

UWB+BLE Combo Module Data Sheet

Decawave QM33120W Chipset and
Nordic nRF52840 Chipset
for 802.15.4 UWB + Bluetooth 5.2

Design Name: Type2AB
MP P/N : LBUA5QJ2AB-828
Sample P/N : LBUA5QJ2AB-828SMP

This Datasheet is preliminary version, and subject to change without notice

Revision History

Revision Code	Date	Description	Comments
-	June 8 th 2021	First Issue	
A	Feb 9 th 2022	Update DC/RF characteristics Update Certificate information	
B	Feb 16 th 2022	Update Block Diagram Update Dimensions Marking and Configurations DC /RF characteristics	
C	July 12 th 2022	Update Certification information Update PIN Layout and PIN descriptions	
D	April. 21st. 2023	Fix PIN descriptions in <i>11. Reference Circuit</i> Update <i>4.1 Radio Certification</i> Add <i>Section 15</i> and <i>Appendix</i>	
E	July 10 th 2023	Updated <i>4.1 Radio Certification</i> with new information of Japan TELEC certification	
F	Sep. 11 th 2023	Updated antenna information in section 15.3. Antenna Application Guidance.	

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 Please be aware that an important notice concerning availability, standard warranty and use in critical applications of Murata products and disclaimers thereto appears at the end of this specification sheet.

1. Scope

This specification is applied to the IEEE802.15.4-2015/IEEE802.15.4z(BPRF mode) UWB + Bluetooth 5.2 combo module.

- Interface : USB, UART, SPI, I2C
- IC P/N : Qorvo / QM33120W
: Nordic / nRF52840
- Reference Clock : Reference clock embedded
- Weight : 0.31g
- Package : Resin mold
- RoHS : This component can meet with RoHS compliance.
- MSL : Level 3

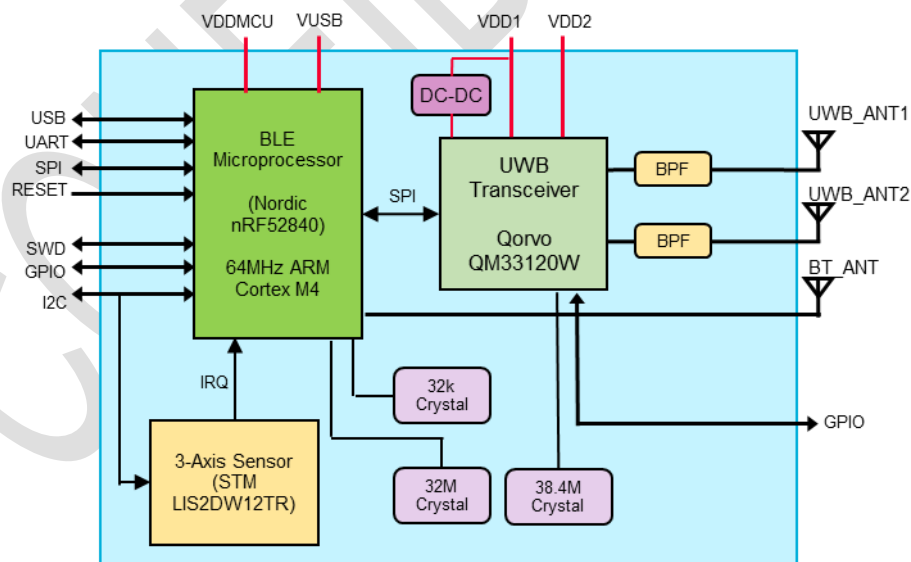
*This product is moisture sensitive. Please check the detail in 13.1 Storage Condition section.

2. Part Number

Ordering Part Number	Description
LBUA5QJ2AB-828SMP	In case of sample order
LBUA5QJ2AB-828	Mass Produced Product
LBUA5QJ2AB-828EVB	Evaluation board

"Type2AB" is design name of this module. Design name may be used in certification test report.

3. Block Diagram



4. Certification Information

4.1. Radio Certification

USA/Canada

FCC ID: VPYLB2AB

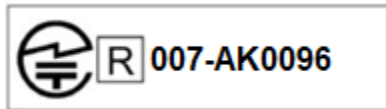
IC: 772C-LB2AB

*Please follow the guide in section 15.

Europe

Model No: LBUA5QJ2AB

Japan



NOTE: This certificate matches the condition that the maximum TX antenna gain is 5.00 dBi. Refer to test report No. 4789832012 for details.



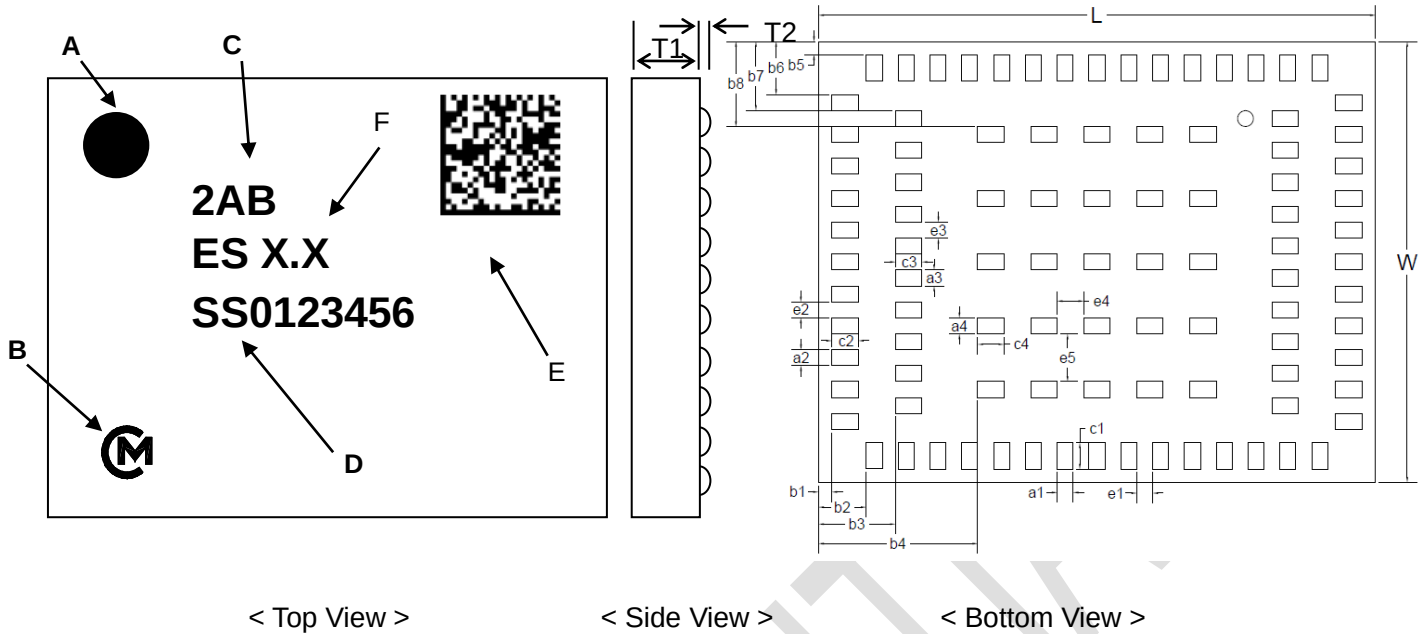
NOTE: This certificate matches the condition that the maximum TX antenna gain is 3.00 dBi. Refer to test report No. 4790916114 for details.

4.2. Bluetooth® Qualification

QDID: 138767

5. Dimensions, Marking and Terminal Configurations

5.1. Dimensions

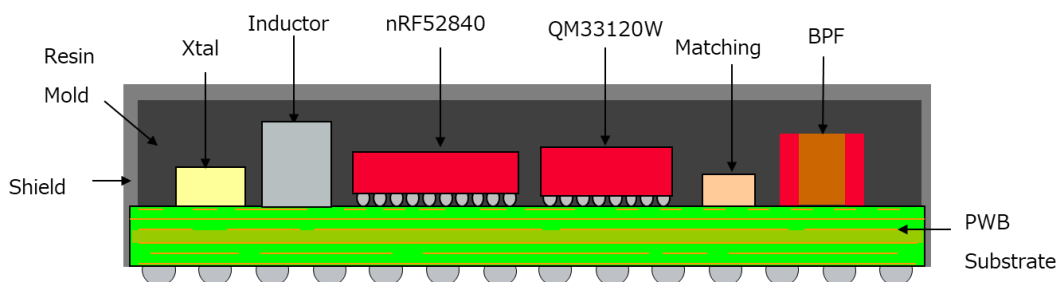


Marking	Meaning
A	Pin 1 Marking
B	Murata Logo
C	Module Type
D	Inspection Number
E	2D Code (Internal use)
F	ES Ver. (only ES stage)

