LBAD0ZZ1SE

LTE CAT M1/NB-IoT Module

Features

- LTE Cat M1 – Class 3, up to 23dBm
- NB-IoT (NB1) Rel. 13
- STM32L462RE/Cortex M4 w/512KB Flash and 160 KB SRAM
- 1MB on-board Serial Flash
- Dimension: 15.4 x 18.0 x 2.5 mm (max)
- Package: LGA
- SIM card: internal eSIM (WLCSP)
- Antenna configurations: U.FL antenna connection
- 3GPP eDRX and PSM modes
- Power Consumption: enables up to 10-year battery life
- Operating temperature range: -40 °c to 85 °c
- Global Certifications: GCF and PTCRB
- IPv4/IPv6 stack with TCP and UDP protocol
- SSL/TLS
- LTE universal modem supports (low-band and mid-band):
    - Low-band B5/B8/B12/B13/B14(CAT M1 Only)/B17/B18/B19/B20/B26/B28
    - Mid-band B1/B2/B3/B4/B25

RoHS Compliance
This component is compliant with RoHS directive.
This component was always RoHS compliant from the first date of manufacture.

Benefits

- Certified as a host device for ease of integration with several different types of applications.
    - Quicker time to market (no additional carrier or regulatory certification).
    - Less development time and costs for developer/device manufacturer in need of LTE Cat M1/NB-IoT connectivity
    - eSIM included in certification.
- Build/Develop applications with the use of ST's vast set of software modules.
- Availability of ST's Community and Development Forums.

Notice

- This module cannot be used in a smartphone or other wireless telephone or a tablet and any device that is capable of providing a wireless hotspot for other devices, is capable of providing two-way voice communication.

Revision History

Revision	Date	Author	Change Description
1.0	10/05/2020	RF PD	Initial release
1.1	02/25/2021	RF PD	Add Introduction section title and include block diagram, acronyms and reference to this section.
1.2	11/11/2021	RF PD	Add Notice to Page1. Updated 7 Packaging and Marking Information

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1 Introduction

1.1 Scope

This product is designed to meet 3GPP Rel-13 specifications.

Table 1-1 Module Specifications

Part Number	LBAD0ZZ1SE
Connectivity	3GPP Release 13/Optimized for LTE Class 3 output power (+23 dBm)
Universal LTE (LB & MB)	Low-band: B5/B8/B12/B13/B14(CAT M1 Only) /B17/B18/B19/B20/B26/B28 Mid-band: B1/B2/B3/B4/B25
Voltage Input	3.3-5V
Antenna	Off board multi-band antenna
Dimension	15.4 x 18.0 x 2.5 mm (max)
Peripheral Interfaces	GPIO, ADC, I2C, PWM, SPI, UART
Operating Temp	-40° to 85° C

1.2 Block Diagram
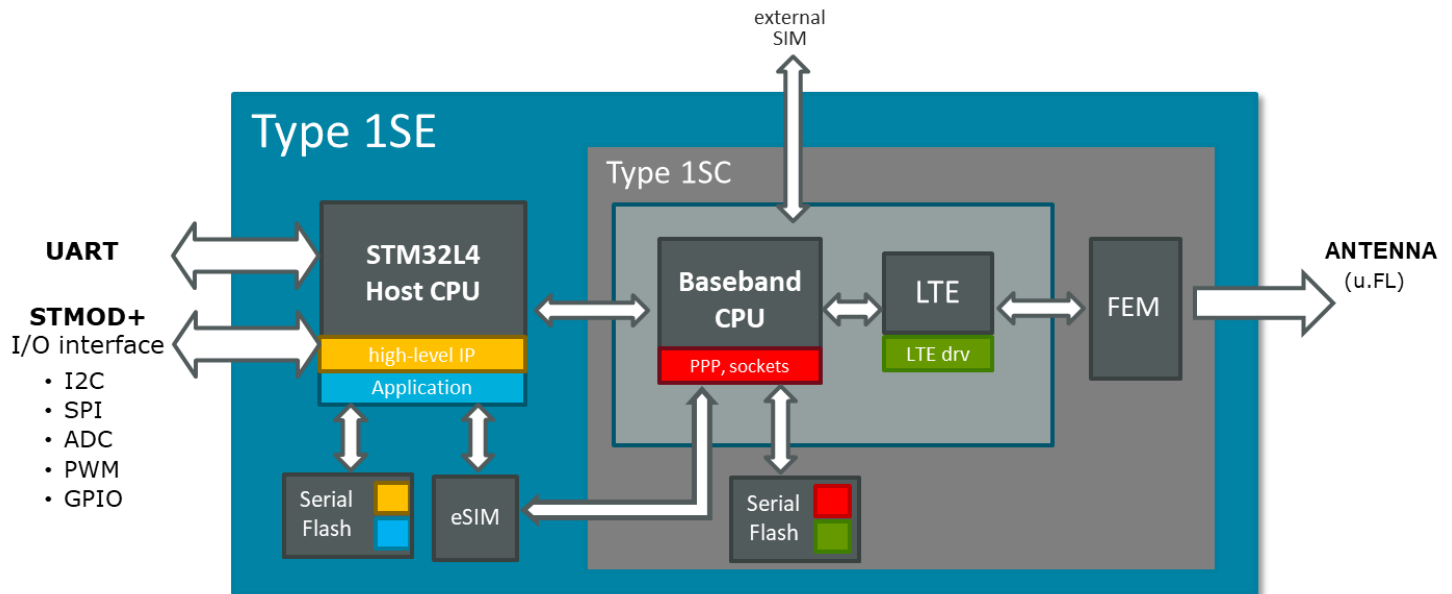
Figure 1 Type 1SE Block Diagram

1.3 Acronyms
- LTE   Long Term Evolution
- UART   Universal Asynchronous Receiver Transmitter
- eUICC   Embedded SIM (Subscriber Identity Module
- LGA   Land Grid Array
- BB   Baseband
- RFIC   Radio Frequency Integrated Circuit
- LB   Low Band (699 MHz to 915 MHz frequency range)
- MB   Mid Band (1710 MHz to 2025 MHz frequency range)
- PSM   Power Save Mode
- eDRX   Extended Discontinuous Receive

1.4 Reference
[1] STMicroelectronics, STM32L462CE STM32L462RE STM32L462VE datasheet, May 2018.
[2] STMicroelectronics, B-L462E-CELL1 Discovery Kit for NB/M1 communication Discovery Board, UM2743, User Manual

2 Mechanical Specification

2.1 Module Dimensions

Table 2-1: Module Dimensions

Parameter	Typical	Unit
Dimension (L x W x H)	15.4 ±0.2mm x 18.0 ±0.2mm x 2.5 (max)	mm

