

# PTM20

## MirX2 Bluetooth® Module

*User Guide V3.0*

*(24 July, 2023 )*

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## General Inforamtion

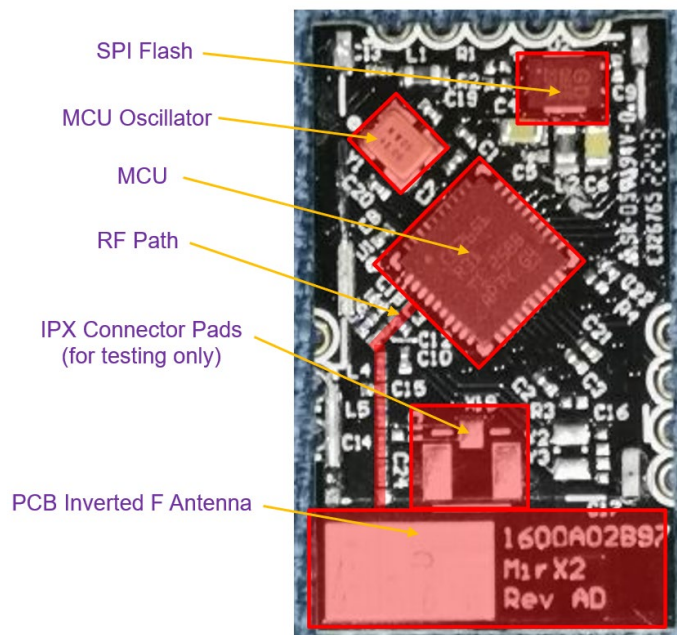
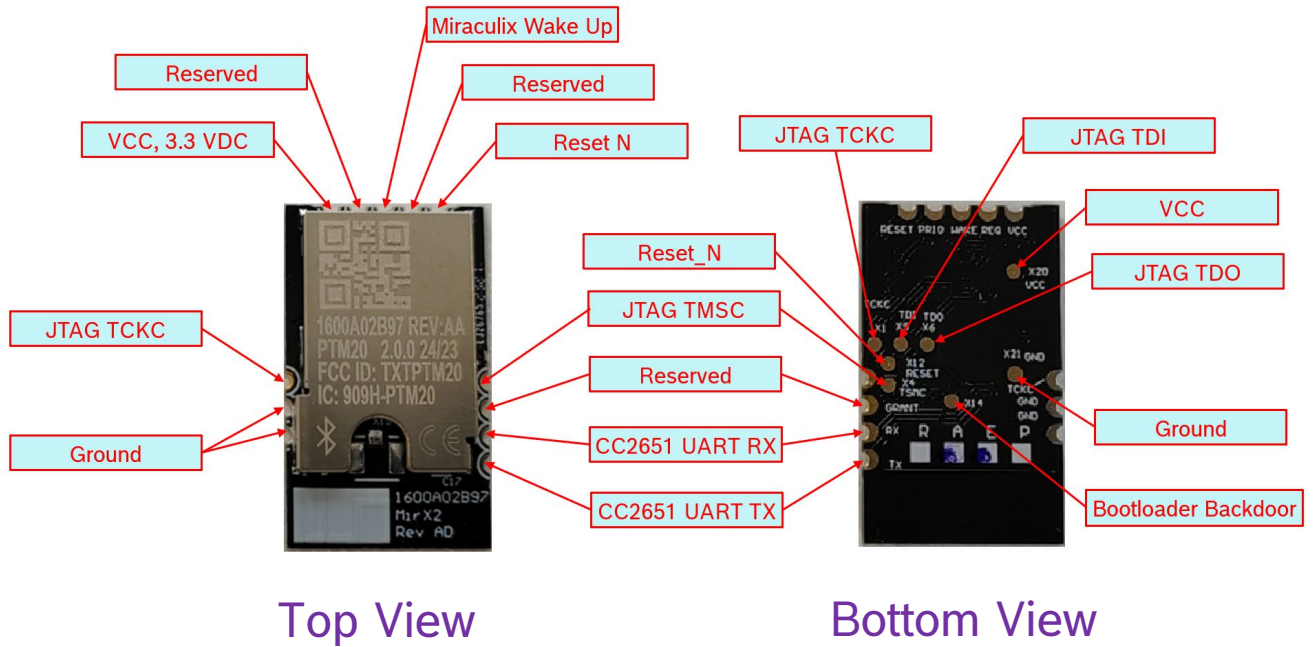
The PTM20 was designed to be integrated into products as combined equipment, not to be used independently. The nominal size of the Bluetooth module is 25.4mm x 15.0mm x 2.0 mm thick. The difference between PTM20R and PTM20 is the real time clock (RTC) function. Both modules share the same PCB trace layout, electronic parts, physical connections arrangement and electrical characteristics except the real time clock related function, i.e. 32.768 kHz crystal. The R designation of the module name is the indication of RTC function.