Mark	Dimensions	Mark	Dimensions	Mark	Dimensions
L	10.50±0.10	W	8.30±0.10	T1	1.44 max
a1	0.30±0.10	a2	0.30±0.10	a3	0.30±0.10
a4	0.30±0.10	b1	0.30±0.15	b2	0.90±0.15
b3	1.50±0.15	b4	3.025±0.15	b5	0.30±0.15
b6	1.00±0.15	b7	1.30±0.15	b8	1.60±0.15
c1	0.45±0.10	c2	0.45±0.10	c3	0.45±0.10
c4	0.45±0.10	e1	0.30±0.10	e2	0.30±0.10
e3	0.30±0.10	e4	0.55±0.10	e5	0.90±0.10
T2	0.045±0.025				

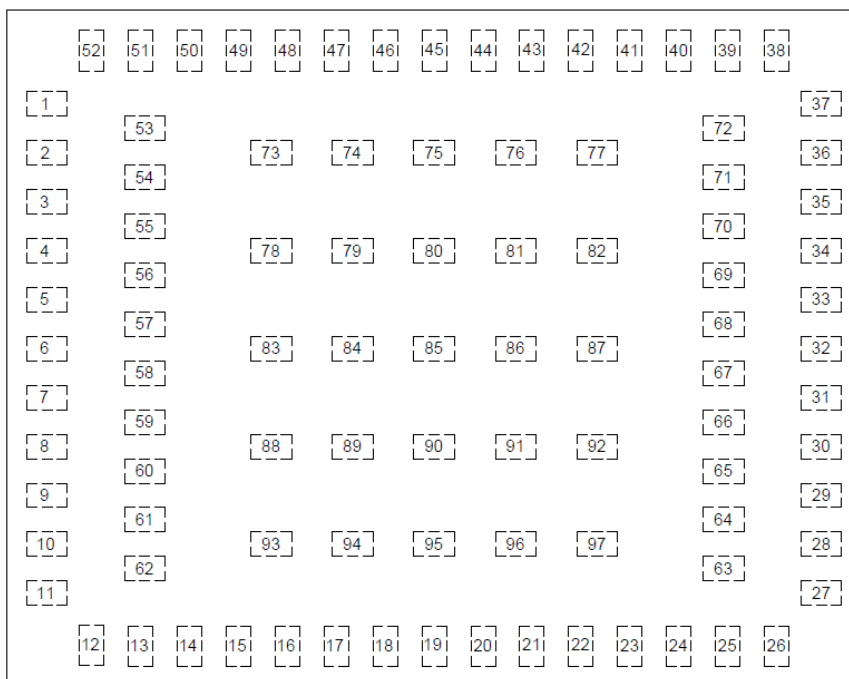
(unit : mm)

Structure



5.2. Pin Layout and PIN Descriptions

<TOP View>



No.	Terminal Name	No.	Terminal Name	No.	Terminal Name	No.	Terminal Name
1	GND	21	P1.06	41	GND	61	P1.14
2	P0.05/AIN3	22	P1.05	42	Reserved	62	GND
3	P0.04/AIN2	23	GND	43	VDD2	63	DW_GPIO0
4	P0.27	24	SWDCLK	44	VDD1	64	DW_GPIO1
5	P0.26	25	SWDIO	45	VUSB	65	DW_GPIO2
6	P0.30/AIN6	26	GND	46	VDDMCU	66	DW_GPIO3
7	P0.28/AIN4	27	ANT2	47	GND	67	DW_GPIO4
8	P0.02/AIN0	28	GND	48	P1.08	68	DW_GPIO6
9	P0.03/AIN1	29	P0.22	49	P1.09	69	DW_GPIO5
10	P1.13	30	P0.19	50	P0.08	70	Reserved
11	P1.12	31	GND	51	P0.07	71	Reserved
12	P1.11	32	DW_GPIO7	52	P0.06	72~97	GND
13	P1.10	33	P0.24	53	GND		
14	P0.10/NFC2	34	P0.21	54	P0.12		
15	P0.09/NFC1	35	P0.18/nRESET	55	P0.11		
16	GND	36	GND	56	P0.13		
17	BT_ANT	37	ANT1	57	P0.14		
18	GND	38	GND	58	P0.31/AIN7		
19	GND	39	USB_D+	59	P0.29/AIN5		
20	P1.07	40	USB_D-	60	P1.15		

Pin NO.	Terminal Name	Connection to IC terminal	Description	Recommended usage
1	GND	-	Ground	
2	P0.05/AIN3	P0.05/AIN3	General purpose I/O Analog input	
3	P0.04/AIN2	P0.04/AIN2	General purpose I/O Analog input	
4	P0.27	P0.27	General purpose I/O	
5	P0.26	P0.26	General purpose I/O	
6	P0.30/AIN6	P0.30/AIN6	General purpose I/O Analog input	Standard drive, low frequency I/O only
7	P0.28/AIN4	P0.28/AIN4	General purpose I/O Analog input	Standard drive, low frequency I/O only
8	P0.02/AIN0	P0.02/AIN0	General purpose I/O Analog input	Standard drive, low frequency I/O only
9	P0.03/AIN1	P0.03/AIN1	General purpose I/O Analog input	Standard drive, low frequency I/O only
10	P1.13	P1.13	General purpose I/O	Standard drive, low frequency I/O only
11	P1.12	P1.12	General purpose I/O	Standard drive, low frequency I/O only
12	P1.11	P1.11	General purpose I/O	Standard drive, low frequency I/O only
13	P1.10	P1.10	General purpose I/O	Standard drive, low frequency I/O only
14	P0.10/NFC2	P0.10/NFC2	General purpose I/O NFC antenna connection	Standard drive, low frequency I/O only
15	P0.09/NFC1	P0.09/NFC1	General purpose I/O NFC antenna connection	Standard drive, low frequency I/O only
16	GND	GND	Ground	
17	BT_ANT	BT_ANT	RF port for BT antenna	
18	GND	GND	Ground	
19	GND	GND	Ground	
20	P1.07	P1.07	General purpose I/O	Standard drive, low frequency I/O only
21	P1.06	P1.06	General purpose I/O	Standard drive, low frequency I/O only
22	P1.05	P1.05	General purpose I/O	Standard drive, low frequency I/O only
23	GND	GND	Ground	
24	SWDCLK	SWDCLK	Serial wire debug clock input for debug and programming	
25	SWDIO	SWDIO	Serial wire debug I/O for debug and programming	

Pin NO.	Terminal Name	Connection to	Description	Recommended usage
		IC terminal		
26	GND	GND	Ground	
27	ANT2	ANT2	RF port for UWB antenna 2	PDoA option, in non PDoA application, it should be grounded with 50 Ω
28	GND	GND	Ground	
29	P0.22	P0.22/ STMLIS2DW I2C_SDA	General purpose I/O	I2C_SDA
30	P0.19	P0.19/ STMLIS2DW I2C_SCL	General purpose I/O	I2C_SCL
31	GND	GND	Ground	
32	DW_GPIO7	QM33120W GPIO7	General purpose I/O of QM33120W	Left open
33	P0.24	P0.24	General purpose I/O	
34	P0.21	P0.21	General purpose I/O	
35	P0.18/nRESET	P0.18/nRESET	General purpose I/O	
			Configurable as pin reset	
36	GND	GND	Ground	
37	ANT1	ANT1	RF port for UWB antenna 1	
38	GND	GND	Ground	
39	USB_D+	D+	USB D+	USB
40	USB_D-	D-	USB D-	USB
41	GND	GND	Ground	
42	Reserved	-		Left open
43	VDD2	QM33120W VDD2	Power Supply(2.5~3.6V) for QM33120W	
44	VDD1	QM33120W VDD1	Main Power Supply(2.5~3.6V) for QM33120W, should be always ON	
45	VUSB	VBUS	Power Supply(4.4~5.5V) for MCU USB 3.3 V regulator	Left open if USB interface is not used.
46	VDDMCU	VDD and VDDH	Main Power Supply(2.5~3.6V) for MCU	
47	GND	GND	Ground	
48	P1.08	P1.08	General purpose I/O	
49	P1.09	P1.09/TRACEDATA3	General purpose I/O	
			Trace buffer TRACEDATA[3]	
50	P0.08	P0.08	General purpose I/O	UART_RX
51	P0.07	P0.07/TRACECLK	General purpose I/O	UART_TX
			Trace buffer clock	
52	P0.06	P0.06	General purpose I/O	
53	GND	GND	Ground	

Pin NO.	Terminal Name	Connection to	Description	Recommended usage
		IC terminal		
54	P0.12	P0.12/TRACEDATA1	General purpose I/O	
			Trace buffer TRACEDATA[1]	
55	P0.11	P0.11/TRACEDATA2	General purpose I/O	
			Trace buffer TRACEDATA[2]	
56	P0.13	P0.13	General purpose I/O	
57	P0.14	P0.14	General purpose I/O	
58	P0.31/AIN7	P0.31/AIN7	General purpose I/O	
			Analog input	
59	P0.29/AIN5	P0.29/AIN5	General purpose I/O	
			Analog input	
60	P1.15	P1.15	General purpose I/O	Standard drive, low frequency I/O only
61	P1.14	P1.14	General purpose I/O	Standard drive, low frequency I/O only
62	GND	GND	Ground	
63	DW_GPIO0	QM33120W GPIO0	General purpose I/O of QM33120W	Left open
64	DW_GPIO1	QM33120W GPIO1	General purpose I/O of QM33120W	Left open
65	DW_GPIO2	QM33120W GPIO2	General purpose I/O of QM33120W	Left open
66	DW_GPIO3	QM33120W GPIO3	General purpose I/O of QM33120W	Left open
67	DW_GPIO4	QM33120W GPIO4	General purpose I/O of QM33120W	Left open
68	DW_GPIO6	QM33120W GPIO6	General purpose I/O of QM33120W	Left open
69	DW_GPIO5	QM33120W GPIO5	General purpose I/O of QM33120W	Left open
70	Reserved	-	-	Left open
71	Reserved	-	-	Left open
72~97	GND	GND	Ground	

Note:

1. For more information on standard drive, see GPIO — General purpose input/output in nRF52840 datasheet. Low frequency I/O is signals with a frequency up to 10 kHz.
2. GPIO pins are to be left OPEN if not used.

