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# RF EXPOSURE REPORT

Murata Manufacturing Co., Ltd.

Applicant: 10-1, Higashikotari 1-chome, Nagaokakyo-shi, Kyoto 617-

8555 Japan

Communication Module **Product Name:** 

**Brand Name:** muRata

FCC Model No.: LBEE5XV1XA, LBEE5XV2BA, LBEE5XV1ZA

LBEE5XV1XA 3ANT, LBEE5XV1XA 2ANT,

IC Model No.: LBEE5XV2BA 3ANT, LBEE5XV2BA 2ANT,

LBEE5XV1ZA 3ANT, LBEE5XV1ZA 2ANT

**Model Difference:** Please refer to the tables on page 5 for further details.

**Report Number:** ER/2020/90111

FCC ID: VPYLBEE5XV1XA

IC: 772C-LBEE5XV1XA

**FCC Rule Part:** Part 2.1091

IC Rule: RSS-102 issue 5 Mar. 19, 2015

Issue Date: Jan. 07, 2021

This report is only calculated based on the test results, there Date of Test:

will be no date of test.

Date of EUT Received: Sep. 22, 2020

We hereby certify that:

The above equipment was verified by SGS Taiwan Ltd. The evaluation in this report is in compliance with the above rule(s).

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

Approved By:

John Yeh / Asst. Manager





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Revision History								
Report Number	Revision	Description	Issue Date	Remark				
ER/2020/90111	Rev.00	Original.	Jan. 07, 2021	Revised By: Violetta Tang				

### Note:

- 1 · Multiple Model numbers or Trademarks The variant model numbers are assessed as identical in hardware and software to each other, hence all variants are fully covered by the test results in this test report without further verification test.
- 2 · Disclaimer Variant information among model numbers is provided by the applicant, test results of this report are applicable to the sample EUT received.
- 3 · Disclaimer Antenna information is provided by the applicant, test results of this report are applicable to the sample EUT received.

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# **DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)**

## General:

Product Name:	Communication Module
Brand Name:	muRata
FCC Model No.:	LBEE5XV1XA, LBEE5XV2BA, LBEE5XV1ZA
IC Model No.:	LBEE5XV1XA_3ANT, LBEE5XV1XA_2ANT, LBEE5XV2BA_3ANT, LBEE5XV2BA_2ANT, LBEE5XV1ZA_3ANT, LBEE5XV1ZA_2ANT
Model Difference:	Please refer to the tables on page 5 for further details.
Hardware Version:	1.0
Software Version:	CYW4359D0_004.001.016.0200.0000_Generic_UART_ 37_4MHz_wlbga_BU_dLNA_test_build_20200910.hcd  CYW4359D0_004.001.016.0200.0000_Generic_UART _37_4MHz_wlbga_BU_sLNA_test_build_20200909.hcd
EUT Series No.:	63_3A
Power Supply:	3.3Vdc

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# **Product Diversity Description Table** Difference for module

Number	Main model 1	2	5	6	9	10
Model Name	LBEE5XV1XA_3 ANT	LBEE5XV1XA_2 ANT	LBEE5XV2BA_3 ANT	LBEE5XV2BA_2 ANT	LBEE5XV1ZA_3 ANT	LBEE5XV1ZA_2 ANT
IC P/N	CYW54591	CYW54591	CYW54590	CYW54590	CYW88459	CYW88459
WiFi I/F	PCle	PCle	PCle	PCle	PCle	PCle
Antenna type/Gain	Dipole type	Same as 1XA_3ANT	Same as 1XA_3ANT	Same as 1XA_3ANT	Same as 1XA_3ANT	Same as 1XA_3ANT
Circuit Diagram	1XA	Same as 1XA_3ANT	Same as 1XA_3ANT	Same as 1XA_3ANT	Same as 1XA_3ANT	Same as 1XA 3ANT
Module PCB layout	1XA	Same as 1XA_3ANT	Same as 1XA_3ANT	Same as 1XA_3ANT	Same as 1XA_3ANT	Same as 1XA 3ANT
Internal Component	1XA	Same as 1XA_3ANT	Same as 1XA_3ANT	Same as 1XA_3ANT	Same as 1XA_3ANT	Same as 1XA_3ANT
Appearance Print	1XA	Same as 1XA_3ANT	Diffenrence 1XA ->2BA	Diffenrence 1XA ->2BA	Diffenrence 1XA ->1ZA	Diffenrence 1XA ->1ZA
Function/ Capability	1 Χ Δ		RSDB is desabled from 1XA_3ANT	RSDB is desabled from 1XA_3ANT	Same as 1XA_3ANT	Same as 1XA_3ANT
Other			·			