2.2 Top and Side View
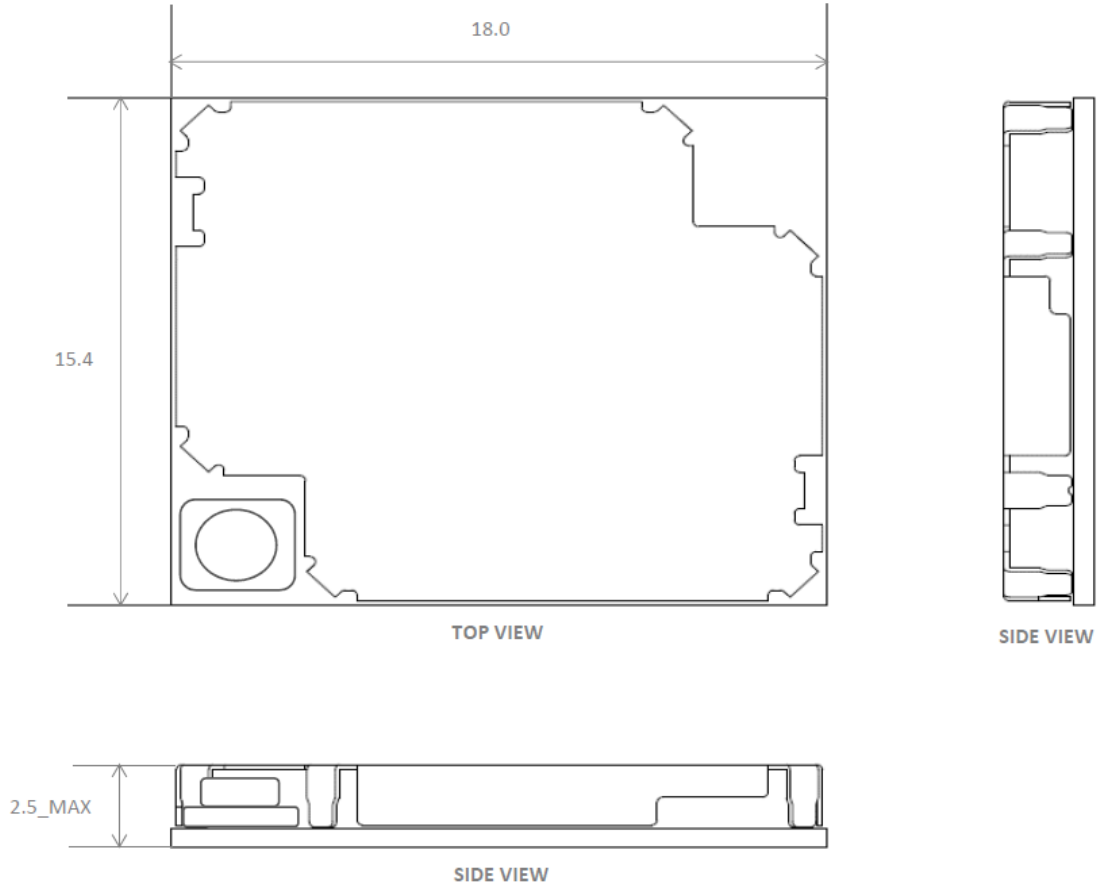
Figure 2.1 Module Top and Side View (Unit: mm)

2.3 PCB Footprint Top View
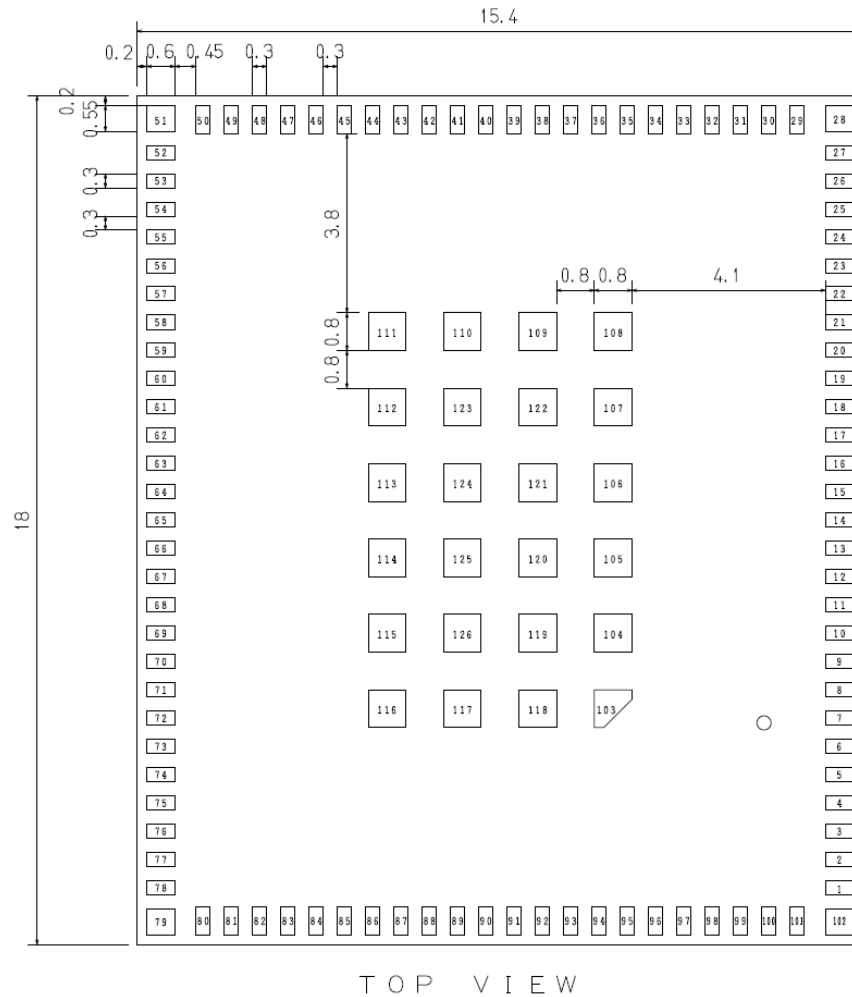
Figure 2.2 Module Footprint Top View (Unit: mm)

Tolerance

Subject	Tolerance(mm)
Product Outline	18.0 ± 0.20 × 15.4 ± 0.20
Peripheral pin size	0.60 ± 0.10 × 0.30 ± 0.10
Peripheral pin size（Corner）	0.60 ± 0.10 × 0.55 ± 0.10
Center pin size（except pin103）	0.80 ± 0.10 × 0.80 ± 0.10
Location between pin to pin	±0.10
Location between pin to PCB edge	± 0.20

2.4 Pin Configuration

For further detail of the built-in STM32, please refer to the STM32L462CE STM32L462RE STM32L462VE datasheet [1].