6. Rating

Parameter		Min	Max	Unit
Storage Temperature		-40	85	°C
Supply Voltage	VDD1	-0.3	4	V
	VDD2	-0.3	4	V
	VUSB	-0.3	5.8	V
	VDDMCU	-0.3	3.9	V

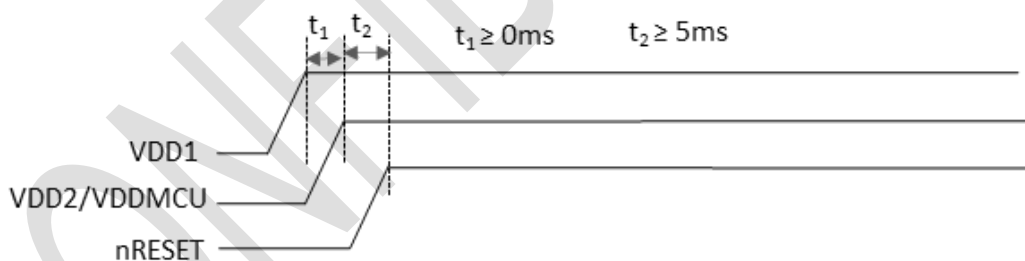
* Stresses in excess of the absolute ratings may cause permanent damage. Functional operation is not implied under these conditions. Exposure to absolute ratings for extended periods of time may adversely affect reliability. No damage assuming only one parameter is set at limit at a time with all other parameters are set within operating condition.

7. Operating Condition

Parameter		Min	Typ	Max	Unit
Storage Temperature Range		-40	25	85	°C
Supply Voltage	VDD1	2.5	3.0	3.6	V
	VDD2	2.5	3.0	3.6	V
	VUSB	4.35	5.0	5.5	V
	VDDMCU	2.5	3.0	3.6	V

8. Power Up Sequence

8.1. Power Up Sequence



9. DC / RF Characteristics

Conditions : 25deg.C, VDD1,VDD2 and VDDMCU = 3.0V

9.1. Current consumption

Items	Min.	Typ.	Max.	Unit
Supply current DEEP Sleep mode QM33120W: Deep sleep nRF52840: System OFF		560		nA
Supply current DEEP Sleep mode QM33120W: Deep sleep nRF52840: System ON, RTC and Sensor are disabled		2.8		uA
Supply current DEEP sleep mode QM33120W: Deep sleep nRF52840: System ON, RTC and Sensor operational, all other peripherals in lowest power consumption mode.		4.0		uA
Supply current IDLE-RC mode QM33120W: IDLE-RC mode nRF52840: a wake.		8.4		mA
Supply current INIT -RC mode QM33120W INIT -RC mode nRF52840 awake		4.4		mA
Peak current continuous TX/RX				
TX CH5(nominal power@-41.3dBm/MHz)		41.9		mA
TX CH5(maximum power@-33dBm/MHz)		54.8		mA
TX CH9(nominal power@-41.3dBm/MHz)		50.8		mA
TX CH9(maximum power@-35dBm/MHz)		60.8		mA
RX CH5		51.6		mA
RX CH9		61.2		mA

9.2. Receiver Characteristics (UWB)

Items	Min.	Typ.	Max.	Unit
Frequency range	6000		8500	MHz
Center Frequency Channel 5		6489.6		MHz
Center Frequency Channel 9		7987.2		MHz
Channel bandwidths		499.2		MHz

Minimum Input Level Sensitivity

Test conditions of sensitivity measurements	
Frequency range	Value
Supply voltage	3.0V
PRF	64MHz
PHR rate (of data packets)	850Kbps
Payload length (of data packets)	20 bytes
Preamble Code	9
Preamble length (symbols)	64
STS length (symbols)	n/a
SFD type	IEEE 802.15.4z defined 8-symbol SFD
Carrier frequency offset	±10 ppm

Data Rate 850 kbps (PER ≤ 1%)		T.B.D.	T.B.D.	dBm/500MHz
Data Rate 6.8 Mbps (PER ≤ 1%) CH5		-89	-86	dBm/500MHz
Data Rate 6.8 Mbps (PER ≤ 1%) CH9		-88.5	-85.5	

9.3. Transmitter Characteristics (UWB)

Items		Min.	Typ.	Max.	Unit
Frequency range		6250		8250	MHz
Center Frequency Channel 5			6489.6		
Center Frequency Channel 9			7987.2		
Channel bandwidths			499.2		MHz
Output Power spectral density (programmable)*1				-41	dBm/MHz
Output Chanel Power			-18.5		dBm
Output Power variation with temperature	5CH		0.01		dB/°C
	9CH		0.02		
Output Power variation with voltage			0		dB/V

*1 If using the pre-loaded embedded firmware of the 2AB module, otherwise see the DW3000 datasheet.

9.4. DC/RF Characteristics for Bluetooth (LE)

Items	Contents			
Bluetooth specification (power class)	Version 5.0(LE)			
Channel frequency (spacing)	2402 to 2480 MHz (2MHz)			
Number of RF Channel	40			
Data Rate	2Mbps			
Item / Condition	Min.	Typ.	Max.	Unit
Center Frequency	2402	-	2480	MHz
Channel Spacing	-	2	-	MHz
Number of RF channel	-	40	-	-
Output power	-20	-	8	dBm
Modulation Characteristics				
1) $\Delta f_{1\text{avg}}$	450	-	550	kHz
2) $\Delta f_{2\text{max}}$ (at 99.9%)	370	-	-	kHz
3) $\Delta f_{2\text{avg}} / \Delta f_{1\text{avg}}$	0.8	-	-	-
Carrier frequency offset and drift				
1) Frequency offset	-	-	150	kHz
2) Frequency drift	-	-	50	kHz
3) Drift rate	-	-	20	kHz
Receiver sensitivity (PER < 30.8%)	-	-92	-70	dBm
Maximum received signal strength (PER< 0.1%)	0	-	-	dBm
PER Report Integrity (-30dBm input)	50	-	65.4	%

Items	Contents			
Bluetooth specification (power class)	Version 5.0(LE)			
Channel frequency (spacing)	2402 to 2480 MHz (2MHz)			
Number of RF Channel	40			
Data Rate	1 Mbps			
Item / Condition	Min.	Typ.	Max.	Unit
Center Frequency	2402	-	2480	MHz
Channel Spacing	-	2	-	MHz
Number of RF channel	-	40	-	-
Output power	-20	-	8	dBm
Modulation Characteristics				
1) $\Delta f_{1\text{avg}}$	225	-	275	kHz
2) $\Delta f_{2\text{max}}$ (at 99.9%)	185	-	-	kHz
3) $\Delta f_{2\text{avg}} / \Delta f_{1\text{avg}}$	0.8	-	-	-
Carrier frequency offset and drift				
1) Frequency offset	-	-	150	kHz
2) Frequency drift	-	-	50	kHz
3) Drift rate	-	-	20	kHz
Receiver sensitivity (PER < 30.8%)	-	-94	-70	dBm
Maximum received signal strength (PER< 0.1%)	0	-	-	dBm
PER Report Integrity (-30dBm input)	50	-	65.4	%

Items	Contents			
Bluetooth specification (power class)	Version 5.0(LE)			
Channel frequency (spacing)	2402 to 2480 MHz (2MHz)			
Number of RF Channel	40			
Data Rate	500 Kbps			
Item / Condition	Min.	Typ.	Max.	Unit
Center Frequency	2402	-	2480	MHz
Channel Spacing	-	2	-	MHz
Number of RF channel	-	40	-	-
Output power	-20	-	8	dBm
Modulation Characteristics				
1) $\Delta f_{1\text{avg}}$	-	-	-	kHz
2) $\Delta f_{2\text{max}}$ (at 99.9%)	-	-	-	kHz
3) $\Delta f_{2\text{avg}} / \Delta f_{1\text{avg}}$	-	-	-	-
Carrier frequency offset and drift				
1) Frequency offset	-	-	-	kHz
2) Frequency drift	-	-	-	kHz
3) Drift rate	-	-	-	kHz
Receiver sensitivity (PER < 30.8%)	-	-	-70	dBm
Maximum received signal strength (PER< 0.1%)	0	-	-	dBm
PER Report Integrity (-30dBm input)	50	-	65.4	%

