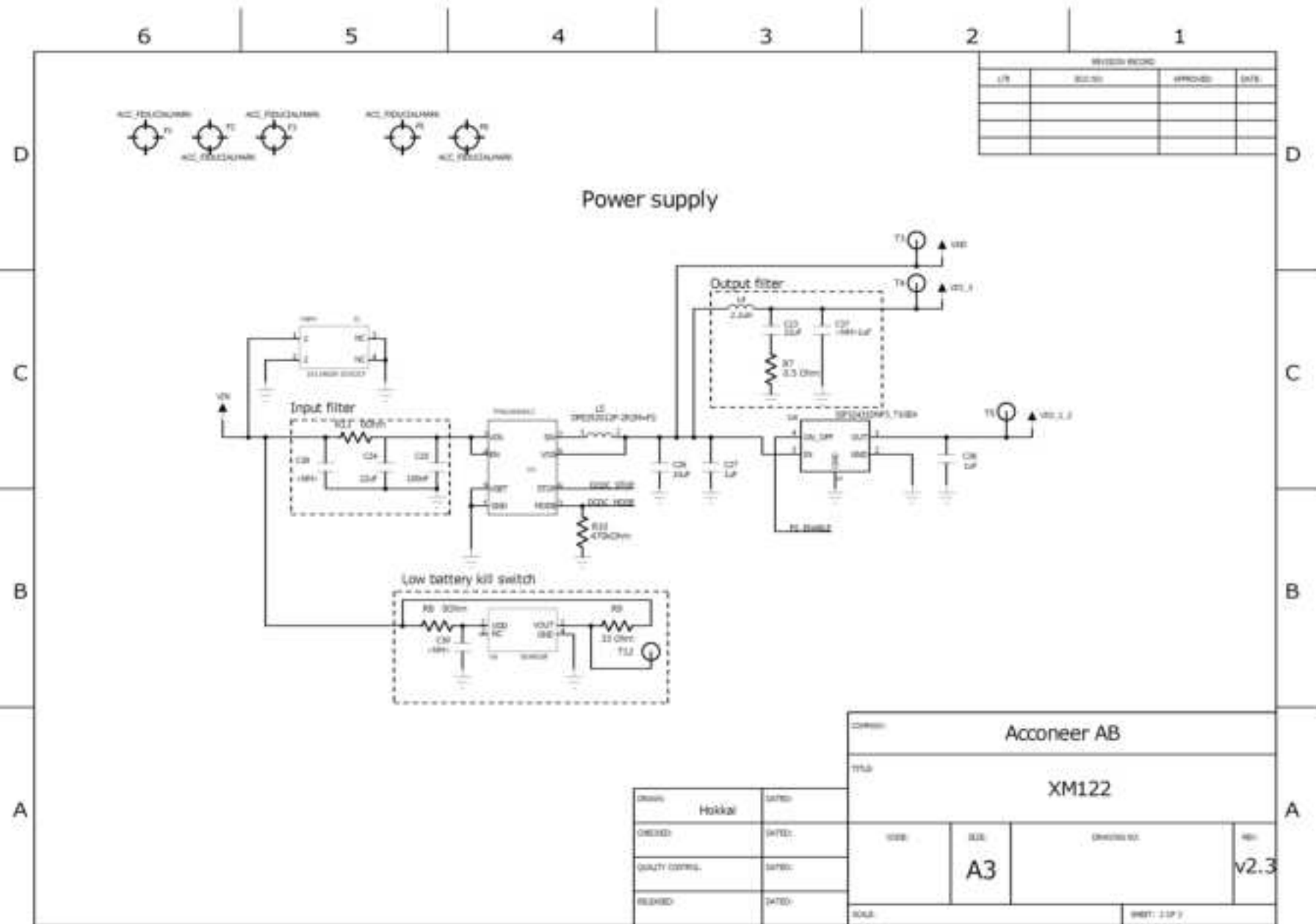
## 5 Reference design description

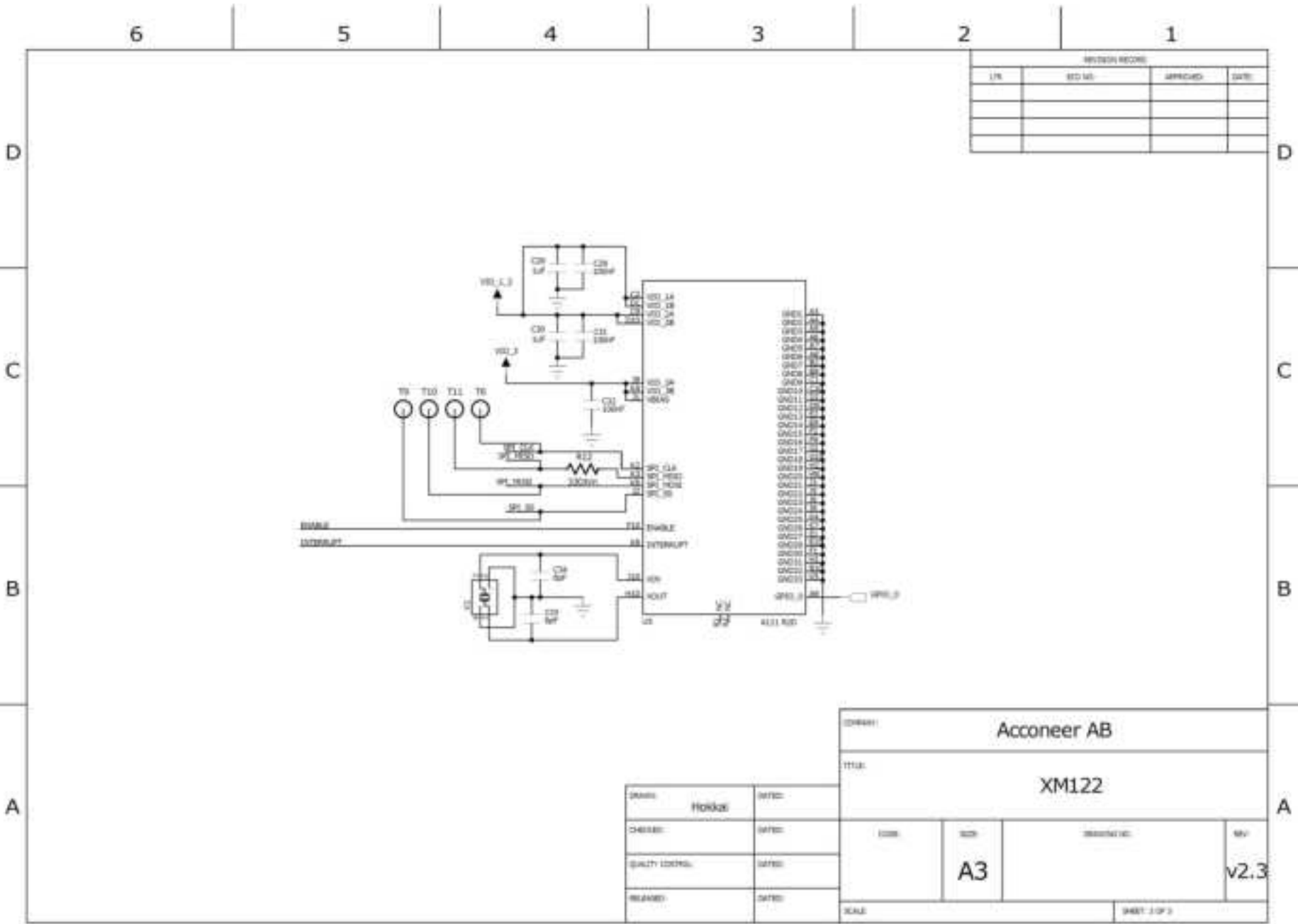
### 5.1 Schematics & BOM

The following pages include the module schematics and bill of materials.

Note that Schematics and BOM includes example implementation with Acconeer A111 radar sensor.







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LN	REV NO.	APPROVED	DATE

DESIGN	DATE
DESIGN	DATE
DESIGN	DATE
DESIGN	DATE

ACONEER AB			
XM122			
CODE	REV	REVISION NO.	REV
A3		v2.3	
SCALE		SHEET 1 OF 1	





## Bill of Material

Table 6.1 shows the BOM for XM122 module.

