Ultra low power DASH7 Modem

868MHz / 915MHz

Applications

- Wireless sensor network
- Data acquisition equipment
- Security systems
- Industrial monitor and control
- Internet of things (IoT)

1 Introduction

Features

- Murata CMWX1ZZABZ-078 module with WizziLab Multimode stack Firmware
- Full DASH7 stack (D7A v1.2), optimized for power, targeted for battery powered sensor application.
- Integrated concurrent LoRaWAN stack
- Firmware Upgrade Over The Air (OTA)
- Connection to host application using standard UART link at 115200bps with DASH7 ALP command set.
- 868 MHz or 915 MHz ISM band operation
- Modulation schemes: 2-FSK, GFSK, LoRa
- Output power up to +18 5 dBm (at RF pin)
- Operates from a single 2.4V to 3.6V supply.
- Operating temperature: -40 °C to 85 °C

Description

- The WM205X is a fully integrated DASH7 modem operating in the 868 MHz and 915 MHz ISM bands
- FCC & CE/RED certified
- Compatible with D7A 1.2 specification (www.dash7-alliance.org)
- Controlled using an ALP command set over a serial link.
- Allows for bi-directional communication with battery operated sensor and actuators.
- WizziLab product line at www.wizzilab.com/products

Table of Contents

List of tables

List of figures

2 Hardware specification

2.1 Absolute maximum ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Min.	Typ.	Max.	Units
T_{STG}	Storage temperature range	-40	-	90	°C
V_{CC}	Supply voltage	-0.3	-	3.9	V
V_{IO}	I/O pin voltage	-0.3	-	3.9	V

2.2 Recommended operating conditions

Table 2. Recommended operating conditions

Symbol	Parameter	Min.	Typ.	Max.	Units
T_A	Operating ambient temperature range	-40	-	85	°C
V_{CC}	Operating supply voltage	2.2V(1)	3.0V	3.6	V

(1) 2.4V when operating at +18dBm

2.3 I/O operating characteristics

Table 3. I/O operating characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units
V_{IL}	I/O input low level voltage	-0.3	-	$0.3*V_{CC}$	V
V_{IH}	I/O input high level voltage	$0.7*V_{CC}$	-	4.0	V

2.4 Electrical Characteristics

Table 4. FSK/OOK Receiver Specification

Symbol	Description	Conditions	Min	Typ	Max	Unit
RFS_F_HF	LnaBoost is turned on	FDA = 5 kHz, BR = 4.8 kb/s		-117.5		dBm
IDDR	Supply current in Receive mode	LnaBoost Off, band 1		22		mA
		LnaBoost On, band 1		23		mA

Table 5. FSK/OOK Transmitter Specification

Symbol	Description	Conditions	Min	Typ	Max	Unit
RF_OP	RF output power in 50 ohms on RFO pin (High efficiency PA)	Programmable with steps	-5		14	dBm
RF_OPH	RF output power in 50 ohms on PA_BOOST pin(Regulated PA)	Programmable with 1 dB steps	2		18.5	dBm
ΔRF_ OPH_V	RF output power stability on PA_BOOST pin versus voltage supply.			+/-1		dB
ΔRF_T	RF output power stability versus temperature on PA_BOOST pin.	From T = -40 °C to +85 °C		+/-1.5		dB
IDDT	Supply current in Transmit Mode with impedance matching	RFOP = +20 dBm, on PA_BOOST		128		mA
		RFOP = +17 dBm, on PA_BOOST		106		mA
		RFOP = +14 dBm, on RFO_HF pin		47		mA
		RFOP = + 7 dBm, on RFO_HF pin		34		mA

LoRa Transceiver Specification

Conditions:
The table below gives the electrical specifications for the transceiver operating with LoRaTM modulation. Following conditions apply unless otherwise specified: Supply voltage = 3.3 V, Temperature = 25° C, FXOSC = 32 MHz, Error Correction Code (EC) = 4/5, Packet Error Rate (PER)= 1%, CRC on payload enabled, Payload length = 10 bytes. With matched impedances

