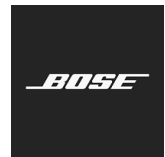




PRODUCT ASSURANCE ENGINEERING  
COMPLIANCE  
EMC TEST REPORT



Test Type: Emissions

Product Type: *Wireless Earbud*

Product Name/Number: *Model 911L*

FCC ID: *A94911L*  
IC: *3232A-911L*

Prepared For: *Product Assurance Engineering Department,  
Bose Corporation*

Name of manufacturing agency applying for equipment type approval: Bose Corporation

Postal Address of manufacturing Agency: The Mountain  
Framingham MA 01701  
USA

Test Results: Pass

Applicable Standards: *FCC 47 CFR PART 15 SUBPART C  
ISED RSS-247 ISSUE 2  
ISED RSS-GEN ISSUE 5*

Report Number: *EMC.435911.22.202.2(4)*

General Comments/Special Test Conditions:  
This report relates only to the items tested.

	Print Name	Signature	Date
Prepared By:	Michael A. Royer		September 5, 2022
Electrical Engineer Review* By:	Bryan Cerqua		September 5, 2022

\* Since every test result is separately reviewed after its completion, the electrical engineer review indicated above represents a higher-level review to ensure this report lists and contains all applicable and appropriate requirements.



Certificate # 1514.1

PRODUCT ASSURANCE ENGINEERING
COMPLIANCE
EMC TEST REPORT



If the report carries the "accredited" logo, the reviewer must verify all the tests in this report are covered under the current ISO17025 accreditation. The A2LA-accredited logo must be removed if any of the tests in the report are not performed under the current scope of accreditation. It is the responsibility of the reviewer to ensure the A2LA advertising policy is followed.

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Certificate # 1514.1

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EMC TEST REPORT



# Test Report Summary

Product Information:

Description

*Truly Wireless In Ear (TWIE) earbud. The bud uses Bluetooth classic (BT) Bluetooth Low Energy (BLE), and Qualcomm High Speed (QHS). The QHS is used for bud-to-bud communications. The role of master/puppet can be changed to best meet radio link conditions during operation. The unit is not supplied with an AC to USB adapter. The antenna is an inverted F with a maximum gain of 1dBi formed by Laser Direct Sequence on the inside of the top cover of the earbud.*

EUT Condition

*Product was as built in the factory. And for the conducted measurements the antenna was removed, and coaxial cable was installed in its place. Where necessary USB debug wires were added to allow control of the Radio. Worst case data rate was determined to be 1Mbps.*

Firmware Version

*0.6.16, 0.11.2*

Bluetest3 Version

*Bluesuite 3.3.12*

Setup (Cables and Accessories)

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
AC Adapter	Bose	S008VU0500160	072246Z00802252AE	N/A

Test Objective:

Verify product meets all applicable EMC requirements for the Bluetooth Low Energy mode.

Results:

Product complies with all applicable EMC requirements. All final results represent worst-case emissions and/or immunity.

Conclusions:

The device under test (D.U.T.):

meets all test standards on page 1 of this report.



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# Test Results Summary

TEST NAME	TEST RESULT PASS or N/A	COMMENT(S)
On Time and Duty Cycle	N/A	No limits, for information only
99% Occupied Bandwidth	N/A	No limits, for information only
6dB Occupied Bandwidth	Pass	
Output Power	Pass	
Power Spectral Density	Pass	
Conducted Spurious Emissions	Pass	
RF Conducted Emissions – AC Mains	Pass	
RF Radiated Emissions 30MHz -1GHz	Pass	
Radiated RF Emissions 1-25GHz	Pass	
Radiated Band Edge	Pass	

## Environmental Conditions

Ambient:  
 Temperature: 22±4°C  
 Humidity: 30-60%RH  
 Mains Voltage: 120VAC, 5VDC USB

## FCC Test Site Accreditation:

Display Exhibits	Display Correspondence	Display Scopes	Firm Name	Location	Accreditation	MRA Designation Number	Expiration Date	Contact Name	Contact Title	Address	P.O. Mail Box	City	State	Zip	Country	E-mail Address	Phone Number	Fax Number
			Scopes Bose Corporation	1 New York Avenue, Framingham, MA	American Association for Laboratory Accreditation	N/A US1088	07/31/2022	Mr. Cable Best	Quality Manager	Mail Stop 450 The Mountain	N/A 450	Framingham	Massachusetts	01701	United States	Cable_Best@bose.com	1 508 508 766 766	508 6137 1145

## Canadian Test Site Registration:

Organization	.CAB identifier	Scope/Recognition Date (yyyy-mm-dd)	Expiration (yyyy-mm-dd)
<b>BOSE CORPORATION</b>  1 New York Avenue Framingham, MA 01701 UNITED STATES  <b>Company Number: 3232A</b>  Contact: Mario Espinal <a href="mailto:mario_espinal@bose.com">mario_espinal@bose.com</a>	US0210	RSS-GEN (2019-02-11)  RSS-210 (2019-02-11) RSS-247 (2019-02-11) RSS-248 (2021-11-19)	<b>RECOGNIZED UNTIL: 2022-07-31</b>  A2LA ISO/IEC 17025:2017 Expires: 2022-07-31

# RF Conducted Measurements

## On Time and Duty Cycle

<b>Model number</b>	911L	<b>Build Phase:</b>	C1.5		
<b>Tested by:</b>	Mike Royer	<b>Date:</b>	July 21, 2022		
<b>Requirements Standard(s):</b>		<b>Referenced Standard(s):</b>	ANSI C63.10-2013		
<b>EUT powered with:</b>	5V USB	<b>Temp / Humidity:</b>	n/a	<b>Test location:</b>	Braun Room
<b>Test equipment used TN's:</b>	2409				
<b>EUT Serial number(s):</b>	084233M1333A080AE				
<b>EUT Software installed:</b>	0.6.16+g302b20e				
<b>EUT Modification(s):</b>	Product was tested as built except the antenna was disconnected and a coaxial cable was installed.				

### Conclusion:

This test is for information only.

### Limits:

None; for reporting purposes only.

### Procedure:

ANSI C63.10, Section 11.6: Zero-Span Spectrum Analyzer Method.

### Data Collection:

Mode	ON Time (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
<b>2.4GHz Band</b>					
BLE 1M	2.135	2.5	.85	85	.700
BLE 2M	1.079	1.876	.575	58	2.40



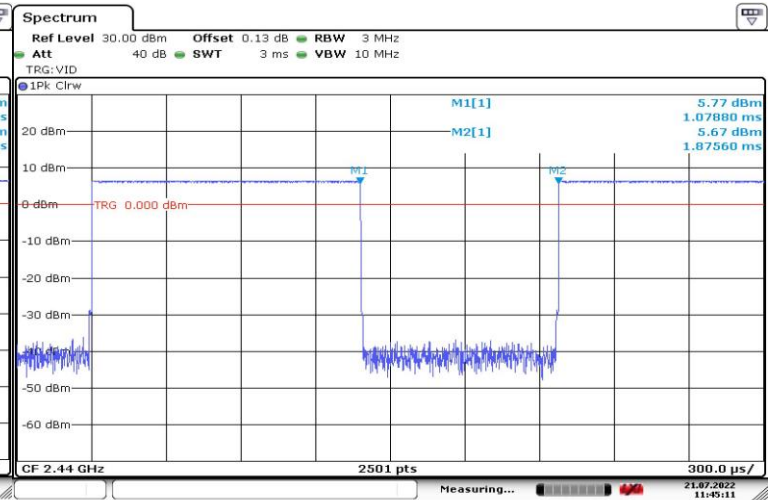
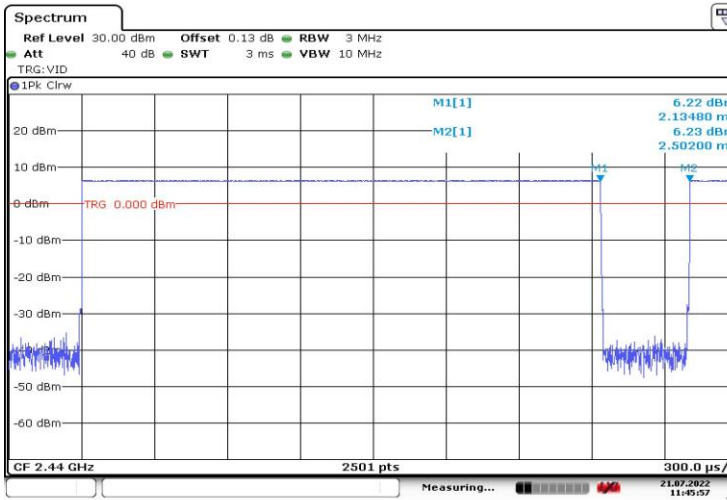
Certificate # 1514.1

# DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



BLE 1M

BLE 2M



Date: 21.JUL.2022 11:45:57

Date: 21.JUL.2022 11:45:11

## Equipment Used:

TN	Description	Model	S/N	Manufacturer	Most Recent Calibration	Calibration Due Date
2409	Signal and Spectrum Analyzer	FSV40	101413	Rohde & Schwarz	21-Mar-2022	21-Mar-2024



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# 99% Occupied Bandwidth

<b>Model number</b>	911L	<b>Build Phase:</b>	C1.5		
<b>Tested by:</b>	Mike Royer	<b>Date:</b>	July 19, 2022		
<b>Requirements Standard(s):</b>	CFR 47 Part 15.247	<b>Referenced Standard(s):</b>	ANSI C.63.10-2013 6.9.3		
<b>EUT powered with:</b>	5V USB	<b>Temp / Humidity:</b>	n/a	<b>Test location:</b>	Braun Room
<b>Test equipment used TN's:</b>	2409				
<b>EUT Serial number(s):</b>	084233M1333A080AE				
<b>EUT Software installed:</b>	0.11.2				
<b>EUT Modification(s):</b>	Product was tested as built except the antenna was disconnected and a coaxial cable was installed.				

## Conclusion:

This test is for information only.

## Limits:

None; for reporting purposes only.



