

RF EXPOSURE REPORT

OF

Applicant: Murata Manufacturing Co., Ltd.
1-10-1, Higashikotari, Nagaokakyo-shi, Kyoto 617-8555
Japan

Product Name: Communication Module

Brand Name: muRata

Model No.: LBEE5XV1YM

Model Difference: N/A

Report Number: ER/2020/C0067

FCC ID: VPYLB1YM

IC: 772C-LB1YM

FCC Rule Part Part 2.1091

IC Rule: RSS-102 issue 5 Mar. 19, 2015

Issue Date: Dec. 30, 2020

We hereby certify that:

The above equipment was verified by SGS Taiwan Ltd. The evaluation in this report is in compliance with the above rule(s).

The results of this report relate only to the sample identified in this report.

Approved By:

John Teh

John Yeh / Asst. Manager

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Revision History

Report Number	Revision	Description	Issue Date	Remark
ER/2020/C0067	Rev.00	Original.	Dec. 30, 2020	Revised By: Elle Chang

Note:

- 1、Disclaimer
Antenna information is provided by the applicant, test results of this report are applicable to the sample EUT received.

- 2、Measurement results in the original test report ER/2020/80124 are fully leveraged in this test report without further verification test.

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1 DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)

1.1 General:

Product Name:	Communication Module
Brand Name:	muRata
Model No.:	LBEE5XV1YM
Model Difference:	N/A
Hardware Version:	1.0
Software Version:	1.0
Power Supply:	3.3Vdc

1.2 Maximum Output power

The Max. output power value is derived from test report.

BT	Report Number:	ER/2020/C0062
	Test Lab:	SGS Taiwan Ltd.
BLE	Report Number:	ER/2020/C0063
	Test Lab:	SGS Taiwan Ltd.
WLAN 2.4GHz	Report Number:	ER/2020/C0064
	Test Lab:	SGS Taiwan Ltd.
WLAN 5GHz	Report Number:	ER/2020/C0065
	Test Lab:	SGS Taiwan Ltd.

Note: EUT serial number is 1617633250 and sample number is DUT No. 20.

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1.3 Antenna Information:

1.3.1 BT / WLAN 2.4GHz

Antenna Type	Supplier	Antenna Part No.	Freq. (MHz)	Peak Antenna Gain (dBi)	Worst Antenna Gain
Dipole	Molex	146153	2.4GHz	3.20	
		146187		3.40	V

WLAN 2.4GHz Directional Gain = 6.41 dBi

1.3.2 WLAN 5GHz

Antenna Type	Supplier	Antenna Part No.	Freq. (MHz)	Peak Antenna Gain (dBi)	Worst Antenna Gain
Dipole	Molex	146153	5GHz	4.25	
		146187		4.75	V

WLAN 5GHz Directional Gain = 7.76 dBi

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1.4 Rated Power

1.4.1 Bluetooth / WLAN 2.4GHz

Mode	Freq. Range (MHz)	Channels	Modulation Technology	Max Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Worst Case
BR+EDR	2402-2480	79	GFSK + $\pi/4$ DQPSK + 8DPSK	5.7	3.40	9.10	
BLE	2402-2480	40	GFSK	5.8		9.20	
802.11b/g/n_HT20 ac_VHT20	2412-2462	11	DSSS & OFDM	20.73	6.41	27.14	V
Modulation type:		CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in 802.11ac only					

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1.4.2 WLAN 5GHz:

802.11	Freq. Range (MHz)	Modulation Technology	Max. Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Worst Case
a	5150~5250	OFDM	12.74	7.76	20.50	
	5250~5350		18.89	7.76	26.65	
	5470~5725		18.82	7.76	26.58	
	5725~5850		19.98	7.76	27.74	V
n HT20 ac VHT20	5150~5250		12.79	7.76	20.55	
	5250~5350		18.97	7.76	26.73	
	5470~5725		18.94	7.76	26.70	
	5725~5850		19.56	7.76	27.32	
n HT40 ac VHT40	5150~5250		14.86	7.76	22.62	
	5250~5350		17.83	7.76	25.59	
	5470~5725		17.84	7.76	25.60	
	5725~5850		18.98	7.76	26.74	
ac VHT80	5150~5250		9.59	7.76	17.35	
	5250~5350		9.86	7.76	17.62	
	5470~5725		16.98	7.76	24.74	
	5725~5850		17.97	7.76	25.73	

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2 FCC MAXIMUM PERMISSIBLE EXPOSURE (MPE)

2.1 FCC Standard Applicable

According to §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

This is a Mobile device, the MPE is required.

