Application Note

Type 1XK/2XK Wi-Fi™ + Bluetooth® Module

NXP IW416 Chipset for 802.11a/b/g/n + Bluetooth 5.2 Radio Law Certification Application Note - Rev. 2.0

- Design Name: Type 1XK / Type 2XK
- P/N: LBEE5CJ1XK / LBEE5CJ2XK

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About This Document

Murata's Type 1XK/2XK are a small and high-performance module based on NXP IW416 combo chipset, supporting IEEE 802.11a/b/g/n + Bluetooth 5.2 BR/EDR/LE. This application note provides radio law certification user manual. It is designed to ensure that module manufacturers correctly communicate the necessary information to host manufacturers that incorporate their modules. Refer to Type 1XK Datasheet and Type 2XK Datasheet for module specification.

Audience & Purpose

The intended audience of this document are the manufacturers and host manufacture that will integrate this module to their modules.

Document Conventions

Table 1 describes the document conventions.

Table 1: Document Conventions

Conventions	Description
	Warning Note Indicates very important note. Users are strongly recommended to review.
	Info Note Intended for informational purposes. Users should review.
	Menu Reference Indicates menu navigation instructions. **Example**: Insert➔Tables➔Quick Tables➔Save Selection to Gallery
	External Hyperlink This symbol indicates a hyperlink to an external document or website. **Example**: Murata Click on the text to open the external link.
	Internal Hyperlink This symbol indicates a hyperlink within the document. **Example**: Operating Conditions Click on the text to open the link.
`Console input/output or code snippet`	**Console I/O or Code Snippet** This text ***Style*** denotes console input/output or a code snippet.
`# Console I/O comment` `// Code snippet comment`	**Console I/O or Code Snippet Comment** This text ***Style*** denotes a console input/output or code snippet comment. • Console I/O comment (preceded by "#") is for informational purposes only and does not denote actual console input/output. • Code Snippet comment (preceded by "//") may exist in the original code.

1 General Information for Radio Regulatory Certification

This section contains the following topics:

- Application model part number
- Markings/Dimensions
- Pin Layout
- Operating Conditions
- Package Label
- Country of Origin

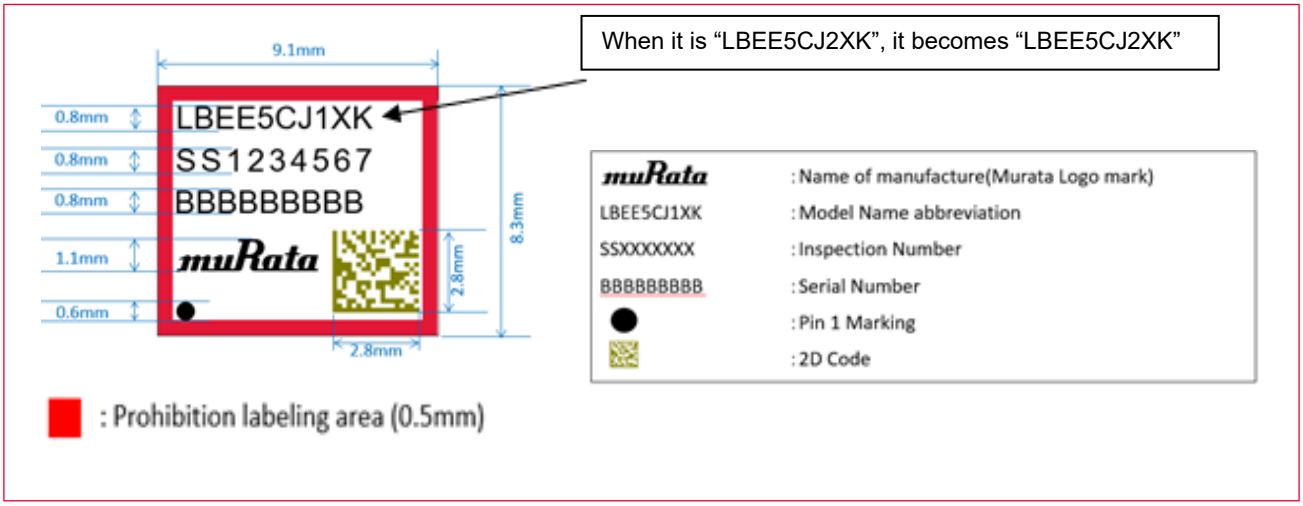
1.1 Application Model Part Number

Basically, we apply for **"LBEE5CJ1XK"** and **"LBEE5CJ2XK"** in each country.

1.2 Labels

Figure 1 shows the module's marking and dimension labels.

Figure 1: Labels



Since there is no space to describe the notational requirements of each country, we are applying for the notational requirements to be posted in the manual and package.

1.3 Pin Layout

Figure 2 shows the pin layout.

Figure 2: Pin Layout

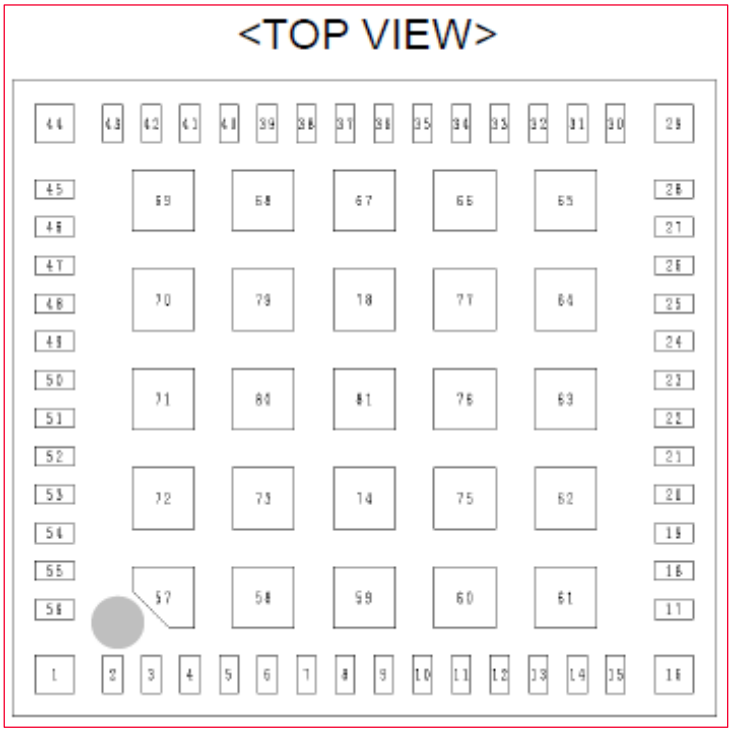


Table 2 describes the pin numbers.

Table 2: Terminal Configurations

No.	Terminal Name	No.	Terminal Name	No.	Terminal Name
1	GND	20	GPIO(3)TDO	39	GND
2	VIO	21	GND	40	GND
3	SD_D2	22	VBAT	41	GND
4	SD_CLK	23	VBAT	42	RF_CONTL2_N
5	SD_D0	24	GND	43	RF_CONTL3_P
6	SD_CMD	25	GND	44	GND
7	GPIO(9)UART_RXD	26	GND	45	BT_ANTSHARED
8	GPIO(6)	27	GND	46	GND
9	GPIO(7)	28	GND	47	BT_ANTDEDICATED
10	NC	29	GND	48	GND
11	GPIO(4)	30	GND	49	GND
12	GPIO(1)	31	PMIC_EN	50	GND
13	GPIO(15)TMS	32	WCI_SOUT	51	GPIO(11)UART_RTS
14	GPIO(5)	33	WCI_SIN	52	GPIO(0)
15	GPIO(8)UART_CTS	34	GPIO(12)	53	GPIO(13)
16	GND	35	RF_CONTL1_P	54	GPIO(10)UART_TXD
17	GPIO(14)TCK	36	RF_CONTL0_N	55	SD_D3
18	GPIO(2)TDI	37	GND	56	SD_D1
19	SLP_CLK_IN	38	RF_ANT	57-81	GND

1.4 Operating Conditions

Table 3 describes the operating conditions.

Table 3: Operating Conditions

Parameter		Minimum	Typical	Maximum	Unit
Operating Temperature		-40	25	85	°C
Supply Voltage	VBAT	2.7	3.3	5.5	V
	VIO	1.62	1.8 or 3.3	3.47	V

VBAT: Only this power supply affects the RF characteristics.

1.5 Package Label

Figure 3 shows the package. **Figure 4** and **Figure 5** show examples of the package label for Type 1XK and 2XK modules.

