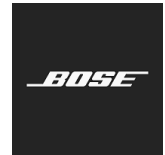




Certificate # 1514.1

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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.435911.22.198.1(4)*

General Comments/Special Test Conditions:

This report relates only to the items tested. This report covers EMC marking requirements for *Enter product and any special modifications or test conditions.*

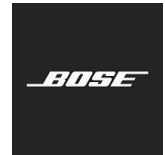
	Print Name	Signature	Date
Prepared By:	Michael A. Royer	<i>Michael A. Royer</i>	September 5, 2022
Electrical Engineer Review* By:	Bryan Cerqua	<i>Bryan H Cerqua</i>	

\* 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

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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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# 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.*

Scope:

This report covers EMC requirements. *FCC or ISED, FHSS low power transceiver.*

Test Objective:

Verify product meets all applicable EMC requirements.

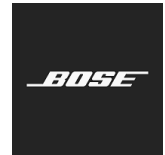
Results:

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.):

**[X]** meets all test standards on page 1 of this report.



# Test Results Summary

TEST NAME	TEST RESULT PASS or N/A	COMMENT(S)
On Time and Duty Cycle	N/A	Measurements included
99% Occupied Bandwidth	N/A	Measurements included
20dB Occupied Bandwidth	Pass	
Hopping Frequency Separation	Pass	
Number of Hopping Channels	Pass	
Average Time of Occupancy	Pass	
Output Power	Pass	
Conducted Spurious Emissions	Pass	
RF Conducted Emissions – AC Mains	Pass	In a separate report
RF Radiated Emissions 30MHz -1GHz	Pass	In a separate report
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

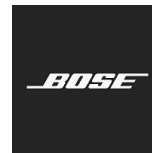
# FCC Test Site Accreditation:

Display Exhibits	Display Correspondence	Display Scopes	Firm Name	Location	Accreditation	MRA Designation Number	Expiration Date	Contact Name	Contact Title	Address	P.O. Box	Mail Stop	City	State	Zip	Country	E-mail Address	Phone Number	Fax Number
		<a href="#">Scopes</a>	<a href="#">Bose Corporation</a>	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	1 508 766 6137	508 766 1145



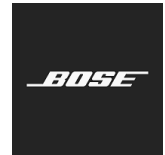
Certificate # 1514.1

PRODUCT ASSURANCE ENGINEERING  
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# Canadian Test Site Registration:

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



# RF Conducted Measurements

## On Time and Duty Cycle

<b>Project number (Integrity):</b>	911L	<b>Build Phase:</b>	C1.5			
<b>Tested by:</b>	Mike Royer	<b>Date:</b>	21 July 2022			
<b>Requirements Standard(s):</b>		<b>Referenced Standard(s):</b>				
<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.

### Procedure:

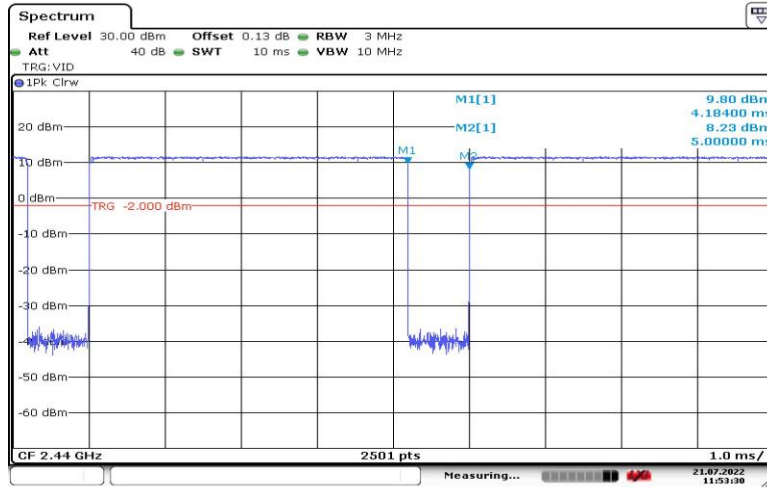
ANSI C63.10, Section 11.6: Zero-Span Spectrum Analyzer Method.

### Equipment Used:

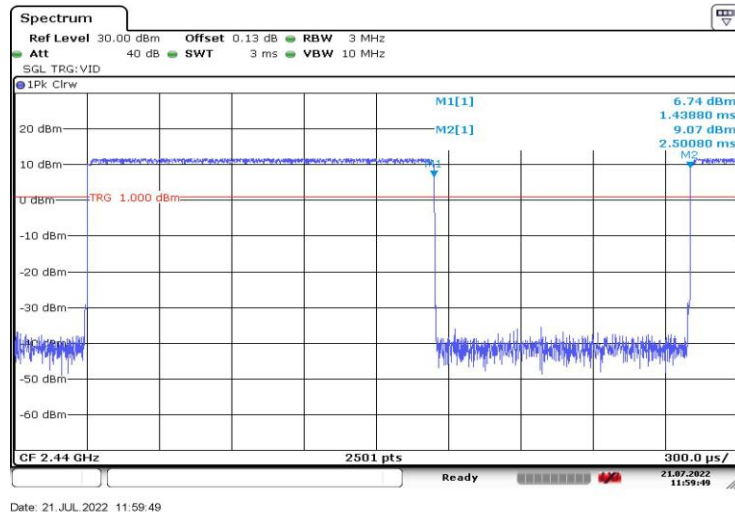
TN	Description	Model	S/N	Manufacturer	Most Recent Calibration	Calibration Due Date
2409	Signal and Spectrum Analyzer	FSV40	101413	Rohde & Schwarz	21-Mar-2022	21-Mar-2024

# Data Collection:

Mode	ON Time (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
QHS P2	4.184	5	.837	84	0.77
QHS P6	1.439	2.5	.576	58	2.40



QHS P2



QHS P6



# 99% Occupied Bandwidth

<b>Project code name:</b>		<b>Marketing name:</b>		<b>Model number:</b>	911L
<b>Project number (Integrity):</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>		<b>Referenced Standard(s):</b>			
<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.

