

WiFi+Bluetooth Combo Module Data Sheet

NXP 88W9098 Chipset
for 802.11a/b/g/n/ac/ax 2x2 MIMO + Bluetooth 5.1

Design Name: Type1XL
Sample P/N : LBEE5ZZ1XL-SMP

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

Revision History

Revision Code	Date	Description	Comments
-	Nov. 20 2020	First Issue	
A	Mar. 15 2021	5. Dimensions, Marking and Terminal Configurations 6.1. Pin Assignments	Changed module size and pin function information.
B	Mar. 29 2021	5. Dimensions, Marking and Terminal Configurations 6.2. Pin Descriptions	Changed module height and pin function information.
C	Apr. 5 2021	5. Dimensions, Marking and Terminal Configurations	Corrected e5 value from 1.09 to 1.10mm.
D	Apr. 28 2021	5. Dimensions, Marking and Terminal Configurations 12. Reference Circuit	Added Marking information. Added reference circuit.
E	May 5 2021	6.2. Pin Descriptions	Corrected pin description
F	Jun. 14, 2021	5. Dimensions, Marking and Terminal Configurations	Modified Marking information.

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

1. Scope

This specification is applied to the IEEE802.11 a/b/g/n/ac/ax + Bluetooth 5.1 module.

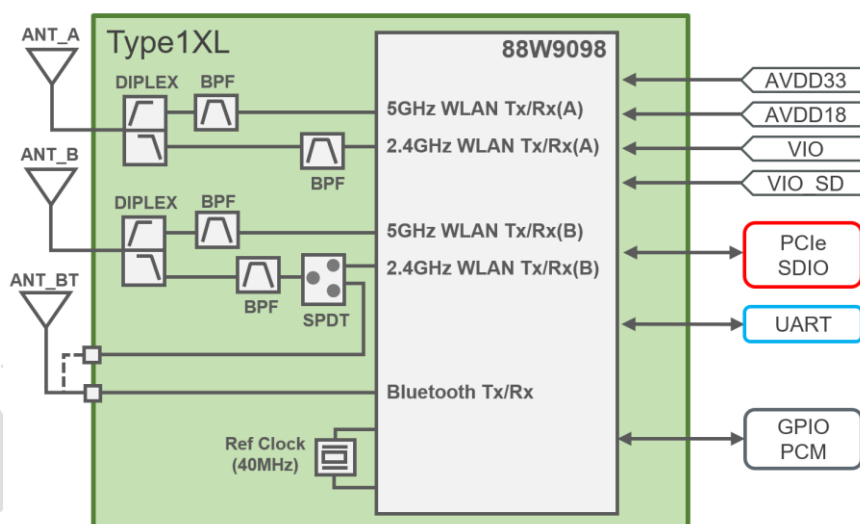
- Module Size : 19.1mm x 16.5mm x 2.1(max.)mm
- Host Interface
 - WLAN : PCIe / SDIO
 - Bluetooth : UART
- IC P/N : NXP 88W9098
- Reference Clock : Reference clock embedded
- Weight : (TBD)
- MSL : 3 (TBD)
- RoHS : This component can meet with RoHS compliance.

2. Part Number

Ordering Part Number	Description
LBEE5ZZ1XL-SMP	In case of sample order
LBEE5ZZ1XL-EVB	Evaluation Board

"Type1XL" is design name of this module. Design name may be used in certification test report.

3. Block Diagram



4. Certification Information

4.1. Radio Certification

USA/Canada

FCC ID : TBD

IC : TBD

*Please follow installation manual of Appendix

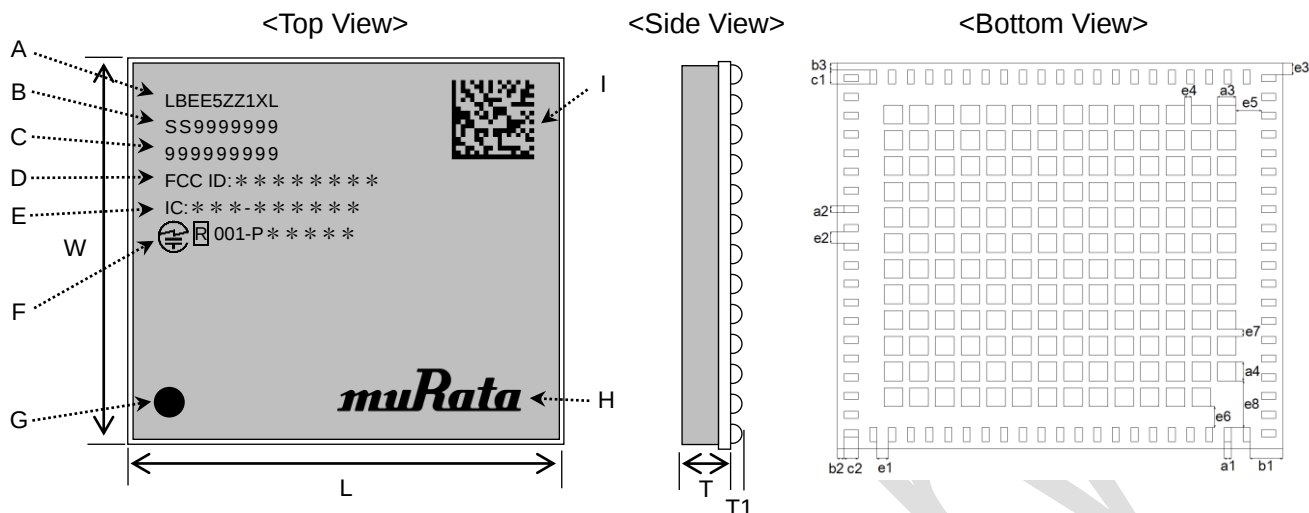
Europe

TBD

4.2. Bluetooth® Qualification

TBD

5. Dimensions, Marking and Terminal Configurations



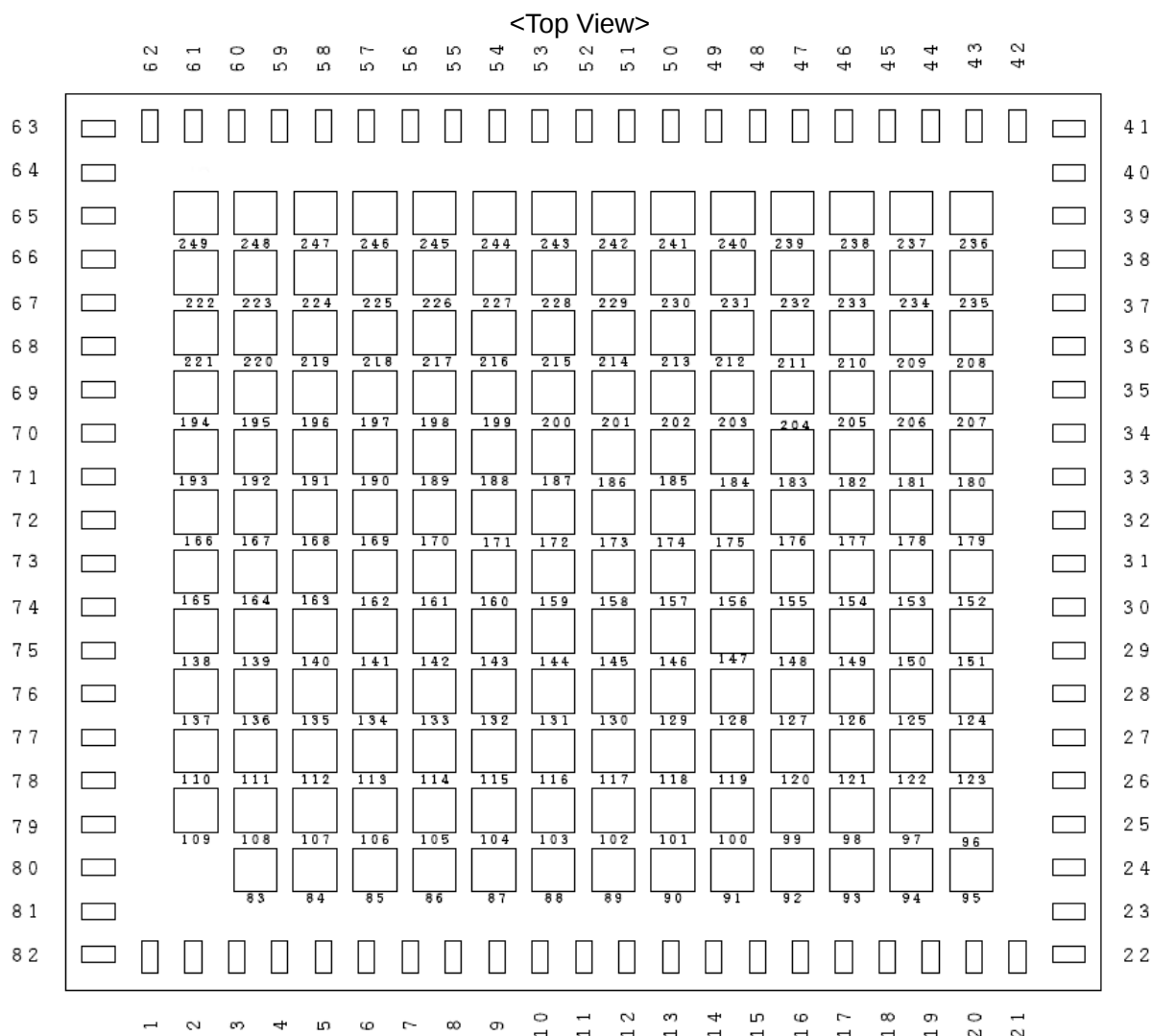
Marking	Meaning
A	Module Type
B	Production Process Number
C	Serial Number
D	FCC ID
E	ISED ID
F	Japan certification mark & ID
G	Pin-1 Marking
H	Murata Logo
I	2D code