Figure 3: Package (Humidity Proof Packaging)

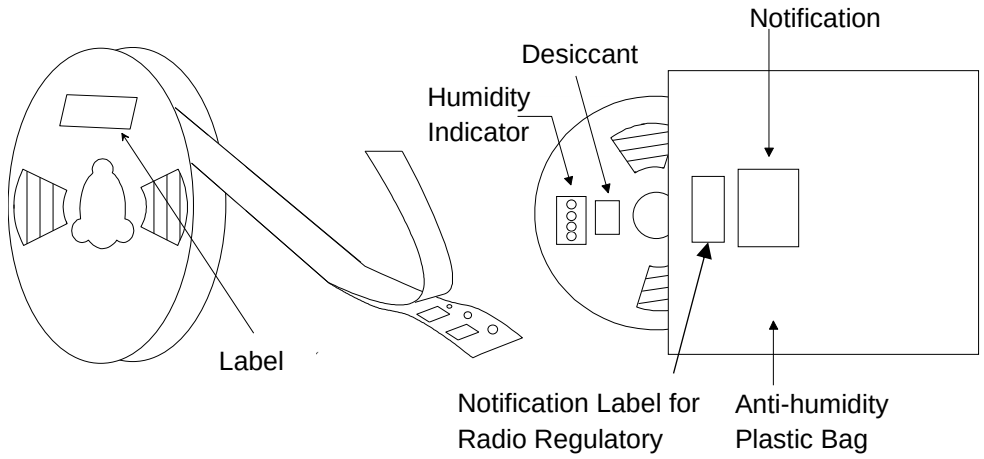


Figure 4: Package Label Display Example - Type 1XK

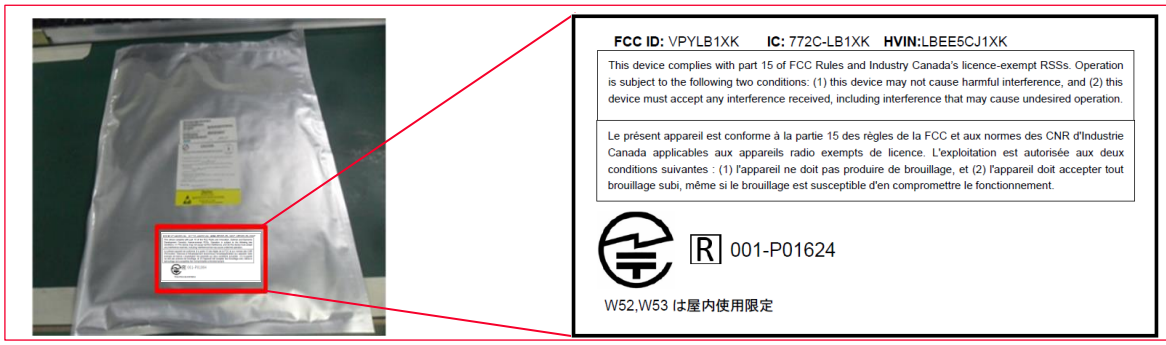
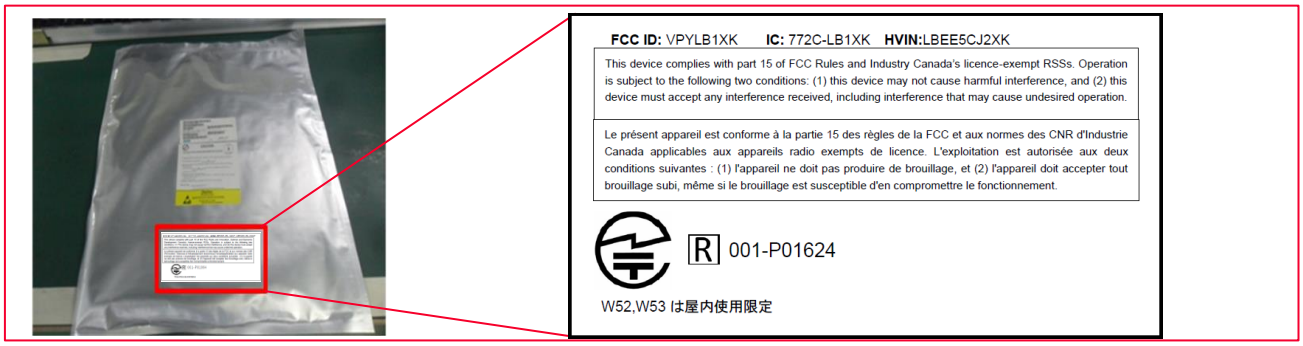


Figure 5: Package Label Display Example - Type 2XK



The package label may be attached on one side only.

1.6 Country of Origin

China

SHENZHEN MURATA TECHNOLOGY CO., LTD.

Some countries have applied for certification in two countries, China and Japan, in preparation for future factory changes, but the production site in the delivery specifications is the above-mentioned factory in China.

2 Radio Regulatory Certification Information by Country

This section contains the following country/region specific information:

- FCC (USA)
- ISED (Canada)
- EU
- Japan

2.1 FCC

FCC ID: VPYLB1XK

Since this module is not sold to general end users directly, there is no user manual of module.
For the details about this module, please refer to the specification sheet of module.
This module should be installed in the host device according to the interface specification (installation procedure).

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 OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the end user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as shown in User manual.

This device complies with below part 15 of FCC Rules.
- Part 15 Subpart C
- Part 15 Subpart E

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

This transmitter must not be co-located or operated in conjunction with any other antenna or transmitter.

Since there is no space which indicates FCC ID on this module, FCC ID is indicated in a manual. If the FCC ID is not visible when the module is installed inside another device, then the module is installed must also display a label referring to the enclosed module.

2.1.1 Setting RF Power

This section describes the RF power settings.

2.1.1.1 RF Power Setting for 2.4 GHz WLAN

Table 4 describes the RF power settings for 2.4 GHz WLAN.

Table 4: WLAN RF Power Setting for 2.4 GHz 802.11 b/g/n (HT20) - FCC

Mode	Rate/MCS index	Channel	Maximum Tune Up Tolerance (dBm)
IEEE 802.11b	All Rate	1 ~ 11	17.0 ± 2.0
IEEE 802.11g	All Rate	1 ~ 3, 9 ~ 11	14.0 ± 2.0
	6Mbps, 9Mbps, 12Mbps, 18Mbps	4 ~ 8	17.0 ± 2.0
	24Mbps, 36Mbps, 48Mbps, 54Mbps	4 ~ 8	16.0 ± 2.0
IEEE 802.11n (HT20)	All MCS index	1 ~ 3, 9 ~ 11	13.0 ± 2.0
	MCS0 ~ MCS2	4 ~ 8	16.0 ± 2.0
	MCS3 ~ MCS7	4 ~ 8	15.0 ± 2.0

2.1.1.2 RF Power Setting for BT (BR/EDR) / BLE

Table 5 describes the RF power settings for BT (BR/EDR) and BLE.

Table 5: BT / BLE RF Power Setting - FCC

Mode	Maximum Tune Up Tolerance [dBm]	
	Type 1XK / Shared BT Antenna (PIN No. 45)	Type 2XK / Dedicated BT Antenna (PIN No. 47)
BR	3.0 ± 3.0	3.3 ± 3.0
EDR	0.0 ± 3.0	0.3 ± 3.0
LE	3.0 ± 3.0	3.3 ± 3.0
LE 2 Mbps	3.0 ± 3.0	3.3 ± 3.0
LE 125 kbps	3.0 ± 3.0	3.3 ± 3.0

Mode	Maximum Tune Up Tolerance [dBm]	
	Type 1XK / Shared BT Antenna (PIN No. 45)	Type 2XK / Dedicated BT Antenna (PIN No. 47)
LE 500 kbps	3.0 ± 3.0	3.3 ± 3.0

2.1.1.3 RF Power Setting for 5 GHz WLAN

Table 6, **Table 7**, and **Table 8** describe the RF power settings for 5 GHz WLAN.

Table 6: WLAN RF Power Setting for 5 GHz 802.11a - FCC

Mode	Rate	Band	Channel	Maximum Tune Up Tolerance (dBm)
IEEE 802.11a	All Rate	W52/W53	36, 64	14.0 ± 2.0
		W52/W53	40 ~ 60	16.0 ± 2.0
		W56	100, 144	14.0 ± 2.0
		W56	104 ~ 140	15.0 ± 2.0
		W58	149 ~ 165	15.0 ± 2.0

Table 7: WLAN RF Power Setting for 5 GHz 802.11n (HT20) - FCC

Mode	MCS Index	Band	Channel	Maximum Tune Up Tolerance (dBm)
IEEE 802.11n (HT20)	All MCS Index	W52/W53	36, 64	13.0 ± 2.0
		W52/W53	40 ~ 60	15.0 ± 2.0
		W56	100, 144	13.0 ± 2.0
		W56	104 ~ 140	14.0 ± 2.0
		W58	149 ~ 165	14.0 ± 2.0

Table 8: WLAN RF Power Setting for 5 GHz 802.11n (HT40) - FCC

Mode	MCS Index	Band	Channel	Maximum Tune Up Tolerance (dBm)
IEEE 802.11n (HT40)	All MCS index	W52/W53	38, 62	12.0 ± 2.0
		W52/W53	46, 54	14.0 ± 2.0
		W56	102, 142	12.0 ± 2.0
		W56	110 ~ 134	14.0 ± 2.0
		W58	151, 159	14.0 ± 2.0

2.1.2 Theory of Operation

Table 9 describes the theory of operation for FCC.

Table 9: Theory of Operation - FCC

Frequency of Operation			Scan	Ad hoc Mode
2.4 GHz	11b/g/n (BW20)	2412-2462 MHz	Active	Yes
	BT	2402-2480 MHz	N/A	N/A
	BLE	2402-2480 MHz	N/A	N/A
W52	11a/n (BW20)	5180-5240 MHz	Active	Yes
	11n (BW40)	5190-5230 MHz	Active	Yes
W53	11a/n (BW20)	5260-5320 MHz	Passive	No
	11n (BW40)	5270-5310 MHz	Passive	No
W56	11a/n (BW20)	5500-5720 MHz	Passive	No
	11n (BW40)	5510-5710 MHz	Passive	No
W58	11a/n (BW20)	5745-5825 MHz	Active	Yes
	11n (BW40)	5755-5795 MHz	Active	Yes

DFS MASTER function not available.
DFS client function available.

2.1.3 Antenna

Table 10 lists the antennas for FCC.

Table 10: Antennas - FCC

No.	Part number	Vendor	Peak Gain [dBi]		Type	Connector
			2.4 GHz	5 GHz		
1	146153	Molex	3.2	4.25	Dipole	u.FL
2	146187	Molex	3.0	4.25	Dipole	u.FL
3	LBEE5CJ1XK-Antenna	Murata	3.6	4.6	Monopole	Trace

Please perform the antenna design that followed the specifications of the antenna.
About the signal line between an antenna and a module

- It is a 50Ω line design.
- Fine tuning of return loss etc. can be performed using a matching network.
- However, it is required to check "Class1 change" and "Class2 change" which the authorities define then.