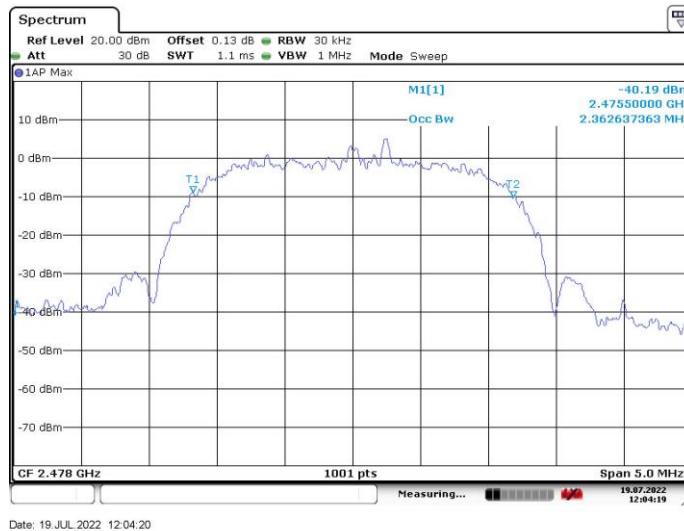
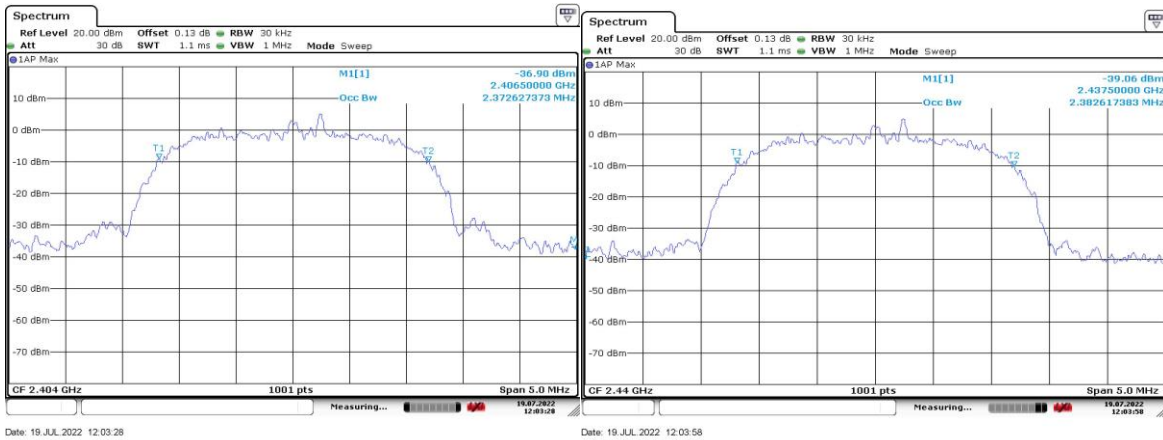
## Procedure:

The transmitter output is connected to a spectrum analyzer. The RBW is set to  $\geq 1-5\%$  of the 99% Occupied Bandwidth. The VBW is set to  $\geq$  RBW.



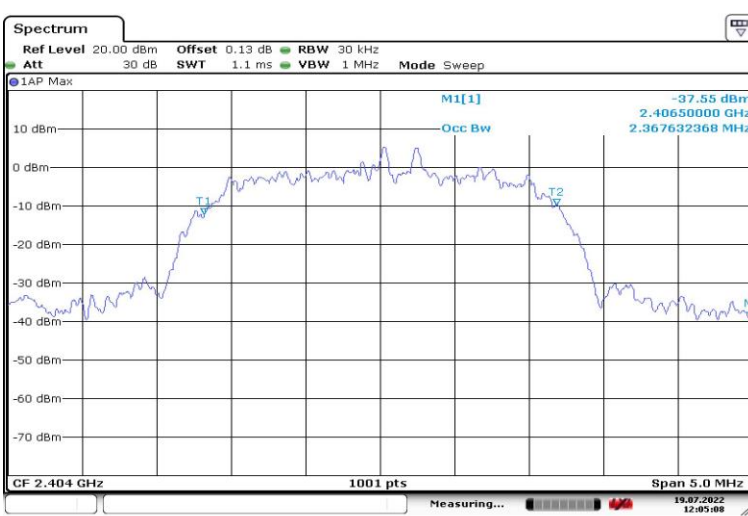
# QHS P2 Data Collection:

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2404	2.373
Middle	2440	2.383
High	2478	2.363

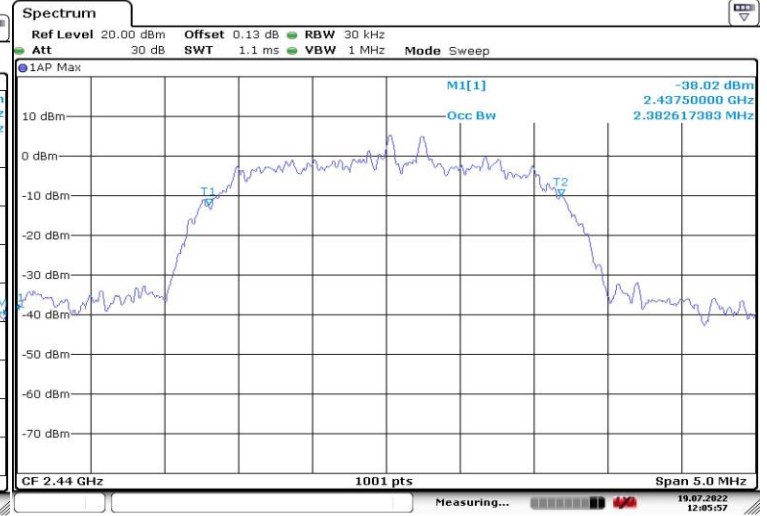


# QHS P6 Data Collection:

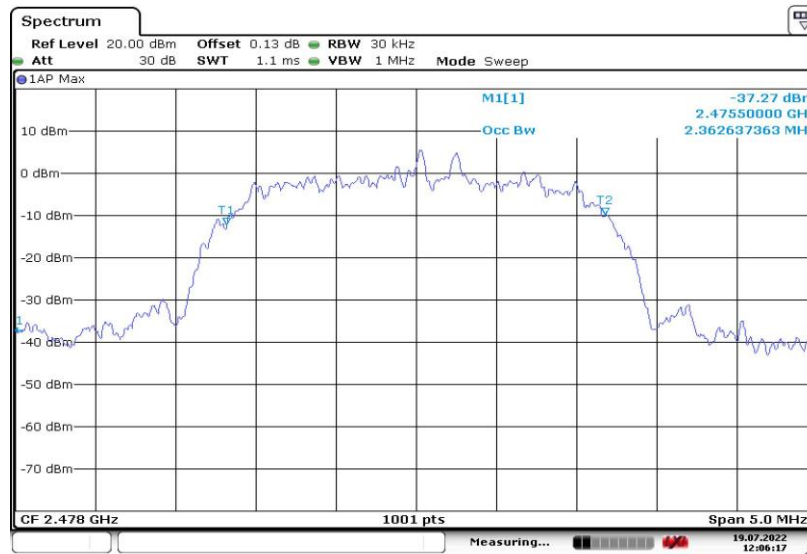
Channel	Frequency (MHz)	99% Bandwidth (MHz)	
Low	2404	2.368	
Middle	2440	2.383	
High	2478	2.363	



Date: 19.JUL.2022 12:05:08



Date: 19.JUL.2022 12:05:58



Date: 19.JUL.2022 12:06:17

## 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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# 20dB Occupied Bandwidth

<b>Project number (Integrity):</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>		<b>Referenced Standard(s):</b>	ANSI 63.10:2013 - 6.9.2		
<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:

This test is for information only.