Table 2-2 Pinouts

Pin #	Pin Name	STM32L462	Type	Description
1	USART2_RTS	E6	I/O	PA1/USART2_RTS
2	USART2_RX	F6	I/O	PA3/USART2_RX
3	USART2_TX	G7	I/O	PA2/USART2_TX
4	USART2_CTS	H8	I/O	PA0/USART2_CTS
5	VDDA	F7	Power	ADC power; connect to VDD_1V8 if not used
6	VSSA	G8	Power	ADC GND
7	NRST	F8	Reset	Reset STM32
8	NC			No Connect
9	NC			No Connect
10	GPIO_EXTI7	E1	I/O	PC7/GPIO_EXTI7
11	NC_RST_IND		I/O	Reserved for internal usage and testing
12	NC			No Connect
13	NC			No Connect
14	NC			No Connect
15	NC			No Connect
16	RFT_UART2_CTS		I	Recovery UART_CTS
17	RFT_UART2_TX		O	Recovery UART_RX
18	RFT_UART2_RTS		O	Recovery UART_RTS
19	RFT_UART2_RX		I	Recovery UART_TX
20	NC			No Connect
21	NC			No Connect
22	NC			No Connect
23	RFT_UART1_RTS		O	Log UART_RTS
24	RFT_UART1_TX		O	Log UART_TX
25	RFT_UART1_RX		I	Log UART_RX
26	RFT_UART1_CTS		I	Log UART_CTS
27	NC			No Connect
28	GND		GND	GND
29	NC			No Connect
30	NC			No Connect
31	NC			No Connect
32	NC			No Connect
33	NC			No Connect
34	NC			No Connect
35	NC			No Connect

Pin #	Pin Name	STM32L462	Type	Description
36	NC			No Connect
37	PMU_AT_IN		I	Connect to GND
38	NC			No Connect
39	NC			No Connect
40	NC			No Connect
41	NC			No Connect
42	GND		GND	
43	VDD		Power	Power supply for Type1SE
44	VDD		Power	Power supply for Type1SE
45	VDD		Power	Power supply for Type1SE
46	GND		GND	GND
47	NC			No Connect
48	NC			No Connect
49	NC_SIM_CLK		O	SIM clock
50	NC_VSIM		O	SIM power supply
51	GND		GND	GND
52	NC_SIM_DETECT		I	SIM detect
53	NC_SIM_RST		O	SIM reset
54	PH1_OSC_OUT	E8	I/O	PH1/RCC_OSC_OUT
55	PH0_OSC_IN	D8	I/O	PH0/RCC_OSC_IN
56	NC			No Connect
57	NC_SIM_IO		I/O	SIM data
58	ADC1_IN1	D7	I/O	PC0/ADC1_IN1
59	ADC1_IN3	D6	I/O	PC2/ADC1_IN3
60	ADC1_IN2	D5	I/O	PC1/ADC1_IN2
61	ADC1_IN4	E7	I/O	PC3/ADC1_IN4
62	RTC_TAMP1	B8	I/O	PC13/RTC_TAMP1
63	BOOT0	B6	I/O	PH3/BOOT0
64	SF_EN	B5	I/O	PB6/SF_EN
65	RCC_MCO	E3	I/O	PA8/RCC_MCO
66	NC			No Connect
67	NC			No Connect
68	VDD_1V8		Power	Reserved for codec supply/MCU VBAT/MCU VDDA
69	I2C1_SDA	C6	I/O	PB9/I2C1_SDA
70	I2C1_SCL	A6	I/O	PB8/I2C1_SCL
71	VBAT	B7	Power	Backup supply; connect to VDD_1V8 if not used
72	SPI1_SCK	F5	I/O	PA5/SPI1_SCK
73	SPI1_MOSI	C5	I/O	PB5/SPI1_MOSI
74	SPI1_MISO	A4	I/O	PB4/SPI1_MISO/NJTRST
75	SPI1_NSS	A2	I/O	PA15/SPI1_NSS/JTDI

Pin #	Pin Name	STM32L462	Type	Description
76	TIM2_CH2	B4	I/O	PB3/TIM2_CH2/JTDO/TRACESWO
77	NC			No Connect
78	NC			No Connect
79	GND		GND	GND
80	NC			No Connect
81	eSIM_SWP		I/O	SWP for NFC to ST33
82	NC			No Connect
83	NC			No Connect
84	VDDUSB	A1	Power	3.0 to 3.6 V supply for USB; connect to VDD_1V8 if not used
85	SWCLK	C3	I/O	PA14/JTCK/SWCLK
86	SWDIO	C2	I/O	PA13/JTMS/SWDIO
87	USB_DP	D3	I/O	PA12/USB_DP
88	USB_DM	D2	I/O	PA11/USB_DM
89	USART1_RX	C1	I	PA10/USART1_RX
90	USART1_TX	D1	O	PA9/USART1_TX
91	TIM15_CH2	F1	I/O	PB15/TIM15_CH2
92	TIM15_CH1	G1	I/O	PB14/TIM15_CH1
93	TIM3_CH4	E2	I/O	PC9/TIM3_CH4
94	TIM3_CH1	F2	I/O	PC6/TIM3_CH1
95	QUADSPI_IO0	F4	I/O	PB1/QUADSPI_BK1_IO0
96	QUADSPI_CLK	H4	I/O	PB10/QUADSPI_CLK
97	QUADSPI_nCS	H3	I/O	PB11/QUADSPI_BK1_NCS; connect to 98 to use internal serial flash
98	SF_nCS		I/O	Internal serial flash chip select
99	QUADSPI_IO1	H5	I/O	PB0/QUADSPI_BK1_IO1
100	QUADSPI_IO3	H6	I/O	PA6/QUADSPI_BK1_IO3
101	QUADSPI_IO2	E5	I/O	PA7/QUADSPI_BK1_IO2
102-126	GND		GND	Ground

3 DC Electrical Specification

3.1 Tx Output Power

The module is compliant to the 3GPP spec for release 13 and rated at a Class 3 device (23 dBm)

3.2 Rx Sensitivity

Table 3-1 Rx Sensitivity

Items		Contents			
		Min	Typ.	Max	Unit
Frequency Range	LB	703		960	MHz
	MB	1710		2170	MHz
Rx Sensitivity	MCS5, BER<5%		-103		dBm

4 Environmental Specification

4.1 Absolute Maximum Rating

Table 4-1 Absolute Maximum Rating

Description	Min	Max	Unit
VDD	-0.3	6	V
PA Stability		6:1	VSWR

4.2 Recommended Operating Condition

Table 4-2 Recommended Operating Condition

Description	Min	Max	Unit
VDD	3.3	5.0	V

4.3 Temperature Range

Table 4-3 Temperature Range

Description	Range	Note
Storage temperature range	-40 ºC – 85 ºC	Storage and non-operational
Operating temperature range	-40 ºC – 85 ºC	Module is fully functional†
	-10 ºC – 55 ºC	Module is fully functional† and fully meets 3GPP specification

(†) Functional: the module is able to connect to PDN and transfer data.