The concrete contents of a check are the following three points.

- It is the same type as the antenna type of antenna specifications.
- An antenna gain is lower than a gain given in antenna specifications.
- The emission level is not getting worse.

For "146153" and "146187" antennas, you need to make a copy of this EVB design from the feedline to the antenna connector.

For " LBEE5CJ1XK-Antenna " antennas, you need to copy the entire antenna design, including the feedline.

The design of EVB used for the certification test is shown in **Figure 6**.

Figure 6: EVB Design Used for Testing - FCC

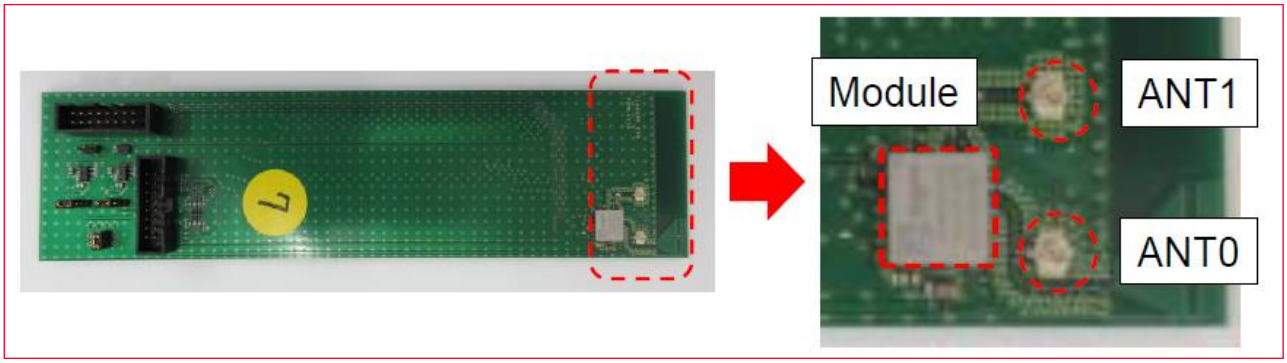
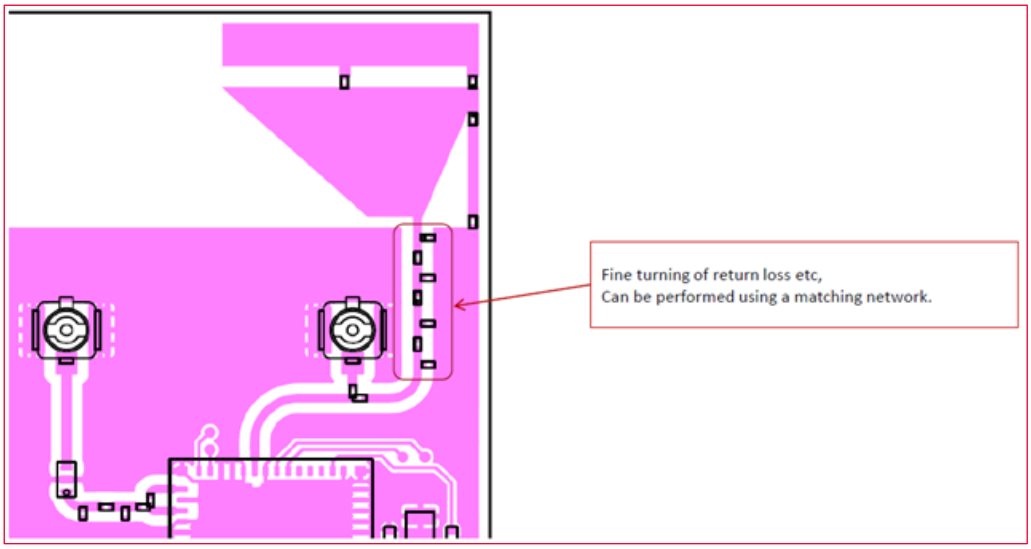


Figure 7 shows the antenna layout for Type 1XK module.

Figure 7: Antenna Layout



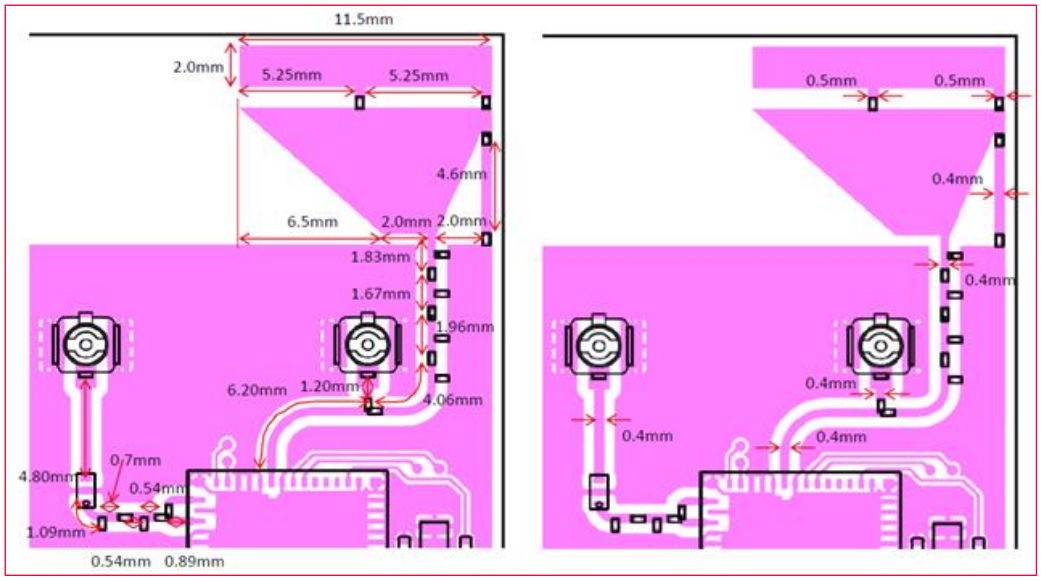


Table 11 shows the antenna connection configuration for LBEE5CJ1XK and LBEE5CJ2XK with respect to the part layout design**.**

Table 11: Antenna Connection Configuration for LBEE5CJ1XK and LBEE5CJ2XK

Connection Configuration Name	WLAN Antenna (PIN No.38 side)	BT Antenna (PIN No.47 side)	Parts Layout Diagram
Shared BT antenna connection configuration	LBEE5CJ1XK-Antenna	LBEE5CJ1XK-Antenna	Refer to Diagram A
	146153 / 146187	146153 / 146187	Refer to Diagram B
Dedicated BT antenna connection configuration	LBEE5CJ1XK-Antenna	146153 / 146187	Refer to Diagram C
	146153 / 146187	146153 / 146187	Refer to Diagram D

Figure 8 shows the layout diagram for antenna connection configurations.