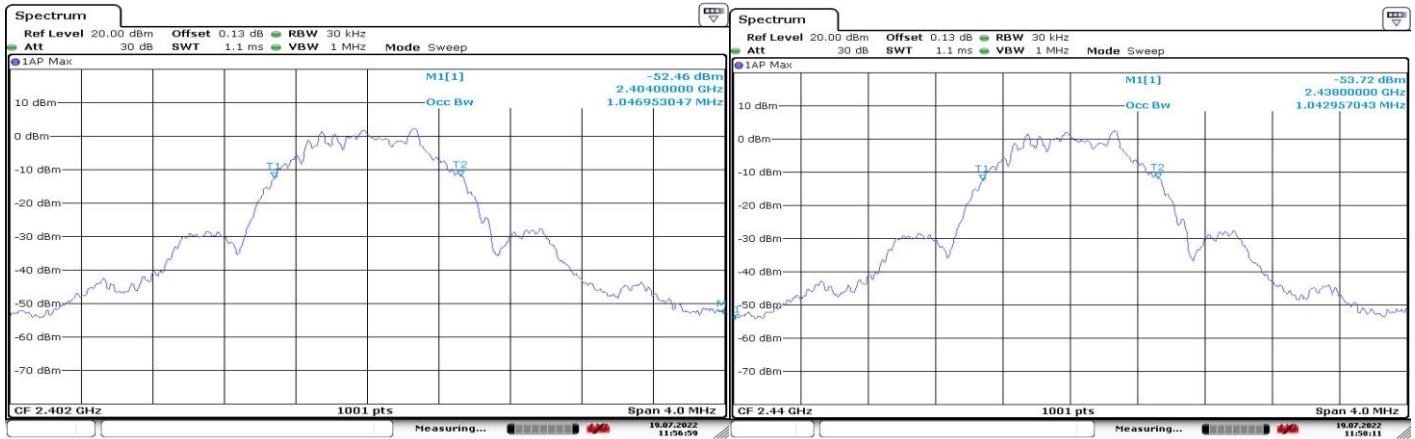
Certificate # 1514.1

# DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



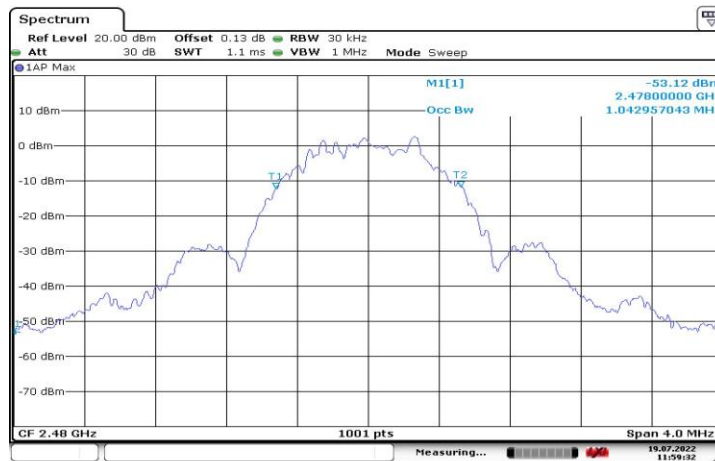
## BLE 1M Data Collection:

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.047
Middle	2441	1.043
High	2480	1.043



Date: 19 JUL 2022 11:56:59

Date: 19 JUL 2022 11:58:11



Date: 19 JUL 2022 11:59:33





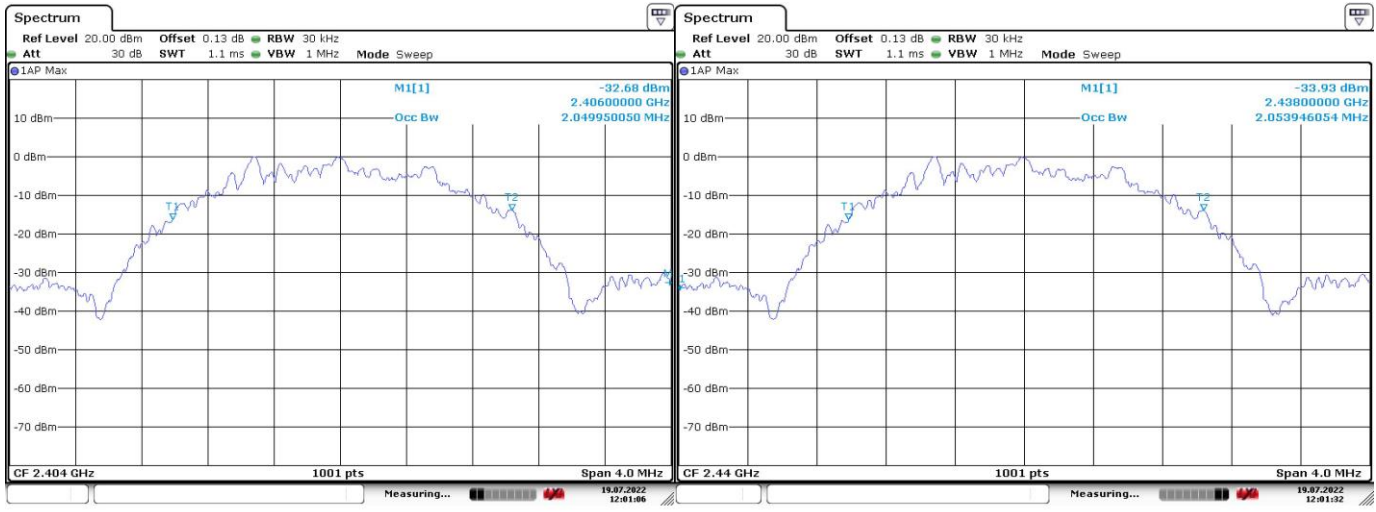
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# DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



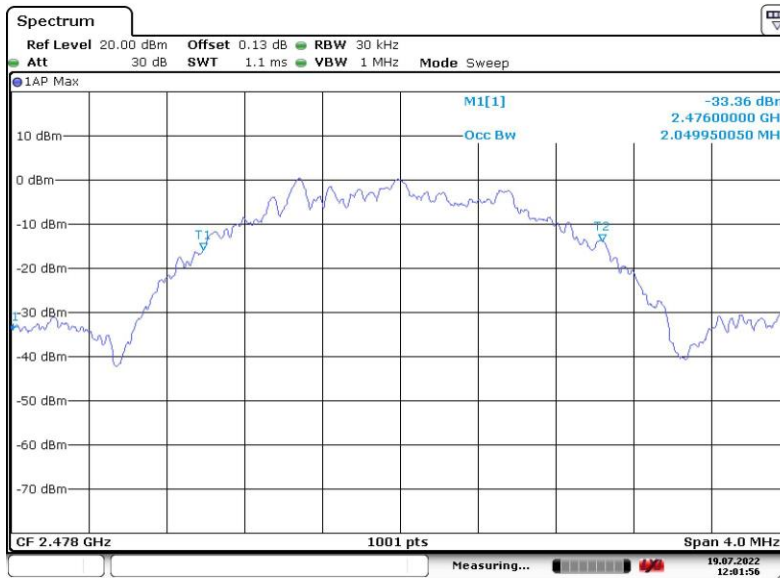
## BLE 2M Data Collection:

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2404	2.050
Middle	2441	2.054
High	2478	2.050



Date: 19 JUL 2022 12:01:06

Date: 19 JUL 2022 12:01:32



Date: 19 JUL 2022 12:01:56



## Equipment Used:

TN	Description	Model	S/N	Manufacturer	Most Recent Calibration	Calibration Due Date
2409	Signal and Spectrum Analyzer	FSV40	101413	Rohde & Schwarz	21-Mar-2022	21-Mar-2024



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COMPLIANCE  
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# 6dB Occupied Bandwidth

<b>Model</b>	911L	<b>Build Phase:</b>	C1.5		
<b>Tested by:</b>	Mike Royer	<b>Date:</b>	July 22, 2022, and August 31, 2022		
<b>Requirements Standard(s):</b>	FCC §15.247 (a) (2) RSS-247 5.2 (a)	<b>Referenced Standard(s):</b>	ANSI 63.10:2013 - 11.8		
<b>EUT powered with:</b>	5V USB	<b>Temp / Humidity:</b>	n/a	<b>Test location:</b>	Braun Room
<b>Test equipment used TN's:</b>	2409				
<b>EUT Serial number(s):</b>	084233M1333A080AE				
<b>EUT Software installed:</b>	0.11.2				
<b>EUT Modification(s):</b>	Product was tested as built except the antenna was disconnected and a coaxial cable was installed.				

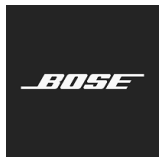
## Conclusion:

The lowest recorded 6dB bandwidth measured was 707 kHz which is more than the required minimum of 500 kHz by 207 kHz.



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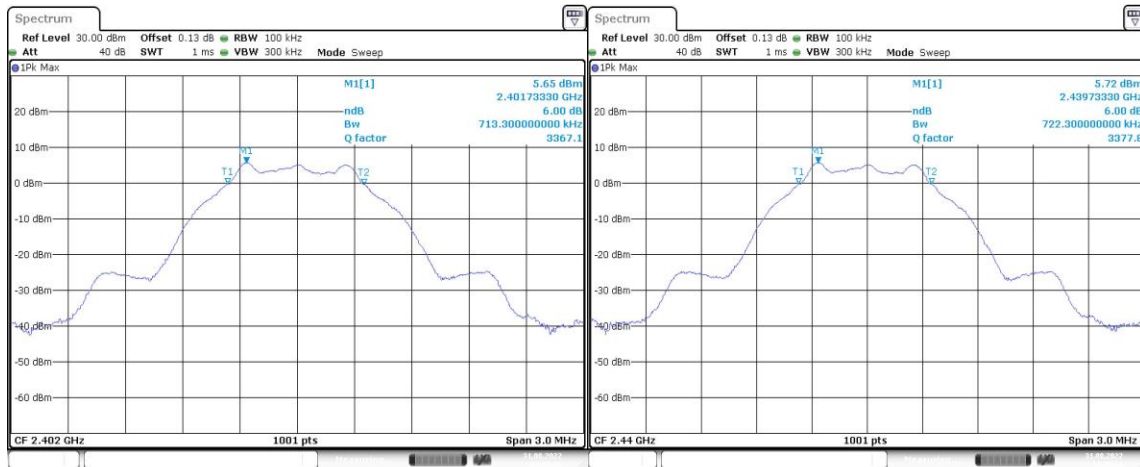
# DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



## Data Collection:

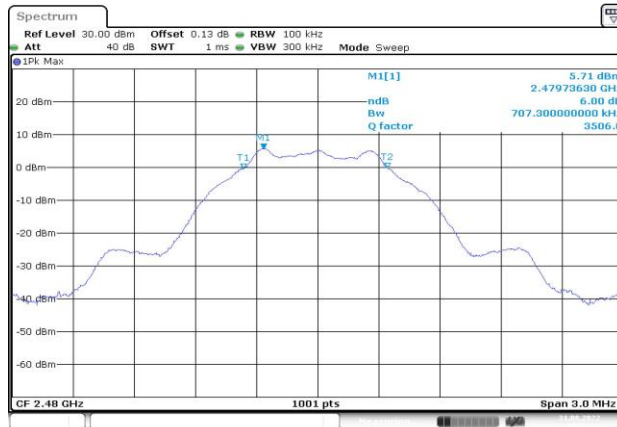
DTS Bandwidth Summary Table (BLE)						
Channel	Frequency MHz	Mode	DTS BW kHz	Limit kHz	Margin kHz	Result
Low	2402	BLE 1M	713	500	213	Pass
Middle	2440	BLE 1M	722	500	222	Pass
High	2480	BLE 1M	707	500	207	Pass
Low	2404	BLE 2M	1226	500	726	Pass
Middle	2440	BLE 2M	1226	500	726	Pass
High	2478	BLE 2M	1222	500	722	Pass

