

Woori-Net

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WM-H801UE

Hardware Manual

Contents

1.Introduction	6
1.1 Overview	6
1.2 Frequency Band	6
1.2.1 Frequency Bands.....	6
2.Main Features	7
2.1 Main Features	7
2.2 Block Diagram.....	8
3.PINS ALLOCATION.....	9
3.1 Pin Assignment	9
3.2 I/O Parameter definitions.....	10
3.3 Pin Description	10
3.4 Signal that Must be connected	13
3.5 Configuration Pins.....	13
4.RF Specification	14
4.1 RF performance	14
4.1.1 Maximun Transmit Output Power	14
4.1.2 Minimum Receiver Sensitivity	14
4.2 Antenna specification	15
4.2.1 Antenna Configuration	15
4.2.2 Antenna Connector.....	16

4.2.3	mmWave Antenna Connector.....	17
4.2.4	Antenna Requirements	18
4.2.5	GNSS Receiver	18
4.2.6	GNSS RF Front End Design(TBD)	19
5.	Application Interface	19
5.1	Power Sources.....	19
5.1.1	Power Supply Requirements	19
5.1.2	Power Consumption(TBD).....	19
5.2	Turn on and off Scenarios.....	20
5.2.1	Full_CARD_PWR_OFF_N.....	20
5.3	Reset the Module	21
5.3.1	Hardware Reset.....	21
5.4	(U)SIM Interface	22
5.5	USB Interface.....	23
5.6	I ² C Interface	24
5.7	PCIe Interface	25
5.8	LED	27
5.9	Antenna Tuner Control Interfaces	27
5.10	ADC Interface.....	28
5.11	GPIO Interface	28
5.11.1	Using a GPIO pin as Input.....	29

5.11.2 Using a GPIO Pin as output.....	29
5.12 FORCED_USB_BOOT Interface.....	29
6.Mechanical Dimensions	30
6.1 Top and Bottom Views of the Module	30
6.2 Mechanical Dimensions of the Module.....	30
6.3 Module Stand-off(PAN NUT).....	31
6.3.1 Recommended Main Board Hole.....	31
6.3.2 Electrical Ground Path.....	31
6.3.3 Stand-off Guideline	31
6.3.4 Screw Guideline.....	32
7.Label.....	33
7.1 Label	33
7.2 Label Notations	33
8.Waring	34
9.FCC statements	34

➤ Revision History

All revisions made to this document are listed below;

Version	Date	Description
0.1	2022-02	문서 초안 작성
0.2	2022-07	If I2C interface are used, 2.2K Ω pull-up registers are required in the customer board.
0.3	2022-10	Memory spec was changed from 4Gbit NAND Flash + 4Gbit LPDDR4 to 8Gbit NAND Flash + 8Gbit LPDDR4
0.4	2022-12	Added Label and warning

1. Introduction

1.1 Overview

WM-H801UE is M.2 Module for application, such as M2M application and industrial IoT device platform based on 5G CBRS n48 networks for data communication.

1.2 Frequency Band

1.2.1 Frequency Bands

The operating frequencies in 5G CBRS n48 mode conform to the 3GPP specifications.

5G NR Sub6 Band supportive

NR Band	Duplex Mode	Uplink Frequency(MHz)	Downlink Frequency(MHz)	Channels	SCS (kHz)
n48 - 3600	TDD	3550 - 3700		T/Rx: 636668 - 646666	30

2. Main Features

2.1 Main Features

Function	Features
Physical	M.2 Type 3253-XX-B
Cellular technology	5G CBRS n48
2x2 MIMO	5G: n48
GNSS	Dual-Frequency GNSS Upper L-band: GPS/Glonass/Beidou/Galileo Lower L-band: GPS/Galileo
USIM port – dual voltage	Support for SIM Class B and Class C support Clock rates up to 4 MHz
Application processor	Application processor to run customer application code 32 bit ARM Cortex-A7 up to 1.5 GHz running the Linux operating system 8Gbit NAND Flash + 8Gbit LPDDR4 MCP is supported
Main Interfaces	PCIe Gen3 x 1-lane USB 3.1 Gen 2 Peripheral Ports – GPIOs I2C
Antenna connection	4 x MHF-4 type Cellular/GNSS antenna connectors 1 x MHF-4 type Dedicated GNSS antenna connector
Form factor	M.2 Form factor (32 * 53 * 3.55 mm), accommodating the multiple RF bands