Component Ref.	Specification	QTY	Value	Comment
C2,C7,C18,C22,C25,C29,C31,C32	100/NF/K/50V/X7R/1005	8	100 nF	
C3,C5,C27,C28,C30,C36	1/UF/K/10V/X5R/1005	6	1uF	
C4	47/NF/K/50V/X5R/1005	1	47nF	
C8,C9	15/PF/J/50V/NP0/1005	2	15pF	
C10	100/PF/J/10V/NP0,C0G/1005	1	100pF	
C12,C13,C33,C34	8/PF/C/50V/NP0,C0G/1005	4	8pF	
C14	0.75/PF/B/50V/C0G/1005	1	0.8pF	
C15	0.5/PF/C/50V/C0G/1005	1	0.5pF	
C17	4.7/UF/M/10V/X5R/1005	1	4.7uF	
C19	820/PF/F/50V/NP0/1005	1	820pF	
C23,C24	22/UF/M/10V/X5R/1608	2	22uF	
C26	10/UF/M/10V/X5R/1005	1	10uF	
C40	2/PF/C/50V/N/A/1005	1	2pF	
D2	LTST-C190CKT	1		638nm LED RED CLEAR CHIP SMD
J1	MM8130-2600	1		
J2	DF40HC(3.5)-30DS-0.4V(51)	1		Manufacturer: Hirose
L1	15/NH/1005/J	1	15nH	Manufacturer: Murata Part number: LQG15HS15NJ02
L2	10/UH/1608	1	10uH	Manufacturer: TDK Part number: MLZ1608N100LT000
L3	4.7/nH/1005/+0.3nH	1	4.7nH	Manufacturer: TDK Part number: MHQ1005P4N7ST000
L4	2.2/uH/1608/M	1	2.2uH	Manufacturer: TDK Part number: MLZ1608N2R2LT000

