

W-LAN+Bluetooth Combo Module Data Sheet

NXP IW416 Chipset
for 802.11a/b/g/n + Bluetooth 5.2

Design Name: Type1XK
P/N : LBEE5CJ1XK-687


Revision History

Revision Code	Date	Description	Comments
-	2020.12.16	First Issue	
A	2021.03.23	Top page 4. Block Diagram 9. Operating Conditions 11.2 High-speed UART specifications 12. DC/RF Characteristics	- Removed "ac" - Updated - Updated operating temperature. - Added default baud rate information. - Added 802.11n 40MHz in 2.4GHz. - Added Tx power values.
B	2021.03.31	14. Reference Circuit 15. Tape and Reel Packing	- Added circuit for dedicated BT antenna. - Added
C	2021.04.05	2. Key feature & 5.2 Bluetooth Qualification 7.1 Pin Assignments 7.2 Pin Descriptions	- Added a comment on supported Bluetooth functions - Corrected pin number - Corrected pin number
D	2021.04.14	14. Reference Circuit	- Corrected circuit for dedicated BT antenna
E	2021.05.19	2. Key Features 7.5 Pin States 14. Reference Circuit 12.8 DC/RF Characteristics for Bluetooth 12.9 DC/RF Characteristics for Bluetooth Low Energy	- Added Weight - Added Internal pull values - Corrected circuit for Shard BT antenna - Updated Output Power - Updated Output Power
F	2021.06.10	12. DC/RF Characteristics	- Delete 802.11n 40MHz in 2.4GHz.
G	2021.07.30	5. Certification Information 9. Operating Conditions 14. Reference Circuit	- Added Certification Information - Added DC current - Removed dedicated BT antenna
H	2021.09.15	13. Land patterns	- Updated figure
I	2021.10.14	3. Ordering Information 7. Module Pin Descriptions 12. DC / RF Characteristics 14. Reference Circuit	- Added part number for MP - Updated description of GPIOs and WCI IF - Corrected values of WiFi Current consumption. - Corrected typo
J	2021.11.19	11.1.2 High Speed Mode 15. Tape and Reel Packing	- Corrected the note on SDIO 2.0 mode. - Corrected Dimensions of Tape
K	2021.11.25	6. Dimensions, Marking and Terminal Configurations	- Corrected Dimensions e1: 0.38 → 0.375 e3: 0.48 → 0.475
L	2021.12.14	7.2 Pin Descriptions 7.4 Pin States 9.1 Operating Conditions 9.2 External Sleep Clock Requirements 10. Power Sequence 14. Reference Circuit	- Added comments to pin 10 - Added SLP_CLK_IN, WCI-2_SIN and WCI-2_SOUT. - Defined IO current and Peak current - Added a comment - Defined timing parameters - Pull-down RF_CNTL2_N and updated descriptions.

TABLE OF CONTENTS

1. Scope	4
2. Key Features	4
3. Ordering Information	4
4. Block Diagram	4
5. Certification Information	5
5.1. Radio Certification	5
5.2. Bluetooth Qualification	5
6. Dimensions, Marking and Terminal Configurations	6
7. Module Pin Descriptions	7
7.1. Pin Assignments	7
7.2. Pin Descriptions	8
7.3. Configuration Pins	10
7.4. Pin States	11
8. Absolute Maximum Ratings	13
9. Operating Conditions	13
9.1. Operating conditions	13
9.2. External Sleep Clock Requirements	13
9.3. Digital I/O Requirements	13
10. Power Sequence	14
10.1. Power On Sequence	14
10.2. Power Off Sequence	14
11. Interface Timing	15
11.1. SDIO Timing	15
11.1.1. Default Speed Mode	15
11.1.2. High Speed Mode	15
11.1.3. SDR12,SDR25,SDR50 Modes(up to 100 MHz)(1.8V)	16
11.1.4. DDR50 Mode(50MHz)(1.8V)	17
11.2. UART Timing (Default Mode)	19
11.3. Bluetooth PCM Timing	19
11.3.1. Master mode	19
11.3.2. Slave mode	20
12. DC / RF Characteristics	21
12.1. DC/RF Characteristics for IEEE802.11b - 2.4GHz	21
12.1.1. High Rate Condition for IEEE802.11b – 2.4GHz	21
12.1.2. Low Rate Condition for IEEE802.11b – 2.4GHz	22
12.2. DC/RF Characteristics for IEEE802.11g - 2.4GHz	23
12.2.1. High Rate Condition for IEEE802.11g – 2.4GHz	23
12.2.2. Low Rate Condition for IEEE802.11g – 2.4GHz	24
12.3. DC/RF Characteristics for IEEE802.11n - 2.4GHz	25
12.3.1. High Rate Condition for IEEE802.11n 20MHz BW – 2.4GHz	25
12.3.2. Low Rate Condition for IEEE802.11n 20MHz BW – 2.4GHz	26
12.4. DC/RF Characteristics for IEEE802.11a - 5GHz	27
12.4.1. High Rate Condition for IEEE802.11a – 5GHz	27
12.4.2. Low Rate Condition for IEEE802.11a – 5GHz	28
12.5. DC/RF Characteristics for IEEE802.11n(HT20) - 5GHz	29
12.5.1. High Rate Condition for IEEE802.11n(HT20) – 5GHz	29
12.5.2. Low Rate Condition for IEEE802.11n(HT20) – 5GHz	30
12.6. DC/RF Characteristics for IEEE802.11n(HT 40MHz) - 5GHz	31
12.6.1. High Rate Condition for IEEE802.11n(HT40) – 5GHz	31
12.6.2. Low Rate Condition for IEEE802.11n(HT40) – 5GHz	32
12.7. DC/RF Characteristics for Bluetooth	33
12.7.1. Basic Data Rate Condition	33
12.7.2. Enhanced Data Rate Condition	34
12.8. DC/RF Characteristics for Bluetooth Low Energy	35
12.8.1. 1Mbps PHY Condition	35
12.8.2. 2Mbps PHY Condition	36
13. Land Patterns	37

14. Reference Circuit..... 38
15. Tape and Reel Packing 40
16. Notice 43
 16.1. Storage Conditions: 43
 16.2. Handling Conditions: 43
 16.3. Standard PCB Design (Land Pattern and Dimensions):..... 43
 16.4. Notice for Chip Placer:..... 43
 16.5. Soldering Conditions: 44
 16.6. Cleaning:..... 44
 16.7. Operational Environment Conditions: 44
17. Preconditions to Use Our Products..... 45
APPENDIX 46

 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 IEEE802.11a/b/g/n WLAN + Bluetooth® 5.2 combo module.

2. Key Features

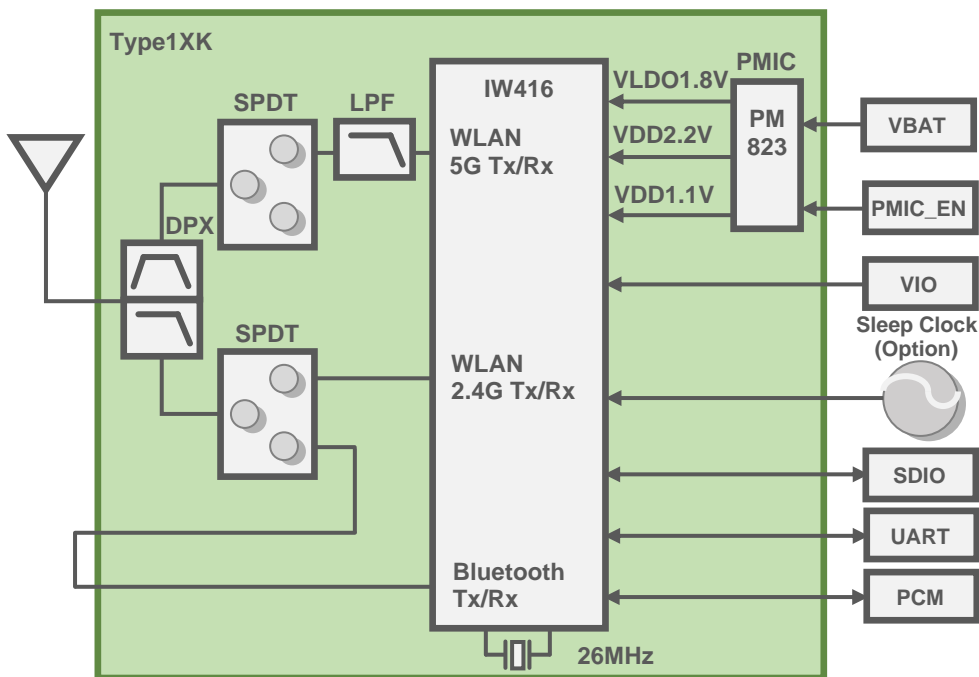
- NXP IW416 inside
- Compliant with IEEE802.11a/b/g/n, SISO
- Compliant with Bluetooth® specification v5.2 (See PIC for supported Bluetooth functions on Bluetooth SIG site)
- Supports standard SDIO3.0 interface for WLAN
- UART interfaces support for Bluetooth is Host Controller Interface (HCI)
- Surface mount type 9.1 x 8.3 mm(Typical), H = 1.3 mm(Max.)
- Weight :268.8 mg
- MSL : 3
- RoHS compliant

3. Ordering Information

Ordering Part Number	Description
LBEE5CJ1XK-687	MP order
LBEE5CJ1XK-SMP	In case of sample order
LBEE5CJ1XK-EVB	EVB

“LBEE5CJ1XK” is used in certification test report.

4. Block Diagram



5. Certification Information

5.1. Radio Certification

USA

FCC ID: VPYLB1XK
Country Code: US
Tx Power limit file
free RTOS: wlan_txpwrlimit_cfg_US.c
Linux: txpwrlimit_cfg_US.bin

Canada

IC: 772C-LB1XK
Country Code: CA
Tx Power limit file
free RTOS: wlan_txpwrlimit_cfg_CA.c
Linux: txpwrlimit_cfg_CA.bin

Europe

EN300328/301893, EN300440 conducted test report is prepared.
Country Code: DE
Tx Power limit file
free RTOS: wlan_txpwrlimit_cfg_EU.c
Linux: txpwrlimit_cfg_EU.bin

Japan

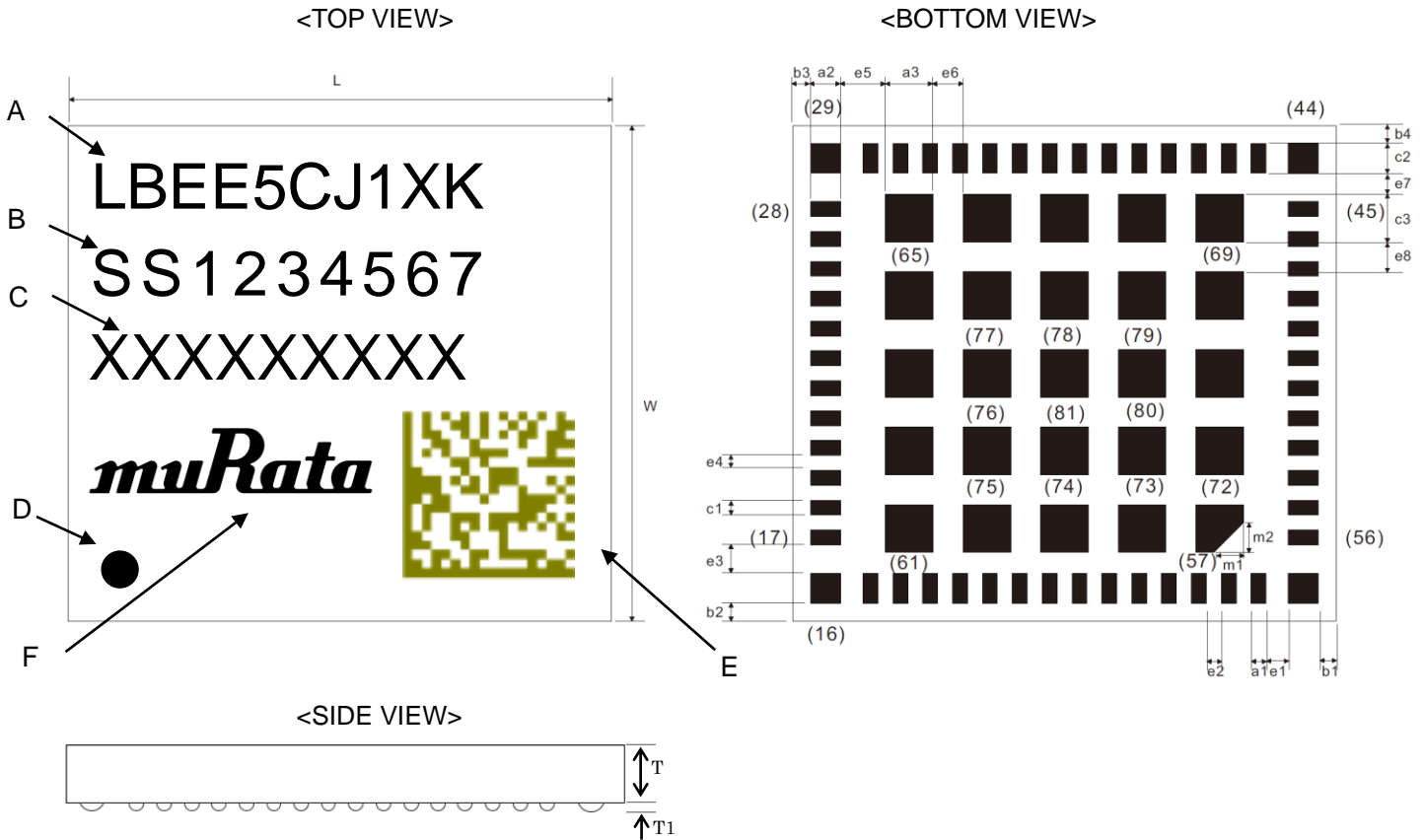
Japanese type certification is prepared.
[R] 001-P01624
Country Code: JP
Tx Power limit file
free RTOS: wlan_txpwrlimit_cfg_JP.c
Linux: txpwrlimit_cfg_JP.bin

The each country code are defined by Murata's db.txt file.
Please ask your contact person from Murata.

5.2. Bluetooth Qualification

QDID: 169159
*Set Bluetooth Tx Power to Class1 by using "bt_power_config_1.sh".
**See PICS for supported Bluetooth functions on Bluetooth SIG site

6. Dimensions, Marking and Terminal Configurations



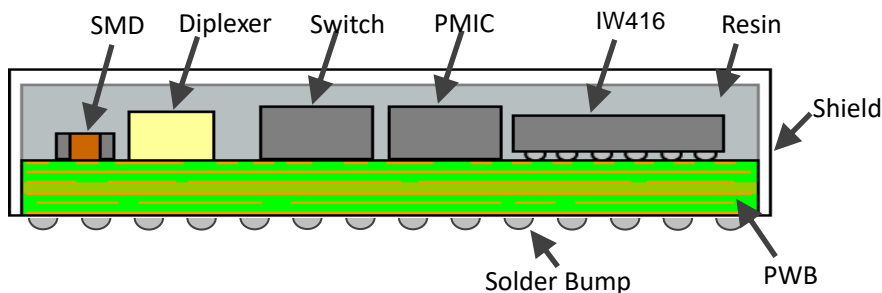
Marking	Meaning
A	Module Type
B	Inspection Number
C	Serial Number
D	Pin 1 Marking
E	2D code
F	Murata Logo

(unit : mm)

Mark	Dimensions	Mark	Dimensions	Mark	Dimensions	Mark	Dimensions
L	9.1 ± 0.2	W	8.3 ± 0.2	T	1.3 max.	a1	0.25 ± 0.1
a2	0.5 ± 0.1	a3	0.8 ± 0.2	b1	0.3 ± 0.2	b2	0.3 ± 0.2
b3	0.3 ± 0.2	b4	0.3 ± 0.2	c1	0.25 ± 0.1	c2	0.5 ± 0.1
c3	0.8 ± 0.1	e1	0.375 ± 0.1	e2	0.25 ± 0.1	e3	0.475 ± 0.1
e4	0.25 ± 0.1	e5	0.75 ± 0.1	e6	0.5 ± 0.1	e7	0.35 ± 0.1
e8	0.5 ± 0.1	m1	0.5 ± 0.2	m2	0.5 ± 0.2	T1	0.045 typ.

* T dimension does not include height of solder bumps.

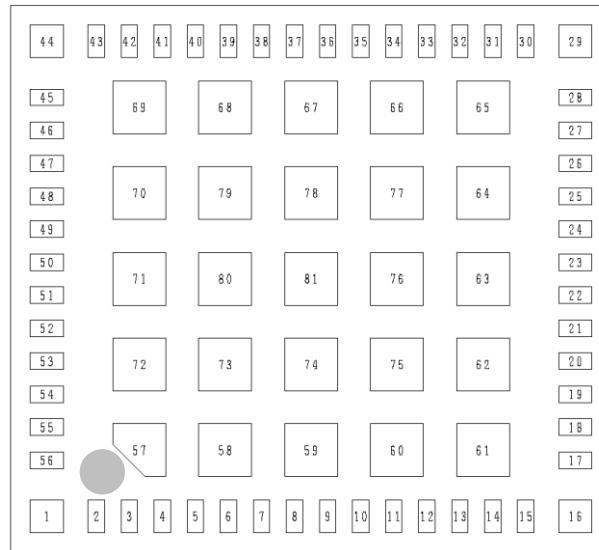
Structure



7. Module Pin Descriptions

7.1. Pin Assignments

<TOP VIEW>



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_CNTL2_N
5	SD_D0	24	GND	43	RF_CNTL3_P
6	SD_CMD	25	GND	44	GND
7	GPIO(9) UART_RXD	26	GND	45	BT_ANT SHARED
8	GPIO(6)	27	GND	46	GND
9	GPIO(7)	28	GND	47	BT_ANT DEDICATED
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_CNTL1_P	54	GPIO(10) UART_TXD
17	GPIO(14) TCK	36	RF_CNTL0_N	55	SD_D3
18	GPIO(2) TDI	37	GND	56	SD_D1
19	SLP_CLK_IN	38	RF_ANT	57-81	GND

7.2. Pin Descriptions

No.	Pin name	Type	Connection to	Description
			IC pin name	
1	GND	-	-	Ground
2	VIO	P	VIO VIO_RF VIO_SD	Power supply
3	SD_D2	I	SD_DAT[2]	SDIO 4-bit mode: Data line Bit[2] or read wait (optional) SDIO 1-bit mode: Read wait (optional)
4	SD_CLK	I	SD_CLK	SDIO Clock input
5	SD_D0	I	SD_DAT[0]	SDIO 4-bit mode: Data line Bit[0] SDIO 1-bit mode: Data line
6	SD_CMD	I/O	SD_CMD	SDIO 4-bit mode: Command/response (input/output) SDIO 1-bit mode: Command line
7	GPIO(9) UART_RXD	I/O	GPIO[9]	GPIO mode: GPIO[9] (input/output) UART mode: UART_SIN (input)
8	GPIO(6)	I/O	GPIO[6]	GPIO mode: GPIO[6] (input/output) PCM mode: PCM_CLK - PCM data clock (input if slave, output if master). I2S mode: I2S_BCLK - I2S bit clock (input if slave, output if master). PTA mode: EXT_PRI - External radio priority signal (input).
9	GPIO(7)	I/O	GPIO[7]	GPIO mode: GPIO[7] (input/output) PCM mode: PCM_SYNC - PCM frame sync (input if slave, output if master). I2S mode: I2S_LRCLK - I2S left-right clock (input if slave, output if master). PTA mode: EXT_REQ - Request from the external radio (input).
10	NC	-	-	NC *Floating terminal pad. Recommended grounding for mechanical strength.
11	GPIO(4)	I/O	GPIO[4]	GPIO mode: GPIO[4] (input/output) PCM mode: PCM_DOUT ^[3] - PCM transmit signal (output). I2S mode: I2S_DOUT/I2S_DIN (depending on the configuration. If GPIO[5] is configured as I2S_DIN, then GPIO[4] is set as I2S_DOUT, and vice-verse). PTA mode: EXT_FREQ - External radio frequency signal (input). Out-of-band wake-up mode: IW416 Bluetooth to host wake-up signal (output) ^[4]
12	GPIO(1)	I/O	GPIO[1]	GPIO mode: GPIO[1] (input/output) This pin is used as a configuration pin: CON[9] (input). PTA mode: EXT_STATE - External radio state signal (input). Out-of-band wake-up mode: IW416 Wi-Fi to host wake-up signal (output) Do not drive this signal during boot-up
13	GPIO(15) TMS	I/O	GPIO[15]	GPIO mode: GPIO[15] (input/output) JTAG mode: JTAG_TMS - JTAG test mode select (input). Reset recovery mode: Independent software reset for Bluetooth subsystem (input)
14	GPIO(5)	I/O	GPIO[5]	GPIO mode: GPIO[5] (input/output) PCM mode: PCM_DIN ^[2] - PCM receive signal (input). I2S mode: I2S_DOUT/I2S_DIN - I2S transmit/receive signal (output/input) (depending on the configuration). PTA mode: EXT_GNT - External radio grant signal (output).
15	GPIO(8) UART_CTS	I/O	GPIO[8]	GPIO mode: GPIO[8] (input/output) This pin is used as a configuration pin: CON[7] (input) UART mode: UART_CTSn - UART clear-to-send input signal (input, active low). Do not drive this signal during boot-up
16	GND	-	-	Ground
17	GPIO(14) TCK	I/O	GPIO[14]	GPIO mode: GPIO[14] (input/output) JTAG mode: JTAG_TCK - JTAG test clock (input). Reset recovery mode: Independent software reset for Wi-Fi subsystem (input)
18	GPIO(2) TDI	I/O	GPIO[2]	GPIO mode: GPIO[2] (input/output) Power management mode: DVSC[0], Digital voltage scaling control (output) JTAG mode: JTAG_TDI, JTAG test data (input).
19	SLP_CLK_IN	I	SLP_CLK_IN	Sleep Clock Input (optional) Used for lower power operation in sleep mode. • An external sleep clock of 32.768 kHz can be used for lowest current consumption in sleep mode. • An external sleep clock is required if automatic reference clock frequency detection is used. • If no external sleep clock is used, leave this pin floating (DNC).
20	GPIO(3) TDO	I/O	GPIO[3]	GPIO mode: GPIO[3] (input/output) Power management mode: DVSC[1], Digital voltage scaling control (output) JTAG mode: JTAG_TDO, JTAG test data (output). PCM mode: PCM_MCLK (output) - PCM clock signal (output, optional). I2S mode: I2S_CCLK - I2S clock (output, optional).
21	GND	-	-	Ground
22	VBAT	P	PVIN(PMIC)	Power supply

23	VBAT	P	PVIN(PMIC)	Power supply
24	GND	-	-	Ground
25	GND	-	-	Ground
26	GND	-	-	Ground
27	GND	-	-	Ground
28	GND	-	-	Ground
29	GND	-	-	Ground
30	GND	-	-	Ground
31	PMIC_EN	I	EN(PMIC)	Enable build-in PMIC. Logic high enables internal regulators and internal hardware reset is de-asserted. Logic low disables regulators and internal hardware reset is asserted. Do not float this pin
32	WCI_SOUT			WCI-2_SOUT (output)
33	WCI_SIN			WCI-2_SIN (input)
34	GPIO(12)	I/O	GPIO[12]	GPIO mode: GPIO[12] (input/output) UART mode: UART_DSRn - UART data-set-ready (input) (active low). Host wake-up mode: Host to IW416 Bluetooth wake-up (input)
35	RF_CNTL1_P	O	RF_CNTL1_P	Reserved Set to 1.
36	RF_CNTL0_N	O	RF_CNTL0_N	RF Control 0—RF Control Output Low (output) This pin is used as a configuration pin: CON[0] (input).
37	GND	-	-	Ground
38	RF_ANT			
39	GND	-	-	Ground
40	GND	-	-	Ground
41	GND	-	-	Ground
42	RF_CNTL2_N	O	RF_CNTL2_N	Reserved Do not pull-up externally.
43	RF_CNTL3_P	O	RF_CNTL3_P	Reserved
44	GND	-	-	Ground
45	BT_ANT SHARED	I	-	BT in(Feedback)
46	GND	-	-	Ground
47	BT_ANT DEDICATED	O	-	BT output
48	GND	-	-	Ground
49	GND	-	-	Ground
50	GND	-	-	Ground
51	GPIO(11) UART_RTS	I/O	GPIO[11]	GPIO mode: GPIO[11] (input/output) This pin is used as a configuration pin: CON[8] (input) UART mode: UART_RTSn - UART request-to-send (output) (active low). Do not drive this signal during boot-up
52	GPIO(0)	I/O	GPIO[0]	GPIO mode: GPIO[0] (input/output) This pin is used as a configuration pin: CON[9] (input). Oscillator enable mode: XOSC_EN (output) (active high) 0 = disable external oscillator 1 = enable external oscillator PTA mode: EXT_STATE - External radio state signal (input). Out-of-band wake-up mode: IW416 Wi-Fi to host wake-up signal (output)
53	GPIO(13)	I/O	GPIO[13]	GPIO mode: GPIO[13] (input/output) UART mode: UART_DTRn - UART data-terminal-ready (output). Out-of-band wake-up mode: Host to IW416 Wi-Fi wake-up (input)
54	GPIO(10) UART_TXD	I/O	GPIO[10]	GPIO mode: GPIO[10] (input/output) UART mode: UART_SOUT - UART serial (output).
55	SD_D3	I	SD_DAT[3]	SDIO 4-bit mode: Data line Bit[3] SDIO 1-bit mode: Reserved
56	SD_D1	I	SD_DAT[1]	SDIO 4-bit mode: Data line Bit[1] SDIO 1-bit mode: Interrupt
57-81	GND	-	-	Ground

[1] Not all GPIO pins can be used for Host-to-SoC wake-up signals.