Environment and quality requirements	<i>The device is designed and qualified by Woori-net to satisfy environmental and quality requirements.</i>
Single supply module	The module internally generates all its required internal supply voltages.
Operating temperature	Range -20°C to +60°

4. RF Specification

4.1 RF performance

The RF performance in 5G, LTE and WCDMA modes conform to the 3GPP specifications

4.1.1 Maximun Transmit Output Power

TX power follows the measurement conditions and specifications defined in 3GPP.

Band	Power class
5G CBRS n48	3 (0.2W)

4.1.2 Minimum Receiver Sensitivity

Receiver Sensitivity follows the measurement conditions and specifications defined in 3GPP.

Technology	3GPP Compliance
5G CBRS n48	Throughput >95%

*3.3Voltage/ Room temperature

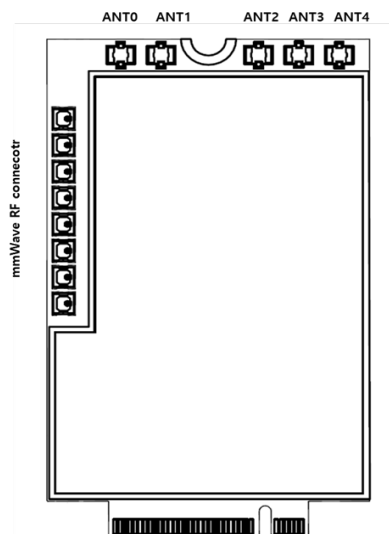
Scenario: n48 40MHz sen LMH

Band	Bandwidth	Channel	Test Item	Meas. Value[dBm]
n48	10MHz	637000	NR FR1 RXSENS_SEARCH UL[DFT_QPSK_REFSSENS]&DL[QPSK_Outer_FullRB](24@0)	-102.50
n48	10MHz	641666	NR FR1 RXSENS_SEARCH UL[DFT_QPSK_REFSSENS]&DL[QPSK_Outer_FullRB](24@0)	-103.00
n48	10MHz	646332	NR FR1 RXSENS_SEARCH UL[DFT_QPSK_REFSSENS]&DL[QPSK_Outer_FullRB](24@0)	-102.50
n48	20MHz	637334	NR FR1 RXSENS_SEARCH UL[DFT_QPSK_REFSSENS]&DL[QPSK_Outer_FullRB](50@0)	-99.50

n48	20MHz	641666	NR FR1 RXSENS_SEARCH UL[DFT_QPSK_REFSSENS]&DL[QPSK_Outer_FullRB](50@0)	-99.50
n48	20MHz	646000	NR FR1 RXSENS_SEARCH UL[DFT_QPSK_REFSSENS]&DL[QPSK_Outer_FullRB](50@0)	-99.00
n48	30MHz	637668	NR FR1 RXSENS_SEARCH UL[DFT_QPSK_REFSSENS]&DL[QPSK_Outer_FullRB](75@0)	-98.00
n48	30MHz	641666	NR FR1 RXSENS_SEARCH UL[DFT_QPSK_REFSSENS]&DL[QPSK_Outer_FullRB](75@0)	-97.50
n48	30MHz	645666	NR FR1 RXSENS_SEARCH UL[DFT_QPSK_REFSSENS]&DL[QPSK_Outer_FullRB](75@0)	-97.50
n48	40MHz	638000	NR FR1 RXSENS_SEARCH UL[DFT_QPSK_REFSSENS]&DL[QPSK_Outer_FullRB](100@0)	-96.50
n48	40MHz	641666	NR FR1 RXSENS_SEARCH UL[DFT_QPSK_REFSSENS]&DL[QPSK_Outer_FullRB](100@0)	-95.50
n48	40MHz	645332	NR FR1 RXSENS_SEARCH UL[DFT_QPSK_REFSSENS]&DL[QPSK_Outer_FullRB](100@0)	-96.00