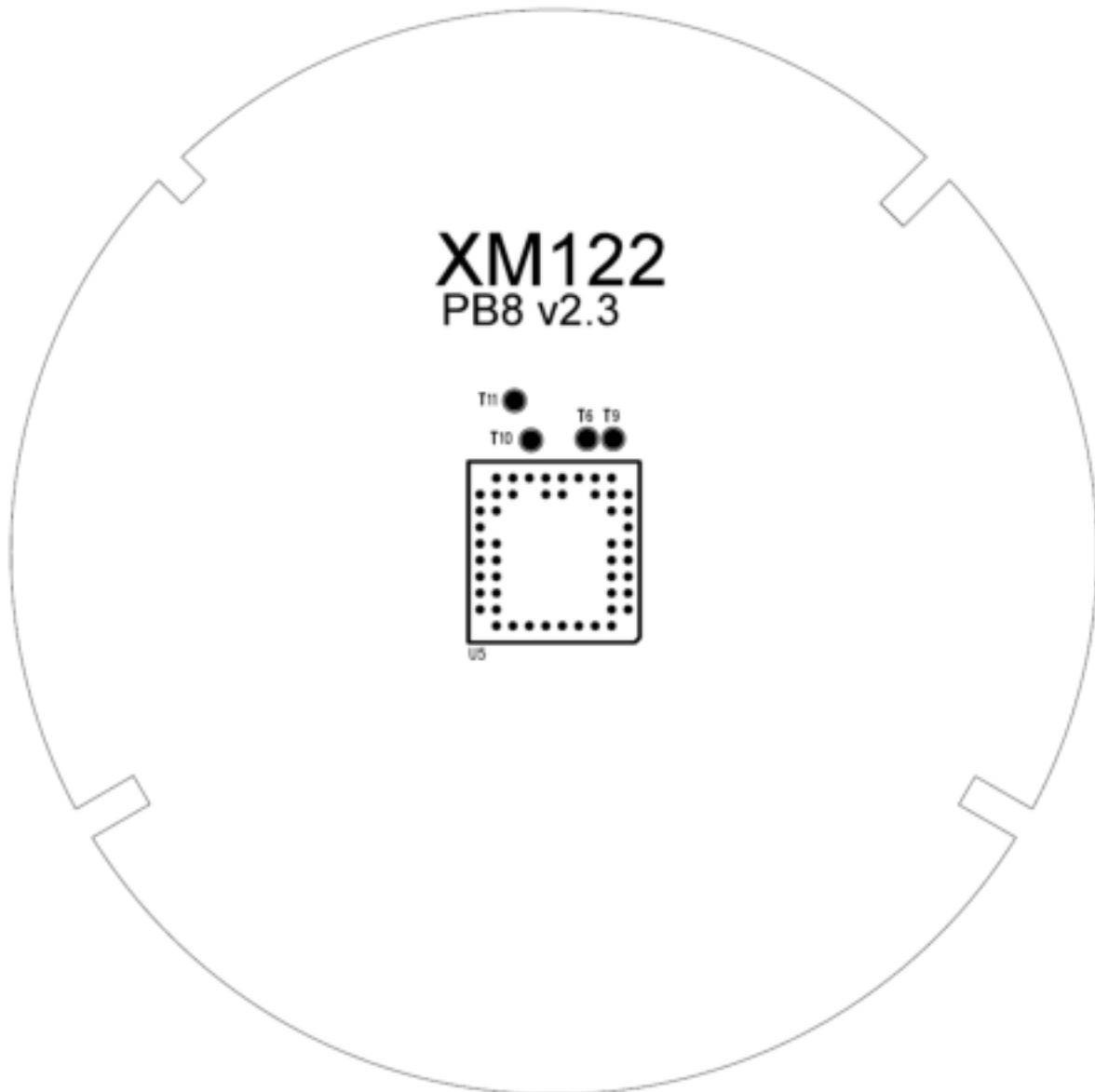
L5	2.2/UH/2520/M	1	2.2uH	Manufacturer: Murata Part number: DFE252012P-2R2M=P2
R1	360/Kohm/J/1005	1	360 kOhm	
R2	180/KOHM/F/1005	1	180kOhm	
R6, R9, R12	33/OHM/F/1005	3	33 Ohm	
R7	0.5/OHM/J/1005	1	0.5 Ohm	
R8, R13	0/OHM/J/1005	2	0 Ohm	
R10	470/KOHM/F/1005	1	470 kOhm	
U1, U4	SIP32431DNP3_T1GE4	2		
U2	NORDIC_BT5.0_LONGRANGE_NRF52840	1		NRF52840_QIAA
U3	TPS62840DLCR	1		
U5	A111 R2D	1		
U6	BU4818F-TR	1		
X1	32MHz/10ppm/10PF/50OHM/2520	1		
X2	32.768kHz/20ppm/9.5PF/90KOHM/2	1		
X3	TSX-3225 24.0000MF20G-AC0/SMD	1		