According to §1.1310 and §2.1091 RF exposure is calculated.

Limits for Maximum Permissive Exposure (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minute)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f ²)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-15000	/	/	1.0	30

f = frequency in MHz

* = Plane-wave equipment power density

Prediction of MPE limit at a given distance

$$S = PG / 4\pi R^2$$

Where: S = Power density

P = Power input to antenna

G = Power gain of the antenna in the direction of interest relative to an isotropic radiator

R = Distance to the center of radiation of the antenna

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2.2 ISED Standard Applicable

This submittal(s) (test report) is intended to comply with RSS-102 issue 5 Radio frequency Radiation Exposure requirement.

This is a Mobile device, the MPE is required.

Limits for Maximum Permissible Exposure (MPE)

RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)				
Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field Strength (A/m rms)	Power Density (W/m ²)	Reference Period (minutes)
0.003-10	83	90	-	Instantaneous*
0.1-10	-	0.73/ <i>f</i>	-	6**
1.1-10	87/ <i>f</i> ^{0.5}	-	-	6**
10-20	27.46	0.0728	2	6
20-48	58.07/ <i>f</i> ^{0.25}	0.1540/ <i>f</i> ^{0.25}	8.944/ <i>f</i> ^{0.5}	6
48-300	22.06	0.05852	1.291	6
300-6000	3.142 <i>f</i> ^{0.3417}	0.008335 <i>f</i> ^{0.3417}	0.02619 <i>f</i> ^{0.6834}	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ <i>f</i> ^{1.2}
150000-300000	0.158 <i>f</i> ^{0.5}	4.21 x 10 ⁻⁴ <i>f</i> ^{0.5}	6.67 x 10 ⁻⁵ <i>f</i>	616000/ <i>f</i> ^{1.2}

F = frequency in MHz

* = Based on nerve stimulation (NS).

** = Based on specific absorption rate (SAR)

Maximum Permissible Exposure (MPE) Evaluation

Prediction of MPE limit at a given distance

$$S = PG / 4\pi R^2$$

Where: S = Power density

P = Power input to antenna

G = Power gain of the antenna in the direction of interest relative to an isotropic radiator

R = Distance to the center of radiation of the antenna

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2.3 Power Density Calculation (Worst Case)

FCC Standalone MPE

Operation Mode	Evaluation Frequency (MHz)	Operation Distance (cm)	Max. output Power (dBm)	Antenna Gain (dBi)	Max. output Power EIRP (mW)	Power Density (PD) (mW/cm ²)	Limit (mW/cm ²)	Pass / Fail	Power Density / Limit
BLE	2480.00	20	5.8	3.40	8.32	0.002	1.000	Pass	0.002
WLAN 2.4G	2452.00	20	20.73	6.41	517.61	0.103	1.000	Pass	0.103
WLAN 5G	5745.00	20	19.98	7.76	594.29	0.118	1.000	Pass	0.118

ISED Standalone MPE

Operation Mode	Evaluation Frequency (MHz)	Operation Distance (cm)	Max. output Power (dBm)	Antenna Gain (dBi)	Output Power EIRP (mW)	Power Density (PD) (W/m ²)	Limit (W/m ²)	Pass / Fail	Power Density / Limit
BLE	2480.00	20	5.8	3.40	8.32	0.017	5.469	Pass	0.003
WLAN 2.4G	2452.00	20	20.73	6.41	517.61	1.030	5.427	Pass	0.190
WLAN 5G	5745.00	20	19.98	7.76	594.29	1.183	9.710	Pass	0.122

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2.4 Collocated Power Density Calculation

FCC Collocated MPE

Max BT PD / Limit	Max WLAN PD / Limit	Σ (Power Density / Limit) of BT+ WLAN + WWAN
0.002	0.118	0.120

ISED Collocated MPE

Max BT PD / Limit	Max WLAN PD / Limit	Σ (Power Density / Limit) of BT+ WLAN + WWAN
0.003	0.190	0.193

Note:

1. Σ (E- Field Strength / Limit): This is a summation of [(E- Field Strength for each transmitter/antenna included in the simultaneous transmission) / (corresponding MPE limit)].
2. Considering the collocated transmitters, the aggregated (E- Field Strength /limit) is smaller than 1, and MPE of collocated transmitters is compliant

~ End of Report ~

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