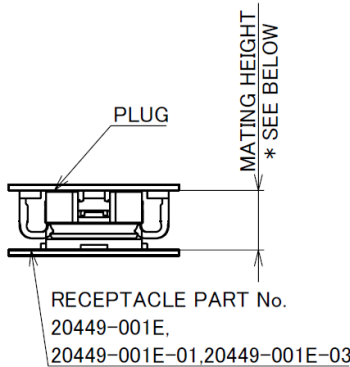
4.2 Antenna specification

4.2.1 Antenna Configuration

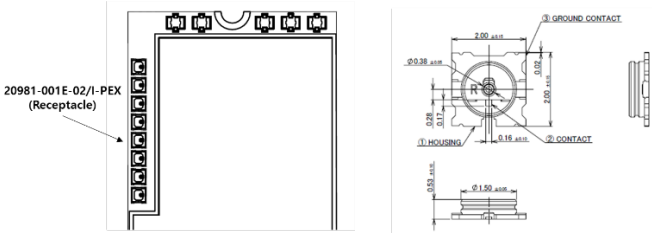
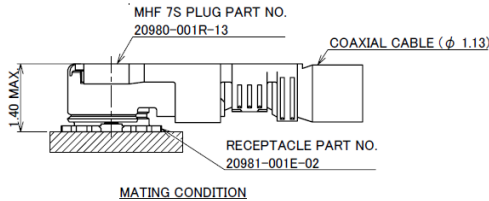


Antenna Port	Technology	Tx	Rx	GNSS
ANT0	5G NR FR1	n48	n48	-
ANT1	5G NR FR1	-	n48	-
ANT2	5G NR FR1	n48	n48	-
ANT3	5G NR FR1	-	n48	GPS L1, Galileo E1, Beidou B1, Glonass G1
ANT4	GNSS	-	-	GPS L1, Galileo E1, Beidou B1, Glonass G1

Proprietary & Confidential

		Max.1.7T 20632-001R-37
SMT Type		SMT type plug Part No. (I-PEX) Mating height Max.1.2T 20462-001E (I-PEX)

4.2.3 mmWave Antenna Connector

RECEPTACLE		
		MHF 7S Receptacle Part No. 20981-001E-02 (I-PEX)
PLUG		
		MHF 7S PLUG Part No. Max.1.4T 20980-001R-13 (I-PEX)

4.2.4 Antenna Requirements

The antenna must specifications meet the following requirements

LTE/5G Sub-6 Antenna Requirements

Frequency Range	Depending by frequency band(s) provided by the network operator, the customer shall use the most suitable antenna for that/those band(s)
Impedance	50Ω
Input Power	> 24 dBm average power in LTE & 5G Sub-6
VSWR absolute max.	<= 10:1
VSWR recommended	<= 2:1

4.2.5 GNSS Receiver

The WM-H801UE integrates a GNSS receiver that could be used in Standalone mode and in A-GPS (assisted GPS), according to the different configurations.

Frequency Range	• Wide-band GNSS: 1559–1606 MHz recommended • GPS: 2.046 MHz BW NB GPS (centered on 1575.42 MHz) • Glonass (GLO): ~ 8.3 MHz BW (1597–1606 MHz) • BeiDou (BDS): 4.092 MHz BW (1559.05 – 1563.14 MHz) • Galileo (GAL): 4.092 MHz BW (centered on 1575.42 MHz)
Impedance	50Ω
Gain	1.5 dBi < Gain < 3 dBi
Amplification	18 dB < Gain < 21 dB
Supply Voltage	3.1 V
Current consumption	20 mA Typical

4.2.6 GNSS RF Front End Design(TBD)

The WM-H801UE contains an integrated LNA and pre-select SAW filter. This allows the module to work well with a passive GNSS antenna. If the antenna cannot be located near the WM-H801UE, then an active antenna (that is, an antenna with a low noise amplifier built in) can be used with an external dedicated power supply circuit. GNSS receive path uses either the dedicated GNSS connector or the shared Secondary #3 antenna connector.