Table 6. LoRa Receiver Specification

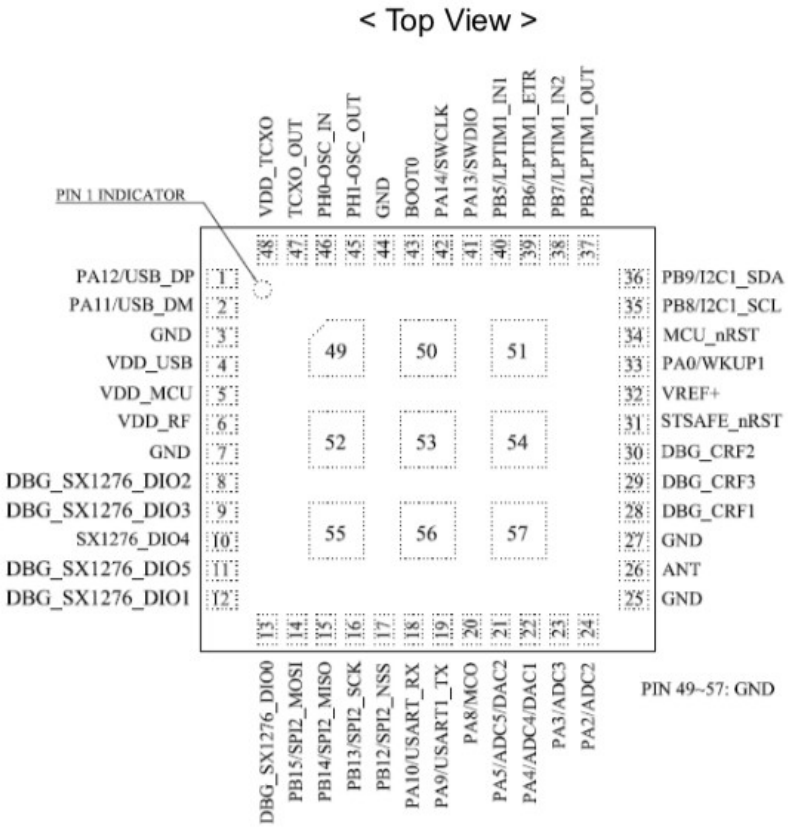
Symbol	Description	Conditions	Min	Typ	Max	Unit
IDDR_L	Supply current in receiver LoRa mode, LnaBoost off	Band 1, BW = 125 kHz		21.5		mA
		Band 1, BW = 250 kHz		22.2		mA
		Band 1, BW = 500 kHz		23.6		mA
RFS_L125_HF	RF sensitivity, Long-Range Mode, highest LNA gain, LnaBoost for Band1, using split Rx/Tx path 125 kHz bandwidth	SF = 6		-117.5		dBm
		SF = 7		-122.5		dBm
		SF = 8		-125.5		dBm
		SF = 9		-128.5		dBm
		SF = 10		-131.0		dBm
		SF = 11		-133.5		dBm
		SF = 12		-135.5		dBm
RFS_L250_HF	RF sensitivity, Long-Range Mode, highest LNA gain, LnaBoost for Band1, using split Rx/Tx path 250 kHz bandwidth	SF = 6		-114.0		dBm
		SF = 7		-119.0		dBm
		SF = 8		-122.0		dBm
		SF = 9		-125.0		dBm
		SF = 10		-127.5		dBm
		SF = 11		-130.0		dBm
		SF = 12		-133.0		dBm

Table 7. LoRa Transmitter Specification

Symbol	Description	Conditions	Min.	Typ	Max	Unit
IDDT_L	Supply current in transmitter mode	RFOP setting = 14 dBm		47		mA
		RFOP setting = 10 dBm		36		mA
IDDT_H_L	Supply current in transmitter mode	Using PA_BOOST pin RFOP setting = 20 dBm		128		mA

