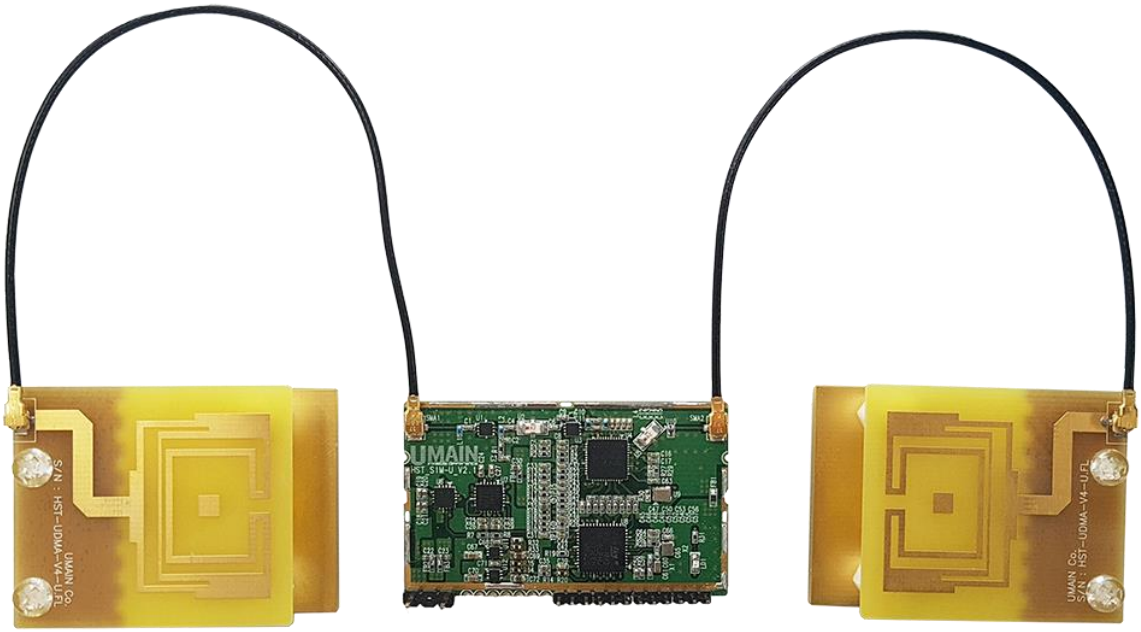

User’s Manual

HST-S1M-CT (for CE/FCC/KC Certification)

Doc No. HST-S1M-CT_Manual_V0.8_ENG

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Table of Contents

1 Outline

1.1 Summary

This document is a user manual for using HST-S1M-CT. The manual consists of the following. Chapter 2 is the product configurations. Chapter 3 offers detailed instructions on each hardware. Chapter 4 explains the provided application softwares with the software structure.

Figure 1. Product Image (without shield can)

1.2 Remarks

This product is UWB radar sensor which is employed solely for indoor operation under FCC rule 15.517.

① This product is capable of operation only indoors. It is necessary to operate this product with a fixed indoor location.

② This product shall not be intentionally directed outside of the building in which the product is located, such as through a window or doorway, to perform an outside function, such as the detection of persons about to enter a building.

③ The use of outdoor mounted antennas, e.g., antennas mounted on the outside of a building or on a telephone pole, or any other outdoors infrastructure is prohibited.

④ This product transmits and receives radar signals through internally integrated antennas automatically when the power is applied.

⑤ This product can be integrated in a different application product such as home appliance, indoor light control equipment, or etc. For those applications, this product is usually used for detecting human's presence or distance.