Figure 8: Antenna Connection Configurations

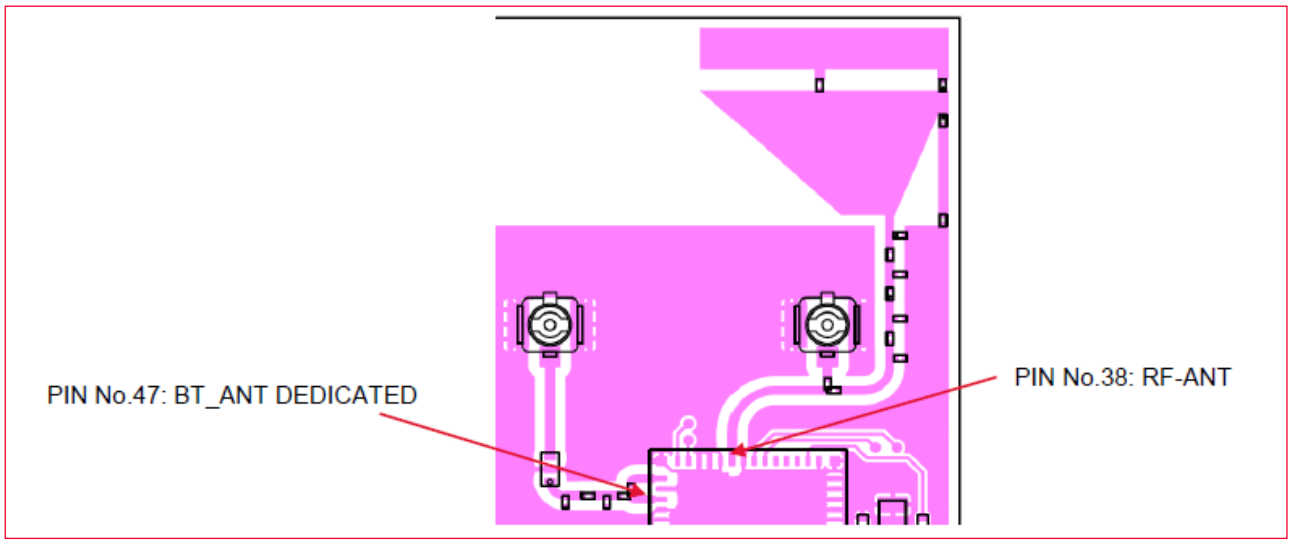


Figure 9: Antenna Connection Configurations - Diagram A

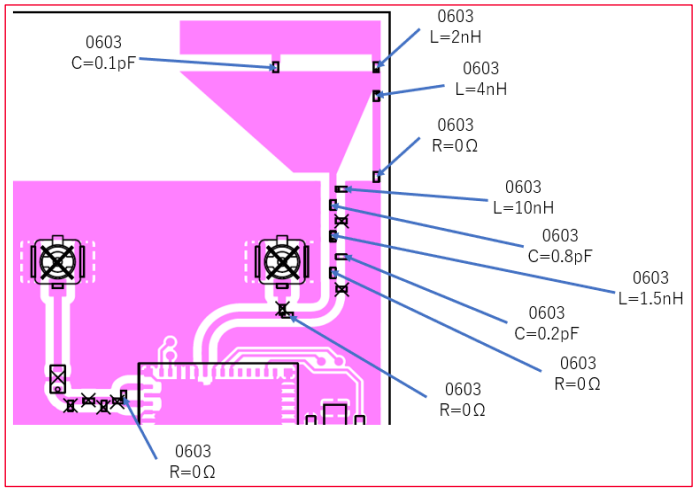


Figure 10: Antenna Connection Configurations - Diagram B

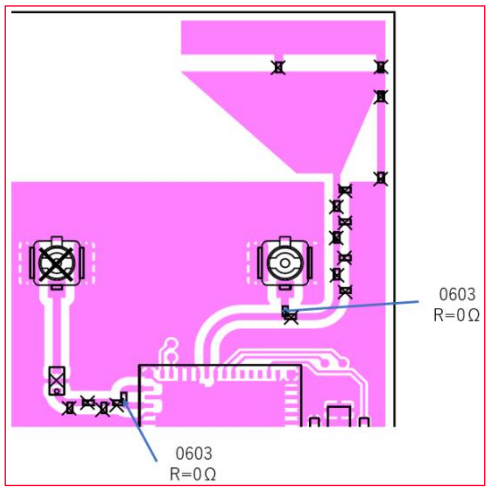


Figure 11: Antenna Connection Configurations - Diagram C

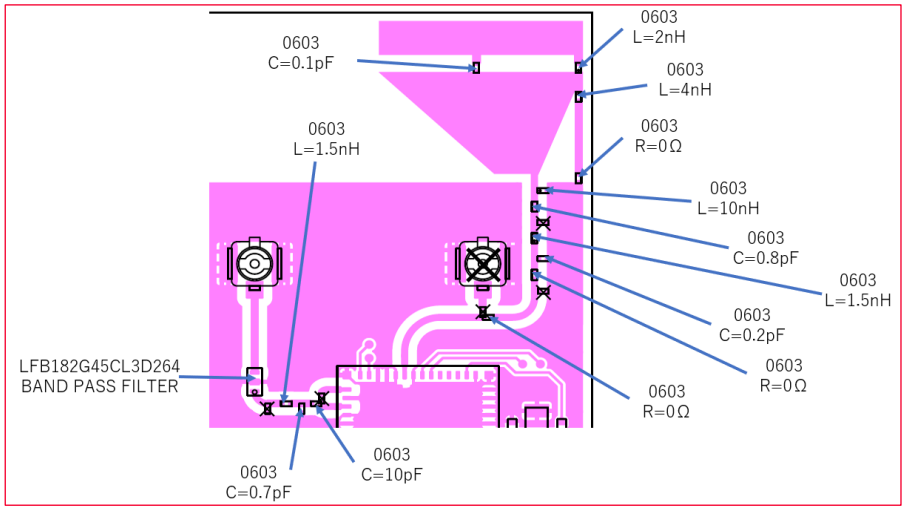
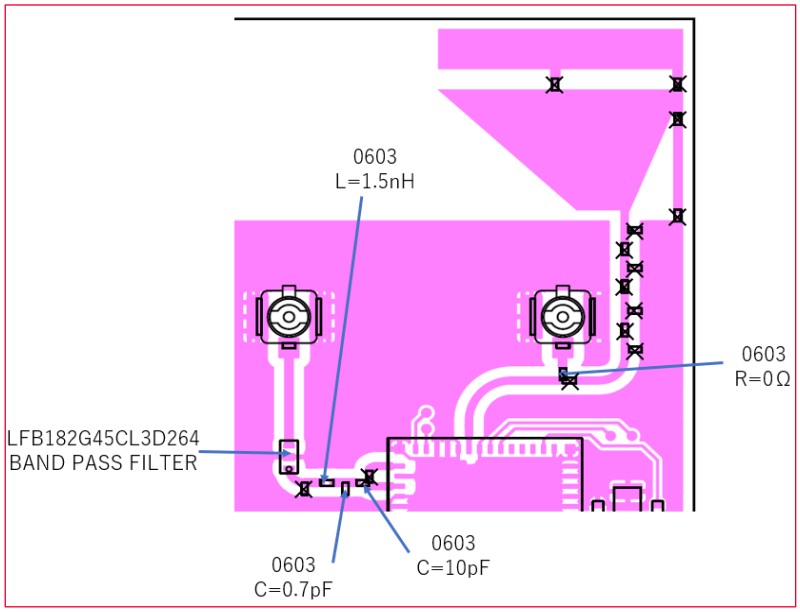


Figure 12: Antenna Connection Configurations - Diagram D



2.1.4 About LBEE5CJ1XK and LBEE5CJ2XK

This FCC modular approval with FCC ID: VPYLB1XK has been granted with LBEE5CJ1XK as the original certification model.

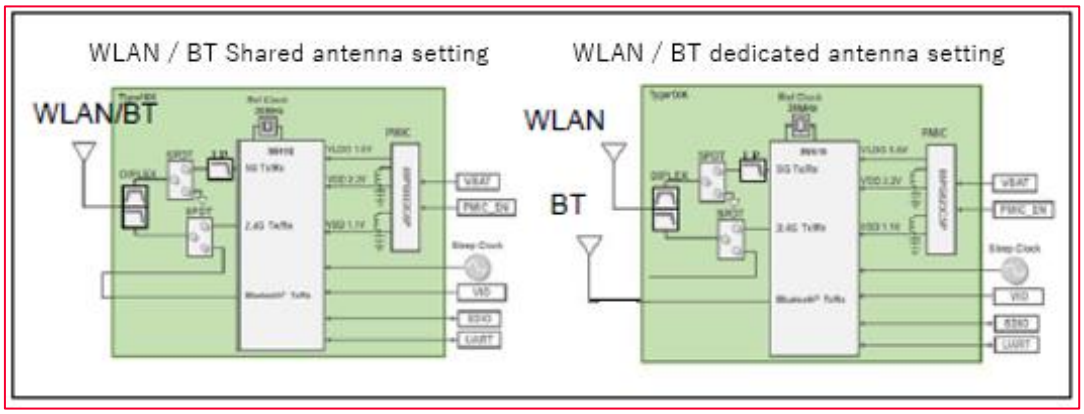
This is a certification that allows both “configuration of WLAN/BT shared antenna setting” and “configuration of BT dedicated antenna setting”.

However, due to the complexity of management, a module with the same design except for the model’s name and newly created as “LBEE5CJ2XK”. And we made an addition and change of the product name to decide the configuration of the default antenna setting for each. This is a Class Ⅰ permissive change.

- LBEE5CJ1XK: default is used with WLAN/BT shared antenna setting
- LBEE5CJ2XK: default is used with WLAN/BT dedicated antenna setting

Figure 13 shows the antenna configuration for Type 1XK and Type 2XK modules.

Figure 13: Antenna Configuration for Type 1XK and Type 2XK Modules



2.1.5 Integration Instructions

The following statements must be described on the user manual of the host device of this module.

Contains Transmitter Module FCC ID: VPYLB1XK	OR	Contains FCC ID: VPYLB1XK

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.

If it is difficult to describe this statement on the host product due to the size, please describe in the User's manual and also either describe on the device packaging or on a removable label attached to the device.

FCC CAUTION

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

Frequency Tolerance: ±20 ppm

This transmitter must not be co-located or operated in conjunction with any other antenna or transmitter.

Compliance with FCC requirement 15.407(c)

Data transmission is always initiated by software, which is the passed down through the MAC, through the digital and analog baseband, and finally to the RF chip. Several special packets are initiated by the MAC. These are the only ways the digital baseband portion will turn on the RF transmitter, which it then turns off at the end of the packet. Therefore, the transmitter will be on only while one of the aforementioned packets is being transmitted. In other words, this device automatically discontinue transmission in case of either absence of information to transmit or operational failure.

When installing it in a mobile equipment. Please describe the following warning to the manual.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines. This equipment should be installed and operated keeping the radiator at least 20cm or more away from person's body.

When installing it in a portable equipment. Please describe the following warning to the manual.

- It is necessary to take a SAR test with your set mounting this module.
- Class Ⅱ permissive change application is necessary using the SAR report.
- Please contact Murata.

- **Portable equipment:** Equipment for which the spaces between human body and antenna are used within 20 cm.
- **Mobile equipment:** Equipment used at position in which the spaces between human body and antenna exceeded 20 cm.

2.2 ISED

PMN: LBEE5CJ1XK	**HVIN:** LBEE5CJ1XK LBEE5CJ2XK	**IC:** 772C-LB1XK

Since this module is not sold to general end users directly, there is no user manual of module.
For the details about this module, please refer to the specification sheet of module.
This module should be installed in the host device according to the interface specification (installation procedure).

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the end user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as shown in User manual.

The following information must be indicated on the host device of this module.

Contains IC: 772C-LB1XK

In case of the final product which can be carried around to outdoor. The following indication is necessary to the final product.

- When the STA function is used in channel 52, 54. At the time of the channel 52 or 54 setting, please indicate "for indoor use only channel". During connecting, please show the channel number which connects.
- And please indicate that the end user may find out "for indoor use only channel".

The following statements must be described on the user manual of the host device of this module.