## Limits:

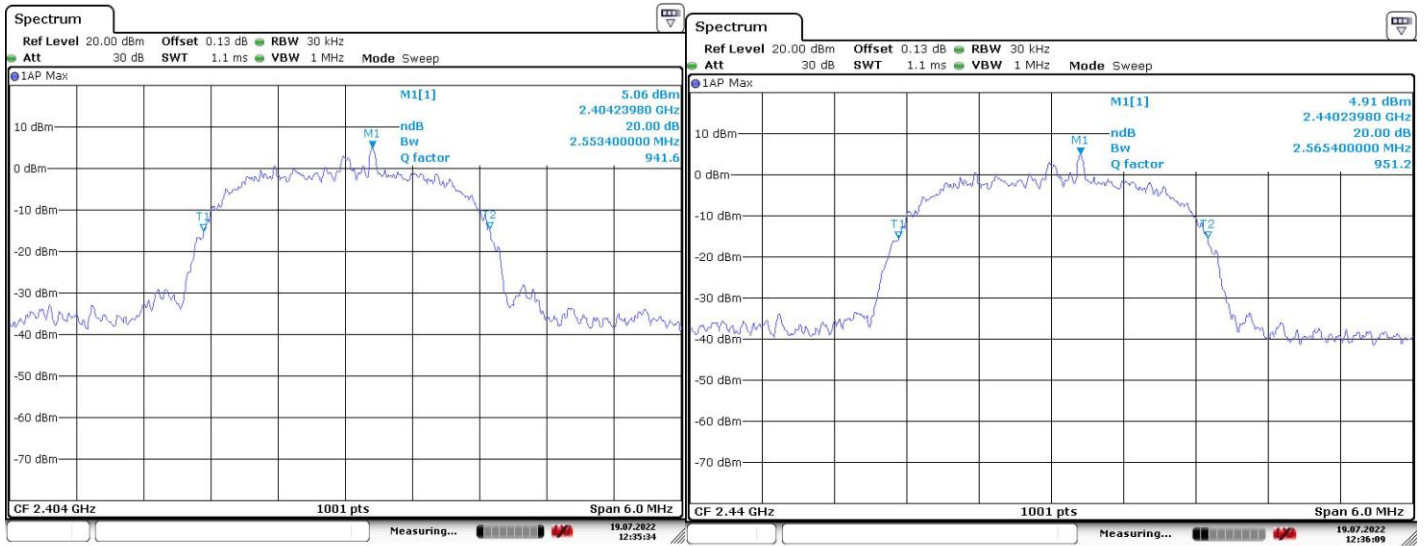
None; for reporting purposes only.

## Procedure:

The transmitter output is connected to a spectrum analyzer. The RBW is set to  $\geq 1-5\%$  of the 20dB bandwidth. The VBW is set to  $\geq$  RBW.

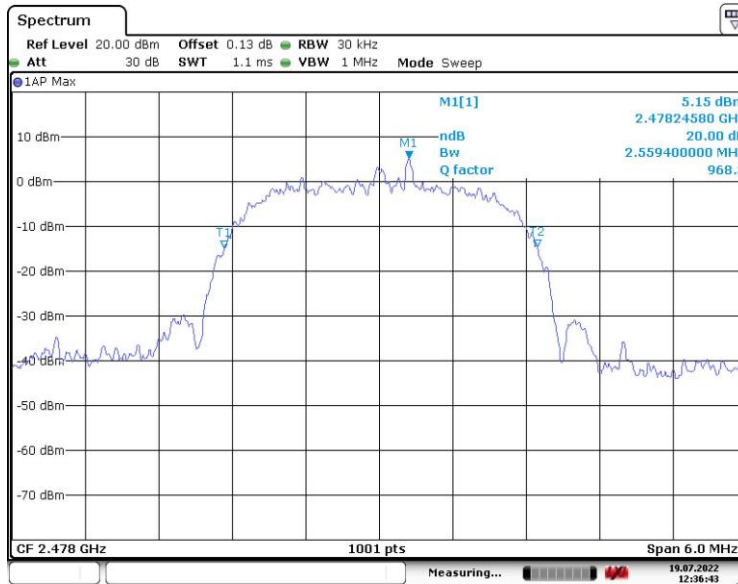
# QHS P2 Data Collection:

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
Low	2404	2.553
Middle	2440	2.565
High	2478	2.559



Date: 19 JUL 2022 12:35:35

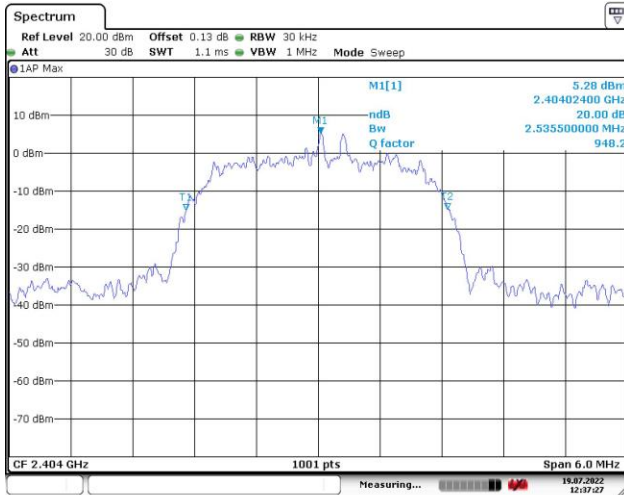
Date: 19 JUL 2022 12:36:10



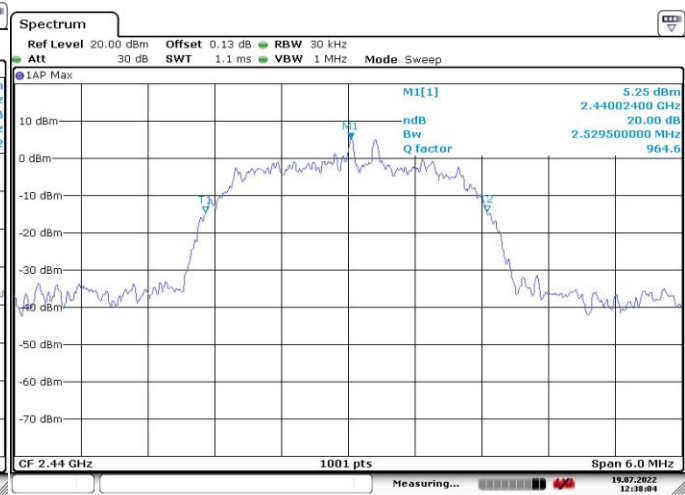
Date: 19 JUL 2022 12:36:43

## QHS P6 Data Collection:

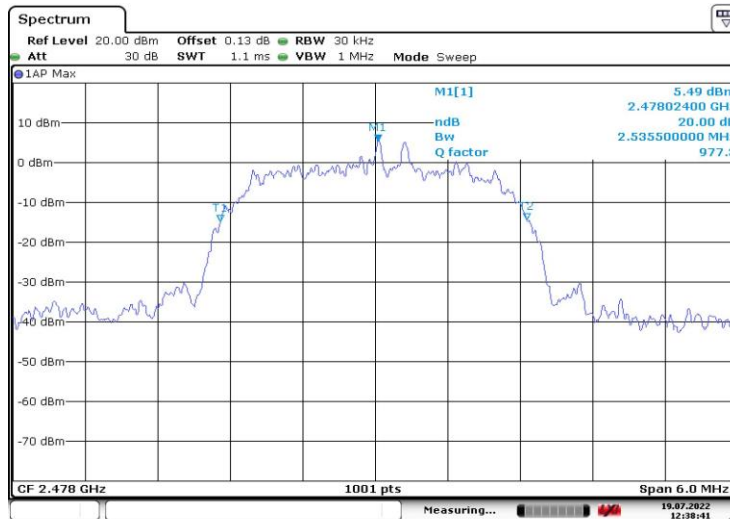
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2404	2.536
Middle	2440	2.530
High	2478	2.536



Date: 19 JUL 2022 12:37:28



Date: 19 JUL 2022 12:38:04



Date: 19 JUL 2022 12:38:42

## 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



# Hopping Frequency Separation

<b>Project number (Integrity):</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 (a) (1), IC RSS-247 5.1 (b)		<b>Referenced Standard(s):</b>	ANSI C63.10-2013 section 7.8.2	
<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:

Hopping frequencies are separated by 2 MHz which is more than the required minimum of 25kHz and more than 2/3 of the 20dB bandwidth of the hopping channel which would be 1710Hz.