2 Product Structure and Configurations

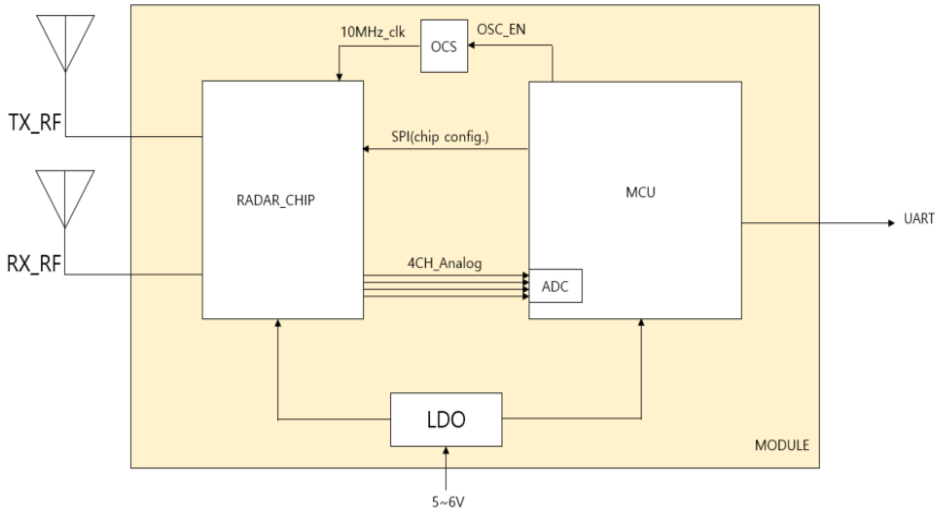
2.1 Product Description

This product is the smallest version of module based upon the HST-C1R main chipset that implements high-resolution radar transmitting and receiving ultra-wideband(UWB) impulse on a single chip.

It measures and analyses displacement signals generated from the human body to detect biological signals such as respiration. Not only it detects distance and obstacles but also distinguishes humans from animals. It can be used on its own or paired with another device through the provided interface.

The whole product is shielded by shield can. TX and RX are connected to the antenna by a U.FL type RF connector. The external 4 to 6V is converted to 1.2V and 3.3V by the internal constant voltage circuit and used as the system power supply.

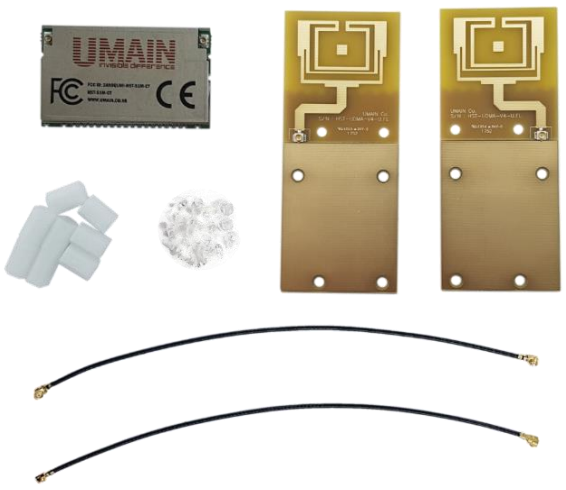
Figure 2. Block Diagram



2.2 Product Configurations

- UWB Radar Sensor Module 1 ea
- Directional Antenna & Bottom Panel 1 set
- Plastic Support 10mm 8 ea
- Plastic bolt 5mm 12 ea
- RF Cable 2 ea

Figure 3. Product Configurations



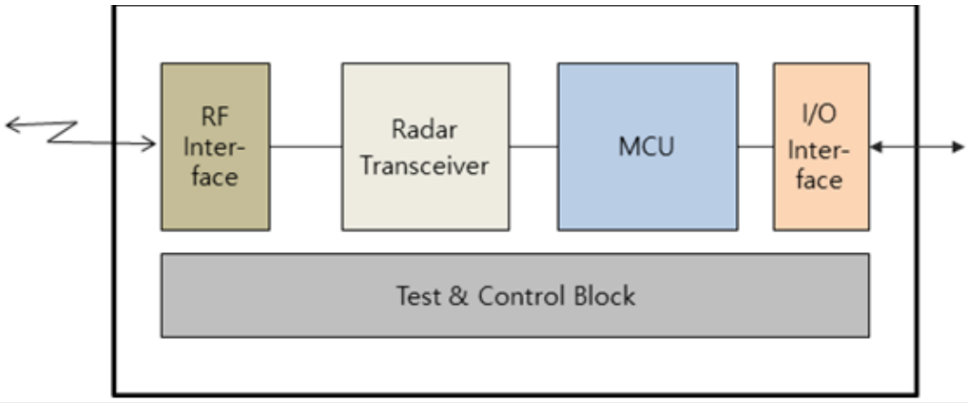
** The product is shipped as one piece or separated at random.