[2] The function can be swapped with GPIO[4] using a software command without affecting the hardware connection.

[3] The function can be swapped with GPIO[5] using a software command without affecting the hardware connection.

[4] If PCM and UART interfaces are used in application, use GPIO[0] as alternative for this wake-up signal

7.3. Configuration Pins

Configuration Bits	Pin Name	Configuration Function
CON[1]	RF_CNTL2_N	Firmware Boot Options No hardware impact. Software reads and boots accordingly. See the table below. Note: Boot code needs to use this host boot strap status to decide the correct boot sequence.
CON[0]	RF_CNTL0_N	

CON[1]	CON[0]	Wi-Fi	Bluetooth/LE
1	0	SDIO	UART
1	1	Reserved	Reserved

7.4. Pin States

Pin states information for the tables below include:

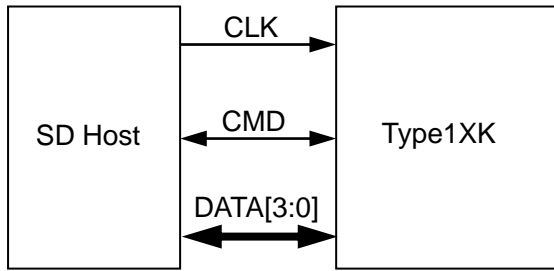
- After firmware is downloaded, the pads (GPIO, Serial interface, RF control) are programmed in functional mode per the functionality of the pins.
- For SDIO, once the command is received from the host, the pads are configured accordingly.
- Pull-up and pull-down are only effective when the pad is in input mode.
- The power-down state shown is the default configuration. Many pads have programmable power-down values, which can be set by firmware.

I/O State Table

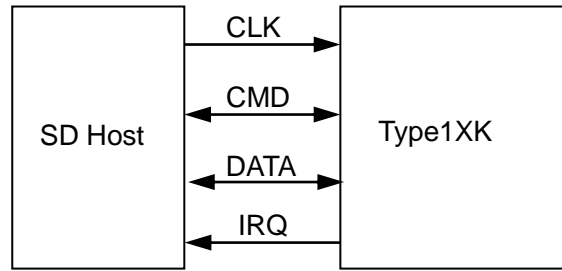
Pin Name	Supply	No Pad Power State	Reset State	HW State	PD State	PD Prog	Internal PU/PD	Int'l Pull Value[Ω]
GPIO0	VIO	tristate	output	output	drive low	yes	nominal PU	90K
GPIO1	VIO	tristate	input	input	tristate	yes	weak PU	800K
GPIO2	VIO	tristate	input	input	tristate	yes	weak PU	800K
GPIO3	VIO	tristate	input	input	tristate	yes	weak PU	800K
GPIO4	VIO	tristate	output	input	tristate	yes	nominal PU	90K
GPIO5	VIO	tristate	input	input	tristate	yes	weak PU	800K
GPIO6	VIO	tristate	input	input	tristate	yes	nominal PU	90K
GPIO7	VIO	tristate	input	input	tristate	yes	nominal PU	90K
GPIO8	VIO	tristate	input	input	drive low	yes	weak PU	800K
GPIO9	VIO	tristate	output	input	tristate	yes	nominal PU	90K
GPIO10	VIO	tristate	input	input	tristate	yes	nominal PU	90K
GPIO11	VIO	tristate	output	input	drive high	yes	weak PU	800K
GPIO12	VIO	tristate	input	input	tristate	yes	nominal PU	90K
GPIO13	VIO	tristate	input	input	drive high	yes	nominal PU	90K
SD_CLK	VIO_SD	tristate	input	Input	tristate	no	nominal PD	90K
SD_CMD	VIO_SD	tristate	input	Input	tristate	no	nominal PD	90K
SD_D0	VIO_SD	tristate	input	Input	tristate	no	nominal PD	90K
SD_D1	VIO_SD	tristate	input	Input	tristate	no	nominal PD	90K
SD_D2	VIO_SD	tristate	input	Input	tristate	no	nominal PD	90K
SD_D3	VIO_SD	tristate	input	Input	tristate	no	nominal PD	90K
RF_CNTL0_N	VIO_RF	tristate	input	output	drive low	yes	weak PU	800K
RF_CNTL1_P	VIO_RF	tristate	input	output	drive high	yes	weak PU	800K
RF_CNTL2_N	VIO_RF	tristate	input	output	drive low	yes	weak PU	800K
RF_CNTL3_P	VIO_RF	tristate	input	output	drive high	yes	weak PU	800K
SLP_CLK_IN	AVDD18	tristate	input	input	tristate	no	nominal PU	90K
WCI-2_SIN	AVDD18	tristate	input	input	tristate	no	weak PU	800K
WCI-2_OUT	AVDD18	tristate	output	output	tristate	no	weak PU	800K

SDIO Pin Descriptions

No.	Pin Name	(i) SD 4-bit Mode		(ii) SD 1-bit Mode	
4	SDIO_CLK	CLK	Clock	CLK	Clock
5	SDIO_D0	DATA0	Data line 0	DATA	Data line
45	SDIO_D1	DATA1	Data line 1	IRQ	Interrupt
3	SDIO_D2	DATA2	Data line 2	RW	Read wait (optional)
46	SDIO_D3	DATA3	Data line 3	NC	Reserved
6	SDIO_CMD	CMD	Command/response	CMD	Command line



(i) SD 4-bit Mode



(ii) SD 1-bit Mode

8. Absolute Maximum Ratings

Parameter		min.	max.	Unit
Storage Temperature		-40	85	deg.C
Supply Voltage	VBAT	-0.3	6.0	V
	VIO	-	4.0	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.

9. Operating Conditions

9.1. Operating conditions

Parameter		min.	typ.	max.	unit
Operating Temperature		-40	25	+85	deg.C
Supply Voltage	VBAT	2.7	-	5.5	V
	VIO	1.62	1.8	1.98	V
		2.97	3.3	3.47	V
IO Current	VIO	-	0.1	0.5	mA
Peak Current*	VBAT	-	550	850	mA

Note) Operation beyond the recommended operating conditions is neither recommended nor guaranteed.

*Peak current of VBAT (RF portion) is happen during DPD calibration when the firmware is downloaded.

9.2. External Sleep Clock Requirements

Symbol	Parameter	Min	Typ	Max	Unit
CLK	Clock frequency range/accuracy CMOS input clock signal type ±250 ppm (initial , aging, temperature)	-	32.768	-	kHz
PN	Phase Noise Requirement (@ 100kHz)	-	-125	-	dBc/Hz
Jc	Cycle jitter	-	1.5	-	ns(RMS)
SR	Slew rate limit (10-90%)	-	-	100	ns
DC	Duty cycle tolerance	20	-	80	%

Voltage input level = 1.8V

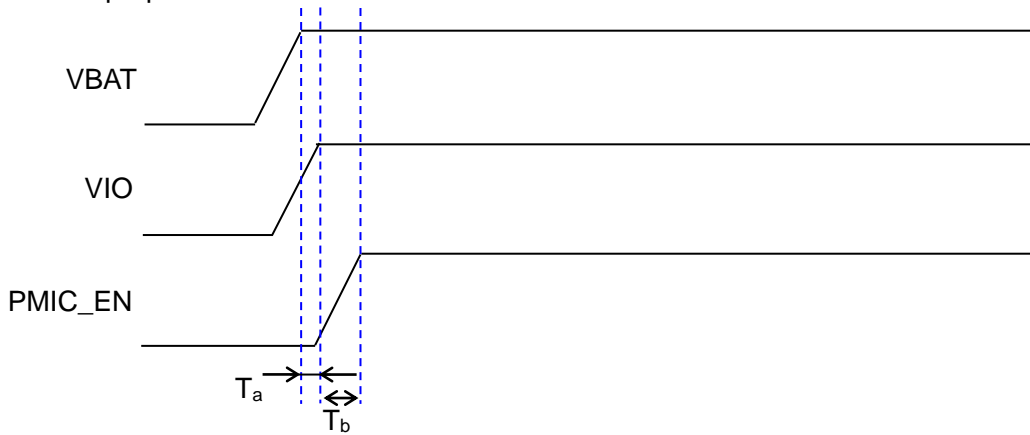
9.3. Digital I/O Requirements

Symbol	Parameter	Condition	Min	Typ	Max	Unit
V _{IH}	Input high voltage	-	0.7*VIO	-	VIO+0.4	V
V _{IL}	Input low voltage	-	-0.4	-	0.3*VIO	V
V _{HYS}	Input hysteresis	-	100	-	-	mV
V _{OH}	Output high voltage	-	VIO-0.4	-	-	V
V _{OL}	Output low voltage	-	-	-	0.4	V

10. Power Sequence

10.1. Power On Sequence

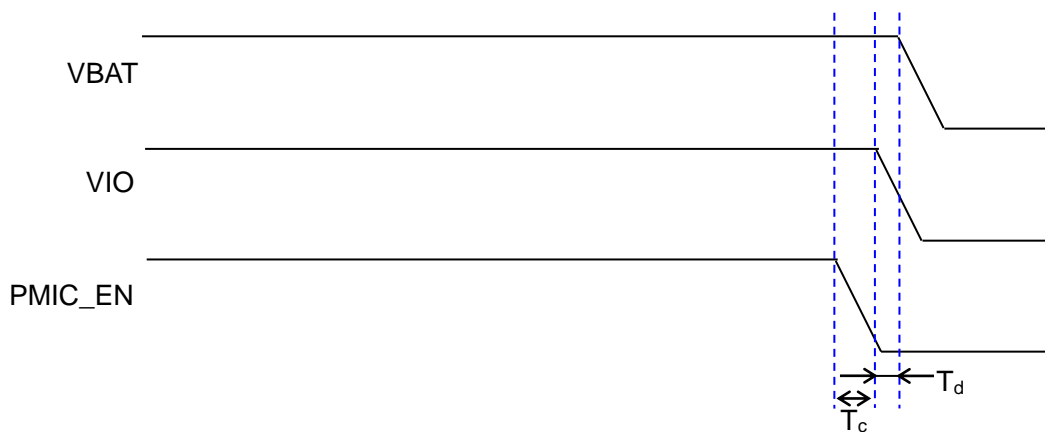
- VBAT and VIO must be good (90%) at the same time or before assert PMIC_EN (= 0 to 1).
- Rump-up time of VIO must be <100ms



Symbol	Parameter	Min	Typ	Max	Unit
T_a	VBAT to VIO time	0	-	-	msec
T_b	VIO to PMIC_EN time	0	-	-	msec

10.2. Power Off Sequence

- VBAT and VIO must be down at the same time or before de-assert PMIC_EN (= 1 to 0).
- Rump-down time of VIO must be <100ms



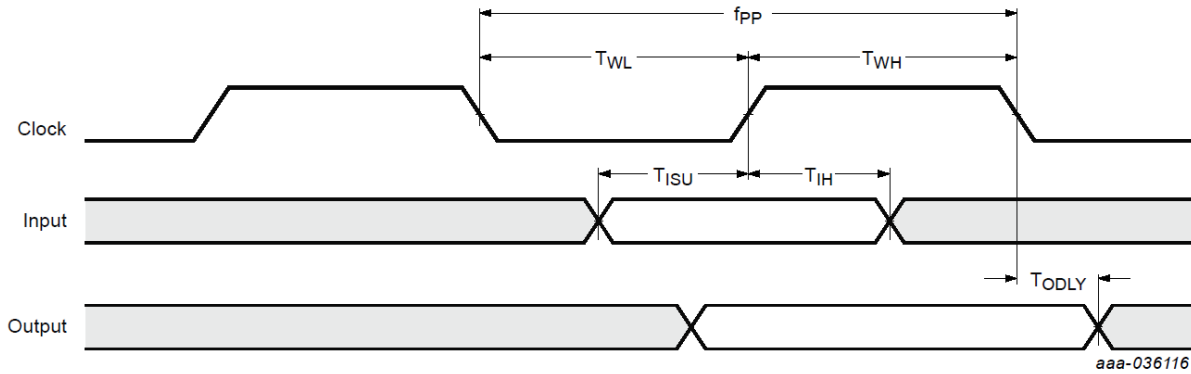
Symbol	Parameter	Min	Typ	Max	Unit
T_c	PMIC_EN to VIO time	0	-	-	msec
T_d	VIO to VBAT time	0	-	-	msec

11. Interface Timing

11.1. SDIO Timing

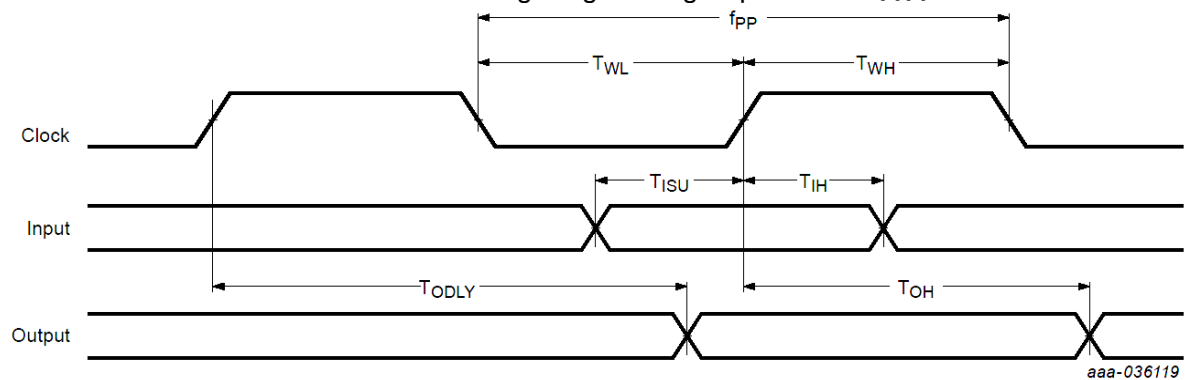
11.1.1. Default Speed Mode

SDIO Protocol Timing Diagram-Default Speed Mode



11.1.2. High Speed Mode

SDIO Protocol Timing Diagram-High Speed Mode^{[1] [2]}

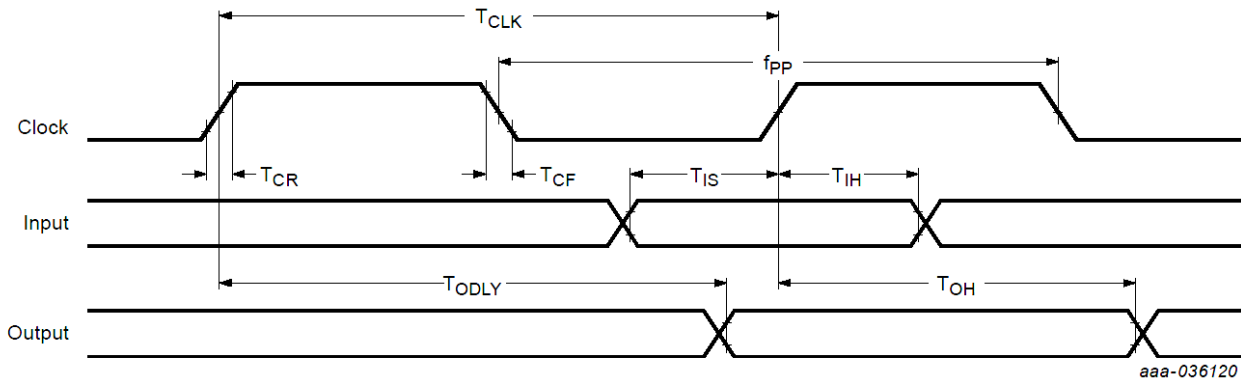


Symbol	Parameter	Condition	Min	Typ	Max	Unit
f _{PP}	Clock frequency	Normal	0	--	25	MHz
		High-speed	0	--	50	MHz
T _{WL}	Clock low time	Normal	10	--	--	ns
		High-speed	7	--	--	ns
T _{WH}	Clock high time	Normal	10	--	--	ns
		High-speed	7	--	--	ns
T _{ISU}	Input setup time	Normal	5	--	--	ns
		High-speed	6	--	--	ns
T _{IH}	Input hold time	Normal	5	--	--	ns
		High-speed	2	--	--	ns
T _{ODLY}	Output delay time	Normal	--	--	14	ns
	CL ≤ 40 pF (1 card)	High-speed	--	--	14	ns
T _{OH}	Output hold time	High-speed	2.5	--	--	ns

For SDIO 2.0 running at 25 MHz and 50 MHz clock frequency, VIO_SD must be 3.3V.

11.1.3. SDR12,SDR25,SDR50 Modes(up to 100 MHz)(1.8V)

SDIO Protocol Timing Diagram-SDR12,SDR25,SDR50 Mode(up to 100MHz)(1.8V)

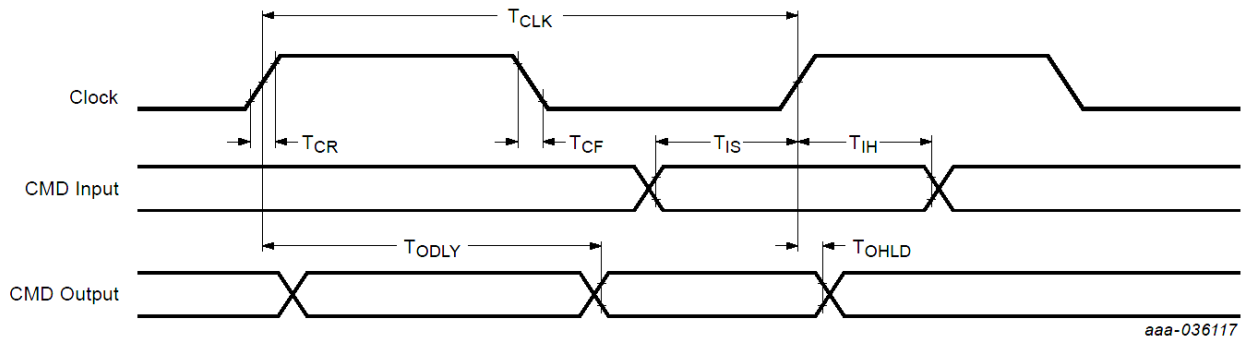


aaa-036120

Symbol	Parameter	Condition	Min	Typ	Max	Unit
f_{PP}	Clock frequency	SDR12/25/50	25	--	100	MHz
T_{IS}	Input setup time	SDR12/25/50	3	--	--	ns
T_{IH}	Input hold time	SDR12/25/50	0.8	--	--	ns
T_{CLK}	Clock time	SDR12/25/50	10	--	40	ns
T_{CR}, T_{CF}	Rise time, fall time $T_{CR}, T_{CF} < 2$ ns (max) at 100 MHz $C_{CARD} = 10$ pF	SDR12/25/50	--	--	$0.2 * T_{CLK}$	ns
T_{ODLY}	Output delay time $C_L \leq 30$ pF	SDR12/25/50	--	--	7.5	ns
T_{OH}	Output hold time $C_L = 15$ pF	SDR12/25/50	1.5	--	--	ns

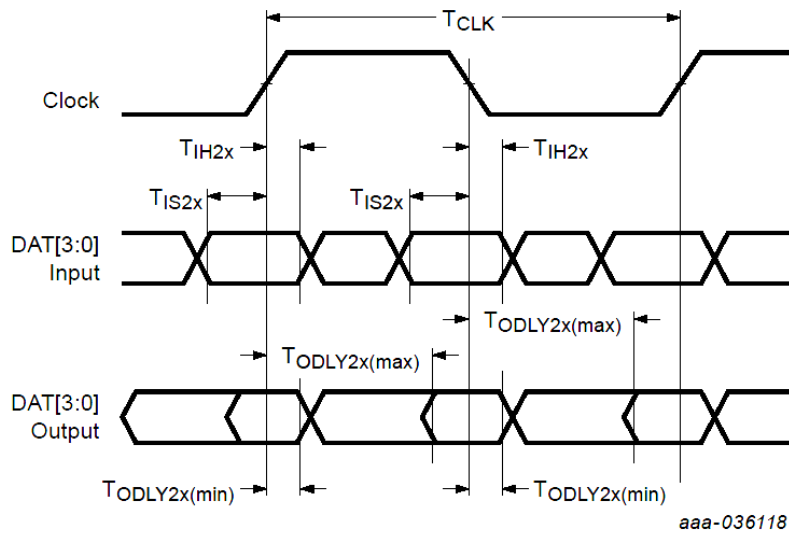
11.1.4. DDR50 Mode(50MHz)(1.8V)

SDIO CMD Timing Diagram-DDR50 Mode (50MHz)



In DDR50 mode, DAT[3:0] lines are sampled on both edges of the clock (not applicable for CMD line).

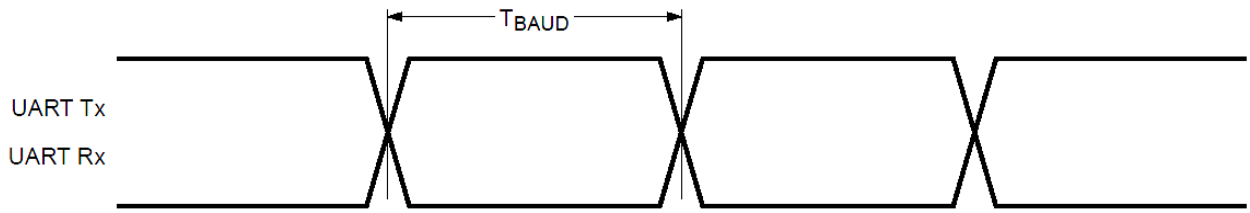
SDIO DATA Timing Diagram-DDR50 Mode



Symbol	Parameter	Condition	Min	Typ	Max	Unit
Clock						
T _{CLK}	Clock time 50 MHz (max) between rising edges	DDR50	20	--	--	ns
T _{CR} , T _{CF}	Rise time, fall time T _{CR} , T _{CF} < 4.00 ns (max) at 50 MHz C _{CARD} = 10 pF	DDR50	--	--	0.2*T _{CLK}	ns
Clock Duty	--	DDR50	45	--	55	%
CMD Input (referenced to clock rising edge)						
T _{IS}	Input setup time C _{CARD} ≤ 10 pF (1 card)	DDR50	6	--	--	ns
T _{IH}	Input hold time C _{CARD} ≤ 10 pF (1 card)	DDR50	0.8	--	--	ns
CMD Output (referenced to clock rising edge)						
T _{ODLY}	Output delay time during data transfer mode C _L ≤ 30 pF (1 card)	DDR50	--	--	13.7	ns
T _{OHLd}	Output hold time C _L ≥ 15 pF (1 card)	DDR50	1.5	--	--	ns
DAT[3:0] Input (referenced to clock rising and falling edges)						
T _{IS2x}	Input setup time C _{CARD} ≤ 10 pF (1 card)	DDR50	3	--	--	ns
T _{IH2x}	Input hold time C _{CARD} ≤ 10 pF (1 card)	DDR50	0.8	--	--	ns
DAT[3:0] Output (referenced to clock rising and falling edges)						
T _{ODLY2x (max)}	Output delay time during data transfer mode C _L ≤ 25 pF (1 card)	DDR50	--	--	7.0	ns
T _{ODLY2x (min)}	Output hold time C _L ≥ 15 pF (1 card)	DDR50	1.5	--	--	ns

11.2. UART Timing (Default Mode)

Default baud rate is 115200 bps. Baud rate is configurable by the host stack.



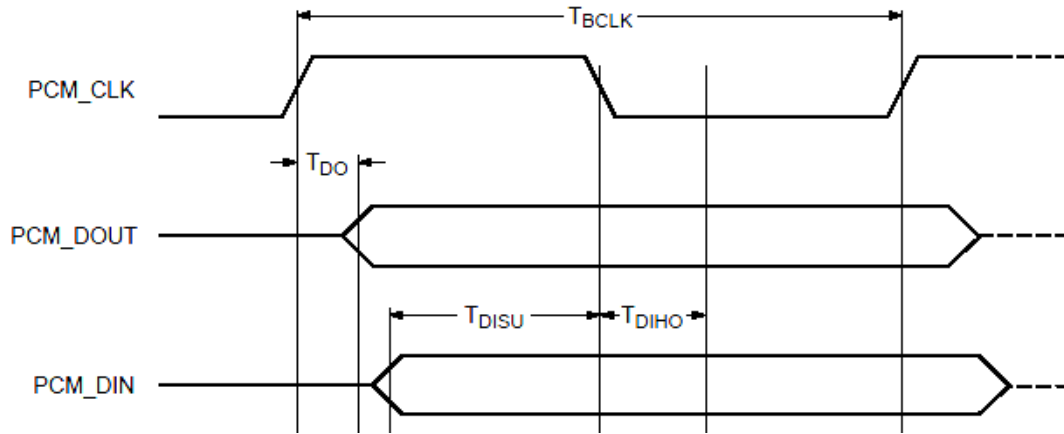
aaa-036128

Symbol	Parameter	Condition	Min	Typ	Max	Unit
T_{BAUD}	Baud rate	38.4MHz	250	-	-	ns

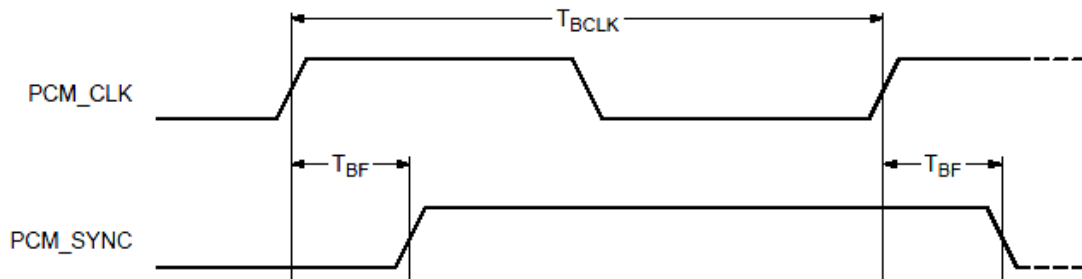
* The acceptable deviation from the UART Rx target baud rate is $\pm 3\%$.