The BW is a little larger than the separation, so the carrier to carrier separation is judged by the spur on the spectral profile of each channel.

## Limits:

FCC §15.247 (a) (1)

RSS-247 (5.1) (b)

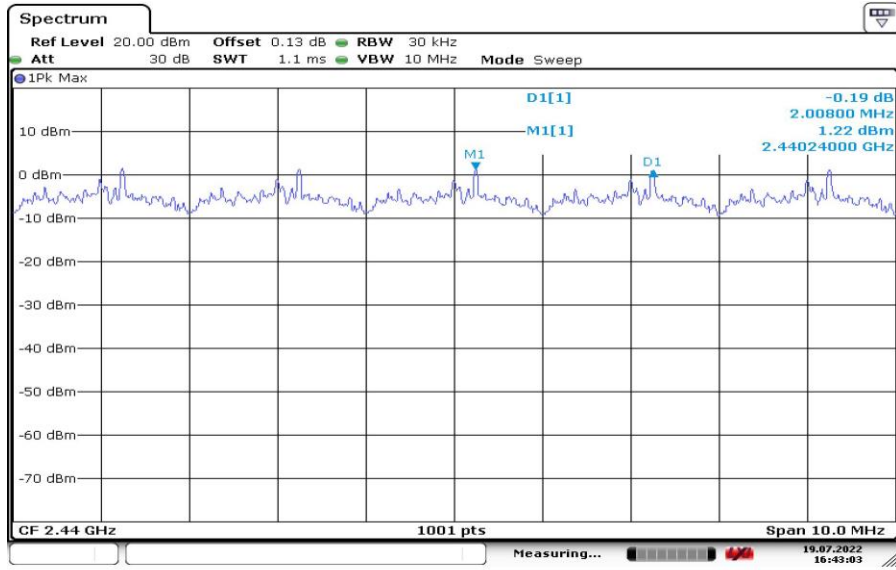
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20dB bandwidth of the hopping channel, whichever is greater.

Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

## Equipment Used:

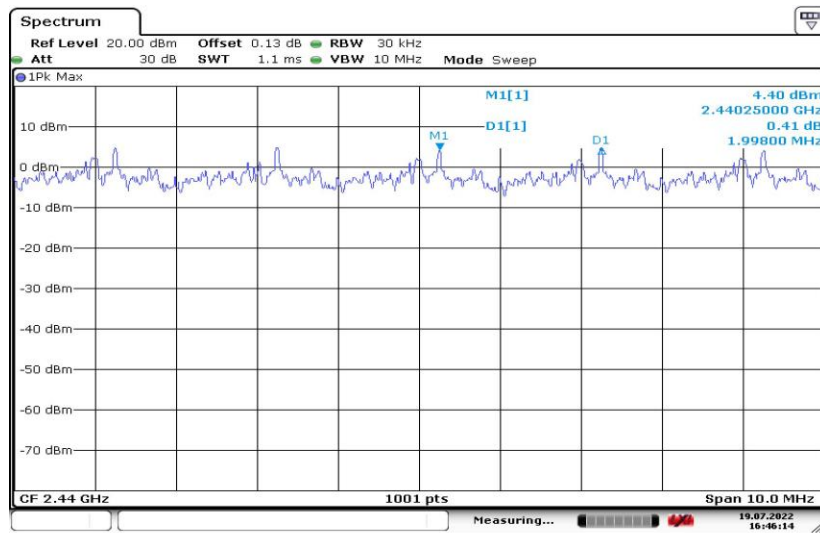
TN	Description	Model	S/N	Manufacturer	Most Recent Calibration	Calibration Due Date
2409	Signal and Spectrum Analyzer	FSV40	101413	Rohde & Schwarz	21-Mar-2022	21-Mar-2024

# Data Collection:



Date: 19 JUL 2022 16:43:04

QHS P2 hopping



Date: 19 JUL 2022 16:46:14

QHS P6 hopping





# Number of Hopping Channels

<b>Project number (Integrity):</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 (a) (1) (iii) IC RSS-247 5.1 (d)	<b>Referenced Standard(s):</b>	ANSI C63.10-2013 Section 7.8.3		
<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:

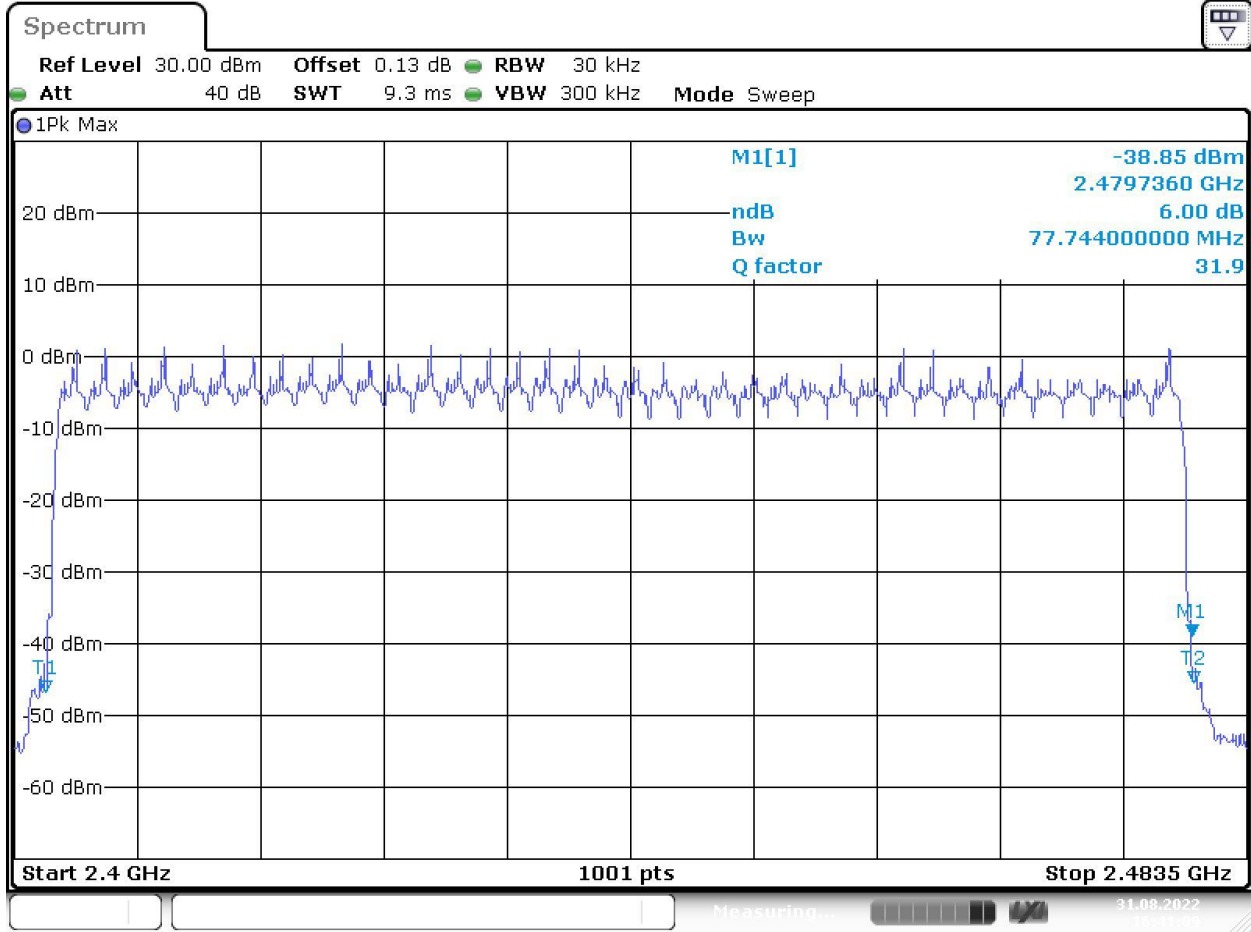
Bose Model 911L uses 38 hopping channels in QHS operation and always uses at least 15, both of which are more than the required 15.