3 Hardware Description

HST-S1M-CT has following specifications.

3.1 Summary

Figure 4. Hardware Connection



3.2 Radar Sensor Module

3.2.1 Features and Specifications

Table 1. Features of the Radar Sensor Module

Parameter	Value	Comment
Detecting Range	Max 13.4M or more	For human: 7~8M Can be adjusted within the power limit
Frequency Range	Korea - 3.735~4.8GHz US and Europe – 3.1 ~ 4.8 GHz	
Output Power	Typ. -41.3dBm	
Distance Resolution	2.03cm	Can be adjusted within the power limit
Dimension	49mm x 29.5mm	

Table 2. Electrical Specifications

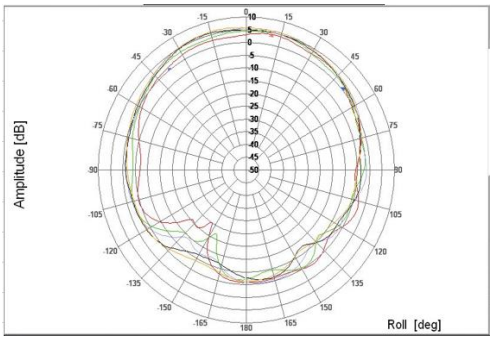
Parameter	Value	Comment
Supply Voltage	5V	
IO-voltage	3.3V	
Max current consumption	200mA	
Operating Temperature range	-40°C ~ +85°C	