### 1.1 Key Specifications

The follow lists the key specifications of PTM20

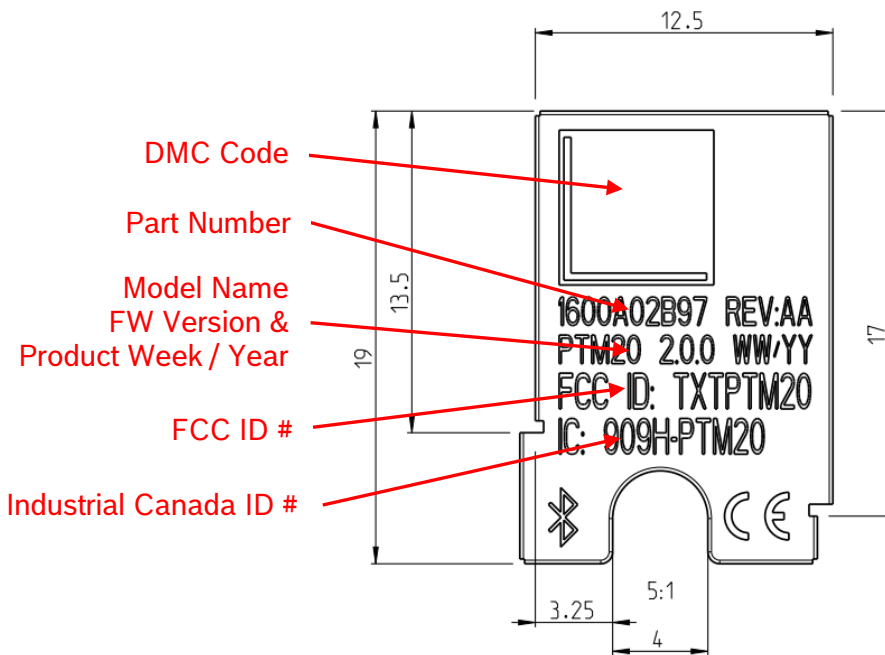
CATEGORY	FEATURE	SPECIFICATIUN
Wireless Specification	Bluetooth®	5.2 Low Energy
	Frequency Band	2400 MHz to 2483.5 MHz
	Frequency Range	2402 MHz to 2480 MHz
	Support Function	2.4 GHz ISM Band
	Frequency Modulation	GFSK
	Number of Channels	40
	Channel Separation	2 MHz
	Maximum conducted average output power	5 dBm ±1 dBm
	Antenna Type	Integrate PCB, inverted F design
	Antenna Gain	-1.24 dBi
	Antenna Efficiency	-4.5 dB (TBC; coupling + radiation)
	Receiver Sensitivity	-104 dBm (125 kbps)
		-100 dBm (500 kbps)
		-97 dBm (1Mbps)
	-92 dBm (2Mbps)	
Communication	UART Interface	Tx, Rx; Baud Rate 115200
TI MCU	2.4 GHz Wireless MCU	CC2561R3; output power up to +5 dBm
External Memory	SPI Flash	16 Mbit, 2.7 V – 3.6 V
Electrical Interface	VCC	2.7 VDC to 3.6 VDC
	Current Consumption	< 15 mA (RF transmission dependent)
	GND	
	JTAG	TCKC; TMSC
	JTAG Reset N	Active low
	Miraculix Wake Up	active high
Mechanical Dimension	PCB dimension	-25.4 mm x 15.0 mm ( -0.0 / + 0.1 mm)
	PCB thickness	0.8 mm, 2 layers
	RF shield can	1.2 mm overall thick (material wall thickness 0.15 mm)
	Total module thickness	2.0mm ( -0.0 / +0.2 mm)
Environment	Operating Temperature	-10 °C to +50 °C