Mark	Dimensions	Mark	Dimensions	Mark	Dimensions
L	19.1 +/- 0.2	W	16.5 +/- 0.2	T	2.1 max
T1	TBD	a1	0.3 +/- 0.1	a2	0.3 +/- 0.1
a3	0.8 +/- 0.1	a4	0.8 +/- 0.1	b1	1.4 +/- 0.2
b2	0.3 +/- 0.2	b3	0.5 +/- 0.2	c1	0.6 +/- 0.1
c2	0.6 +/- 0.1	e1	0.5 +/- 0.1	e2	0.5 +/- 0.1
e3	0.5 +/- 0.2	e4	0.3 +/- 0.1	e5	1.1 +/- 0.1
e6	0.9 +/- 0.1	e7	0.3 +/- 0.1	e8	2.0 +/- 0.1

(unit : mm)

6. Module Pin Descriptions

6.1. Pin Assignments



No.	Terminal Name	No.	Terminal Name	No.	Terminal Name
1	GND	29	PCIE_RX_N	57	GPIO[12]
2	GND	30	PCIE_RX_P	58	GPIO[13]
3	CONFIG_HOST[0]	31	GND	59	GPIO[24]
4	CONFIG_HOST[1]	32	NC	60	GPIO[25]
5	CONFIG_HOST[2]	33	NC	61	GPIO[26]
6	GPIO[1]	34	GND	62	GPIO[27]
7	GPIO[0]	35	VIO_SD	63	GND
8	GPIO[14]	36	SD_CLK	64	GND
9	GPIO[4]	37	SD_CMD	65	BT_RF_OUT
10	GPIO[6]	38	SD_D[0]	66	GND
11	GPIO[5]	39	SD_D[1]	67	GND
12	GPIO[7]	40	SD_D[2]	68	BT_RF_IN
13	GPIO[16]	41	GND	69	GND

14	GPIO[15]	42	SD_D[3]	70	GPIO[22]
15	PD_N	43	PCIE_PERST_N	71	GPIO[23]
16	GND	44	PCIE_CLKREQ_N	72	GPIO[19]
17	VDD33	45	PCIE_WAKE_UP_N	73	GPIO[18]
18	VDD33	46	W_DISABLE1N	74	GPIO[17]
19	VIO	47	GPIO[31]	75	GND
20	VDD18	48	GPIO[29]	76	WL_B_ANT/ WL_B_BT_ANT
21	VDD18	49	GPIO[30]	77	GND
22	GND	50	GPIO[28]	78	GND
23	PCIE_CLK_N	51	GPIO[3]	79	GND
24	PCIE_CLK_P	52	GPIO[2]	80	WL_A_ANT
25	GND	53	GPIO[11]	81	GND
26	PCIE_TX_P	54	GPIO[10]	82	GND
27	PCIE_TX_N	55	GPIO[9]	83-248	GND
28	GND	56	GPIO[8]	249	NC

6.2. Pin Descriptions

No.	Terminal Name	Type	Power Supply	Description
(1)	GND	GND	-	Ground
(2)	GND	GND	-	Ground
(3)	CONFIG_HOST[0]	I	AVDD18	Host configuration options. Selects the host interface used for Wi-Fi and Bluetooth. See the table CONFIG_HOST pins setting . Internal pull-up
(4)	CONFIG_HOST[1]	I	AVDD18	Host configuration options. Selects the host interface used for Wi-Fi and Bluetooth. See the table CONFIG_HOST pins setting . Internal pull-up
(5)	CONFIG_HOST[2]	I	AVDD18	Host configuration options. Selects the host interface used for Wi-Fi and Bluetooth. See the table CONFIG_HOST pins setting . Internal pull-down(51k ohm) on this pin
(6)	GPIO[1]	I/O	VIO	GPIO[1]
(7)	GPIO[0]	I/O	VIO	GPIO[0]
(8)	GPIO[14]	I/O	VIO	CONFIG_AUTO_REF_DET GPIO[14] Internal pull-down(51k ohm) on this pin Keep open or input level high until finished power up sequence.
(9)	GPIO[4]	I/O	VIO	PCM Mode: Receive PCM input. I2S Mode: Receive I2S input. GPIO[4]
(10)	GPIO[6]	I/O	VIO	PCM Mode: PCM Clock I2S Mode: I2S bit clock. - Output if master - Input if slave GPIO[6]
(11)	GPIO[5]	I/O	VIO	PCM Mode: Transmit PCM output. I2S Mode: Transmit I2S output. GPIO[5]
(12)	GPIO[7]	I/O	VIO	PCM Mode: PCM frame sync. I2S Mode: I2S left-right clock. - Output if master - Input if slave GPIO[7]
(13)	GPIO[16]	I/O	VIO	GPIO[16] Keep open or input level high until finished power up sequence.
(14)	GPIO[15]	I/O	VIO	GPIO[15] Keep open or input level high until finished power up sequence.
(15)	PD_N	I	AVDD18	Full Power Down (active low) 0 = full power down mode 1 = normal mode • Connect to power down pin of host or VDD33 External host required to drive this pin high for normal
(16)	GND	GND	-	Ground
(17)	VDD33	P	-	3.3V Voltage Input
(18)	VDD33	P	-	3.3V Voltage Input
(19)	VIO	P	-	1.8V/3.3V Digital I/O Power Supply
(20)	VDD18	P	-	1.8V Voltage Input
(21)	VDD18	P	-	1.8V Voltage Input
(22)	GND	GND	-	Ground
(23)	PCIE_CLK_N	I	AVDD18	PCI Express Differential Clock Input—Negative

(24)	PCIE_CLK_P	I	AVDD18	PCI Express Differential Clock Input—Positive
(25)	GND	GND	-	Ground
(26)	PCIE_TX_P	O	AVDD18	PCI Express Transmit Data—Positive
(27)	PCIE_TX_N	O	AVDD18	PCI Express Transmit Data—Negative
(28)	GND	GND	-	Ground
(29)	PCIE_RX_N	I	AVDD18	PCI Express Receive Data—Negative
(30)	PCIE_RX_P	I	AVDD18	PCI Express Receive Data—Positive
(31)	GND	GND	-	Ground
(32)	NC	-	-	No Connection
(33)	NC	-	-	No Connection
(34)	GND	GND	-	Ground
(35)	VIO_SD	P	-	1.8V/3.3V Digital I/O SDIO power supply • For SDIO ultra-high speed mode (25 to 208 MHz), VIO_SD must be 1.8V. • For SDIO default mode (up to 25 MHz) and high-speed mode (up to 50 MHz), VIO_SD must be 1.8V or 3.3V.
(36)	SD_CLK	I	VIO_SD	SDIO 4-bit Mode: Clock input SDIO 1-bit Mode: Clock input Internal pull-up
(37)	SD_CMD	I/O	VIO_SD	SDIO 4-bit Mode: Command/response (input/output) SDIO 1-bit Mode: Command line Internal pull-up
(38)	SD_D[0]	I/O	VIO_SD	SDIO 4-bit Mode: Data line Bit[0] SDIO 1-bit Mode: Data line Internal pull-up
(39)	SD_D[1]	I/O	VIO_SD	SDIO 4-bit Mode: Data line Bit[1] SDIO 1-bit Mode: Interrupt Internal pull-up
(40)	SD_D[2]	I/O	VIO_SD	SDIO 4-bit Mode: Data line Bit[2] or read wait (optional) SDIO 1-bit Mode: Read wait (optional) Internal pull-up
(41)	GND	GND	-	Ground
(42)	SD_D[3]	I/O	VIO_SD	SDIO 4-bit Mode: Data line Bit[3] SDIO 1-bit Mode: Reserved Internal pull-up
(43)	PCIE_PERST_N	I	VIO	PCIe host indication to reset the device (input)(active low) Note: Muxed with GPIO[20].(input/output) Internal pull-up
(44)	PCIE_CLKREQ_N	I/O	VIO	PCIe clock request (input/output) (active low) Note: An external pull-up (on host side) is required.
(45)	PCIE_WAKEUP_N	I/O	VIO	PCIe wake signal (input/output) (active low) Note: An external pull-up (on host side) is required.
(46)	W_DISABLE1N	I	VIO	GPIO Mode: GPIO[21] (input/output) Default Mode: W_DISABLE1n (input) (active low) Host indication to disable the Wi-Fi function of the device. See GPIO[12] for W_DISABLE2n (input) (active low).
(47)	GPIO[31]	I/O	VIO	GPIO Mode: GPIO[31] (input/output) JTAG Mode: JTAG_TDO, JTAG test data (output) Coexistence Mode: UART_LTE_SOUT (LTE coexistence data output signal)
(48)	GPIO[29]	I/O	VIO	GPIO Mode: GPIO[29] (input/output) JTAG Mode: JTAG_TMS, JTAG controller select (input)
(49)	GPIO[30]	I/O	VIO	GPIO Mode: GPIO[30] (input/output) JTAG Mode: JTAG_TDI, JTAG test data (input) Coexistence Mode: UART_LTE_SIN (LTE coexistence data input signal)
(50)	GPIO[28]	I/O	VIO	GPIO Mode: GPIO[28] (input/output) JTAG Mode: JTAG_TCK, JTAG test clock (input)
(51)	GPIO[3]	I/O	VIO	GPIO Mode: GPIO[3] (input/output) LED Mode: LED_OUT_BT (output) I2S Mode: I2S_CCLK (output, optional) PCM Mode: PCM_MCLK (output, optional)