5. Application Interface

5.1 Power Sources

5.1.1 Power Supply Requirements

Nominal supply voltage	3.3V
Supply voltage range	3.135V – 3.465V
Maximum ripple on module input supply	30 mV
Peak current consumption	3.3V @ 2A

5.1.2 Power Consumption(TBD)

Below table provides typical current consumption values of WM-H801UE for various operation modes.

Current Consumption

Mode	Average[Typ.]	Mode Description
IDLE Mode		
CFUN=1	TBD	No call connection

		USB2.0 is connected to a host
Power Saving Mode (PSMWDISACFG=1, W_DISABLE_N:Low)		
CFUN=4		Tx and Rx are disabled; module is not registered on the network (Flight mode)
CFUN=5		in standby mode
Operative Mode (NR-FR1)		
SA mode 1FR1(2T4R)	500mA	FR1 : BW100MHz, Full RB, UL:2x2 MIMO DL: 4x4 MIMO UL: 256QAM DL :256QAM UL:400Mbps DL:900Mbps

*3.3V / room temperature

5.2 Turn on and off Scenarios

5.2.1 Full_CARD_PWR_OFF_N

Pin	Signal	I/O	Function	Comment
Turn On/Off				
6	FULL_CARD_PWR_OFF_N	I	Module On/Off	1.8V/3.3V

FULL_CARD_POWER_OFF# signal is an Active Low input that is used to turn off the entire module. When the input signal is asserted high (≥ 1.19 V) the Module will be enabled. When the input signal is driven low signal (≤ 0.2 V), it will force the module to shut down.

The FULL_CARD_POWER_OFF# pin has internally pulled low with a weak pull-down 100 k Ω resistor.

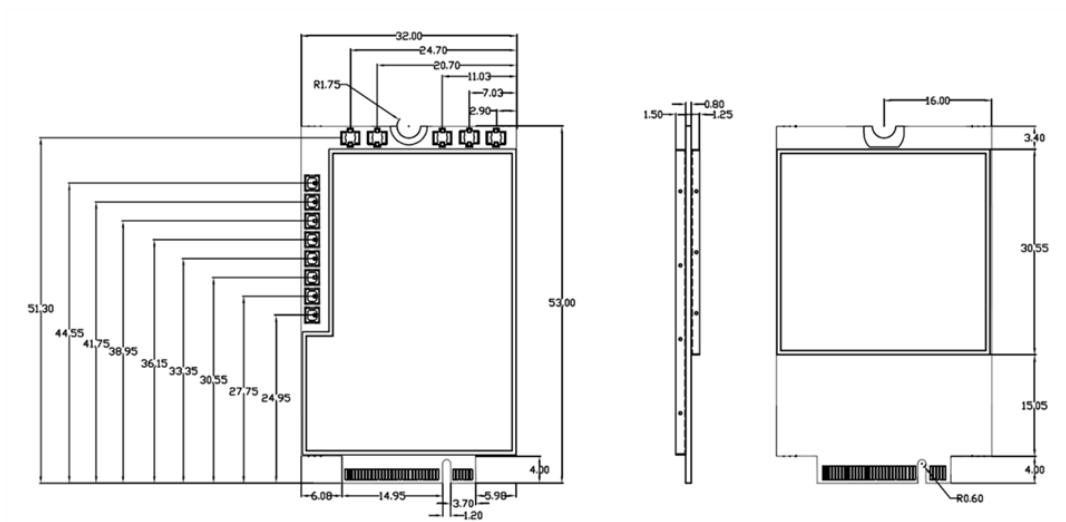
The input must be 3.3 V tolerant but can be driven by either 1.8 V or 3.3 V GPIO.

6. Mechanical Dimensions

6.1 Top and Bottom Views of the Module



6.2 Mechanical Dimensions of the Module



6.3 Module Stand-off(PAN NUT)

The modules will need a mechanical retention at the end of the board. The module specifies a 5.5 mm diameter Keep-out zone at the end for attaching a screw. This section provides a guideline for using a M2 x 0.4 mm screw with a shoulder stand-off.

