

RF EXPOSURE REPORT



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

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

Product Name: Communication Module

Brand Name: muRata

Model No.: LBEE5XV1YM

Model Difference: N/A

Report Number: TESA2402000090ES

FCC ID VPYLB1YM

IC: 772C-LB1YM

Date of EUT Received: February 20, 2024

Issue Date: April 3, 2024

Approved By

John Yeh

John Yeh

We hereby certify that:

The above equipment was evaluated by SGS Taiwan Ltd. The evaluation in this report is in compliance with FCC Rule Part §2.1091 and RSS-102.

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

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Revision History

Report Number	Revision	Description	Issue Date	Revised By	Remark
TESA2402000090ES	00	Original.	April 3, 2024	Susan Lin	

Note:

- The remark "*" indicates modification of the report upon requests from certification body.

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1 DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)

1.1 Product Description

Product Name:	Communication Module
Brand Name:	muRata
Model No.:	LBEE5XV1YM
Model Difference:	N/A
Hardware Version:	1.0
Firmware Version:	1.0
EUT Series No.:	000038946
Power Supply:	3.3Vdc

1.2 Evaluation site

Laboratory	Site Address	FCC Designation number	ISED Company Number	CAB Identifier
SGS Taiwan Ltd. Central RF Lab. (TAF code 3702)	<input type="checkbox"/> No. 134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, 24803, Taiwan.	TW0027	4620A	TW3702
	<input checked="" type="checkbox"/> No. 2, Keji 1st Rd., Guishan Township, Taoyuan County, 333 Taiwan.	TW0028	4620E	
	<input type="checkbox"/> 1F, No. 8, Alley 15, Lane 120, Sec. 1, Nei Hu Road, Nei Hu District, Taipei City, 222 Taiwan.	TW0029	23862	

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1.3 Antenna Information:

1.3.1 BT / WLAN 2.4GHz

Antenna Type	Supplier	Main / Aux	Freq. (MHz)	Peak Antenna Gain (dBi)	MIMO Antenna Gain (dBi)
Monopole	Devialet	PathA	2.4GHz	3.10	5.62
		PathB		2.10	5.62

1.3.2 WLAN 5GHz

Antenna Type	Supplier	Main / Aux	Note
Monopole	Devialet	PathA	Ant 1
		PathB	Ant 2

Operating Frequency (MHz)	Ant 1 Peak Gain (dBi)	Ant 2 Peak Gain (dBi)
5150.0 ~ 5250.0	1.90	4.20
5250.0 ~ 5350.0	1.90	4.20
5470.0 ~ 5725.0	4.30	3.00
5725.0 ~ 5850.0	4.50	1.80

Note: Antenna information is provided by the applicant.

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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)	Antenna Directional Gain (dBi)	EIRP (dBm)	Worst Case
BR+EDR	2402-2480	79	GFSK + π / 4DQPSK + 8DPSK	6	2.10	N/A	8.10	V
BLE	2402-2480	40	GFSK	6	2.10		8.10	
802.11b/g/n_HT20	2412-2462	11	DSSS & OFDM	21	2.10	5.62	26.62	V
802.11 ac_VHT20				20	2.10	5.62	25.62	
Modulation type:			CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM					

1.4.2 WLAN 5GHz (FCC):

802.11	Freq. Range (MHz)	Modulation Technology	Max. Output Power Include Tolerance (dBm)	Antenna Gain (dBi)	Antenna Directional Gain (dBi)	EIRP (dBm)	Worst Case
a	5150~5250	OFDM	13.00	4.20	6.12	19.12	
	5250~5350		19.00	4.20	6.12	25.12	
	5470~5725		19.00	4.30	6.68	25.68	
	5725~5850		20.00	4.50	6.27	26.27	V
n HT20 ac VHT20	5150~5250		13.00	4.20	6.12	19.12	
	5250~5350		19.00	4.20	6.12	25.12	
	5470~5725		19.00	4.30	6.68	25.68	
	5725~5850		20.00	4.50	6.27	26.27	V
n HT40 ac VHT40	5150~5250		15.00	4.20	6.12	21.12	
	5250~5350		18.00	4.20	6.12	24.12	
	5470~5725		18.00	4.30	6.68	24.68	
	5725~5850		19.00	4.50	6.27	25.27	
ac VHT80	5150~5250		10.00	4.20	6.12	16.12	
	5250~5350		10.00	4.20	6.12	16.12	
	5470~5725		17.00	4.30	6.68	23.68	
	5725~5850		18.00	4.50	6.27	24.27	