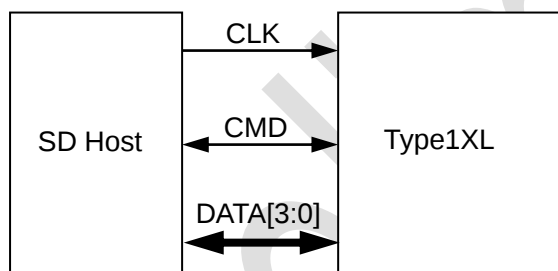
(52)	GPIO[2]	I/O	VIO	GPIO Mode: GPIO[2] (input/output) LED Mode: LED_OUT_WLAN (output)
(53)	GPIO[11]	I/O	VIO	GPIO Mode: GPIO[11] (input/output) UART Mode: UART_RTSn (output) (active low)
(54)	GPIO[10]	I/O	VIO	GPIO Mode: GPIO[10] (input/output) UART Mode: UART_CTSn (input) (active low)
(55)	GPIO[9]	I/O	VIO	GPIO Mode: GPIO[9] (input/output) UART Mode: UART_SIN (input)
(56)	GPIO[8]			
(57)	GPIO[12]	I/O	VIO	GPIO Mode: GPIO[12] (input/output) UART Mode: UART_DSRn (input) (active low) Default Mode: W_DISABLE2n (input) (active low) Host indication to disable the Wi-Fi function of the device. See GPIO[21] for W_DISABLE1n (input) (active low).
(58)	GPIO[13]	I/O	VIO	GPIO Mode: GPIO[13] (input/output) UART Mode: UART_DTRn (output) (active low)
(59)	GPIO[24]	I/O	VIO	GPIO Mode: GPIO[24] (input/output)
(60)	GPIO[25]	I/O	VIO	GPIO Mode: GPIO[25] (input/output)
(61)	GPIO[26]	I/O	VIO	GPIO Mode: GPIO[26] (input/output)
(62)	GPIO[27]	I/O	VIO	GPIO Mode: GPIO[27] (input/output)
(63)	GND	GND	-	Ground
(64)	GND	GND	-	Ground
(65)	BT_RF_OUT	RF	-	2-ANT Mode: Connect to BT_RF_IN 3-ANT Mode: Bluetooth Transmit/Receive
(66)	GND	GND	-	Ground
(67)	GND	GND	-	Ground
(68)	BT_RF_IN	RF	-	2-ANT Mode: Connect to BT_RF_OUT 3-ANT Mode: Keep this pin open
(69)	GND	GND	-	Ground
(70)	GPIO[22]	I/O	VIO	GPIO[22]
(71)	GPIO[23]	I/O	VIO	GPIO[23]
(72)	GPIO[19]	I/O	VIO	GPIO[19]
(73)	GPIO[18]	I/O	VIO	GPIO[18]
(74)	GPIO[17]	I/O	VIO	GPIO[17]
(75)	GND	GND	-	Ground
(76)	WL_B_ANT/ WL_B_BT_ANT	RF	-	2-ANT Mode: WLAN Transmit/Receive - Path B + Bluetooth 3-ANT Mode: WLAN Transmit/Receive - Path B
(77)	GND	GND	-	Ground
(78)	GND	GND	-	Ground
(79)	GND	GND	-	Ground
(80)	WL_A_ANT	RF		WLAN Transmit/Receive – Path A
(81)	GND	GND	-	Ground
(82)	GND	GND	-	Ground
(83)- (248)	GND	GND	-	Ground
(249)	NC	GND	-	No Connection

CONFIG HOST pins setting

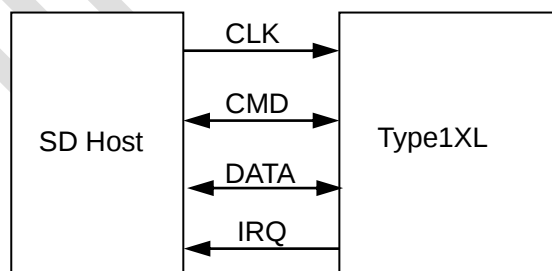
Strap Value			WLAN	Bluetooth/LE
CONFIG_HOST[2]	CONFIG_HOST[1]	CONFIG_HOST[0]		
0	0	0	SDIO	UART
0	0	1	reserved	reserved
0	1	0	reserved	reserved
0	1	1	PCIe	UART
1	0	0	reserved	reserved
1	0	1	reserved	reserved
1	1	0	reserved	reserved
1	1	1	reserved	reserved

SDIO Pin Description

No.	Pin Name	(i) SD 4-bit Mode		(ii) SD 1-bit Mode	
55	SD_CLK	CLK	Clock	CLK	Clock
59	SD_D[0]	DATA0	Data line 0	DATA	Data line
61	SD_D[1]	DATA1	Data line 1 /Interrupt	IRQ	Interrupt
63	SD_D[2]	DATA2	Data line 2	NC	Not used
65	SD_D[3]	DATA3	Data line 3	NC	Not used
57	SD_CMD	CMD	Command line	CMD	Command line



(i) SD 4-bit Mode



(ii) SD 1-bit Mode

7. Rating

Parameter		Min	Max	Unit
Storage Temperature		-40	+85	deg.C
Supply Voltage	AVDD33	-	3.63	V
	AVDD18	-	2.16	V
	VIO (1.8V)	-	1.98	V
	VIO(3.3V)	-	3.63	V
	VIO_SD(1.8V)	-	1.98	V
	VIO_SD(3.3V)	-	3.63	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.

8. Operating Condition

8.1. Operating condition

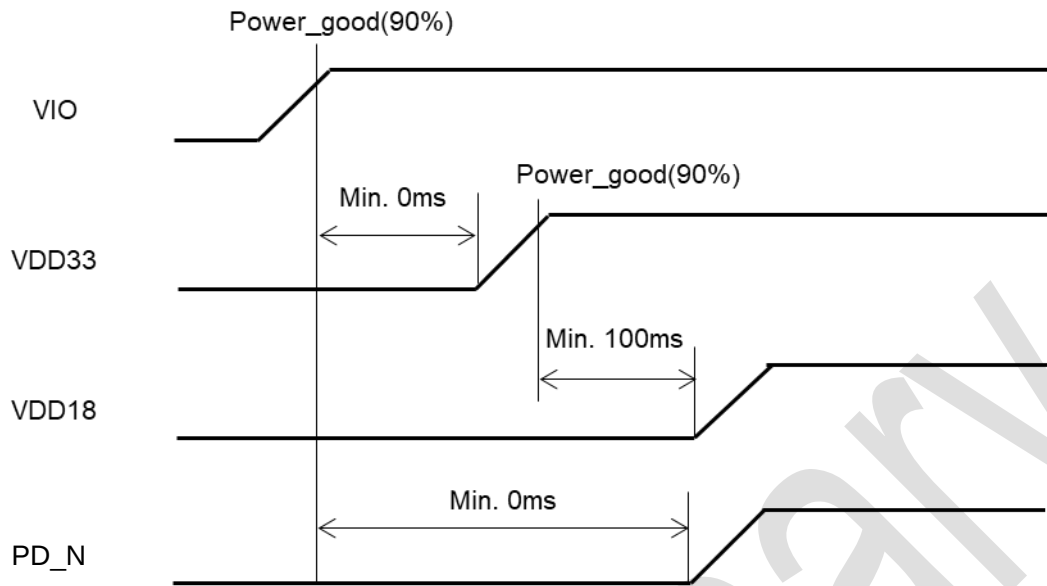
Parameter		Min	Typ	Max	Unit
Operating Temperature Range ¹		-40	+25	+85	deg.C
Specification Temperature Range		TBD	+25	TBD	deg.C
Supply Voltage	AVDD33	3.14	3.3	3.46	V
	AVDD18	1.71	1.8	1.89	V
	VIO	1.71	1.8	1.89	V
		3.14	3.3	3.46	V
	VIO_SD	1.71	1.8	1.89	V
		3.14	3.3	3.46	V

¹ Functionality is guaranteed but specifications require derating at extreme temperatures

9. Power-Up / Power-Down Sequence

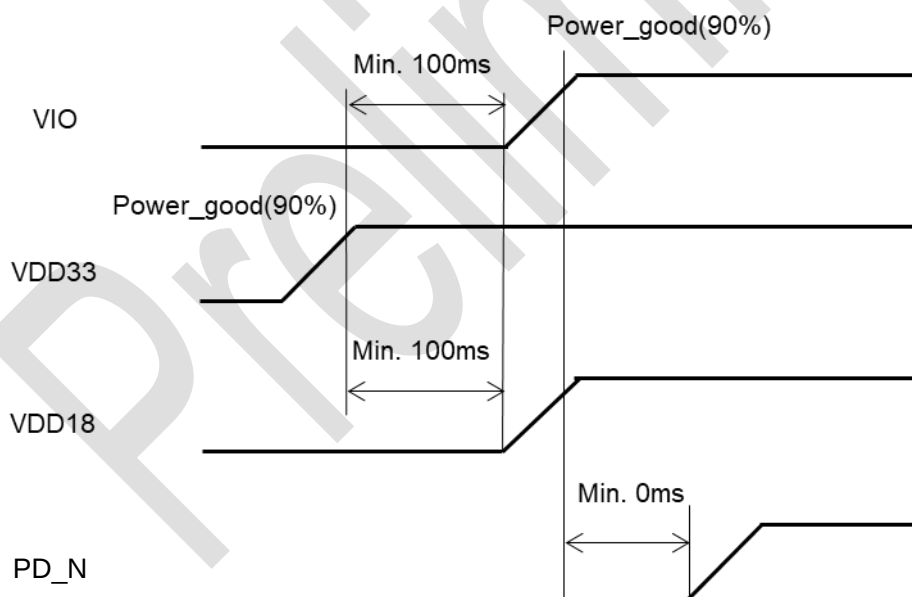
9.1. Power-Up Sequence

(1) VIO=3.3V



Ramp-up time of VIO must be <100ms.
Ramp-up time of VDD33 must be <100ms.
Ramp-up time of VDD18 must be <100ms.