*Table 6.1. XM122 connectivity module BOM list.*

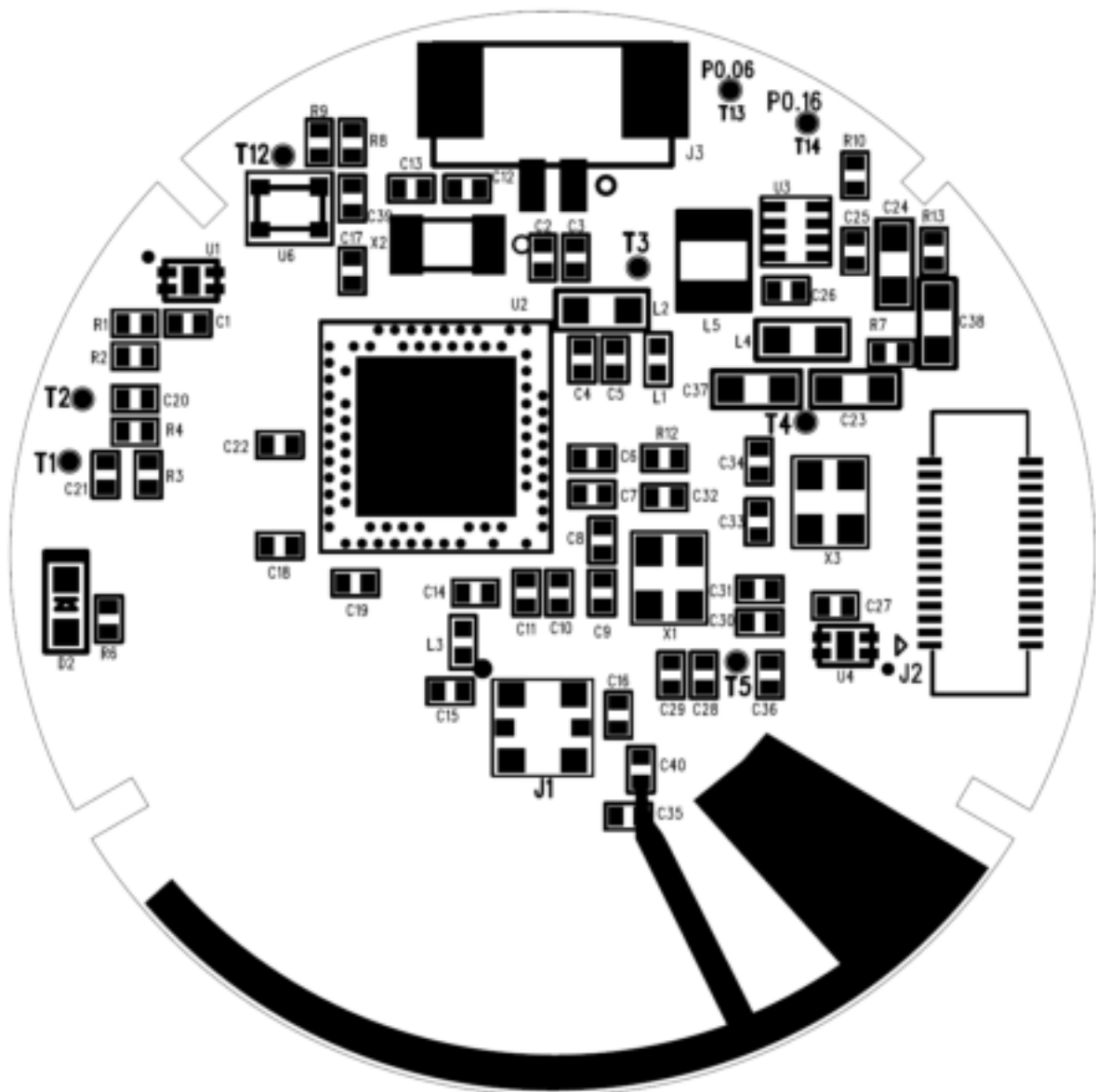
## 5.2 Component Placement Drawing

The component placement drawing of XM122 connectivity module is found below:

Top side

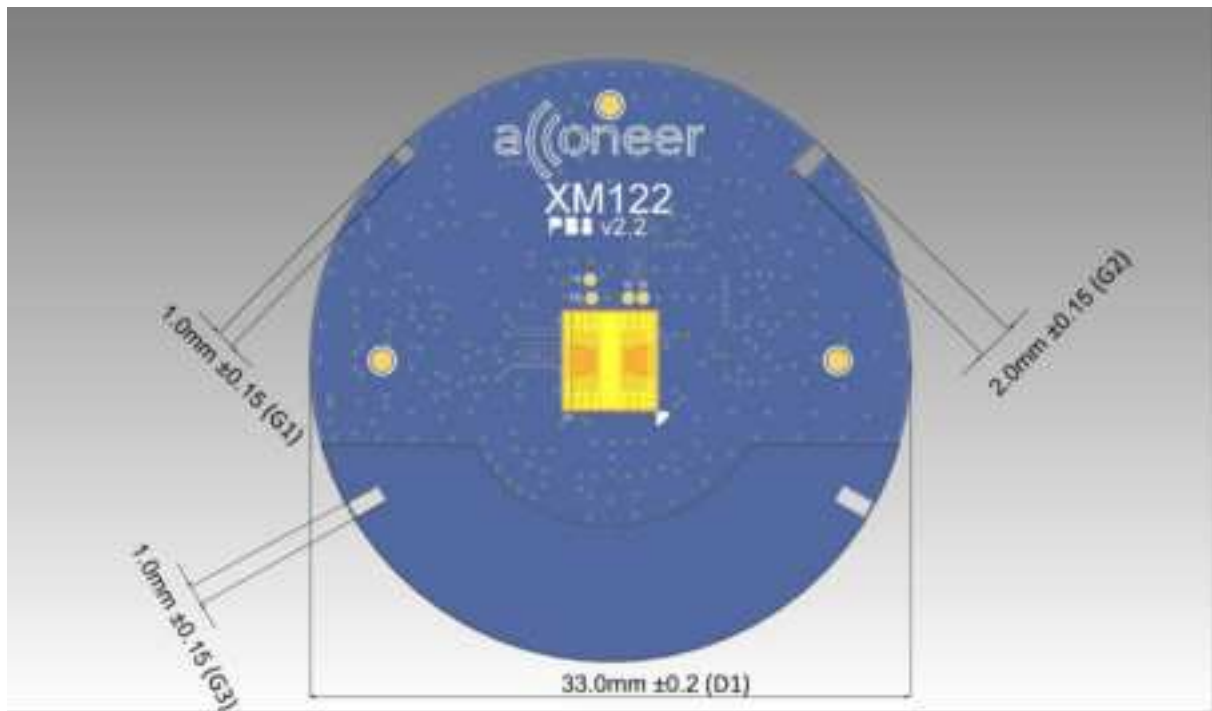


Bottom side:

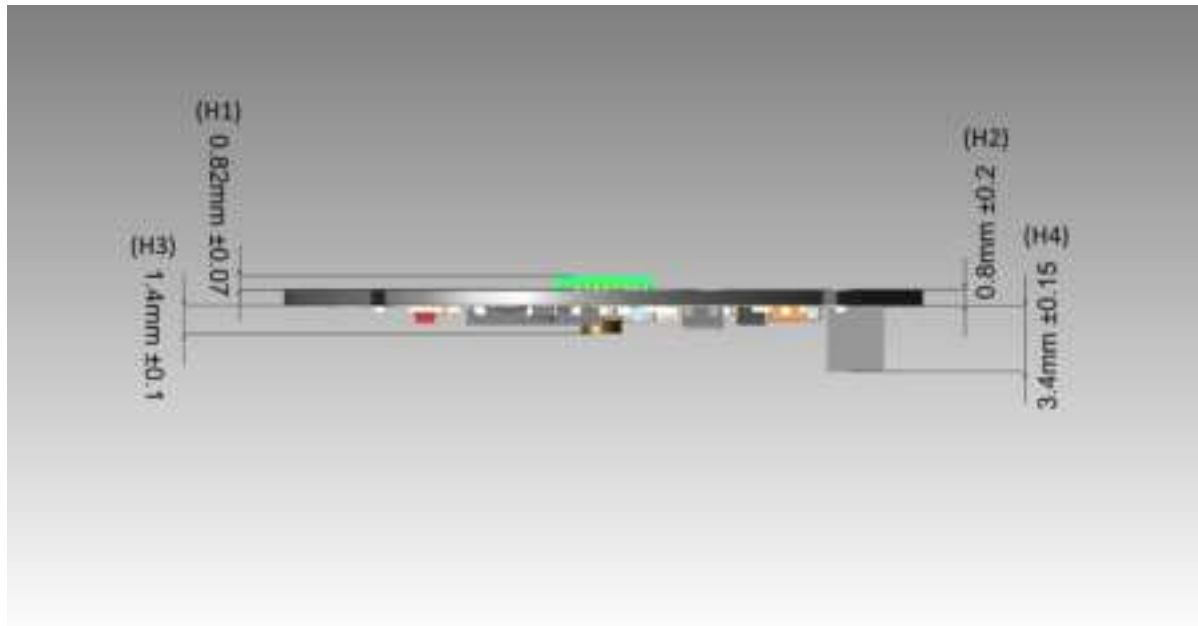


## 6 Mechanical specifications

### XM122 connectivity module outline – Top view



# XM122 connectivity module outline – Side view



Distance	Value	Tolerance
D1	33.0 mm	+/-0.2 mm
H1	0.82 mm	+/-0.07 mm
H2	0.8 mm	+/-0.2 mm
H3	1.4 mm	+/-0.1 mm
H4	3.4 mm	+/-0.15 mm
G1	1.0 mm	+/-0.15 mm
G2	2.0 mm	+/-0.15 mm
G3	1.0 mm	+/-0.15 mm

## 7 Regulatory Approval (In progress)

### 7.1 FCC Approval (In progress)

Hereby, Acconeer declares that the XM122 Connectivity module has limited modular approval granted by FCC.