11.3. Bluetooth PCM Timing

11.3.1. Master mode



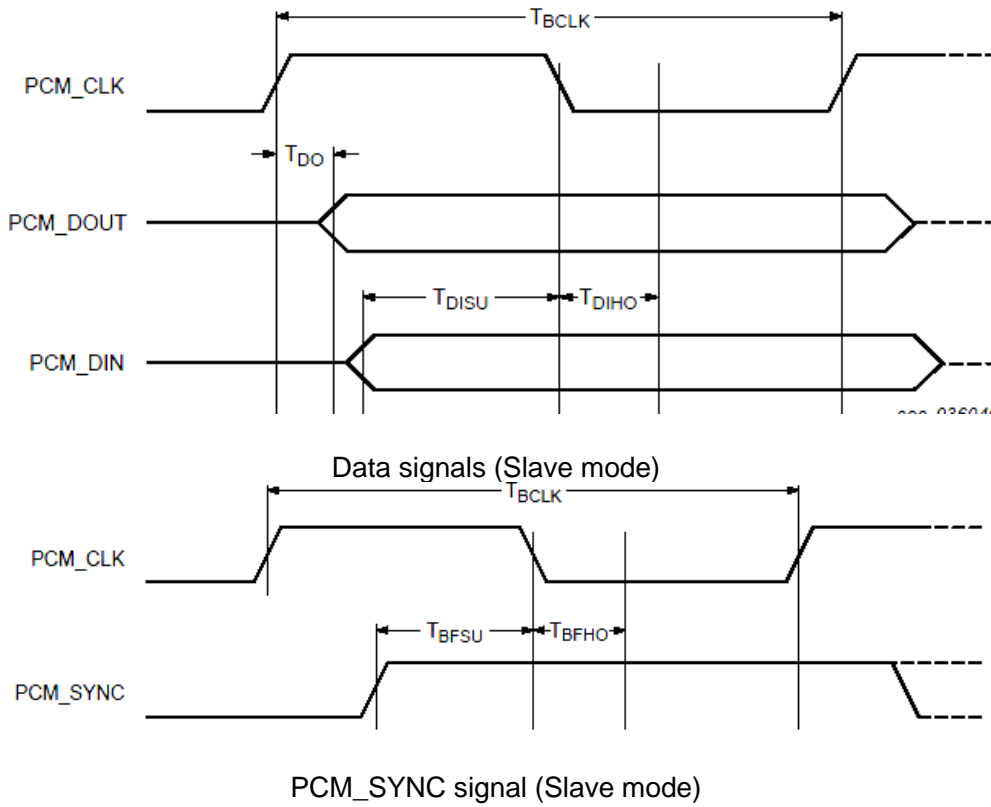
Data signals (Master mode)



PCM_SYNC signal (Master mode)

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
F_{BCLK}	Bit clock frequency	--	--	2/2.048	--	MHz
Duty Cycle $_{BCLK}$	Bit clock duty cycle	--	0.4	0.5	0.6	--
$T_{BCLK\ rise/fall}$	PCM_CLK rise/fall time	--	--	3	--	ns
T_{DO}	Delay from PCM_CLK rising edge to PCM_DOUT rising edge	--	--	--	15	ns
T_{DISU}	Setup time for PCM_DIN before PCM_CLK falling edge	--	20	--	--	ns
T_{DIHO}	Hold time for PCM_DIN after PCM_CLK falling edge	--	15	--	--	ns
T_{BF}	Delay from PCM_CLK rising edge to PCM_SYNC rising edge	--	--	--	15	ns

11.3.2. Slave mode



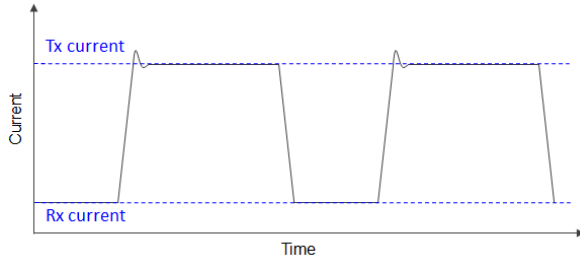
Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
F_{BCLK}	Bit clock frequency	--	--	2/2.048	--	MHz
Duty Cycle $_{BCLK}$	Bit clock duty cycle	--	0.4	0.5	0.6	--
$T_{BCLK\ rise/fall}$	PCM_CLK rise/fall time	--	--	3	--	ns
T_{DO}	Delay from PCM_CLK rising edge to PCM_DOUT rising edge	--	--	--	30	ns
T_{DISU}	Setup time for PCM_DIN before PCM_CLK falling edge	--	15	--	--	ns
T_{DIHO}	Hold time for PCM_DIN after PCM_CLK falling edge	--	10	--	--	ns
T_{BFSU}	Setup time for PCM_SYNC before PCM_CLK falling edge	--	15	--	--	ns
T_{BFHO}	Hold time for PCM_SYNC after PCM_CLK falling edge	--	10	--	--	ns

12. DC / RF Characteristics

- ALL DC/RF characteristics are defined by following file.

WLAN Tx Power	txpower_US.bin, txpower_CA.bin, txpower_EU.bin, txpower_JP.bin
WLAN Regulatory Limit	db.txt
Energy Detect	ed_mac.bin
Bluetooth Power	bt_power_config_1.sh (Class1)

- Burst current definition



12.1. DC/RF Characteristics for IEEE802.11b - 2.4GHz

Specification	IEEE802.11b
Mode	DSSS / CCK
Channel Frequency	2412 - 2472MHz
Data rate	1, 2, 5.5, 11Mbps

12.1.1. High Rate Condition for IEEE802.11b – 2.4GHz

Conditions : 25deg.C, VBAT=3.3V, VIO=1.8V, Output power setting=17dBm at module pad, 11Mbps mode

Items	Contents			
	Min.	Typ.	Max.	Unit
- DC Characteristics -				
1. DC current				
1) Tx mode	-	364	510	mA
2) Rx mode	-	50	65	mA
- Tx Characteristics -	Min.	Typ.	Max.	Unit
2. Output Power	15.0	17.0	19.0	dBm
3. Spectrum Mask Margin				
1) 1st side lobes	0	-	-	dB
2) 2nd side lobes	0	-	-	dB
4. Power-on/off ramp	-	-	2.0	Usec
5. RF Carrier Suppression	15	-	-	dB
6. Modulation Accuracy	-	-	35	%
7. Frequency tolerance	-20		20	ppm
8. Spurious Emissions				
1) 30-47MHz (BW=100kHz)	-	-	-36	dBm
2) 47-74MHz (BW=100kHz)	-	-	-54	dBm
3) 74-87.5MHz (BW=100kHz)	-	-	-36	dBm
4) 87.5-118MHz (BW=100kHz)	-	-	-54	dBm
5) 118-174MHz (BW=100kHz)	-	-	-36	dBm
6) 174-230MHz (BW=100kHz)	-	-	-54	dBm
7) 230-470MHz (BW=100kHz)	-	-	-36	dBm
8) 470-862MHz (BW=100kHz)	-	-	-54	dBm
9) 862-1000MHz (BW=100kHz)	-	-	-36	dBm
10) 1000-12750MHz (BW=1MHz)	-	-	-30	dBm
- Rx Characteristics -	Min.	Typ.	Max.	Unit
9. Minimum Input Level (FER≤ 8%)	-	-	-76	dBm
10. Maximum Input Level (FER ≤ 8%)	-10	-	-	dBm
11. Adjacent Channel Rejection (FER < 8%)	35	-	-	dB

12.1.2. Low Rate Condition for IEEE802.11b – 2.4GHz

Conditions : 25deg.C, VBAT=3.3V, VIO=1.8V, Output power setting=17dBm at module pad, 1Mbps mode

Items	Contents			
	Min.	Typ.	Max.	Unit
- DC Characteristics -				
1. DC current				
1) Tx mode	-	387	550	mA
2) Rx mode	-	50	65	mA
- Tx Characteristics -	Min.	Typ.	Max.	Unit
2. Output Power	15.0	17.0	19.0	dBm
3. Spectrum Mask Margin				
1) 1st side lobes	0	-	-	dB
2) 2nd side lobes	0	-	-	dB
4. Power-on/off ramp	-	-	2.0	Usec
5. RF Carrier Suppression	15	-	-	dB
6. Modulation Accuracy	-	-	35	%
7. Frequency tolerance	-20		20	ppm
8. Spurious Emissions				
1) 30-47MHz (BW=100kHz)	-	-	-36	dBm
2) 47-74MHz (BW=100kHz)	-	-	-54	dBm
3) 74-87.5MHz (BW=100kHz)	-	-	-36	dBm
4) 87.5-118MHz (BW=100kHz)	-	-	-54	dBm
5) 118-174MHz (BW=100kHz)	-	-	-36	dBm
6) 174-230MHz (BW=100kHz)	-	-	-54	dBm
7) 230-470MHz (BW=100kHz)	-	-	-36	dBm
8) 470-862MHz (BW=100kHz)	-	-	-54	dBm
9) 862-1000MHz (BW=100kHz)	-	-	-36	dBm
10) 1000-12750MHz (BW=1MHz)	-	-	-30	dBm
- Rx Characteristics -	Min.	Typ.	Max.	Unit
9. Minimum Input Level (FER _≤ 8%)	-	-	-80	dBm
10. Maximum Input Level (FER _≤ 8%)	-4	-	-	dBm
11. Adjacent Channel Rejection (FER < 8%)	35	-	-	dB

12.2. DC/RF Characteristics for IEEE802.11g - 2.4GHz

Specification	IEEE802.11g
Mode	OFDM
Channel Frequency	2412 - 2472MHz
Data rate	6, 9, 12, 18, 24, 36, 48, 54Mbps

12.2.1. High Rate Condition for IEEE802.11g – 2.4GHz

Conditions : 25deg.C, VBAT=3.3V, VIO=1.8V, Output power setting=16dBm at module pad, 54Mbps mode

Items	Contents			
	Min.	Typ.	Max.	Unit
- DC Characteristics -				
1. DC current				
1) Tx mode	-	249	350	mA
2) Rx mode	-	50	65	mA
- Tx Characteristics -	Min.	Typ.	Max.	Unit
2. Output Power	14.0	16.0	18.0	dBm
3. Spectrum Mask Margin				
1) 9MHz to 11MHz (0~ -20dB)	0	-	-	dB
2) 11MHz to 20MHz (-20~ -28dB)	0	-	-	dB
3) 20MHz to 30MHz (-28~ -40dB)	0	-	-	dB
4) 30MHz to 33MHz (-40dB)	0	-	-	dB
4. Constellation Error (EVM)	-	-	-25	dB
5. Frequency tolerance	-20		20	ppm
6. Spurious Emissions				
1) 30-47MHz (BW=100kHz)	-	-	-36	dBm
2) 47-74MHz (BW=100kHz)	-	-	-54	dBm
3) 74-87.5MHz (BW=100kHz)	-	-	-36	dBm
4) 87.5-118MHz (BW=100kHz)	-	-	-54	dBm
5) 118-174MHz (BW=100kHz)	-	-	-36	dBm
6) 174-230MHz (BW=100kHz)	-	-	-54	dBm
7) 230-470MHz (BW=100kHz)	-	-	-36	dBm
8) 470-862MHz (BW=100kHz)	-	-	-54	dBm
9) 862-1000MHz (BW=100kHz)	-	-	-36	dBm
10) 1000-12750MHz (BW=1MHz)	-	-	-30	dBm
- Rx Characteristics -	Min.	Typ.	Max.	Unit
7. Minimum Input Level (PER < 10%)	-	-	-65	dBm
8. Maximum Input Level (PER < 10%)	-20	-	-	dBm
9. Adjacent Channel Rejection(PER< 10%)	-1	-	-	dB

12.2.2. Low Rate Condition for IEEE802.11g – 2.4GHz

Conditions : 25deg.C, VBAT=3.3V, VIO=1.8V, Output power setting=17dBm at module pad, 6Mbps mode

Items	Contents			
	Min.	Typ.	Max.	Unit
- DC Characteristics -				
1. DC current				
1) Tx mode	-	358	510	mA
2) Rx mode	-	50	65	mA
- Tx Characteristics -	Min.	Typ.	Max.	Unit
2. Output Power	15.0	17.0	19.0	dBm
3. Spectrum Mask Margin				
1) 9MHz to 11MHz (0~ -20dB)	0	-	-	dB
2) 11MHz to 20MHz (-20~ -28dB)	0	-	-	dB
3) 20MHz to 30MHz (-28~ -40dB)	0	-	-	dB
4) 30MHz to 33MHz (-40dB)	0	-	-	dB
4. Constellation Error (EVM)	-	-	-5	dB
5. Frequency tolerance	-20		20	ppm
6. Spurious Emissions				
1) 30-47MHz (BW=100kHz)	-	-	-36	dBm
2) 47-74MHz (BW=100kHz)	-	-	-54	dBm
3) 74-87.5MHz (BW=100kHz)	-	-	-36	dBm
4) 87.5-118MHz (BW=100kHz)	-	-	-54	dBm
5) 118-174MHz (BW=100kHz)	-	-	-36	dBm
6) 174-230MHz (BW=100kHz)	-	-	-54	dBm
7) 230-470MHz (BW=100kHz)	-	-	-36	dBm
8) 470-862MHz (BW=100kHz)	-	-	-54	dBm
9) 862-1000MHz (BW=100kHz)	-	-	-36	dBm
10) 1000-12750MHz (BW=1MHz)	-	-	-30	dBm
- Rx Characteristics -	Min.	Typ.	Max.	Unit
7. Minimum Input Level (PER < 10%)	-	-	-82	dBm
8. Maximum Input Level (PER < 10%)	-20	-	-	dBm
9. Adjacent Channel Rejection(PER< 10%)	-1	-	-	dB

12.3. DC/RF Characteristics for IEEE802.11n - 2.4GHz

Specification	IEEE802.11n 20MHz BW
Mode	OFDM
Channel Frequency	2412 - 2472MHz
Data rate	MCS0-MCS7

12.3.1. High Rate Condition for IEEE802.11n 20MHz BW – 2.4GHz

Conditions : 25deg.C, VBAT=3.3V, VIO=1.8V, Output power setting=15dBm at module pad, MCS7 mode

Items	Contents			
	Min.	Typ.	Max.	Unit
- DC Characteristics -				
1. DC current				
1) Tx mode	-	230	330	mA
2) Rx mode	-	50	65	mA
- Tx Characteristics -				
	Min.	Typ.	Max.	Unit
2. Output Power	13.0	15.0	17.0	dBm
3. Spectrum Mask Margin				
1) 9MHz to 11MHz (0~ -20dBr)	0	-	-	dB
2) 11MHz to 20MHz (-20~ -28dBr)	0	-	-	dB
3) 20MHz to 30MHz (-28~ -45dBr)	0	-	-	dB
4) 30MHz to 33MHz (-45dBr)	0	-	-	dB
4. Constellation Error (EVM) (measured at enhanced mode)	-	-	-27	dB
5. Frequency tolerance	-20		20	ppm
6. Spurious Emissions				
1) 30-47MHz (BW=100kHz)	-	-	-36	dBm
2) 47-74MHz (BW=100kHz)	-	-	-54	dBm
3) 74-87.5MHz (BW=100kHz)	-	-	-36	dBm
4) 87.5-118MHz (BW=100kHz)	-	-	-54	dBm
5) 118-174MHz (BW=100kHz)	-	-	-36	dBm
6) 174-230MHz (BW=100kHz)	-	-	-54	dBm
7) 230-470MHz (BW=100kHz)	-	-	-36	dBm
8) 470-862MHz (BW=100kHz)	-	-	-54	dBm
9) 862-1000MHz (BW=100kHz)	-	-	-36	dBm
10) 1000-12750MHz (BW=1MHz)	-	-	-30	dBm
- Rx Characteristics -				
	Min.	Typ.	Max.	Unit
7. Minimum Input Level (PER ≤ 10%)	-	-	-64	dBm
8. Maximum Input Level (PER < 10%)	-20	-	-	dBm
9. Adjacent Channel Rejection(PER ≤ 10%)	-2	-	-	dB

12.3.2. Low Rate Condition for IEEE802.11n 20MHz BW – 2.4GHz

Conditions : 25deg.C, VBAT=3.3V, VIO=1.8V, Output power setting=16dBm at module pad, MCS0 mode

Items	Contents			
	Min.	Typ.	Max.	Unit
- DC Characteristics -				
1. DC current				
1) Tx mode	-	334	570	mA
2) Rx mode	-	50	65	mA
- Tx Characteristics -				
2. Output Power	14.0	16.0	18.0	dBm
3. Spectrum Mask Margin				
1) 9MHz to 11MHz (0~ -20dBr)	0	-	-	dB
2) 11MHz to 20MHz (-20~ -28dBr)	0	-	-	dB
3) 20MHz to 30MHz (-28~ -45dBr)	0	-	-	dB
4) 30MHz to 33MHz (-45dBr)	0	-	-	dB
4. Constellation Error (EVM) <small>(measured at enhanced mode)</small>	-	-	-5	dB
5. Frequency tolerance	-20		20	ppm
6. Spurious Emissions				
1) 30-47MHz (BW=100kHz)	-	-	-36	dBm
2) 47-74MHz (BW=100kHz)	-	-	-54	dBm
3) 74-87.5MHz (BW=100kHz)	-	-	-36	dBm
4) 87.5-118MHz (BW=100kHz)	-	-	-54	dBm
5) 118-174MHz (BW=100kHz)	-	-	-36	dBm
6) 174-230MHz (BW=100kHz)	-	-	-54	dBm
7) 230-470MHz (BW=100kHz)	-	-	-36	dBm
8) 470-862MHz (BW=100kHz)	-	-	-54	dBm
9) 862-1000MHz (BW=100kHz)	-	-	-36	dBm
10) 1000-12750MHz (BW=1MHz)	-	-	-30	dBm
- Rx Characteristics -				
7. Minimum Input Level (PER ≤ 10%)	-	-	-82	dBm
8. Maximum Input Level (PER < 10%)	-20	-	-	dBm
9. Adjacent Channel Rejection(PER ≤ 10%)	-2	-	-	dB

12.4. DC/RF Characteristics for IEEE802.11a - 5GHz

Specification	IEEE802.11a
Mode	OFDM
Channel Frequency	5180 to 5240MHz, 5260 to 5320MHz, 5500 to 5720MHz, 5745 to 5825MHz
Data rate	6, 9, 12, 18, 24, 36, 48, 54Mbps

12.4.1. High Rate Condition for IEEE802.11a – 5GHz

Conditions : 25deg.C, VBAT=3.3V, VIO=1.8V, Output power setting=16dBm at module pad, 54Mbps mode

Items	Contents			
	min.	Typ.	Max.	Unit
- DC Characteristics -				
1. DC current				
1) Tx mode	-	287	410	mA
2) Rx mode	-	62	80	mA
- Tx Characteristics -				
	min.	Typ.	Max.	Unit
2. Output Power	14.0	16.0	18.0	dBm
3. Spectrum Mask Margin				
1) 9MHz to 11MHz (0~ -20dBr)	0	-	-	dB
2) 11MHz to 20MHz (-20~ -28dBr)	0	-	-	dB
3) 20MHz to 30MHz (-28~ -45dBr)	0	-	-	dB
4) 30MHz to 33MHz (-45dBr)	0	-	-	dB
4. Constellation Error (EVM) (measured at enhanced mode)	-	-	-25	dB
5. Frequency tolerance	-20		20	ppm
6. Spurious Emissions				
1) 30-47MHz (BW=100kHz)	-	-	-36	dBm
2) 47-74MHz (BW=100kHz)	-	-	-54	dBm
3) 74-87.5MHz (BW=100kHz)	-	-	-36	dBm
4) 87.5-118MHz (BW=100kHz)	-	-	-54	dBm
5) 118-174MHz (BW=100kHz)	-	-	-36	dBm
6) 174-230MHz (BW=100kHz)	-	-	-54	dBm
7) 230-470MHz (BW=100kHz)	-	-	-36	dBm
8) 470-862MHz (BW=100kHz)	-	-	-54	dBm
9) 862-1000MHz (BW=100kHz)	-	-	-36	dBm
10) 1000-5150MHz (BW=1MHz)	-	-	-30	dBm
11) 5350-5470MHz (BW=1MHz)	-	-	-30	dBm
12) 5725-26000MHz (BW=1MHz)	-	-	-30	dBm
- Rx Characteristics -	Min.	Typ.	Max.	Unit
7. Minimum Input Level (PER ≤ 10%)	-	-	-65	dBm
8. Maximum Input Level (PER < 10%)	-30	-	-	dBm
9. Adjacent Channel Rejection (PER ≤ 10%)	-1	-	-	dB

12.4.2. Low Rate Condition for IEEE802.11a – 5GHz

Conditions : 25deg.C, VBAT=3.3V, VIO=1.8V, Output power setting=16dBm at module pad, 6Mbps mode

Items	Contents			
	min.	Typ.	Max.	Unit
- DC Characteristics -				
1. DC current				
1) Tx mode	-	376	530	mA
2) Rx mode	-	62	80	mA
- Tx Characteristics -				
2. Output Power	14.0	16.0	18.0	dBm
3. Spectrum Mask Margin				
1) 9MHz to 11MHz (0~ -20dBr)	0	-	-	dB
2) 11MHz to 20MHz (-20~ -28dBr)	0	-	-	dB
3) 20MHz to 30MHz (-28~ -45dBr)	0	-	-	dB
4) 30MHz to 33MHz (-45dBr)	0	-	-	dB
4. Constellation Error (EVM) <small>(measured at enhanced mode)</small>	-	-	-5	dB
5. Frequency tolerance	-20		20	ppm
6. Spurious Emissions				
1) 30-47MHz (BW=100kHz)	-	-	-36	dBm
2) 47-74MHz (BW=100kHz)	-	-	-54	dBm
3) 74-87.5MHz (BW=100kHz)	-	-	-36	dBm
4) 87.5-118MHz (BW=100kHz)	-	-	-54	dBm
5) 118-174MHz (BW=100kHz)	-	-	-36	dBm
6) 174-230MHz (BW=100kHz)	-	-	-54	dBm
7) 230-470MHz (BW=100kHz)	-	-	-36	dBm
8) 470-862MHz (BW=100kHz)	-	-	-54	dBm
9) 862-1000MHz (BW=100kHz)	-	-	-36	dBm
10) 1000-5150MHz (BW=1MHz)	-	-	-30	dBm
11) 5350-5470MHz (BW=1MHz)	-	-	-30	dBm
12) 5725-26000MHz (BW=1MHz)	-	-	-30	dBm
- Rx Characteristics -				
7. Minimum Input Level (PER ≤ 10%)	-	-	-82	dBm
8. Maximum Input Level (PER < 10%)	-30	-	-	dBm
9. Adjacent Channel Rejection (PER ≤ 10%)	-1	-	-	dB

12.5. DC/RF Characteristics for IEEE802.11n(HT20) - 5GHz

Specification	IEEE802.11n
Mode	OFDM
Channel Frequency	5180 to 5240MHz, 5260 to 5320MHz, 5500 to 5720MHz, 5745 to 5825MHz
Data rate	MCS0-MCS7

12.5.1. High Rate Condition for IEEE802.11n(HT20) – 5GHz

Conditions : 25deg.C, VBAT=3.3V, VIO=1.8V, Output power setting=15dBm at module pad, MCS7 mode

Items	Contents			
	min.	Typ.	Max.	Unit
- DC Characteristics -				
1. DC current				
1) Tx mode	-	267	380	mA
2) Rx mode	-	62	80	mA
- Tx Characteristics -				
	min.	Typ.	Max.	Unit
2. Output Power	13.0	15.0	17.0	dBm
3. Spectrum Mask Margin				
1) 9MHz to 11MHz (0~ -20dBr)	0	-	-	dB
2) 11MHz to 20MHz (-20~ -28dBr)	0	-	-	dB
3) 20MHz to 30MHz (-28~ -45dBr)	0	-	-	dB
4) 30MHz to 33MHz (-45dBr)	0	-	-	dB
4. Constellation Error (EVM) (measured at enhanced mode)	-	-	-27	dB
5. Frequency tolerance	-20		20	ppm
6. Spurious Emissions				
1) 30-47MHz (BW=100kHz)	-	-	-36	dBm
2) 47-74MHz (BW=100kHz)	-	-	-54	dBm
3) 74-87.5MHz (BW=100kHz)	-	-	-36	dBm
4) 87.5-118MHz (BW=100kHz)	-	-	-54	dBm
5) 118-174MHz (BW=100kHz)	-	-	-36	dBm
6) 174-230MHz (BW=100kHz)	-	-	-54	dBm
7) 230-470MHz (BW=100kHz)	-	-	-36	dBm
8) 470-862MHz (BW=100kHz)	-	-	-54	dBm
9) 862-1000MHz (BW=100kHz)	-	-	-36	dBm
10) 1000-5150MHz (BW=1MHz)	-	-	-30	dBm
11) 5350-5470MHz (BW=1MHz)	-	-	-30	dBm
12) 5725-26000MHz (BW=1MHz)	-	-	-30	dBm
- Rx Characteristics -				
	Min.	Typ.	Max.	Unit
7. Minimum Input Level (PER ≤ 10%)	-	-	-64	dBm
8. Maximum Input Level (PER < 10%)	-30	-	-	dBm
9. Adjacent Channel Rejection (PER ≤ 10%)	-2	-	-	dB

12.5.2. Low Rate Condition for IEEE802.11n(HT20) – 5GHz

Conditions : 25deg.C, VBAT=3.3V, VIO=1.8V, Output power setting=15dBm at module pad, MCS0 mode