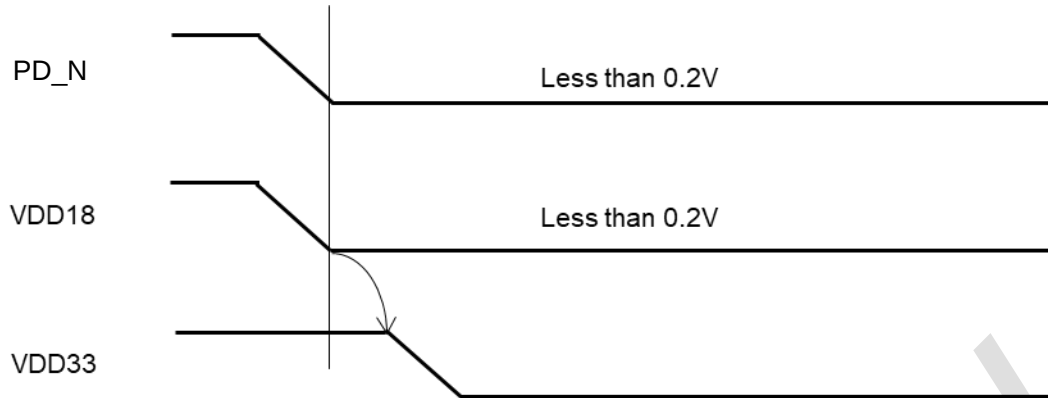
(2) VIO=1.8V



Ramp-up time of VIO must be <100ms.
Ramp-up time of VDD33 must be <100ms.
Ramp-up time of VDD18 must be <100ms.

VIO should be the same as VDD18 or earlier. After power_good state of VDD33, then VIO can ramp up. At that time VDD18 can be the same or later than VIO.

9.2. Power-Down Sequence



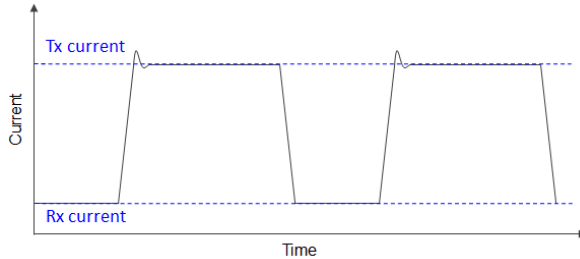
To reduce leakage, ramp down VDD18 before VDD33 when powering down the SoC. It is not required specific timing for VIO for its power-down.

10. DC / RF Characteristics

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

TBD	TBD
TBD	TBD

- Burst current definition



10.1. 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

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

Conditions : 25deg.C, AVDD33=3.3V, AVDD18=1.8V VIO=1.8V, Output power setting=TBD, 11Mbps mode

Items	Contents			
- DC Characteristics -	Min.	Typ.	Max.	Unit
1. DC current				
1) Tx mode*1	-	-	TBD	mA
2) Rx mode	-	-	TBD	mA
- Tx Characteristics *1 -	Min.	Typ.	Max.	Unit
2. Output Power	TBD	TBD	TBD	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

*1: Defined when output power setting is TBD at Murata module antenna pad

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

Conditions : 25deg.C, AVDD33=3.3V, AVDD18=1.8V VIO=1.8V, Output power setting=TBD, 1Mbps mode

Items	Contents			
- DC Characteristics -	Min.	Typ.	Max.	Unit
1. DC current				
1) Tx mode*2	-	-	TBD	mA
2) Rx mode	-	-	TBD	mA
- Tx Characteristics *2 -	Min.	Typ.	Max.	Unit
2. Output Power	TBD	TBD	TBD	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%)	-10	-	-	dBm
11. Adjacent Channel Rejection (FER< 8%)	35	-	-	dB

*2: Defined when output power setting is TBD at Murata module antenna pad

10.2. 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

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

Conditions : 25deg.C, AVDD33=3.3V, AVDD18=1.8V VIO=1.8V, Output power setting=TBD, 54Mbps mode

Items	Contents			
	Min.	Typ.	Max.	Unit
- DC Characteristics -				
1. DC current				
1) Tx mode*3	-	-	TBD	mA
2) Rx mode	-	-	TBD	mA
- Tx Characteristics*3 -	Min.	Typ.	Max.	Unit
2. Output Power	TBD	TBD	TBD	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~ -40dBr)	0	-	-	dB
4) 30MHz to 33MHz (-40dBr)	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

*3: Defined when output power setting is TBD at Murata module antenna pad

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

Conditions : 25deg.C, AVDD33=3.3V, AVDD18=1.8V VIO=1.8V, Output power setting=TBD, 6Mbps mode

Items	Contents			
- DC Characteristics -	Min.	Typ.	Max.	Unit
1. DC current				
1) Tx mode*4	-	-	TBD	mA
2) Rx mode	-	-	TBD	mA
- Tx Characteristics*4 -	Min.	Typ.	Max.	Unit
2. Output Power	TBD	TBD	TBD	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~ -40dBr)	0	-	-	dB
4) 30MHz to 33MHz (-40dBr)	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%)	-	-	-82	dBm
8. Maximum Input Level (PER < 10%)	-20	-	-	dBm
9. Adjacent Channel Rejection (PER< 10%)	-1	-	-	dB

*4: Defined when output power setting is TBD at Murata module antenna pad

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

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

10.3.1. High Rate Condition for IEEE802.11n – 2.4GHz

Conditions : 25deg.C, AVDD33=3.3V, AVDD18=1.8V VIO=1.8V, Output power setting=TBD, MCS7 mode

Items	Contents			
- DC Characteristics -	Min.	Typ.	Max.	Unit
1. DC current				
1) Tx mode*5	-	-	TBD	mA
2) Rx mode	-	-	TBD	mA
- Tx Characteristics*5 -	Min.	Typ.	Max.	Unit
2. Output Power	TBD	TBD	TBD	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

*5: Defined when output power setting is TBD at Murata module antenna pad

10.3.2. Low Rate Condition for IEEE802.11n – 2.4GHz

Conditions : 25deg.C, AVDD33=3.3V, AVDD18=1.8V VIO=1.8V, Output power setting=TBD, MCS0 mode

Items	Contents			
- DC Characteristics -	Min.	Typ.	Max.	Unit
1. DC current				
1) Tx mode*6	-	-	TBD	mA
2) Rx mode	-	-	TBD	mA
- Tx Characteristics*6 -	Min.	Typ.	Max.	Unit
2. Output Power	TBD	TBD	TBD	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%)	-	-	-82	dBm
8. Maximum Input Level (PER < 10%)	-20	-	-	dBm
9. Adjacent Channel Rejection (PER ≤ 10%)	-2	-	-	dB

*6: Defined when output power setting is TBD at Murata module antenna pad

10.4. DC/RF Characteristics for IEEE802.11ax - 2.4GHz

Specification	IEEE802.11ax
Mode	OFDM
Channel Frequency	2412 - 2472MHz
Data rate	MCS0-MCS11

10.4.1. High Rate Condition for IEEE802.11ax – 2.4GHz

Conditions : 25deg.C, AVDD33=3.3V, AVDD18=1.8V VIO=1.8V, Output power setting=TBD, MCS11 mode

Items	Contents			
- DC Characteristics -	Min.	Typ.	Max.	Unit
1. DC current				
1) Tx mode*5	-	-	TBD	mA
2) Rx mode	-	-	TBD	mA
- Tx Characteristics*5 -	Min.	Typ.	Max.	Unit
2. Output Power	TBD	TBD	TBD	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)	-	-	-35	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%)	-	-	-69	dBm
8. Maximum Input Level (PER < 10%)	TBD	-	-	dBm
9. Adjacent Channel Rejection (PER ≤ 10%)	-2	-	-	dB

*5: Defined when output power setting is TBD at Murata module antenna pad

10.4.2. Low Rate Condition for IEEE802.11ax – 2.4GHz

Conditions : 25deg.C, AVDD33=3.3V, AVDD18=1.8V VIO=1.8V, Output power setting=TBD, MCS0 mode

Items	Contents			
- DC Characteristics -	Min.	Typ.	Max.	Unit
1. DC current				
1) Tx mode*6	-	-	TBD	mA
2) Rx mode	-	-	TBD	mA
- Tx Characteristics*6 -	Min.	Typ.	Max.	Unit
2. Output Power	TBD	TBD	TBD	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)	-	-	-19	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%)	-	-	-69	dBm
8. Maximum Input Level (PER < 10%)	TBD	-	-	dBm
9. Adjacent Channel Rejection (PER ≤ 10%)	-2	-	-	dB