6.3.1 Recommended Main Board Hole

The recommended plated-hole sizes for the main board are:

- Drill size 4.3 mm
- Finish size 4.2 $\pm$ 0.075 mm
- Pad size 6.5 mm

6.3.2 Electrical Ground Path

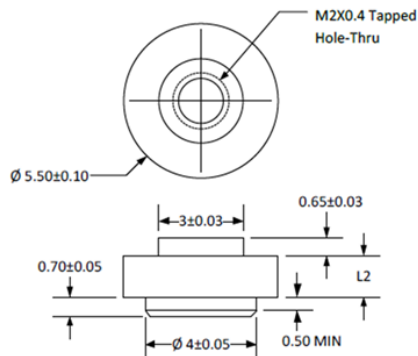
The module Stand-off and mounting screw also serve as part of the module Electrical Ground path.

The Stand-off should be connected directly to the ground plane on the platform. So that when the module is mounted and the mounting screw is screwed on to hold the module in place, this will make the electrical ground connection from the module to the platform ground plane.

6.3.3 Stand-off Guideline

A shoulder stand-off is a board-level SMT component that has a 2 x 0.4 thread. The height of the stand-off is determined by what connector is used.

* Our manual doesn't provide a flat stand-off



Connector Height Descriptor	L2
H3.2	1.45 ± 0.03
H4.2	2.45 ± 0.03

*L2 depends on your M.2 connector height.

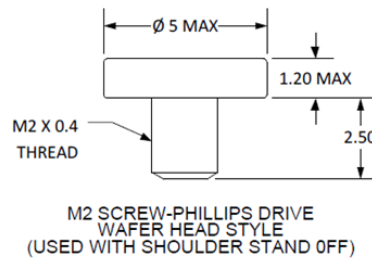
✓ Requirements for SMT

- Polyimide patch required for vacuum pick-up
- Minimum thermal conductivity of 50 W/(mK) or greater
- Material = Steel
- Finish = Matte tin, 1.2 microns minimum average
- Tape and reel

6.3.4 Screw Guideline

Screw consideration should be made to usage model. The tolerances of the connector, module and stand-off allow for a gap to exist between the seating plane and the contact.

the guidelines of a wafer-head style M2 screw are provided. This screw is intended for use only with the shouldered stand-off. The length is to be determined by the system design; 2 mm length supports L2=1.45 and 2.45 stand-off.



7. Label

7.1 Label



7.2 Label Notations

- Model No. WM-H801UE
- FCC ID : 2A9FK-WM-H801UE

9. FCC statements

FCC Part 15.19 Statements:

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.

FCC Part 15.21 statement

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Responsible Party Information

Supplier's Declaration of Conformity

47 CFR §2.1077 Compliance

Information Responsible Party –U.S. Contact Information

Celona Inc.

900 East Hamilton Ave, Suite 200, Campbell, CA, 95008

contact@rhodos.biz

+1 (408)-504-5487

FCC Part 15.105 statement

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.

2. Regulatory notice to host manufacturer see KDB Publication 996369 D04 for guidance.

This module has been granted modular approval as below listed FCC rule parts.

- FCC Rule parts 96

RF exposure considerations

The end manual should include regulatory information/warnings about:

- The module must be installed and operated with minimum distance of 20cm Between the antenna radiating structures and nearby persons.
- The module is classified as a mobile device for RF exposure purposes.
- The antenna(s) used for this module must not simultaneously with any other antenna or transmitter, except in accordance with FCC multiple transmitter product procedures.

As long as the three conditions above are followed, further FCC equipment authorizations may not be required. Refer to FCC publication 996369 D04 for guidance.

Antennas list

This module is certified with the following integrated antenna.

- Type: DIPOLE
- n48 Max. peak Antenna gain : 2.2 dBi

3. Label and compliance information

End Product Labeling

The module is labeled with its own FCC ID. If the FCC ID are 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. In that case, the final end product must be labeled in a visible area with the following:

Contains FCC ID: 2A9FK-WM-H801UE

Information on test modes and additional testing requirements

OEM integrator is still responsible for testing their end-product for any additional compliance required with this module installed (for example, digital device emissions, PC peripheral requirements, additional transmitter in the host, etc.).

Additional testing, Part 15 Subpart B disclaimer

The final host product also requires Part 15 subpart B compliance testing with the modular transmitter installed to be properly authorized for operation as a Part 15 digital device.