## Limits:

FCC 15.247 (a) (1) (iii), IC RSS-247 5.1 (d)

Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping channels.

# Data Collection:

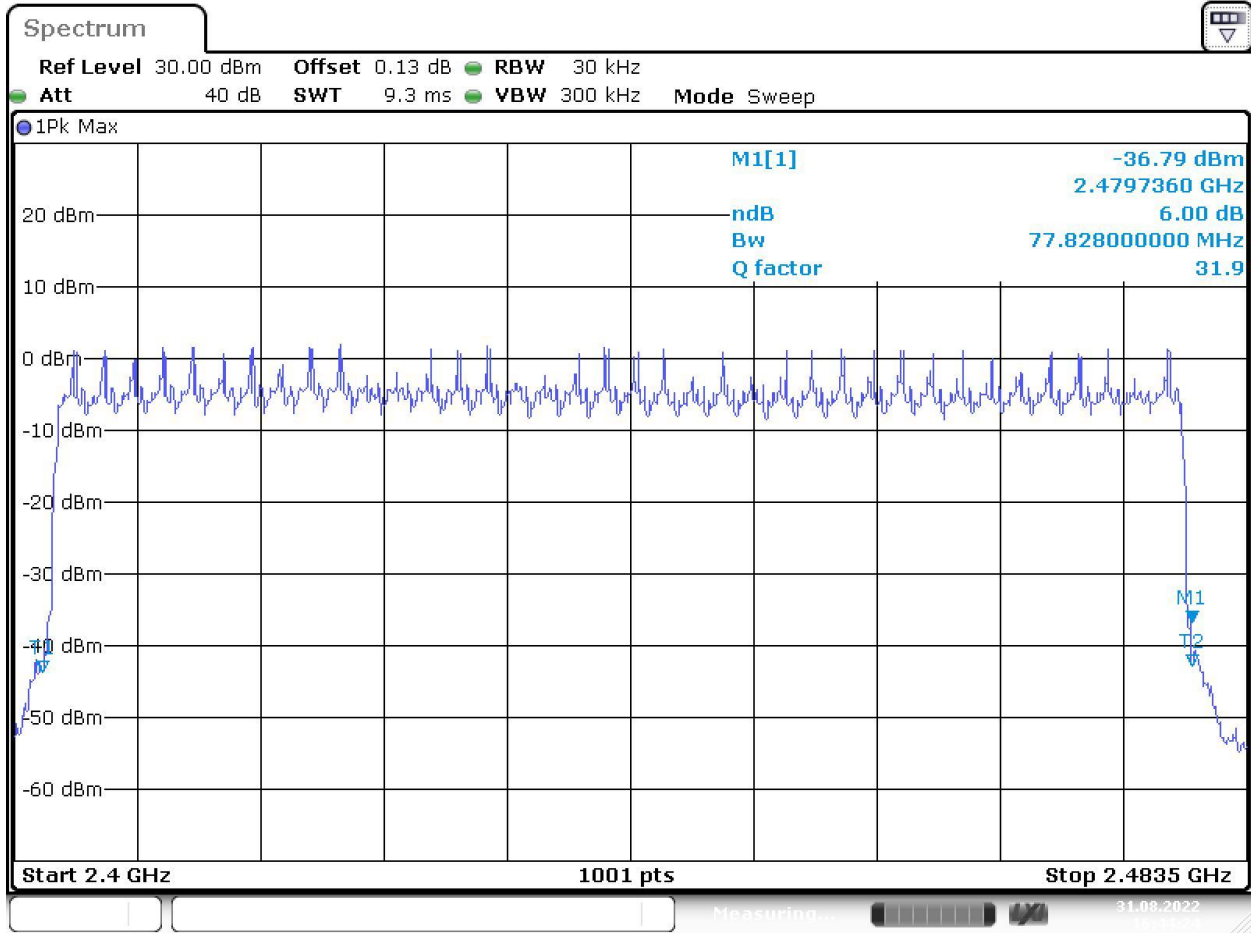


Date: 31.AUG.2022 16:41:10

38 hopping channels active QHS P2



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Date: 31.AUG.2022 16:44:25

38 Hopping channels QHS P6

## 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



# Average Time of Occupancy

<b>Project number (Integrity):</b>	911L	<b>Build Phase:</b>	C1.5		
<b>Tested by:</b>	Mike Royer	<b>Date:</b>	27 July 2022		
<b>Requirements Standard(s):</b>	FCC 15.247 (a) (1) (iii) IC RSS-247 5.1 (d)	<b>Referenced Standard(s):</b>	ANSI C63.10-2013 Section 7.8.4		
<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 highest time of occupancy in any mode is 376 mS which meets the 400mS limit by 24mS.