*6: Defined when output power setting is TBD at Murata module antenna pad

10.5. 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

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

Conditions : 25deg.C, AVDD33=3.3V, AVDD18=1.8V VIO=1.8V, Output power setting=TBD, 54Mbps mode

Items	Contents			
- DC Characteristics -	min.	Typ.	Max.	Unit
1. DC current				
1) Tx mode*7	-	-	TBD	mA
2) Rx mode	-	-	TBD	mA
- Tx Characteristics*7 -	min.	Typ.	Max.	Unit
2. Output Power	TBD	TBD	TBD	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

*7: Defined when output power setting is TBD at Murata module antenna pad

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

Conditions : 25deg.C, AVDD33=3.3V, AVDD18=1.8V VIO=1.8V, Output power setting=TBD, 6Mbps mode

Items	Contents			
- DC Characteristics -	min.	Typ.	Max.	Unit
1. DC current				
1) Tx mode*8	-	-	TBD	mA
2) Rx mode	-	-	TBD	mA
- Tx Characteristics*8 -	min.	Typ.	Max.	Unit
2. Output Power	TBD	TBD	TBD	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%)	-	-	-82	dBm
8. Maximum Input Level (PER < 10%)	-30	-	-	dBm
9. Adjacent Channel Rejection (PER≤ 10%)	-1	-	-	dB

*8: Defined when output power setting is TBD at Murata module antenna pad

10.6. 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

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

Conditions : 25deg.C, AVDD33=3.3V, AVDD18=1.8V VIO=1.8V, Output power setting=TBD, MCS7 mode

Items	Contents			
- DC Characteristics -	min.	Typ.	Max.	Unit
1. DC current				
1) Tx mode*9	-	-	TBD	mA
2) Rx mode	-	-	TBD	mA
- Tx Characteristics*9 -	min.	Typ.	Max.	Unit
2. Output Power	TBD	TBD	TBD	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

*9: Defined when output power setting is TBD at Murata module antenna pad

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

Conditions : 25deg.C, AVDD33=3.3V, AVDD18=1.8V VIO=1.8V, Output power setting=TBD, MCS0 mode

Items	Contents			
- DC Characteristics -	min.	Typ.	Max.	Unit
1. DC current				
1) Tx mode*10	-	-	TBD	mA
2) Rx mode	-	-	TBD	mA
- Tx Characteristics*10 -	min.	Typ.	Max.	Unit
2. Output Power	TBD	TBD	TBD	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%)	-	-	-82	dBm
8. Maximum Input Level (PER < 10%)	-30	-	-	dBm
9. Adjacent Channel Rejection (PER≤ 10%)	-2	-	-	dB

*10: Defined when output power setting is TBD at Murata module antenna pad

10.7. DC/RF Characteristics for IEEE802.11ac(HT20) - 5GHz

Specification	IEEE802.11ac
Mode	OFDM
Channel Frequency	5180 to 5240MHz, 5260 to 5320MHz, 5500 to 5720MHz, 5745 to 5825MHz
Data rate	MCS0-MCS8

10.7.1. High Rate Condition for IEEE802.11ac(VHT20) – 5GHz

Conditions : 25deg.C, AVDD33=3.3V, AVDD18=1.8V VIO=1.8V, Output power setting=TBD, MCS8 mode

Items	Contents			
- DC Characteristics -	min.	Typ.	Max.	Unit
1. DC current				
1) Tx mode*11	-	-	TBD	mA
2) Rx mode	-	-	TBD	mA
- Tx Characteristics*11 -	min.	Typ.	Max.	Unit
2. Output Power	TBD	TBD	TBD	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)	-	-	-30	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%)	-	-	-59	dBm
8. Maximum Input Level (PER < 10%)	-30	-	-	dBm
9. Adjacent Channel Rejection (PER ≤ 10%)	-7	-	-	dB

*11: Defined when output power setting is TBD at Murata module antenna pad

10.7.2. Low Rate Condition for IEEE802.11ac(VHT20) – 5GHz

Conditions : 25deg.C, AVDD33=3.3V, AVDD18=1.8V VIO=1.8V, Output power setting=TBD, MCS0 mode

Items	Contents			
- DC Characteristics -	min.	Typ.	Max.	Unit
1. DC current				
1) Tx mode*12	-	-	TBD	mA
2) Rx mode	-	-	TBD	mA
- Tx Characteristics*12 -	min.	Typ.	Max.	Unit
2. Output Power	TBD	TBD	TBD	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)	-	-	-30	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%)	-	-	-82	dBm
8. Maximum Input Level (PER < 10%)	-30	-	-	dBm
9. Adjacent Channel Rejection (PER≤ 10%)	-7	-	-	dB

*12: Defined when output power setting is TBD at Murata module antenna pad

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

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

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

Conditions : 25deg.C, AVDD33=3.3V, AVDD18=1.8V VIO=1.8V, Output power setting=TBD, MCS7 mode

Items	Contents			
- DC Characteristics -	min.	Typ.	Max.	Unit
1. DC current				
1) Tx mode*13	-	-	TBD	mA
2) Rx mode	-	-	TBD	mA
- Tx Characteristics*13 -	min.	Typ.	Max.	Unit
2. Output Power	TBD	TBD	TBD	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

*13: Defined when output power setting is TBD at Murata module antenna pad

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

Conditions : 25deg.C, AVDD33=3.3V, AVDD18=1.8V VIO=1.8V, Output power setting=TBD, MCS0 mode

Items	Contents			
- DC Characteristics -	min.	Typ.	Max.	Unit
1. DC current				
1) Tx mode*14	-	-	TBD	mA
2) Rx mode	-	-	TBD	mA
- Tx Characteristics*14 -	min.	Typ.	Max.	Unit
2. Output Power	TBD	TBD	TBD	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%)	-	-	-79	dBm
8. Maximum Input Level (PER ≤ 10%)	-30	-	-	dBm
9. Adjacent Channel Rejection (PER ≤ 10%)	-2	-	-	dB

*14: Defined when output power setting is TBD at Murata module antenna pad

10.9. DC/RF Characteristics for IEEE802.11ac(VHT 40MHz) - 5GHz

Specification	IEEE802.11ac
Mode	OFDM
Frequency	5190 to 5795MHz
Data rate	MCS0-MCS9

10.9.1. High Rate Condition for IEEE802.11ac(VHT40) – 5GHz

Conditions : 25deg.C, AVDD33=3.3V, AVDD18=1.8V VIO=1.8V, Output power setting=TBD, MCS9 mode

Items	Contents			
- DC Characteristics -	min.	Typ.	Max.	Unit
1. DC current				
1) Tx mode*15	-	-	TBD	mA
2) Rx mode	-	-	TBD	mA
- Tx Characteristics*15 -	min.	Typ.	Max.	Unit
2. Output Power	TBD	TBD	TBD	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)	-	-	-32	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%)	-	-	-54	dBm
8. Maximum Input Level (PER ≤ 10%)	-30	-	-	dBm
9. Adjacent Channel Rejection (PER ≤ 10%)	-9	-	-	dB

*15: Defined when output power setting is TBD at Murata module antenna pad

10.9.2. Low Rate Condition for IEEE802.11ac(VHT40) – 5GHz

Conditions : 25deg.C, AVDD33=3.3V, AVDD18=1.8V VIO=1.8V, Output power setting=TBD, MCS0 mode

Items	Contents			
- DC Characteristics -	min.	Typ.	Max.	Unit
1. DC current				
1) Tx mode*16	-	-	TBD	mA
2) Rx mode	-	-	TBD	mA
- Tx Characteristics*16 -	min.	Typ.	Max.	Unit
2. Output Power	TBD	TBD	TBD	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)	-	-	-32	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%)	-	-	-79	dBm
8. Maximum Input Level (PER ≤ 10%)	-30	-	-	dBm
9. Adjacent Channel Rejection (PER ≤ 10%)	-9	-	-	dB

*16: Defined when output power setting is TBD at Murata module antenna pad

10.10. DC/RF Characteristics for IEEE802.11ac(VHT 80MHz)-5GHz

Specification	IEEE802.11ac
Mode	OFDM
Channel Frequency	5210 - 5775MHz
Data rate	MCS0-MCS9

10.10.1. High Rate Condition for IEEE802.11ac(VHT80) – 5GHz

Conditions : 25deg.C, AVDD33=3.3V, AVDD18=1.8V VIO=1.8V, Output power setting=TBD, MCS9 mode

Items	Contents			
	min.	Typ.	Max.	Unit
- DC Characteristics -				
1. DC current				
1) Tx mode*9	-	-	TBD	mA
2) Rx mode	-	-	TBD	mA
- Tx Characteristics*9 -				
	min.	Typ.	Max.	Unit
2. Output Power	TBD	TBD	TBD	dBm
3. Spectrum Mask Margin				
1) 39MHz to 41MHz (0~ -20dB)	0	-	-	dB
2) 41MHz to 80MHz (-20~ -28dB)	0	-	-	dB
3) 80MHz to 120MHz (-28~ -40dB)	0	-	-	dB
4) 120MHz to 140MHz (-40dB)	0	-	-	dB
4. Constellation Error (EVM) (measured at enhanced mode)	-	-	-32	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
6. Minimum Input Level (PER ≤ 10%)	-	-	-51	dBm
7. Maximum Input Level (PER ≤ 10%)	-30	-	-	dBm
8. Adjacent Channel Rejection (PER ≤ 10%)	-9	-	-	dB