English Version This device complies with Industry Canada's applicable licence-exempt RSSs. Operation is subject to the following two conditions: • This device may not cause interference; and • This device must accept any interference, including interference that may cause undesired operation of the device.
French Version Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: • l'appareil ne doit pas produire de brouillage; • l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

If it is difficult to describe this statement on the host product due to the size, please describe in the User's manual

If the antenna of the end product is removed, please describe the follow warning on the manual of the end product which contains this module.

English Version

This radio transmitter (772C-LB1XK) has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated.
Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

: Dipole Antenna	Gain: 3.2 dBi@2.4GHz/4.25 dBi@5GHz
: Dipole Antenna	Gain: 3.0 dBi@2.4GHz/4.25 dBi@5GHz
: Monopole Antenna	Gain: 3.6 dBi@2.4GHz/4.6 dBi@5GHz

French Version

Le présent émetteur radio (772C-LB1XK) a été approuvé par Innovation, Sciences et Développement économique Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal.
Les types d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué pour tout type figurant sur la liste, sont strictement interdits pour l'exploitation de l'émetteur.

: Dipole Antenna	Gain: 3.2 dBi@2.4GHz/4.25 dBi@5GHz
: Dipole Antenna	Gain: 3.0 dBi@2.4GHz/4.25 dBi@5GHz
: Monopole Antenna	Gain: 3.6 dBi@2.4GHz/4.6 dBi@5GHz

If the final product uses the following frequency, please note that there is a limit.

English Version

For indoor use only (5150-5250 MHz band and channel 52, 54).

French Version

Pour usage intérieur seulement (5150-5250 MHz band and channel 52, 54)

The following statements must be described on the user manual of the host device of this module.

English Version

Data transmission is always initiated by software, which is the passed down through the MAC, through the digital and analog baseband, and finally to the RF chip. Several special packets are initiated by the MAC. These are the only ways the digital baseband portion will turn on the RF transmitter, which it then turns off at the end of the packet. Therefore, the transmitter will be on only while one of the aforementioned packets is being transmitted. In other words, this device automatically discontinue transmission in case of either absence of information to transmit or operational failure.

French Version

La transmission des données est toujours initiée par le logiciel, puis les données sont transmises par l'intermédiaire du MAC, par la bande de base numérique et analogique et, enfin, à la puce RF. Plusieurs paquets spéciaux sont initiés par le MAC. Ce sont les seuls moyens pour qu'une partie de la bande de base numérique active l'émetteur RF, puis désactive celui-ci à la fin du paquet. En conséquence, l'émetteur reste uniquement activé lors de la transmission d'un des paquets susmentionnés. En d'autres termes, ce dispositif interrompt automatiquement toute transmission en cas d'absence d'information à transmettre ou de défaillance.

If it is difficult to describe this statement on the host product due to the size, please describe in the User's manual.

When installing it in a mobile equipment. Please describe the following warning to the manual.

English Version

This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment and meets RSS-102 of the IC radio frequency (RF) Exposure rules. This equipment should be installed and operated keeping the radiator at least 20cm or more away from person's body.

French Version

Cet équipement est conforme aux limites d'exposition aux rayonnements énoncées pour un environnement non contrôlé et respecte les règles d'exposition aux fréquences radioélectriques (RF) CNR-102 de l'IC. Cet équipement doit être installé et utilisé en gardant une distance de 20 cm ou plus entre le radiateur et le corps humain.

When installing it in a portable equipment. Please describe the following warning to the manual.

- It is necessary to take an SAR test with your set mounting this module.
- Class 4 permissive change application is necessary using the SAR report.
- Please contact Murata.

- **Portable equipment:** Equipment for which the spaces between human body and antenna are used within 20 cm.
- **Mobile equipment:** Equipment used at position in which the spaces between human body and antenna exceeded 20 cm.

2.2.1 Setting RF Power

This section describes the RF power settings.

2.2.1.1 RF Power Setting for 2.4 GHz WLAN

Table 12 describes the RF power settings for 2.4 GHz WLAN.

Table 12: WLAN RF Power Setting for 2.4 GHz 802.11 b/g/n (HT20) - ISED

Mode	Rate/MCS index	Channel	Maximum Tune Up Tolerance (dBm)
IEEE 802.11b	All Rate	1 ~ 11	17.0 ± 2.0
IEEE 802.11g	All Rate	1 ~ 3, 9 ~ 11	14.0 ± 2.0
	6Mbps, 9Mbps, 12Mbps, 18Mbps	4 ~ 8	17.0 ± 2.0
	24Mbps, 36Mbps, 48Mbps, 54Mbps	4 ~ 8	16.0 ± 2.0
IEEE 802.11n (HT20)	All MCS index	1 ~ 3, 9 ~ 11	13.0 ± 2.0
	MCS0 ~ MCS2	4 ~ 8	16.0 ± 2.0
	MCS3 ~ MCS7	4 ~ 8	15.0 ± 2.0

2.2.1.2 RF Power Setting for BT (BR/EDR) / BLE

Table 13 describes the RF power settings for BT (BR/EDR) and BLE.

Table 13: BT / BLE RF Power Setting - ISED

Mode	Maximum Tune Up Tolerance [dBm]	
	Type 1XK / Shared BT Antenna (PIN No. 45)	Type 2XK / Dedicated BT Antenna (PIN No. 47)
BR	3.0 ± 3.0	3.3 ± 3.0
EDR	0.0 ± 3.0	0.3 ± 3.0
LE	3.0 ± 3.0	3.3 ± 3.0
LE 2 Mbps	3.0 ± 3.0	3.3 ± 3.0
LE 125 kbps	3.0 ± 3.0	3.3 ± 3.0
LE 500 kbps	3.0 ± 3.0	3.3 ± 3.0

2.2.1.3 RF Power Setting for 5 GHz WLAN

Table 14, **Table 15**, and **Table 16** describe the RF power settings for 5 GHz WLAN.

Table 14: WLAN RF Power Setting for 5 GHz 802.11a - ISED

Mode	Rate	Band	Channel	Maximum Tune Up Tolerance (dBm)
IEEE 802.11a	All Rate	W52/W53	36 ~ 48, 64	14.0 ± 2.0
		W53	52 ~ 60	16.0 ± 2.0
		W56	100, 144	14.0 ± 2.0

Mode	Rate	Band	Channel	Maximum Tune Up Tolerance (dBm)
		W56	104 ~ 116, 132 ~ 140	15.0 ± 2.0
		W58	149 ~ 165	15.0 ± 2.0

Table 15: WLAN RF Power Setting for 5 GHz 802.11n (HT20) - ISED

Mode	MCS Index	Band	Channel	Maximum Tune Up Tolerance (dBm)
IEEE 802.11n (HT20)	All MCS Index	W52/W53	36, 64	13.0 ± 2.0
		W52	40 ~ 48	14.0 ± 2.0
		W53	52 ~ 60	15.0 ± 2.0
		W56	100, 144	13.0 ± 2.0
		W56	104 ~ 116, 132 ~ 140	14.0 ± 2.0
		W58	149 ~ 165	14.0 ± 2.0

Table 16: WLAN RF Power Setting for 5 GHz 802.11n (HT40) - ISED

Mode	MCS Index	Band	Channel	Maximum Tune Up Tolerance (dBm)
IEEE 802.11n (HT40)	All MCS index	W52/W53	38, 62	12.0 ± 2.0
		W52/W53	46, 54	14.0 ± 2.0
		W56	102, 142	12.0 ± 2.0
		W56	110, 134	14.0 ± 2.0
		W58	151, 159	14.0 ± 2.0

2.2.2 Theory of Operation

Table 17 describes the theory of operation for ISED.

Table 17: Theory of Operation - ISED

Frequency of Operation			Scan	Ad hoc Mode
2.4 GHz	11b/g/n (BW20)	2412-2462 MHz	Active	Yes
	BT	2402-2480 MHz	N/A	N/A
	BLE	2402-2480 MHz	N/A	N/A
W52	11a/n (BW20)	5180-5240 MHz	Active	Yes
	11n (BW40)	5190-5230 MHz	Active	Yes
W53	11a/n (BW20)	5260-5320 MHz	Passive	No
	11n (BW40)	5270-5310 MHz	Passive	No
W56	11a/n (BW20)	5500-5720 MHz (*ISED:5600-5650MHz disable)	Passive	No
	11n (BW40)	5510-5710 MHz (*ISED:5600-5650MHz disable)	Passive	No
W58	11a/n (BW20)	5745-5825 MHz	Active	Yes
	11n (BW40)	5755-5795 MHz	Active	Yes

DFS MASTER function not available.
DFS client function available.

2.2.3 Antenna

Table 18 lists the antennas for ISED.

Table 18: Antenna - ISED

No.	Part number	Vendor	Peak Gain [dBi]		Type	Connector
			2.4 GHz	5 GHz		
1	146153	Molex	3.2	4.25	Dipole	u.FL
2	146187	Molex	3.0	4.25	Dipole	u.FL
3	LBEE5CJ1XK-Antenna	Murata	3.6	4.6	Monopole	Trace

Please perform the antenna design that followed the specifications of the antenna.
About the signal line between an antenna and a module

- It is a 50Ω line design.
- Fine tuning of return loss etc. can be performed using a matching network.
- However, it is required to check "Class1 change" and "Class2 change" which the authorities define then.

The concrete contents of a check are the following three points.

- It is the same type as the antenna type of antenna specifications.
- An antenna gain is lower than a gain given in antenna specifications.
- The emission level is not getting worse.

For "146153" and "146187" antennas, you need to make a copy of this EVB design from the feedline to the antenna connector.

For " LBEE5CJ1XK-Antenna " antennas, you need to copy the entire antenna design, including the feedline.

The design of EVB used for the certification test is shown in **Figure 14**.