Items	Contents			
	min.	Typ.	Max.	Unit
- DC Characteristics -				
1. DC current				
1) Tx mode	-	355	500	mA
2) Rx mode	-	62	80	mA
- Tx Characteristics -				
2. Output Power	13.0	15.0	17.0	dBm
3. Spectrum Mask Margin				
1) 9MHz to 11MHz (0~ -20dBr)	0	-	-	dB
2) 11MHz to 20MHz (-20~ -28dBr)	0	-	-	dB
3) 20MHz to 30MHz (-28~ -45dBr)	0	-	-	dB
4) 30MHz to 33MHz (-45dBr)	0	-	-	dB
4. Constellation Error (EVM) <small>(measured at enhanced mode)</small>	-	-	-5	dB
5. Frequency tolerance	-20		20	ppm
6. Spurious Emissions				
1) 30-47MHz (BW=100kHz)	-	-	-36	dBm
2) 47-74MHz (BW=100kHz)	-	-	-54	dBm
3) 74-87.5MHz (BW=100kHz)	-	-	-36	dBm
4) 87.5-118MHz (BW=100kHz)	-	-	-54	dBm
5) 118-174MHz (BW=100kHz)	-	-	-36	dBm
6) 174-230MHz (BW=100kHz)	-	-	-54	dBm
7) 230-470MHz (BW=100kHz)	-	-	-36	dBm
8) 470-862MHz (BW=100kHz)	-	-	-54	dBm
9) 862-1000MHz (BW=100kHz)	-	-	-36	dBm
10) 1000-5150MHz (BW=1MHz)	-	-	-30	dBm
11) 5350-5470MHz (BW=1MHz)	-	-	-30	dBm
12) 5725-26000MHz (BW=1MHz)	-	-	-30	dBm
- Rx Characteristics -				
7. Minimum Input Level (PER ≤ 10%)	-	-	-82	dBm
8. Maximum Input Level (PER < 10%)	-30	-	-	dBm
9. Adjacent Channel Rejection (PER ≤ 10%)	-2	-	-	dB

12.6. DC/RF Characteristics for IEEE802.11n(HT 40MHz) - 5GHz

Specification	IEEE802.11n
Mode	OFDM
Frequency	5190 to 5795MHz
Data rate	MCS0-MCS7

12.6.1. High Rate Condition for IEEE802.11n(HT40) – 5GHz

Conditions : 25deg.C, VBAT=3.3V, VIO=1.8V, Output power setting=14dBm at module pad, MCS7 mode

Items	Contents			
	min.	Typ.	Max.	Unit
- DC Characteristics -				
1. DC current				
1) Tx mode	-	218	330	mA
2) Rx mode	-	69	90	mA
- Tx Characteristics -				
	min.	Typ.	Max.	Unit
2. Output Power	12.0	14.0	16.0	dBm
3. Spectrum Mask Margin				
1) 19MHz to 21MHz (0~ -20dBr)	0	-	-	dB
2) 21MHz to 40MHz (-20~ -28dBr)	0	-	-	dB
3) 40MHz to 60MHz (-28~ -45dBr)	0	-	-	dB
4) 60MHz to 80MHz (-45dBr)	0	-	-	dB
4. Constellation Error (EVM) (measured at enhanced mode)	-	-	-27	dB
5. Frequency tolerance	-20		20	ppm
6. Spurious Emissions				
1) 30-47MHz (BW=100kHz)	-	-	-36	dBm
2) 47-74MHz (BW=100kHz)	-	-	-54	dBm
3) 74-87.5MHz (BW=100kHz)	-	-	-36	dBm
4) 87.5-118MHz (BW=100kHz)	-	-	-54	dBm
5) 118-174MHz (BW=100kHz)	-	-	-36	dBm
6) 174-230MHz (BW=100kHz)	-	-	-54	dBm
7) 230-470MHz (BW=100kHz)	-	-	-36	dBm
8) 470-862MHz (BW=100kHz)	-	-	-54	dBm
9) 862-1000MHz (BW=100kHz)	-	-	-36	dBm
10) 1000-5150MHz (BW=1MHz)	-	-	-30	dBm
11) 5350-5470MHz (BW=1MHz)	-	-	-30	dBm
12) 5725-26000MHz (BW=1MHz)	-	-	-30	dBm
- Rx Characteristics -	Min.	Typ.	Max.	Unit
7. Minimum Input Level (PER ≤ 10%)	-	-	-61	dBm
8. Maximum Input Level (PER ≤ 10%)	-30	-	-	dBm
9. Adjacent Channel Rejection (PER ≤ 10%)	-2	-	-	dB

12.6.2. Low Rate Condition for IEEE802.11n(HT40) – 5GHz

Conditions : 25deg.C, VBAT=3.3V, VIO=1.8V, Output power setting=14dBm at module pad, MCS0 mode

Items	Contents			
	min.	Typ.	Max.	Unit
- DC Characteristics -				
1. DC current				
1) Tx mode	-	320	450	mA
2) Rx mode	-	69	90	mA
- Tx Characteristics -				
2. Output Power	12.0	14.0	16.0	dBm
3. Spectrum Mask Margin				
1) 19MHz to 21MHz (0~ -20dBr)	0	-	-	dB
2) 21MHz to 40MHz (-20~ -28dBr)	0	-	-	dB
3) 40MHz to 60MHz (-28~ -45dBr)	0	-	-	dB
4) 60MHz to 80MHz (-45dBr)	0	-	-	dB
4. Constellation Error (EVM) <small>(measured at enhanced mode)</small>	-	-	-5	dB
5. Frequency tolerance	-20		20	ppm
6. Spurious Emissions				
1) 30-47MHz (BW=100kHz)	-	-	-36	dBm
2) 47-74MHz (BW=100kHz)	-	-	-54	dBm
3) 74-87.5MHz (BW=100kHz)	-	-	-36	dBm
4) 87.5-118MHz (BW=100kHz)	-	-	-54	dBm
5) 118-174MHz (BW=100kHz)	-	-	-36	dBm
6) 174-230MHz (BW=100kHz)	-	-	-54	dBm
7) 230-470MHz (BW=100kHz)	-	-	-36	dBm
8) 470-862MHz (BW=100kHz)	-	-	-54	dBm
9) 862-1000MHz (BW=100kHz)	-	-	-36	dBm
10) 1000-5150MHz (BW=1MHz)	-	-	-30	dBm
11) 5350-5470MHz (BW=1MHz)	-	-	-30	dBm
12) 5725-26000MHz (BW=1MHz)	-	-	-30	dBm
- Rx Characteristics -				
7. Minimum Input Level (PER ≤ 10%)	-	-	-79	dBm
8. Maximum Input Level (PER ≤ 10%)	-30	-	-	dBm
9. Adjacent Channel Rejection (PER ≤ 10%)	-2	-	-	dB

12.7. DC/RF Characteristics for Bluetooth

Items	Contents
Bluetooth specification (power class)	Version 5.2 (Class1)
Channel frequency (spacing)	2402 to 2480 MHz (1MHz)
Number of RF Channel	79

12.7.1. Basic Data Rate Condition

Conditions : 25deg.C, VBAT=3.3V, VIO=1.8V

Items	Contents			
	Min.	Typ.	Max.	Unit
Current Consumption				
1) Tx mode DH5	-	84	110	mA
2) Rx mode DH5	-	65	90	mA
- Tx Characteristics -	Min.	Typ.	Max.	Unit
Output Power@DH5	0	3.0	6.3	dBm
Frequency range	2400	-	2483.5	MHz
20dB bandwidth	-		1	MHz
Adjacent Channel Power*				
1) [M-N] =2	-	-	-20	dBm
2) [M-N] ≥3	-	-	-40	dBm
Modulation characteristics				
1) Modulation Δf1avg	140	151	175	kHz
2) Modulation Δf2max	115		-	kHz
3) Modulation Δf2avg / Δf1avg	0.8	1	-	
Carrier Frequency Drift				
1) 1slot	-25	-	25	kHz
2) 3slot / 5slot	-40	-	40	kHz
3) Maximum drift rate		-	20	kHz/50us
- Rx Characteristics -	Min.	Typ.	Max.	Unit
BR Sensitivity (BER≤0.1%)	-	-93	-70	dBm
Maximum Input Level (BER≤0.1%)	-20	-	-	dBm

* Up to three spurious responses within Bluetooth limits are allowed.

12.7.2. Enhanced Data Rate Condition

Conditions : 25deg.C, VBAT=3.3V, VIO=1.8V

Items	Contents			
	Min.	Typ.	Max.	Unit
Current Consumption				
1) Tx mode 2DH5	-	81	110	mA
2) Rx mode 2DH5	-	65	90	mA
3) Tx mode 3DH5	-	81	110	mA
4) Rx mode 3DH5	-	65	90	mA
- Tx Characteristics -	Min.	Typ.	Max.	Unit
Output Power@2DH5/3DH5	-3.0	0	3.3	dBm
Frequency range	2400	-	2483.5	MHz
20dB bandwidth	-		1	MHz
Adjacent Channel Power*				
1) [M-N] =2	-	-	-20	dBm
2) [M-N] ≥3	-	-	-40	dBm
EDR Relative Power	-4	-	1	dB
EDR Carrier Frequency Stability and Modulation Accuracy				
1) ω_i	-75	-	75	kHz
2) $\omega_i + \omega_o$	-75	-	75	kHz
3) ω_o	-10	-	10	kHz
4) RMS DEVM (DQPSK)	-	-	20	%
5) Peak DEVM (DQPSK)	-	-	35	%
6) 99% DEVM (DQPSK)	-	-	30	%
7) RMS DEVM (8DPSK)	-	-	13	%
8) Peak DEVM (8DPSK)	-	-	25	%
9) 99% DEVM (8DPSK)	-	-	20	%
Spurious Emissions				
1) 30-47MHz (BW=100kHz)	-	-	-36	dBm
2) 47-74MHz (BW=100kHz)	-	-	-54	dBm
3) 74-87.5MHz (BW=100kHz)	-	-	-36	dBm
4) 87.5-118MHz (BW=100kHz)	-	-	-54	dBm
5) 118-174MHz (BW=100kHz)	-	-	-36	dBm
6) 174-230MHz (BW=100kHz)	-	-	-54	dBm
7) 230-470MHz (BW=100kHz)	-	-	-36	dBm
8) 470-862MHz (BW=100kHz)	-	-	-54	dBm
9) 862-1000MHz (BW=100kHz)	-	-	-36	dBm
10) 1000-12750MHz (BW=1MHz)	-	-	-30	dBm
- Rx Characteristics -	Min.	Typ.	Max.	Unit
EDR Sensitivity (BER≤0.007%)@8DPSK	-	-87	-70	dBm
Maximum Input Level (BER≤0.1%)	-20	-	-	dBm

* Up to three spurious responses within Bluetooth limits are allowed.

12.8. DC/RF Characteristics for Bluetooth Low Energy

Items	Contents
Bluetooth specification (power class)	Version 5.2 (Class1.5)
Channel frequency (spacing)	2402 to 2480 MHz (2MHz)
Number of RF Channel	40

12.8.1. 1Mbps PHY Condition

Conditions : 25deg.C, VBAT=3.3V, VIO=1.8V

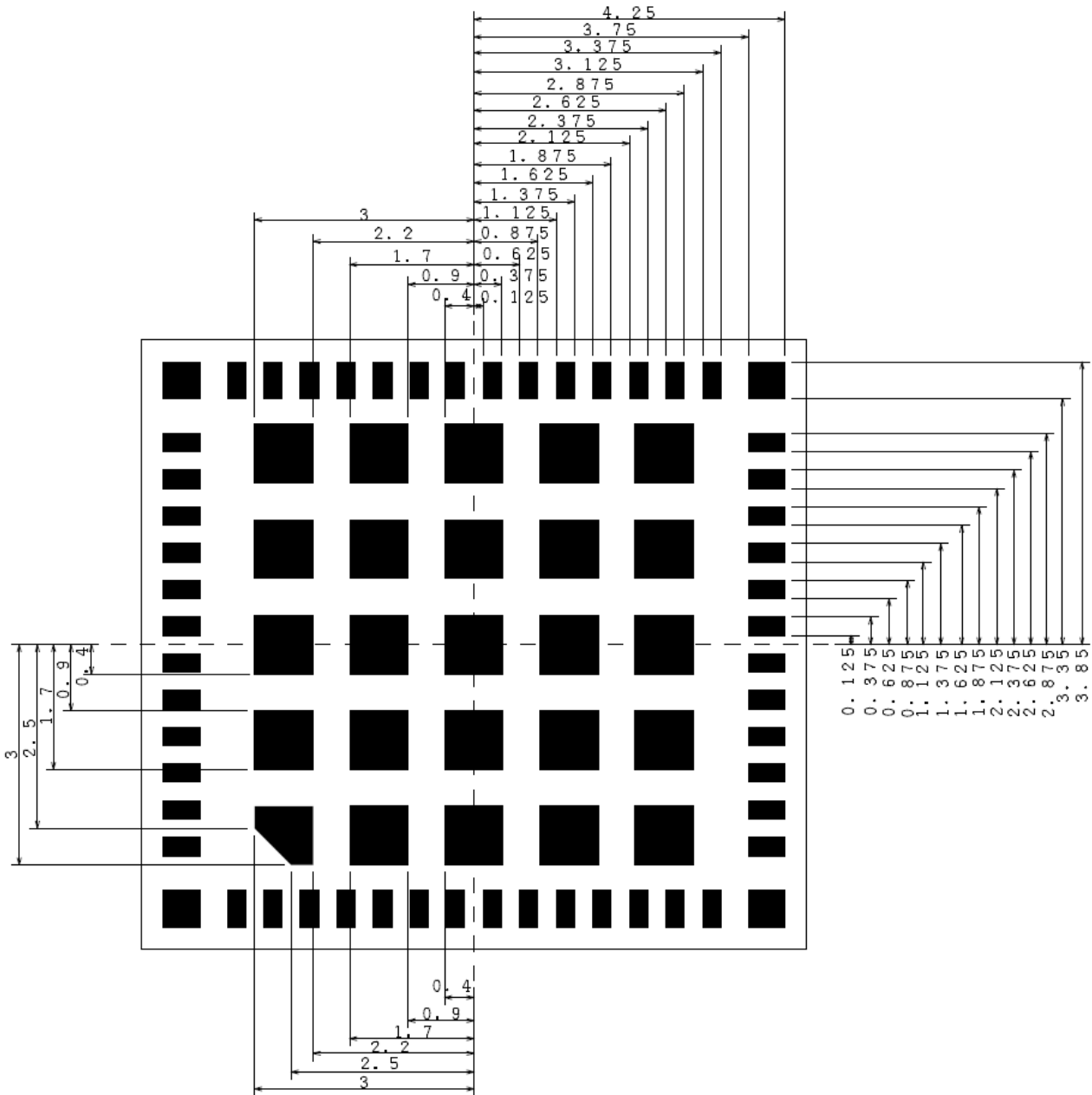
Items	Contents			
	Min.	Typ.	Max.	Unit
Current Consumption				
1) Tx mode	-	80	110	mA
2) Rx mode	-	73	95	mA
- Tx Characteristics -	Min.	Typ.	Max.	Unit
Center Frequency	2402	-	2480	MHz
Channel Spacing	-	2	-	MHz
Number of RF channel	-	40	-	-
Output power	0	3.0	6.3	dBm
In-band emission				
1) $f_{TX} \pm 2\text{MHz}$	-	-	-20	dBm
2) $f_{TX} \pm [3+n]\text{MHz}; n=0,1,2\dots$	-	-	-30	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	-	-	-
Stable Modulation Characteristics				
1) $\Delta f_{1\text{avg}}$	247.5	-	252.5	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 (f_n); $n=0,1,2,3\dots k$	-150	-	150	kHz
2) Frequency drift ($ f_0 - f_n $); $n=2,3,4\dots k$	-	-	50	kHz
3) Drift rate				
a) $ f_1 - f_0 $	-	-	23	kHz
b) $ f_n - f_{n-5} $; $n=6,7,8,\dots k$	-	-	20	kHz
Spurious Emissions				
1) 30-47MHz (BW=100kHz)	-	-	-36	dBm
2) 47-74MHz (BW=100kHz)	-	-	-54	dBm
3) 74-87.5MHz (BW=100kHz)	-	-	-36	dBm
4) 87.5-118MHz (BW=100kHz)	-	-	-54	dBm
5) 118-174MHz (BW=100kHz)	-	-	-36	dBm
6) 174-230MHz (BW=100kHz)	-	-	-54	dBm
7) 230-470MHz (BW=100kHz)	-	-	-36	dBm
8) 470-862MHz (BW=100kHz)	-	-	-54	dBm
9) 862-1000MHz (BW=100kHz)	-	-	-36	dBm
10) 1000-12750MHz (BW=1MHz)	-	-	-30	dBm
- Rx Characteristics -	Min.	Typ.	Max.	Unit
Receiver sensitivity (PER < 30.8%)	-	-101	-70	dBm
Maximum input signal level (PER < 30.8%)	-10	-	-	dBm
PER Report Integrity (-30dBm input)	50	-	65.4	%

12.8.2. 2Mbps PHY Condition

Conditions : 25deg.C, VBAT=3.3V, VIO=1.8V

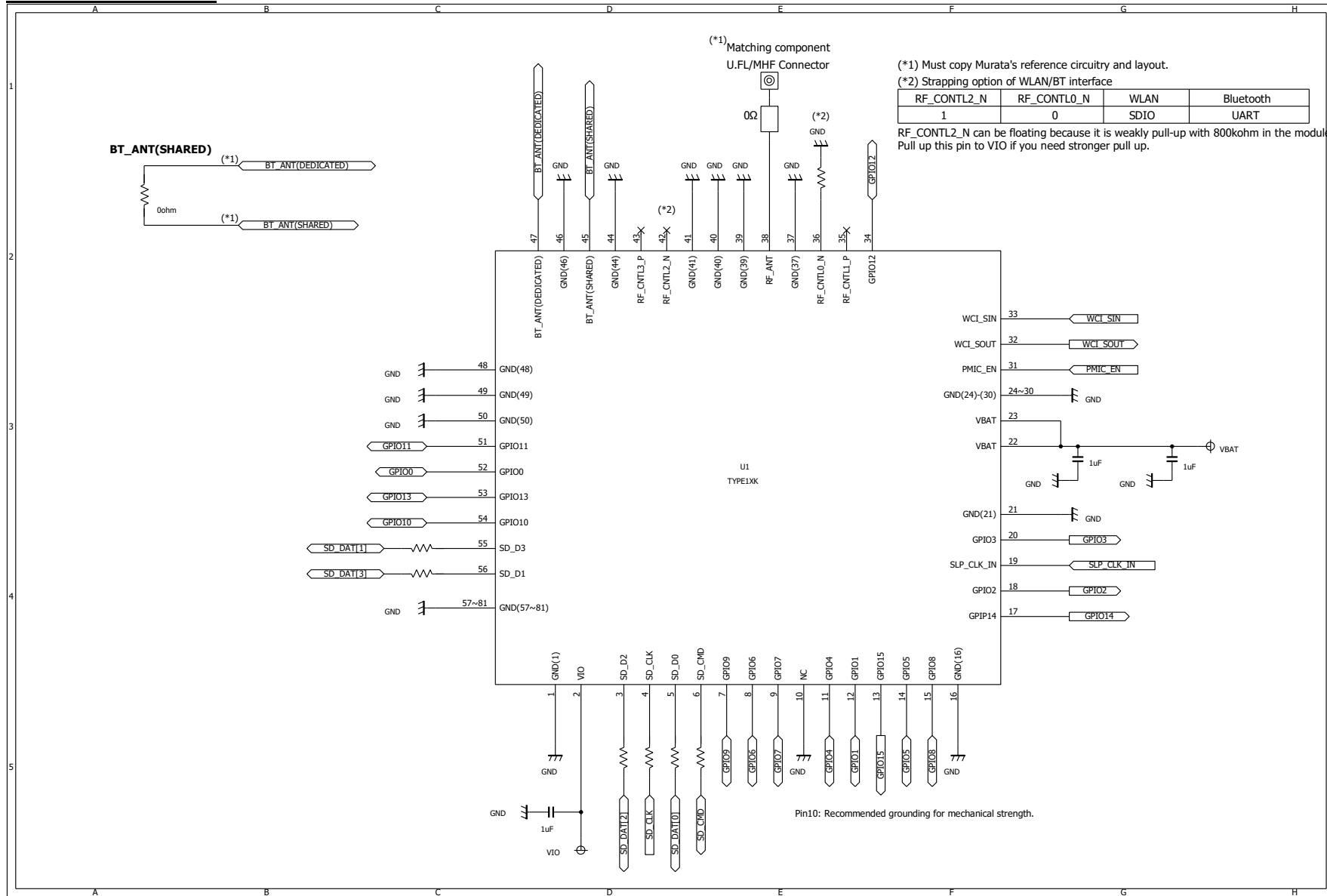
Items	Contents			
	Min.	Typ.	Max.	Unit
Current Consumption				
1) Tx mode	-	76	100	mA
2) Rx mode	-	73	95	mA
- Tx Characteristics -	Min.	Typ.	Max.	Unit
Center Frequency	2402	-	2480	MHz
Channel Spacing	-	2	-	MHz
Number of RF channel	-	40	-	-
Output power	0	3.0	6.3	dBm
In-band emission				
1) $f_{TX} \pm 4\text{MHz}$	-	-	-20	dBm
2) $f_{TX} \pm 5\text{MHz}$	-	-	-20	dBm
2) $f_{TX} \pm [6+n]\text{MHz}; n=0,1,2,\dots$	-	-	-30	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	-	-	-
Stable Modulation Characteristics				
1) $\Delta f_{1\text{avg}}$	495	-	505	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 (f_n); $n=0,1,2,3,\dots,k$	-150	-	150	kHz
2) Frequency drift ($ f_0 - f_n $); $n=2,3,4,\dots,k$	-	-	50	kHz
3) Drift rate				
a) $ f_1 - f_0 $	-	-	23	kHz
b) $ f_n - f_{n-5} $; $n=6,7,8,\dots,k$	-	-	20	kHz
Spurious Emissions				
1) 30-47MHz (BW=100kHz)	-	-	-36	dBm
2) 47-74MHz (BW=100kHz)	-	-	-54	dBm
3) 74-87.5MHz (BW=100kHz)	-	-	-36	dBm
4) 87.5-118MHz (BW=100kHz)	-	-	-54	dBm
5) 118-174MHz (BW=100kHz)	-	-	-36	dBm
6) 174-230MHz (BW=100kHz)	-	-	-54	dBm
7) 230-470MHz (BW=100kHz)	-	-	-36	dBm
8) 470-862MHz (BW=100kHz)	-	-	-54	dBm
9) 862-1000MHz (BW=100kHz)	-	-	-36	dBm
10) 1000-12750MHz (BW=1MHz)	-	-	-30	dBm
- Rx Characteristics -	Min.	Typ.	Max.	Unit
Receiver sensitivity (PER < 30.8%)	-	-99	-70	dBm
Maximum input signal level (PER < 30.8%)	-10	-	-	dBm
PER Report Integrity (-30dBm input)	50	-	65.4	%

13. Land Patterns

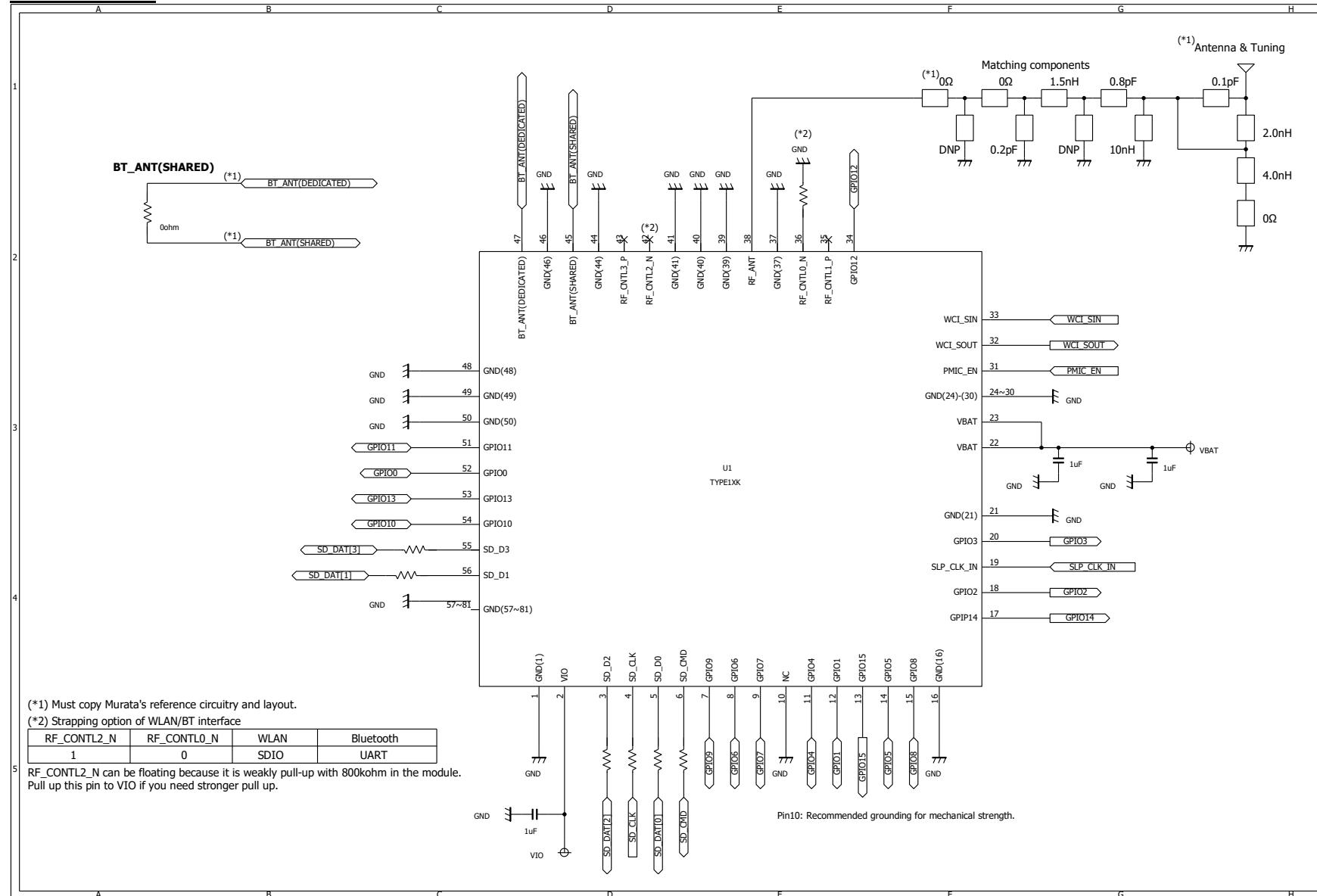


* To avoid the short-circuit between the side shielding and a solder on the module land after the reflow, please locate the module land at 0.2mm away from module outline as above figure.