*9: Defined when output power setting is TBD at Murata module antenna pad

10.10.2. Low Rate Condition for IEEE802.11ac(VHT80) – 5GHz

Conditions : 25deg.C, AVDD33=3.3V, AVDD18=1.8V VIO=1.8V, Output power setting=TBD, MCS0 mode

Items	Contents			
- DC Characteristics -	min.	Typ.	Max.	Unit
1. DC current				
1) Tx mode*9	-	-	TBD	mA
2) Rx mode	-	-	TBD	mA
- Tx Characteristics*9 -	min.	Typ.	Max.	Unit
2. Output Power	TBD	TBD	TBD	dBm
3. Spectrum Mask Margin				
1) 39MHz to 41MHz (0~ -20dBr)	0	-	-	dB
2) 41MHz to 80MHz (-20~ -28dBr)	0	-	-	dB
3) 80MHz to 120MHz (-28~ -40dBr)	0	-	-	dB
4) 120MHz to 140MHz (-40dBr)	0	-	-	dB
4. Constellation Error (EVM) (measured at enhanced mode)	-	-	-19	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
6. Minimum Input Level (PER ≤ 10%)	-	-	-76	dBm
7. Maximum Input Level (PER ≤ 10%)	-30	-	-	dBm
8. Adjacent Channel Rejection (PER ≤ 10%)	-9	-	-	dB

*9: Defined when output power setting is TBD at Murata module antenna pad

10.11. DC/RF Characteristics for IEEE802.11ax(HE 20MHz)-5GHz

Specification	IEEE802.11ax
Mode	OFDM
Channel Frequency	5180 to 5240MHz, 5260 to 5320MHz, 5500 to 5720MHz, 5745 to 5825MHz
Data rate	MCS0-MCS11

10.11.1. High Rate Condition for IEEE802.11ax(HE20) – 5GHz

Conditions : 25deg.C, AVDD33=3.3V, AVDD18=1.8V VIO=1.8V, Output power setting=TBD, MCS11 mode

Items	Contents			
- DC Characteristics -	min.	Typ.	Max.	Unit
1. DC current				
1) Tx mode*9	-	-	TBD	mA
2) Rx mode	-	-	TBD	mA
- Tx Characteristics*9 -	min.	Typ.	Max.	Unit
2. Output Power	TBD	TBD	TBD	dBm
3. Spectrum Mask Margin				
1) 39MHz to 41MHz (0~ -20dBr)	0	-	-	dB
2) 41MHz to 80MHz (-20~ -28dBr)	0	-	-	dB
3) 80MHz to 120MHz (-28~ -40dBr)	0	-	-	dB
4) 120MHz to 140MHz (-40dBr)	0	-	-	dB
4. Constellation Error (EVM) (measured at enhanced mode)	-	-	-32	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
6. Minimum Input Level (PER ≤ 10%)	-	-	-51	dBm
7. Maximum Input Level (PER ≤ 10%)	-30	-	-	dBm
8. Adjacent Channel Rejection (PER ≤ 10%)	-9	-	-	dB

*9: Defined when output power setting is TBD at Murata module antenna pad

10.11.2. Low Rate Condition for IEEE802.11ax(HE20) – 5GHz

Conditions : 25deg.C, AVDD33=3.3V, AVDD18=1.8V VIO=1.8V, Output power setting=TBD, MCS0 mode

Items	Contents			
- DC Characteristics -	min.	Typ.	Max.	Unit
1. DC current				
1) Tx mode*9	-	-	TBD	mA
2) Rx mode	-	-	TBD	mA
- Tx Characteristics*9 -	min.	Typ.	Max.	Unit
2. Output Power	TBD	TBD	TBD	dBm
3. Spectrum Mask Margin				
1) 39MHz to 41MHz (0~ -20dBr)	0	-	-	dB
2) 41MHz to 80MHz (-20~ -28dBr)	0	-	-	dB
3) 80MHz to 120MHz (-28~ -40dBr)	0	-	-	dB
4) 120MHz to 140MHz (-40dBr)	0	-	-	dB
4. Constellation Error (EVM) (measured at enhanced mode)	-	-	-19	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
6. Minimum Input Level (PER ≤ 10%)	-	-	-76	dBm
7. Maximum Input Level (PER ≤ 10%)	-30	-	-	dBm
8. Adjacent Channel Rejection (PER ≤ 10%)	-9	-	-	dB

*9: Defined when output power setting is TBD at Murata module antenna pad

10.12. DC/RF Characteristics for IEEE802.11ax(HE 80MHz)-5GHz

Specification	IEEE802.11ax
Mode	OFDM
Channel Frequency	5210 - 5775MHz
Data rate	MCS0-MCS11

10.12.1. High Rate Condition for IEEE802.11ax(HE80) – 5GHz

Conditions : 25deg.C, AVDD33=3.3V, AVDD18=1.8V VIO=1.8V, Output power setting=TBD, MCS11 mode

Items	Contents			
- DC Characteristics -	min.	Typ.	Max.	Unit
1. DC current				
1) Tx mode*9	-	-	TBD	mA
2) Rx mode	-	-	TBD	mA
- Tx Characteristics*9 -	min.	Typ.	Max.	Unit
2. Output Power	TBD	TBD	TBD	dBm
3. Spectrum Mask Margin				
1) 39MHz to 41MHz (0~ -20dB)	0	-	-	dB
2) 41MHz to 80MHz (-20~ -28dB)	0	-	-	dB
3) 80MHz to 120MHz (-28~ -40dB)	0	-	-	dB
4) 120MHz to 140MHz (-40dB)	0	-	-	dB
4. Constellation Error (EVM) (measured at enhanced mode)	-	-	-32	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
6. Minimum Input Level (PER ≤ 10%)	-	-	-51	dBm
7. Maximum Input Level (PER ≤ 10%)	-30	-	-	dBm
8. Adjacent Channel Rejection (PER ≤ 10%)	-9	-	-	dB

*9: Defined when output power setting is TBD at Murata module antenna pad

10.12.2. Low Rate Condition for IEEE802.11ax(HE80) – 5GHz

Conditions : 25deg.C, AVDD33=3.3V, AVDD18=1.8V VIO=1.8V, Output power setting=TBD, MCS0 mode

Items	Contents			
- DC Characteristics -	min.	Typ.	Max.	Unit
1. DC current				
1) Tx mode*9	-	-	TBD	mA
2) Rx mode	-	-	TBD	mA
- Tx Characteristics*9 -	min.	Typ.	Max.	Unit
2. Output Power	TBD	TBD	TBD	dBm
3. Spectrum Mask Margin				
1) 39MHz to 41MHz (0~ -20dBr)	0	-	-	dB
2) 41MHz to 80MHz (-20~ -28dBr)	0	-	-	dB
3) 80MHz to 120MHz (-28~ -40dBr)	0	-	-	dB
4) 120MHz to 140MHz (-40dBr)	0	-	-	dB
4. Constellation Error (EVM) (measured at enhanced mode)	-	-	-32	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
6. Minimum Input Level (PER ≤ 10%)	-	-	-76	dBm
7. Maximum Input Level (PER ≤ 10%)	-30	-	-	dBm
8. Adjacent Channel Rejection (PER ≤ 10%)	-9	-	-	dB

*9: Defined when output power setting is TBD at Murata module antenna pad

10.13. DC/RF Characteristics for Bluetooth

10.13.1. Basic Data Rate Condition

Conditions : 25deg.C, AVDD33=3.3V, AVDD18=1.8V VIO=1.8V,

Items	Contents			
Bluetooth specification (power class)	Version 5.1			
Channel frequency (spacing)	2402 to 2480 MHz (1MHz)			
Current Consumption	Min.	Typ.	Max.	unit
1) Tx mode DH5	-	TBD	TBD	mA
2) Rx mode DH5	-	TBD	TBD	mA
- Tx Characteristics -	Min.	Typ.	Max.	Unit
Output Power@DH5	TBD	TBD	TBD	dBm
Frequency range	2400	-	2483.5	MHz
20dB bandwidth	-		1	MHz
Adjacent Channel Power *1				
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
BDR Sensitivity (BER≤0.1%)	-	-91	-86	dBm
C/I Performance (BER≤0.1%) *2				
1) co-channel	-	-	11	dB
2) 1MHz	-	-	0	dB
3) 2MHz	-	-	-30	dB
4) 3MHz	-	-	-40	dB
5) image (+4MHz)	-	-	-9	dB
6) image +/- 1MHz	-	-	-20	dB
Maximum Input Level (BER≤0.1%)	-20	-	-	dBm

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

*2: Up to five spurious responses within Bluetooth limits are allowed.

10.13.2. Enhanced Data Rate Condition

Conditions : 25deg.C, AVDD33=3.3V, AVDD18=1.8V VIO=1.8V,

Items	Contents			
Bluetooth specification (power class)	Version 5.1			
Channel frequency (spacing)	2402 to 2480 MHz (1MHz)			
Current Consumption	Min.	Typ.	Max.	unit
1) Tx mode 2DH5	-	TBD	TBD	mA
2) Rx mode 2DH5	-	TBD	TBD	mA
3) Tx mode 3DH5	-	TBD	TBD	mA
4) Rx mode 3DH5	-	TBD	TBD	mA
- Tx Characteristics -	Min.	Typ.	Max.	Unit
Output Power@2DH5/3DH5	TBD	TBD	TBD	dBm
Frequency range	2400	-	2483.5	MHz
20dB bandwidth	-		1	MHz
Adjacent Channel Power ^{*1}				
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	-	-88	-82	dBm
C/I Performance (BER≤0.1%) ^{*2}				
1) co-channel	-	-	11	dB
2) 1MHz	-	-	0	dB
3) 2MHz	-	-	-30	dB
4) 3MHz	-	-	-40	dB
5) image (+4MHz)	-	-	-9	dB
6) image +/- 1MHz	-	-	-20	dB
Maximum Input Level (BER≤0.1%)	-20	-	-	dBm

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

*2: Up to five spurious responses within Bluetooth limits are allowed.