## 1.2 PCBA Electrical Interface



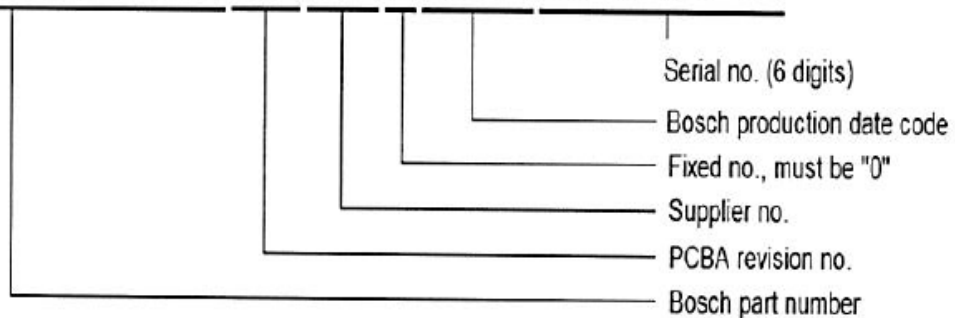
### 1.3 RF Shield Marking

The RF shield will receive a laser marking with DMC code, the RB HW part number and revision of the MirX hardware, production week and year, as well as the received certification ID and approval numbers of FCC and IC. The BT- and CE-symbol will be at the corners.



DMC code unit (24 digits) :

1	6	0	X	X	X	X	X	X	X	A	A	X	Y	0	Z	Z	Z	9	9	9	9	9	9
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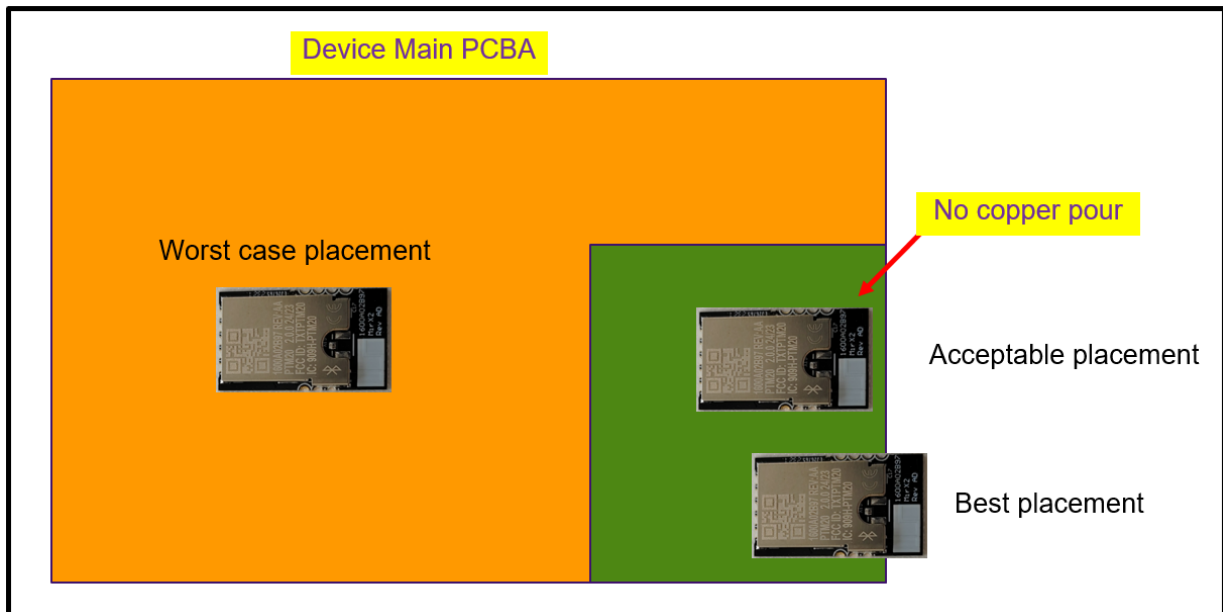
## 1.4 Module Placement Requirements on the Host PCBA (ELO)

- (i) This module was designed to be integrated into Bosch Power Tool products to support connectivity functions.
- (ii) There is no Real Time Clock (RTC) on MirX2. Therefore, if ELO has RTC needs, the RTC function must be added by ELO.
- (iii) When routing UART traces between ELO and MirX2, R=0 Ohm in-line resistors should be used and placed side-by-side as shown below of the GND / TX / RX / VCC signal. This is to aid test sample preparation as the MirX2 UART bus must be disconnected from the ELO and connected to test PC during conductive and radiative RF tests.



- (iv) For better TX/RX performance, high pass filtering capacitor (1 – 2 pF) can be placed between the TX line and GND or RX line and GND on the ELO PCBA just outside the MirX2 soldering pads.
- (v) The module can be soldered on the host board (ELO) and a clearance must be provided for the antenna where no routing or ground is allowed in any layer. Here is an example of a module placed in a host board. Placing the module at the edge is recommended as it gives the best RF performance and does not require any clearance surrounding the antenna.

