



a module solution provider

MM5D91E0B

MM5D91-0B Entrance Counter

Evaluation Kit

User Guide

Draft 0.1

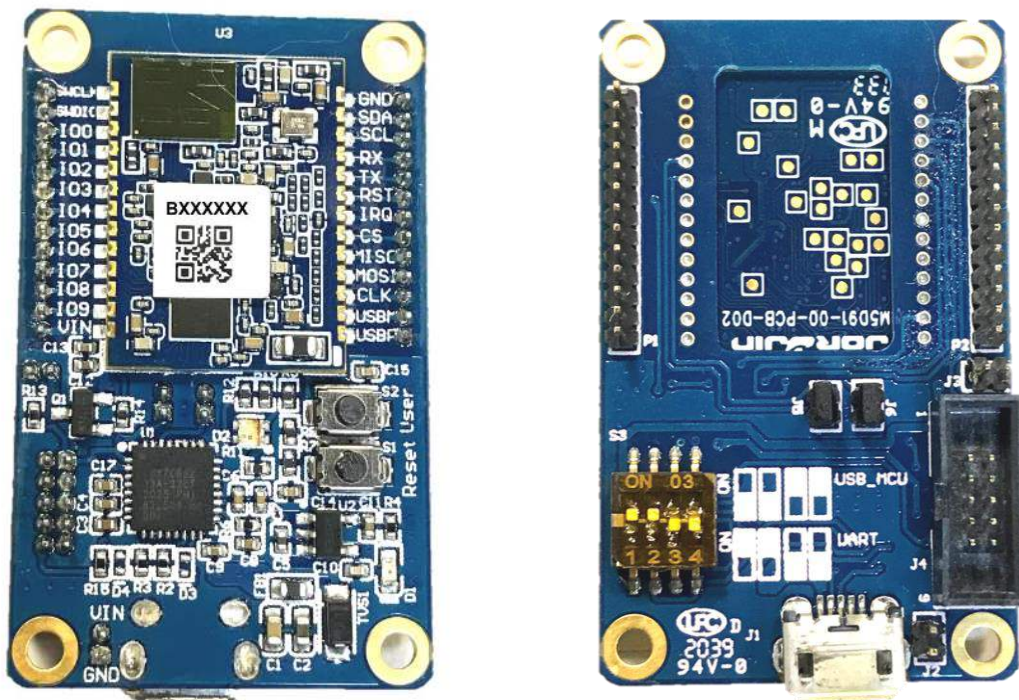
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1. INTRODUCTION

The MM5D91-0B is the Smart Entrance Counter sensor solution which integrates 60GHz mmWave technology counts number of people entering and/or exiting an entrance. The module simplifies the implementation of mmWave sensors in the band of 61.0 to 61.5GHz, and it includes the ARM Cortex-M4F based processor system, 1Tx 3Rx antenna and onboard regulator.

The Jorjin mmWave Radar sensor evaluation kit MM5D91E0B shows as below. Based on the MM5D91-0B Radar sensor module, evaluation board is built to demonstrate the function of entrance counter of the 60 GHz radar sensor with its sophisticated radar presence detection algorithms. This evaluation kit is easy for demo and development for customer.



TOP side

Bottom side

Figure 1-1. MM5D91E0B mmWave Radar Evaluation Kit

2. HARDWARE DESCRIPTION

2.1. Hardware Overview

The following figure and table describe physical sections of the board.