10.14. DC/RF Characteristics for Bluetooth Low Energy

10.14.1. 1Mbps PHY Condition

Conditions : 25deg.C, AVDD33=3.3V, AVDD18=1.8V VIO=1.8V,

Items	Contents			
Bluetooth specification (power class)	Version 5.1			
Channel frequency (spacing)	2402 to 2480 MHz (2MHz)			
Number of RF Channel	40			
Current Consumption	Min.	Typ.	Max.	Unit
1) Tx mode	-	TBD	TBD	mA
2) Rx mode	-	TBD	TBD	mA
- Tx Characteristics -	Min.	Typ.	Max.	Unit
Center Frequency	2402	-	2480	MHz
Channel Spacing	-	2	-	MHz
Number of RF channel	-	40	-	-
Output power	TBD	TBD	TBD	dBm
Modulation Characteristics				
1) Δf_{1avg}	225	-	275	kHz
2) Δf_{2max} (at 99.9%)	185	-	-	kHz
3) $\Delta f_{2avg} / \Delta f_{1avg}$	0.8	-	-	-
Carrier frequency offset and drift				
1) Frequency offset	-	-	150	kHz
2) Frequency drift	-	-	50	kHz
3) Drift rate	-	-	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%)	-	-95	-90	dBm
Maximum input signal level (PER < 30.8%)	-10	-	-	dBm
PER Report Integrity (-30dBm input)	50	-	65.4	%

10.14.2. 2Mbps PHY Condition

Conditions : 25deg.C, AVDD33=3.3V, AVDD18=1.8V VIO=1.8V,

Items	Contents			
Bluetooth specification (power class)	Version 5.1			
Channel frequency (spacing)	2402 to 2480 MHz (2MHz)			
Number of RF Channel	40			
Current Consumption	Min.	Typ.	Max.	Unit
1) Tx mode	-	TBD	TBD	mA
2) Rx mode	-	TBD	TBD	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	6	dBm
Modulation Characteristics				
1) $\Delta f_{1\text{avg}}$	225	-	275	kHz
2) $\Delta f_{2\text{max}}$ (at 99.9%)	185	-	-	kHz
3) $\Delta f_{2\text{avg}} / \Delta f_{1\text{avg}}$	0.8	-	-	-
Carrier frequency offset and drift				
1) Frequency offset	-	-	150	kHz
2) Frequency drift	-	-	50	kHz
3) Drift rate	-	-	20	kHz
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%)	-	-95	-90	dBm
Maximum input signal level (PER < 30.8%)	-10	-	-	dBm
PER Report Integrity (-30dBm input)	50	-	65.4	%

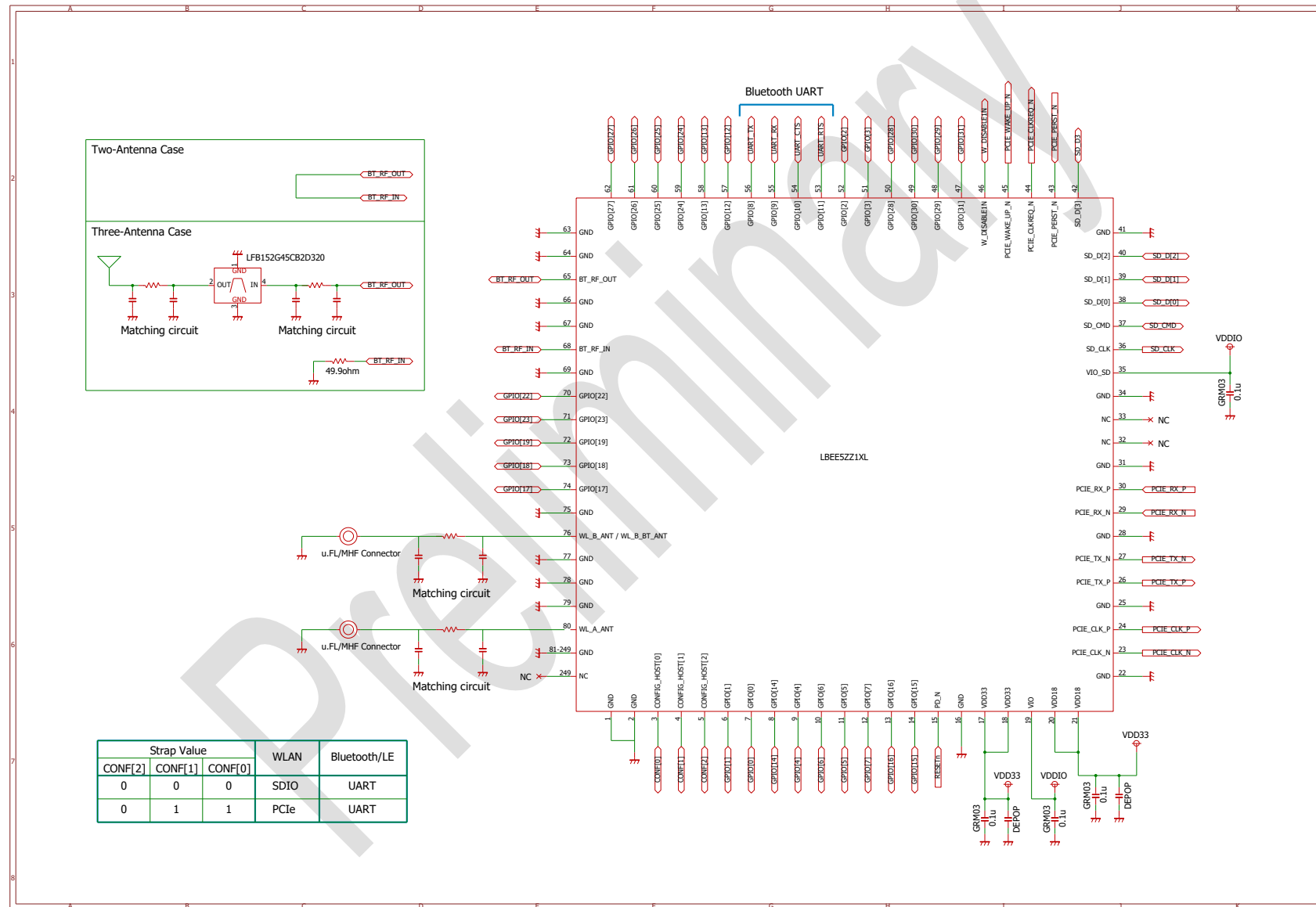
11. Land Patterns

TBD

(unit : mm)