## Limit:

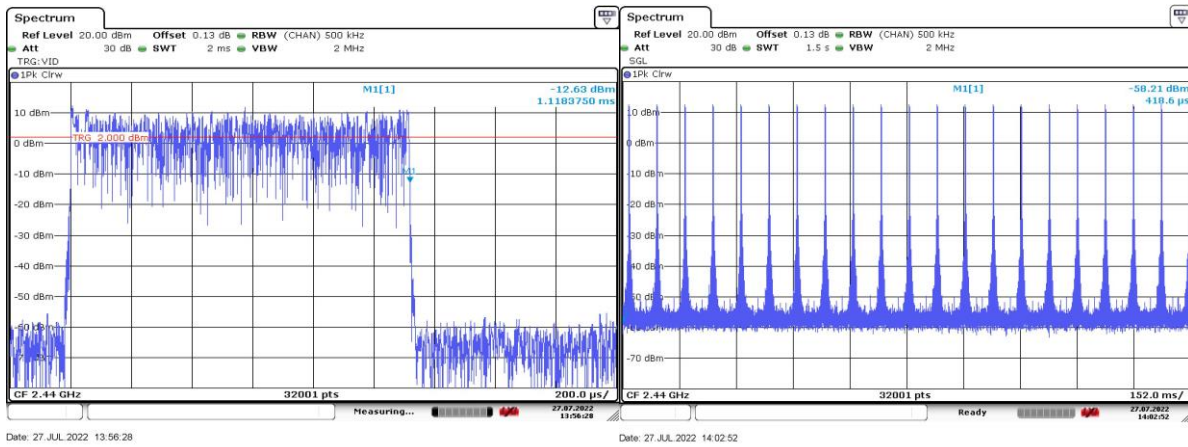
The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

When hopping with Bluetest3 as in this test, there are 40 hopping channels \* 400 mS = 16 seconds. Set the observation time to 1.5 seconds and count the pulses. Then multiply by 16/1.5=10.67 to get the number of pulses in 16 seconds.

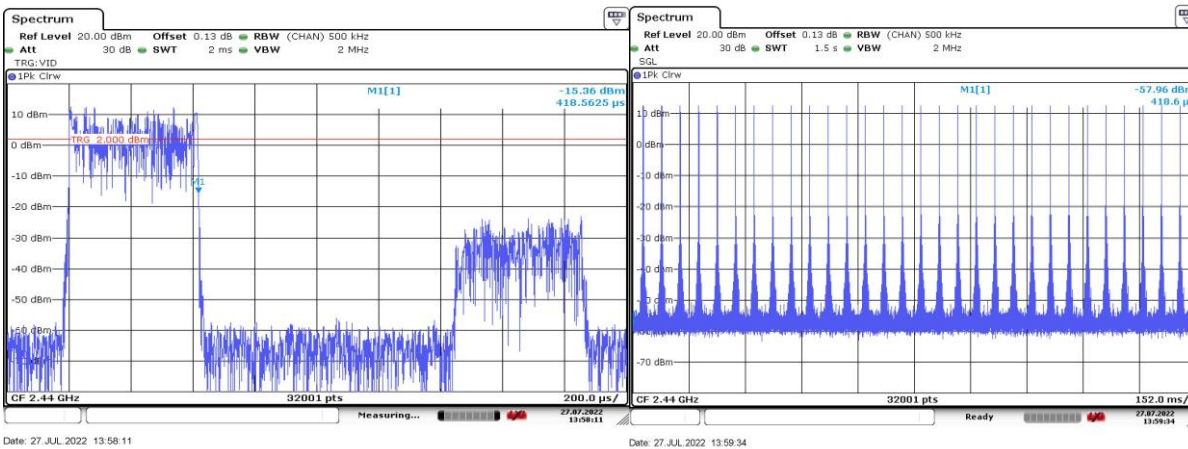
## Data Collection:

Mode	1 pulse mS	Pulse count	Total TX time in 15.2 S mS	Limit mS	Margin	Result
QHS P2	1.12	21	251	400	149	Pass
QHS P6	0.42	30	134	400	265	Pass

**QHS P2**



**QHS P6**



## Equipment Used:

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



PRODUCT ASSURANCE ENGINEERING  
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# Output Power

<b>Project number (Integrity):</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) (1) RSS-247 5.4 (b)	<b>Referenced Standard(s):</b>	ANSI C63.10-2013 Section 7.8.5		
<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 unit passes output power by 17.66.

## Limits:

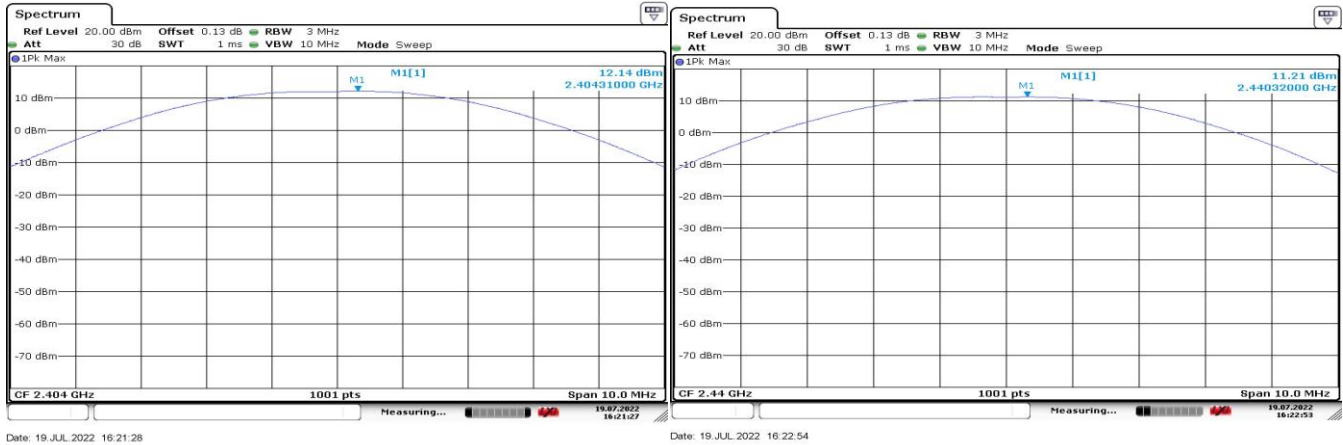
FCC §15.247 (b) (1)

RSS-247 5.4 (b)

The device maintains a minimum of 15 hopping channels. The limit is 21 dBm.

# QHS P2 Data Collection:

Output Power Summary Table (Basic Rate: 1 Mbps)							
Channel	Frequency (MHz)	Mode	Output Power (dBm)	Directional Gain (dBi)	Limit (dB)	Margin (dB)	Result
Low	2404	QHS P2	12.14	1	21	8.86	Pass
Middle	2440	QHS P2	11.21	1	21	9.79	Pass
High	2478	QHS P2	12.07	1	21	8.93	Pass