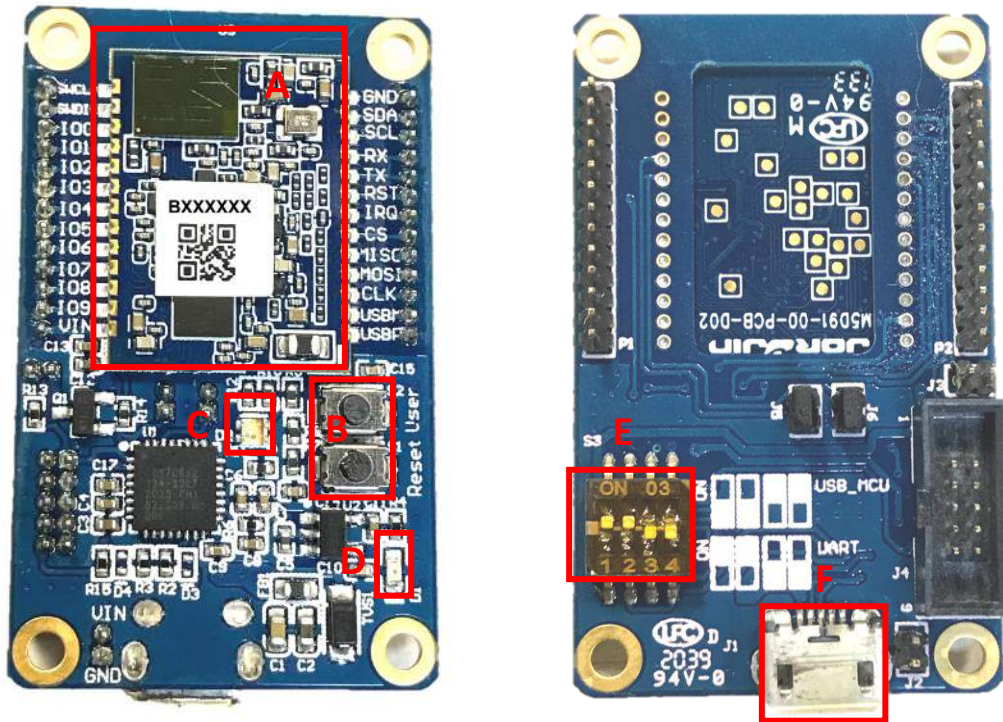


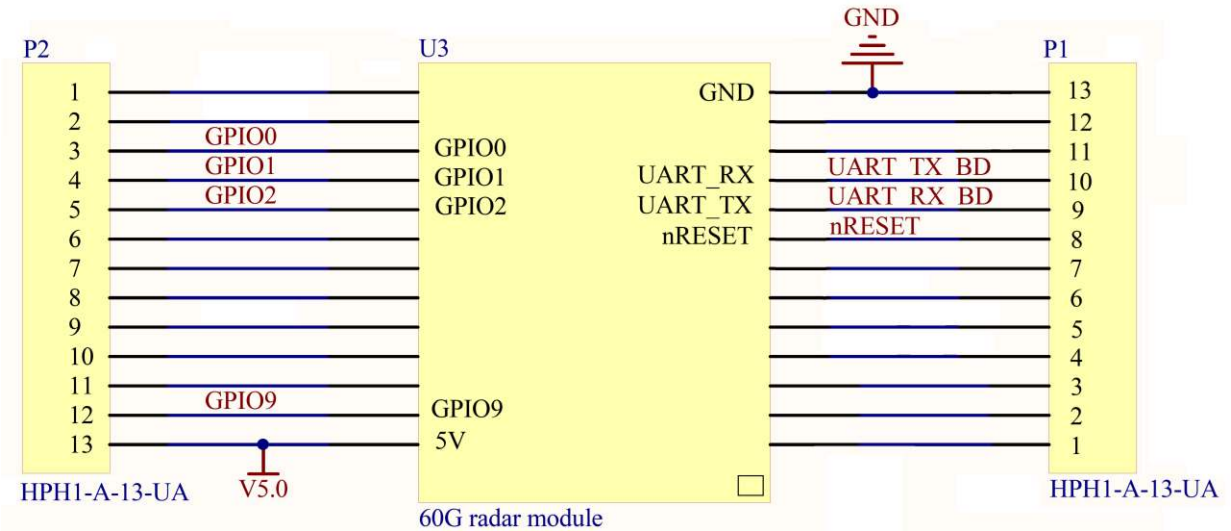
Figure 2-1. Hardware description of Evaluation Kit

Table 2-1. Evaluation Kit component descriptions list

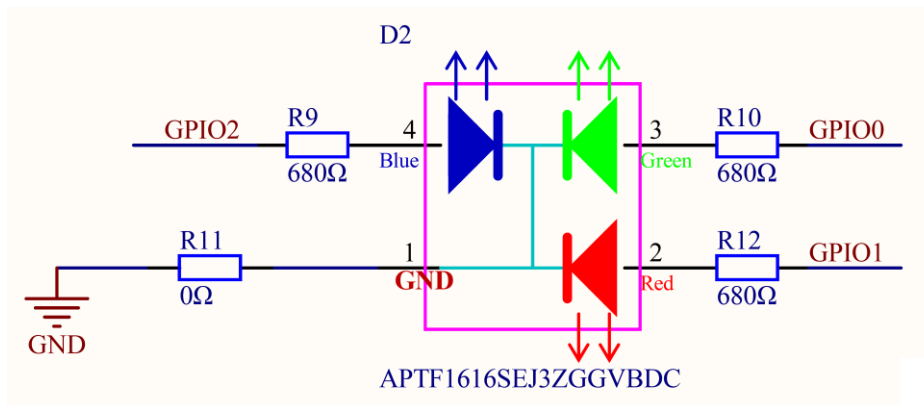
Region	Description
A	Jorjin mmWave Radar sensor module.
B	User - Press the button and power up or reset to enter bootloader mode. Reset - Radar sensor module reset switch.
C	LED of radar detect status: - Green color: No people detected. - Red color: People are detected in setting area.
D	Red LED light when the evaluation kit is power on.
E	Interface setting: Turn up of left two / Turn down of right two. Please keep the setting always.
F	Micro USB connector. Connected to PC (config tool) or power bank to demo.