Items	Contents			
Bluetooth specification (power class)	Version 5.0(LE)			
Channel frequency (spacing)	2402 to 2480 MHz (2MHz)			
Number of RF Channel	40			
Data Rate	125 Kbps			
Item / Condition	Min.	Typ.	Max.	Unit
Center Frequency	2402	-	2480	MHz
Channel Spacing	-	2	-	MHz
Number of RF channel	-	40	-	-
Output power	-20	-	8	dBm
Modulation Characteristics				
1) $\Delta f_{1\text{avg}}$	225	-	275	kHz
2) $\Delta f_{2\text{max}}$ (at 99.9%)	185	-	-	kHz
3) $\Delta f_{2\text{avg}} / \Delta f_{1\text{avg}}$	-	-	-	-
Carrier frequency offset and drift				
1) Frequency offset	-	-	150	kHz
2) Frequency drift	-	-	50	kHz
3) Drift rate	-	-	19.2	kHz
Receiver sensitivity (PER < 30.8%)	-	-103	-82	dBm
Maximum received signal strength (PER< 0.1%)	0	-	-	dBm
PER Report Integrity (-30dBm input)	50	-	65.4	%

Technical drawing of a rectangular floor plan. The overall dimensions are 9.90 (width) by 7.70 (depth). The drawing shows a central area with a grid of rooms, surrounded by a perimeter of rooms. Key dimensions and features include:

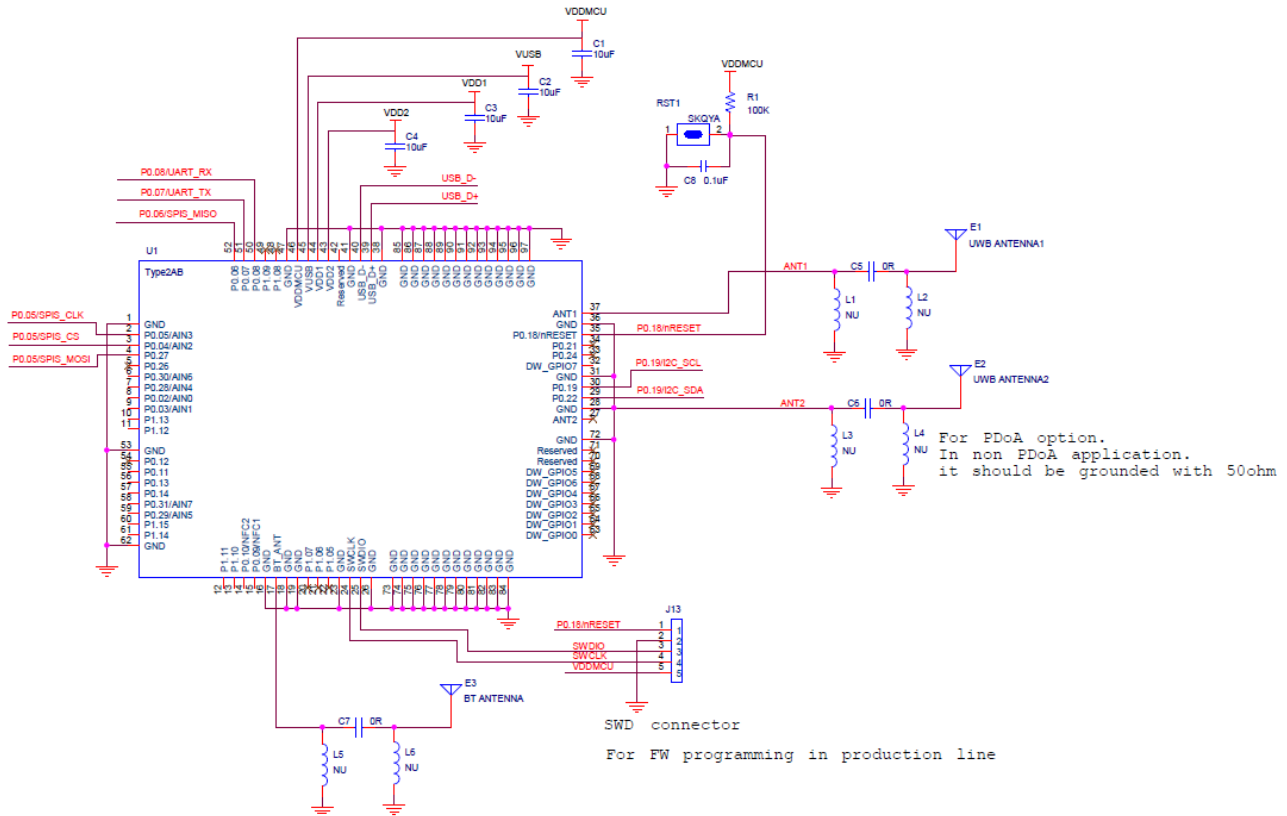
- Overall width: 9.90
- Overall depth: 7.70
- Internal width (excluding perimeter): 9.00
- Internal depth (excluding perimeter): 7.50
- Perimeter room width: 0.30
- Perimeter room depth: 0.30
- Central room width: 0.90
- Central room depth: 0.55
- Central room offset: 0.15

Note:

This land pattern is for reference purpose only.

Consult your manufacturing group to ensure your company's manufacturing guidelines are met.

11. Reference Circuit

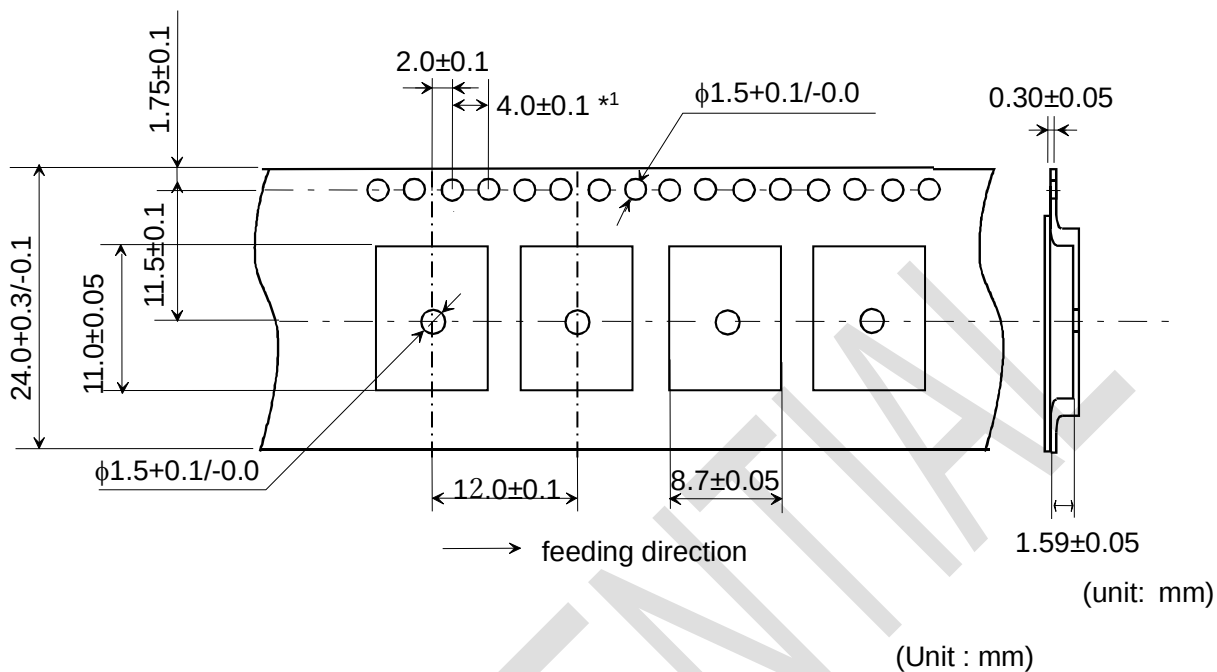


Notes:

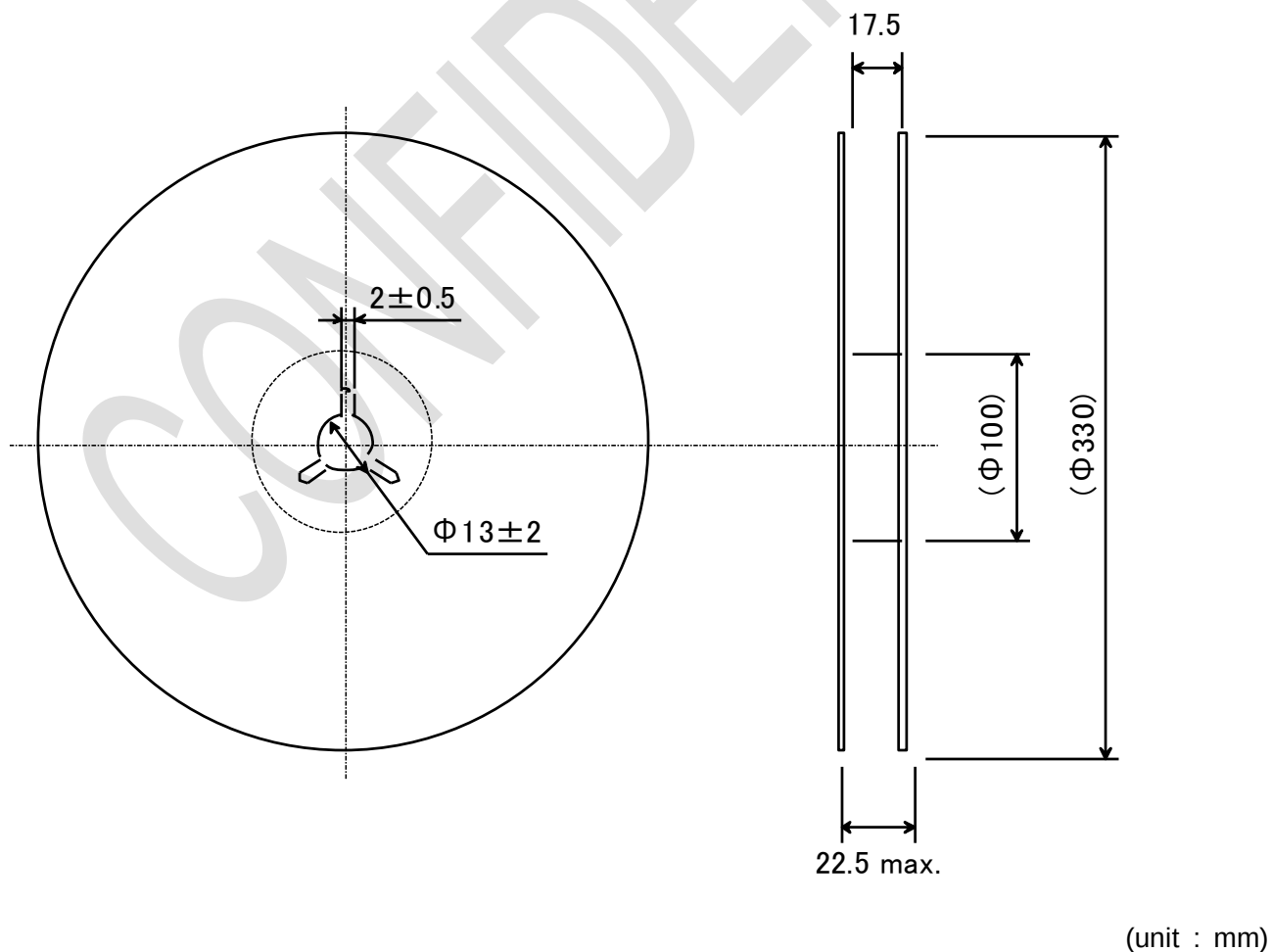
- 1) The UART, SPI and I2C interface definition in circuit above is based on 2AB test FW configuration. These interfaces can be mapped to other physical pins according to customer FW configuration.
- 2) If don't use USB interface, please left VUSB, USB_D+ and USB_D- open.

12. Tape and Reel Packing

(1) Dimension of Tape



(2) Dimensions of Reel



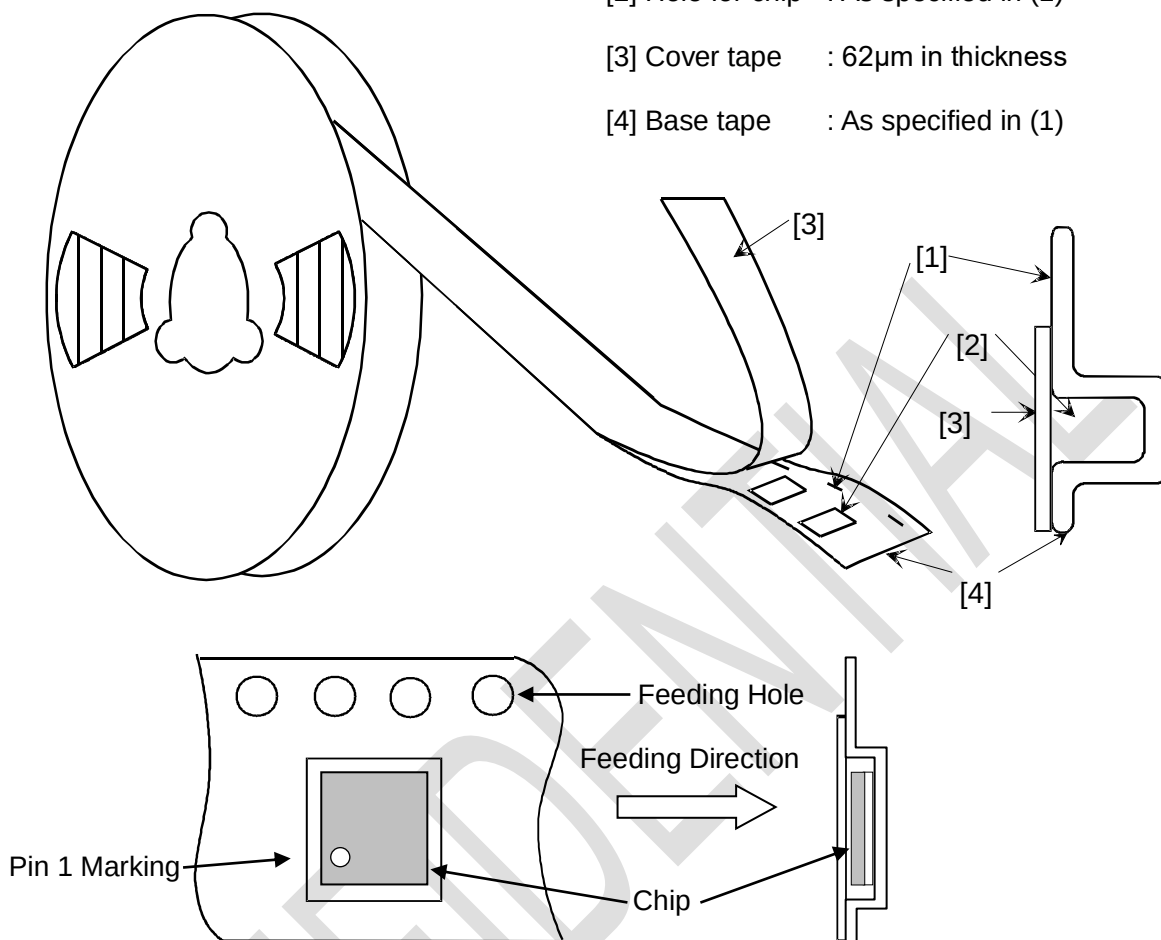
(3) Taping Diagrams

[1] Feeding Hole : As specified in (1)

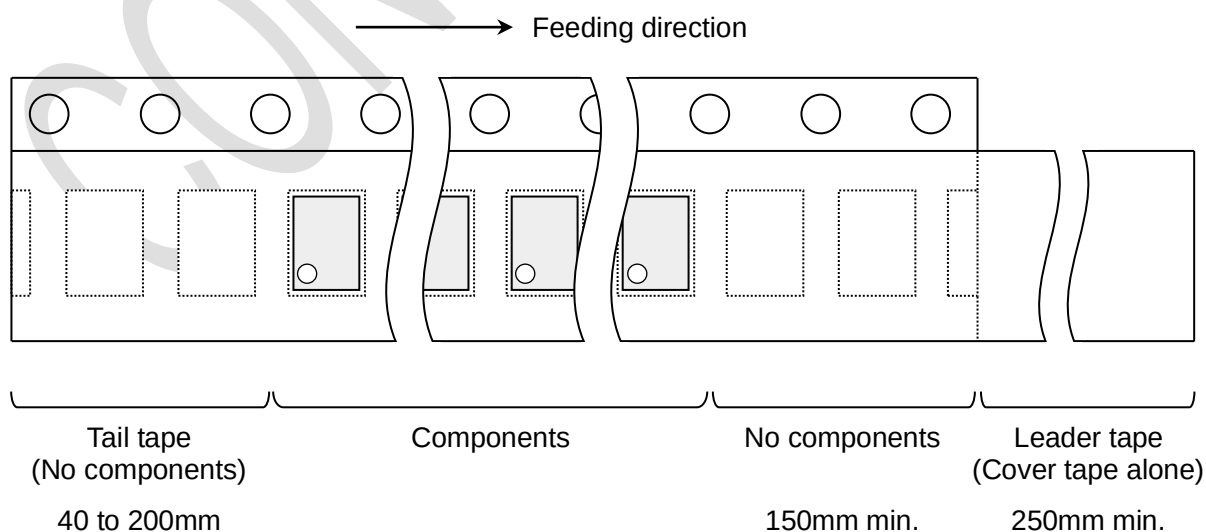
[2] Hole for chip : As specified in (1)

