

RF EXPOSURE REPORT



Applicant: Murata Electronics North America
2200 Lake Park Drive Smyrna Georgia United States 30080-7604

Manufacturer: Murata Electronics North America
2200 Lake Park Drive Smyrna Georgia United States 30080-7604

Product Name: LBES0ZZ2FR

Brand Name: Murata Electronics North America

Model No.: LBES0ZZ2FR

FCC ID HSW2FR

IC: 4492A-2FR

Date of EUT Received: Dec. 29, 2023

Issue Date: Aug. 13, 2024

Approved By

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 §1.1307, KDB 447498 D04 v01 and RSS-102 ISSUE 6.

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

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SGS Taiwan Ltd.

No.134,Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan/新北市五股區新北產業園區五工路 134 號

台灣檢驗科技股份有限公司

t (886-2) 2299-3279

f (886-2) 2298-0488

www.sgs.com.tw

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Revision History

Report Number	Revision	Description	Issue Date	Revised By	Remark
TESA2312000785ES	00	Original.	Aug. 13, 2024	Yami Kuo	

Note:

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

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f (886-2) 2298-0488

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1 DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)

1.1 Product Description

Product Name:	LBES0ZZ2FR
Brand Name:	Murata Electronics North America
Model No.:	LBES0ZZ2FR

1.2 Evaluation site

Laboratory	Site Address		FCC Designation number	ISED Company Number	CAB Identifier
SGS Taiwan Ltd. Central RF Lab. (TAF code 3702)	☐	No. 134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, 24803, Taiwan.	TW0027	4620A	TW3702
	☒	No. 2, Keji 1st Rd., Guishan Township, Taoyuan County, 333 Taiwan.	TW0028	4620E	
	☐	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	Freq. (MHz)	Peak Antenna Gain (dBi)
PCB Monopole	2.4GHz	2.60
Flex Dipole	2.4GHz	3.20

1.3.2 WLAN 5GHz

Antenna Type	Freq. (MHz)	Peak Antenna Gain (dBi)
PCB Monopole	5GHz	3.60
Flex Dipole	5GHz	4.25

Note: Antenna information is provided by the applicant.

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2 DETERMINATION OF MPE EXEMPTION

2.1 FCC

2.1.1 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

2.1.2 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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2.1.3 Single RF Source Evaluation Results

Band	Frequency (MHz)	Max. tune-up power (dBm)	Peak gain (dBi)	ERP (dBm)	ERP (W)	Permissible Minimum separation distance ($\lambda/2\pi$) (m)	R = actual Minimum separation distance(m)	ERP _{th} (W)	ERP/ERP _{th}	Simultaneous transmission modes					
										1	2	3	4	5	6
BT/BLE	2442	14.5	3.2	15.55	0.036	0.0196	0.200	0.768	0.047	V	V				
Zigbee	2442	13.5	3.2	14.55	0.029	0.0196	0.200	0.768	0.038			V	V		
WiFi 2.4GHz	2442	20	3.2	21.05	0.127	0.0196	0.200	0.768	0.165	V		V			
WiFi 5GHz	5250	20	4.25	22.1	0.162	0.0091	0.200	0.768	0.211		V		V		

Note: For conservativeness, the lowest uplink frequency of each band is used to determine the minimum separation distance of that band. All the single RF source results (P or ERP) are less than their corresponding threshold (P_{th} or ERP_{th}), so they are exempt from RF exposure testing.

2.2 Multiple RF Sources Evaluation Results

Simultaneous transmission modes	Σ ERP/ERP _{th}	Criteria
1	0.212	1
2	0.258	1
3	0.203	1
4	0.249	1

Note:

1. Σ (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

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2.3 MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Standard Applicable

According to RSS-102 issue 6 §6.6 RF Exposure Evaluation

Field reference level (FRL) exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm (i.e. mobile devices), except when the device operates as follows:

below 20 MHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than 1 W (adjusted for tune-up tolerance)

at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than $4.49/f^{0.5}W$

(adjusted for tune-up tolerance), where f is in MHz

at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance)

at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834} W$

(adjusted for tune-up tolerance), where f is in MHz

at or above 6 GHz and the source-based, time-averaged maximum EIRP of the device is equal to or less than 5 W (adjusted for tune-up tolerance)

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the EIRP was derived.

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2.3.1 Field reference level (FRL) exposure exemption

Operation Mode	Evaluation Frequency (MHz)	Max. output Power include Tolerance (dBm)	Antenna Gain (dBi)	Max. EIRP (W)	Limit (W)	Max. EIRP / Limit	Pass / Fail	Simultaneous transmission modes						
								1	2	3	4	5	6	7
BT/BLE	2442.00	14.5	3.20	0.06	2.707	0.022	Pass	V	V					
Zigbee	2442.00	13.5	3.20	0.05	2.707	0.018	Pass			V	V			
WiFi 2.4GHz	2442.00	20	3.20	0.21	2.707	0.078	Pass	V		V				
WiFi 5GHz	5250.00	20	4.25	0.27	4.567	0.059	Pass		V		V			

Note: For conservativeness, the lowest uplink frequency of each band is used to determine the MPE limit of that band.

2.3.2 Exemption evaluation for simultaneous transmission

Simultaneous transmission modes	Σ Max. EIRP/Limt	Criteria
1	0.100	1
2	0.081	1
3	0.096	1
4	0.077	1

Note:

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

~ End of Report ~

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