14. Reference Circuit
U.FL/MHF Connector



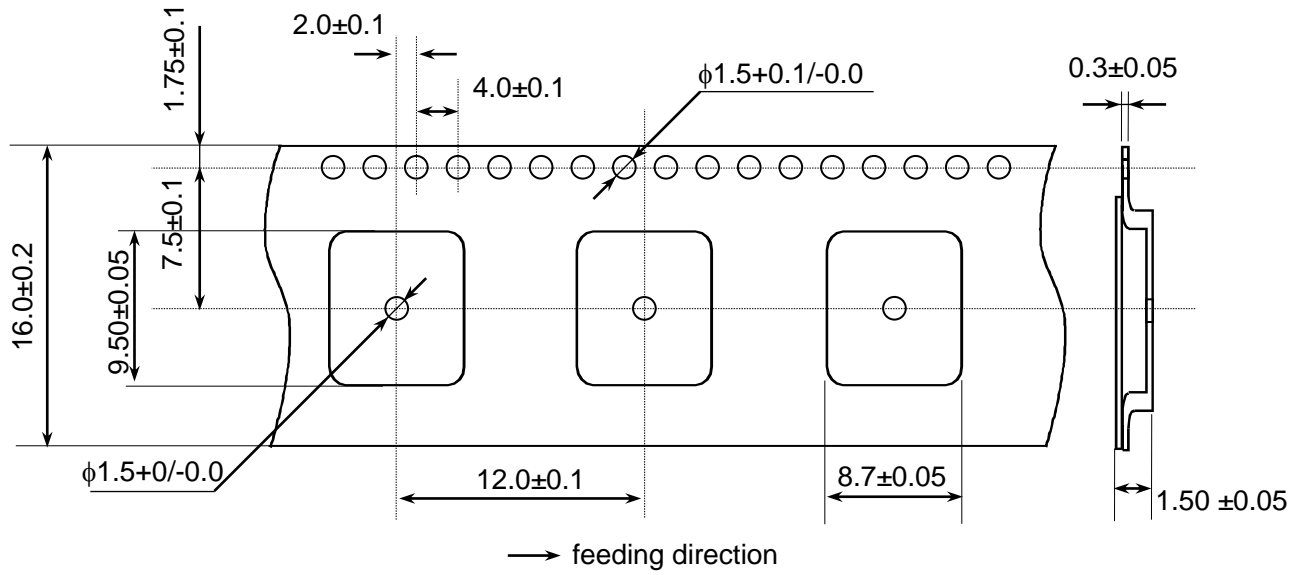
Trace Antenna



15. Tape and Reel Packing

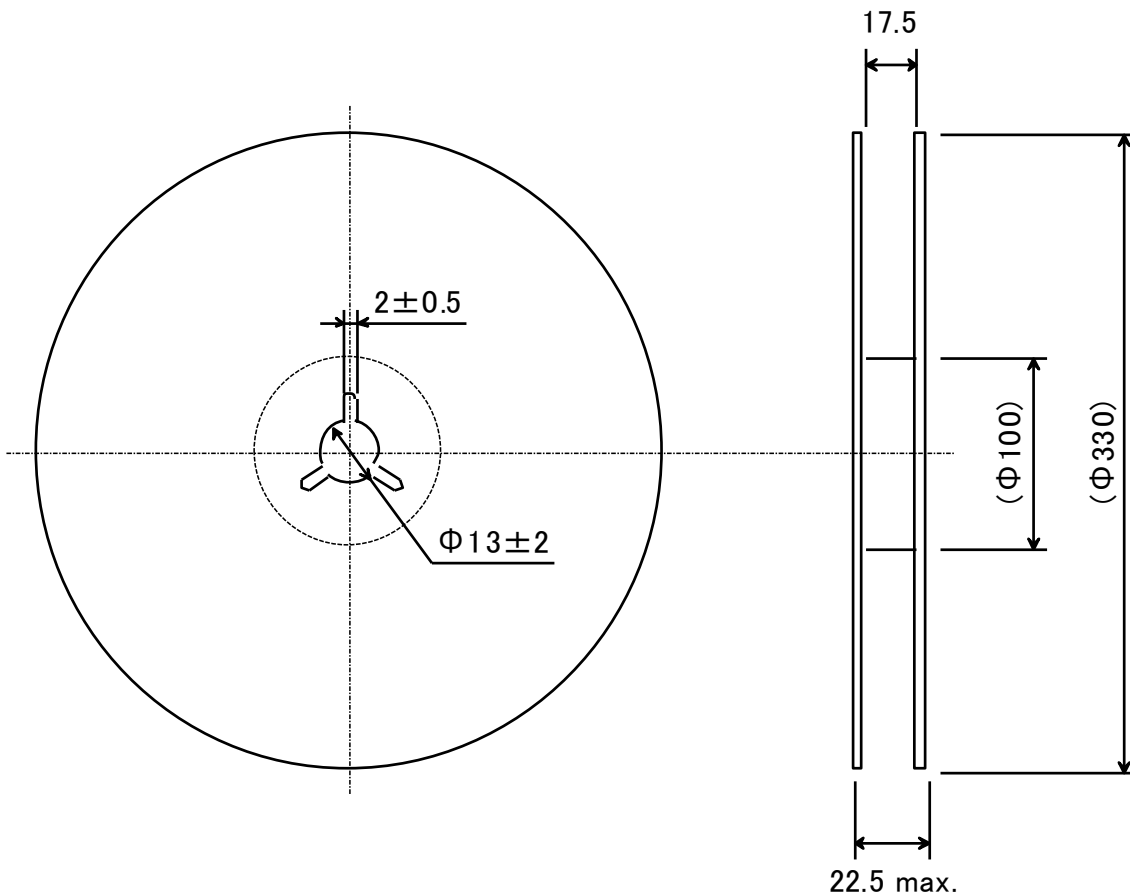
(1) Dimensions of Tape (Plastic tape)

*1. Cumulative tolerance of max. 40.0 ± 0.15 every 10 pitches



(Unit : mm)

(2) Dimensions of Reel



(unit : mm)

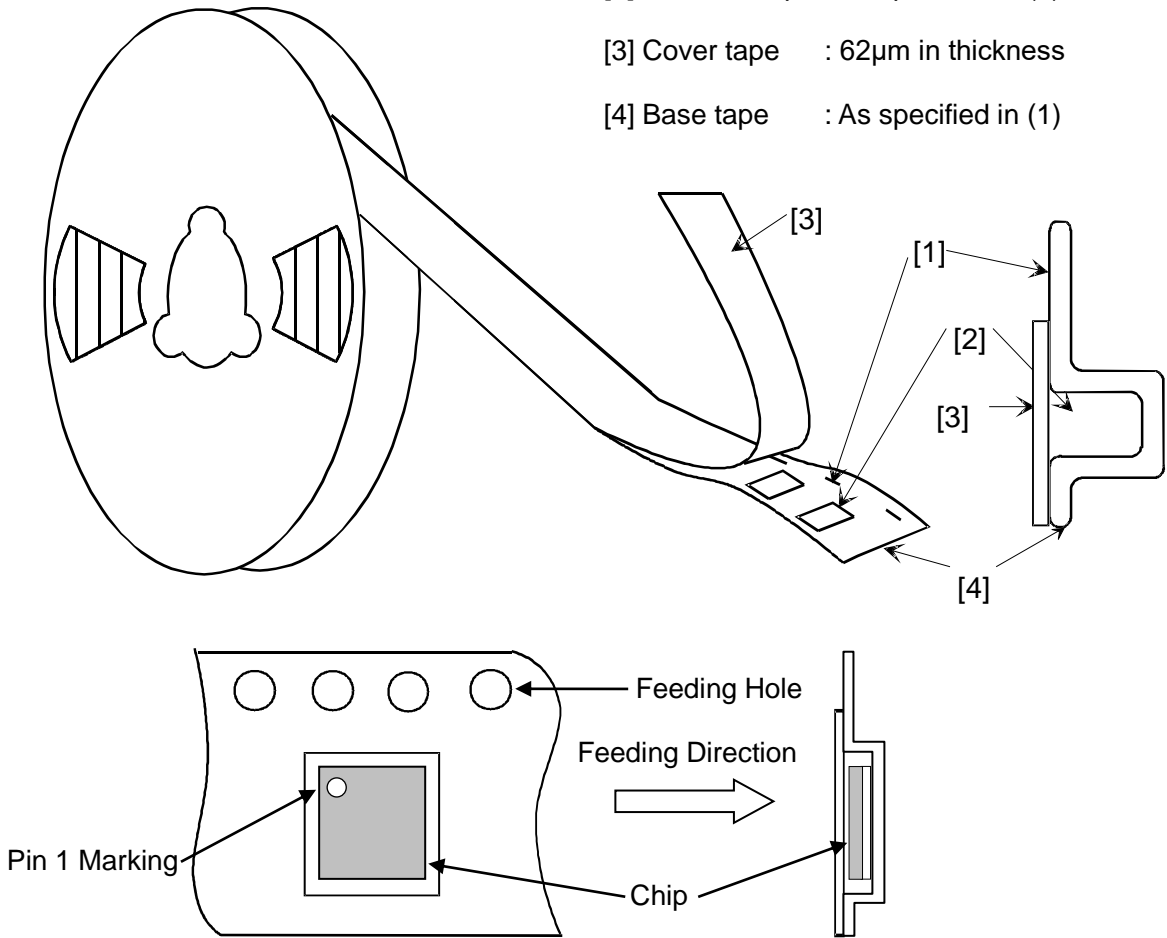
(3) Taping Diagrams

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

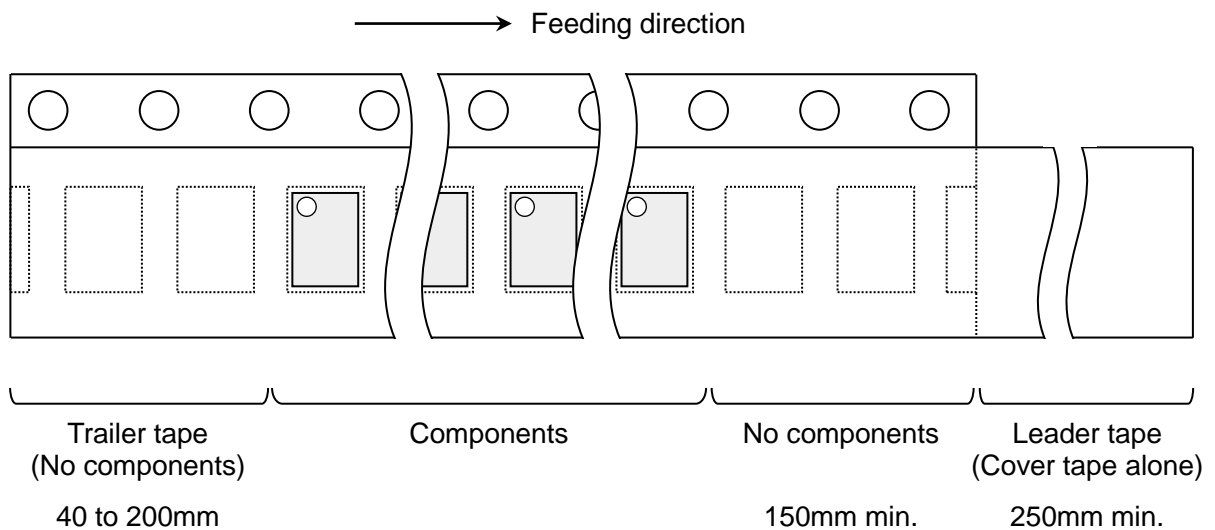
[2] Hole for chip : As specified in (1)

[3] Cover tape : 62μm in thickness

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

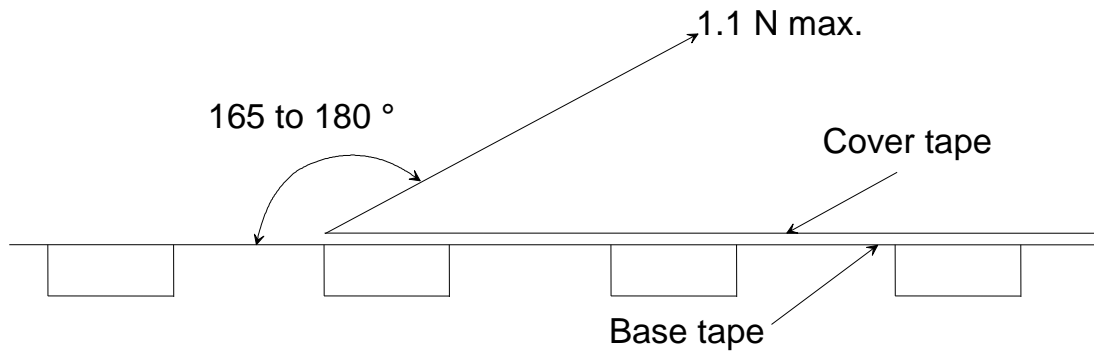


(4) Leader and Tail tape

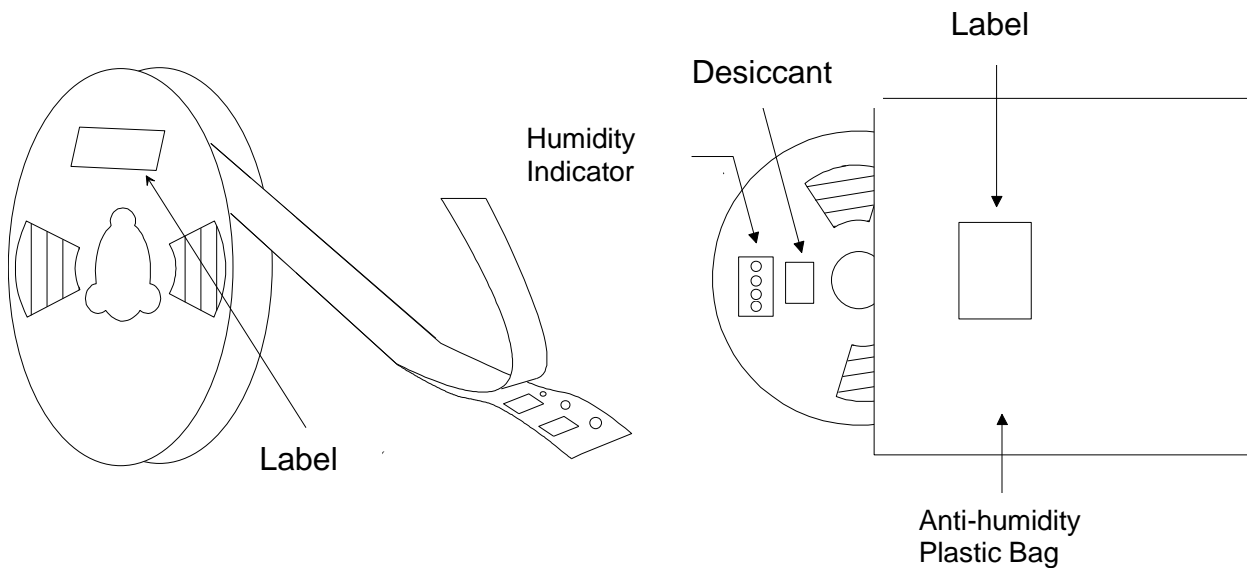


(5) The tape for chips are wound clockwise, the feeding holes to the right side as the tape is pulled toward the user.

- (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.

16. Notice

16.1. 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 solderbility 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.
- 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.

16.2. 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.

16.3. 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.

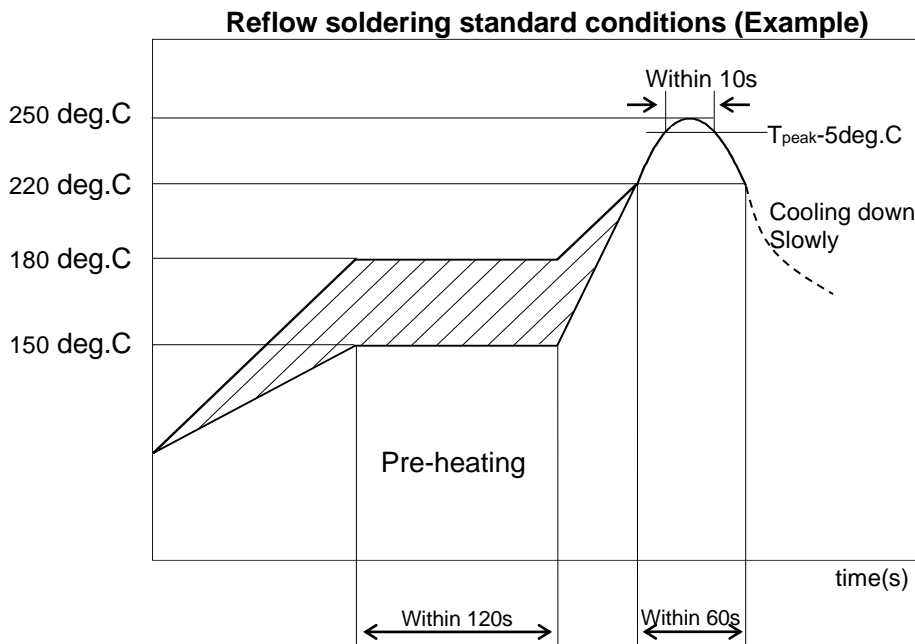
16.4. Notice for Chip Placer:

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.

16.5. 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.

16.6. 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.

16.7. 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.

17. Preconditions 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 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.

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.

APPENDIX

TABLE OF CONTENTS

1. General for Radio Regulatory Certification for LBEE5CJ1XK and LBEE5CJ2XK

Application model part number
Label
Package Label
Country of Origin

2. Radio Regulatory certification by country for LBEE5CJ1XK and LBEE5CJ2XK

<日本電波法>

< FCC >

< ISED >

< Europe >

Precautions when using report number

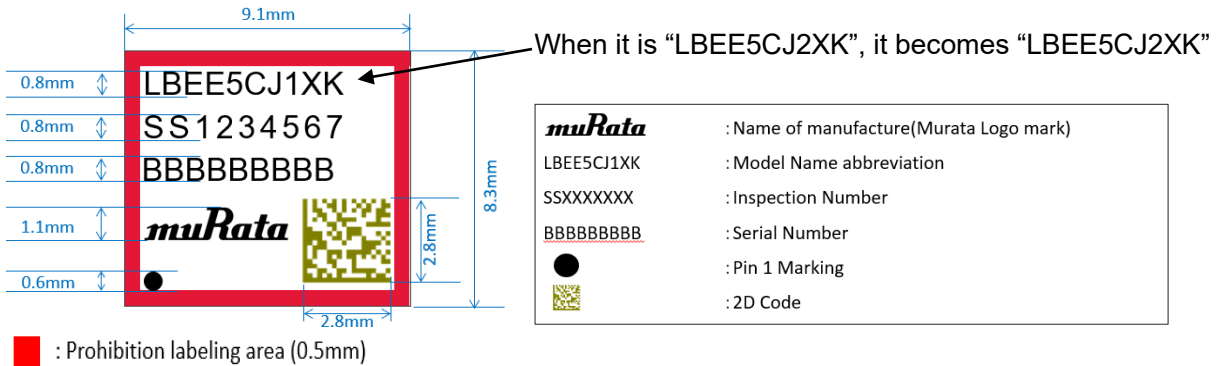
E2/2021/30010 ~ E2/2021/30015 (RF Conducted test result only) for final product DoC.

1. General for Radio Regulatory Certification for LBEE5CJ1XK and LBEE5CJ2XK

Application model part number

Basically, we apply for “LBEE5CJ1XK” and “LBEE5CJ2XK” in each country.

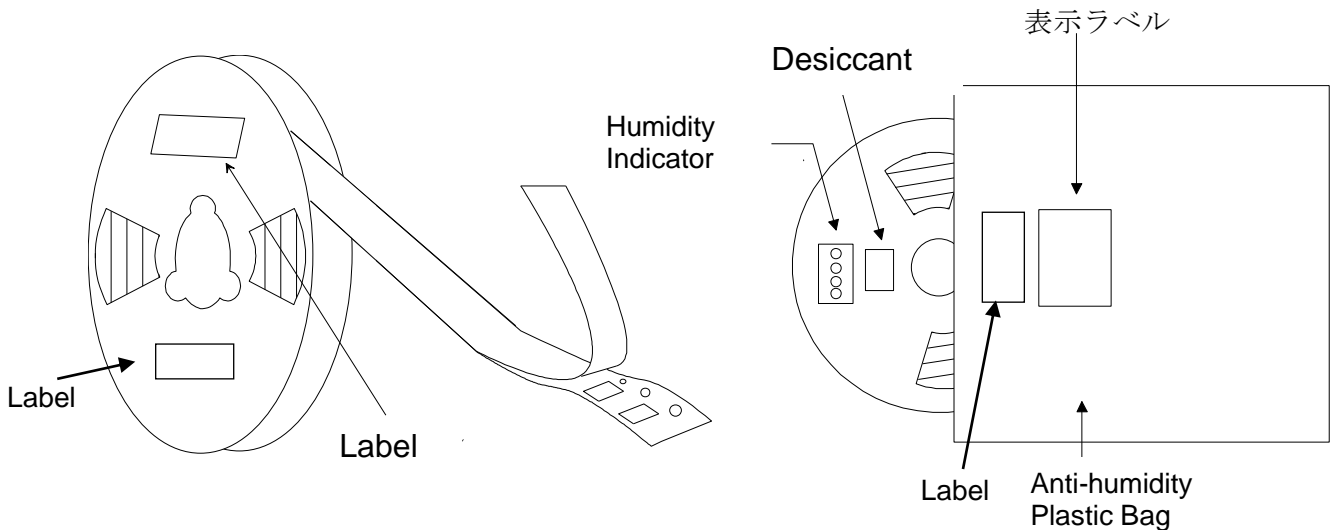
Label



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 or package.

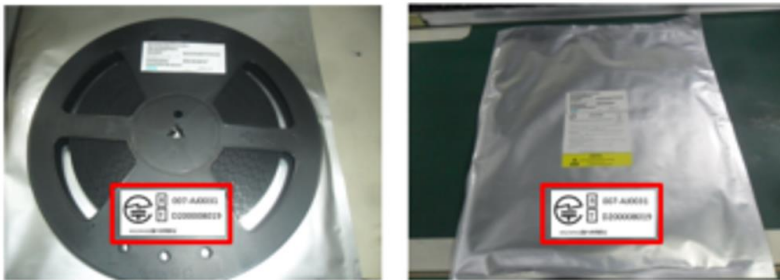
Package Label

PACKAGE (Humidity proof Packing)



The package label may be attached on one side only.

Package label display example



※ 技術マークの直径は3mm以上

The above pictures are examples. It may be attached to only one of them.

Country of Origin

China
SHENZHEN MURATA TECHNOLOGY CO., LTD.