3.3 Antenna

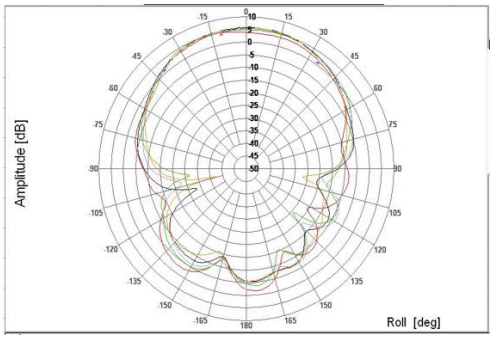
3.3.1 Features and Specifications

Figure 5. Antenna Plane

Antenna - A

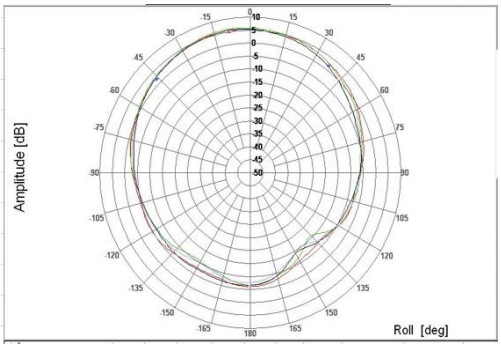


X-Z plane

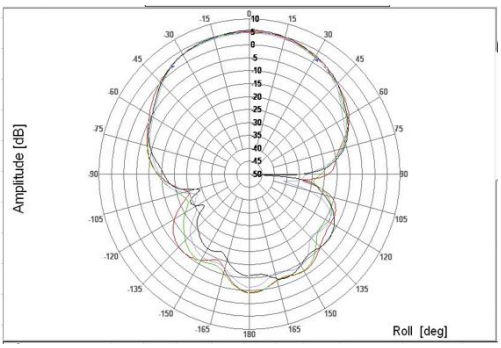


Y-Z plane

Antenna - B



X-Z plane



Y-Z plane

Table 3. Antenna Specifications

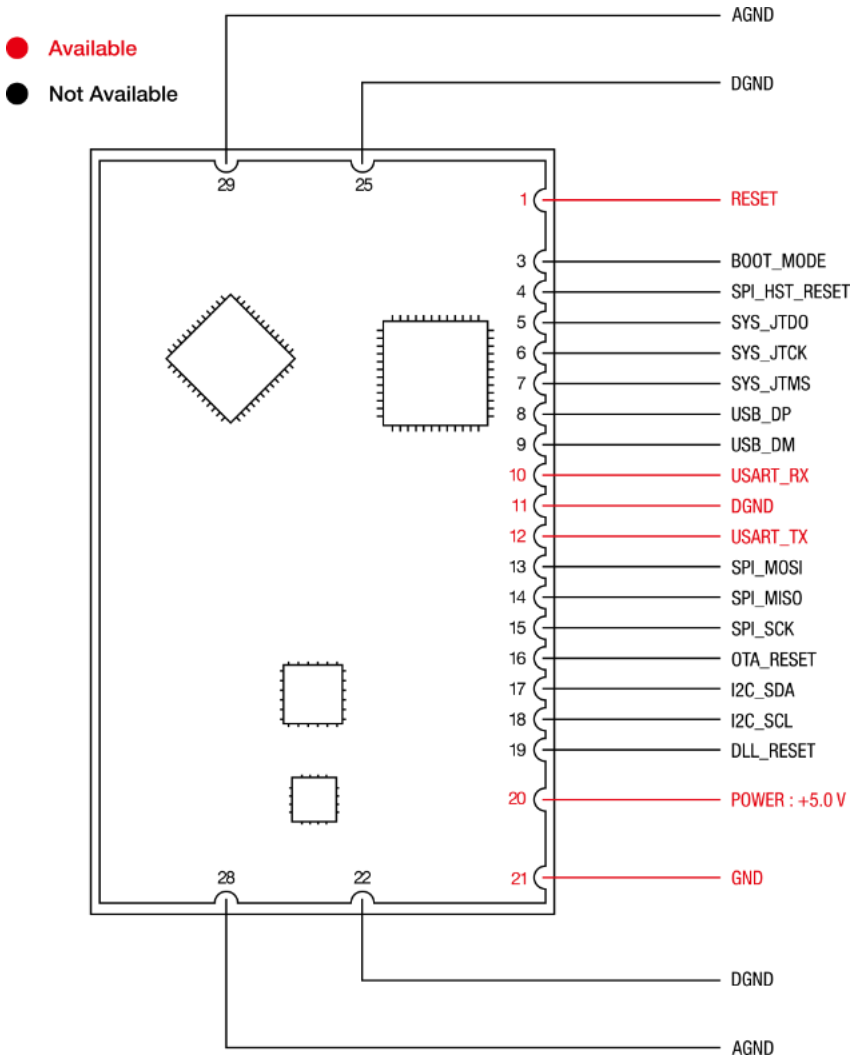
Parameter	Value	
Type	UWB Directional Antenna	
Material	FR-4	
Gain	XZ Plane : 4.91(min.) dBi	YZ Plane : 4.66(min.) dBi
Antenna angle (3.8GHz ~ 4.5GHz)	81.60°(X-Z plane) ~ 69.61°(Y-Z plane)	
Size	34mm x 44mm x 17mm	

4 How to connect the hardware

4.1 Hardware Connection

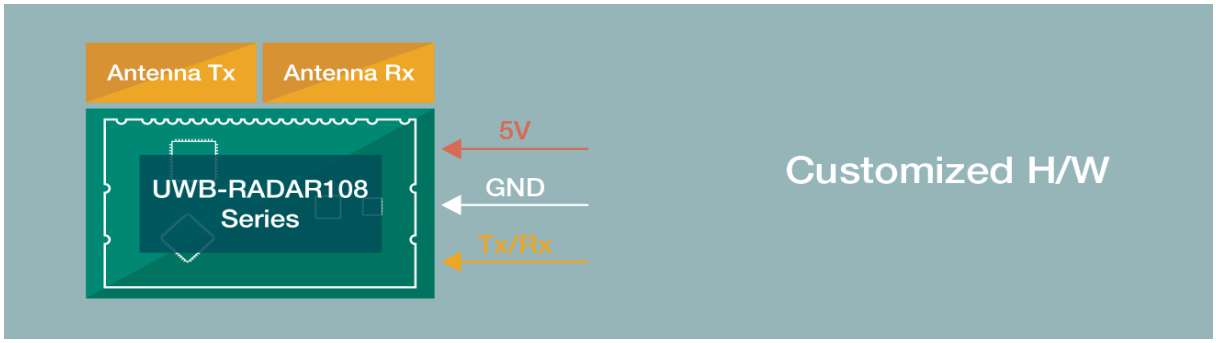
- After connecting 3 pins of Reset, USART_TX, USART_RX, connect + 5V, GND to supply power.
- Output begins through serial after power is supplied. The reset pin is Active High, and the low value cause the board to reboot.
- Caution : Reset pin should be suppplied with 3.3V. Do not supply with 5V.

