

**RF EXPOSURE REPORT**

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

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

**Product Name:** Communication Module

**Brand Name:** muRata

**Model No.:** For FCC:  
LBEE5XV2EA, LBEE5XV2EB  
For ISED:  
LBEE5XV2EA\_SANT, LBEE5XV2EA\_DANT,  
LBEE5XV2EB\_SANT, LBEE5XV2EB\_DANT

**Model Difference:** Refer to section 1.3

**Report Number:** TESA2211000469ES

**FCC ID** VPYLBEE5XV2EA

**IC:** 772C-LBEE5XV2EA

**Issue Date:** June 14, 2023

**Date of EUT Received:** November 08, 2022

**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 and RSS-102.

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
TESA2211000469ES	00	Original	May 04, 2023	Violetta Tang	
TESA2211000469ES	01	Remove HMN information from page 5	June 02, 2023	Violetta Tang	
TESA2211000469ES	02	Correct firmware information on page 4	June 14, 2023	Violetta Tang	

### Note:

- 1、The remark "" indicates modification of the report upon requests from certification body.
- 2、Variant information of model numbers is provided by the applicant, test results of this report are applicable to the sample EUT(s) received.

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## 1 DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)

### 1.1 Product Description

Product Name:	Communication Module
Brand Name:	muRata
Model No.:	For FCC: LBEE5XV2EA, LBEE5XV2EB For ISED: LBEE5XV2EA_SANT, LBEE5XV2EA_DANT, LBEE5XV2EB_SANT, LBEE5XV2EB_DANT
Model Difference:	Refer to section 1.3
Hardware Version:	1.0
Firmware Version:	1.1.1.1 1.1.2.1 1.1.1.2 1.1.2.2
EUT Series No.:	SA2022019000001046
Power Supply:	3.3Vdc, 1.8Vdc

### 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 checked="" type="checkbox"/>	No. 134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, 24803, Taiwan.	TW0027	4620A	TW3702
	<input 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 Model Variants

The LBEE5XV2EA\_SANT and LBEE5XV2EA\_DANT are electrically identical.

Model For ISED	Model For FCC	Chip on C101	RF functions
LBEE5XV2EA_SANT	LBEE5XV2EA	CYW55573	2x2 WLAN2.4GHz,5GHz, 6GHz +BT/ BLE
LBEE5XV2EA_DANT			

The LBEE5XV2EB\_SANT and LBEE5XV2EB\_DANT are electrically identical.

Model For ISED	Model For FCC	Chip on C101	RF functions
LBEE5XV2EB_SANT	LBEE5XV2EB	CYW55572	2x2 WLAN2.4GHz,5GHz +BT/ BLE
LBEE5XV2EB_DANT			

In addition, the differences of firmware versions are

Model	Firmware versions	Antenna connector(s)	WLAN	BT	BLE
LBEE5XV2EA_DANT	1.1.2.1	3 (ANT0, ANT1, BT_ANT)	ANT0, ANT1	BT_ANT	BT_ANT
LBEE5XV2EB_DANT	1.1.2.2				
LBEE5XV2EA_SANT	1.1.1.1	2 (ANT0, ANT1)	ANT0, ANT1	ANT0	ANT0
LBEE5XV2EB_SANT	1.1.1.2				

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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  $\lambda$  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 <sup>2</sup>
1.34	-	30	35.6m	-	1.6m	3450 R <sup>2</sup> /f <sup>2</sup>
30	-	300	1.6m	-	159mm	3.83 R <sup>2</sup>
300	-	1500	159mm	-	31.8mm	0.0128 R <sup>2</sup> f
1500	-	100000	31.8mm	-	0.5mm	19.2R <sup>2</sup>

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

Operation Mode (ANT0)	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 <sub>th</sub> (W)	ERP/ERP <sub>th</sub>	Simultaneous transmission modes								
										1	2	3	4	5	6	7	8	9
BT / BLE	2442	10.5	3.2	11.55	0.014	0.0196	0.200	0.768	0.018									
WLAN 2.4G	2422	20	3.2	21.05	0.127	0.0197	0.200	0.768	0.165	V			V			V		
WLAN 5G	5745	18	4.25	20.1	0.102	0.0083	0.200	0.768	0.133		V			V			V	
WLAN 6G	6945	14	5.8	17.65	0.058	0.0069	0.200	0.768	0.076			V			V			V