5 Application Information

5.1 Recommended PCB Landing Pattern

The recommended PCB landing pattern is the same as the module footprint, see Figure 2.2.

5.2 External Antenna

The Type 1SE module has a built-in standard u.FL RF connector. To select any external antenna please read the regulatory information in section 8 Regulatory Information first. Make sure that you pick the antenna that covers the correct frequency for the appropriate band and make sure 50-Ohm impedance matching.

5.3 Development Kit and Reference Design

The development kit of type 1SE module is jointly developed by Murata and STMicroelectronics. Please refer to STMicroelectronics B-L462E-CELL1 Discovery Kit and related documents for detail [2].

6 Assembly Information

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

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

Reflow soldering standard conditions:

Reflow soldering standard conditions(Example)
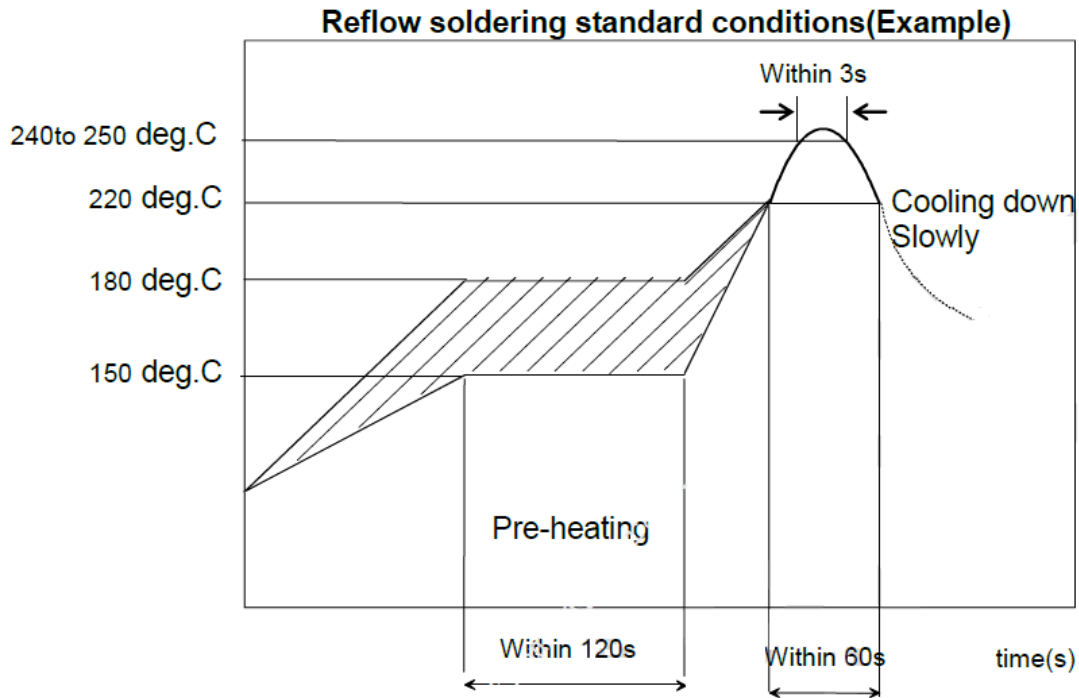
Figure 6.1 Reflow Profile

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.

Since this Product is Moisture Sensitive, any cleaning is NOT permitted.

7 Packaging and Marking Information

7.1 Dimensions of Tape (Plastic tape)

Figure 7.1 Tape Dimensions (Unit in mm)

7.2 Dimensions of Reel
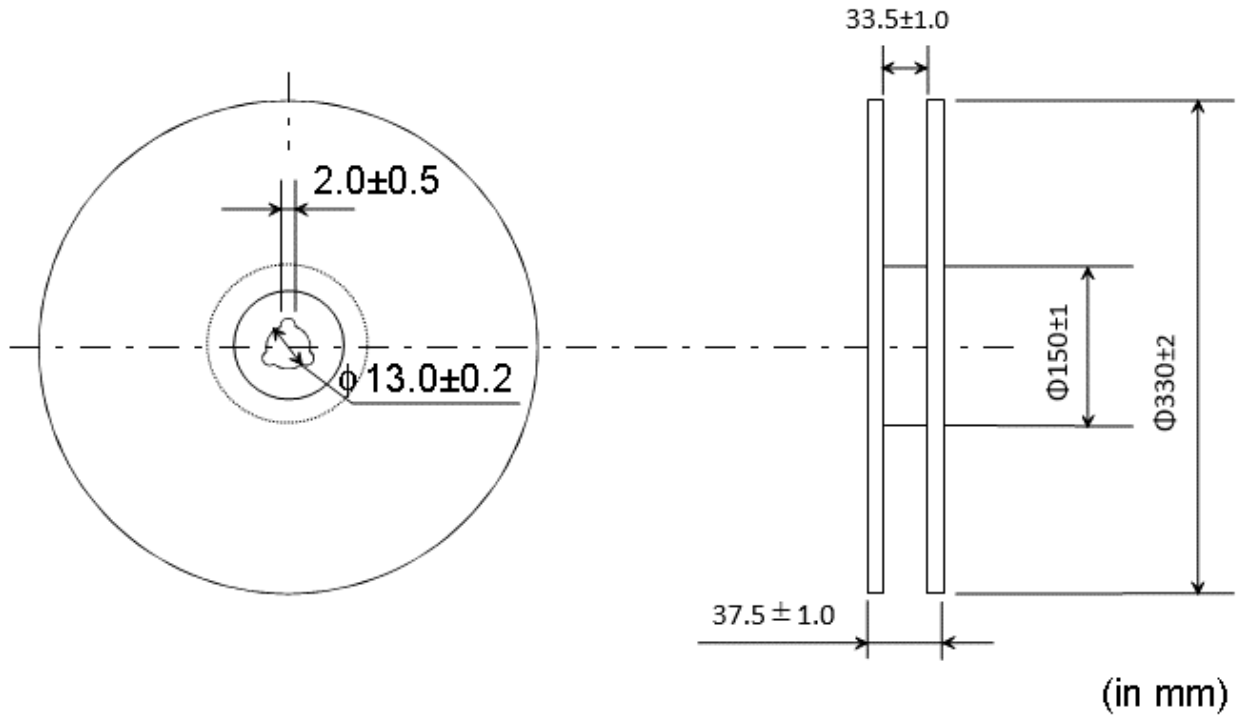
Figure 7.2 Reel Dimensions (Unit in mm)

7.3 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)