### Difference for WLAN IC

Number	CYW54591	CYW54590	CYW88459
IC Size	5.155x7.698	Same as CYW54591	Same as CYW54591
Ball Number	194	Same as CYW54591	Same as CYW54591
Circuit Diagram	CYW54591	Same as CYW54591	Same as CYW54591
RF performance	CYW54591	Same as CYW54591	Same as CYW54591
Appearance	CYW54591	Difference ->Marking : CYW54590	Difference ->Marking : CYW88459
Function/Capability	CYW54591	RSDB doesn't support by Software	Same as CYW54591
Other	Consumer Grade	Same as CYW54591	Industrial Grade*

<sup>\*</sup>IC vendor just want to control P/N for Consumer and Industrial. But IF fo Hardware/Software from point of view it is same.

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#### 1.2 **Antenna Information:**

#### 1.2.1 BT / WLAN 2.4GHz

Antenna Type	Supplier	Antenna Part No.	Freq. (MHz)	Peak Antenna Gain (dBi)	Worst Antenna Gain
Dinala	Molov	146153	2.40117	3.20	
Dipole	Molex	146187	2.4GHz	3.40	V

#### 1.2.2 **WLAN 5GHz**

Antenna Type	Supplier	Antenna Part No.	Freq. (MHz)	Peak Antenna Gain (dBi)	Worst Antenna Gain
Dipole	Molex	146153	5GHz	4.25	
ырые		146187	JGHZ	4.75	V

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#### 1.3 **Rated Power**

#### Bluetooth / WLAN 2.4GHz 1.3.1

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Mode	Freq. Range (MHz)	Channels	Modulation Technology	Max Output Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)	Worst Case	
BR+EDR	2402-2480	79	GFSK + π/4DQPSK + 8DPSK	9.94		13.34	V	
BLE	2402-2480	40	GFSK	7.25	3.40	10.65		
802.11b/g/n_HT20	2412-2462	11	DSSS & OFDM	19.32		22.72	V	
Modulation type:		CCK, DQPSK, DBPSK for DSSS						
iviodulation type.		64QAM, 16QAM, QPSK, BPSK for OFDM						

#### 1.3.2 WLAN 5GHz:

802.11	Freq. Range (MHz)	Modulation Technology	•	Antenna Gain (dBi)	EIRP (dBm)	Worst Case
	5150~5250		15.98	4.75	20.73	
	5250~5350		17.40	4.75	22.15	
а	5470~5725		17.38	4.75	22.13	
	5725~5850		17.50	4.75	22.25	
	5150~5250		15.89	4.75	20.64	
n HT20	5250~5350		19.28	4.75	24.03	
1111120	5470~5725		19.98	4.75	24.73	
	5725~5850	OFDM	20.48	4.75	25.23	V
	5150~5250	OI DIVI	15.20	4.75	19.95	
n HT40	5250~5350		19.38	4.75	24.13	
1111140	5470~5725		19.22	4.75	23.97	
	5725~5850		19.42	4.75	24.17	
	5150~5250		11.23	4.75	15.98	
ac VHT80	5250~5350		9.39	4.75	14.14	
ac viiiou	5470~5725		19.44	4.75	24.19	
	5725~5850		15.93	4.75	20.68	