### BLE 1M



Date: 31 AUG 2022 14:33:47

Date: 31 AUG 2022 14:35:11

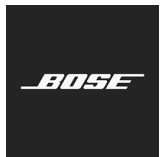


Date: 31 AUG 2022 14:35:51

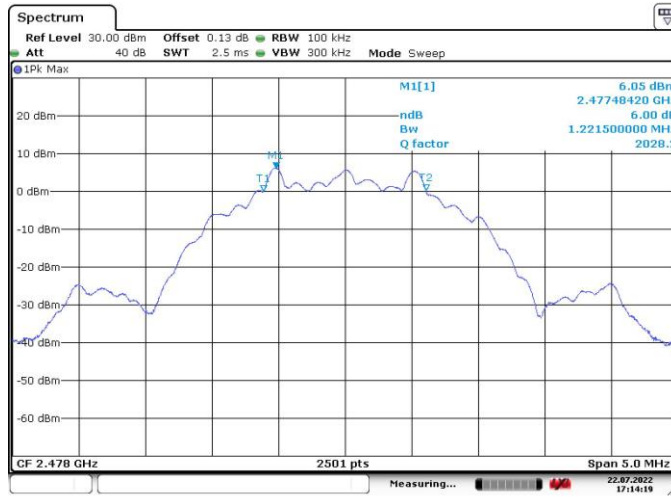
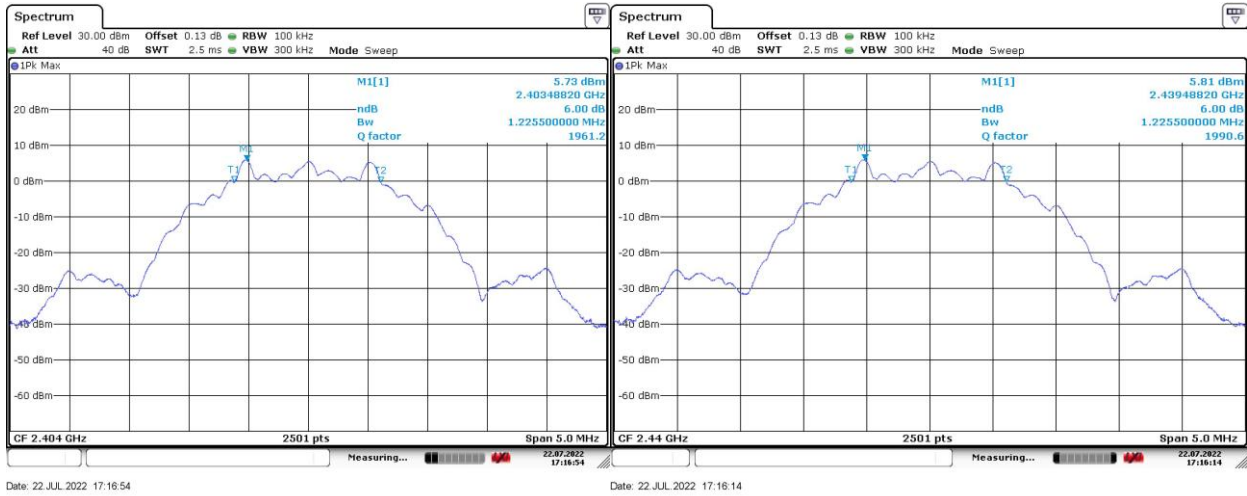


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# DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



## BLE 2M





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## Limits:

FCC §15.247 (a) (2)

RSS-247 5.2 (a)

ANSI 63.10:2013 – 11.8

The minimum 6 dB bandwidth shall be at least 500 kHz.

## Equipment Used:

TN	Description	Model	S/N	Manufacturer	Most Recent Calibration	Calibration Due Date
2409	Signal and Spectrum Analyzer	FSV40	101413	Rohde & Schwarz	21-Mar-2022	21-Mar-2024



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EMC TEST REPORT



# Output Power

<b>Model number</b>	911L	<b>Build Phase:</b>	C1.5		
<b>Tested by:</b>	Mike Royer	<b>Date:</b>	July 19, 2022		
<b>Requirements Standard(s):</b>	FCC §15.247 (b) (3) RSS-247 5.4 (d)	<b>Referenced Standard(s):</b>	ANSI C63.10-2013 11.9.1.1		
<b>EUT powered with:</b>	5V USB	<b>Temp / Humidity:</b>	n/a	<b>Test location:</b>	Braun Room
<b>Test equipment used TN's:</b>	2409				
<b>EUT Serial number(s):</b>	084233M1333A080AE				
<b>EUT Software installed:</b>	0.11.2				
<b>EUT Modification(s):</b>	Product was tested as built except the antenna was disconnected and a coaxial cable was installed.				

## Conclusion:

The Bose Model 911L passes output power by 22.74dB.

Method from ANSI C63.10-2013 section 11.9.1.1 was used.

Cable loss was accounted for in the Spectrum Analyzer offset.



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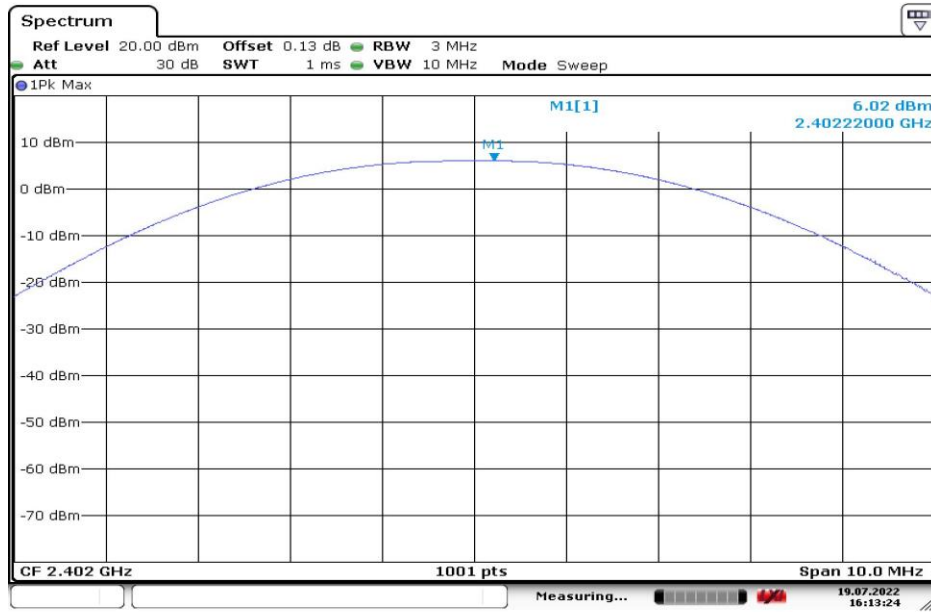
# DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



## Data Collection:

Output Power Summary Table							
Channel	Frequency	Mode	Output Power dBm	Directional Gain dBi	Limit	Margin	Result
Low	2402	BLE 1M	6.02	1	30	23.98	Pass
Middle	2440	BLE 1M	5.93	1	30	24.07	Pass
High	2480	BLE 1M	6.12	1	30	23.88	Pass
Low	2404	BLE 2M	6.18	1	30	23.82	Pass
Middle	2440	BLE 2M	5.95	1	30	24.05	Pass
High	2478	BLE 2M	6.26	1	30	23.74	Pass

Example Plot, Low, BLE 2M



Date: 19 JUL 2022 16:13:25





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## Limits:

FCC §15.247 (b) (3)

RSS-247 5.4 (d)

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

## Equipment Used:

TN	Description	Model	S/N	Manufacturer	Most Recent Calibration	Calibration Due Date
2409	Signal and Spectrum Analyzer	FSV40	101413	Rohde & Schwarz	21-Mar-2022	21-Mar-2024



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# Power Spectral Density

<b>Model Number</b>	911L	<b>Build Phase:</b>	C1.5		
<b>Tested by:</b>	Mike Royer	<b>Date:</b>	July 25, 2022		
<b>Requirements Standard(s):</b>	FCC §15.247 (e) RSS-247 (5.2) (b)	<b>Referenced Standard(s):</b>	ANSI 63.10 (11.10.2)		
<b>EUT powered with:</b>	5V USB	<b>Temp / Humidity:</b>	n/a	<b>Test location:</b>	Braun Room
<b>Test equipment used TN's:</b>	2409				
<b>EUT Serial number(s):</b>	084233M1333A080AE				
<b>EUT Software installed:</b>	0.11.2				
<b>EUT Modification(s):</b>	Product was tested as built except the antenna was disconnected and a coaxial cable was installed.				

## Conclusion:

The Bose Model 911L passes spectral density by 20.82 dB.

Test method is ANSI C63.10-2013 (11.10.2)

The cable loss is accounted for in the Spectrum Analyzer offset. The earbud is set to transmit continuously, duty cycle = 100%.

# Limits:

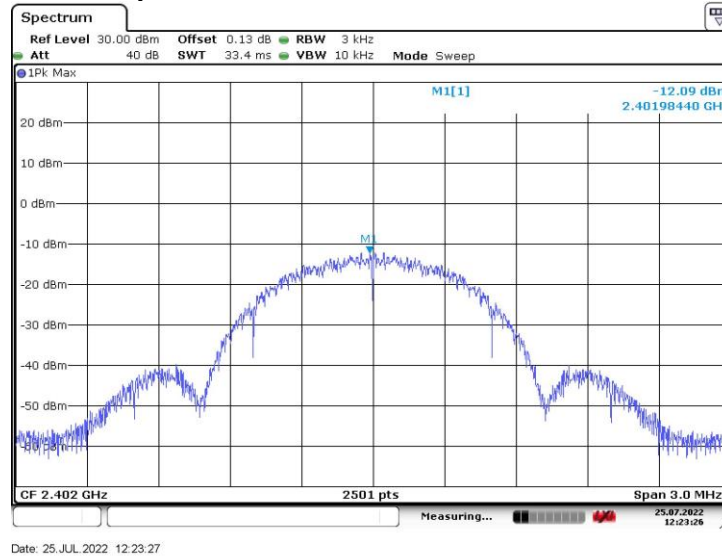
- FCC §15.247 (e)
- RSS-247 (5.2) (b)
- ANSI 63.10 (11.10.2)

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

# Data Collection:

Mode	Channel	Frequency MHz	Max reading from SA dBm	Limit dBm	Margin dB	Result
BLE 1M	Low	2402	-12.09	8	20.09	Pass
BLE 1M	Middle	2440	-12.05	8	20.05	Pass
BLE 1M	High	2480	-11.82	8	19.82	Pass
BLE 2M	Low	2404	-12.62	8	20.62	Pass
BLE 2M	Middle	2440	-12.69	8	20.69	Pass
BLE 2M	High	2478	-12.41	8	20.41	Pass

BLE 1M Low channel Power Spectral Density measurement.





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## Equipment Used:

TN	Description	Model	S/N	Manufacturer	Most Recent Calibration	Calibration Due Date
2409	Signal and Spectrum Analyzer	FSV40	101413	Rohde & Schwarz	21-Mar-2022	21-Mar-2024



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COMPLIANCE  
EMC TEST REPORT



# Conducted Spurious Emissions

<b>Model number:</b>	911L	<b>Build Phase:</b>	C1.5		
<b>Tested by:</b>	Mike Royer	<b>Date:</b>	July 25 and 27, 2022		
<b>Requirements Standard(s):</b>	FCC §15.247 (d) RSS-247 5.5	<b>Referenced Standard(s):</b>	ANSI 63.10 (7.8.8)		
<b>EUT powered with:</b>	5V USB	<b>Temp / Humidity:</b>	n/a	<b>Test location:</b>	Braun Room
<b>Test equipment used TN's:</b>	2409				
<b>EUT Serial number(s):</b>	084233M1333A080AE				
<b>EUT Software installed:</b>	0.11.2				
<b>EUT Modification(s):</b>	Product was tested as built except the antenna was disconnected and a coaxial cable was installed.				