Operation Mode (ANT1)	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 <sub>th</sub> (W)	ERP/ERP <sub>th</sub>	Simultaneous transmission modes								
										1	2	3	4	5	6	7	8	9
WLAN 2.4G	2422	20	3.2	21.05	0.127	0.0197	0.200	0.768	0.165	V						V		
WLAN 5G	5745	18	4.25	20.1	0.102	0.0083	0.200	0.768	0.133		V						V	
WLAN 6G	6945	14	5.8	17.65	0.058	0.0069	0.200	0.768	0.076			V						V

Operation Mode (BT_ANT)	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 <sub>th</sub> (W)	ERP/ERP <sub>th</sub>	Simultaneous transmission modes								
										1	2	3	4	5	6	7	8	9
BT / BLE	2442	10.5	3.2	11.55	0.014	0.0196	0.200	0.768	0.018				V	V	V	V	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<sub>th</sub> or ERP<sub>th</sub>), so they are exempt from RF exposure testing.

### 2.2 Multiple RF Sources Evaluation Results

Simultaneous transmission modes	$\Sigma$ ERP/ERP <sub>th</sub>	Criteria
1	0.330	1
2	0.266	1
3	0.152	1
4	0.183	1
5	0.151	1
6	0.094	1
7	0.348	1
8	0.284	1
9	0.170	1

**Note:**

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

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### 2.3 ISED mobile RF exposure

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 <sup>2</sup> )	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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### 2.3.1 Power Density Calculation (Worst Case)

#### ISED Standalone MPE

Operation Mode (ANT0)	Evaluation Frequency (MHz)	Operation Distance (cm)	Max. Output Power Include Tolerance (dBm)	Antenna Gain (dBi)	Max. EIRP (mW)	Power Density (PD) (W/m <sup>2</sup> )	Limit (W/m <sup>2</sup> )	Pass / Fail	Power Density / Limit	Simultaneous transmission modes									
										1	2	3	4	5	6	7	8	9	
BT / BLE	2442.00	20	10.5	3.20	23.44	0.047	5.412	Pass	0.009										
WLAN 2.4G	2422.00	20	20	3.20	208.93	0.416	5.381	Pass	0.077	V			V			V			
WLAN 5G	5745.00	20	18	4.25	167.88	0.334	9.710	Pass	0.034		V			V			V		
WLAN 6G	6945.00	20	14	5.80	95.50	0.190	10.000	Pass	0.019			V			V			V	

Operation Mode (ANT1)	Evaluation Frequency (MHz)	Operation Distance (cm)	Max. Output Power Include Tolerance (dBm)	Antenna Gain (dBi)	Max. EIRP (mW)	Power Density (PD) (W/m <sup>2</sup> )	Limit (W/m <sup>2</sup> )	Pass / Fail	Power Density / Limit	Simultaneous transmission modes									
										1	2	3	4	5	6	7	8	9	
WLAN 2.4G	2422.00	20	20	3.20	208.93	0.416	5.381	Pass	0.077	V							V		
WLAN 5G	5745.00	20	18	4.25	167.88	0.334	9.710	Pass	0.034		V							V	
WLAN 6G	6945.00	20	14	5.80	95.50	0.190	10.000	Pass	0.019			V							V

Operation Mode (BT_ANT)	Evaluation Frequency (MHz)	Operation Distance (cm)	Max. Output Power Include Tolerance (dBm)	Antenna Gain (dBi)	Max. EIRP (mW)	Power Density (PD) (W/m <sup>2</sup> )	Limit (W/m <sup>2</sup> )	Pass / Fail	Power Density / Limit	Simultaneous transmission modes								
										1	2	3	4	5	6	7	8	9
BT / BLE	2442.00	20	10.5	3.20	23.44	0.047	5.412	Pass	0.009				V	V	V	V	V	V

### 2.3.2 Collocated Power Density Calculation

#### ISED Collocated MPE

Simultaneous transmission modes	$\Sigma$ Power Density / Limit	Criteria
1	0.154	1
2	0.068	1
3	0.038	1
4	0.086	1
5	0.043	1
6	0.028	1
7	0.163	1
8	0.077	1
9	0.047	1

#### Note:

1.  $\Sigma$ (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 ~

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

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