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# FCC MAXIMUM PERMISSIBLE EXPOSURE (MPE)

# **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	Electric Field	Magnetic Field	Power Density	Averaging Time						
(MHz)	Strength (V/m)	Strength (A/m)	(mW/cm <sup>2</sup> )	(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 <sup>2</sup> )	30						
30-300	27.5	0.073	0.2	30						
300-1500	/	1	f/1500	30						
1500-15000	/	1	1.0	30						

f = frequency in MHz

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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<sup>\* =</sup> 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 Permissive 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 Power Density F Strength (W/m²)  (A/m rms)		Reference Period (minutes)					
0.003-10	83	90	-	Instantaneous*					
0.1-10	-	0.73/ f	-	6**					
1.1-10	87/ f <sup>0.5</sup>	-	-	6**					
10-20	27.46	0.0728	2	6					
20-48	58.07/ f <sup>0.25</sup>	0.1540/ f <sup>0.25</sup>	8.944/ f <sup>0.5</sup>	6					
48-300	22.06	0.05852	1.291	6					
300-6000	3.142 f <sup>0.3417</sup>	$0.008335 f^{0.3417}$	$0.02619f^{0.6834}$	6					
6000-15000	61.4	0.163	10	6					
15000-150000	61.4	0.163	10	616000/ f <sup>1.2</sup>					
150000-300000	0.158 <i>f</i> <sup>0.5</sup>	4.21 x 10-4 f <sup>0.5</sup>	6.67 x 10-5 <i>f</i>	616000/ f <sup>1.2</sup>					

F = frequency in MHz

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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<sup>\* =</sup> Based on nerve stimulation (NS).

<sup>\*\* =</sup> Based on specific absorption rate (SAR)



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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 (dBm)	Antenna Gain (dBi)	Max. output Power EIRP (mW)	Power Density (PD) (mW/cm²)	Limit (mW/cm²)	Pass / Fail	Power Density / Limit	Collocated MPE
BT	2402.00	20	9.94	3.40	21.58	0.004	1.000	Pass	0.004	V
WLAN 2.4G	2442.00	20	19.32	3.40	187.07	0.037	1.000	Pass	0.037	V
WLAN 5G	5785.00	20	20.48	4.75	333.43	0.066	1.000	Pass	0.066	V

## **ISED Standalone MPE**

Operation Mode	Evaluation Frequency (MHz)	•	Max. output Power (dBm)	Antenna Gain (dBi)	Output Power EIRP (mW)	Power Density (PD) (W/m²)	Limit (W/m²)	Pass / Fail	Power Density / Limit	Collocated MPE
BT	2402.00	20	9.94	3.4	21.58	0.043	5.351	Pass	0.008	V
WLAN 2.4G	2442.00	20	19.32	3.4	187.07	0.372	5.412	Pass	0.069	V
WLAN 5G	5785.00	20	20.48	4.75	333.43	0.664	9.756	Pass	0.068	V

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# **Collocated Power Density Calculation**

### **FCC Collocated MPE**

Max BT PD / Limit	Max WLAN 2.4G PD / Limit	Max WLAN 5G PD / Limit	Σ(Power Density / Limit) of BT+ WLAN 2.4G + WLAN 5G		
0.004	0.037	0.066	0.107		

### ISED Collocated MPE

Max BT PD / Limit	Max WLAN 2.4G PD / Limit	Max WLAN 5G PD / Limit	Σ(Power Density / Limit) of BT+ WLAN 2.4G + WLAN 5G
0.008	0.069	0.068	0.145

### Note:

- 1. Σ(E- Field Strength / Limit): This is a summation of [(E- Field Strength for each transmitter/antenna included in the simultaneous transmission) / (corresponding MPE limit)].
- 2. Considering the collocated transmitters, the aggregated (E- Field Strength /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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