Date: 19 JUL 2022 16:21:28

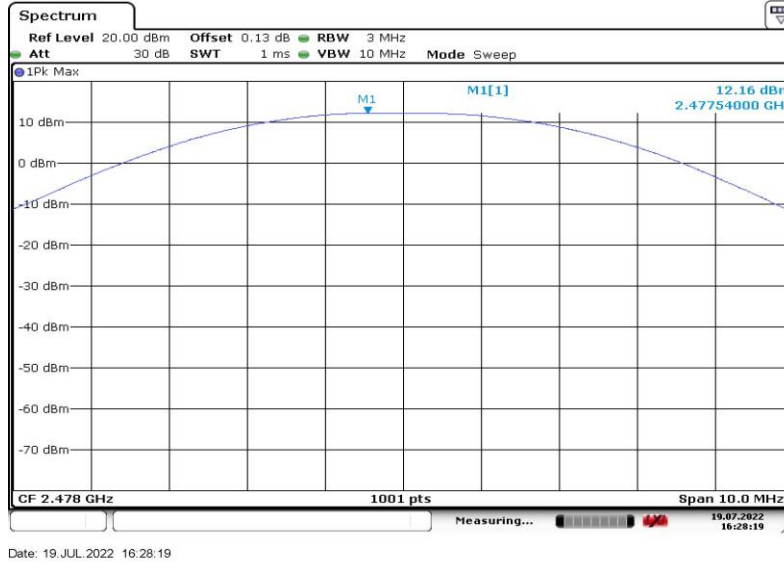
Date: 19 JUL 2022 16:22:54



Date: 19 JUL 2022 16:24:10

# QHS P6 Data Collection:

Output Power Summary Table (Enhanced Rate: 3 Mbps)							
Channel	Frequency (MHz)	Mode	Output Power (dBm)	Directional Gain (dBi)	Limit (dB)	Margin (dB)	Result
Low	2404	QHS P6	12.14	1	21	8.86	Pass
Middle	2440	QHS P6	11.29	1	21	9.71	Pass
High	2478	QHS P6	12.16	1	21	8.84	Pass



# 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





# Conducted Spurious Emissions

<b>Project number (Integrity):</b>	911L	<b>Build Phase:</b>	C1.5		
<b>Tested by:</b>	Mike Royer	<b>Date:</b>	21 July 2022		
<b>Requirements Standard(s):</b>	FCC §15.247 (d) RSS-247 5.5	<b>Referenced Standard(s):</b>	ANSI C63.10-2013 Section 7.8.8		
<b>EUT powered with:</b>	5V USB	<b>Temp / Humidity:</b>	n/a	<b>Test location:</b>	
<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

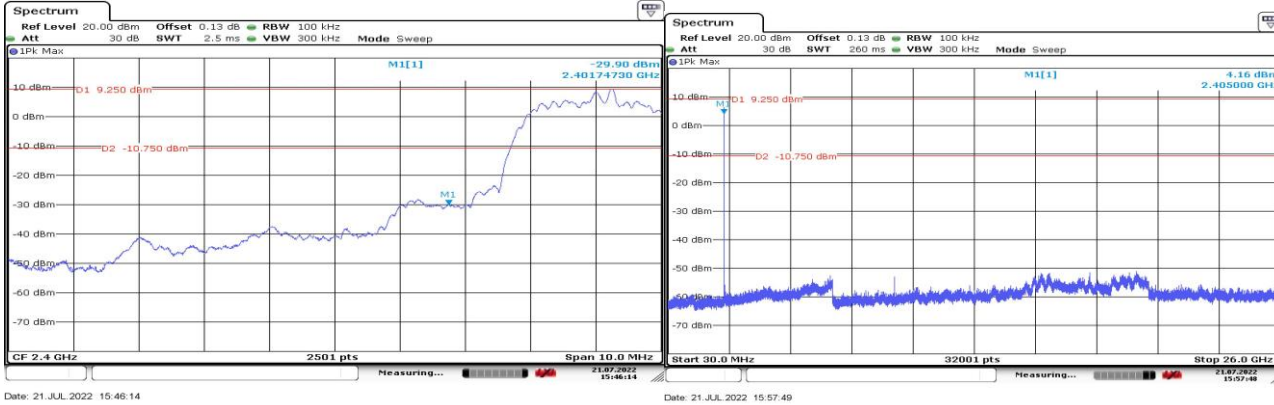
Output power was measured based on the use of a peak measurement; therefore, the required attenuation is 20 dB down from the peak amplitude.

The offset was inserted to account for cable loss, but is not important in this measurement.

# Data Collection:

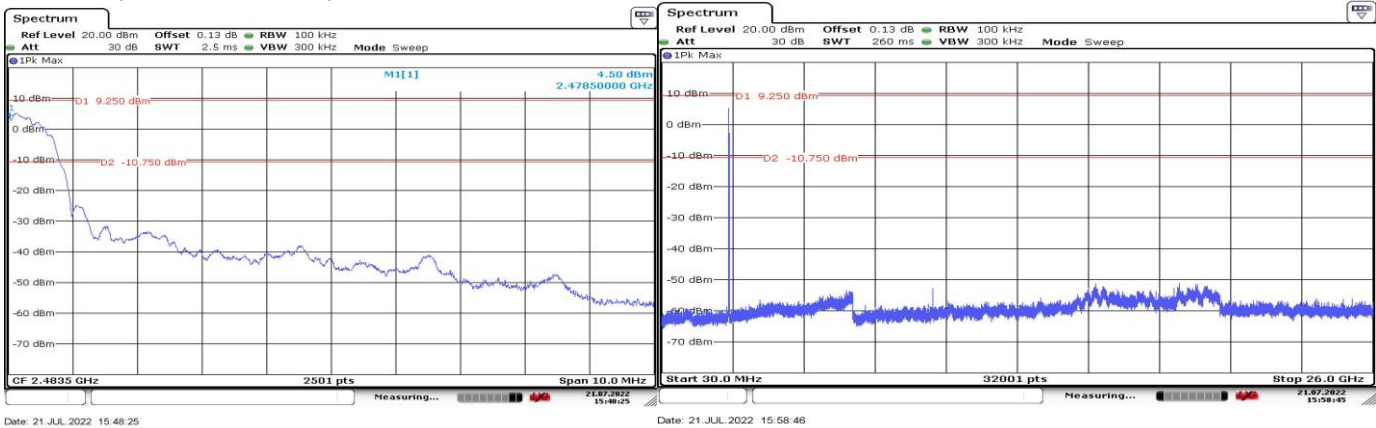
QHS P2 low channel band-edge. More than 20 dB down at center freq.

Out of band low channel (2404MHz)



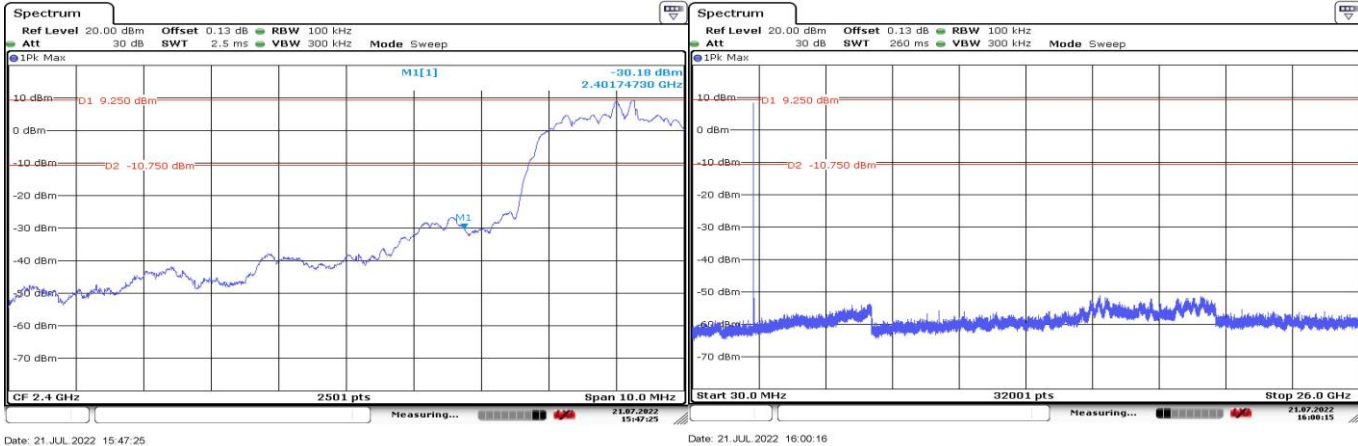
QHS P2 high channel band-edge

Out of band high channel (2478MHz)