## Conclusion:

The Bose Model 911L passes Conducted Spurious Emissions by more than 10dB.

## Limits

FCC §15.247 (d)

RSS-247 5.5

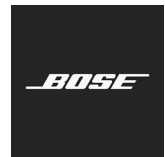
Output power was measured based on the use of a peak measurement; therefore, the required attenuation is 20 dB.

Note: Note that the BLE 2M rate does not support operation on channels 0,12, and 39 (2402, 2426, 2480).



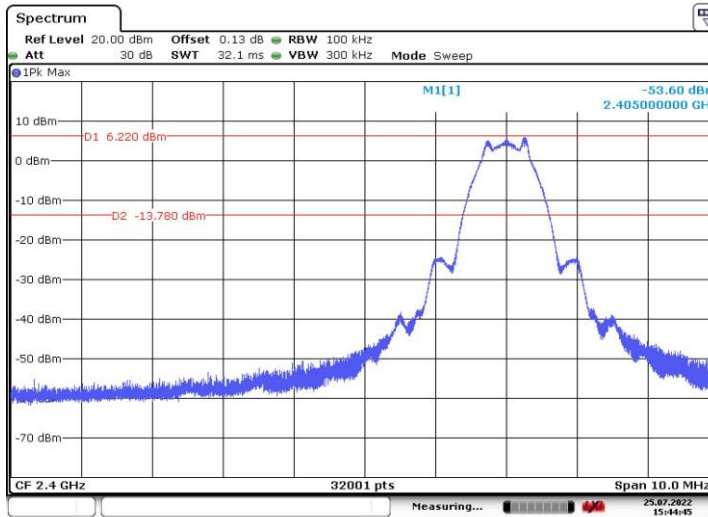
Certificate # 1514.1

# DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



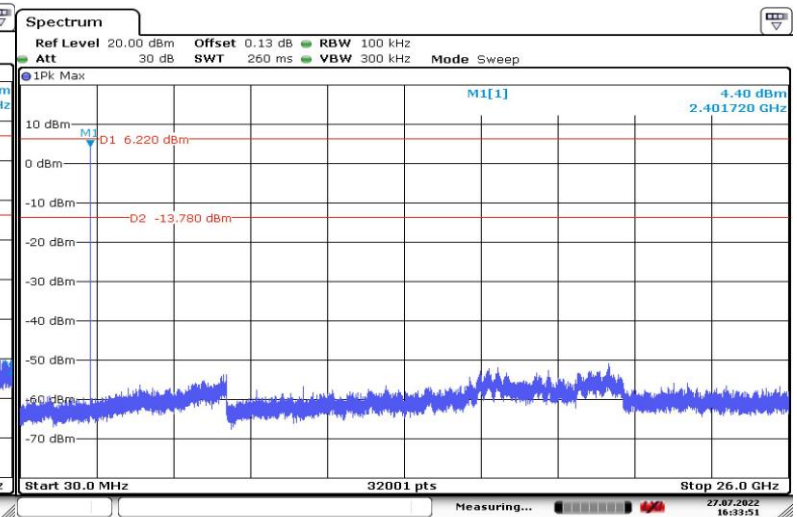
## Data Collection:

### BLE 1M LOW CHANNEL BANDEDGE



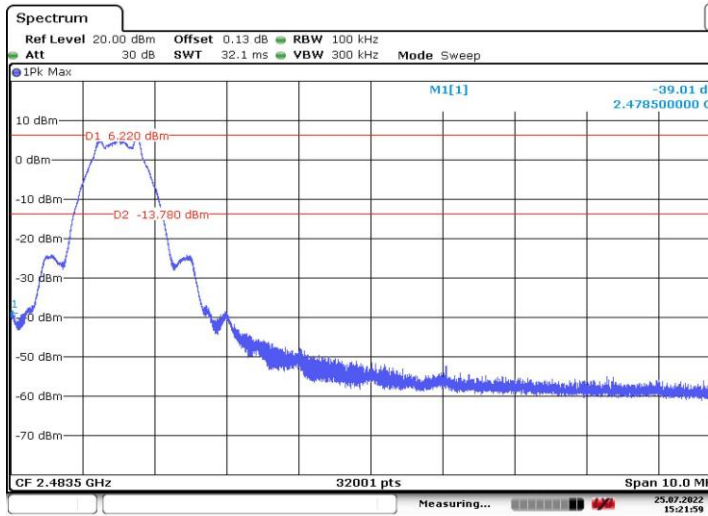
Date: 25 JUL 2022 15:44:45

### OUT-OF-BAND LOW CHANNEL



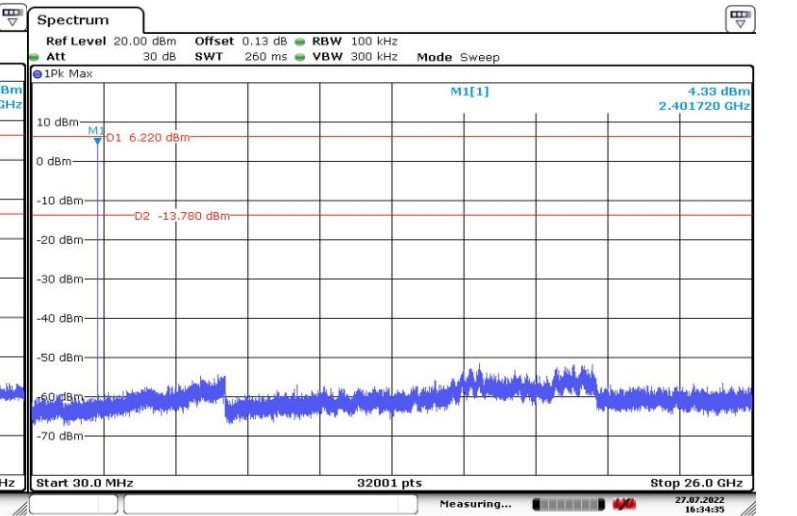
Date: 27 JUL 2022 16:33:51

### BLE 1M HIGH CHANNEL BANDEDGE



Date: 25 JUL 2022 15:22:00

### OUT-OF-BAND HIGH CHANNEL

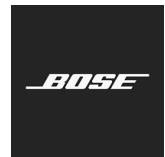


Date: 27 JUL 2022 16:34:35

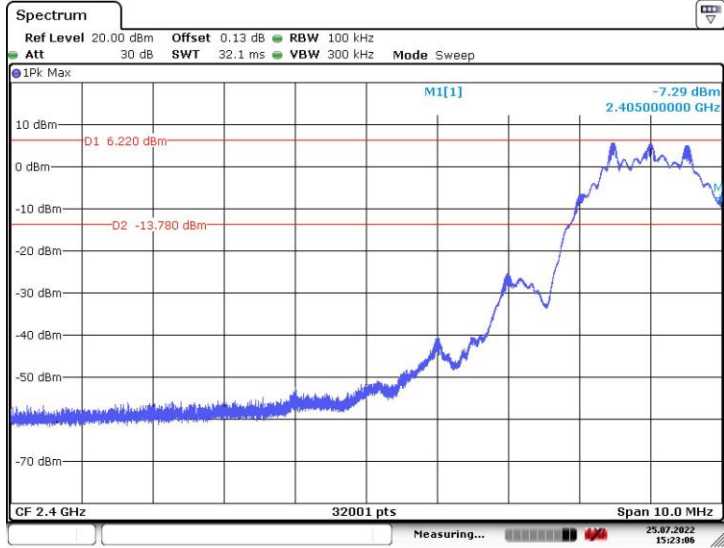


Certificate # 1514.1

# DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT

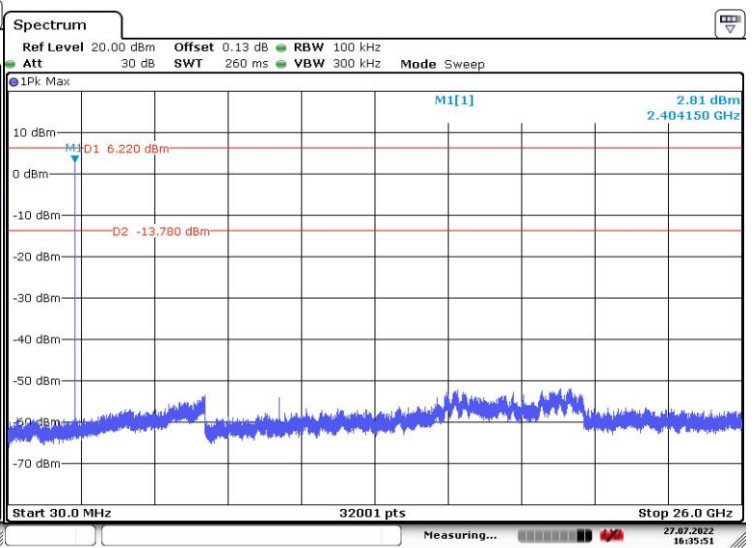


## BLE 2M LOW CHANNEL BANDEDGE



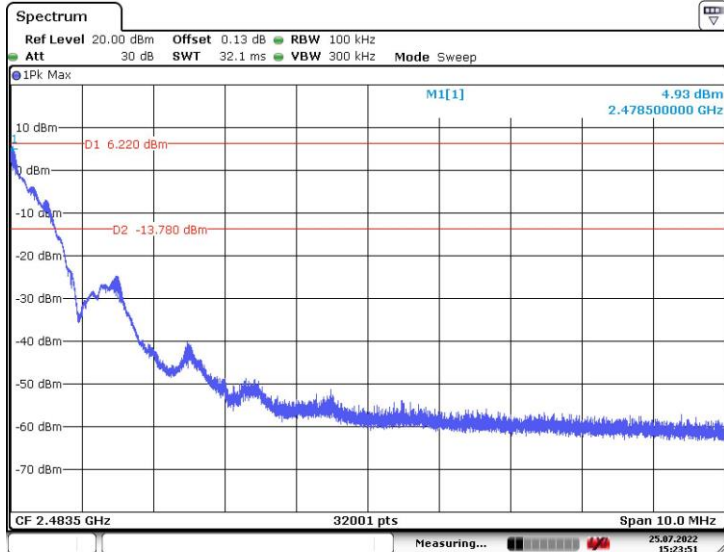
Date: 25.JUL.2022 15:23:06

## OUT-OF-BAND LOW CHANNEL



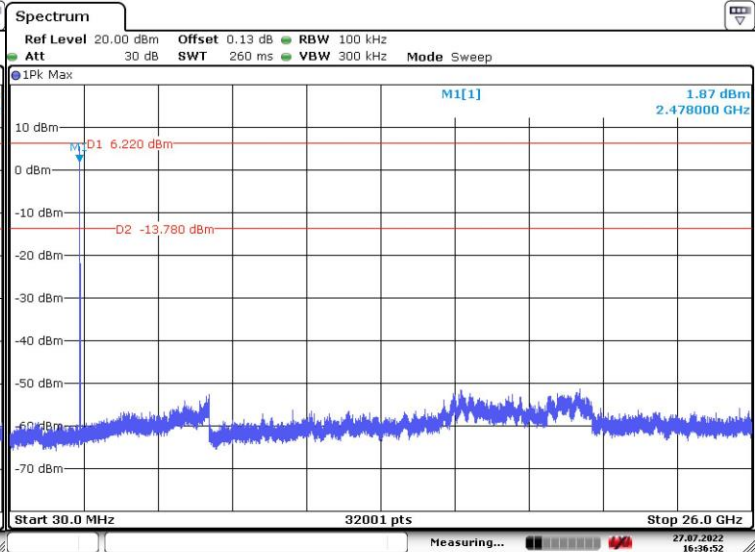
Date: 27.JUL.2022 16:35:51

## BLE 2M HIGH CHANNEL BANDEDGE



Date: 25.JUL.2022 15:23:51

## OUT-OF-BAND HIGH CHANNEL



Date: 27.JUL.2022 16:36:52



DESIGN ASSURANCE ENGINEERING  
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EMC TEST REPORT



# Equipment Used:

TN	Description	Model	S/N	Manufacturer	Most Recent Calibration	Calibration Due Date
2409	Signal and Spectrum Analyzer	FSV40	101413	Rohde & Schwarz	21-Mar-2022	21-Mar-2024