[3] Cover tape : 62μm in thickness

[4] Base tape : As specified in (1)



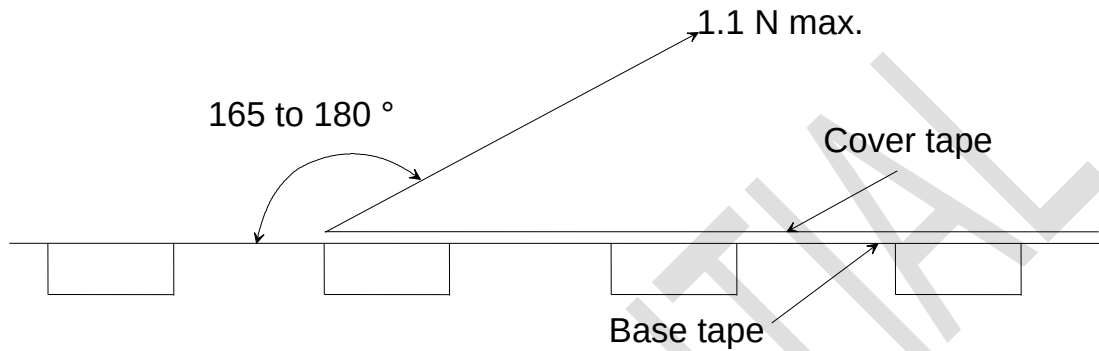
(4) Leader and Tail tape



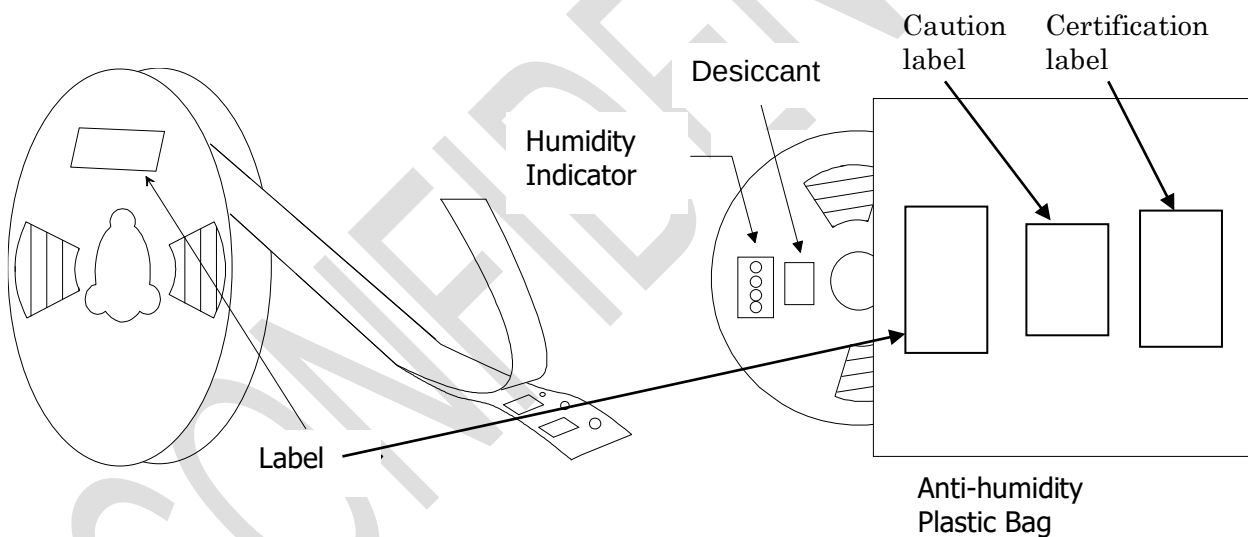
(5) The tape for chips are wound clockwise, the feeding holes to the right side as the tape is pulled toward the user.

(6) The cover tape and base tape are not adhered at no components area for 250mm min.

- (7) Tear off strength against pulling of cover tape : 5N min.
- (8) Packaging unit : 1000pcs./ reel
- (9) material : Base tape : Plastic
Real : Plastic
Cover tape, cavity tape and reel are made the anti-static processing.
- (10) Peeling of force : 1.1N max. in the direction of peeling as shown below.

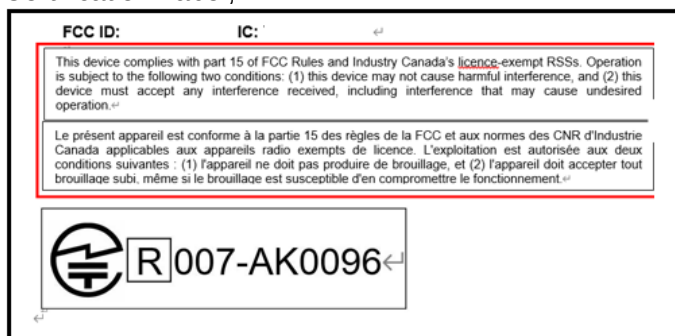


- (11) Packaging (Humidity proof Packing)



Tape and reel must be sealed with the anti-humidity plastic bag. The bag contains the desiccant and the humidity indicator.

Certification Label;



13. NOTICE

13.1. Storage Conditions:

Please use this product within 6month after receipt.

- The product shall be stored without opening the packing under the ambient temperature from 5 to 35 °C and humidity from 20 ~ 70 %RH.

(Packing materials, in particular, may be deformed at the temperature over 40 °C)

- The product left more than 6months after reception, it needs to be confirmed the solder ability before used.

- The product shall be stored in non-corrosive gas (CL2, NH3, SO2, NOx, etc.).

- Any excess mechanical shock including, but not limited to, sticking the packing materials by sharp object and dropping the product, shall not be applied in order not to damage the packing materials.

This product is applicable to MSL3 (Based on IPC/JEDEC J-STD-020)

- After the packing opened, the product shall be stored at <30 °C / <60 %RH and the product shall be used within 168 hours.

Please record and manage the time after opening.

- Product should be repacked with desiccating agent immediately after using.

- When the color of the indicator in the packing changed, the product shall be baked before soldering.

Baking condition: 125 +5/-0 °C, 24 hours, 1 time

The products shall be baked on the heat-resistant tray because the material (Base Tape, Reel Tape and Cover Tape) are not heat-resistant.

*For the MSL standard, see IPC/JEDEC J-STD-020 (can be downloaded from www.jedec.org).

If the storage environment is not conducted above standard conditions, it will cause some issue (e.g., Operation issue, Overcurrent, Malfunction) we shall not be responsible for that.

Before using please refer to "PRECONDITIONS TO USE MURATA PRODUCTS"

13.2. Handling Conditions:

Be careful in handling or transporting products because excessive stress or mechanical shock may break products.

Handle with care if products may have cracks or damages on their terminals, the characteristics of products may change. Do not touch products with bare hands that may result in poor solder ability and destroy by static electrical charge.

13.3. Standard PCB Design (Land Pattern and Dimensions):

All the ground terminals should be connected to the ground patterns. Furthermore, the ground pattern should be provided between IN and OUT terminals. Please refer to the specifications for the standard land dimensions.

The recommended land pattern and dimensions is as Murata's standard. The characteristics of products may vary depending on the pattern drawing method, grounding method, land dimensions, land forming method of the NC terminals and the PCB material and thickness. Therefore, be sure to verify the characteristics in the actual set. When using non-standard lands, contact Murata beforehand.

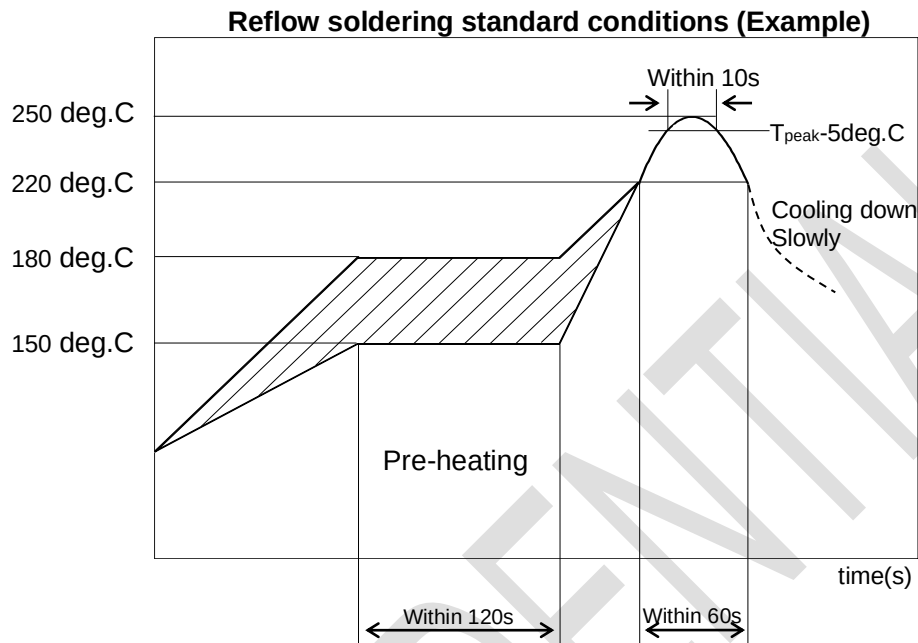
13.4. Notice for Chip Placer:

When placing products on the PCB, products may be stressed and broken by uneven forces from a worn-out chucking locating claw or a suction nozzle. To prevent products from damages, be sure to follow the specifications for the maintenance of the chip placer being used. For the positioning of products on the PCB, be aware that mechanical chucking may damage products.