Feeding Hole

Feeding Direction

Chip

Pin 1 Marking

7.4 Leader and Tail tape

Feeding direction

Tail tape
(No components)

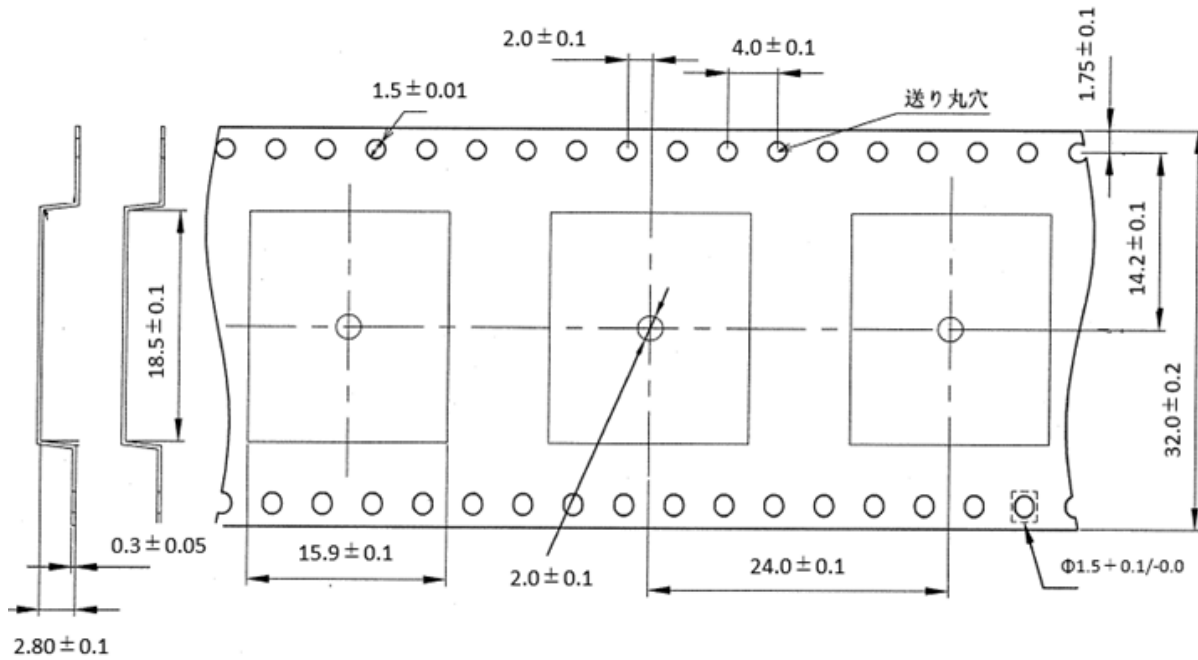40 to 200mm

Components

No components

150mm min.
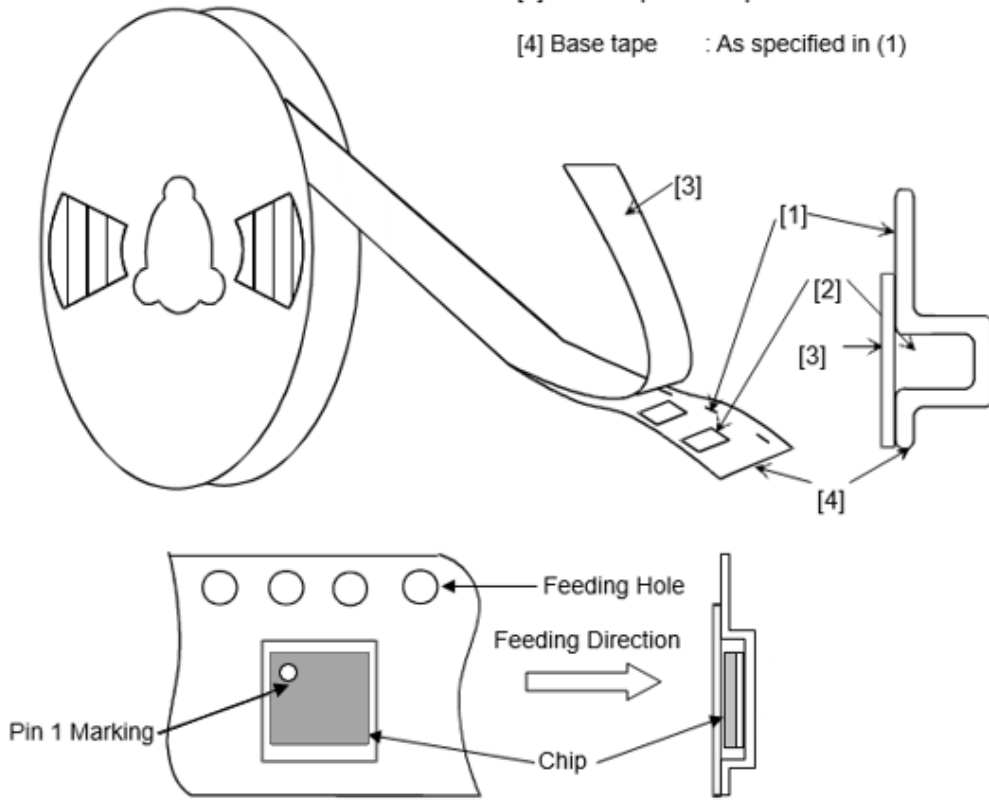
Leader tape
(Cover tape
alone)
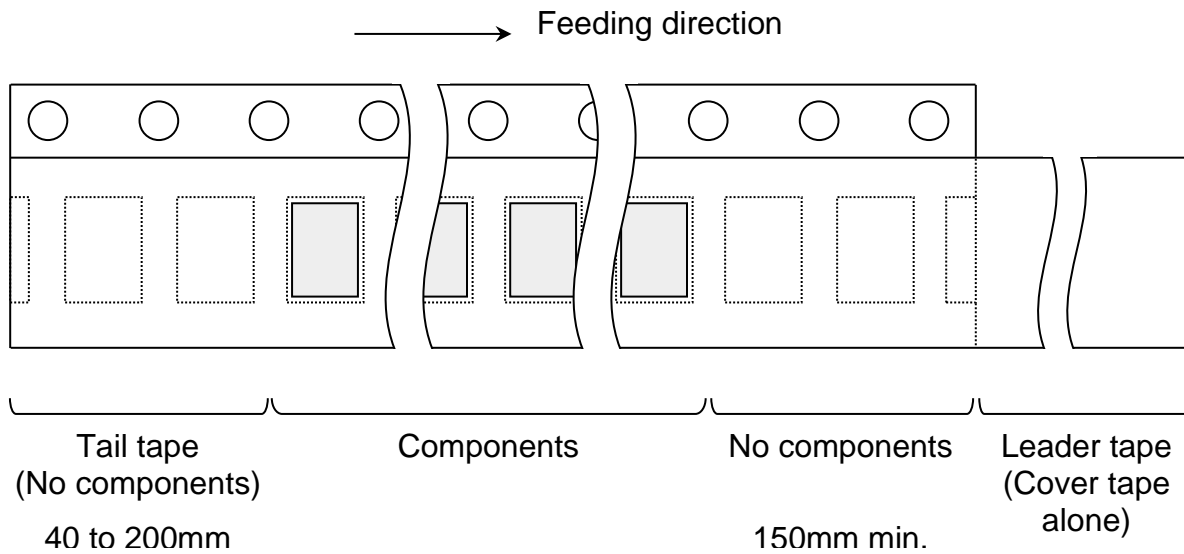
Figure 7.3 Tape Leader and Tail