# Radiated Measurements

## RF Radiated Emissions 30MHz -1GHz

### Test Information:

<b>Project number (Integrity):</b>	435911	<b>Build Phase:</b>	DV		
<b>Tested by:</b>	K Thibodeau	<b>Date:</b>	7/14/2022		
<b>Requirements Standard(s):</b>	FCC §15.247 (d) RSS-247 Section 5.5	<b>Referenced Standard(s):</b>	ANSI C63.10-2013		
<b>EUT powered with:</b>	EUT battery	<b>Temp / Humidity:</b>	N/A	<b>Test location:</b>	Maxwell House
<b>Test equipment used TN's:</b>	644,1541,2319,2077,1445,1569				
<b>EUT Serial number(s):</b>	Right: Etched on bud:O4-2R SN: 084232M21440096AE Left: Etched on bud:O4-2L SN: 084233M21650042AE Case: 084231M21500145AE				
<b>EUT Software installed:</b>	Right: 0.11.6 Left: 0.11.6 Case: 0.11.2				
<b>EUT Modification(s):</b>	None				

### Objective/Summary/Conclusion:

EUT meets FCC §15.247 (d) and RSS-247 Section 5.5 requirements with a worst-case passing margin of 20.8dB at 70.985MHz.

### Additional EUT Information:

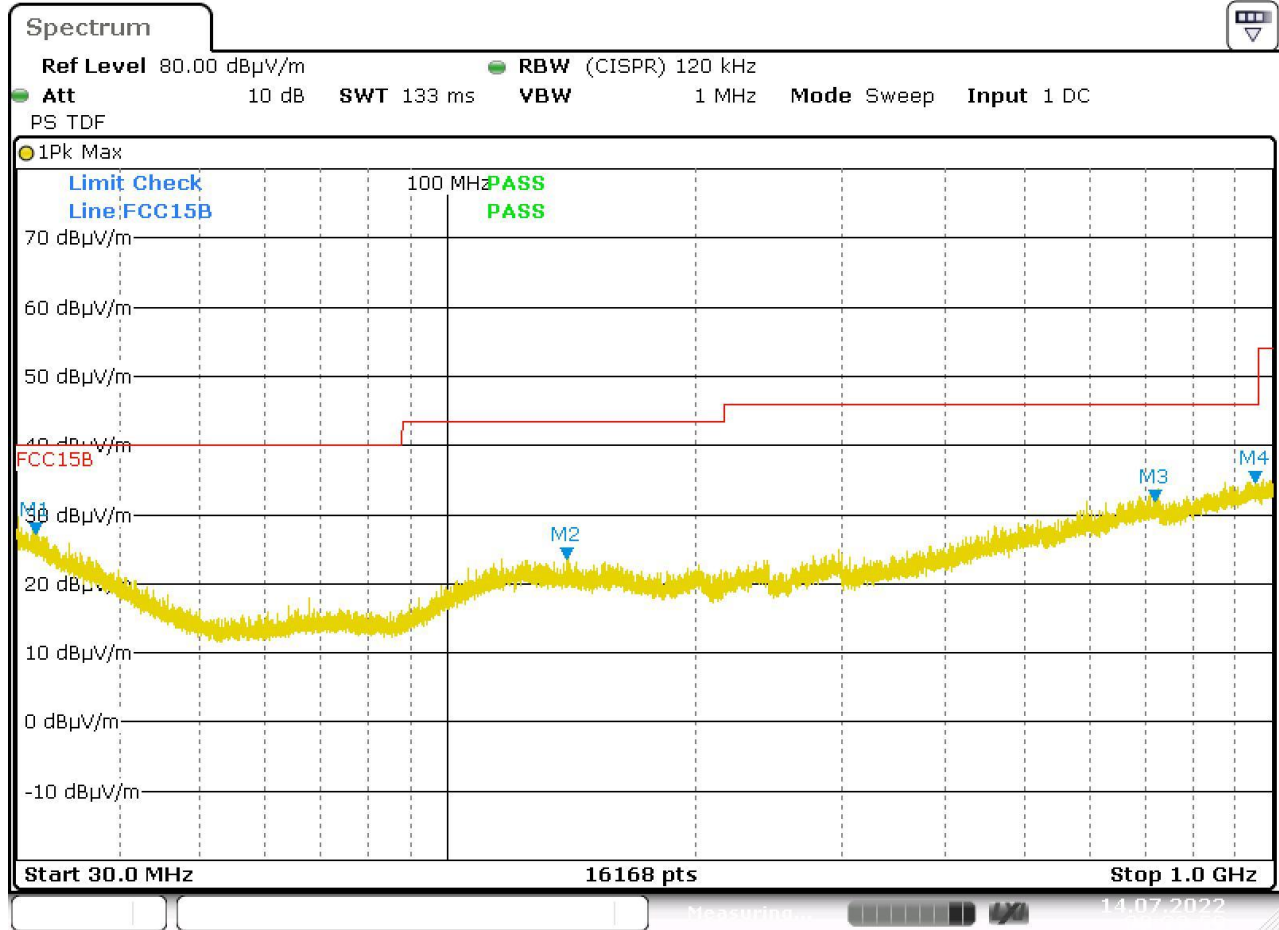
The EUT was tested in a 3m Semi Anechoic Chamber on an insulating turntable 80 cm high.

### Test Setup Details:

EUT Emissions levels contained within this report are calculated on the following basis:

**Radiated Emission Level (dBµV/m) = EMI Receiver Reading (dBµV) + Antenna Correction Factor (dB/m) – Pre-amplifier Gain (dB) + Cable Loss (dB)**

# Data Collection:



Date: 14.JUL.2022 09:23:59

<b>Plots are pre-compliance investigative information. Tables contain the compliance data.</b>											
EUT S/N:	See page 1	Power applied:	EUT battery								Plot#
EUT Mods:	None										
EUT Setup:	EUT earbuds playing pink noise from phone. ANR ON.										
Comments:											

FCC §15.247 (d) RSS-247 Section 5.5 @ 3 Meters											
MK #	Emission Frequency (MHz)	Measured Amplitude (dBµV/m) QP/AVG*	Measured Amplitude (dBµV/m) Peak	Limit (dBµV/m) QP/AVG*	Limit (dBµV/m) Peak	Margin (dB) QP/AVG	Margin (dB) Peak	Table Azimuth (0°closest to ant)	Receiving Antenna		*Average detector used for frequencies above 1 GHz. Notes/Mode
									Pol (H/V)	Height (Meters)	
1	31.675	19.00	28.60	40.0	N/A	21.0	N/A	0	V	1.00	Noise floor
2	139.046	10.70	21.20	43.5	N/A	32.8	N/A	0	V	1.00	Noise floor
3	720.291	20.50	31.60	46.0	N/A	25.5	N/A	233	V	1.00	Noise floor
4	951.894	22.50	33.70	46.0	N/A	23.5	N/A	360	V	1.00	Noise floor



## Limits:

Standard	Freq Range (MHz)	Limits (dBuV QP <sup>1</sup> )			Comments
		Class A		Class B	
		10 m	3 m <sup>2</sup>	3 m	
FCC §15.247 (d) RSS-247 Section 5.5	30-88	39	49	40	Measurements above 1 GHz are made using average and peak detectors. Mains cables draped to floor, not bundled. <b>*For measurements above 1 GHz, peak limits must also be met that are 20 dB higher than average limits.</b>
	88-216	43.5	53.5	43.5	
	216-960	46.5	56.5	46	
	>960	49.5*	59.5*	54*	
bandwidth and Detector Settings:					
Freq. Range (MHz)	RBW (kHz)	VBW (kHz)	Detector		
30 – 1000	120	>300	QP		
> 1000	1000	>1000	Pk and AVG		

## Equipment Used:

TN	Description	Model	S/N	Manufacturer	Most Recent Calibration	Calibration Due Date	Most Recent Verification	Verification Due Date
644	Maxwell House 3 Meter Semi-Anechoic Chamber	N/A	1698A	EM Test	N/A	N/A	19-Jan-2022	19-Jan-2024
1541	Antenna 30MHz - 6GHz	JB6	A050807	Sunol Sciences Corp	14-Dec-2021	14-Dec-2023	N/A	N/A
2319	EMI Test Receiver	ESR26	101276	Rohde & Schwarz	17-Mar-2022	17-Mar-2023	N/A	N/A
2077	PreAmplifier	N/A	N/A	Bose Corporation	N/A	N/A	01-Sep-2021	01-Sep-2022
1445	Maxwell House Radiated Emissions Cable Set	N/A	N/A	Bose Corporation	N/A	N/A	01-Sep-2021	01-Sep-2022
1569	Comb Generator 20MHz - 4.5GHz	CG-520	451016	Com-Power Corporation	N/A	N/A	13-Jul-2022	13-Jul-2023



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# Uncertainty:

Uncertainty Budget				
Title:		Radiated RF Emissions (30MHz-1GHz)		
Source of Uncertainty	Value units:± dB	Distribution	Divisor	Uncertainty (± dB)
Receiver - absolute level	0.3	Rect.	1.73	0.17
Receiver - frequency response	0.8	Rect.	1.73	0.46
Receiver - attenuator switching	0.2	Rect.	1.73	0.12
Receiver - bandwidth switching	0.2	Rect.	1.73	0.12
Receiver - display	0.5	Rect.	1.73	0.29
Antenna factor	0.8	Norm.	2.00	0.38
Antenna directivity	1.0	Norm.	2.00	0.50
Preamp correction factor	0.5	Norm.	2.00	0.25
Cable correction factor	0.5	Norm.	2.00	0.25
Site imperfection - NSA	4.0	Triang.	2.45	1.63
Test table impact	1.1	Rect.	1.73	0.64
Combined uncertainty (RSS):				1.98
Coverage factor (2 sigma):				2.00
Extended uncertainty (95% confidence):				<b>3.97</b>



# Radiated Spurious Emissions 1-25GHz

<b>Project number (Integrity):</b>	911L	<b>Build Phase:</b>	C1.5		
<b>Tested by:</b>	Mike Royer	<b>Date:</b>	14-22, June, 2022		
<b>Requirements Standard(s):</b>	15.247d and RSS-247 Section 5.5	<b>Referenced Standard(s):</b>	ANSI C63.10-2013		
<b>EUT powered with:</b>	Battery	<b>Temp / Humidity:</b>	N/A	<b>Test location:</b>	Marconi Manor
<b>Test equipment used TN's:</b>	2385,1663,2357,2479,2373,2349,2602,2414,1757,2379,1596				
<b>EUT Serial number(s):</b>	084233M2011G016AE				
<b>EUT Software installed:</b>	0.11.2				
<b>EUT Modification(s):</b>	USB Debug wires were attached to the earbud to allow control of the radio.				