3 Hardware design

3.1 Pin assignment



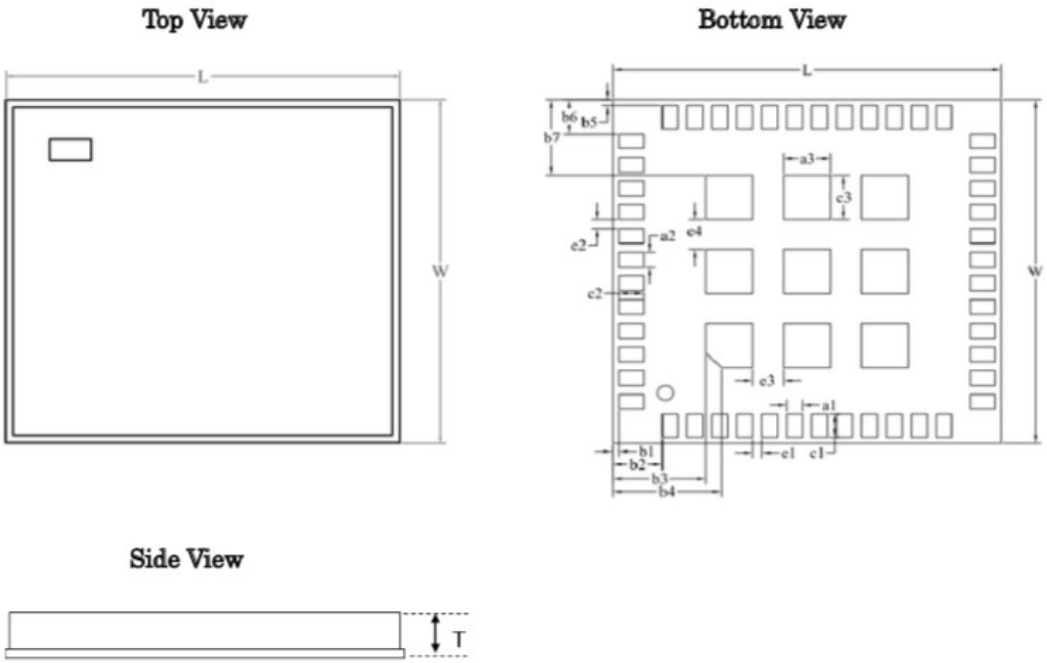
Pin NO.	Terminal Name	Type	Connection to IC terminal	Description
1	PA12/USB_DP	I/O	STM32L082_PA12	GPIO Mode:PA12.(Power supplied by VDD_USB) USB_DP
2	PA11/USB_DM	I/O	STM32L082_PA11	GPIO Mode:PA11,(Power supplied by VDD_USB) USB_DM
3	GND	Ground	-	Ground
4	VDD_USB	Power	-	Power supply for USB
5	VDD_MCU	Power	-	Power supply for MCU
6	VDD_RF	Power	-	Power supply for RF IC
7	GND	Ground	-	Ground

8	DBG_SX1276_DIO2	I/O	SX1276_DIO2	Debug pin for SX1276, customer cannot use it
9	DBG_SX1276_DIO3	I/O	SX1276_DIO3	Debug pin for SX1276, customer cannot use it
10	SX1276_DIO4	I/O	SX1276_DIO4	SX1276 DIO4. Possible to connect to Pin21 PA5 for future usage. Contact ST for further information
11	DBG_SX1276_DIO5	I/O	SX1276_DIO5	Debug pin for SX1276. Possible to connect to Pin22 PA4 for future usage. Contact ST for further information
12	DBG_SX1276_DIO1	I/O	SX1276_DIO1	Debug pin for SX1276, customer cannot use it
13	DBG_SX1276_DIO0	I/O	SX1276_DIO0	Debug pin for SX1276, customer cannot use it
14	PB15/SPI2_MOSI	I/O	STM32L082_PB15	GPIO Mode:PB15 SPI2_MOSI
15	PB14/SPI2_MISO	I/O	STM32L082_PB14	GPIO Mode:PB14 SPI2_ MISO
16	PB13/SPI2_SCK	I/O	STM32L082_PB13	GPIO Mode:PB13 SPI2_SCK
17	PB12/SPI2_NSS	I/O	STM32L082_PB12	GPIO Mode:PB12 SPI2_NSS
18	PA10/ USART1_RX	I/O	STM32L082_PA10	GPIO Mode:PA10 USART1_RX
19	PA9/USART1_TX	I/O	STM32L082_PA9	GPIO Mode:PA9 USART1_TX
20	PA8/MCO	I/O	STM32L082_PA8	GPIO Mode:PA8 MCO
21	PA5/ADC5/DAC2	I/O	STM32L082_PA5	GPIO Mode:PA5 COMP2_INM ADC_IN5 DAC_OUT2 Possible to connect to Pin10 for future usage. Contact ST for more information
22	PA4/ADC4/DAC1	I/O	STM32L082_PA4	GPIO Mode:PA4 COMP2_INM ADC_IN4 DAC_OUT1 Possible to connect to Pin11 for future usage. Contact ST for more information
23	PA3/ADC3	I/O	STM32L082_PA3	GPIO Mode:PA3 COMP2_ INP ADC_IN3 USART2_RX
24	PA2/ADC2	I/O	STM32L082_PA2	GPIO Mode:PA2 COMP2_OUT ADC_IN2 USART2_TX
25	GND	Ground	-	Ground
26	ANT	A,I/O	-	Transmit / Receive Antenna