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1.4.3 WLAN 5GHz (IC):

802.11	Freq. Range (MHz)	Modulation Technology	Max. Output Power Include Tolerance (dBm)	Antenna Gain (dBi)	Antenna Directional Gain (dBi)	EIRP (dBm)	Power Density (PD) (W/m ²)	Limit (W/m ²)	Power Density / Limit	Worst Case
a	5180 ~ 5240	OFDM	13.00	4.20	6.12	19.12	0.163	9.047	0.018	
	5260 ~ 5320		19.00	4.20	6.12	25.12	0.647	9.142	0.071	
	5500 ~ 5580		19.00	4.30	6.68	25.68	0.736	9.425	0.078	
	5660 ~ 5700		19.00	4.30	6.68	25.68	0.736	9.612	0.077	
	5745 ~ 5825		20.00	4.50	6.27	26.27	0.843	9.710	0.087	V
n HT20 ac VHT20	5180 ~ 5240		13.00	4.20	6.12	19.12	0.163	9.047	0.018	
	5260 ~ 5320		19.00	4.20	6.12	25.12	0.647	9.142	0.071	
	5500 ~ 5580		19.00	4.30	6.68	25.68	0.736	9.425	0.078	
	5660 ~ 5700		19.00	4.30	6.68	25.68	0.736	9.612	0.077	
	5745 ~ 5825		20.00	4.50	6.27	26.27	0.843	9.710	0.087	
n HT40 ac VHT40	5190 ~ 5230		15.00	4.20	6.12	21.12	0.258	9.059	0.028	
	5270 ~ 5310		18.00	4.20	6.12	24.12	0.514	9.154	0.056	
	5510 ~ 5550		18.00	4.30	6.68	24.68	0.585	9.437	0.062	
	5670 ~ 5670		18.00	4.30	6.68	24.68	0.585	9.624	0.061	
	5755 ~ 5795		19.00	4.50	6.27	25.27	0.670	9.722	0.069	
ac VHT80	5210 ~ 5210	10.00	4.20	6.12	16.12	0.081	9.083	0.009		
	5290 ~ 5290	10.00	4.20	6.12	16.12	0.081	9.178	0.009		
	5530 ~ 5530	17.00	4.30	6.68	23.68	0.464	9.460	0.049		
	5775 ~ 5775	18.00	4.50	6.27	24.27	0.532	9.745	0.055		

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2 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
1500-100000	/	/	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 Include Tolerance (dBm)	Antenna Gain (dBi)	Max. EIRP (mW)	Power Density (PD) (mW/cm ²)	Limit (mW/cm ²)	Pass / Fail	Power Density / Limit	Collocated MPE
BT	2480.00	20	6	2.10	6.46	0.0013	1.000	Pass	0.001	V
WLAN 2.4G_MIMO	2462.00	20	21	5.62	459.20	0.091	1.000	Pass	0.091	V
WLAN 5G_MIMO	5725.00	20	20	6.27	423.64	0.084	1.000	Pass	0.084	V

ISED Standalone MPE

Operation Mode	Evaluation Frequency (MHz)	Operation Distance (cm)	Max. Output Power Include Tolerance (dBm)	Antenna Gain (dBi)	Max. EIRP (mW)	Power Density (PD) (W/m ²)	Limit (W/m ²)	Pass / Fail	Power Density / Limit	Collocated MPE
BT	2480.00	20	6	2.10	6.46	0.013	5.469	Pass	0.002	V
WLAN 2.4G_MIMO	2462.00	20	21	5.62	459.20	0.914	5.442	Pass	0.168	V
WLAN 5G_MIMO	5745.00	20	20	6.27	423.64	0.843	9.710	Pass	0.087	V

2.4 Collocated Power Density Calculation

FCC Collocated MPE

Operation Mode	Σ (Power Density / Limit)
WLAN 5G_MIMO+BT	0.085
WLAN 2.4G_MIMO	0.091

ISED Collocated MPE

Operation Mode	Σ (Power Density / Limit)
WLAN 5G_MIMO+BT	0.089
WLAN 2.4G_MIMO	0.168

Note:

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

~ End of Report ~

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