Some countries have applied for 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 by country for LBEE5CJ1XK and LBEE5CJ2XK

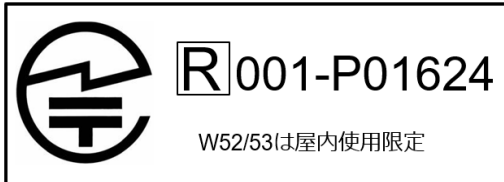
<日本電波法>

製造者名（端末機器の製造者名）：株式会社村田製作所

型式又は名称（端末機器の名称）：LBEE5CJ1XK 又は LBEE5CJ2XK

当モジュールは日本電波法に基づく工事設計認証を受けた製品です。

【（警告）5GHz の周波数帯においては、5.2GHz/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。5.2GHz/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。】



特定無線設備の種類

証明規則第 2 条第 1 項第 19 号の無線設備	2.4GHz 帯高度化小電力データ通信システム
証明規則第 2 条第 1 項第 19 号の 3 の無線設備	5GHz 帯小電力データ通信システム

認可製品概要

当モジュールは無線設備規則第 49 条の 20 に規定する小電力データ通信システムの無線設備です。

内蔵する無線設備は認証 IEEE802.11a/b/g/n および Bluetooth V5.2 基準に準拠した設備で、データ等を送受信をする装置として使用されます。また、2.4GHz と 5GHz(W52、W53、W56)で使用する設備です。W52 は親局、

子局として動作します。(モジュールの機能は W58 も含みますが、日本用の仕様ではソフト等で W58 を使用できないように制限する必要があります)

日本電波法認証申請を行い登録されているアンテナ

アンテナ 1

アンテナ名	LBEE5CJ1XK-Antenna
アンテナメーカー	muRata
種別	Monopole antenna
アンテナゲイン (申請値)	+3.6dBi@2400MHz +4.6dBi@5500MHz
周波数	2400-2484MHz 5150-5850MHz

アンテナ 2

アンテナ名	146153
アンテナメーカー	Molex
種別	Dipole antenna
アンテナゲイン (申請値)	+3.2dBi@2.4GHz +4.25dBi@5GHz
周波数	2400-2500MHz 5150-5850MHz

アンテナ 3

アンテナ名	146187
アンテナメーカー	Molex
種別	Dipole antenna
アンテナゲイン (申請値)	+3.4dBi@2.4GHz +4.75dBi@5GHz
周波数	2400-2500MHz 5150-5850MHz

アンテナ 4

アンテナ名	206994
アンテナメーカー	Molex
種別	Monopole antenna
アンテナゲイン (申請値)	+3.6dBi@2.4GHz +3.6dBi@5GHz
周波数	2400-2500MHz 5150-5850MHz

表記要件について

下記①または②の内容を、当モジュールを組み込む製品に記載を推奨します。

製品上への表示 (①または②) に支障がある場合は当モジュールを組み込む製品のユーザーマニュアルや包装 (梱包) パッケージへの表示または電子表示を推奨いたします。

電子表示の場合は、『電子表示していること』+『その表示までの操作方法』を製品のマニュアルに記載いただく必要がございます。

- 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せん。】

もしくは

- ② 技適マーク+R マーク+モジュールの電波法の認証番号を製品上への表示と下記文言の表示

【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。】

Power Level 2.4GHz WLAN
Per Antenna port

mode	Rate	Channel	MAXIMUM TUNE UP TOLERANCE [dBm]
IEEE 802.11b	All Rates	1~13	16.0±2.0
IEEE 802.11g	6Mbps, 9Mbps, 12Mbps, 18Mbps	1~13	17.0±2.0
	24Mbps, 36Mbps, 48Mbps, 54Mbps	1~13	16.0±2.0
IEEE 802.11n(HT20)	MCS0, MCS1, MCS2	1~13	16.0±2.0
	MCS3, MCS4, MCS5, MCS6, MCS7	1~13	15.0±2.0

Power Level 2.4GHz BT/BLE
Per Antenna port

mode	MAXIMUM TUNE UP TOLERANCE [dBm]	
	Shared BT Antenna (PIN No.45)	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 2Mbps	3.0±3.0	3.3±3.0
LE (Long Range) 125kbps	3.0±3.0	3.3±3.0
LE (Long Range) 500kbps	3.0±3.0	3.3±3.0

Power Level 5GHz WLAN
Per Antenna port

mode	Rate	Band	Channel	MAXIMUM TUNE UP TOLERANCE [dBm]
IEEE 802.11a	All Rates	W52/W53	36~64	14.0±2.0
	All Rates	W56	100~144	15.0±2.0
IEEE 802.11n(HT20)	All Rates	W52/W53	36~64	14.0±2.0
	All Rates	W56	100~144	14.0±2.0
IEEE 802.11n(HT40)	All Rates	W52/W53	38~62	14.0±2.0
	All Rates	W56	102~142	14.0±2.0

Theory of Operation

Frequency of Operation			Scan	Ad-hoc mode
2.4GHz	11b/g/n (HT20)	2412-2462MHz	Active	Yes
W52	11a/n(HT20)	5180-5240MHz	Active	Yes
	11n(HT40)	5190-5230MHz	Active	Yes
W53	11a/n(HT20)	5260-5320MHz	Passive	No
	11n(HT40)	5270-5310MHz	Passive	No
W56	11a/n(HT20)	5500-5720MHz	Passive	No
	11n(HT40)	5510-5710MHz	Passive	No

*DFS MASTER function not available.

*DFS client function available.

*There is a TPC function.

Frequency of Operation			Scan	Ad-hoc node
BT	BR	2402~2480MHz	N/A	N/A
	EDR	2402~2480MHz	N/A	N/A
LE	LE	2402~2480MHz	N/A	N/A
	LE 2Mbps	2402~2480MHz	N/A	N/A
	LE (Long Range) 125kbps	2402~2480MHz	N/A	N/A
	LE (Long Range) 500kbps	2402~2480MHz	N/A	N/A

総務省への届出について

当モジュールは当初 LBEE5CJ1XK で電波法の認可を得ておりましたが、総務省へ以下の届出を行い型式又は名称（端末機器の名称）が「LBEE5CJ1XK」から「LBEE5CJ1XK 又は LBEE5CJ2XK」になっております。

総務省への届出内容

変更した事項 型式又は名称の変更

変更前： LBEE5CJ1XK

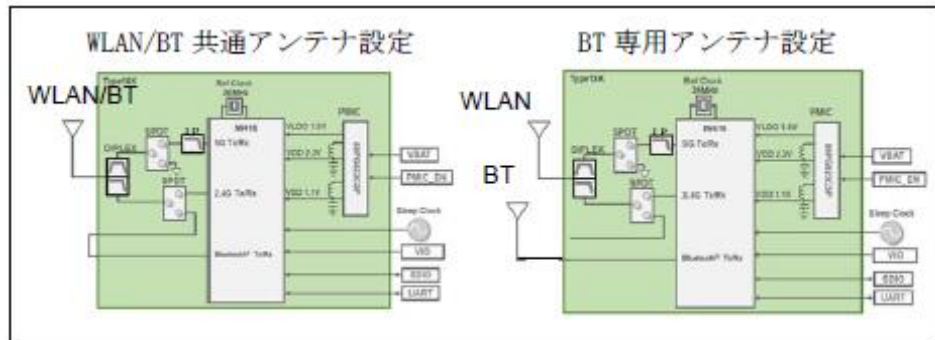
変更後： LBEE5CJ1XK 又は LBEE5CJ2XK

変更した年月日 2021年8月19日

変更理由 すでに型式又は名称を LBEE5CJ1XK、認証番号 001-P01624として認証を得ております。これは下記、『WLAN/BT 共通アンテナ設定の構成』も『BT専用アンテナ設定の構成』も両方可可能な認証です。しかし管理が複雑になるため、型式名称以外は同一設計のモジュールをLBEE5CJ2XKとして新規に設け、それぞれにデフォルトのアンテナ設定の構成を定めることにしたく品名追加変更を行いました。

LBEE5CJ1XK: デフォルトがWLAN/BT共通アンテナ設定で使用

LBEE5CJ2XK: デフォルトがWLAN/BT各専用アンテナ設定で使用



<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).

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 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.

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

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.

Antenna List

Part number	Vendor	Peak Gain[dBi]		Type	Connector
		2.4GHz	5GHz		
146153	Molex	3.2	4.25	Dipole	U.FL
146187	Molex	3.4	4.75	Dipole	U.FL
LBEE5CJ1XK-Antenna	Murata	3.6	4.6	Monopole	---

- The following information must be indicated on 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 device 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

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

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.

When installing it in a mobile equipment.

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.

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.

Note)

Portable equipment : Equipment for which the spaces between human body and antenna are used within 20cm.

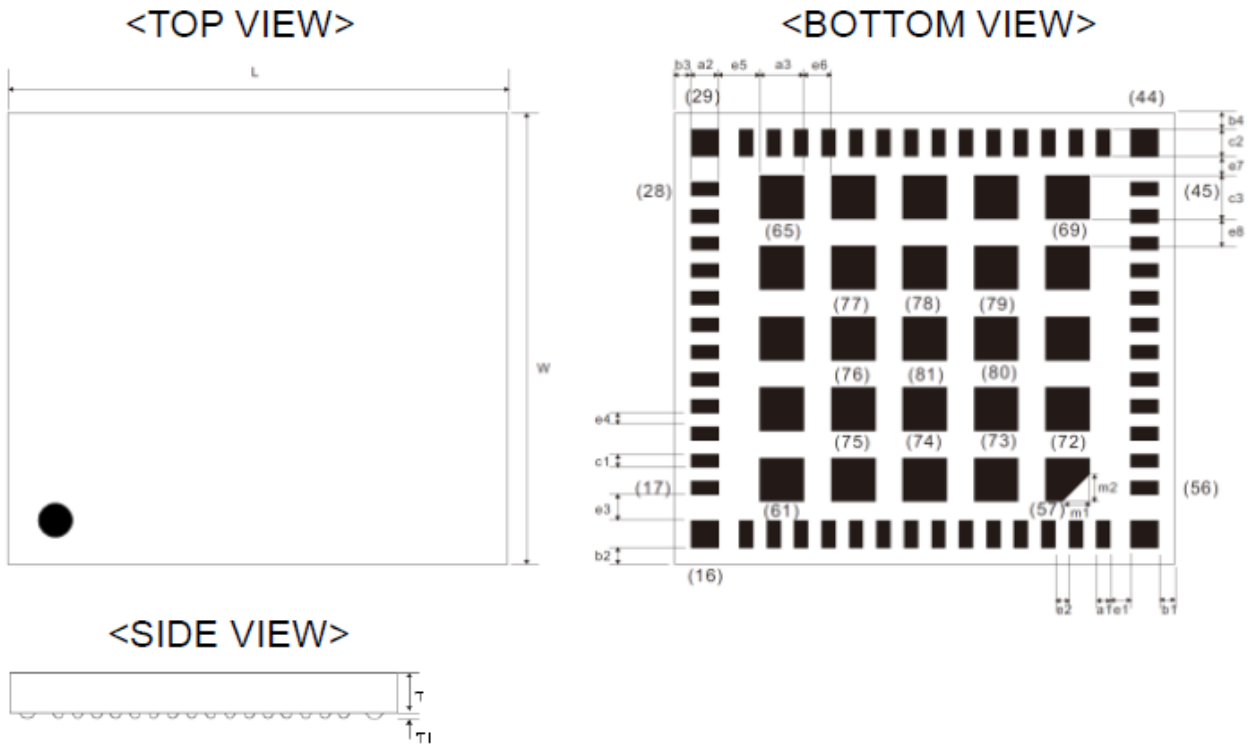
Mobile equipment : Equipment used at position in which the spaces between human body and antenna exceeded 20cm.

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 discontinues transmission in case of either absence of information to transmit or operational failure.

Frequency Tolerance: ± 20 ppm

Dimension



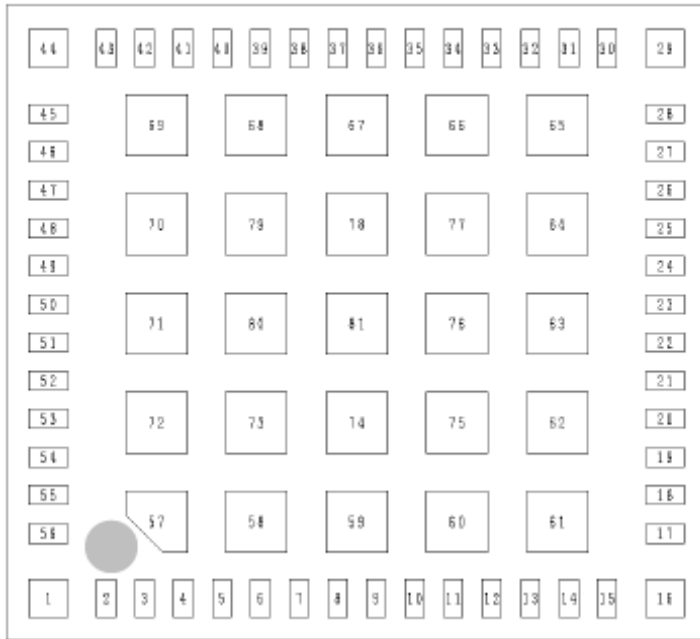
Unit: mm

Mark	Dimensions	Mark	Dimensions	Mark	Dimensions	Mark	Dimensions
L	9.1±0.2	W	8.3±0.2	T	1.3 max	a1	0.25±0.1
a2	0.5±0.1	a3	0.8±0.2	b1	0.3±0.2	b2	0.3±0.2
b3	0.3±0.2	b4	0.3±0.2	c1	0.25±0.1	c2	0.5±0.1
c3	0.8±0.1	e1	0.38±0.1	e2	0.25±0.1	e3	0.48±0.1
e4	0.25±0.1	e5	0.75±0.1	e6	0.5±0.1	e7	0.35±0.1
e8	0.5±0.1	m1	0.5±0.2	m2	0.5±0.2	T1	0.045 typ.

- T dimension does not include height of solder bumps.

Pin Layout

<TOP VIEW>



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

Supply Voltage

PIN_Name	Min.	Typ.	Max.	unit
VBAT	2.7	3.3	5.5	V
VIO	1.62	1.8 or 3.3	3.47	V

*VIO does not affect RF characteristics.

Temperature

	Min.	Typ.	Max.	Unit
Operational Temperature	-40	25	85	deg.C

Power Level 2.4GHz WLAN

Per Antenna port

mode	Rate	Channel	MAXIMUM TUNE UP TOLERANCE [dBm]
IEEE 802.11b	All Rates	1~11	17.0±2.0
IEEE 802.11g	All Rates	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 Rates	1~3, 9~11	13.0±2.0
	MCS0, MCS1, MCS2	4~8	16.0±2.0
	MCS3, MCS4, MCS5, MCS6, MCS7	4~8	15.0±2.0

Power Level 2.4GHz BT/BLE

Per Antenna port

mode	MAXIMUM TUNE UP TOLERANCE [dBm]	
	Shared BT Antenna (PIN No.45)	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 2Mbps	3.0±3.0	3.3±3.0
LE (Long Range) 125kbps	3.0±3.0	3.3±3.0
LE (Long Range) 500kbps	3.0±3.0	3.3±3.0

Power Level 5GHz WLAN
Per Antenna port

mode	Rate	Band	Channel	MAXIMUM TUNE UP TOLERANCE [dBm]
IEEE 802.11a	All Rates	W52/W53	36, 64	14.0±2.0
	All Rates	W52/W53	40~60	16.0±2.0
	All Rates	W56	100, 144	14.0±2.0
	All Rates	W56	104~140	15.0±2.0
	All Rates	W58	149~165	15.0±2.0
IEEE 802.11n(HT20)	All Rates	W52/W53	36, 64	13.0±2.0
	All Rates	W52/W53	40~60	15.0±2.0
	All Rates	W56	100, 144	13.0±2.0
	All Rates	W56	104~140	14.0±2.0
	All Rates	W58	149~165	14.0±2.0
IEEE 802.11n(HT40)	All Rates	W52/W53	38, 62	12.0±2.0
	All Rates	W52/W53	46~54	14.0±2.0
	All Rates	W56	102, 142	12.0±2.0
	All Rates	W56	110~134	14.0±2.0
	All Rates	W58	151, 159	14.0±2.0

Theory of Operation

Frequency of Operation		Scan	Ad-hoc mode	
2.4GHz	11b/g/n (HT20)	2412-2462MHz	Active	Yes
W52	11a/n(HT20)	5180-5240MHz	Active	Yes
	11n(HT40)	5190-5230MHz	Active	Yes
W53	11a/n(HT20)	5260-5320MHz	Passive	No
	11n(HT40)	5270-5310MHz	Passive	No
W56	11a/n(HT20)	5500-5720MHz	Passive	No
	11n(HT40)	5510-5710MHz	Passive	No
W58	11a/n(HT20)	5745-5825MHz	Active	Yes
	11n(HT40)	5755-5795MHz	Active	Yes

*DFS MASTER function not available.

*DFS client function available.

*There is a TPC function.

Frequency of Operation		Scan	Ad-hoc node	
BT	BR	2402~2480MHz	N/A	N/A
	EDR	2402~2480MHz	N/A	N/A
LE	LE	2402~2480MHz	N/A	N/A
	LE 2Mbps	2402~2480MHz	N/A	N/A
	LE (Long Range) 125kbps	2402~2480MHz	N/A	N/A
	LE (Long Range) 500kbps	2402~2480MHz	N/A	N/A

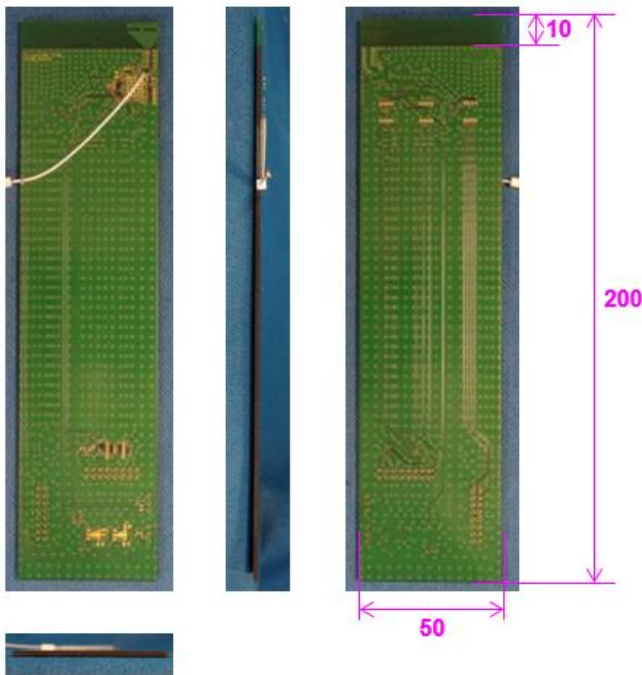
Antenna list

No.	Item	Application contents
1	P/N	146153
	Maker	Molex
	Antenna Type	Dipole
	Antenna Gain	3.2dBi@2.4GHz / 4.25dBi@5GHz
	Frequency	2400-2500MHz / 5250-5850MHz
	Connector	U.FL
2	P/N	146187
	Maker	Molex
	Antenna Type	Dipole
	Antenna Gain	3.4dBi@2.4GHz / 4.75dBi@5GHz
	Frequency	2400-2500MHz / 5250-5850MHz
	Connector	U.FL
3	P/N	LBEE5CJ1XK-Antenna
	Maker	Murata
	Antenna Type	Monopole
	Antenna Gain	3.6dBi@2.4GHz / 4.6dBi@5GHz
	Frequency	2400-2484MHz / 5250-5850MHz
	Connector	N/A

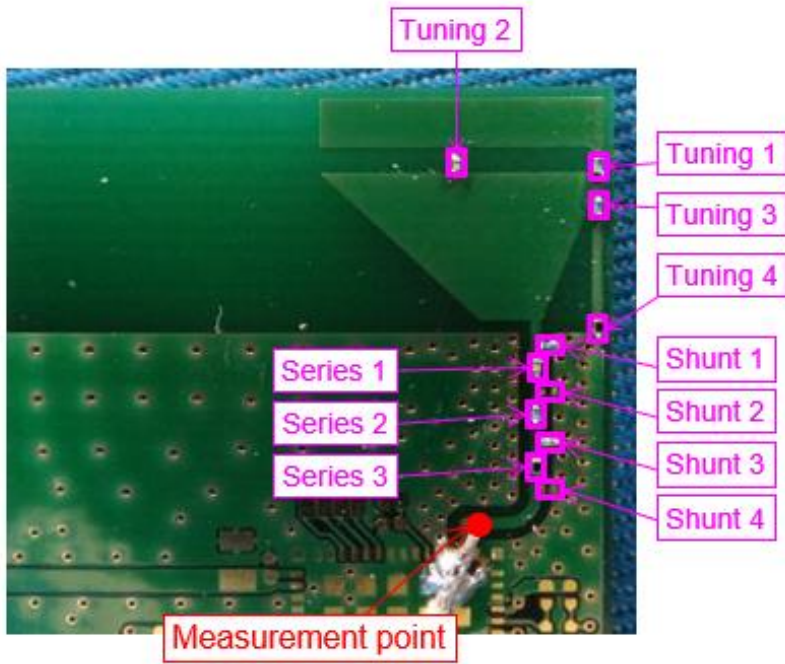
For “146153” and “146187”, please refer to the information such as the antenna data sheet of Molex.

For “LBEE5CJ1XK-Antenna”

Antenna DUT during certification test



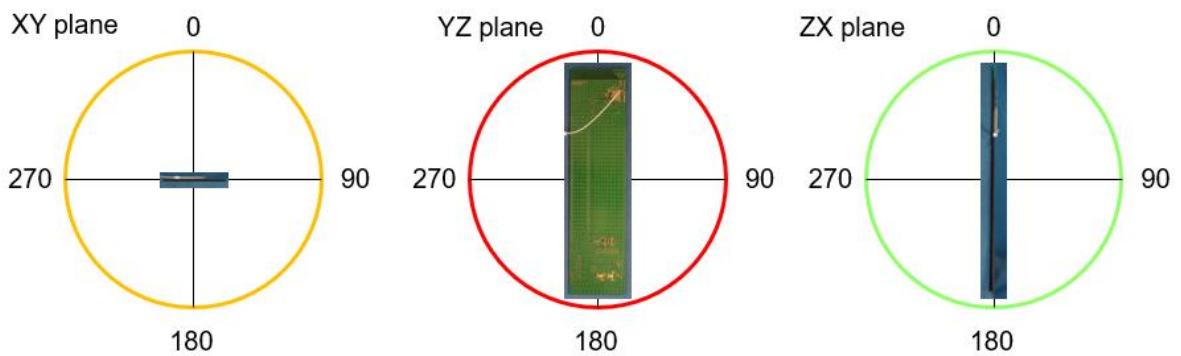
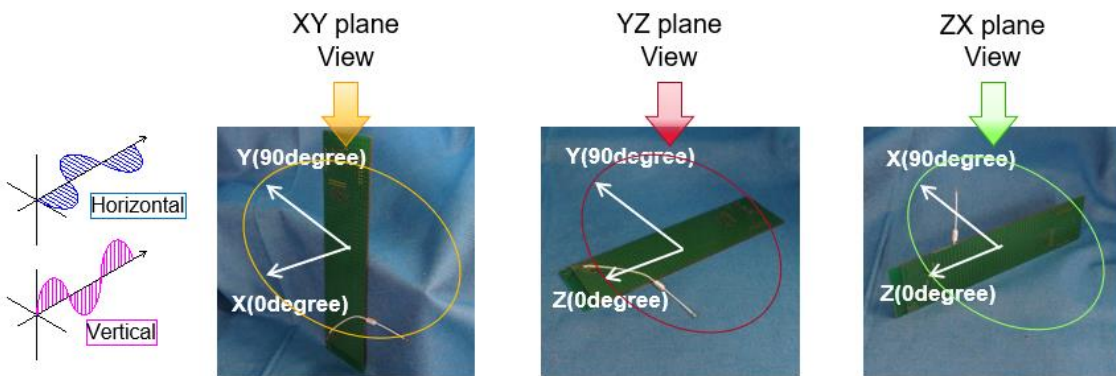
unit: mm



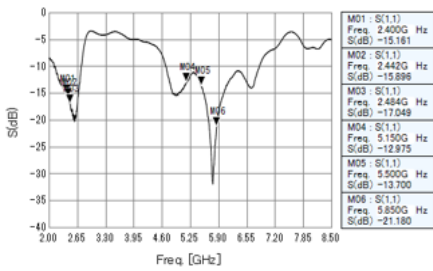
Tuning1	Tuning2	Tuning3	Tuning4	1Matching circuit							
				Shunt1	Series1	Shunt2	Series2	Shunt3	Series3	Sunt4	
2.0nH	0.1pF	4.0nH	0ohm	10nH	0.8pF	None	1.5nH	0.2pF	0ohm	None	

Size: 0603 LQP03 / GRM03 / Resister

Direction



<Return Loss>

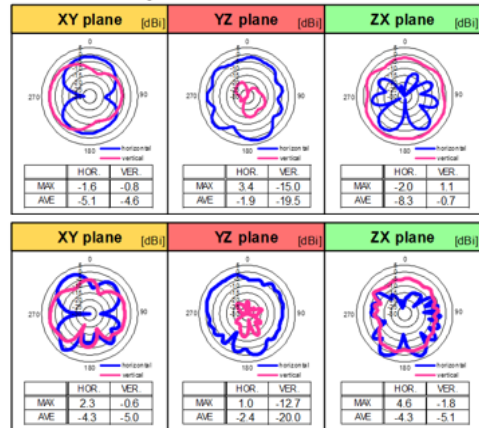


<Efficiency>

LINEAR POLARIZATION		XY-plane [dBi]		YZ-plane [dBi]		ZX-plane [dBi]		Total Efficiency [dB]
		hor.	ver.	hor.	ver.	hor.	ver.	
		2400 MHz	MAX.	-1.6	-0.9	2.6	-16.3	
	AVE.	-4.9	-4.6	-2.0	-20.4	-8.3	-0.9	
2442 MHz	MAX.	-1.6	-0.8	2.4	-15.0	-2.0	1.1	-1.0
	AVE.	-5.1	-4.6	-1.9	-19.5	-8.3	-0.7	
2484 MHz	MAX.	-1.7	-0.7	2.5	-13.6	-1.7	1.6	-0.9
	AVE.	-5.2	-4.5	-1.6	-18.7	-8.2	-0.5	

LINEAR POLARIZATION		XY-plane [dBi]		YZ-plane [dBi]		ZX-plane [dBi]		Total Efficiency [dB]
		hor.	ver.	hor.	ver.	hor.	ver.	
		5150 MHz	MAX.	2.3	0.1	2.2	-11.4	
	AVE.	-4.1	-4.5	-2.0	-19.2	-3.9	-3.9	
5500 MHz	MAX.	2.3	-0.6	1.0	-12.7	3.6	-1.8	-1.6
	AVE.	-4.3	-5.0	-2.4	-20.0	-4.3	-5.1	
5850 MHz	MAX.	2.3	-0.7	1.0	-12.9	3.5	-1.6	-1.5
	AVE.	-4.1	-5.4	-2.4	-19.8	-4.2	-5.5	

<Directivity>



<Measurement result>

Total efficiency	Frequency [MHz]						Average			
	2400	2442	2484	5150	5500	5850	2GHz band	5GHz band	2GHz band	5GHz band
Condition 1	-1.0	-1.0	-0.9	-1.3	-1.6	-1.5	-1.0	-1.5	80.1	71.5

Peak gain	Frequency [MHz]						Max.	
	2400	2442	2484	5150	5500	5850	2GHz band	5GHz band
Condition 1	3.6	3.4	3.5	4.5	4.6	4.5	3.6	4.6

Antenna

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 50-ohm line design.