27	GND	Ground	-	Ground
28	DBG_CRF1	I/O	STM32L082_PA1	Debug pin. Cannot be used as GPIO
29	DBG_CRF3	I/O	STM32L082_PC1	Debug pin. Cannot be used as GPIO
30	DBG_CRF2	I/O	STM32L082_PC2	Debug pin. Cannot be used as GPIO
31	STSAFE_nRST	I	-	Reset for Security IC
32	VREF+	Power	-	Reference Voltage For ADC and DAC
33	PA0/WKUP1	I/O	STM32L082_PA0	GPIO Mode:PA0 COMP1_OUT ADC_IN0
34	MCU_nRST	I	STM32L082_ nRST	NRST
35	PB8/I2C1_SCL	I/O	STM32L082_ PB8	GPIO Mode:PB8 I2C mode: SCL
36	PB9/I2C1_SDA	I/O	STM32L082_ PB9	GPIO Mode: PB9 I2C mode: SDA
37	PB2/LPTIM1_OUT	I/O	STM32L082_PB2	GPIO Mode:PB2 LPTIM1_OUT
38	PB7/LPTIM1_IN2	I/O	STM32L082_PB7	GPIO Mode:PB7 LPTIM1_IN2
39	PB6/LPTIM1_ETR	I/O	STM32L082_ PB6	GPIO Mode:PB6 LPTIM1_ETR
40	PB5/LPTIM1_IN1	I/O	STM32L082_ PB5	GPIO Mode:PB5 LPTIM1_IN1
41	PA13/SWDIO	I/O	STM32L082_PA13	GPIO Mode:PA13 SWDIO LPUART1_RX
42	PA14/SWCLK	I/O	STM32L082_PA14	GPIO Mode:PA14 SWCLK LPUART1_TX
43	BOOT0	I	STM32L082_BOOT0	Boot Option
44	GND	Ground	-	-
45	PH1-OSC_OUT	I/O	STM32L082_PH1	GPIO Mode:PH1 High-speed external clock OSC output
46	PH0-OSC_IN	I/O	STM32L082_PH0	GPIO Mode:PH0 High-speed external clock OSC input
47	TCXO_OUT	O	-	Internal TCXO output
48	VDD _TCXO	Power	-	Power supply for the TCXO IC
49~57	GND	Ground	-	Ground

Table 8. Pin assignment

3.2 Mechanical Data



Dimension (Unit: mm)

Mark	Dimension	Mark	Dimension	Mark	Dimension
L	12.5±0.20	W	11.6±0.20	T	1.76 max
a1	0.50±0.10	a2	0.50±0.10	a3	1.50±0.10
b1	0.20±0.15	b2	1.60±0.15	b3	3.00±0.15
b4	3.50±0.15	b5	0.20±0.15	b6	1.15±0.15
b7	2.55±0.15	c1	0.80±0.10	c2	0.80±0.10
c3	1.50±0.10	e1	0.30±0.10	e2	0.30±0.10
e3	1.00±0.10	e4	1.00±0.10		