2.2. Schematic Diagrams

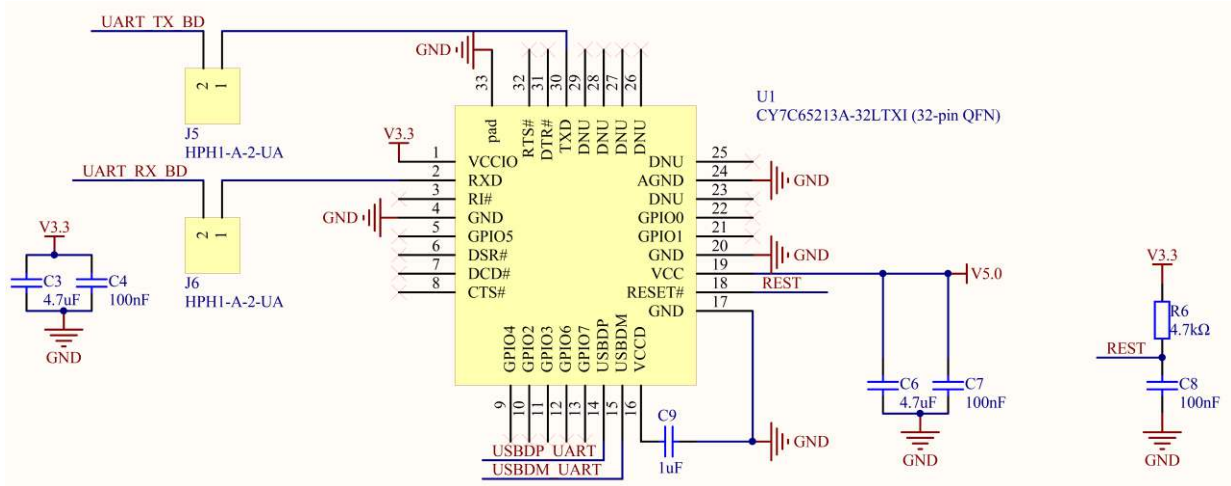
Pin assignment of P1 and P2:



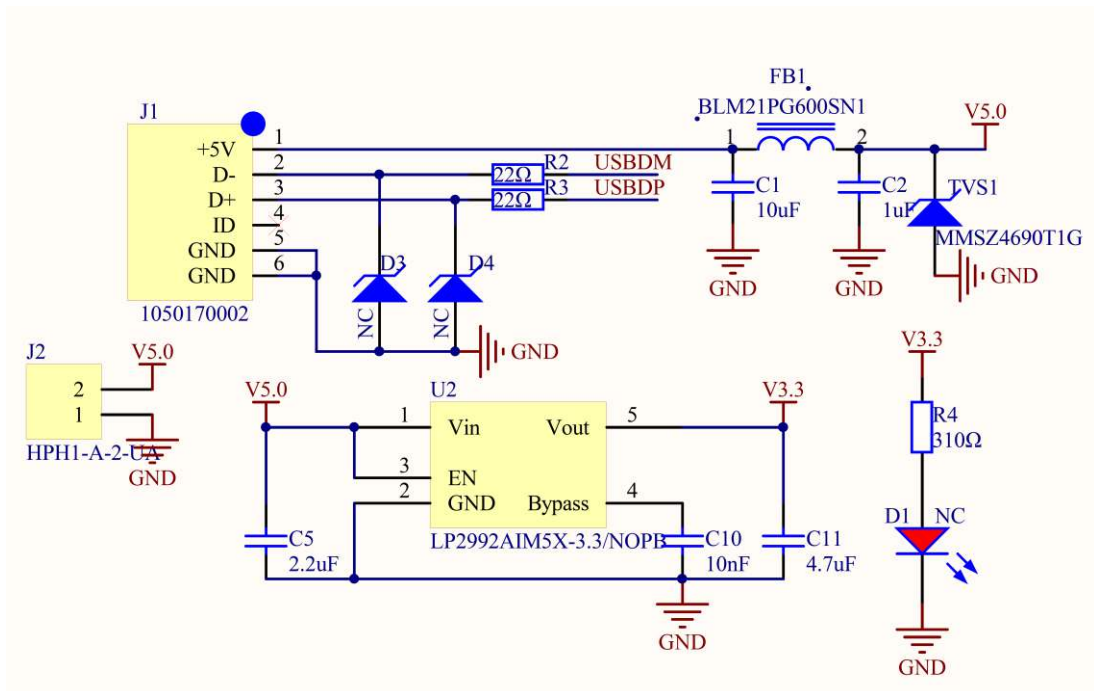
LED indication for presence detection:



UART to USB Conversion:

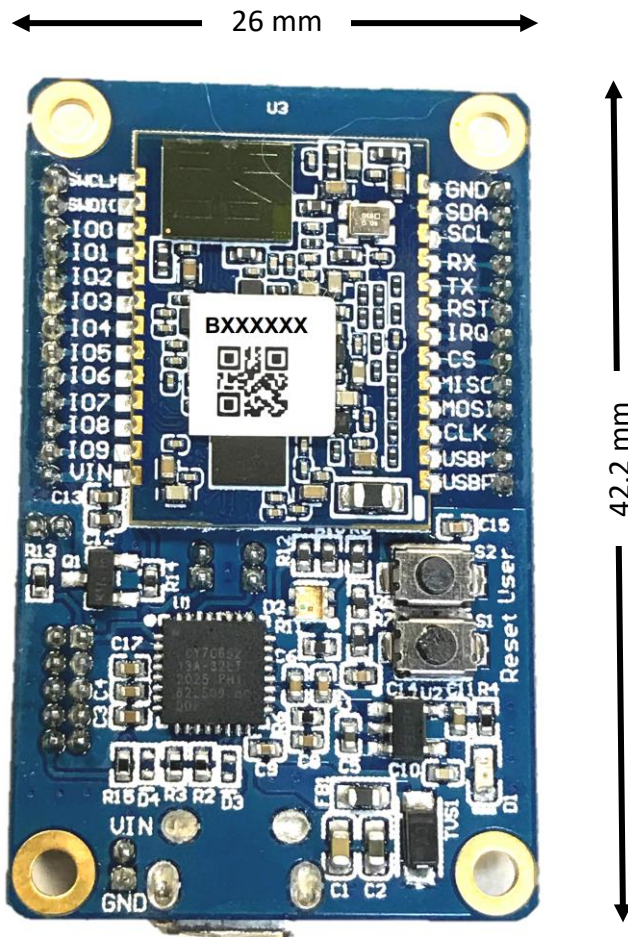


USB circuit:



2.3. Dimensions

MM5D91E0B Board Dimensions.



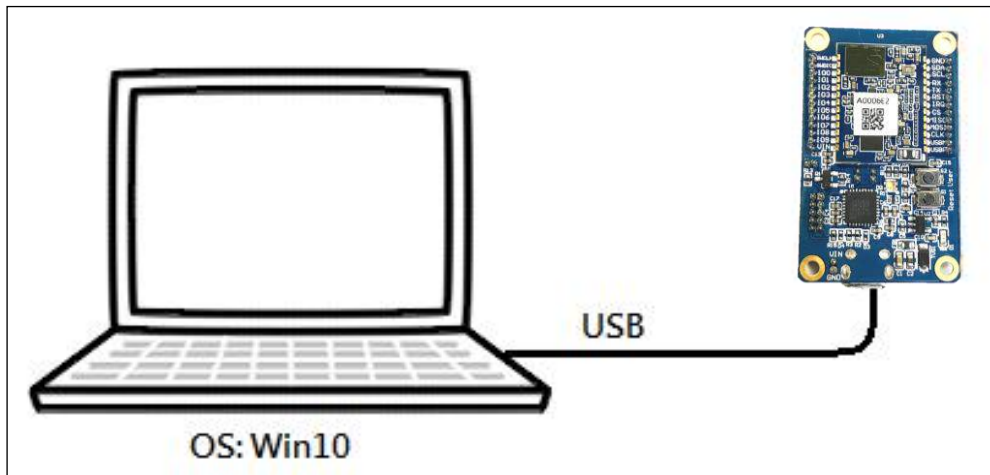
3. SOFTWARE DESCRIPTION

3.1. Module Config Software

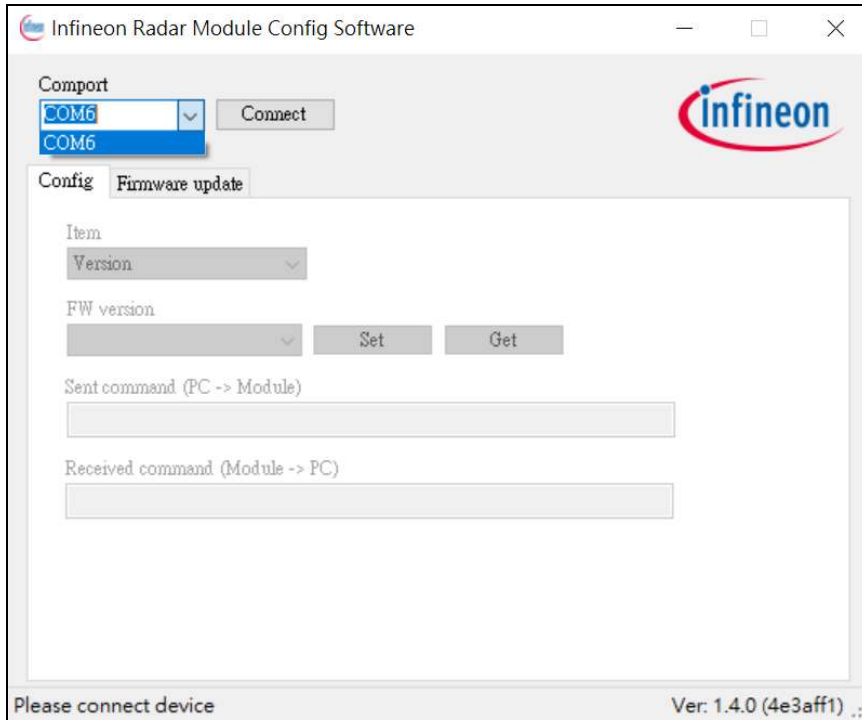
The Entrance Counter Config tool in the link: [TBD](#)

Connect the radar board to PC through USB, open the config tool.

