

RF EXPOSURE REPORT

OF

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

Product Name: Communication Module

Brand Name: muRata

Model No.: LBEQ6ZZ1BN

Model Difference: N/A

Report Number: ER/2019/A0020

FCC ID VPYLB1BN

IC 772C-LB1BN

FCC Rule Part Part 2.1091

IC Rule Part RSS-102

Issue Date: Oct. 24, 2019

Date of Test: Aug. 28, 2018 ~ Oct. 05, 2019

Date of EUT Received: Aug. 22, 2018

We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. The test data, data evaluation in this report is in compliance with FCC Rules Part 2 & ISSED RSS-102.

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

Approved By: _____

John Yeh / Assistant Manager

John Yeh

Testing Laboratory
0513

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Revision History			
Revision	Description	Issue Date	Remark
Rev.00	Original.	Oct. 24, 2019	Revised By: Yuri Tsai

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1 DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)

1.1 General:

Product Name:	Communication Module
Brand Name:	muRata
Model No.:	LBEQ6ZZ1BN
Model Difference:	N/A
Hardware version:	1.0
Software version:	1.0
Power Supply:	Typ. 3.3V, Min 3.0V, Max 3.6V from DC power supply

BLE

Radio Technology:	Bluetooth LE Single mode
Frequency Range:	2402 – 2480MHz
Channel number:	40 channels
Modulation type:	GFSK
Transmit Power:	9.23 dBm
Antenna Designation:	Dipole Antenna, Gain: 2.37dBi Model No: GW.59.3153; Supplier: Taoglas

Bluetooth

Radio Technology:	Bluetooth BR+EDR
Channel number:	79 channels
Modulation type:	GFSK + $\pi/4$ DQPSK + 8DPSK
Transmit Power:	10.25 dBm
Frequency Range:	2.402GHz – 2.480GHz
Dwell Time:	$\leq 0.4s$
Antenna Designation:	Dipole Antenna, Gain: 2.37dBi Model No: GW.59.3153; Supplier: Taoglas

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WLAN 2.4GHz:

Wi-Fi	Frequency Range	Channels	Rated Power in dBm (Peak)	Rated Power in dBm (EIRP)	Type of Emission	Modulation Technology
802.11b	2412-2462	11	19.69	19.15	13M4G1D	DSSS,
802.11g			24.68	18.73	16M8D1D	OFDM
802.11n HT20			25.23	20.63	17M7D1D	
Antenna Designation:		Dipole Antenna, Gain: 2.37dBi Model No: GW.59.3153; Supplier: Taoglas				
Modulation type:		CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM				
Transition Rate:		802.11 b: 1/2/5.5/11 Mbps 802.11 g: 6/9/12/18/24/36/48/54 Mbps 802.11 n_20MHz: 6.5 – 144.4Mbps				

FCC WLAN 5GHz:

Wi-Fi	Frequency Range	Channels	Avg. Power (dBm)	Modulation Technology
11a_20	5150~5250	4	12.48	OFDM
	5250~5350	4	12.51	
	5470~5725	12	12.35	
	5725-5850	5	12.42	
11n_HT / ac_VHT 20M	5150~5250	4	HT: 15.83	OFDM
	5250~5350	4	HT: 15.63	
	5470~5725	12	HT: 15.40	
	5725-5850	5	HT: 15.32	
11n_HT / ac_VHT 40M	5150~5250	2	HT: 15.64	OFDM
	5250~5350	2	HT: 15.49	
	5470~5725	6	HT: 15.63	
	5725-5850	2	HT: 15.30	
11ac VHT80M	5150~5250	1	10.38	OFDM
	5250~5350	1	10.56	
	5470~5725	2	12.44	
	5725-5850	1	12.26	
Antenna Designation:		Dipole Antenna, Supplier: Taoglas Model No.: GW.59.3153 5150~5250MHz Peak Gain: 2.93dBi 5250~5350MHz Peak Gain: 2.93dBi 5470~5725MHz Peak Gain: 2.93dBi 5725~5850MHz Peak Gain: 2.93dBi		