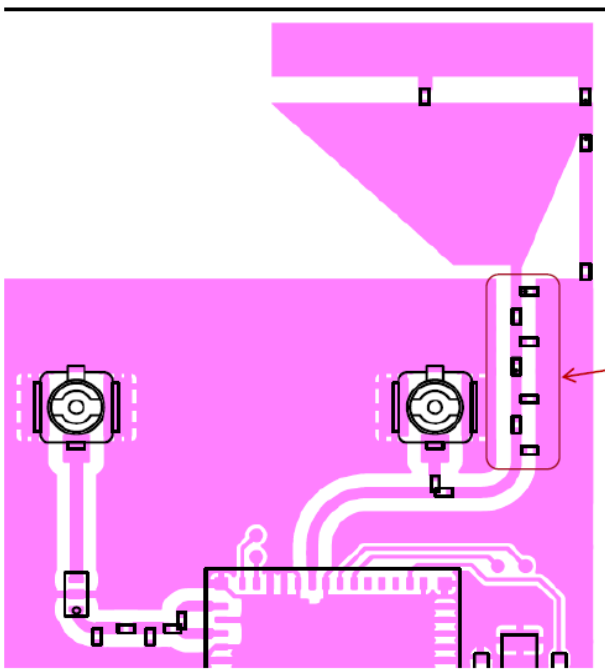
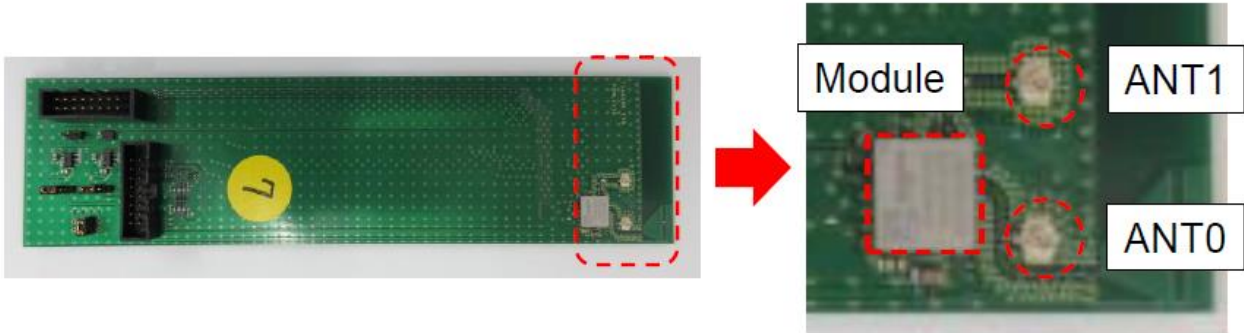
Fine tuning of return loss etc. can be performed using a matching network.

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.

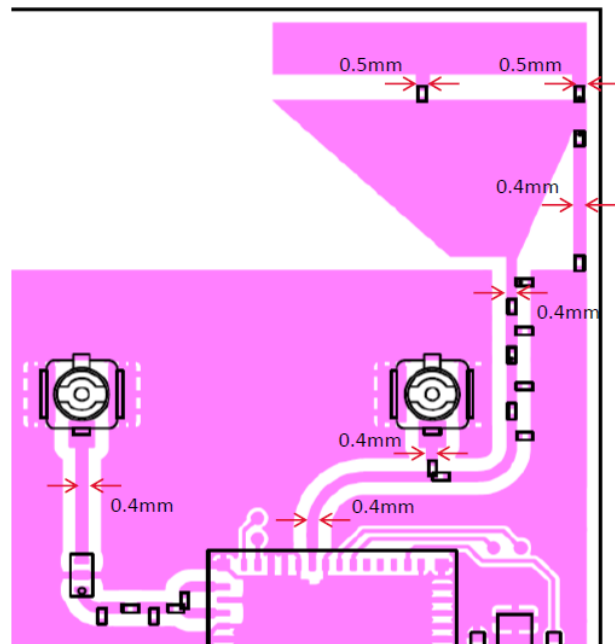
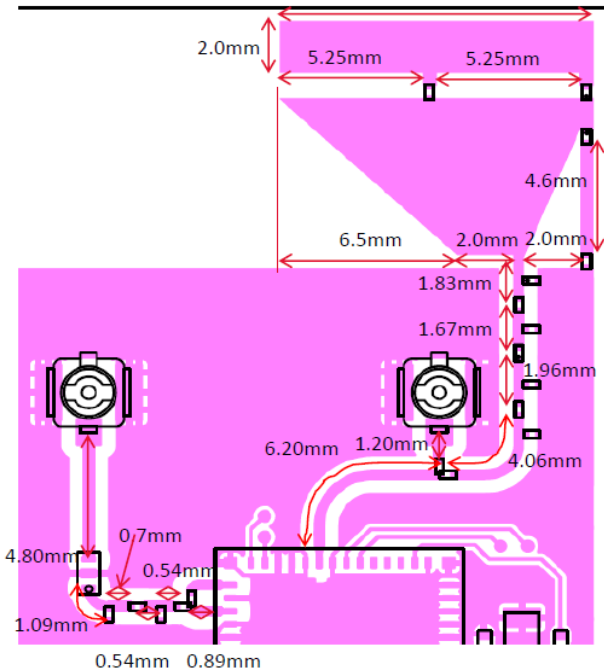
- 1) It is the same type as the antenna type of antenna specifications.
- 2) An antenna gain is lower than a gain given in antenna specifications.
- 3) The emission level is not getting worse.

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 following is the design of EVB used for the certification test



Fine turning of return loss etc,
Can be performed using a matching network.

11.5mm



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

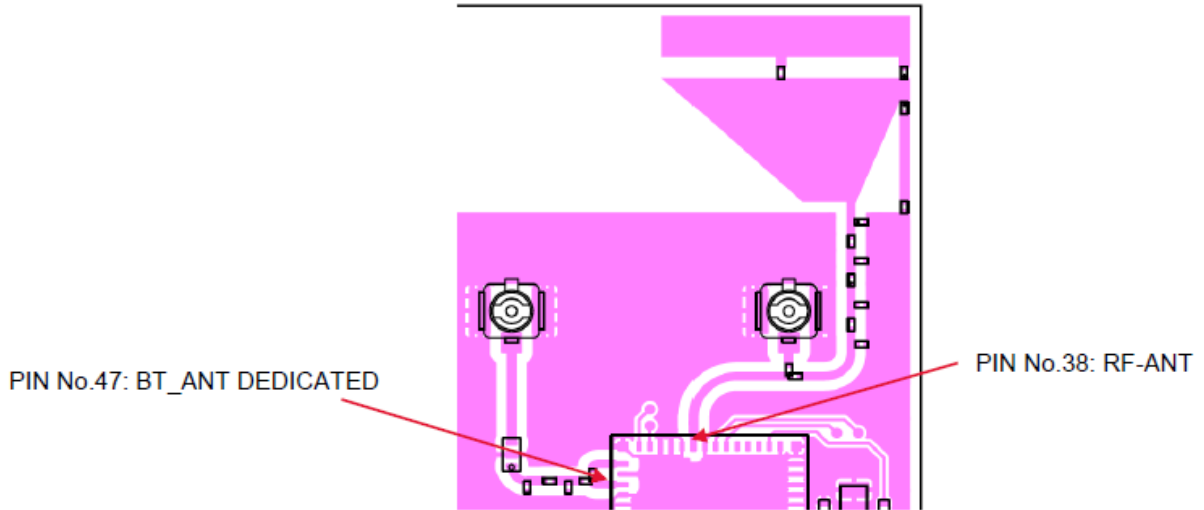


diagram a

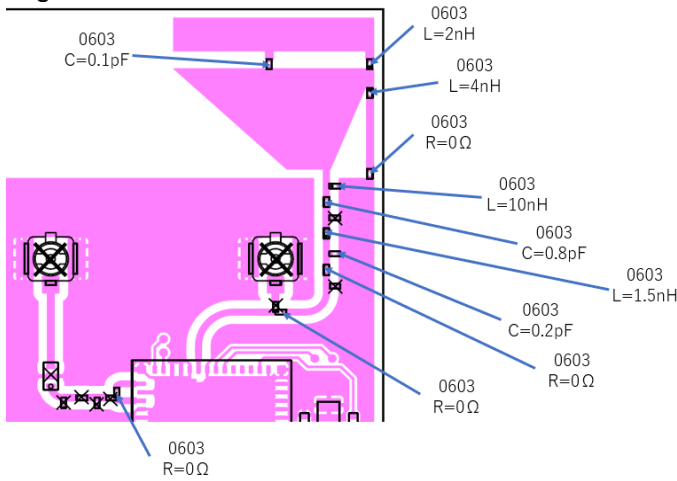


diagram b

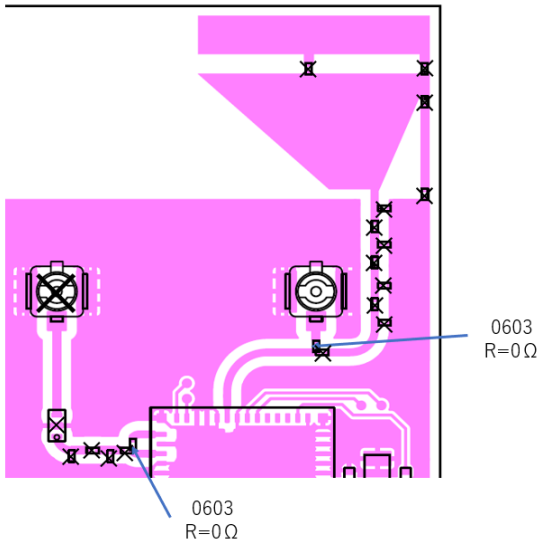


diagram c

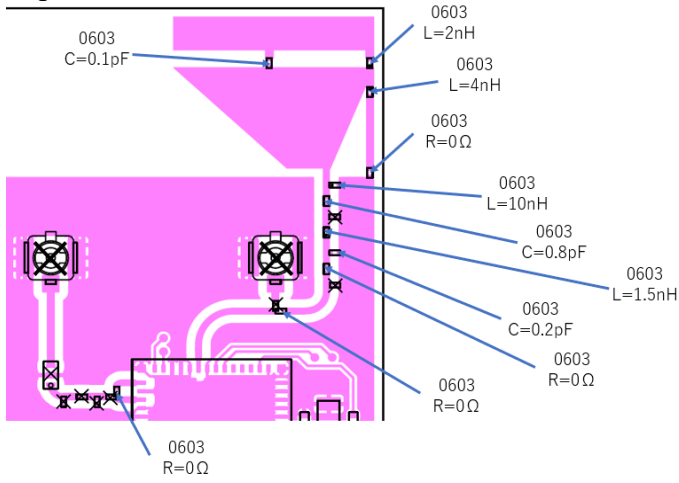
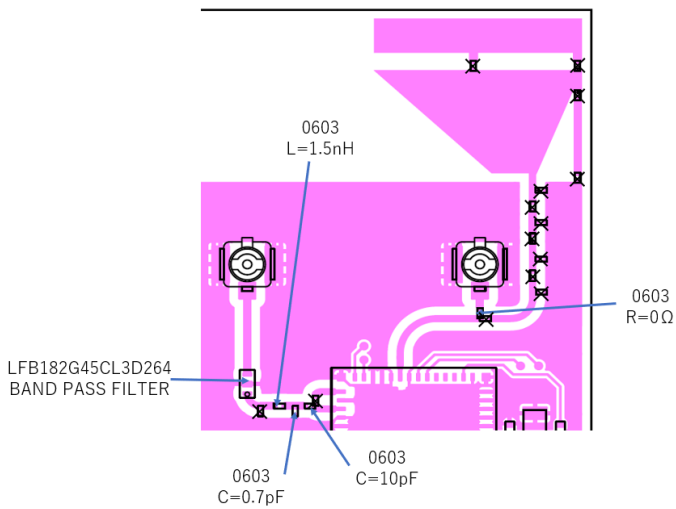


diagram d



About LBEE5CJ1XK and LBEE5CJ2XK:

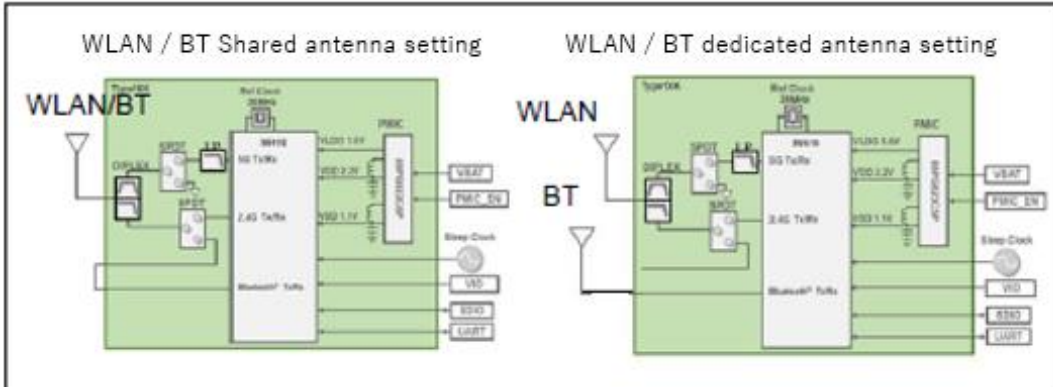
This FCC modular approval with FCC ID: VPYLB1XK has been granted with LBEE5CJ1XK as the original certification model.

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 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



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.

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 then 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 discontinues transmission in case of either absence of information to transmit or operational failure.

Frequency Tolerance: ± 20 ppm

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.

Note)

Portable equipment : Equipment for which the spaces between human body and antenna are used within 20cm.

Mobile equipment : Equipment used at position in which the spaces between human body and antenna exceeded 20cm.

<ISED>

Product Description : Communication Module
HVIN : LBEE5CJ1XK and LBEE5CJ2XK
PMN : LBEE5CJ1XK
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.

This device complies with Industry Canada's applicable licence-exempt RSSs. Operation is subject to the following two conditions:
(1) This device may not cause interference; and
(2) This device must accept any interference, including interference that may cause undesired operation of the device.

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

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: 3.4 dBi@2.4GHz/4.75 dBi@5GHz
: Monopole Antenna Gain: 3.6 dBi@2.4GHz/4.6 dBi@5GHz

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: 3.4 dBi@2.4GHz/4.75 dBi@5GHz
: Monopole Antenna Gain: 3.6 dBi@2.4GHz/4.6 dBi@5GHz

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

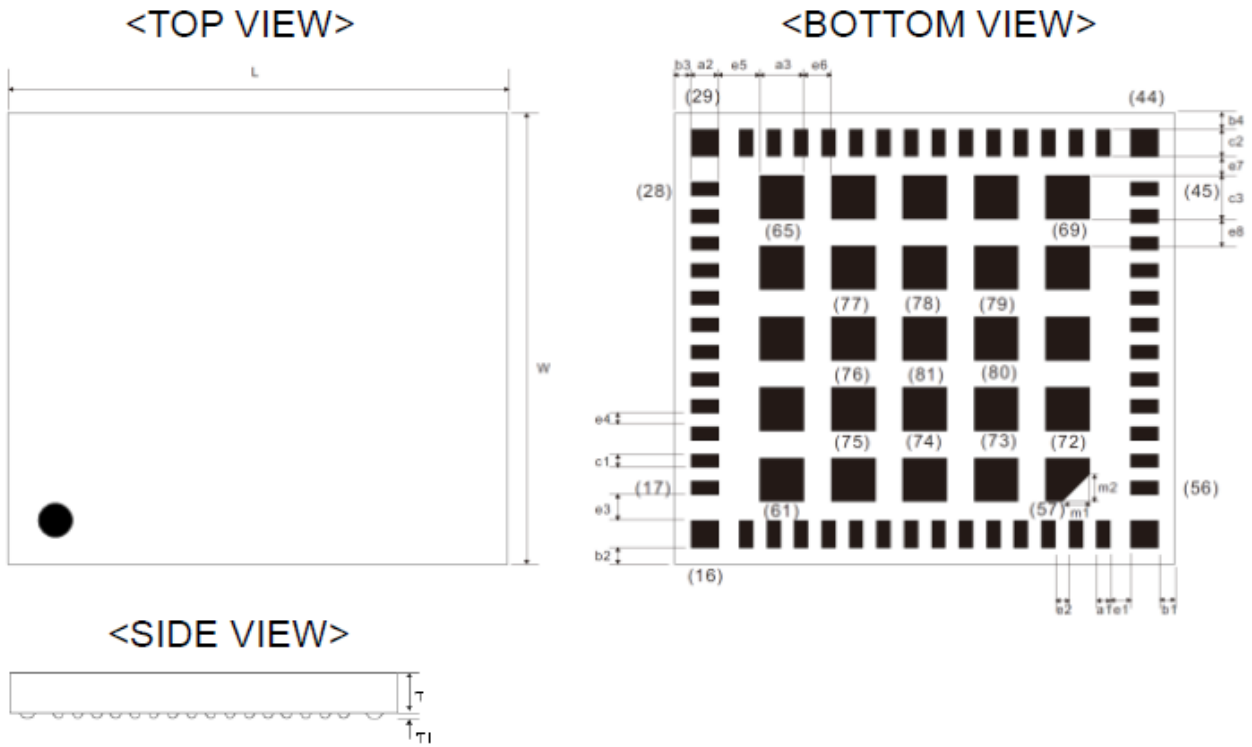
Data transmission is always initiated by software, which is then passed down through the MAC, through the digital and analog baseband, and finally to the RF chip. Several special packets are initiated by the MAC. These are the only ways the digital baseband portion will turn on the RF transmitter, which 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 discontinues transmission in case of either absence of information to transmit or operational failure.

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.

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.

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.

Dimension



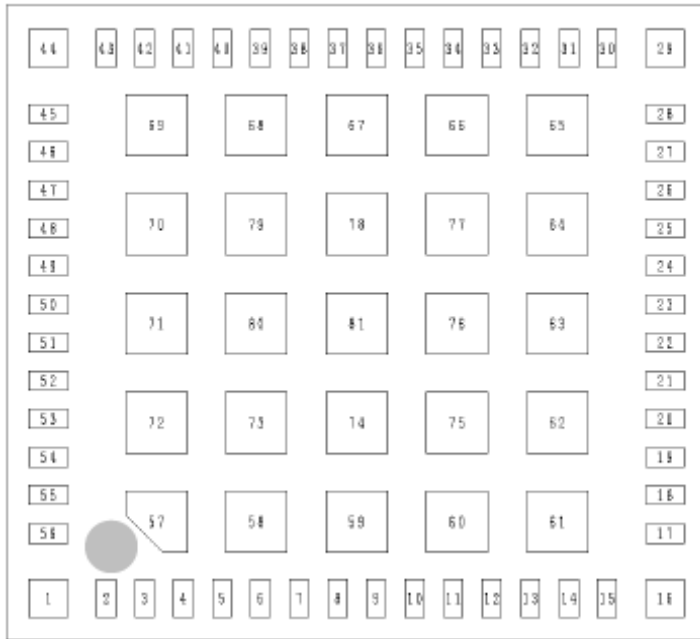
Unit: mm

Mark	Dimensions	Mark	Dimensions	Mark	Dimensions	Mark	Dimensions
L	9.1±0.2	W	8.3±0.2	T	1.3 max	a1	0.25±0.1
a2	0.5±0.1	a3	0.8±0.2	b1	0.3±0.2	b2	0.3±0.2
b3	0.3±0.2	b4	0.3±0.2	c1	0.25±0.1	c2	0.5±0.1
c3	0.8±0.1	e1	0.38±0.1	e2	0.25±0.1	e3	0.48±0.1
e4	0.25±0.1	e5	0.75±0.1	e6	0.5±0.1	e7	0.35±0.1
e8	0.5±0.1	m1	0.5±0.2	m2	0.5±0.2	T1	0.045 typ.

- T dimension does not include height of solder bumps.

Pin Layout

<TOP VIEW>



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

Supply Voltage

PIN_Name	Min.	Typ.	Max.	unit
VBAT	2.7	3.3	5.5	V
VIO	1.62	1.8 or 3.3	3.47	V

*VIO does not affect RF characteristics.

Temperature

	Min.	Typ.	Max.	Unit
Operational Temperature	-40	25	85	deg.C

Power Level 2.4GHz WLAN

Per Antenna port

mode	Rate	Channel	MAXIMUM TUNE UP TOLERANCE [dBm]
IEEE 802.11b	All Rates	1~11	17.0±2.0
IEEE 802.11g	All Rates	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 Rates	1~3, 9~11	13.0±2.0
	MCS0, MCS1, MCS2	4~8	16.0±2.0
	MCS3, MCS4, MCS5, MCS6, MCS7	4~8	15.0±2.0

Power Level 2.4GHz BT/BLE

Per Antenna port

mode	MAXIMUM TUNE UP TOLERANCE [dBm]	
	Shared BT Antenna (PIN No.45)	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 2Mbps	3.0±3.0	3.3±3.0
LE (Long Range) 125kbps	3.0±3.0	3.3±3.0
LE (Long Range) 500kbps	3.0±3.0	3.3±3.0

Power Level 5GHz WLAN
Per Antenna port

mode	Rate	Band	Channel	MAXIMUM TUNE UP TOLERANCE [dBm]
IEEE 802.11a	All Rates	W52/W53	36~48	14.0±2.0
	All Rates	W52/W53	52~60	16.0±2.0
	All Rates	W53	64	14.0±2.0
	All Rates	W56	100, 144	14.0±2.0
	All Rates	W56	104~116, 132~140	15.0±2.0
	All Rates	W58	149~165	15.0±2.0
IEEE 802.11n(HT20)	All Rates	W52/W53	36, 64	13.0±2.0
	All Rates	W52	40~48	14.0±2.0
	All Rates	W53	52~60	15.0±2.0
	All Rates	W56	100, 144	13.0±2.0
	All Rates	W56	104~116, 132~140	14.0±2.0
	All Rates	W58	149~165	14.0±2.0
IEEE 802.11n(HT40)	All Rates	W52/W53	38, 62	12.0±2.0
	All Rates	W52/W53	46, 54	14.0±2.0
	All Rates	W56	102, 142	12.0±2.0
	All Rates	W56	110, 134	14.0±2.0
	All Rates	W58	151, 159	14.0±2.0

Theory of Operation

Frequency of Operation			Scan	Ad-hoc mode
2.4GHz	11b/g/n (HT20)	2412-2462MHz	Active	Yes
W52	11a/n(HT20)	5180-5240MHz	Active	Yes
	11n(HT40)	5190-5230MHz	Active	Yes
W53	11a/n(HT20)	5260-5320MHz	Passive	No
	11n(HT40)	5270-5310MHz	Passive	No
W56	11a/n(HT20)	5500-5720MHz	Passive	No
	11n(HT40)	5510-5710MHz	Passive	No
W58	11a/n(HT20)	5745-5825MHz	Active	Yes
	11n(HT40)	5755-5795MHz	Active	Yes

* The frequency band 5600MHz-5640MHz (11a/n 20M band), 5590MHz-5630MHz (11n 40M band) is restricted in ISED.

*DFS MASTER function not available.

*DFS client function available.

*There is a TPC function.

Frequency of Operation			Scan	Ad-hoc node
BT	BR	2402~2480MHz	N/A	N/A
	EDR	2402~2480MHz	N/A	N/A
LE	LE	2402~2480MHz	N/A	N/A
	LE 2Mbps	2402~2480MHz	N/A	N/A
	LE (Long Range) 125kbps	2402~2480MHz	N/A	N/A
	LE (Long Range) 500kbps	2402~2480MHz	N/A	N/A

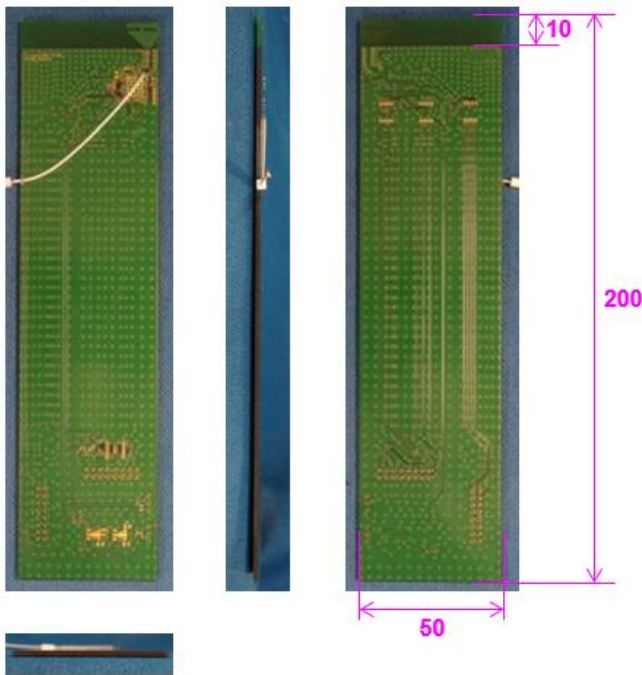
Antenna list

No.	Item	Application contents
1	P/N	146153
	Maker	Molex
	Antenna Type	Dipole
	Antenna Gain	3.2dBi@2.4GHz / 4.25dBi@5GHz
	Frequency	2400-2500MHz / 5250-5850MHz
	Connector	U.FL
2	P/N	146187
	Maker	Molex
	Antenna Type	Dipole
	Antenna Gain	3.4dBi@2.4GHz / 4.75dBi@5GHz
	Frequency	2400-2500MHz / 5250-5850MHz
	Connector	U.FL
3	P/N	LBEE5CJ1XK-Antenna
	Maker	Murata
	Antenna Type	Monopole
	Antenna Gain	3.6dBi@2.4GHz / 4.6dBi@5GHz
	Frequency	2400-2484MHz / 5250-5850MHz
	Connector	N/A

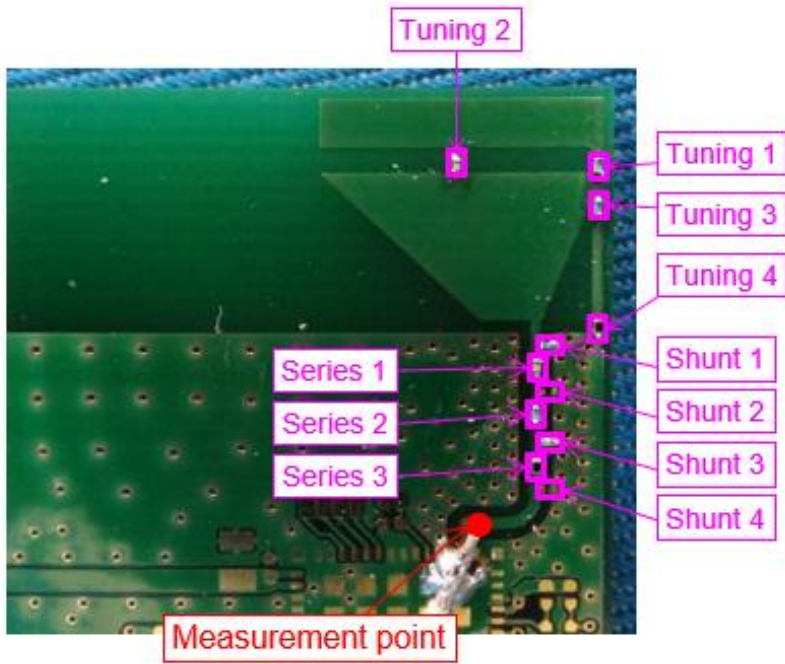
For “146153” and “146187”, please refer to the information such as the antenna data sheet of Molex.