Preliminary

12. Reference Circuit



13. Tape and Reel Packing

TBD

(2) Dimensions of Reel

TBD

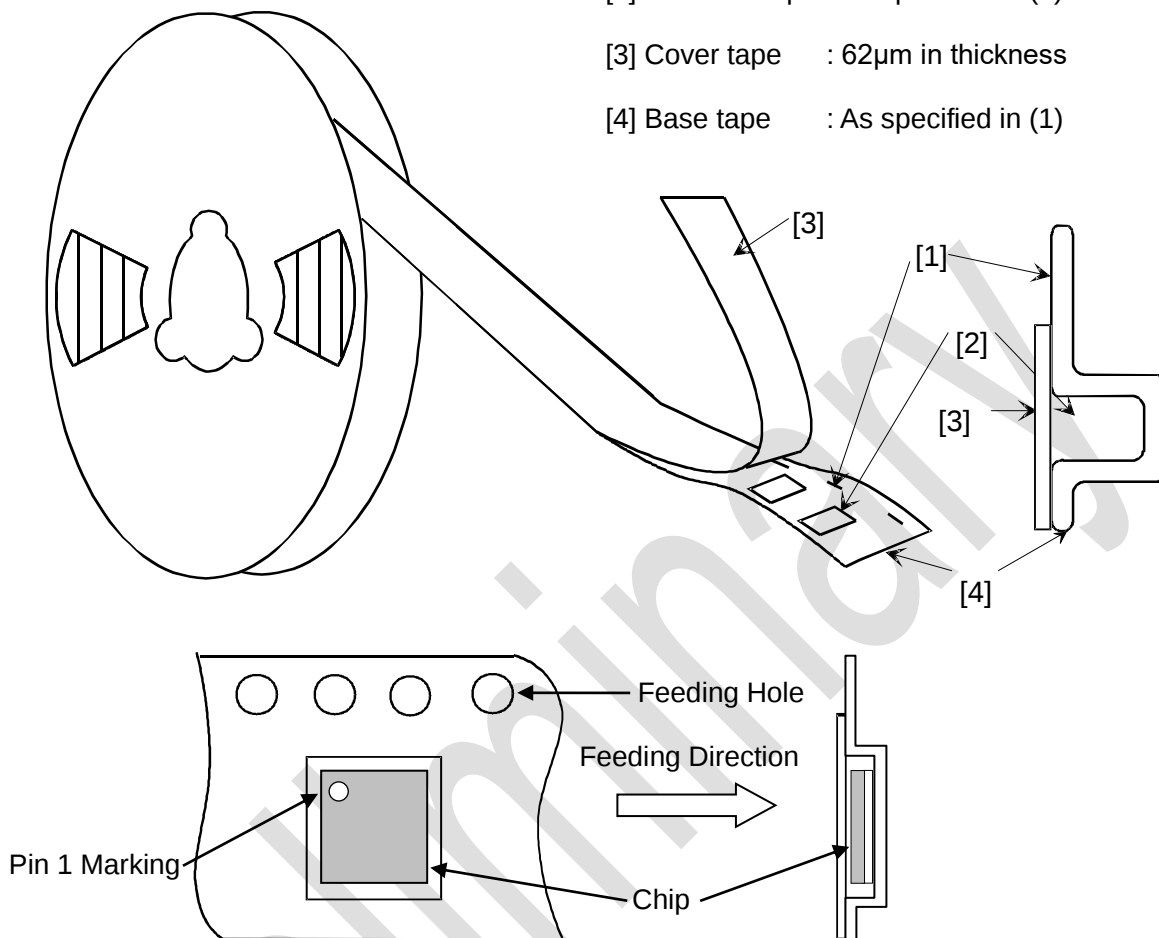
(3) Taping Diagrams

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

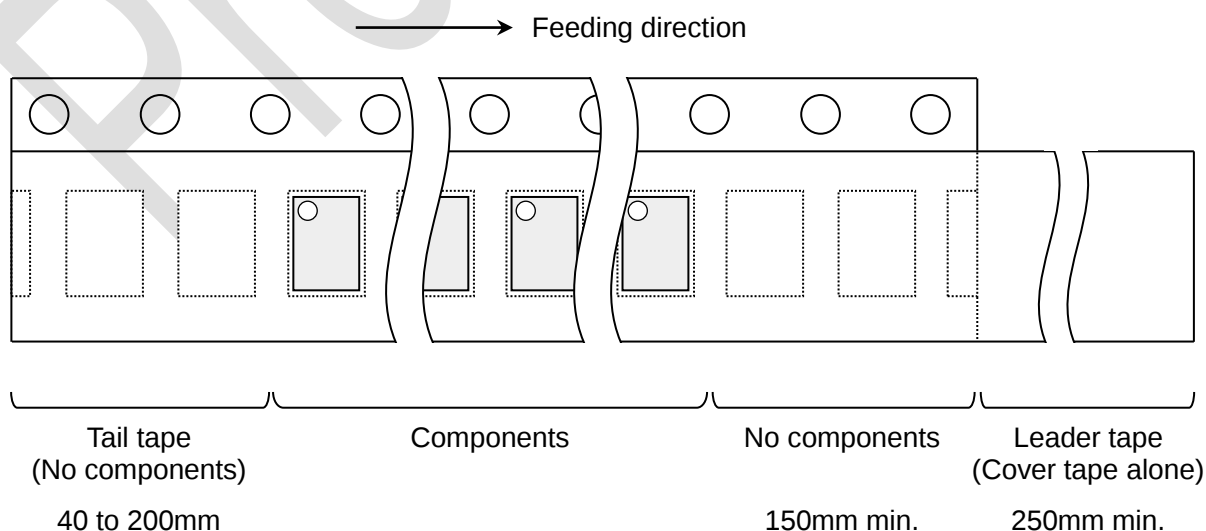
[2] Hole for chip : As specified in (1)

[3] Cover tape : 62μm in thickness

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

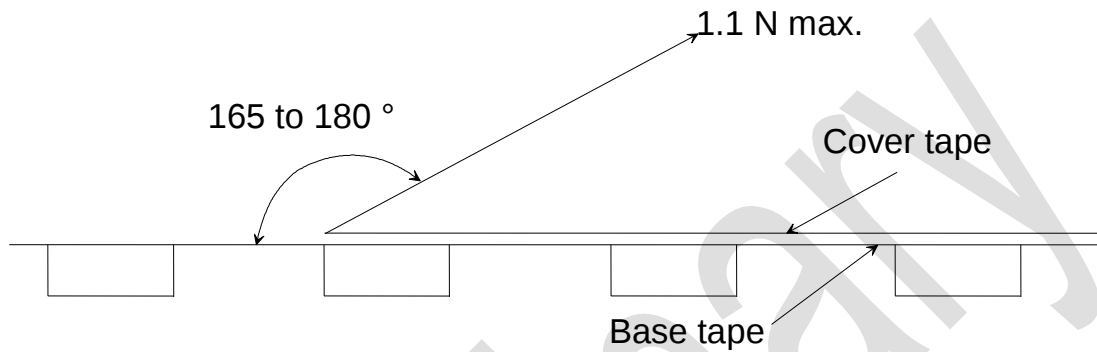


(4) Leader and Tail tape

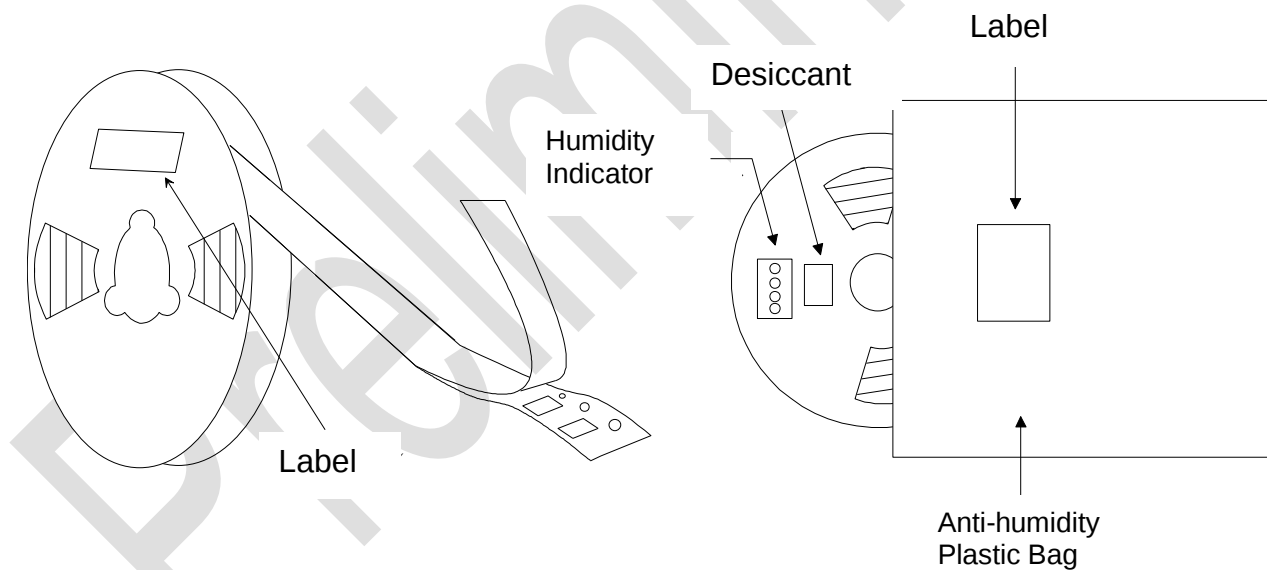


(5) The tape for chips are wound clockwise, the feeding holes to the right side as the tape is pulled toward the user.

- (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 : 1,000 pcs./ 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.

14. NOTICE

14.1. 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.

14.2. 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.

14.3. 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.

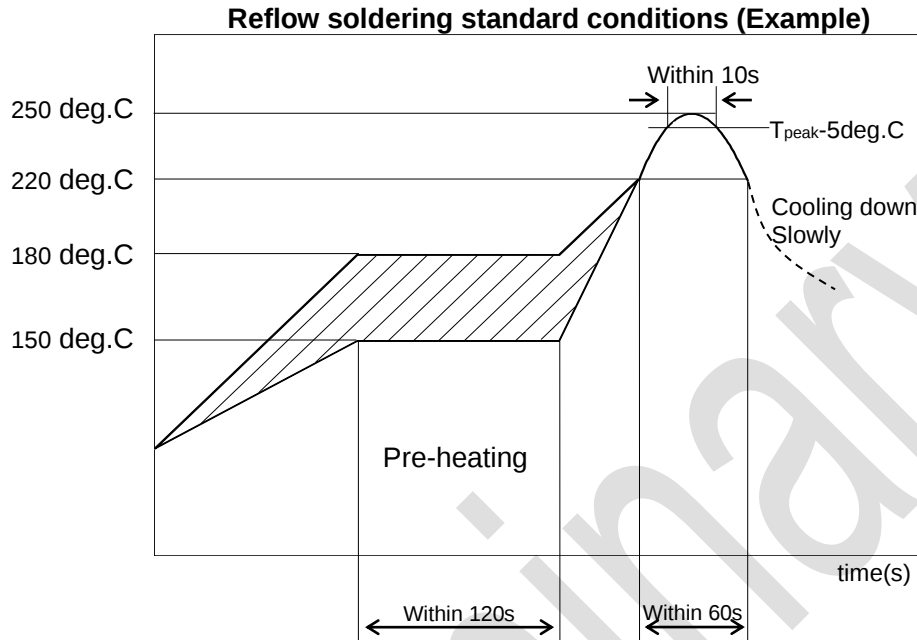
14.4. Notice for Chip Placer:

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.

14.5. 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.

14.6. 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.

14.7. 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 (Cl_2 , NH_3 , 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.

15. PRECONDITION TO USE OUR PRODUCTS

PLEASE READ THIS NOTICE BEFORE USING OUR PRODUCTS.

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

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

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

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