13.5. Soldering Conditions:

The recommendation conditions of soldering are as in the following figure.

Soldering must be carried out by the above mentioned conditions to prevent products from damage. Set up the highest temperature of reflow within 260 °C. Contact Murata before use if concerning other soldering conditions.



Please use the reflow within 2 times.

Use rosin type flux or weakly active flux with a chlorine content of 0.2 wt % or less.

13.6. Cleaning:

Since this Product is Moisture Sensitive, any cleaning is not recommended. If any cleaning process is done the customer is responsible for any issues or failures caused by the cleaning process.

13.7. Operational Environment Conditions:

Products are designed to work for electronic products under normal environmental conditions (ambient temperature, humidity and pressure). Therefore, products have no problems to be used under the similar conditions to the above-mentioned. However, if products are used under the following circumstances, it may damage products and leakage of electricity and abnormal temperature may occur.

- In an atmosphere containing corrosive gas (Cl₂, NH₃, SO_x, NO_x etc.).
- In an atmosphere containing combustible and volatile gases.
- Dusty place.
- Direct sunlight place.
- Water splashing place.
- Humid place where water condenses.
- Freezing place.

If there are possibilities for products to be used under the preceding clause, consult with Murata before actual use.

As it might be a cause of degradation or destruction to apply static electricity to products, do not apply static electricity or excessive voltage while assembling and measuring.

13.8. Input Power Capacity :

Products shall be used in the input power capacity as specified in this specification.

Inform Murata beforehand, in case that the components are used beyond such input power capacity range.

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14. PRECONDITION TO USE OUR PRODUCTS

PLEASE READ THIS NOTICE BEFORE USING OUR PRODUCTS.

Please make sure that your product has been evaluated and confirmed from the aspect of the fitness for the specifications of our product when our product is mounted to your product.

All the items and parameters in this product specification/datasheet/catalog have been prescribed on the premise that our product is used for the purpose, under the condition and in the environment specified in this specification. You are requested not to use our product deviating from the condition and the environment specified in this specification.

Please note that the only warranty that we provide regarding the products is its conformance to the specifications provided herein. Accordingly, we shall not be responsible for any defects in products or equipment incorporating such products, which are caused under the conditions other than those specified in this specification.

WE HEREBY DISCLAIM ALL OTHER WARRANTIES REGARDING THE PRODUCTS, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, THAT THEY ARE DEFECT-FREE, OR AGAINST INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS.

You agree that you will use any and all software or program code (including but not limited to hcd, firmware, nvram, and blob) we may provide or to be embedded into our product ("Software") provided that you use the Software bundled with our product. YOU AGREE THAT THE SOFTWARE SHALL BE PROVIDED TO YOU "AS-IS" BASIS, MURATA MAKES NO REPRESENTATIONS OR WARRANTIES THAT THE SOFTWARE IS ERROR-FREE OR WILL OPERATE WITHOUT INTERRUPTION. AND MORE, MURATA MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WHETHER EXPRESS OR IMPLIED WITH RESPECT TO THE SOFTWARE. MURATA EXPRESSLY DISCLAIM ANY AND ALL WARRANTIES OR CONDITIONS OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE NOR THE WARRANTY OF TITLE OR NON-INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS.

You shall indemnify and hold harmless us, our affiliates and our licensor from and against any and all claims, costs, expenses and liabilities (including attorney's fees), which arise in connection with the using the Software.

The product shall not be used in any application listed below which requires especially high reliability for the prevention of such defect as may directly cause damage to the third party's life, body or property. You acknowledge and agree that, if you use our products in such applications, we will not be responsible for any failure to meet such requirements. Furthermore, YOU AGREE TO INDEMNIFY AND DEFEND US AND OUR AFFILIATES AGAINST ALL CLAIMS, DAMAGES, COSTS, AND EXPENSES THAT MAY BE INCURRED, INCLUDING WITHOUT LIMITATION, ATTORNEY FEES AND COSTS, DUE TO THE USE OF OUR PRODUCTS AND THE SOFTWARE IN SUCH APPLICATIONS.

- Aircraft equipment.
- Aerospace equipment
- Undersea equipment.
- Power plant control equipment
- Medical equipment.
- Traffic signal equipment.
- Burning / explosion control equipment
- Disaster prevention / crime prevention equipment.
- Transportation equipment (vehicles, trains, ships, elevator, etc.).
- Application of similar complexity and/ or reliability requirements to the applications listed in the above.

We expressly prohibit you from analyzing, breaking, reverse-engineering, remodeling altering, and reproducing our product. Our product cannot be used for the product which is prohibited from being manufactured, used, and sold by the regulations and laws in the world.

We do not warrant or represent that any license, either express or implied, is granted under any our patent right, copyright, mask work right, or our other intellectual property right relating to any combination, machine, or process in which our products or services are used. Information provided by us regarding third-party products or services does not constitute a license from us to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from us under our patents or other intellectual property.

Please do not use our products, our technical information and other data provided by us for the purpose of developing of mass-destruction weapons and the purpose of military use.

Moreover, you must comply with "foreign exchange and foreign trade law", the "U.S. export administration regulations", etc.

Please note that we may discontinue the manufacture of our products, due to reasons such as end of supply of materials and/or components from our suppliers.

By signing on specification sheet or approval sheet, you acknowledge that you are the legal representative for your company and that you understand and accept the validity of the contents herein. When you are not able to return the signed version of specification sheet or approval sheet within 30 days from receiving date of specification sheet or approval sheet, it shall be deemed to be your consent on the content of specification sheet or approval sheet. Customer acknowledges that engineering samples may deviate from specifications and may contain defects due to their development status. We reject any liability or product warranty for engineering samples. In particular we disclaim liability for damages caused by

- the use of the engineering sample other than for evaluation purposes, particularly the installation or integration in the product to be sold by you,
- deviation or lapse in function of engineering sample,
- improper use of engineering samples.

We disclaim any liability for consequential and incidental damages.
If you can't agree the above contents, you should inquire our sales.

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15. FCC/ISED Regulatory Certification Guide

15.1. Basic Certification Information

LBUA5QJ2AB module has been FCC/ISED certified as Single Modular Approval with the following IDs:

FCC ID: VPYLB2AB

IC: 772C-LB2AB

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 submitted to Murata for confirmation that the installation for the module into the host is in compliance with regulations of FCC and ISED Canada. 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 the manufacturer could void the user's authority to operate the equipment.

15.2. Guidance to Host Product Manufacture

The module has professional users use condition limitations. Host product manufacturer please ensure giving such warning like "Product is limited to professional users use" in your product's instruction.

Unique antenna connector must be used on our Part 15 authorized transmitters used in the host product. Contact Murata for a list of acceptable unique connectors.

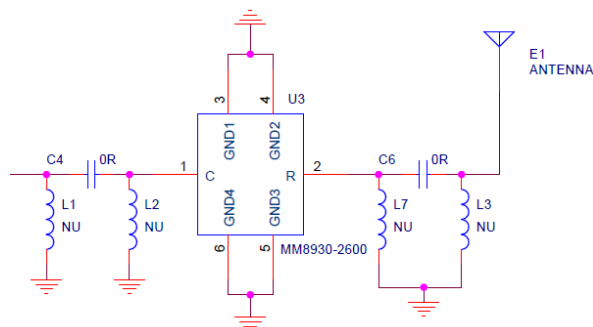
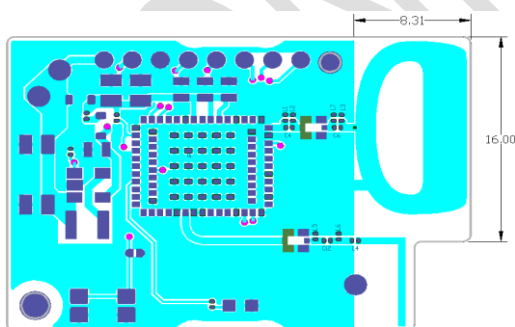
Any deviation(s) from the defined parameters of the antenna trace, as described by this instruction, host product manufacturer must notify us that you wish to change the antenna trace design. In this case, a Class II permissive change application is required to be filed by us, or you (host manufacturer) can take responsibility through the change in FCC ID and ISED ID (new application) procedure followed by a Class II permissive change application.

15.3. Antenna Application Guidance

This module has been approved by FCC to operate with the antenna types with the maximum permissible gain indicated. 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.