The tape for chips are wound clockwise, the feeding holes to the right side as the tape is pulled toward the user.
The cover tape and base tape are not adhered at none components area for 250 mm min.
Tear off strength against pulling of cover tape: 5 N min.
Packaging unit: 500 pcs./ reel
Material:
- Base tape: Plastic
- Reel : Plastic
- Cover tape, cavity tape and reel are made the anti-static processing.

7.5 Peeling Force

1.3 N max. in the direction of peeling as shown below.

1.3 N max.

165 to 180 °

Cover tape
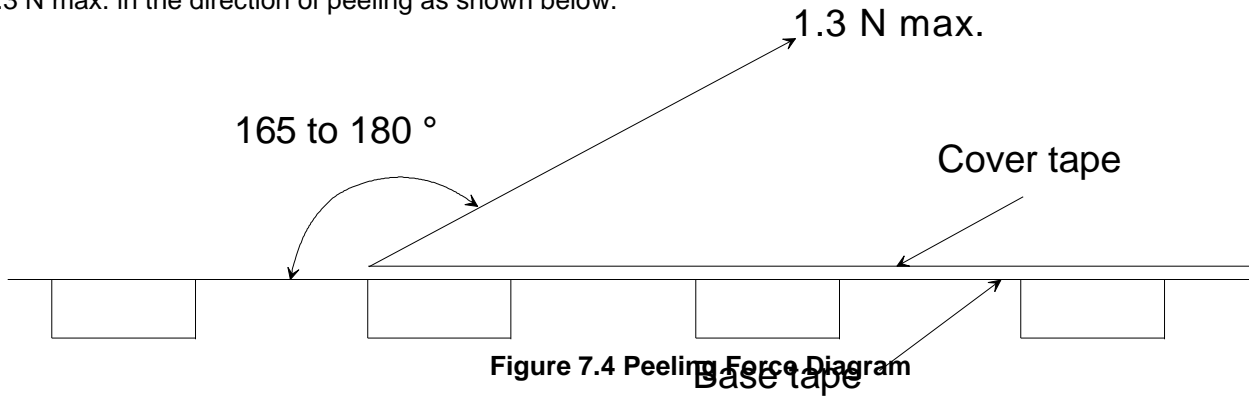
Figure 7.4 Peeling Force Diagram

Base tape

7.6 PACKAGE (Humidity proof Packaging)

Label1

Desiccant

Humidity
Indicator

Label1

Label2

Label2

Anti-humidity
Plastic Bag
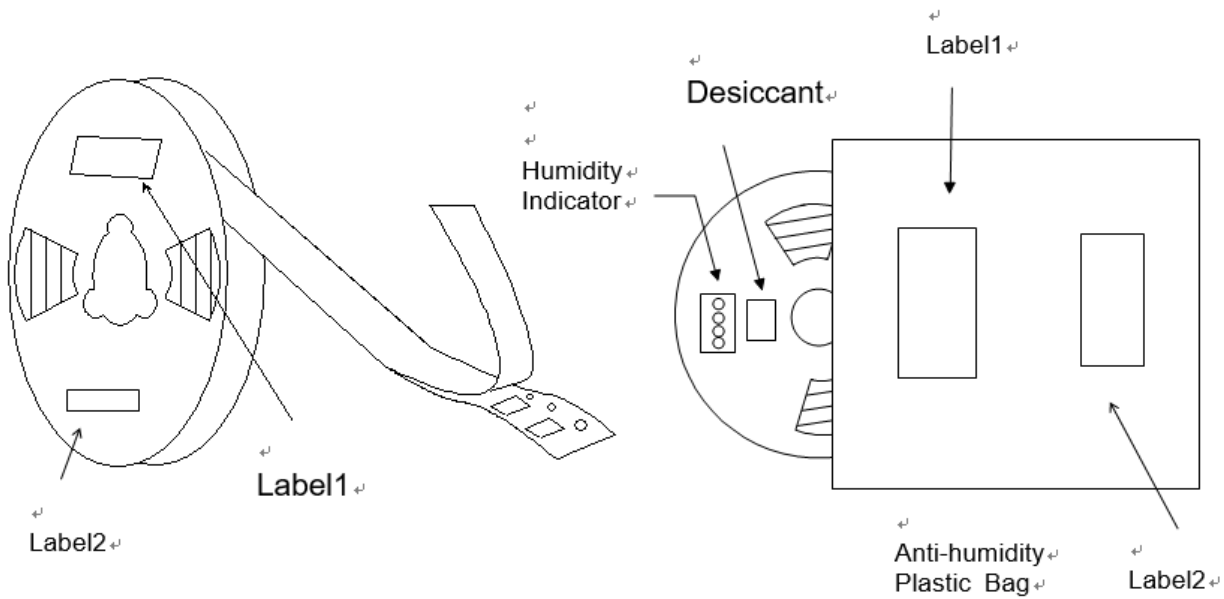
Figure 7.5 Packaging Diagram