Figure 14: EVB Design Used for Testing - ISED

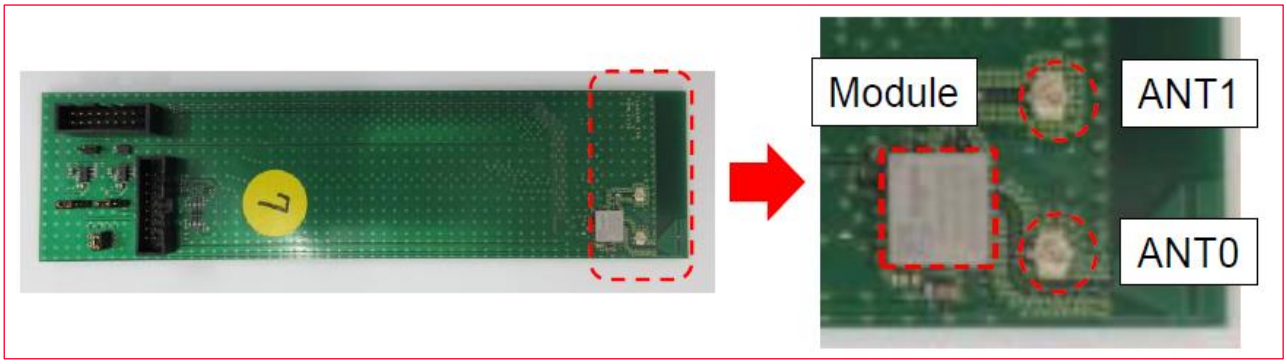


Figure 15 shows the antenna layout for Type 1XK module.

Figure 15: Antenna Layout

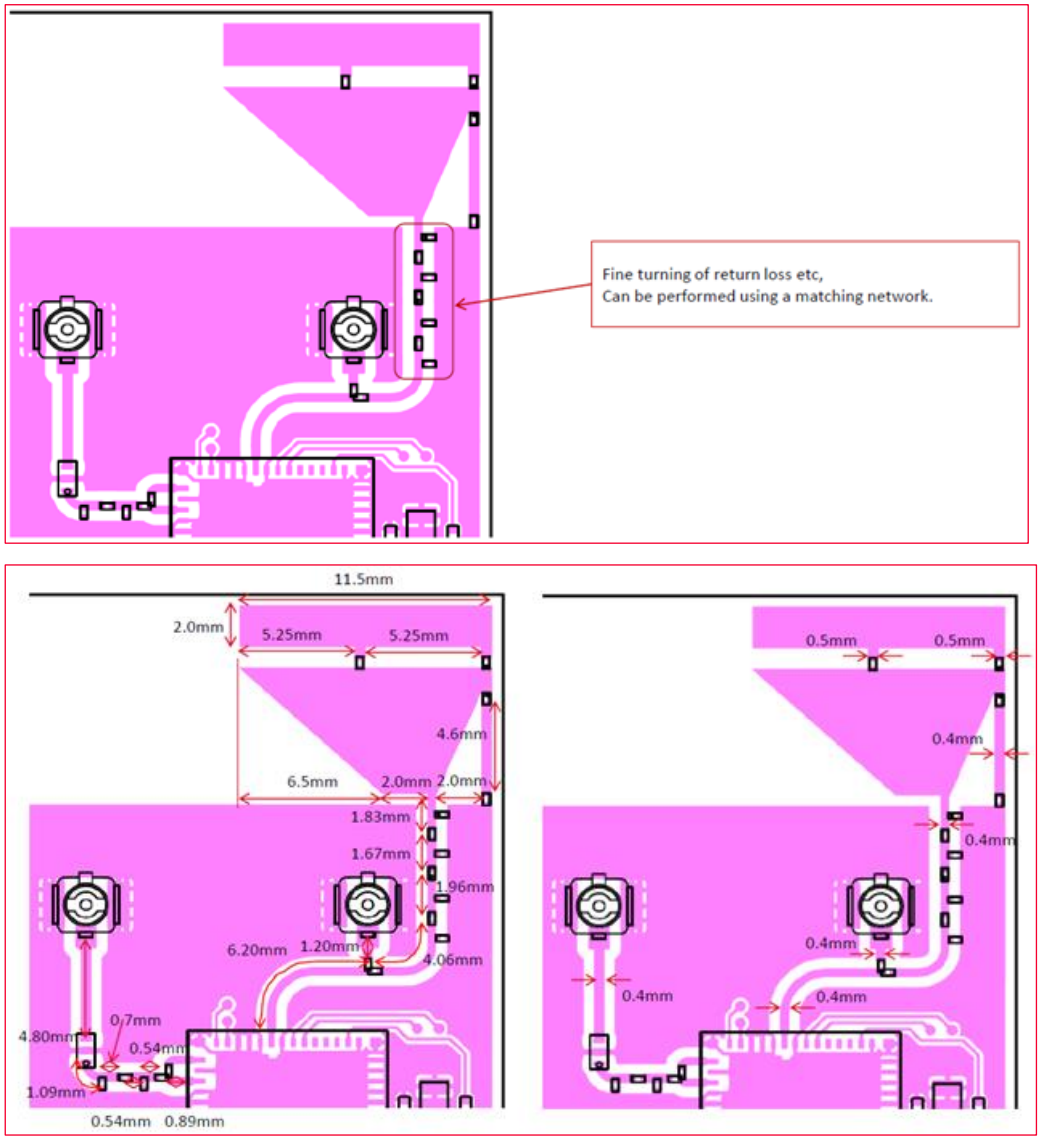


Table 19 Table 11 shows the antenna connection configuration for LBEE5CJ1XK and LBEE5CJ2XK with respect to the part layout design**.**

Table 19: Antenna Connection Configuration for LBEE5CJ1XK and LBEE5CJ2XK

Connection Configuration Name	WLAN Antenna (PIN No.38 side)	BT Antenna (PIN No.47 side)	Parts Layout Diagram
Shared BT antenna connection configuration	LBEE5CJ1XK-Antenna	LBEE5CJ1XK-Antenna	Refer to Diagram A
	146153 / 146187	146153 / 146187	Refer to Diagram B
Dedicated BT antenna connection configuration	LBEE5CJ1XK-Antenna	146153 / 146187	Refer to Diagram C
	146153 / 146187	146153 / 146187	Refer to Diagram D

Figure 16 shows the layout diagrams for antenna connection configurations.