The following antennas have been certified in combination with the module.

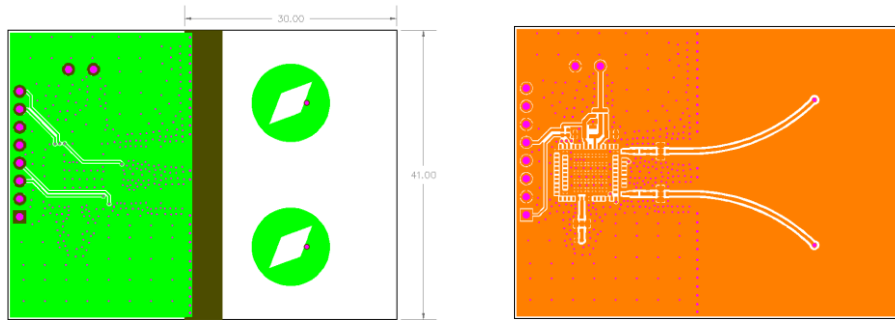
(a) WB003 UWB TWR/TDoA antenna



UWB Channel	CH5 (6239.6 MHz ~ 6739.6 MHz)	CH9 (7737.2 MHz ~ 8237.2 MHz)
Peak Gain (dBi)	3.9	2.8

WB003 antenna is designed by Qorvo. Please download the design files from Qorvo's [WB003](#) webpage

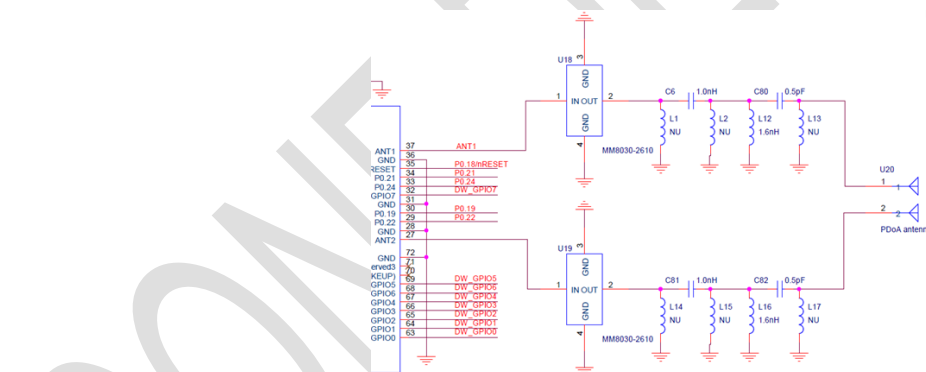
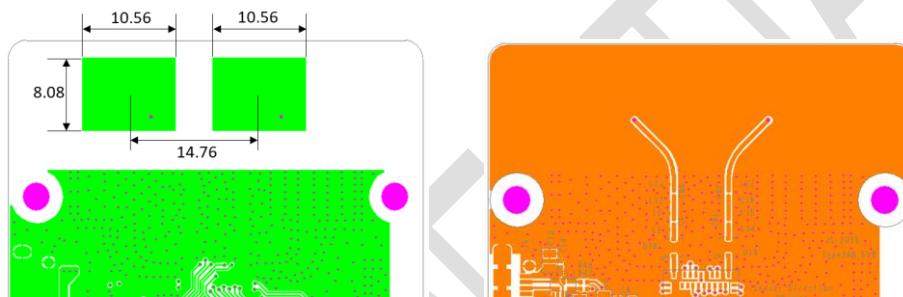
(b) ML005 UWB AoA/PDoA antenna



UWB Channel	CH5 (6239.6 MHz ~ 6739.6 MHz)	CH9 (7737.2 MHz ~ 8237.2 MHz)
Peak Gain (dBi)	1.8	-1.5

ML005 antenna is designed by Qorvo. Please contact Qorvo (or muRata) for the design files.

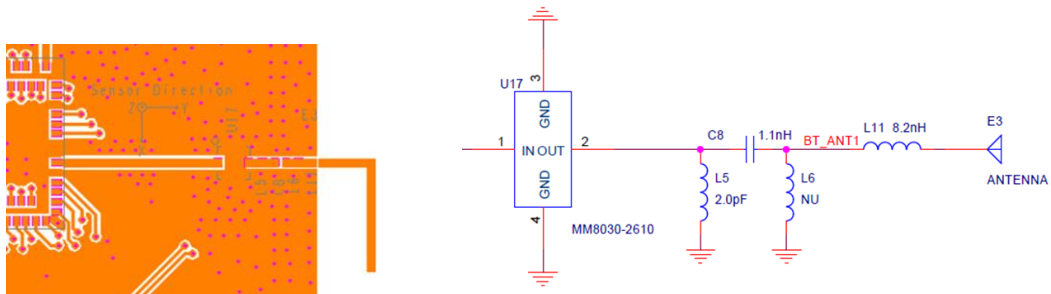
(c) REMC22003 UWB AoA/PDoA antenna



UWB Channel	CH5 (6239.6 MHz ~ 6739.6 MHz)	CH9 (7737.2 MHz ~ 8237.2 MHz)
Peak Gain (dBi)	0.9	2.8

REMC22003 antenna is designed for 2AB JS-1055 EVB by muRata. Please contact muRata for the design files.

(d) PCB antenna for BLE with a peak gain of -3.8 dBi;



Refer to JS-1055_2AB_EVB_Layout.dxf for antenna pattern. Please contact muRata for the design file.

15.4. FCC/ISED Regulatory Compliance Statements

▪ ***§15.19 &RSS-Gen Statement***

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.

▪ ***§ 15.21 Information to user***

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

▪ ***RF Exposure compliance statement***

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

▪ ***Labelling Instruction for Host Product Integrator***

Please notice that if the FCC and ISED 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 FCC ID: VPYLB2AB or Contains IC: 772C-LB2AB

And any similar wording that expresses the same meaning may be used.

§15.19 Labelling requirements shall be complied on end user device.

Labelling rules for special device, please refer to § 2.925, § 15.19 (a)(5) and relevant KDB publications. For E-label, please refer to § 2.935.

▪ ***Installation Notice to Host Product Manufacturer***

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

The module is limited to installation in mobile application, a separate approval is required for all other operating configurations, including portable configurations with respect to § 2.1093 and difference antenna configurations.

▪ ***Antenna Change Notice to Host manufacturer***

If you desire to increase antenna gain and either change antenna type or use same antenna type certified, a Class II permissive change application is required to be filed by us, or you (host manufacturer) can take responsibility through the change in FCC ID (new application) procedure followed by a Class II permissive change application.

▪ ***FCC other Parts, Part 15B Compliance Requirements for Host product manufacturer***

This modular transmitter is only FCC authorized for the specific rule parts listed on our grant, 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.

This device is approved under Part 15.519 for handheld use.

The use of antennas mounted on outdoor structures, e.g., antennas mounted on the outside of a building or on a telephone pole, or any fixed outdoors infrastructure is prohibited. Antennas may be mounted only on the hand held UWB device.

UWB devices may not be employed for the operation of toys. Operation onboard an aircraft, a ship or a satellite is prohibited.

Host manufacturer in any case shall ensure host product which is installed and operating with the module is in compliant with Part 15B requirements.

Please note that For a Class B or Class A digital device or peripheral, the instructions furnished the user manual of the end-user product shall include statement set out in §15.105 Information to the user or such similar statement and place it in a prominent location in the text of host product manual. Original texts as following:

For Class B:

Note: This equipment has been tested and found to comply with the limits for a Class B digital

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< Specification may be changed by Murata without notice >
Murata(China) Investment Co., Ltd.

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.

For Class A:

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

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Appendix. Technical Support

Murata provides its technical support for consumer electronics purpose to this product based on the contents listed in the table below.

Item	Description of Murata's module for Consumer electronics products
Production Line	General equipment, Not IATF complaint
Reliability test conditions	Refer to the "Murata Reliability Test Conditions for IoT module.pdf".
Failure rate (target)	1000ppm (including customer process defects)
Failure Analysis	• 1st report (One day after the factory receives the sample) Appearance confirmation, confirmation by X-ray • 2nd report (one week after 1st report) Confirmation of electrical characteristics by Murata's measurement system • Final report (one month after 1st report) When IC analysis is required, it may take more time to issue the final report
Screening process	Conducted at room temperature
Data storage period of screening process	The data is stored up to 10 years after shipping. Data is provided in the case of failure analysis only.
Operator	General Operator (Not operator for Automotive process)
PCN	PCN is issued as appropriate at Murata's discretion.
Supply	Long-term supply is not guaranteed, and EOL is issued as appropriate at Murata's discretion (e.g. Sudden EOL of parts sometimes forces the module to be EOL). After EOL, Murata does not have a liability to supply the module.
Warranty period	One year after shipping
Factory Audit	Not Supported
Zero Defect	Not Supported
PPAP	Not Supported
Analysis of item consistency	Not Supported
FTA, FMEA	Not Supported