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

7.7 Module Marking Information

Figure 7.6 shows the module marking. Dimensions are nominal, not absolute.
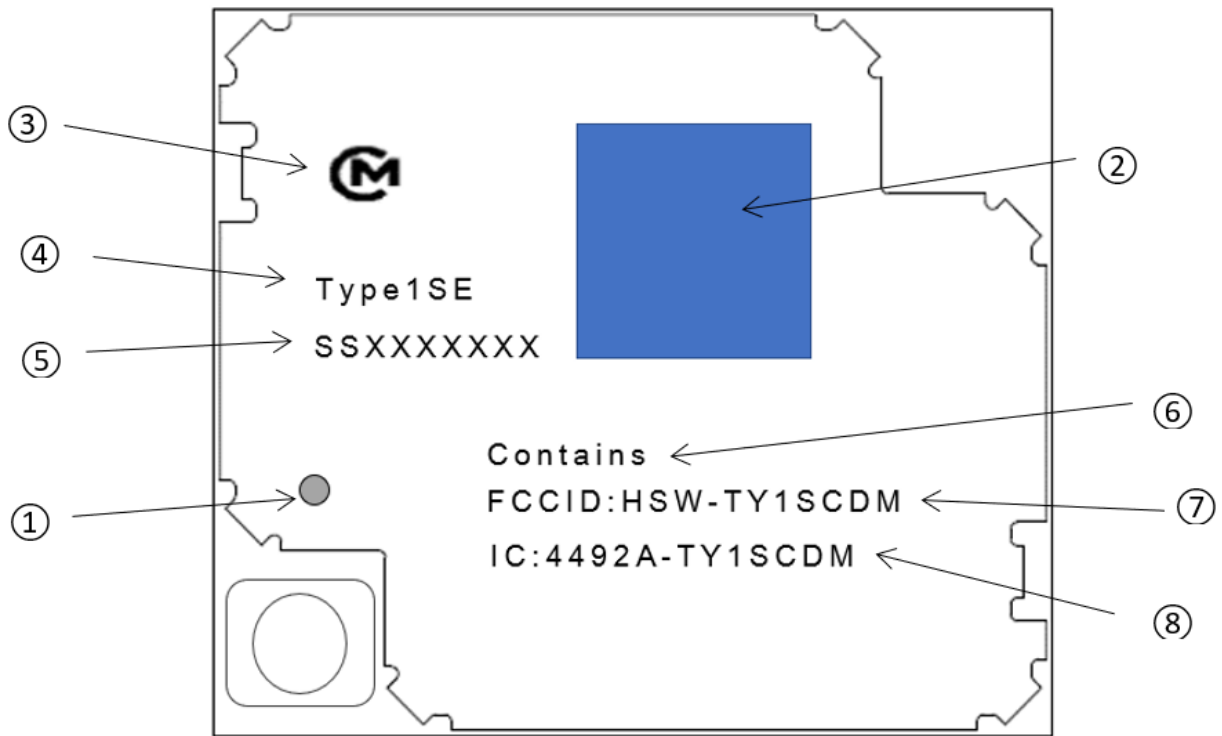
Number	Items	Description
1	#1 pin mark	●
2	2D code	IMEI information
3	Murata mark	Ⓜ
4	Product name	Type1SE
5	Inspection #	SS*******
6	-	Contains
7	FCC certification #	FCCID:HSW-TY1SCDM
8	IC certification #	IC:4492A-TY1SCDM

Figure 7.6 Module Marking Diagram

7.8 Moisture Sensitivity Level

The LBAD0ZZ1SE is planned to be qualified to moisture sensitivity level 4 (MSL4) in accordance with JEDEC J-STD-020.

*This product is moisture sensitive. Please check the detail in 11.1 Storage Condition section.

8 Regulatory Information

8.1 FCC Info

This device has Single Modular Approval. This device is approved for mobile and fixed use with respect to RF exposure compliance and may only be marketed to OEM installers. The antenna(s) used for this transmitter, as described in this filing, must be installed to provide a separation distance of at least 20 cm from all persons. Installers and end-users must be provided with operating conditions for satisfying RF exposure compliance. Maximum permitted antenna gain including cable loss should be determined from tables 8.1 and 8.2. Failure to follow these guidelines will result in radiated RF levels that exceed FCC MPE limits.

8.2 FCC Test Data

Table 8-1 FCC Test Data

FCC CAT M1

Operation Mode	Freq. (MHz)	Operation Distance (cm)	Conducted Average output power (dBm)	Max. output Power include tolerance (dBm)	Antenna Gain (dBi)	EIRP (ERP) Limit (dBm)	Max. output Power (mW)	Power Density (PD) (mW/cm^2)	PD Limit (mW/cm^2)	Allowable Gain according to EIRP (dBi)	Allowable Gain according to PD (dBi)	Max Allowable Gain (dBi)
Band 2	1850.7	20	22.80	23.00	10.20	33.00	2089.30	0.416	1.000	10.20	14.01	10.20
Band 4	1710.7	20	22.97	23.00	7.03	30.00	1006.93	0.200	1.000	7.03	14.01	7.03
Band 5	824.7	20	22.46	23.00	11.41	38.45	2762.20	0.550	0.550	15.99	11.41	11.41
Band 12	699.7	20	20.85	23.00	10.70	34.77	2343.53	0.466	0.466	13.92	10.70	10.70
Band 13	779.5	20	20.71	23.00	11.17	34.77	2610.81	0.520	0.520	14.06	11.17	11.17
Band 14	788.1	20	21.51	23.00	11.22	34.77	2639.61	0.525	0.525	13.26	11.22	11.22
Band 17	704.1	20	22.94	23.00	10.73	34.77	2358.27	0.469	0.469	11.83	10.73	10.73
Band 25	1850.7	20	21.11	23.00	11.89	33.00	3083.19	0.614	1.000	11.89	14.01	11.89
Band 26	814.7	20	20.85	23.00	11.36	38.45	2728.70	0.543	0.543	17.60	11.36	11.36

FCC NB IoT

Operation Mode	Freq. (MHz)	Operation Distance (cm)	Conducted Average output power (dBm)	Max. output Power include tolerance (dBm)	Antenna Gain (dBi)	EIRP (ERP) Limit (dBm)	Max. output Power (mW)	Power Density (PD) (mW/cm^2)	PD Limit (mW/cm^2)	Allowable Gain according to EIRP (dBi)	Allowable Gain according to PD (dBi)	Max Allowable Gain (dBi)
Band 2	1850.2	20	22.75	23.00	10.25	33.00	2113.49	0.421	1.000	10.25	14.01	10.25
Band 4	1710.2	20	22.92	23.00	7.08	30.00	1018.59	0.203	1.000	7.08	14.01	7.08
Band 5	824.2	20	22.46	23.00	11.41	38.45	2760.52	0.549	0.549	15.99	11.41	11.41
Band 12	699.2	20	23.49	24.00	9.70	34.77	2341.85	0.466	0.466	11.28	9.70	9.70
Band 13	777.2	20	23.43	24.00	10.15	34.77	2603.10	0.518	0.518	11.34	10.15	10.15
Band 17	704.2	20	23.55	24.00	9.73	34.77	2358.60	0.469	0.469	11.22	9.73	9.73
Band 25	1850.2	20	20.85	22.00	12.15	33.00	2600.16	0.518	1.000	12.15	15.01	12.15
Band 26	814.1	20	23.40	24.00	10.36	38.45	2726.69	0.543	0.543	15.05	10.36	10.36