Figure 6. Hardware Pin Description



Available Pin	
Power	Supply Voltage : DC +5V
Reset	The pull-up resistor is connected and the board is initialized when the voltage drops to 0V.
Serial	The port for data communication through USART_RX, USART_TX, DGND

4.2 Hardware Integration



Attach HST-S1M-CT module to customized hardware by soldering work. In this case, please refer to the figure 6. “Hardware Pin Description” and figure 7. “Hardware Pin Dimension for Soldering Work” below.

Figure 7. Hardware Pin Dimension for Soldering Work

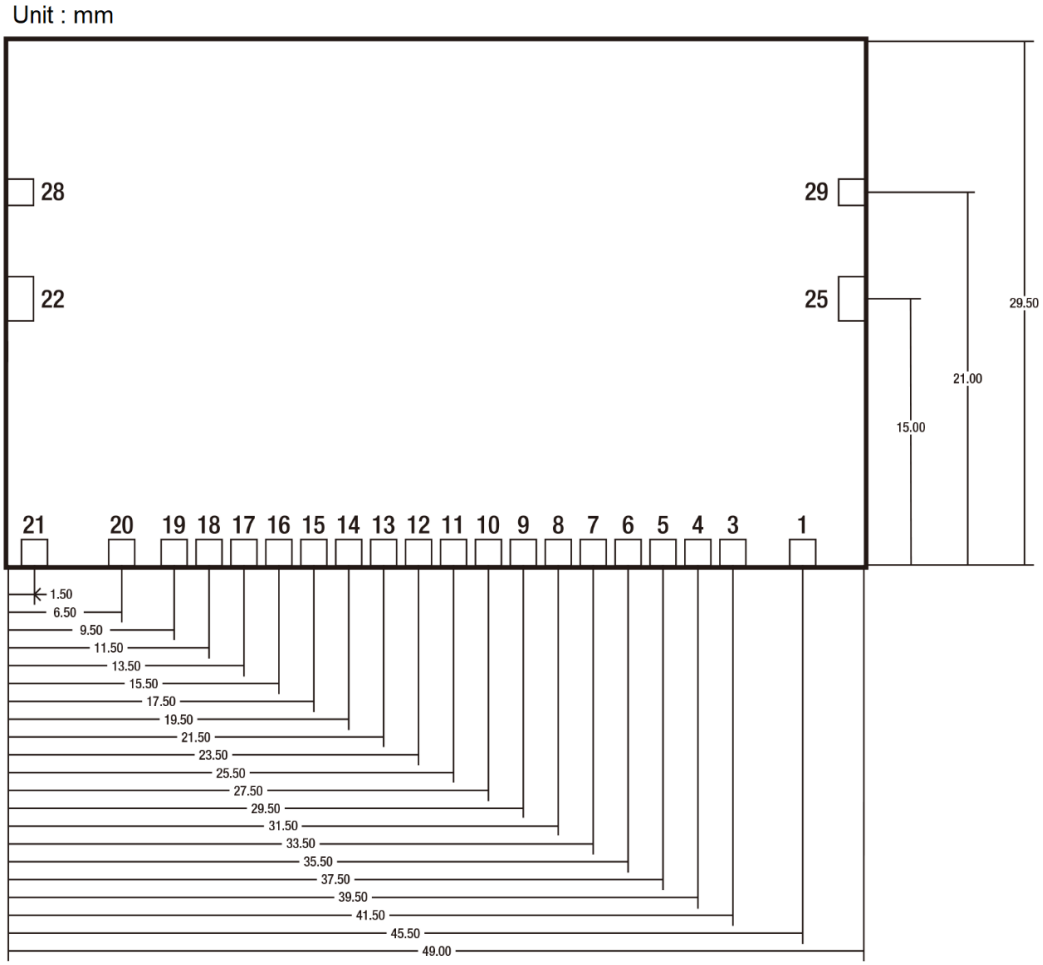


Table 4. Pad dimensions

Pad No. 22, 25	1.4mm X 2.4mm
Pad No. 1~21, 28, 29	1.4mm X 1.4 mm

4.2.1 Compliance Obligations of HOST / OEM manufacturer

Any subsequent associated party (Host device manufacturer, original equipment manufacturer (OEM), integrator, or end-user) shall clearly understand the conditions and limitations for authorized uses of this product under the rules of Subpart F-ULTRA-WIDEBAND OPERATION 15.517. Therefore, the Host / OEM manufacturer must include in their own user manuals which is conforming the rules of 15.517.

A host product incorporating a certified device cannot take advantage of the pre-existing certification of this product (UWB radar sensor module) without conformity with the specific requirements in the instructions.