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IC WLAN 5GHz:

Wi-Fi	Frequency Range	Channels	Avg. or EIRP	Rated Power(dBm) (Worst Case)	Modulation Technology
11a	5150~5250	4	EIRP	15.41	OFDM
	5250~5350	4	Avg.	12.51	
	5470~5725	12	Avg.	12.35	
	5725-5850	5	Avg.	12.42	
11n_HT / ac_VHT 20M	5150~5250	4	EIRP	HT: 21.77	OFDM
	5250~5350	4	Avg.	HT: 15.63	
	5470~5725	12	Avg.	HT: 15.40	
	5725-5850	5	Avg.	HT: 15.32	
11n_HT / ac_VHT 40M	5150~5250	2	EIRP	HT: 21.58	OFDM
	5250~5350	2	Avg.	HT: 15.49	
	5470~5725	6	Avg.	HT: 15.63	
	5725-5850	2	Avg.	HT: 15.30	
11ac VHT80M	5150~5250	1	EIRP	16.32	OFDM
	5250~5350	1	Avg.	10.56	
	5470~5725	2	Avg.	12.44	
	5725-5850	1	Avg.	12.26	
Modulation type		64QAM, 16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in 802.11ac only			
Transition Rate:		802.11 a: 6/9/12/18/24/36/48/54 Mbps 802.11 n_20MHz: 6.5 – 144.4Mbps 802.11 n_40MHz: 13.5 - 300.0Mbps 802.11 ac_20MHz: 6.5 –173.3Mbps 802.11 ac_40MHz: 13.5 – 400 .0Mbps 802.11 ac_80MHz: 29.3 – 866.7Mbps			

1.2 Test data is referenced from cross authorization(s)

Measurement results in the original test report ER/2018/80100 & ER/2018/80101 under FCC ID: VPYLB1PN / IC: 772C-LB1PN are partially leveraged in this test report.

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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

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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)

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	-	$0.73/f$	-	6**
1.1-10	$87/f^{0.5}$	-	-	6**
10-20	27.46	0.0728	2	6
20-48	$58.07/f^{0.25}$	$0.1540/f^{0.25}$	$8.944/f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	$3.142 f^{0.3417}$	$0.008335 f^{0.3417}$	$0.02619 f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	$616000/f^{1.2}$
150000-300000	$0.158 f^{0.5}$	$4.21 \times 10^{-4} f^{0.5}$	$6.67 \times 10^{-5} f$	$616000/f^{1.2}$

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 MPE								
Operation Mode	Evaluation Frequency (MHz)	Operation Distance (cm)	Max. output Power (dBm)	Antenna Gain (dBi)	Max. output Power EIRP (mW)	Power Density (mW/cm ²)	Limit (mW/cm ²)	Pass / Fail
BT	2402.00	20	9.83	2.37	16.60	0.003	1.000	Pass
BLE	2480.00	20	6.47	2.37	7.66	0.002	1.000	Pass
WLAN 2.4G	2437.00	20	16.78	2.37	82.22	0.016	1.000	Pass
WLAN 5G	5220.00	20	15.83	5.94	150.31	0.030	1.000	Pass

IC MPE								
Operation Mode	Evaluation Frequency (MHz)	Operation Distance (cm)	Max. output Power (dBm)	Antenna Gain (dBi)	Output Power EIRP (mW)	Power Density (W/m ²)	Limit (W/m ²)	Pass / Fail
BT	2402.00	20	9.83	2.37	16.60	0.033	5.351	Pass
BLE	2480.00	20	6.47	2.37	7.66	0.015	5.469	Pass
WLAN 2.4G	2437.00	20	16.78	2.37	82.22	0.164	5.404	Pass
WLAN 5G	5220.00	20	15.83	5.94	150.31	0.299	9.095	Pass

~ End of Report ~

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