Module placement on host board:



### Guidelines for Enclosure and Ground Plane

- The type label of the end product must carry a label stating “Contains FCC ID:TXTPTM20” for products sold in the US.
- The type label of the end product must carry a label stating “Contains IC:909H-PTM20” for products sold in the Canada.
- FCC ID:TXTPTM20 must be on the same line on the type label and must be at least 4pt (or 1.41 mm high) and must be legible.
- There should not be any ground directly below the antenna
- Ensure that there is no component, mounting screw, or ground plane near the tip of the antenna or the length of antenna. No large components should be placed near the antenna.
- No battery cable, microphone cable, or any trace should cross the antenna trace on the PCB on the same side of the antenna.
- The antenna should not be covered by a metallic enclosure completely. If the product has a metallic casing or a shield, the casing should not cover the antenna. No metal is allowed in the antenna near field.
- Ensure the paint on the plastic enclosure is nonmetallic near the antenna for best performance.
- The orientation of the antenna should be in line with the final product orientation so that the radiation is maximized in the desired direction. The polarization of the receive antenna and the position of the receive antenna should be taken into account to orient the module in a way that maximum radiation occurs.
- Keep away from antenna, as far as possible, large metal objects to avoid electromagnetic field blocking
- Keep any components that may radiate noise or signals within the 2.4GHz – 2.5GHz frequency band far away from the antenna or better yet, shield the components that are generating the noise. Any noise radiated from the customer PCB in this frequency band will degrade the sensitivity of the module.

## **2 Software Detail and Operation**

### **2.1 PTM20 System Layout**

The MirX2 system is a combination of hardware and software components. The system is built on the HW foundation of the TI CC2651R3 chip including an external SPI flash.

The SW components are basically the TI Bootloader, the Bluetooth lower energy stack and the Robert Bosch PT-MT MirX2 Application SW.

### **2.2 PTM20 UART Communication Interface**

The module needs to be initialized with some basic information to make BLE advertising. The control of the modules is through the UART interface using Bosch PT-MT proprietary protocol, e.g. Miraculix Manager.

## 3 Regulatory and Certification Information

### 3.1 Federal Communications Commission (FCC) Statement

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

#### - List of applicable FCC rules

This device complies with FCC Part 15.247

#### - Limited module procedures

Not applicable.

#### - Summarize the specific operational use conditions

This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

And the module should be installed at a minimum distance of 20 cm away from person nearby. The host product manufacturer should state this information to the host instruction manual.

#### - Trace antenna designs

Not applicable.

#### - RF exposure considerations

This modular complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. This modular must be installed and operated with a minimum distance of 20 cm between the radiator and user body.

#### - Antennas

Antenna Type: PCB Antenna

Antenna Gain: -1.24 dBi @ 2400-2480 MHz

#### - Label and compliance information

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.

Caution: The user is cautioned that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Note:

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.

If the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: "**Contains Transmitter Module FCC ID: TXTPTM20 or Contains FCC ID: TXTPTM20**".

#### - Information on test modes and additional testing requirements

Any final host product with the modular transmitter installed should be under test according to guidance given in KDB 996369 D04. To enter test mode for module, SmartRF Studio 7.exe production kit software and command is necessary. When something wrong happens in configuring test modes for host product with module, host product manufacturer should coordinate with module manufacturer for technical support. It is recommended that some investigative measurements should be taken to confirm that host product with module installed does not exceed the spurious emissions limits or band edge limits.

#### - Additional testing, Part 15 Subpart B disclaimer

The modular transmitter is only FCC authorized for the specific rule parts (FCC Part 15.247) list on the grant, and that 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. The final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed when contains digital circuitry.

## 3.2 Canada Statement

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
- (3) This equipment should be installed and operated with minimum distance 7.9 inches (20 cm) between the radiator & your body.

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.
- (3) Cet équipement doit être installé et utilisé avec une distance minimale de 20 cm (7,9 pouces) entre le radiateur et votre corps.

The end product must carry a label stating "**Contains IC: 909H-PTM20**" or shall use e-labeling.

Un produit hôte doit utiliser une étiquette physique indiquant "**Contains IC: 909H-PTM20**" ou doit utiliser un étiquetage électronique.

The device meets the exemption from the routine evaluation limits in section 2.5 of RSS 102 and compliance with RSS-102 RF exposure, users can obtain Canadian information on RF exposure and compliance.

Le dispositif rencontre l'exemption des limites courantes d'évaluation dans la section 2.5 de RSS 102 et la conformité à l'exposition de RSS-102 rf, utilisateurs peut obtenir l'information canadienne sur l'exposition et la conformité de rf.

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