## Conclusion:

The Bose model 911L passes radiated emissions from 1-25GHz.

For 1 to 18 GHz, The strongest emission measurement in Peak mode is 51.1 dBuV/m. This meets even the average limit of 54 dBuV/m by 2.9 dB. This meets average and peak requirements.

The blue trace is peak mode. The black trace is average detection.

## Procedure:

Each mode tested was measured at all 10 Harmonics, at the low, middle, and high transmit frequencies.

Pretesting showed that the worst orientation was a vertical position. The EUT was taped to a bamboo skewer and stuck into the test support at 150cm above the floor. From there the table was rotated and the antenna scanned up down and horizontal and vertical polarizations.

The 2.4 GHz band is notched out with a filter to protect the pre-amplifier from overloading.

The average measurements are taken with the receiver average power feature on the SA, using a 1 MHz RBW.

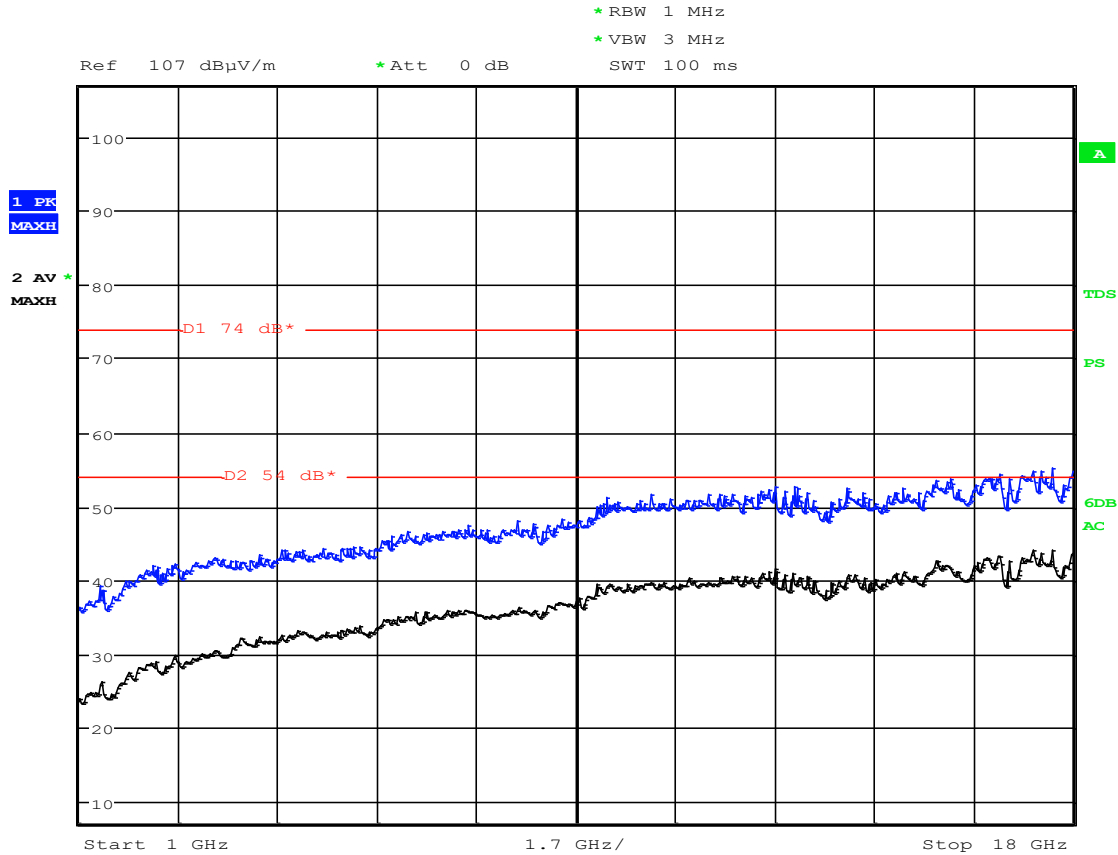


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# Data Collection:

<b>EUT S/N:</b>	Left	<b>Power applied:</b>	Battery		<b>Meas.#</b>	1
<b>EUT Mods:</b>						
<b>EUT Setup:</b>	BLE 1M Low channel 2402 MHz					
<b>Comments:</b>	3m measurement distance(1 to 18 GHz) 30 cm measurement distance(18 to 25 GHz)					

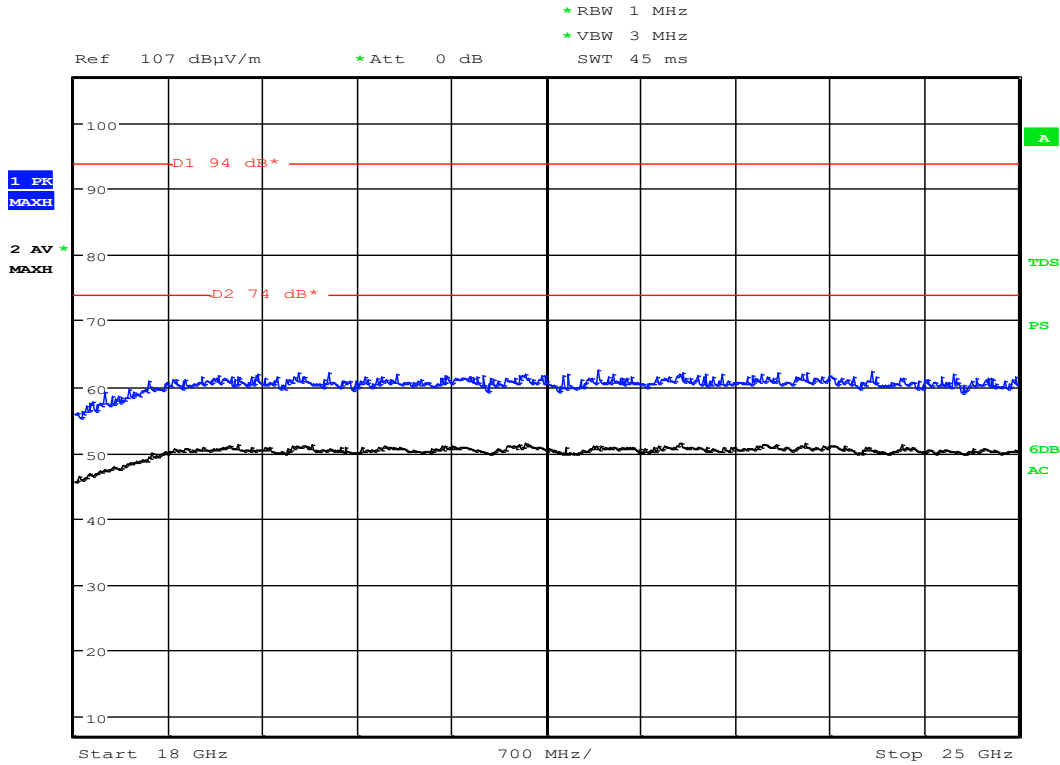


Date: 20.JUN.2022 14:23:38

Measurement Distance 3m



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Date: 21.JUN.2022 17:12:53

Measurement distance 30cm

Limit calculation:

The E field in the far field observes the inverse square law. So that the difference in field strength difference in decibels is;

$$20 \text{ Log} \left( \frac{D1}{D2} \right) = 20 \text{ Log} 10 = 20$$

Peak limit of 74 becomes 94 dBuV at 30cm by adding 20 to 74.

Average limit of 54 becomes 74 dBuV at 30cm by adding 20 to 54.



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<b>EUT S/N:</b>	continued	<b>Power applied:</b>	Battery		<b>Meas.#</b>	1
<b>EUT Mods:</b>						
<b>EUT Setup:</b>	BLE 1M Low channel 2402 MHz					
<b>Comments:</b>	3m measurement distance(1 to 18 GHz) 30 cm measurement distance(18 to 25 GHz)					

FCC 15.247d and RSS-247 Section 5.5 Class B Product (Residential) @ 3 Meters										
Emission Frequency (MHz)	Measured Amplitude (dBµV/m) AVG	Measured Amplitude (dBµV/m) Peak	FCC 15.247d and RSS-247 Section 5.5				Table Azimuth (0° closest to ant)	Receiving Ant		Notes/Mode
			Limit (dBµV/m) AVG	Limit (dBµV/m) Peak	Margin (dB) AVG	Margin (dB) Peak		Pol (H/V)	Height (Meters)	
4804	33.10	45.60	54.0	74.0	20.9	28.4	182	V	1.8	Noise floor
7206	30.70	43.90	54.0	74.0	23.3	30.1	0	H	1.5	Noise floor
9608	32.30	46.40	54.0	74.0	21.7	27.6	322	H	1.8	Noise floor
12010	34.40	48.10	54.0	74.0	19.6	25.9	0	H	1.5	Noise floor
14412	34.60	47.20	54.0	74.0	19.4	26.8	0	H	1.5	Noise floor
16814	36.20	49.10	54.0	74.0	17.8	24.9	0	H	1.5	Noise floor

FCC 15.247d and RSS-247 Section 5.5 Class B Product (Residential) @ 30 cm										
Emission Frequency (MHz)	Measured Amplitude (dBµV/m) AVG	Measured Amplitude (dBµV/m) Peak	FCC 15.247d and RSS-247 Section 5.5				Table Azimuth (0° closest to ant)	Receiving Ant		Notes/Mode
			Limit (dBµV/m) AVG	Limit (dBµV/m) Peak	Margin (dB) AVG	Margin (dB) Peak		Pol (H/V)	Height (Meters)	
19216	44.40	57.60	74.0	94.0	29.6	36.4				Noise floor
21618	43.30	56.50	74.0	94.0	30.7	37.5				Noise floor
24020	42.90	55.90	74.0	94.0	31.1	38.1				Noise floor





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<b>EUT S/N:</b>	Left	<b>Power applied:</b>	Battery		<b>Meas.#</b>	2
<b>EUT Mods:</b>						
<b>EUT Setup:</b>	BLE 1M Mid channel 2440 MHz					
<b>Comments:</b>						