3.3 Typical application circuit

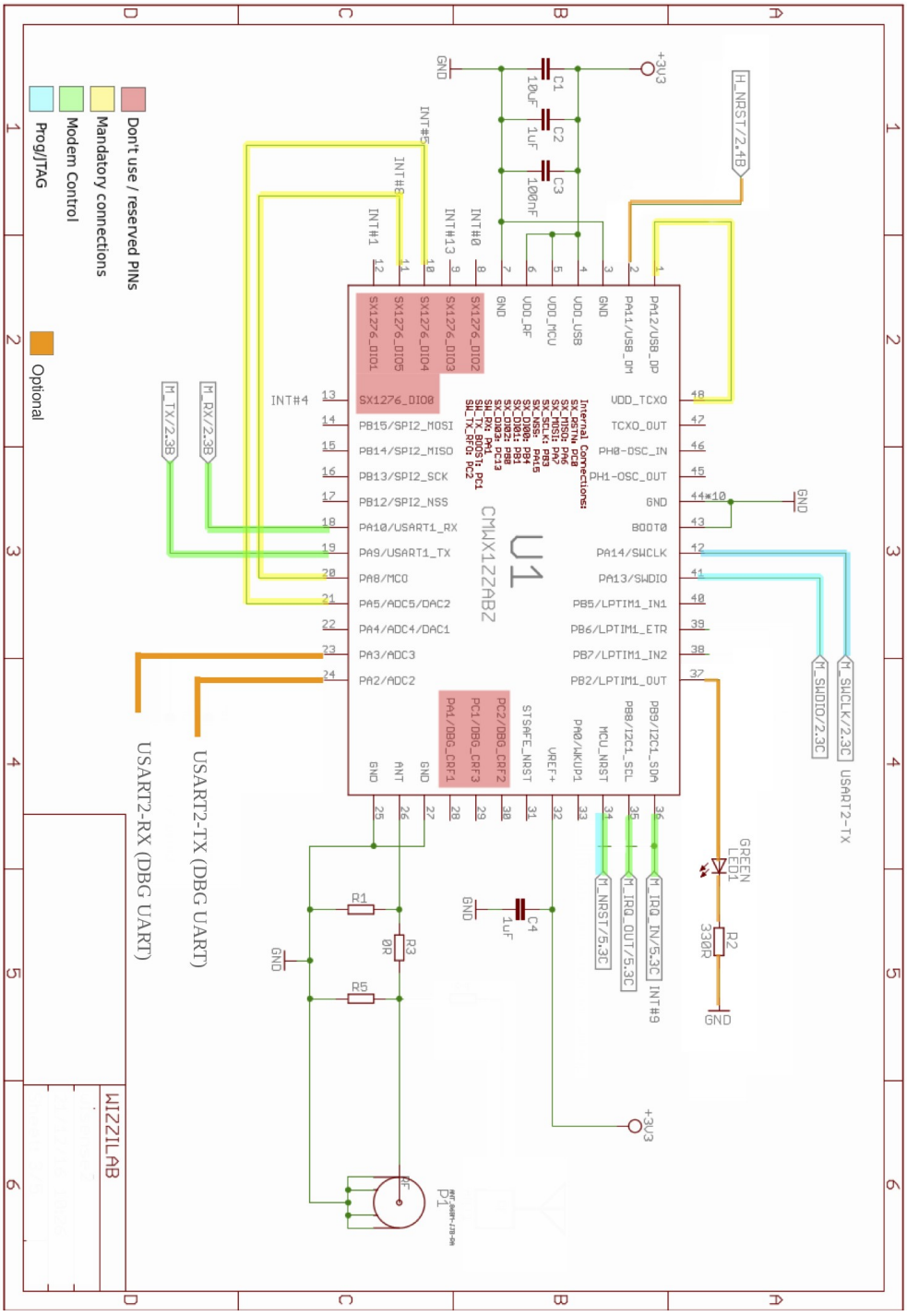
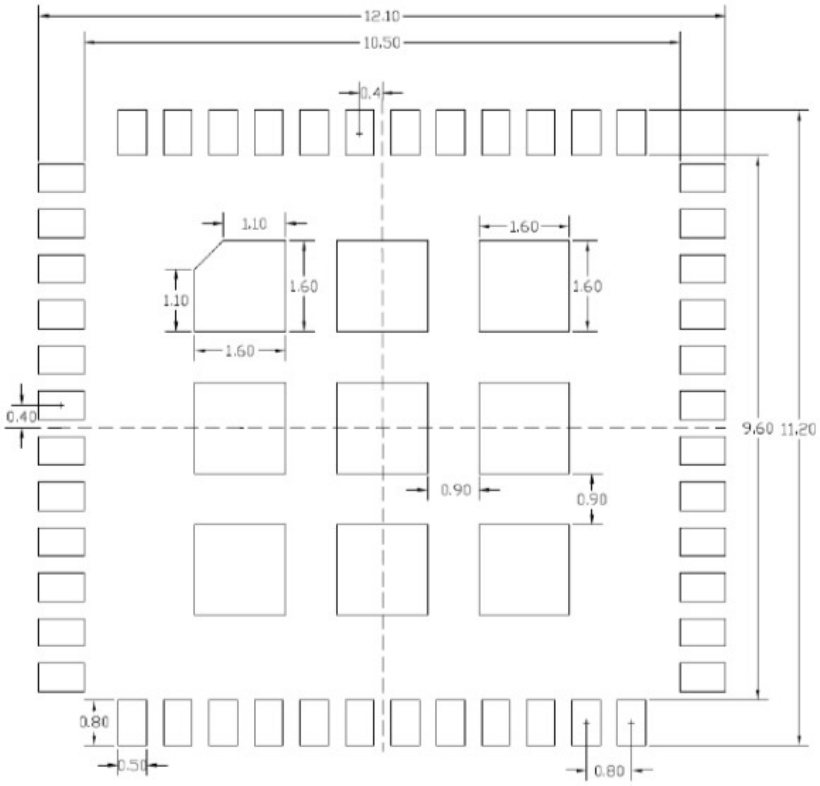