Also, the Host / OEM manufacturer using this product is responsible for including the necessary details for ensuring compliance for RF exposure requirements and the associated usage conditions for mobile, and fixed-mount equipment configurations, as applicable.

4.3 How to utilize the hardware

HST-S1M-CT outputs the distance value of the moving object which is located more than 50 cm from the sensor under the assumption that the moving object is a person.

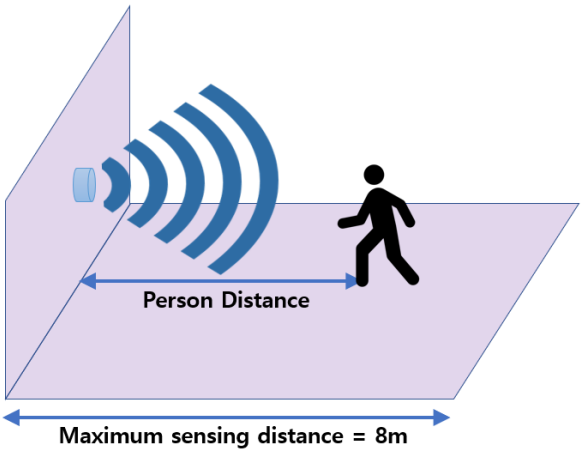
Initial setting is required and there must be no movement in front of the sensor at the initial setting. Otherwise, it may not work correctly.

Also, the sensor must be fixed state in a place during setting.

If no motion is detected for around 60 seconds, the algorithm determines that there is no human, and outputs a value outside the boundary. (812 cm)

As shown in the figure 8, the closest distance value of the person located within 8m from the HST-S1M-CT is outputted.

Figure 8. Operating Instructions



Movement outside 8m is not detected, and motion during initial setting causes sensing error.

Communication settings are as follows.

Communication Setting	
Baud Rate	115200
Stop bit(s)	1
Parity bit(s)	None

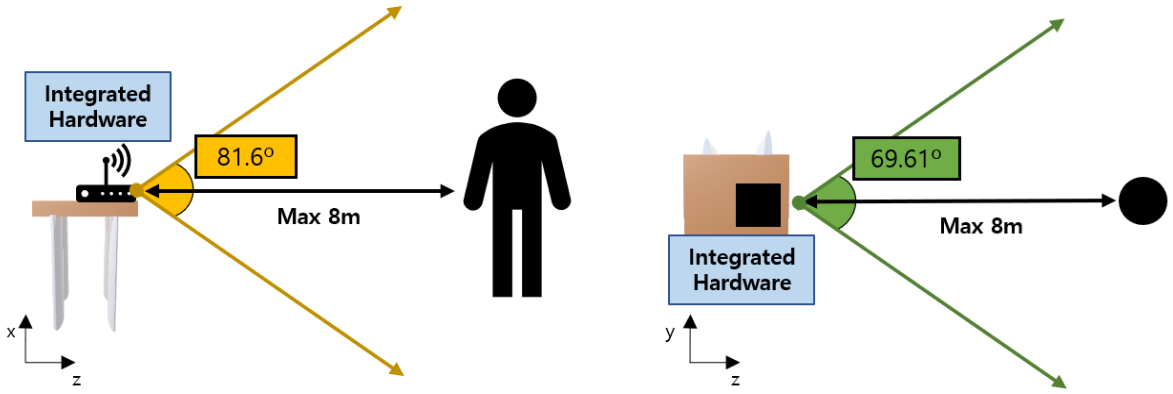
When 5V, GND power is applied HST-S1M-CT (refer to the Chapter 4 : “How to connect the hardware"), the following packet is transmitted through the serial port (USART_RX, USART_TX, DGND). The data packet is transmitted at intervals of about 1 second after the initial setting.