FCC 15.247d and RSS-247 Section 5.5 Class B Product (Residential) @ 3 Meters										
Emission Frequency (MHz)	Measured Amplitude (dBµV/m) AVG	Measured Amplitude (dBµV/m) Peak	FCC 15.247d and RSS-247 Section 5.5				Table Azimuth (0° closest to ant)	Receiving Ant		Notes/Mode
			Limit (dBµV/m) AVG	Limit (dBµV/m) Peak	Margin (dB) AVG	Margin (dB) Peak		Pol (H/V)	Height (Meters)	
4880	32.60	44.60	54.0	74.0	21.4	29.4	185	V	1.7	Noise floor
7320	31.90	44.30	54.0	74.0	22.1	29.7	0	H	1.5	Noise floor
9760	34.80	48.80	54.0	74.0	19.2	25.2	318	H	1.7	Noise floor
12200	35.50	48.20	54.0	74.0	18.5	25.8	0	H	1.5	Noise floor
14640	35.00	48.00	54.0	74.0	19.0	26.0	0	H	1.5	Noise floor
17080	36.40	49.40	54.0	74.0	17.6	24.6	0	H	1.5	Noise floor

FCC 15.247d and RSS-247 Section 5.5 Class B Product (Residential) @ 30 cm										
Emission Frequency (MHz)	Measured Amplitude (dBµV/m) AVG	Measured Amplitude (dBµV/m) Peak	FCC 15.247d and RSS-247 Section 5.5				Table Azimuth (0° closest to ant)	Receiving Ant		Notes/Mode
			Limit (dBµV/m) AVG	Limit (dBµV/m) Peak	Margin (dB) AVG	Margin (dB) Peak		Pol (H/V)	Height (Meters)	
19520	43.30	55.80	74.0	94.0	30.7	38.2				Noise floor
21960	43.70	56.60	74.0	94.0	30.3	37.4				Noise floor
24400	43.60	56.40	74.0	94.0	30.4	37.6				Noise floor



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<b>EUT S/N:</b>	Left	<b>Power applied:</b>	Battery		<b>Meas.#</b>	3
<b>EUT Mods:</b>						
<b>EUT Setup:</b>	BLE 1M High channel 2480 MHz					
<b>Comments:</b>						

FCC 15.247d and RSS-247 Section 5.5 Class B Product (Residential) @ 3 Meters										
Emission Frequency (MHz)	Measured Amplitude (dBµV/m) AVG	Measured Amplitude (dBµV/m) Peak	FCC 15.247d and RSS-247 Section 5.5				Table Azimuth (0° closest to ant)	Receiving Ant		Notes/Mode
			Limit (dBµV/m) AVG	Limit (dBµV/m) Peak	Margin (dB) AVG	Margin (dB) Peak		Pol (H/V)	Height (Meters)	
4960	30.50	43.90	54.0	74.0	23.5	30.1	37	V	1.7	Noise floor
7440	31.80	44.50	54.0	74.0	22.2	29.5	0	H	1.5	Noise floor
9920	35.80	50.30	54.0	74.0	18.2	23.7	313	H	1.7	Noise floor
12400	35.10	48.20	54.0	74.0	18.9	25.8	0	H	1.5	Noise floor
14880	35.70	48.40	54.0	74.0	18.3	25.6	0	H	1.5	Noise floor
17360	38.00	50.60	54.0	74.0	16.0	23.4	0	H	1.5	Noise floor

FCC 15.247d and RSS-247 Section 5.5 Class B Product (Residential) @ 30 cm										
Emission Frequency (MHz)	Measured Amplitude (dBµV/m) AVG	Measured Amplitude (dBµV/m) Peak	FCC 15.247d and RSS-247 Section 5.5				Table Azimuth (0° closest to ant)	Receiving Ant		Notes/Mode
			Limit (dBµV/m) AVG	Limit (dBµV/m) Peak	Margin (dB) AVG	Margin (dB) Peak		Pol (H/V)	Height (Meters)	
19840	44.10	56.70	74.0	94.0	29.9	37.3				Noise floor
22320	44.00	57.00	74.0	94.0	30.0	37.0				Noise floor
24800	43.60	56.60	74.0	94.0	30.4	37.4				Noise floor



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<b>EUT S/N:</b>	Left	<b>Power applied:</b>	Battery		<b>Meas.#</b>	4
<b>EUT Mods:</b>						
<b>EUT Setup:</b>	BLE 2M Low channel 2404 MHz					
<b>Comments:</b>						

FCC 15.247d and RSS-247 Section 5.5 Class B Product (Residential) @ 3 Meters										
Emission Frequency (MHz)	Measured Amplitude (dBµV/m) AVG	Measured Amplitude (dBµV/m) Peak	FCC 15.247d and RSS-247 Section 5.5				Table Azimuth (0° closest to ant)	Receiving Ant		Notes/Mode
			Limit (dBµV/m) AVG	Limit (dBµV/m) Peak	Margin (dB) AVG	Margin (dB) Peak		Pol (H/V)	Height (Meters)	
4808	29.90	42.60	54.0	74.0	24.1	31.4	273	V	1.5	Noise floor
7212	30.70	43.40	54.0	74.0	23.3	30.6	0	H	1.5	Noise floor
9616	31.20	45.40	54.0	74.0	22.8	28.6	132	H	1.5	Noise floor
12020	34.50	47.10	54.0	74.0	19.5	26.9	0	H	1.5	Noise floor
14424	35.00	47.90	54.0	74.0	19.0	26.1	0	H	1.5	Noise floor
16828	35.10	48.00	54.0	74.0	18.9	26.0	0	H	1.5	Noise floor

FCC 15.247d and RSS-247 Section 5.5 Class B Product (Residential) @ 30 cm										
Emission Frequency (MHz)	Measured Amplitude (dBµV/m) AVG	Measured Amplitude (dBµV/m) Peak	FCC 15.247d and RSS-247 Section 5.5				Table Azimuth (0° closest to ant)	Receiving Ant		Notes/Mode
			Limit (dBµV/m) AVG	Limit (dBµV/m) Peak	Margin (dB) AVG	Margin (dB) Peak		Pol (H/V)	Height (Meters)	
19232	44.40	57.30	74.0	94.0	29.6	36.7				Noise floor
21636	43.40	56.20	74.0	94.0	30.6	37.8				Noise floor
24040	43.10	56.70	74.0	94.0	30.9	37.3				Noise floor



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<b>EUT S/N:</b>	Left	<b>Power applied:</b>	Battery		<b>Meas.#</b>	5
<b>EUT Mods:</b>						
<b>EUT Setup:</b>	BLE 2M Mid channel 2440 MHz					
<b>Comments:</b>						

FCC 15.247d and RSS-247 Section 5.5 Class B Product (Residential) @ 3 Meters										
Emission Frequency (MHz)	Measured Amplitude (dBµV/m) AVG	Measured Amplitude (dBµV/m) Peak	FCC 15.247d and RSS-247 Section 5.5				Table Azimuth (0° closest to ant)	Receiving Ant		Notes/Mode
			Limit (dBµV/m) AVG	Limit (dBµV/m) Peak	Margin (dB) AVG	Margin (dB) Peak		Pol (H/V)	Height (Meters)	
4880	30.50	44.10	54.0	74.0	23.5	29.9	0	V	1.5	Noise floor
7320	31.80	45.00	54.0	74.0	22.2	29.0	0	H	1.5	Noise floor
9760	32.90	47.30	54.0	74.0	21.1	26.7	204	V	1.5	Noise floor
12200	34.80	48.00	54.0	74.0	19.2	26.0	0	H	1.5	Noise floor
14640	34.90	47.60	54.0	74.0	19.1	26.4	0	H	1.5	Noise floor
17080	36.50	49.30	54.0	74.0	17.5	24.7	0	H	1.5	Noise floor

FCC 15.247d and RSS-247 Section 5.5 Class B Product (Residential) @ 30 cm										
Emission Frequency (MHz)	Measured Amplitude (dBµV/m) AVG	Measured Amplitude (dBµV/m) Peak	FCC 15.247d and RSS-247 Section 5.5				Table Azimuth (0° closest to ant)	Receiving Ant		Notes/Mode
			Limit (dBµV/m) AVG	Limit (dBµV/m) Peak	Margin (dB) AVG	Margin (dB) Peak		Pol (H/V)	Height (Meters)	
19520	43.20	57.10	74.0	94.0	30.8	36.9				Noise floor
21960	43.70	56.30	74.0	94.0	30.3	37.7				Noise floor
24400	43.60	57.30	74.0	94.0	30.4	36.7				Noise floor



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<b>EUT S/N:</b>	Left	<b>Power applied:</b>	Battery		<b>Meas.#</b>	6
<b>EUT Mods:</b>						
<b>EUT Setup:</b>	BLE 2M High channel 2478 MHz					
<b>Comments:</b>						

FCC 15.247d and RSS-247 Section 5.5 Class B Product (Residential) @ 3 Meters										
Emission Frequency (MHz)	Measured Amplitude (dBµV/m) AVG	Measured Amplitude (dBµV/m) Peak	FCC 15.247d and RSS-247 Section 5.5				Table Azimuth (0° closest to ant)	Receiving Ant		Notes/Mode
			Limit (dBµV/m) AVG	Limit (dBµV/m) Peak	Margin (dB) AVG	Margin (dB) Peak		Pol (H/V)	Height (Meters)	
4956	29.00	43.00	54.0	74.0	25.0	31.0	357	V	1.5	Noise floor
7434	31.60	45.70	54.0	74.0	22.4	28.3	0	H	1.5	Noise floor
9912	33.40	46.80	54.0	74.0	20.6	27.2	0	H	1.5	Noise floor
12390	35.50	48.40	54.0	74.0	18.5	25.6	0	H	1.5	Noise floor
14868	35.50	48.60	54.0	74.0	18.5	25.4	0	H	1.5	Noise floor
17346	38.60	51.10	54.0	74.0	15.4	22.9	0	H	1.5	Noise floor

FCC 15.247d and RSS-247 Section 5.5 Class B Product (Residential) @ 30 cm										
Emission Frequency (MHz)	Measured Amplitude (dBµV/m) AVG	Measured Amplitude (dBµV/m) Peak	FCC 15.247d and RSS-247 Section 5.5				Table Azimuth (0° closest to ant)	Receiving Ant		Notes/Mode
			Limit (dBµV/m) AVG	Limit (dBµV/m) Peak	Margin (dB) AVG	Margin (dB) Peak		Pol (H/V)	Height (Meters)	
19824	44.10	57.30	74.0	94.0	29.9	36.7				Noise floor
22302	44.10	56.70	74.0	94.0	29.9	37.3				Noise floor
24780	43.80	56.70	74.0	94.0	30.2	37.3				Noise floor



## Limits:

Standard	Freq Range (MHz)	Limits (dBuV QP <sup>1</sup> )			Comments
		Class A		Class B	
		10 m	3 m	3 m	
FCC 15.247d and RSS-247 Section 5.5	30-88	39	49	40	Measurements above 1 GHz are made using average and peak detectors. Mains cables draped to floor, not bundled. <b>*For measurements above 1 GHz, peak limits must also be met that are 20 dB higher than average limits.</b>
	88-216	43.5	53.5	43.5	
	216-960	46.5	56.5	46	
	>960	49.5*	59.5*	54*	
CISPR 32			Class A	Class B	Mains cables bundled not draped to floor. <b>*For measurements above 1 GHz, peak limits must also be met that are 20 dB higher than average limits.</b>
			3 m	3 m	
	30-230		50	40	
	230-1000		57	47	
	Freq Range (GHz)				
	1-3		56*	50*	
3-6		60*	54*		
Bandwidth and Detector Settings:					
Freq. Range (MHz)	RBW (kHz)	VBW (kHz)	Detector		
30 – 1000	120	>300	QP		
> 1000	1000	>1000	Pk and AVG		