Figure 16: Antenna Connection Configurations

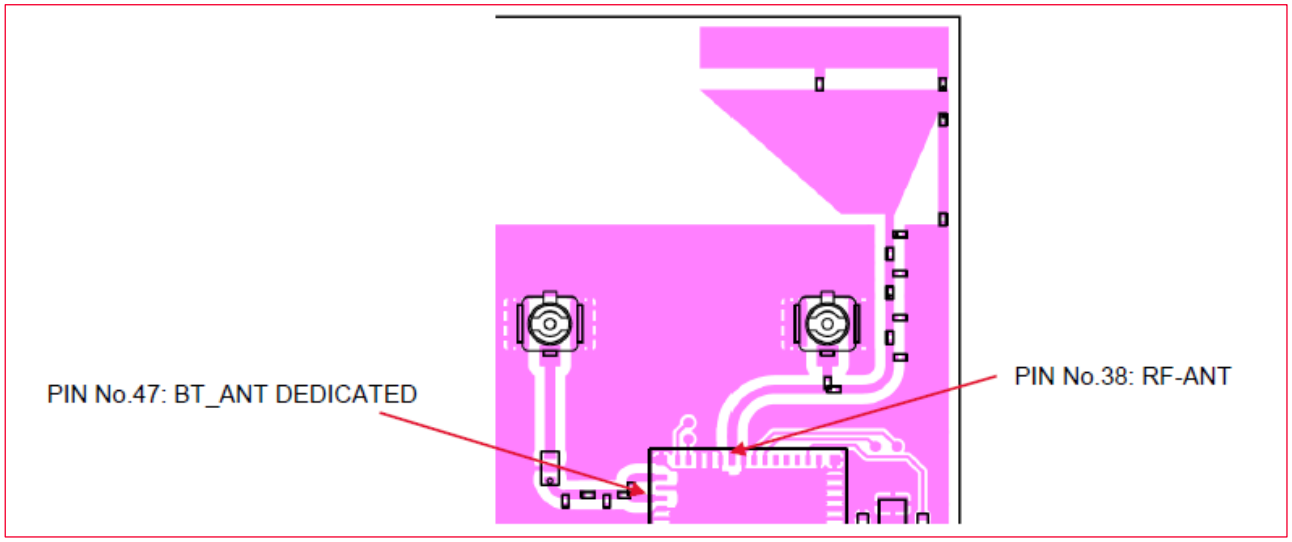


Figure 17: Antenna Connection Configurations - Diagram A

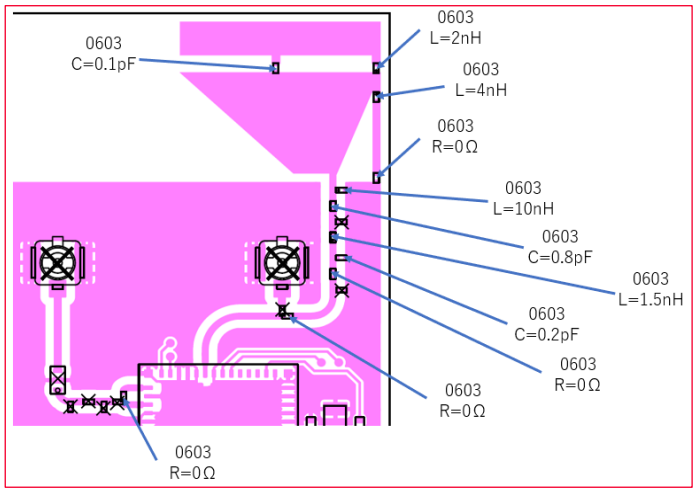


Figure 18: Antenna Connection Configurations - Diagram B

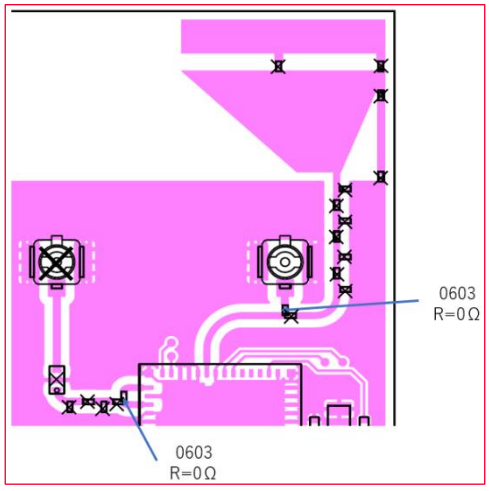


Figure 19: Antenna Connection Configurations - Diagram C

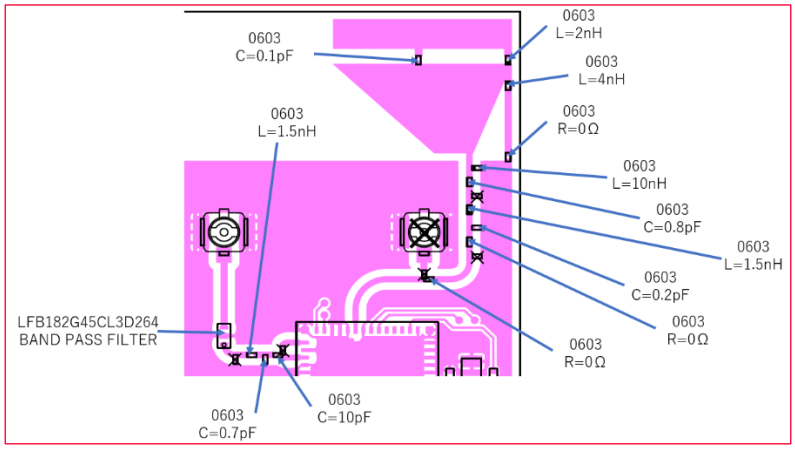
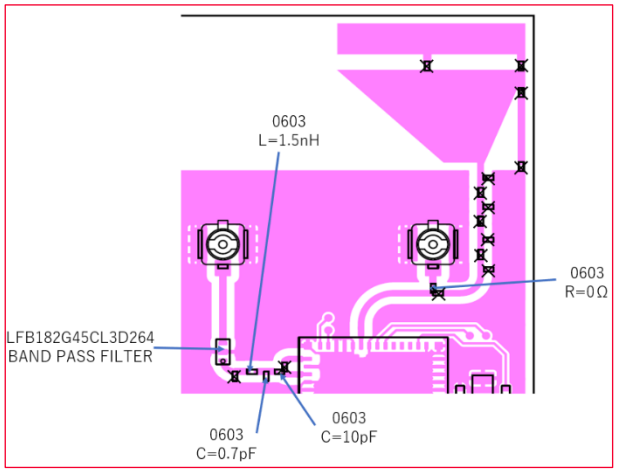


Figure 20: Antenna Connection Configurations - Diagram D

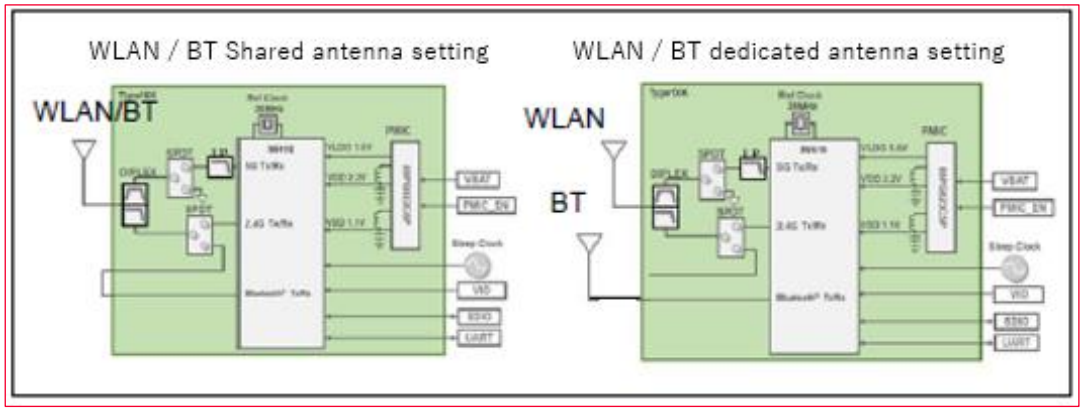


2.2.4 About LBEE5CJ1XK and LBEE5CJ2XK

"LBEE5CJ1XK" and "LBEE5CJ2XK" have the same design except for the type name, but the type name is separated according to the antenna setting for management.

- LBEE5CJ1XK: default is used with WLAN/BT shared antenna setting
- LBEE5CJ2XK: default is used with WLAN/BT dedicated antenna setting

Figure 21: Antenna Configuration for Type 1XK and Type 2XK Modules



2.3 EU

The following report is issued:

Only the Antenna Terminated Conducted test section of each report is available for TCF of the final product.

The radiation characteristic data should be acquired by you in the final product.

Radio Equipment Directive (RED) 2014/53/EU Article 3.2

Conforms to: EN 300 328 v2.2.2:2019

Report No.: E2/2021/30010, E2/2021/30011-01

EN 301 893 v2.1.1:2017

Report No.: E2/2021/30012-01

EN 300 440 v2.1.1:2017

Report No.: E2/2021/30013

Product name: Communication Module

Model: LBEE5CJ1XK, LBEE5CJ2XK

Manufacturer: Murata manufacturing Co., Ltd.

When shipping final products with this module to Europe, make a self-declaration that the product complies with European regulations and apply the CE mark.

2.3.1 Setting RF Power

This section describes the RF power settings.

2.3.1.1 RF Power Setting for 2.4 GHz WLAN

Table 20 describes the RF power settings for 2.4 GHz WLAN.

Table 20: WLAN RF Power Setting for 2.4 GHz - EU

Mode	Rate/MCS index	Channel	Output Power in dBm (typical)
IEEE 802.11b	All Rate	1 ~ 13	14.0
IEEE 802.11g	All Rate	1 ~ 13	14.0
IEEE 802.11n (HT20)	All MCS index	1 ~ 13	14.0

2.3.1.2 RF Power Setting for BT (BR/EDR) / BLE

Table 21 describes the RF power settings for BT (BR/EDR) and BLE.

Table 21: BT / BLE RF Power Setting - EU

Mode	Output Power in dBm (typical)	
	Type 1XK / Shared BT Antenna (PIN No. 45)	Type 2XK / Dedicated BT Antenna (PIN No. 47)
BR	3.0	3.3
EDR	0.0	0.3
LE	3.0	3.3
LE 2 Mbps	3.0	3.3
LE 125 kbps	3.0	3.3
LE 500 kbps	3.0	3.3

2.3.1.3 RF Power Setting for 5 GHz WLAN (W52/W53/W56)

Table 22 describes the RF power settings for 5 GHz WLAN (W52/W53/W56).

Table 22: WLAN RF Power Setting - 5 GHz 802.11a/n for Channels 36 ~ 140 (EU)

Mode	Rate/MCS Index	Channel	Output Power in dBm (typical)
IEEE 802.11a	All Rate	36 ~ 140	15.0
IEEE 802.11n (HT20)	All MCS index	36 ~ 140	14.0
IEEE 802.11n (HT40)	All MCS index	38 ~ 134	14.0

2.3.1.4 RF Power Setting for 5 GHz WLAN (W58)

Table 23 describes the RF power settings for 5 GHz WLAN (W58).

Table 23: WLAN RF Power Setting - 5 GHz 802.11 a/n/ac for Channels 149 ~ 165 (EU)

Mode	Rate/MCS Index	Channel	Output Power in dBm (typical)
IEEE 802.11a	All Rate	149 ~ 165	7.0
IEEE 802.11n (HT20)	All MCS index	149 ~ 165	7.0
IEEE 802.11n (HT40)	All MCS index	151, 159	7.0

2.3.2 Theory of Operation

Table 24 describes the theory of operation for EU.

Table 24: Theory of Operation - EU

Frequency of Operation			Scan	Ad hoc Mode
2.4 GHz	11b/g/n(BW20)	2412-2472 MHz	Active	Yes
	BT	2402-2480 MHz	N/A	N/A
	BLE	2402-2480 MHz	N/A	N/A
W52	11a/n (BW20)	5180-5240 MHz	Active	Yes
	11n (BW40)	5190-5230 MHz	Active	Yes
W53	11a/n (BW20)	5260-5320 MHz	Passive	No
	11n (BW40)	5270-5310 MHz	Passive	No
W56	11a/n (BW20)	5500-5700 MHz	Passive	No
	11n (BW40)	5510-5670 MHz	Passive	No

Frequency of Operation			Scan	Ad hoc Mode
W58	11a/n (BW20)	5745-5825 MHz	Active	Yes
	11n (BW40)	5755-5795 MHz	Active	Yes

DFS MASTER function not available.
DFS client function available.

2.4 Japan

- **Manufacturer Name:** Murata Manufacturing Co., Ltd.
- **Model or Product Name:** LBEE5CJ1XK or LBEE5CJ2XK

This module has received “CERTIFICATION for TYPE CERTIFICATION" under the Japanese Radio Act.