The XM122 Connectivity module meets the title 47 of the Code of Federal Regulations, part 15C.

FCC ID: 2AQ6KXM001

The host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the limited modular transmitter grant of certification.

#### 7.1.1 FCC Regulatory Notes

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s) and complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation of the device.

#### Applicable FCC rules

The XM122 Connectivity module transmitter complies with FCC part 15 rules. The XM122 Connectivity module transmitter is only FCC authorized for the specific rule parts listed in the grant. The host product manufacturer is responsible for compliance to any other FCC rule that apply to the host not covered by the modular transmitter grant of certification.

The XM122 Connectivity module has limited modular approval granted by FCC. The approval is limited as shielding is not included and this must be considered by the host manufacturer when demonstrating compliance with FCC part 15 rules.

#### Modifications

Acconeer has not approved any changes to this device. Any changes or modifications to this device could invalid the FCC approval.

#### Interference statement

This device complies with Part 15 of the FCC rules. 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.

#### RF exposure

This device complies with the FCC radiation exposure limits set forth for an uncontrolled environment. Co-location of this module with other transmitters that operate simultaneously are required to be evaluated using the FCC multi-transmitter procedures.

The RF exposure has been calculated with a 20 cm separation distance I.e. Mobile devices.

#### Labelling requirements for the host device

The host device shall be labelled to identify the modules within the host device, which means that the host device shall be labelled to display the FCC ID of the module preceded by words "Contains transmitter module" or "Contains", E.g.

*Contains FCC ID: 2AQ6KXM001*





## 7.2 Industry Canada Approval (In progress)

The XM122 Connectivity Module meets the ISED's Radio Standards Specifications for unlicensed equipment according to RSS-247.

IC certification number: 24388-XM122

*Le module de connectivité XM122 répond aux spécifications des normes radio de l'ISED pour les équipements sans licence selon RSS-247.*

*Numéro d'identification IC: 24388-XM122*

### 7.2.1 Regulatory Information Canada

Acconeer has not approved any changes to this device. Any changes or modifications to this device could invalid the usage of the module.

*Acconeer n'a pas approuvé aucun changement de ce dispositif. Tout changement ou toute modification de ce dispositif pourrait invalider l'usage du module.*

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.

*Le présent appareil est conforme aux CNR d'Industrie 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, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.*

#### RF Exposure

Radiation Exposure Statement This equipment complies with Canada radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

*Déclaration d'exposition aux radiations*

*Cet équipement est conforme Canada limites d'exposition aux radiations dans un environnement non contrôlé. Cet équipement doit être installé et utilisé à distance minimum de 20cm entre le radiateur et votre corps.*

### Labelling requirements for the host device

The host device should be labelled to identify the modules within the host device, which means that the host device shall be labelled to display the IC of the module preceded by words "Contains transmitter module" or "Contains", or similar wording expressing the same meaning, as follows

*Contains IC: 24388-A111*

*Le dispositif hôte doit être étiqueté afin d'identifier les modules du dispositif hôte, ce qui veut dire que le dispositif hôte doit être étiqueté pour exposer le IC du module précédé par les mots "Contient module émetteur" ou "Contient", ou des termes similaires exprimant le même sens, comme suit:*

*Contient IC: 24388-A111*

## 8 Reference documents

- [1] Nordic nRF52840 product specification & manual:  
[Nordic Semiconductor](#)

## 9 Abbreviations

BLE	Bluetooth Low Energy
BOM	Bill of Materials
GND	Ground
GPIO	General Purpose Input/Output
HW	HardWare
I2C	Inter-Integrated Circuit
MAC	Media Access Control
MCU	MicroController Unit
RF	Radio Frequency
SoC	System on Chip
SPI	Serial Peripheral Interface
SW	SoftWare
SWD	Serial Wire Debug
UART	Universal Asynchronous Receiver/Transmitter

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