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## Equipment Used:

TN	Description	Model	S/N	Manufacturer	Most Recent Service	Service Due Date
2385	Marconi Manor	3 Meter Semi Anechoic Chamber	N/A	AP Americas	20-Jan-2022	
1663	EMI Test Receiver	ESU40	100098	Rohde & Schwarz	18-Mar-2022	18-Mar-2023
2357	RF Cable 30MHz-18GHz	TRU-300	TRU-12707-03	TRU Corporation	20-Mar-2022	20-Mar-2023
2479	RF cable 30MHz-18GHz	257-257-3052640	N/A	SRC Haverhill	20-Mar-2022	20-Mar-2023
2349	Double Ridge Waveguide Horn Antenna 1-18GHz	3117	00152406	ETS Lindgren	17-Feb-2021	17-Feb-2023
2602	Miteq pre-amp 1-18GHz 35dB	AFS42-01001800-28-10P-42	N/A	Miteq	07-Jul-2021	07-Jul-2022
2414	Band Reject Filter (2.4GHz)	BRM50702-07	003	Micro-Tronics	20-Mar-2022	20-Mar-2023
1757	18GHz-40GHz Preamp	JS4018004000-30-8P-A1	1406279	Miteq	07-Jul-2021	07-Jul-2022
1596	Horn Antenna 18GHz - 26.5GHz	AT4640	309234	Amplifier Research		



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# Uncertainty:

Uncertainty Budget				
Title:		Radiated Emissions (>1GHz)		
Source of Uncertainty	Value units:± dB	Distribution	Divisor	Uncertainty (± dB)
Receiver - absolute level	0.3	Rect.	1.73	0.17
Receiver - frequency response	2.0	Rect.	1.73	1.16
Receiver - attenuator switching	0.2	Rect.	1.73	0.12
Receiver - bandwidth switching	0.2	Rect.	1.73	0.12
Receiver - display	0.5	Rect.	1.73	0.29
Antenna factor	0.4	Norm.	2.00	0.20
Antenna directivity	1.0	Norm.	2.00	0.50
Preamp correction factor	0.5	Norm.	2.00	0.25
Cable correction factor	0.5	Norm.	2.00	0.25
Site imperfection - NSA	3.0	Triang.	2.45	1.22
Test table impact	1.7	Rect.	1.73	0.98
Combined uncertainty (RSS):				2.09
Coverage factor (2 sigma):				2.00
Extended uncertainty (95% confidence):				<b>4.17</b>





# Radiated Band Edge

<b>Model Number:</b>	911L	<b>Build Phase:</b>	C1.5		
<b>Tested by:</b>	Mike Royer	<b>Date:</b>	20 June 2022		
<b>Requirements Standard(s):</b>	CFR47 Part 15.247, RSS-247 Section 5.5	<b>Referenced Standard(s):</b>	ANSI C63.10-2013		
<b>EUT powered with:</b>	Battery	<b>Temp / Humidity:</b>	N/A	<b>Test location:</b>	Marconi Manor
<b>Test equipment used TN's:</b>	1663,2373,2479,2357,2349,2385, 2929				
<b>EUT Serial number(s):</b>	084232M2011G099AE				
<b>EUT Software installed:</b>	0.6.18+g5d320d0				
<b>EUT Modification(s):</b>	USB Debug wires were attached to the earbud to allow control of the radio.				

## Conclusion:

The Bose model 911L passes Radiated Band Edge.

The blue trace is peak mode. The black trace is average detection.

Note that the BLE 2M rate does not support channels 0, 12, or 39 (2402 MHz, 2426 MHz, or 2480 MHz)

Note that the EUT was placed on a skewer stick and rotated in 3 axes to find the maximum signal strength.

## Procedure:

For BLE 1M lower band edge measurements the transmit frequency was 2402 MHz.

For BLE 1M upper band edge measurements the transmit frequency was 2480 MHz

For BLE 2M lower band edge measurements the transmit frequency was 2404 MHz.

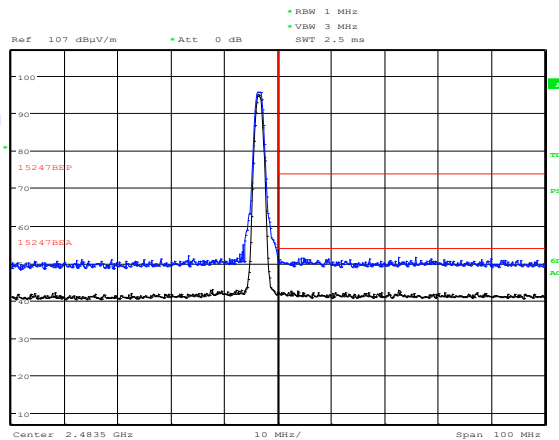
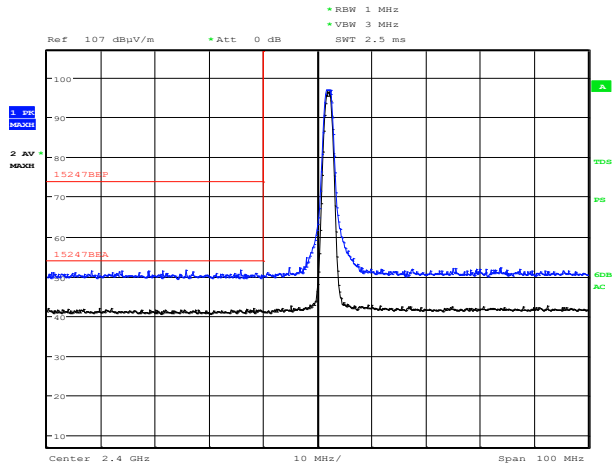
For BLE 2M upper band edge measurements the transmit frequency was 2478 MHz.

Tabular data is from the average detector built into the receiver with a 1 MHz RBW.

# Data Collection:

Lower Bandedge, BLE 1M

Upper Bandedge, BLE 1M

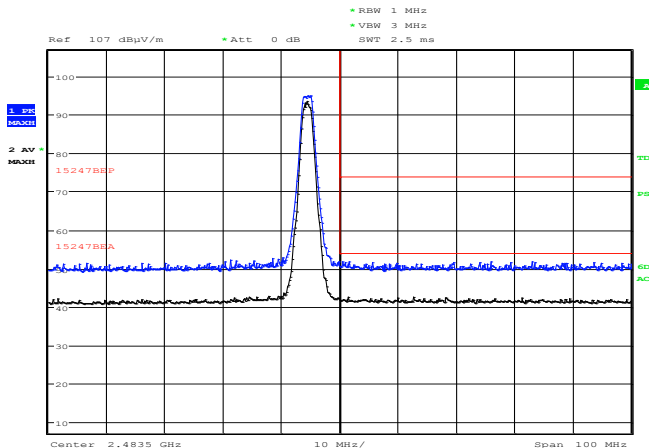
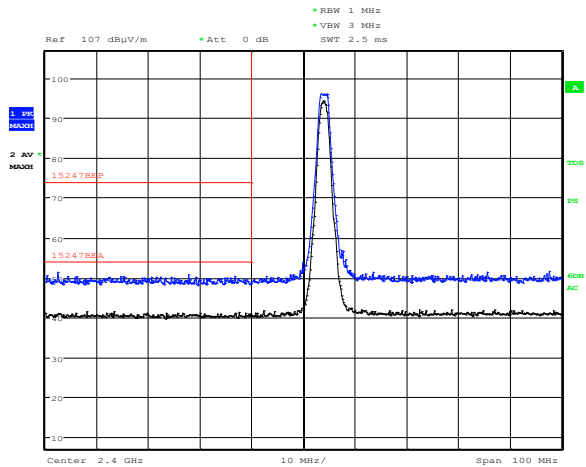


Date: 20.JUN.2022 17:43:00

Date: 20.JUN.2022 17:47:04

Lower Bandedge, BLE 2M

Upper Bandedge, BLE 2M



Date: 20.JUN.2022 17:52:31

Date: 20.JUN.2022 17:57:51



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FCC 15.247d and RSS-247 Section 5.5 @ 3 Meters

Emission Frequency (MHz)	Measured Amplitude (dBµV/m) AVG	Measured Amplitude (dBµV/m) Peak	RBW 1 MHz				Table Azimuth (0°closest to ant)	Receiving Antenna		Notes/Mode
			Limit (dBµV/m) AVG	Limit (dBµV/m) Peak	Margin (dB) AVG	Margin (dB) Peak		Pol (H/V)	Height (Meters)	
2483.500	37.90	50.90	54.0	74.0	16.1	23.1	0	H	150.00	BLE 1M, 100% DC
2483.500	37.70	50.60	54.0	74.0	16.3	23.4	0	H	150.00	BLE 2M, 100% DC



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## Limits:

Standard	Freq Range (MHz)	Limits (dBuV QP <sup>1</sup> )			Comments
		Class A		Class B	
		10 m	3 m	3 m	
FCC RSS-GEN	30-88	39	49	40	Measurements above 1 GHz are made using average and peak detectors. Mains cables draped to floor, not bundled. <b>*For measurements above 1 GHz, peak limits must also be met that are 20 dB higher than average limits.</b>
	88-216	43.5	53.5	43.5	
	216-960	46.5	56.5	46	
	>960	49.5*	59.5*	54*	
CISPR 32			Class A	Class B	Mains cables bundled not draped to floor. <b>*For measurements above 1 GHz, peak limits must also be met that are 20 dB higher than average limits.</b>
			3 m	3 m	
	30-230		50	40	
	230-1000		57	47	
	Freq Range (GHz)				
	1-3		56*	50*	
	3-6		60*	54*	
Bandwidth and Detector Settings:					
Freq. Range (MHz)	RBW (kHz)	VBW (kHz)	Detector		
30 – 1000	120	>300	QP		
> 1000	1000	>1000	Pk and AVG		

## Equipment Used:

TN	Description	Model	S/N	Manufacturer	Most Recent Service	Service Due Date
1663	EMI Test Receiver	ESU40	100098	Rohde & Schwarz	18-Mar-2022	18-Mar-2024
2479	RF cable 30MHz-18GHz	257-257-3052640	N/A	SRC Haverhill	20-Mar-2022	20-Mar-2023
2357	RF Cable 30MHz-18GHz	TRU-300	TRU-12707-03	TRU Corporation	20-Mar-2022	20-Mar-2023
2349	Double Ridge Waveguide Horn Antenna 1-18GHz	3117	00152406	ETS Lindgren	24-Feb-2022	24-Feb-2024
2385	Marconi Manor	3 Meter Semi Anechoic Chamber	N/A	AP Americas	20-Jan-2022	20-Jan-2024
2929	Mini-circuits band-edge pre-amp 300 MHz - 8 GHz 20 dB	ZX60HV-83LN+	N/A	Mini-Circuits	20-Mar-2022	20-Mar-2023



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End of Report