8.3 ISED Test Data

Table 8-2 ISED Test Data

ISED CAT M1

Operation Mode	Freq. (MHz)	Operation Distance (cm)	Conducted Average output power (dBm)	Max. output Power include tolerance (dBm)	Antenna Gain (dBi)	EIRP (ERP) Limit (dBm)	Max. output Power (mW)	Power Density (PD) (W/m²)	Limit (W/m²)	Allowable Gain according to EIRP (dBi)	Allowable Gain according to PD (dBi)	Max Allowable Gain (dBi)
Band 2	1850.7	20	22.80	23.00	10.20	33.00	2089.30	4.159	4.477	10.20	10.52	10.20
Band 4	1710.7	20	22.97	23.00	7.03	30.00	1006.93	2.004	4.243	7.03	10.29	7.03
Band 5	824.7	20	22.46	23.00	8.12	38.45	1294.74	2.577	2.577	15.99	8.12	8.12
Band 12	699.7	20	20.85	23.00	7.63	34.77	1157.17	2.303	2.303	13.92	7.63	7.63
Band 13	779.5	20	20.71	23.00	7.95	34.77	1245.81	2.480	2.480	14.06	7.95	7.95
Band 17	704.1	20	22.94	23.00	7.65	34.77	1162.14	2.313	2.313	11.83	7.65	7.65
Band 25	1850.7	20	21.11	23.00	10.52	33.00	2249.48	4.477	4.477	11.89	10.52	10.52
Band 26	814.7	20	20.85	23.00	8.09	38.45	1283.99	2.556	2.556	17.60	8.09	8.09

ISED NB IoT

Operation Mode	Freq. (MHz)	Operation Distance (cm)	Conducted Average output power (dBm)	Max. output Power include tolerance (dBm)	Antenna Gain (dBi)	EIRP (ERP) Limit (dBm)	Max. output Power (mW)	Power Density (PD) (W/m²)	Limit (W/m²)	Allowable Gain according to EIRP (dBi)	Allowable Gain according to PD (dBi)	Max Allowable Gain (dBi)
Band 2	1850.2	20	22.75	23.00	10.25	33.00	2113.49	4.207	4.477	10.25	10.52	10.25
Band 4	1710.2	20	22.92	23.00	7.08	30.00	1018.59	2.027	4.242	7.08	10.29	7.08
Band 5	824.2	20	22.46	23.00	8.12	38.45	1294.20	2.576	2.576	15.99	8.12	8.12
Band 12	699.2	20	23.49	24.00	6.63	34.77	1156.61	2.302	2.302	11.28	6.63	6.63
Band 13	777.2	20	23.43	24.00	6.95	34.77	1243.30	2.475	2.475	11.34	6.95	6.95
Band 17	704.2	20	23.55	24.00	6.65	34.77	1162.25	2.313	2.313	11.22	6.65	6.65
Band 25	1850.2	20	20.85	22.00	11.52	33.00	2249.07	4.477	4.477	12.15	11.52	11.52
Band 26	814.1	20	23.40	24.00	7.08	38.45	1283.34	2.554	2.554	15.05	7.08	7.08

8.4 List of Applicable FCC Rules

This module complies with below part 22, 24, 27 and 90 of the FCC Rules.

Part 22 Subpart H
Part 24 Subpart 24E
Part 27 Subpart B, C & L
Part 90 R & S

8.5 Labeling Requirements

Any device incorporating this module must include an external, visible, permanent marking or label which states:
"Contains FCC ID: HSW-TY1SCDM" and "Contains IC :4492A-TY1SCDM"

Obligation d'étiquetage du produit final:
Tout dispositif intégrant ce module doit comporter un externe, visible, marquage permanent
ou une étiquette qui dit: "Contient IC: 4492A-TY1SCDM"

8.6 Additional Testing Requirements

The modular transmitter is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, and that the 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.

The final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

8.7 Test Modes

Murata Manufacturing Co., Ltd. uses various test mode programs for test set up which operate separate from production firmware. Host integrators should contact Murata Manufacturing Co., Ltd. for assistance with test modes needed for module/host compliance test requirements.

Federal Communications Commission (FCC) Statement
15.21
You are cautioned that changes or modifications not expressly approved by the part responsible for compliance could void the user's authority to operate the equipment.

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 of the device.

ISED
Canadian Notice
This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

1. *This device may not cause interference.*
2. *This device must accept any interference, including interference that may cause undesired operation of the device.*

Avis Canadien
L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

1. *L'appareil ne doit pas produire de brouillage;*
2. *L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.*

9   RoHS Information

The LBAD0ZZ1SE module is conformed to RoHS requirement.

10 Ordering Information

Table 10-1 Ordering Information

Product	Model Name	Murata Ordering Part Number	Standard Order Increment
Sample Module	Type 1SE	LBAD0ZZ1SE-743SMP	1 pcs
Production Module	Type 1SE	LBAD0ZZ1SE-743	500 pcs

11 Notice

11.1 Storage Conditions

Please use this product within 6 months after receipt.

- The product shall be stored in original under with an ambient temperature from 5 to 35°C, and humidity from 20% to 70%RH. (Packing materials, in particular, may become deformed if the temperature exceeds 40°C.)

- If the product is not used for more than 6months after receipt, confirm the solderability before use.

- Store the product in non-corrosive gas (Cl_2, NH_3, SO_2, NO_x, etc.).

- Avoid mechanical shock, such as dropping or puncturing the product, to preserve integrity of the packing materials.

  This product is applicable to MSL4 (Based on JEDEC Standard J-STD-020)

- After the package is opened, store it at <30°C / <60%RH and use the product within 72hours.

  Please record and manage the time after opening.

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

- If the color of the indicator in the packing changes, bake the product before soldering.

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

  Baked the product on a heat-resistant tray because other materials (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"

11.2 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 bear hands that may result in poor solder ability and destroy by static electrical charge.

11.3 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. If use non-standard lands, contact Murata beforehand.

11.4 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.

11.5 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 (Cl_2, NH_3, SOx, NOx, 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.

11.6 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.

12 PRECONDITIONS TO USE MURATA 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 DISCLAIMS 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.

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 IN SUCH APPLICATIONS.

- Aircraft equipment.   - Aerospace equipment   - Undersea equipment.
- Power plant control equipment   - Medical equipment.
- Transportation equipment (vehicles, trains, ships, elevator, etc.).
- Traffic signal equipment.   - Disaster prevention / crime prevention equipment.
-Burning / explosion control equipment
- 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.