HST-S1M-CT Data Communication

Start (1Byte)	Board Type (1Byte)	Data1 (1Byte)	Data2	End (1Byte)
(0xff)	'S' (0x53)	In Setting (0x30)	(char) XXX (3Byte) : Setting Progress [%] e.g.) ASCII Data: 67 % Setting '0' '6' '7'	(0xfe)
		In Operation (0x31)	(char) XXXX.XX (7Byte) : Detected Distance [cm] e.g) ASCII Data: 256.89 cm '0' '2' '5' '6' '.' '8' '9'	

4.4 Test conditions

Figure 9. Integrated Hardware Installation location



It is recommended to install the hardware integrated with HST-S1M-CT in front of the person as shown on the figure 9.

4.5 Test conditions and order

The initial conditions of HST-S1M-CT are as follows. These conditions are satisfied only once after power is applied.

1. **Apply power to the product (with supply voltage at 5V)**
2. **During initialization, <u>there must be no movement in front of product</u>. The initialization is completed after 25 seconds**
3. **Detection begins**

The operating conditions of HST-S1M-CT are follows.

1. The module must be fixed at one place in a room. (indoor environment)
2. It outputs the distance value of only the closest object from the module.
3. The less obstacles are around, the better the performance is.
4. The value may not be accurately determined depending on the installation environment or angle.
5. If no movement is detected for about 60 seconds after detection, it is judged that there is no person within the boundary. Then, the value outside the boundary is outputted. (812 cm)

5 Regulatory Approval

HST-S1M-CT is designed to meet UWB related KC, FCC and CE standards.

5.1 KC

KC certified	
Product Description	UWB-related or Utilization Unspecified Devices (UWB technology enabled devices)
Product Model Name	HST-S1M-CT
Certification No.	MSIP–CRM–umi-HST-S1M-CT
Applicant Name	Umain Inc.
Manufacturer Name	Umain Inc. / South Korea

5.2 FCC

FCC certified	
This device compiles 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 operations. The antennas used for this transmitter must be installed to provide a separation distance of at least 20-cm from all persons, and must not be co-located or operating in conjunction with any other antenna or transmitter, except the collocation as described in the filling or in accordance with FCC multi-transmitter product guidelines. This device is approved per part 15.517 (indoor use only) and RF exposure.	
FCC ID	2AN8QUMI-HST-S1M-CT
Product Model Name	HST-S1M-CT
Product Manufacturer	Umain Inc.
Country of Manufacturer	South Korea
Address of Manufacturer	H.Q : 9F Nano Fab Center, 291 Daehak-Ro, Yuseong-Gu, Daejeon, South Korea 34341
	R&D : #607, #608,CTCC, ETRI, 218 Gajung-Ro, Yuseong-Gu, Daejeon, South Korea 34129

5.3 CE

CE certified	
Product Model Name	HST-S1M-CT
Product Manufacturer	Umain Inc.
Country of Manufacturer	South Korea
Address of Manufacturer	H.Q : 9F Nano Fab Center, 291 Daehak-Ro, Yuseong-Gu, Daejeon, South Korea 34341
	R&D : #607, #608,CTCC, ETRI, 218 Gajung-Ro, Yuseong-Gu, Daejeon, South Korea 34129

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