For “LBEE5CJ1XK-Antenna”

Antenna DUT during certification test



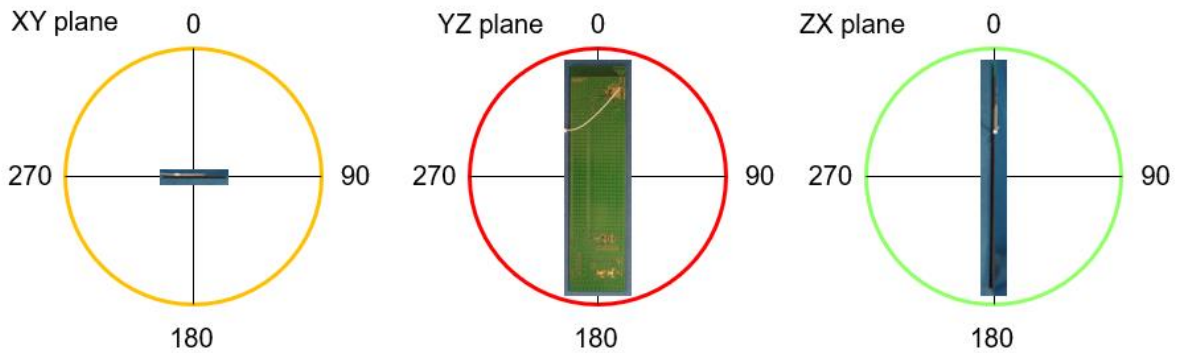
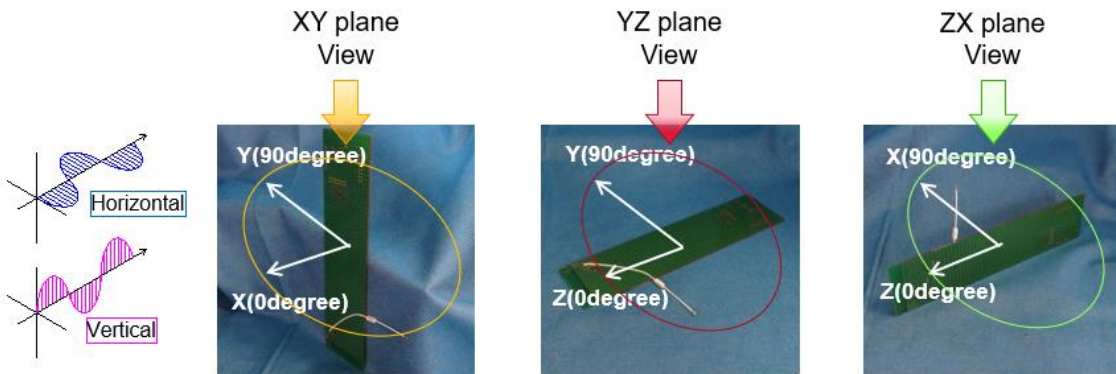
unit: mm



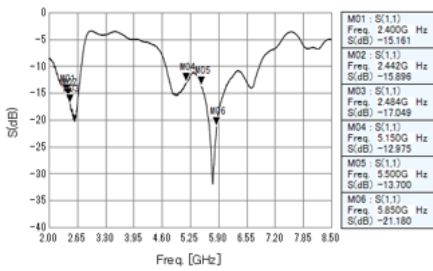
Tuning1	Tuning2	Tuning3	Tuning4	1Matching circuit						
				Shunt1	Series1	Shunt2	Series2	Shunt3	Series3	Sunt4
2.0nH	0.1pF	4.0nH	0ohm	10nH	0.8pF	None	1.5nH	0.2pF	0ohm	None

Size: 0603 LQP03 / GRM03 / Resister

Direction



<Return Loss>

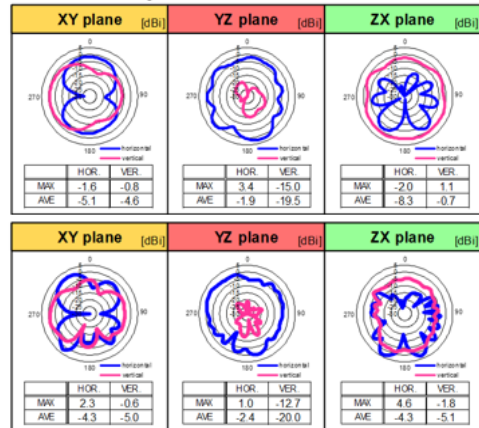


<Efficiency>

LINEAR POLARIZATION		XY-plane [dBi]		YZ-plane [dBi]		ZX-plane [dBi]		Total Efficiency [dB]
		hor.	ver.	hor.	ver.	hor.	ver.	
		2400 MHz	MAX.	-1.6	-0.9	2.6	-16.3	
	AVE.	-4.9	-4.6	-2.0	-20.4	-8.3	-0.9	
2442 MHz	MAX.	-1.6	-0.8	2.4	-15.0	-2.0	1.1	-1.0
	AVE.	-5.1	-4.6	-1.9	-19.5	-8.3	-0.7	
2484 MHz	MAX.	-1.7	-0.7	2.5	-13.6	-1.7	1.6	-0.9
	AVE.	-5.2	-4.5	-1.6	-18.7	-8.2	-0.5	

LINEAR POLARIZATION		XY-plane [dBi]		YZ-plane [dBi]		ZX-plane [dBi]		Total Efficiency [dB]
		hor.	ver.	hor.	ver.	hor.	ver.	
		5150 MHz	MAX.	2.3	0.1	2.2	-11.4	
	AVE.	-4.1	-4.5	-2.0	-19.2	-3.9	-3.9	
5500 MHz	MAX.	2.3	-0.6	1.0	-12.7	3.6	-1.8	-1.6
	AVE.	-4.3	-5.0	-2.4	-20.0	-4.3	-5.1	
5850 MHz	MAX.	2.3	-0.7	1.0	-12.9	3.5	-1.6	-1.5
	AVE.	-4.1	-5.4	-2.4	-19.8	-4.2	-5.5	

<Directivity>



<Measurement result>

Condition	Frequency [MHz]						Average [dB]		Average [%]	
	2400	2442	2484	5150	5500	5850	2GHz band	5GHz band	2GHz band	5GHz band
Condition 1	-1.0	-1.0	-0.9	-1.3	-1.6	-1.5	-1.0	-1.5	80.1	71.5

Condition	Frequency [MHz]						Peak gain [dBi]	
	2400	2442	2484	5150	5500	5850	2GHz band	5GHz band
Condition 1	3.6	3.4	3.5	4.5	4.6	4.5	3.6	4.6

Antenna

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 50-ohm line design.

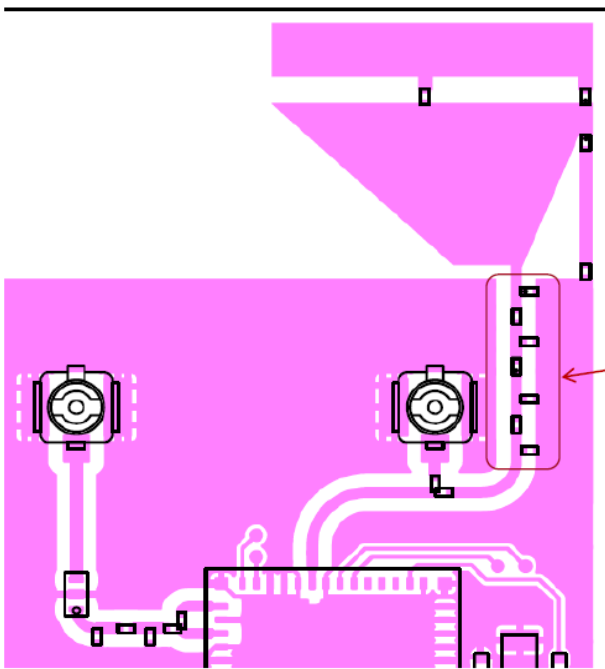
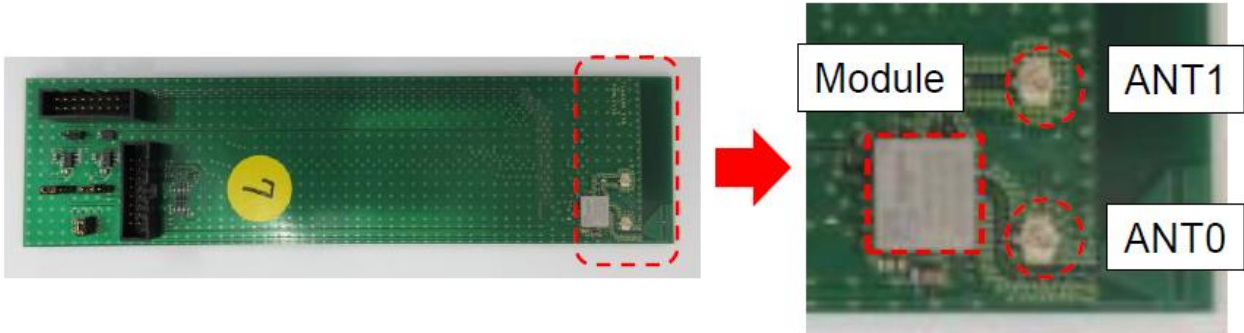
Fine tuning of return loss etc. can be performed using a matching network.

However, it is required to check "Class1 change" and "Class2 change" which the authorities define then.

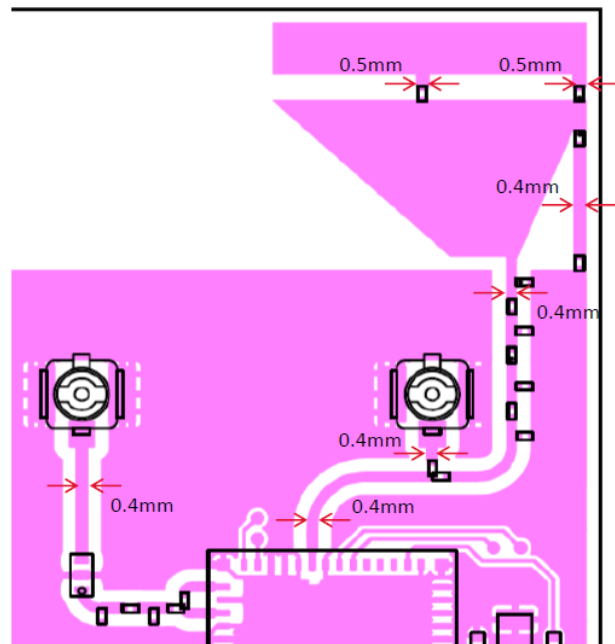
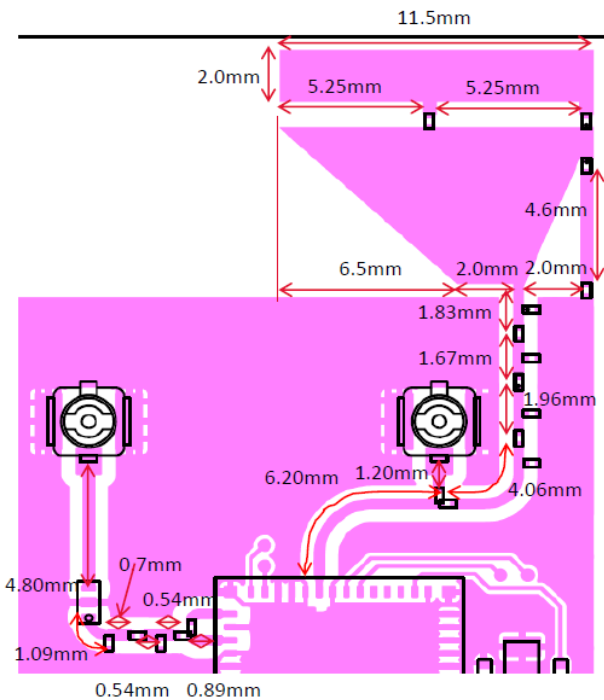
The concrete contents of a check are the following three points.

- 1) It is the same type as the antenna type of antenna specifications.
- 2) An antenna gain is lower than a gain given in antenna specifications.
- 3) 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 following is the design of EVB used for the certification test



Fine turning of return loss etc,
Can be performed using a matching network.



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

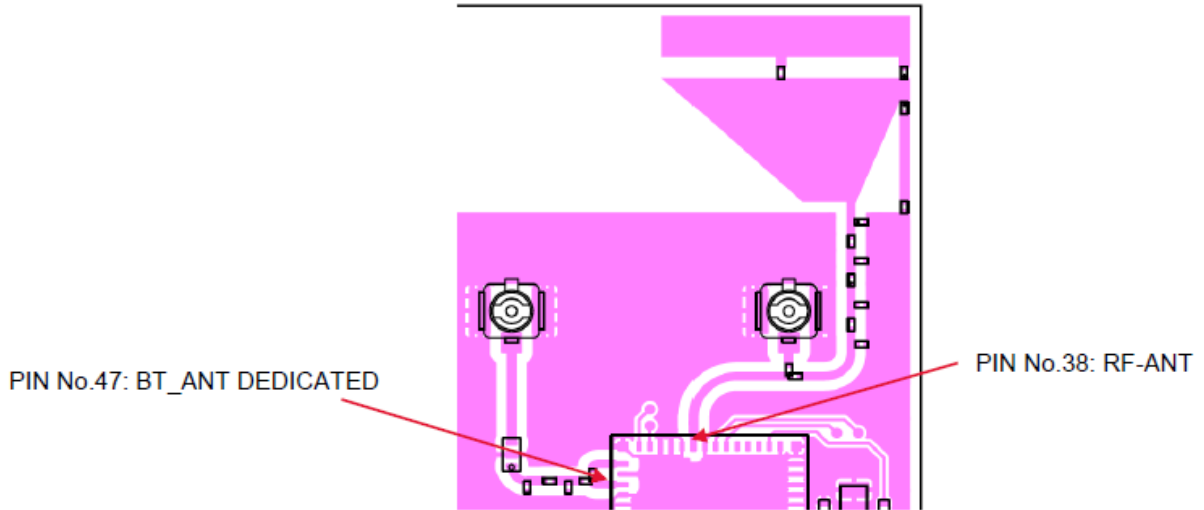


diagram a

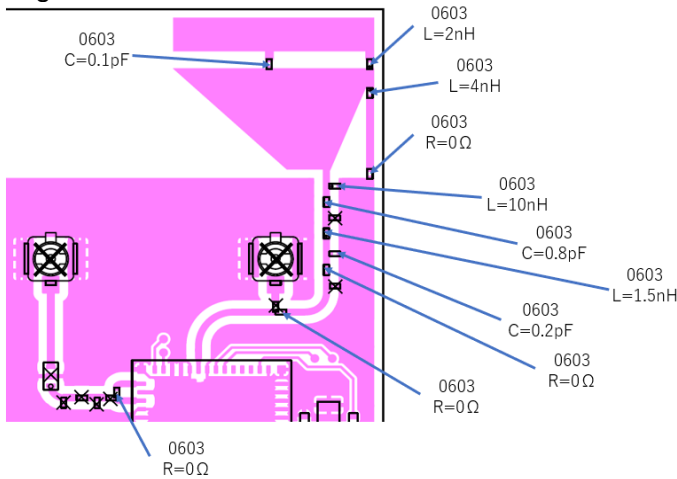


diagram b

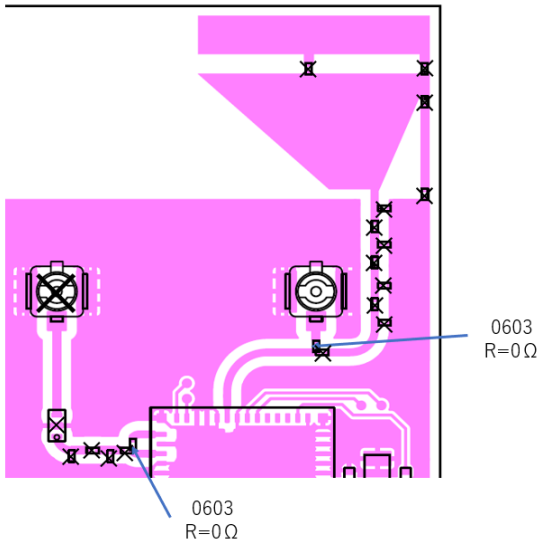


diagram c

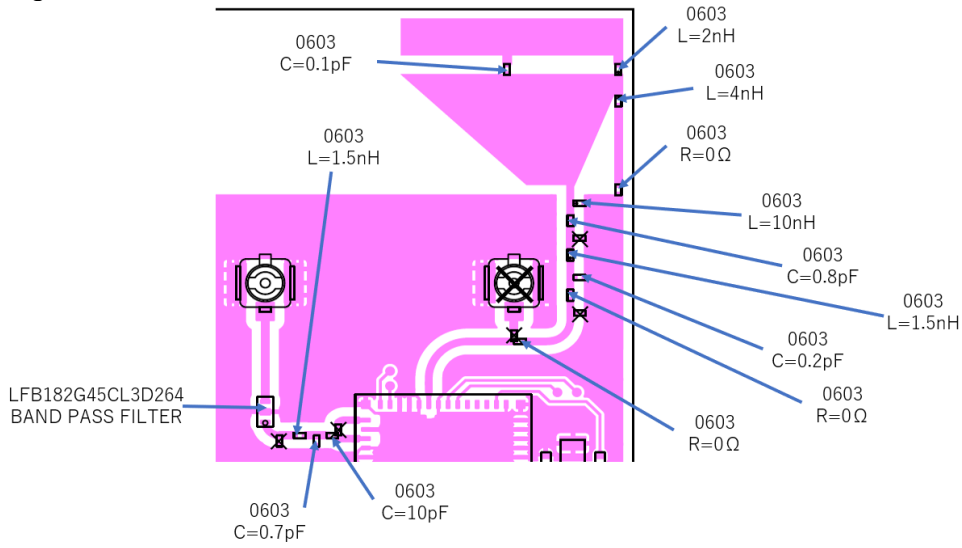
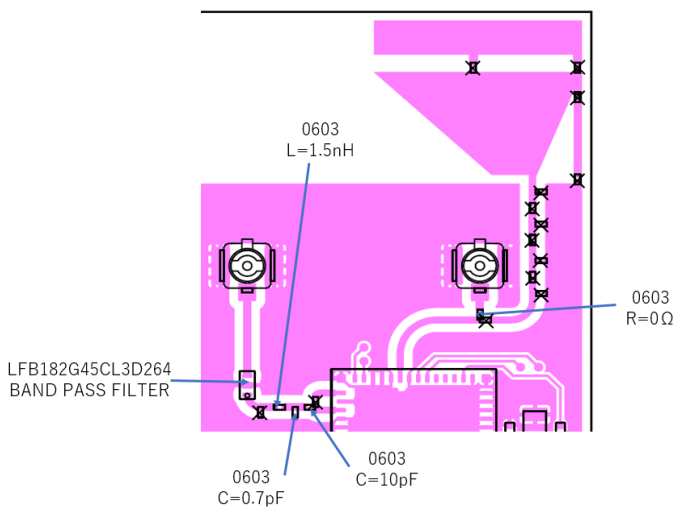


diagram d

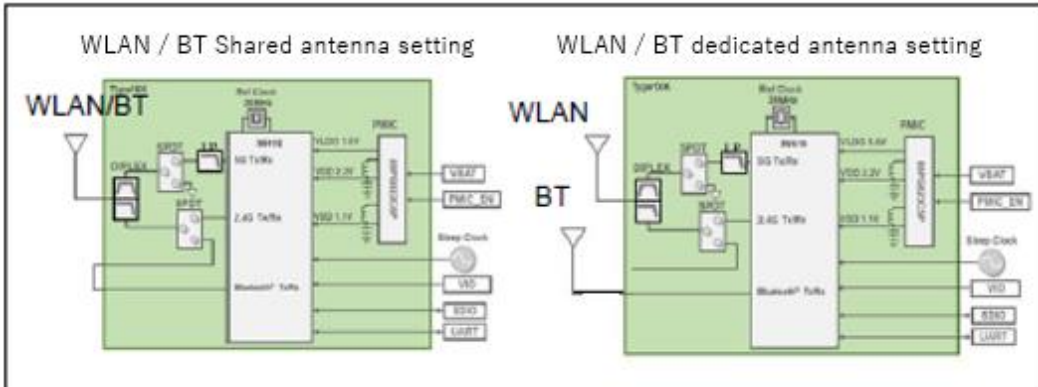


About LBEE5CJ1XK and LBEE5CJ2XK:

“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



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”.

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

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

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

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

This device complies with Industry Canada’s applicable licence-exempt RSSs. Operation is subject to the following two conditions:

- (1) This device may not cause interference; and
- (2) This device must accept any interference, including interference that may cause undesired operation of the device.

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 :

- 1) l’appareil ne doit pas produire de brouillage;
- 2) 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.

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

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 discontinues transmission in case of either absence of information to transmit or operational failure.

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.

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.

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: 3.4 dBi@2.4GHz/4.75 dBi@5GHz
- : Monopole Antenna Gain: 3.6 dBi@2.4GHz/4.6 dBi@5GHz

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: 3.4 dBi@2.4GHz/4.75 dBi@5GHz
- : Monopole Antenna Gain: 3.6 dBi@2.4GHz/4.6 dBi@5GHz

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

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.

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.

It is necessary to take a SAR test with your set mounting this module.

ClassIV permissive change application is necessary using the SAR report.

Please contact Murata.

Note)

Portable equipment : Equipment for which the spaces between human body and antenna are used within 20cm.

Mobile equipment : Equipment used at position in which the spaces between human body and antenna exceeded 20cm.

<Europe >

Precautions when using report number

E2/2021/30010 ~ E2/2021/30015 (RF Conducted test result only) for final product DoC.

Power Level 2.4GHz WLAN

Per Antenna port

mode	Rate	Channel	MAXIMUM TUNE UP TOLERANCE [dBm]
IEEE 802.11b	All Rates	1~13	14.0±2.0
IEEE 802.11g	All Rates	1~13	14.0±2.0
IEEE 802.11n(HT20)	All Rates	1~13	14.0±2.0

Power Level 2.4GHz BT/BLE

Per Antenna port

mode	MAXIMUM TUNE UP TOLERANCE [dBm]	
	Shared BT Antenna (PIN No.45)	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 2Mbps	3.0±3.0	3.3±3.0
LE (Long Range) 125kbps	3.0±3.0	3.3±3.0
LE (Long Range) 500kbps	3.0±3.0	3.3±3.0

Power Level 5GHz WLAN

Per Antenna port

mode	Rate	Band	Channel	MAXIMUM TUNE UP TOLERANCE [dBm]
IEEE 802.11a	All Rates	W52/W53/W56	36~140	15.0±2.0
	All Rates	W58	149~165	7.0±2.0
IEEE 802.11n(HT20)	All Rates	W52/W53/W56	36~140	14.0±2.0
	All Rates	W58	149~165	7.0±2.0
IEEE 802.11n(HT40)	All Rates	W52/W53/W56	38~134	14.0±2.0
	All Rates	W58	151, 159	7.0±2.0

Theory of Operation

Frequency of Operation			Scan	Ad-hoc mode
2.4GHz	11b/g/n (HT20)	2412-2472MHz	Active	Yes
W52	11a/n(HT20)	5180-5240MHz	Active	Yes
	11n(HT40)	5190-5230MHz	Active	Yes
W53	11a/n(HT20)	5260-5320MHz	Passive	No
	11n(HT40)	5270-5310MHz	Passive	No
W56	11a/n(HT20)	5500-5700MHz	Passive	No
	11n(HT40)	5510-5670MHz	Passive	No
W58	11a/n(HT20)	5745-5825MHz	Active	Yes
	11n(HT40)	5755-5795MHz	Active	Yes

*DFS MASTER function not available.

*DFS client function available.

*There is a TPC function.

Frequency of Operation			Scan	Ad-hoc node
BT	BR	2402~2480MHz	N/A	N/A
	EDR	2402~2480MHz	N/A	N/A
LE	LE	2402~2480MHz	N/A	N/A
	LE 2Mbps	2402~2480MHz	N/A	N/A
	LE (Long Range) 125kbps	2402~2480MHz	N/A	N/A
	LE (Long Range) 500kbps	2402~2480MHz	N/A	N/A