電波法の要求に基づく警告
（警告）5 GHz の周波数帯においては、5.2 GHz/5.3GHz/5.6GHz 帯 (W52/W53/W56)の 3 種類の帯域を使用することができます。5.2 GHz/5.3 GHz 帯無線 LAN (W52/W53)の屋外使用は 5.2GHz 帯高出力データ通信システムの基地局又は陸上移動中継局と通信する場合を除き電波法で禁止されています

English Translation
Warning based on the requirements of Japanese Radio Act.
(Warning) In the 5GHz frequency band, you can use 3 bands: 5.2GHz/5.3GHz/5.6GHz(W52/W53/W56).
Outdoor use of 5.2 GHz/5.3 GHz band wireless LANs(W52/W53) is prohibited by the Radio Act except when communicating with 5.2 GHz band high-power data communication system base stations or land mobile relay stations.

2.4GHz と 5GHz(W52,W53,W56)で使用するモジュールです。
W53/W56 は子局としてのみ動作させてください。

English Translation
This is a module for use at 2.4 GHz and 5 GHz (W52, W53, W56).
Operate the W53/W56 only as a client mode.

2.4.1 Product Outline

This specification characterizes the IEEE 802.11 a/b/g/n + Bluetooth BR/EDR/LE combo module.

- **Product Size:** 9.1 x 8.3 mm (Typical), H = 1.3 mm (Maximum)
- **Wireless-IC:** NXP IW416 inside
- **Reference Clock**: 26 MHz X′tal
- **Weight:** 0.269 g

2.4.2 Feature

- **Product Name:** Communication Module
- **Model Name:** LBEE5CJ1XK or LBEE5CJ2XK
- **Purpose of the equipment:** Telecommunication
- **Equipment Type:** Transceiver
- **Frequency band:** 2412-2472 MHz/ 2402-2480 MHz/ 2405-2480 MHz/ 5180-5320 MHz/ 5500-5720 MHz
- **Channel:** (WLAN)1 ~ 13 ch/ 36 ~ 64 ch/ 100 ~ 144 ch
  (BT)1 ~ 79 ch (BLE) 1 ~ 40 ch
- **Bandwidth:** (WLAN) 2.4 GHz 11b (20 MHz)/11g (20 MHz)/11n (20 MHz)
  5 GHz 11a (20 MHz)/11n (20/40 MHz)
  (BT) Hopping off 1 MHz / Hopping on 79 MHz
  (BLE) 1 MHz / 2 MHz
- **Input Voltage to RF parts:** VBAT Typical 3.3V

2.4.3 Setting RF Power

This section describes the RF power settings.

2.4.3.1 RF Power Setting for 2.4 GHz WLAN

Table 25 describes the RF power settings for 2.4 GHz WLAN.

Table 25: WLAN RF Power Setting for 2.4 GHz - Japan

Mode	Rate/MCS index	Channel	Output Power in dBm (typical)
IEEE 802.11b	All Rate	1 ~ 13	16.0
IEEE 802.11g	6Mbps, 9Mbps, 12Mbps, 18Mbps	1 ~ 13	17.0
	24Mbps, 36Mbps, 48Mbps, 54Mbps	1 ~ 13	16.0
IEEE 802.11n (HT20)	MCS0 ~ MCS2	1 ~ 13	16.0
	MCS3 ~ MCS7	1 ~ 13	15.0

2.4.3.2 RF Power Setting for BT (BR/EDR) / BLE

Table 26 describes the RF power settings for BT (BR/EDR) and BLE.

Table 26: BT / BLE RF Power Setting - Japan

Mode	Output Power in dBm (typical)	
	Type 1XK / Shared BT Antenna (PIN No. 45)	Type 2XK / Dedicated BT Antenna (PIN No. 47)
BR	3.0	3.3
EDR	0.0	0.3
LE	3.0	3.3
LE 2 Mbps	3.0	3.3
LE 125 kbps	3.0	3.3
LE 500 kbps	3.0	3.3

2.4.3.3 RF Power Setting for 5 GHz WLAN (W52/W53/W56)

Table 27 describes the RF power settings for 5 GHz WLAN (W52/W53/W56).

Table 27: WLAN RF Power Setting - 5 GHz 802.11a/n/ac for Channels 36 ~ 144 (Japan)

Mode	Rate/MCS Index	Channel	Output Power in dBm (typical)
IEEE 802.11a	All Rate	36 ~ 64	14.0
	All Rate	100 ~ 144	15.0
IEEE 802.11n (HT20)	All MCS index	36 ~ 144	14.0
IEEE 802.11n (HT40)	All MCS index	38 ~ 142	14.0

2.4.4 Types of Radio Emissions

Table 28 describes the types of radio emissions.

Table 28: Types of Radio Emissions

Mode	Rate/MCS Index	Modulation System	Types of Radio Emissions
Bluetooth	BR	GFSK	F1D
	EDR 2Mbps	π/4DQPSK	G1D
	EDR 3Mbps	8DPSK	G1D
	LE 125 kbps, LE 500 kbps, LE 1 Mbps, LE 2 Mbps	GFSK	F1D
IEEE 802.11b	1 Mbps	DBPSK	G1D
	2 Mbps	DQPSK	G1D
	5.5 Mbps, 11 Mbps	CCK	G1D
IEEE 802.11g IEEE 802.11a	6Mbps, 9 Mbps	BPSK	G1D
	12Mbps, 18 Mbps	QPSK	G1D
	24Mbps, 36 Mbps	16 QAM	D1D
	48Mbps, 54 Mbps	64 QAM	D1D
IEEE 802.11n	MCS0	BPSK	G1D
	MCS1, MCS2	QPSK	G1D
	MCS3, MCS4	16 QAM	D1D
	MCS5, MCS6, MCS7	64 QAM	D1D

2.4.5 Theory of Operation

Table 29 describes the theory of operation for Japan.

Table 29: Theory of Operation - Japan

Frequency of Operation			Scan	Ad hoc Mode
2.4 GHz	11b/g/n (BW20)	2412-2472 MHz	Active	Yes
	BT	2402-2480 MHz	N/A	N/A
	BLE	2402-2480 MHz	N/A	N/A
W52	11a/n (BW20)	5180-5240 MHz	Active	Yes
	11n (BW40)	5190-5230 MHz	Active	Yes
W53	11a/n (BW20)	5260-5320 MHz	Passive	No
	11n (BW40)	5270-5310 MHz	Passive	No
W56	11a/n (BW20)	5500-5720 MHz	Passive	No
	11n (BW40)	5510-5710 MHz	Passive	No

2.4.6 Antenna

The antenna registered under the Radio Act Certification of Japan are described in **Table 30**.

Table 30: Antenna - Japan

No.	Part number	Vendor	Peak Gain [dBi]		Type	Connector
			2.4 GHz	5 GHz		
1	146153	Molex	3.2	4.25	Dipole	u.FL
2	146187	Molex	3.0	4.25	Dipole	u.FL
3	206994	Molex	3.6	3.6	Monopole	u.FL
4	LBEE5CJ1XK_Antenna	Murata	3.6	4.6	Monopole	Trace
5	219611	Molex	2.67	3.67	Dipole	u.FL
6	WT32D1-KX	Unictron	3.0	4.0	Dipole	MHF I
7	AA258	Unictron	0.9	3.8	Dipole	MHF I
8	TA-38B-A-W01	Unictron	2.61	3.07	Dipole	RSMA
9	TA-6B-A-WE01	Unictron	2.23	4.59	Dipole	RSMA
10	FXP830.07.0100C	Taoglas	2.5	4.7	Dipole	MHF I
11	GW.48.A151	Taoglas	1.82	3.28	Dipole	RSMA
12	GW.40.2153	Taoglas	3.15	4.39	Dipole	RSMA
13	GW.52.A153	Taoglas	2.93	4.53	Dipole	RSMA
14	SRF2W012	Antenova	3.0	4.0	Dipole	MHF I
15	STDANTEMD-013	Sansei	1.9	2.8	Dipole	MHF I
16	EMF2471A3S	Laird	2.4	4.4	Dipole	MHF I
17	1001932FT	KAVX	2.5	4.4	Dipole	MHF I
18	1001932PT	KAVX	2.03	4.45	Dipole	MHF I
19	W24P-U	Inventek	3.58	NA	Dipole	u.FL

2.4.7 Notification

It is recommended that the indication of (1) or (2) below is described on the product incorporating this module in Japanese. If there is any problem with the indication of (1) or (2) on the product, we recommend indicating (1) or (2) in the user manual or on the package of the product incorporating this module, or electronic display on the product. In the case of the electronic display, it is necessary to describe "using the electronic display" + "how to reach to below indication" in the user manual of the product.

Japan Version

(1)

本製品は、電波法に基づく工事設計認証(認証番号:001-P01624)を受けた特定無線設備を内蔵しています。

(2)

R 001-P01624

5.2GHz/5.3GHz 帯無線 LAN(W52/W53)の屋外使用は 5.2GHz 帯高出力データ通信システムの基地局又は陸上移動中継局と通信する場合を除き電波法で禁止されています。

English Version
(1)

This product incorporates specified radio equipment that has received CERTIFICATION for TYPE CERTIFICATION (certification number: 001-P01624) based on the Japan Radio Act.

(2)

R 001-P01624

Outdoor use of 5.2GHz/5.3GHz band wireless LANs (W52/W53) is prohibited by the Radio Act except when communicating with 5.2GHz band high-power data communication system base stations or land mobile relay stations.

Revision History

Revision	Date	Changed Item	Comment
1.0	Mar 03, 2025	Issued as Application Note.	Initial Release
2.0	Dec 02, 2025	2.3 EU 2.3.1.4 RF Power Setting for 5 GHz WLAN (W58) 2.3.2 Theory of Operation	Removed EN62311 Removed channel 169

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Specifications are subject to change without notice.