Figure 1. Typical application circuit

3.4 Recommended Land Pattern

All dimensions are in millimeters ±0.1mm



4 Ordering information

Contact us at : contact@wizzilab.com

Or visit our website: http://www.wizzilab.com/

5 Regulatory Statements

5.1 FCC 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.

The module is limited to OEM installation ONLY.

The OEM integrator is responsible for ensuring that the end-user has no manual instruction to remove or install module.

Therefore, the final host product must be tested for confirmation that the installation for the module into the host is in compliance with regulations of FCC. Specially, if an antenna other than the model documented in the Filing is used, a Class 2 Permissive Change must be filed with the FCC.

Changes or modifications not expressly approved by WIZZILAB could void the user’s authority to operate the equipment.

The module is for use with external antenna ONLY. The certified antennas include:
(1) ½ Wave Antenna with maximum gain 2.2dBi.
(2) ¼ Wave Antenna with maximum gain -1.3dBi.

This module has been approved by FCC to operate with the antenna types above with the maximum gain at at the antenna feed of 13dBm. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

“IMPORTANT NOTE: To comply with FCC RF exposure compliance requirements, the antenna used for this transmitter must not be colocated or operating in conjunction with any other antenna or transmitter.”

Note: This product 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 product 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 product 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.

Please take attention that changes or modification not expressly approved by the party responsible for compliance could void the user’s authority to operate the equipment.

This equipment should be installed and operated with a minimum distance 20cm between the radiator and your body.

When the FCC ID 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 be use wording ”Contains transmitter module FCC ID: 2ARZVWM” or “Contains FCC ID: 2ARZVWM”.

6 Revision history

Table 9. Document revision history

Date	Revision	Changes
12/06/2018	1.0	Document creation