

RF EXPOSURE REPORT



FCC Applicant: Murata Manufacturing Co., Ltd.
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Japan

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

Product Name: Communication Module

Brand Name: muRata

Model No.: LBEE5ZZ1XL, LBEE5ZZ2XS

Model Difference: Refer to section 1.3

Report Number: TESA2303000128ES

FCC ID VPYLBEE5ZZ1XL

Issue Date: March 29, 2023

Date of EUT Received: January 11, 2022

Approved By

John Yeh

We hereby certify that:

The above equipment was evaluated by SGS Taiwan Ltd. Central RF Lab. The evaluation in this report is in compliance with FCC KDB 447498 D04v01.

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

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Revision History

Report Number	Revision	Description	Issue Date	Revised By	Remark
TESA2303000128ES	00	Original.	March 17, 2023	Karen Huang	
TESA2303000128ES	01	Update Firmware Version	March 29, 2023	Karen Huang	*

Note:

- 1、The remark "*" indicates modification of the report upon requests from certification body.
- 2、The original test report ES/2022/10004 are partially leveraged in this test report
- 3、Variant information of model numbers is provided by the applicant, test results of this report are applicable to the sample EUT(s) received and assessments of RSE, output power, emission bandwidth and frequency separation are conducted to ensure compliance.

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1 DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)

1.1 Product Description

Product Name:	Communication Module
Brand Name:	muRata
Model No.:	LBEE5ZZ1XL, LBEE5ZZ2XS
Hardware Version:	1
Firmware Version:	1.1.1.1
EUT Series No.:	1XL: Sample. No2 2XS: Sample. No5
Power Supply:	3.3Vdc, 1.8Vdc

1.2 Evaluation site

Laboratory	Site Address		FCC Designation number
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
	<input checked="" type="checkbox"/>	No. 2, Keji 1st Rd., Guishan Township, Taoyuan County, 333 Taiwan.	TW0028
	<input type="checkbox"/>	1F, No. 8, Alley 15, Lane 120, Sec. 1, Nei Hu Road, Nei Hu District, Taipei City, 222 Taiwan.	TW0029

1.3 Model Difference

LBEE5ZZ1XL has a dedicated antenna port for BT.

LBEE5ZZ2XS BT shares same antenna port with WLAN.

Some passive components are different between models as below.

LBEE5ZZ1XL	LBEE5ZZ2XS
C 336 No mounted	C336 mounted
C337 mounted	C337 No mounted
L310 mounted	L310 No mounted

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2 DETERMINATION OF MPE EXEMPTION

2.1 Single RF Source

As per §1.1307(b)(3)(i),

- (A) The available maximum time-averaged power is no more than 1 mW, regardless of separation distance. This exemption may not be used in conjunction with other exemption criteria other than those in paragraph (b)(3)(ii)(A) of this section. Medical implant devices may only use this exemption and that in paragraph (b)(3)(ii)(A);
- (B) Or the available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold P_{th} (mW) described in the following formula. This method shall only be used at separation distances (cm) from 0.5 centimeters to 40 centimeters and at frequencies from 0.3 GHz to 6 GHz (inclusive). P_{th} is given by:

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}} (d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases}$$

Where

$$x = -\log_{10} \left(\frac{60}{ERP_{20 \text{ cm}} \sqrt{f}} \right) \text{ and } f \text{ is in GHz;}$$

and

$$ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases}$$

d = the separation distance (cm);

Note: when 10-g extremity SAR applies, SAR test exemption may be considered by applying a factor of 2.5 to the SAR-based exemption thresholds.

- (C) Or using Table 1 and the minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value prescribed for that frequency. For the exemption in Table 1 to apply, R must be at least $\lambda/2\pi$, where λ is the free-space operating wavelength in meters. If the ERP of a single RF source is not easily obtained, then the available maximum time-averaged power may be used in lieu of ERP if the physical dimensions of the radiating structure(s) do not exceed the electrical length of $\lambda/4$ or if the antenna gain is less than that of a half-wave dipole (1.64 linear value).

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**Table 1 to § 1.1307(b)(3)(i)(C) –
Single RF Sources Subject to Routine Environmental Evaluation**

RF Source frequency (MHz)			Minimum Distance			Threshold ERP (W)
fL		fH	$\lambda L / 2\pi$		$\lambda H / 2\pi$	
0.3	-	1.34	159m	-	35.6m	1920 R ²
1.34	-	30	35.6m	-	1.6m	3450 R ² /f ²
30	-	300	1.6m	-	159mm	3.83 R ²
300	-	1500	159mm	-	31.8mm	0.0128 R ² f
1500	-	100000	31.8mm	-	0.5mm	19.2R ²

R= minimum separation distance in meter

f = frequency in MHz

2.2 Multiple RF Sources

In the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation.

$$\sum_{i=1}^a \frac{P_i}{P_{th,i}} + \sum_{j=1}^b \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^c \frac{Evaluated_k}{Exposure Limit_k} \leq 1$$

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2.3 Single RF Source Evaluation Results

Chain 0+1	Frequency (MHz)	Max. tune-up power (dBm)	Peak gain (dBi)	ERP (dBm)	ERP (W)	Permissible Minimum separation distance (1/2p) (m)	R = actual Minimum separation distance(m)	ERP _{th} (W)	ERP/ERP _{th}	Simultaneous transmission modes					
										1	2	3	4	5	6
WiFi 2.4GHz	2417	22.91	6.21	26.97	0.498	0.0198	0.200	0.768	0.648						
WiFi 5GHz	5300	21.94	7.26	27.05	0.507	0.0090	0.200	0.768	0.660	V	V				
2XS	Frequency (MHz)	Max. tune-up power (dBm)	Peak gain (dBi)	ERP (dBm)	ERP (W)	Permissible Minimum separation distance (1/2p) (m)	R = actual Minimum separation distance(m)	ERP _{th} (W)	ERP/ERP _{th}	Simultaneous transmission modes					
										1	2	3	4	5	6
BT	2402	5.96	3.2	7.01	0.005	0.0199	0.200	0.768	0.007	V					
BLE	2442	5.96	3.2	7.01	0.005	0.0196	0.200	0.768	0.007	V					

Note: For conservativeness, the lowest uplink frequency of each band is used to determine the permissible minimum separation distance of that band.

2.4 Multiple RF Sources Evaluation Results

Simultaneous transmission modes	Σ ERP/ERP _{th}	Criteria
1	0.667	1
2	0.667	1

Note:

1. $\Sigma(ERP/ERP_{th})$: This is a summation of [(ERP of RF source / exemption threshold ERP for RF source)].
Considering the collocated transmitters, the aggregated (ERP/ERP_{th}) is smaller than 1, and MPE of collocated transmitters is compliant

~ End of Report ~

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