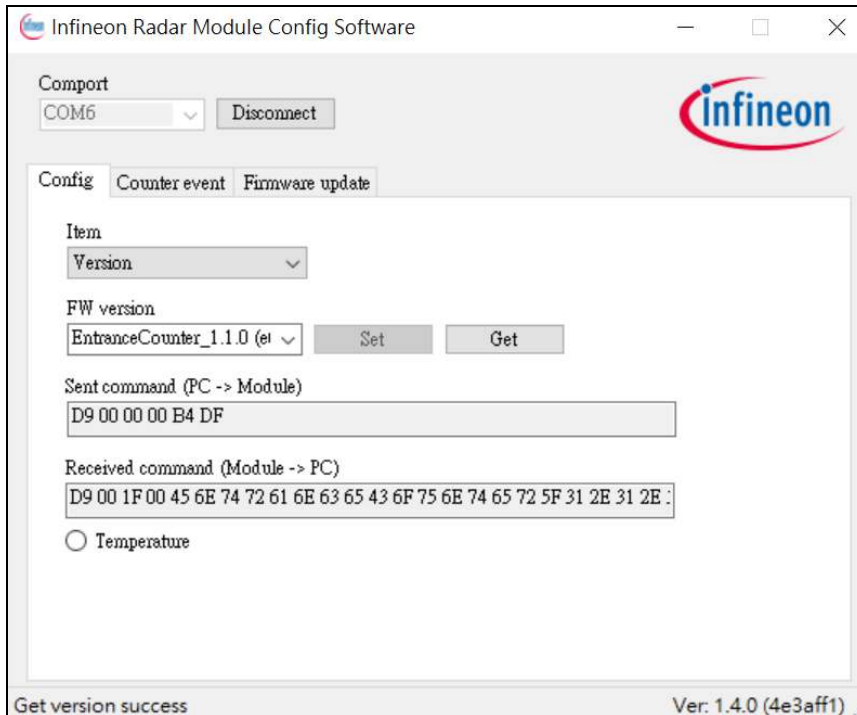
If the OS is Windows 7 or lower, please find the USB driver in the [link](#).



Select the correct COM port number (e.g. COM6) and press **Connect** button.



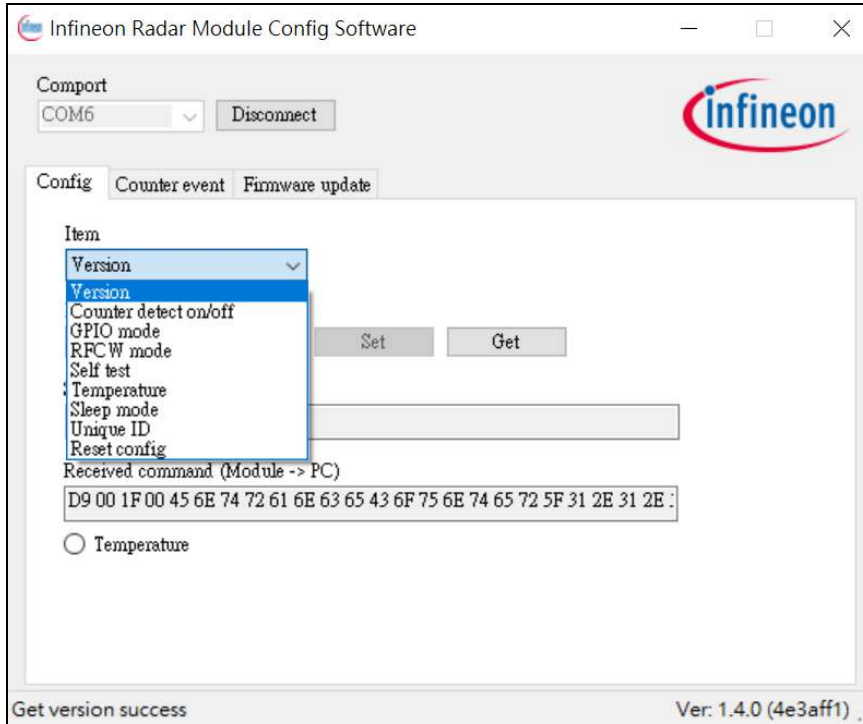
If the board is successfully connected, a firmware version would be shown in the box. Otherwise, a fail message would be shown at bottom.



3.2. Set and Get Configuration

User can set or get the configuration of the radar at the **Config** tab page. Currently following items are available:

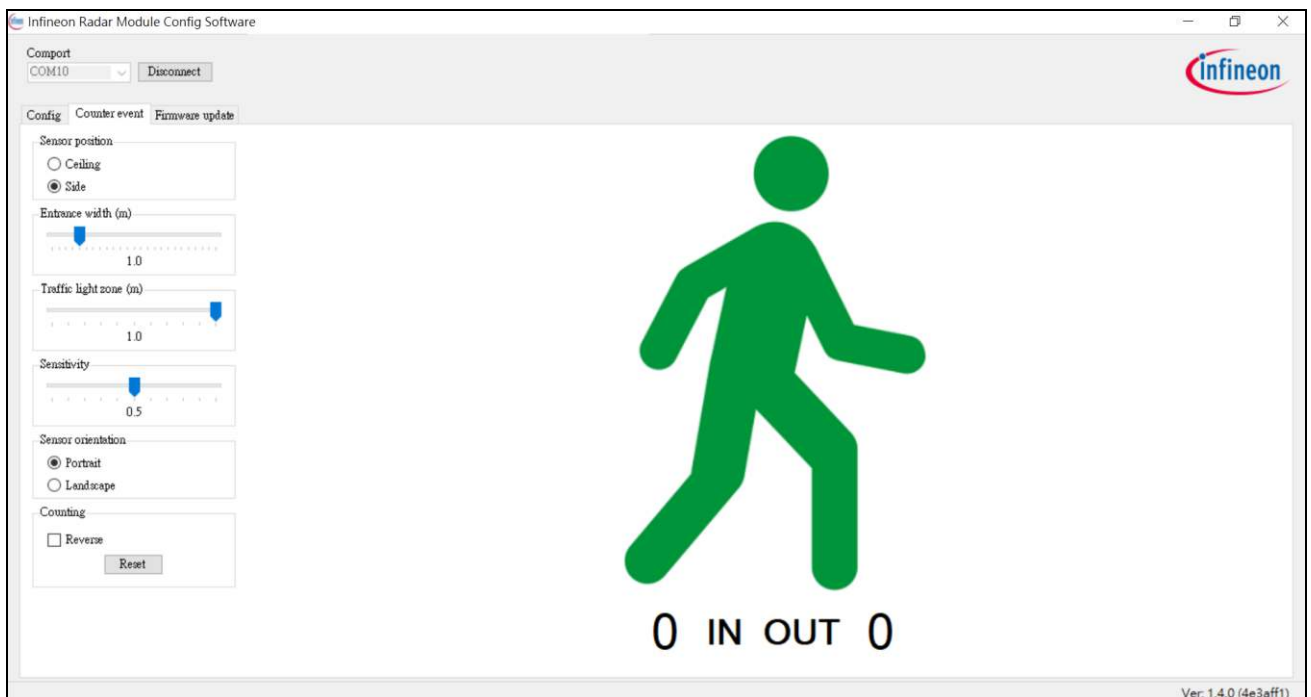
Item	Description
Version	Get the firmware version in MCU.
Counter detect on/off	Set entrance counter detect on or off. Default is on.
RFCW mode	<p>Enable or disable the RF continuous wave mode for FCC test. Presence detection needs to be off before enabling this mode.</p> <p>Disable: Disable RFCW mode.</p> <ul style="list-style-type: none"> - Low: Set RFCW output at 61.02GHz - Mid: Set RFCW output at 61.25GHz - High: Set RFCW output at 61.48GHz - Low TX off: Set RFCW test at 61.02GHz with TX off - Mid TX off: Set RFCW test at 61.25GHz with TX off - High TX off: Set RFCW test at 61.48GHz with TX off
Temperature	Get temperature on radar chip (°C)
Sleep mode	Set the radar module into deep sleep mode. The module would wake up again when data received at UART RX pin. A preamble byte such as 0x00 is needed to add in the next command to have the command correctly received at the module (to compensate wakeup delay time).
Unique ID	Get the unique ID of the module.
Reset config	Reset all setting storing in flash to default.



3.3. Getting Start with Smart Entrance Counter Solution

User can set or get the configuration of the radar at the **Counter event** tab page. Currently setting items are available:

- **Sensor Position** : Depending on the location of installation, select either ceiling or side.
- **Ceiling Height**: The height at which the module is mounted. The maximum height is 3m.
- **Min Person Height**: The height limit of the person. The maximum height is 2m.
- **Entrance Width**: The width of the passage or the entrance. The maximum width is 3m.
- **Traffic Light Zone**: The detection zone of the smart entrance counter solution.
- **Sensitivity**: Changing the sensitivity changes the threshold for triggering the count. At higher sensitivity, the threshold is closer to the noise floor.
- **Sensor Orientation**: The sensor can be mounted either in the portrait mode or in landscape orientation. The figure below describes the definition of longer and shorter edge.
- **Counting**: To set the direction of in / out

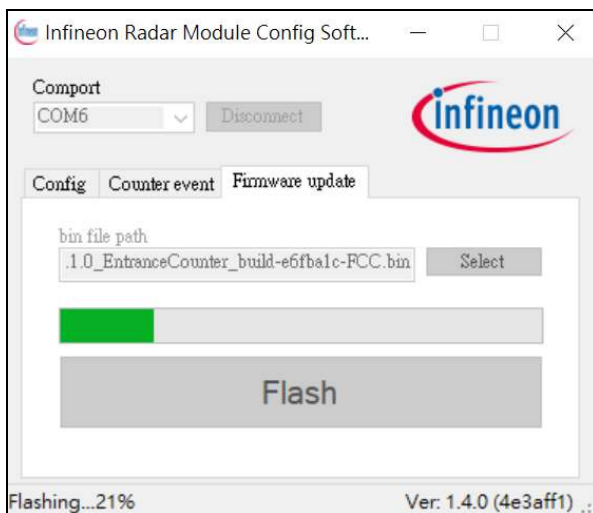


3.4. Firmware update

Firmware update can be done in the **Firmware update** tab page. Select the target .bin file by pressing **Select** button. Bootloader mode would be entered automatically during the update process. In case a non-working firmware is loaded, user can manually force the module to enter bootloader mode by pressing the user button on the mother board after power up or reset. The LED would change to blue color when bootloader mode is entered.



Then press **Flash** button to start the firmware update. Whole update process would take around 30 seconds. Although protection mechanism is added in the update process, it is recommended not unplugging the USB or power off the board to prevent any unexpected error.

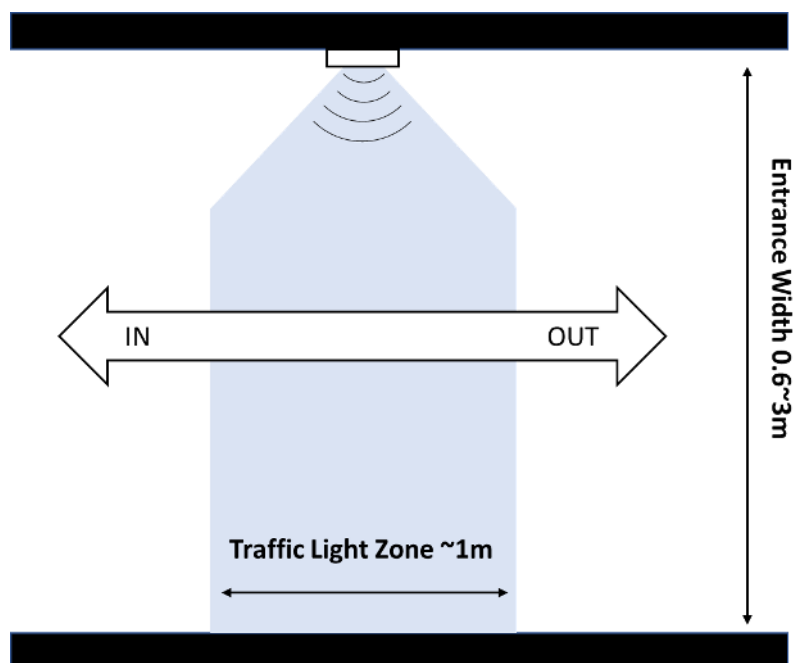


4. SMART ENTRANCE COUNTER SETUP

The Radar evaluation kit can be mounted in following ways:

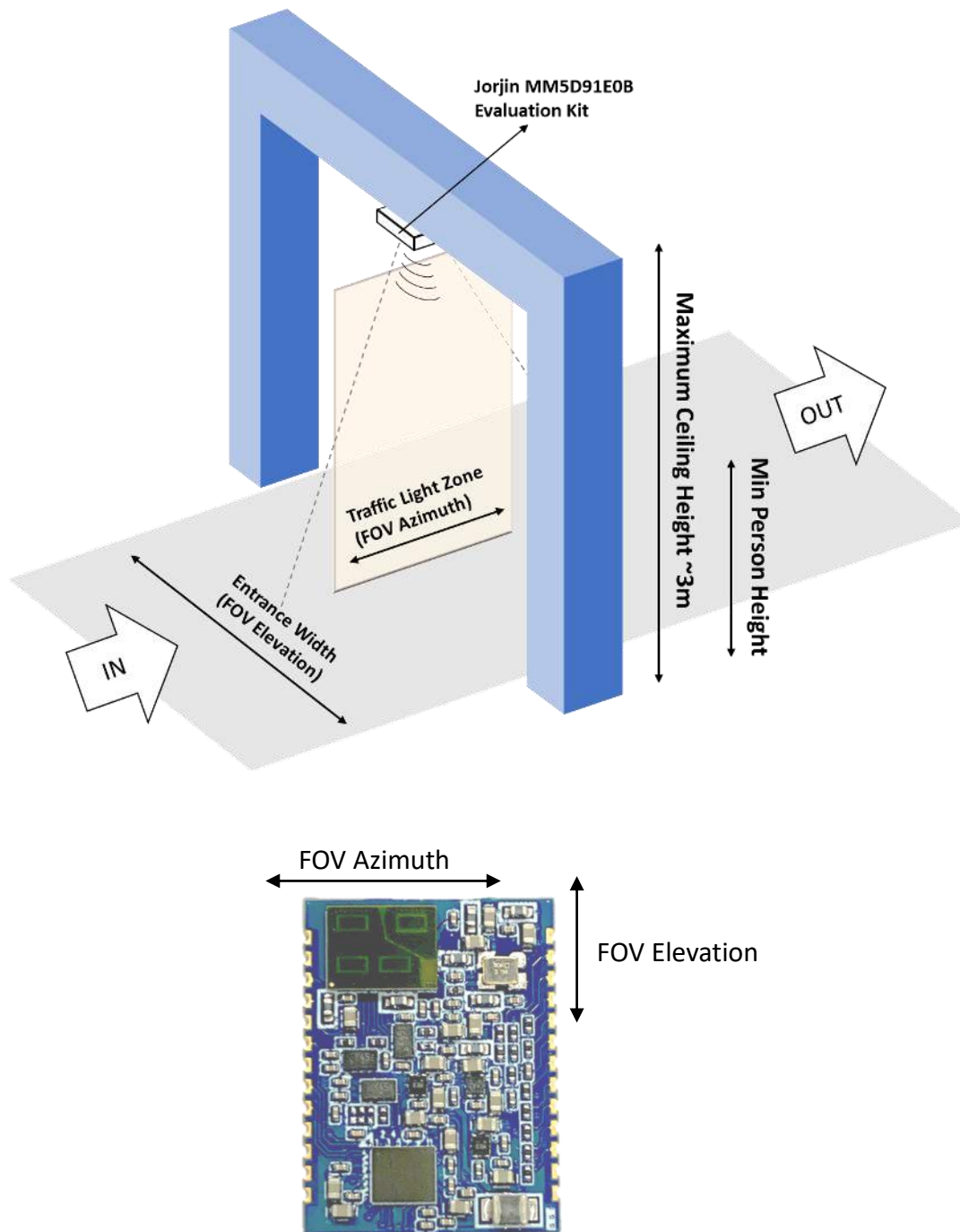
- **Side mount:**

Portrait orientation at around 1.1-1.5m on a wall/door/pillar in such a way that radar sensor is facing the entry/exit passage from side for people counting. For side mount, it is recommended to set the maximum range parameter based on the width of the entrance in such a way that it is lesser than the distance of sensor to the wall (if any).



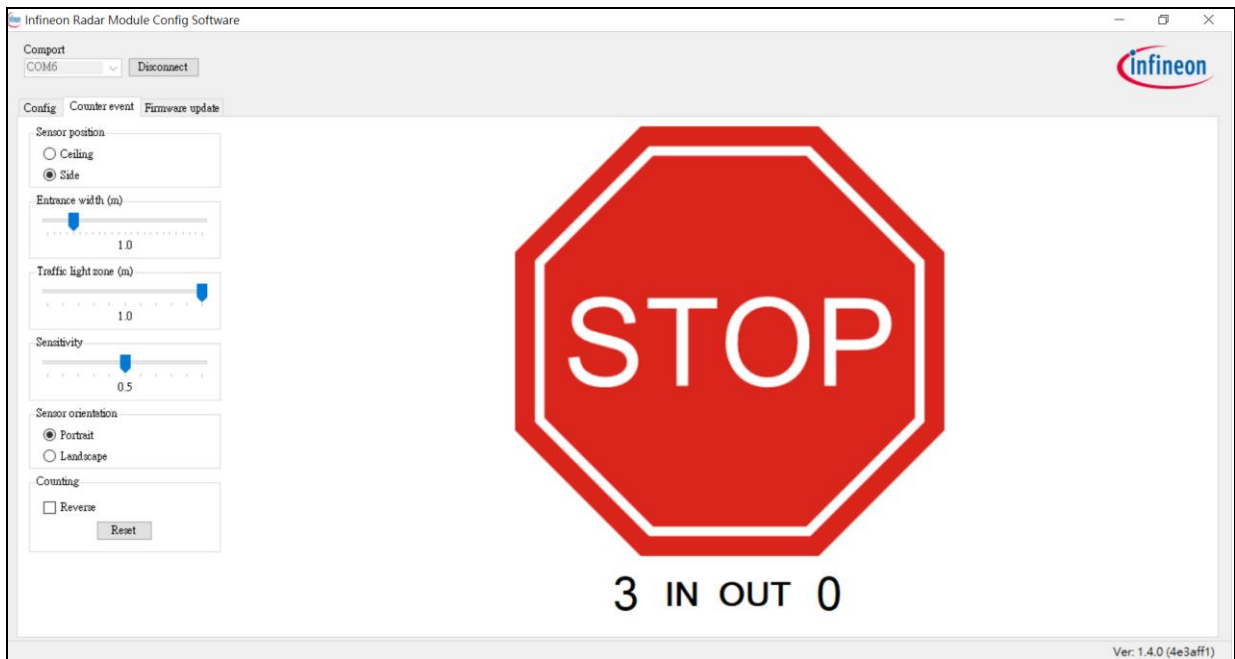
- **Top/Ceiling mount:**

Mounted at a height of up to 3 m from ground, sensor board longer edge (FOV Elevation) being perpendicular to the passage. It is recommended to limit the maximum range of solution to the height of sensor board from ground for good performance.



● **Operating Sequence:**

1. Initial: Traffic light is GREEN
2. Person enters RED area: Traffic light switch to RED (STOP)
3. Person stays in whole sensor area: light keeps RED (STOP)
4. Person goes out of sensor area: light switches to GREEN and IN or OUT event is generated respectively



5. HISTORY CHANGE

Revision	Date	Description
Draft 0.1	2021-03-22	Draft version.