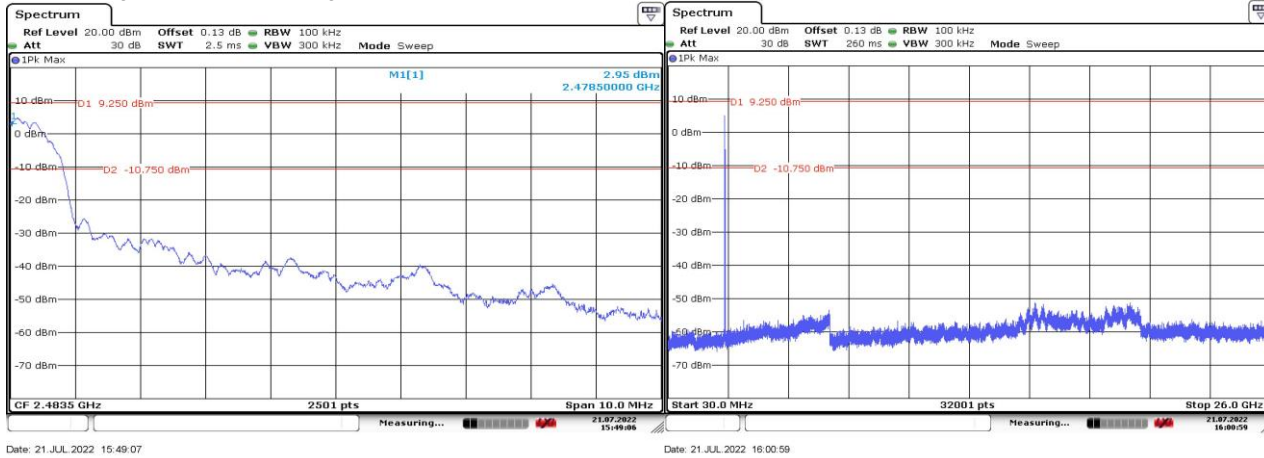
QHS P6 low channel band-edge

Out of band low channel (2404MHz)



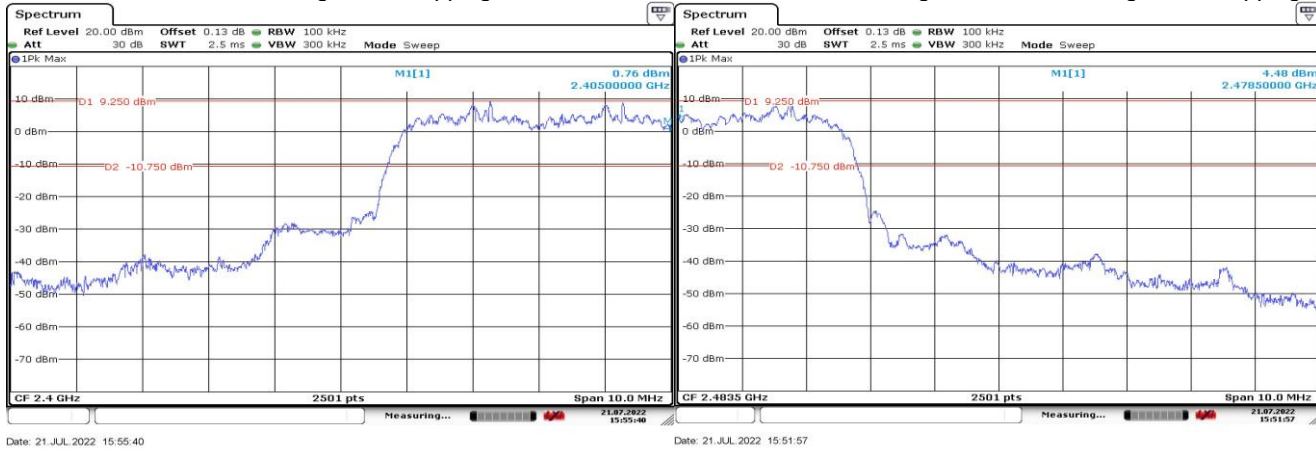
QHS P6 high channel band-edge

Out of band high channel (2478MHz)



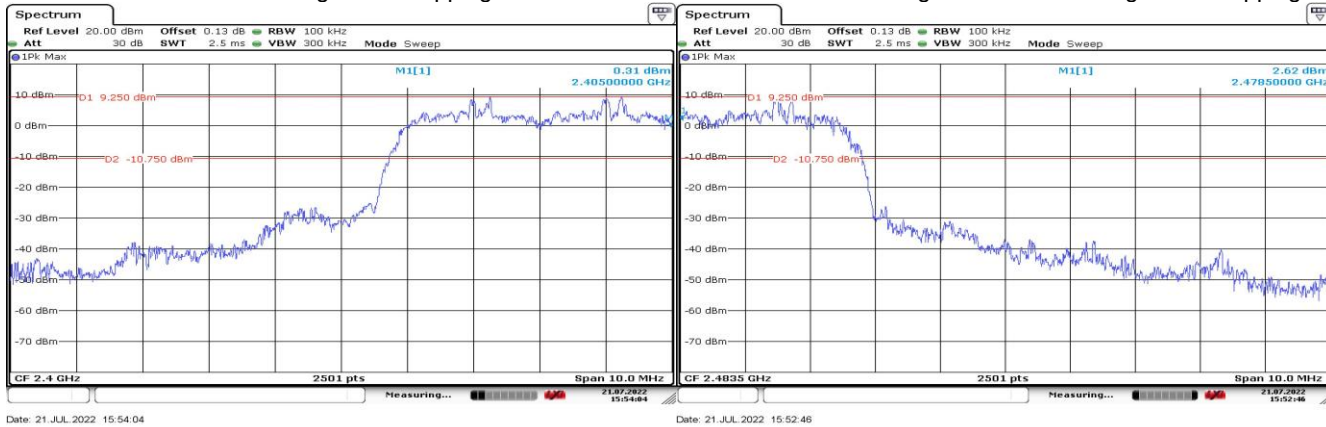
QHS P2 low channel band-edge while hopping

QHS P2 high channel band-edge while hopping



QHS P6 low channel band-edge while hopping

QHS P6 high channel band-edge while hopping





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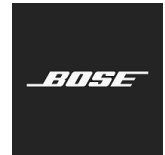
## Equipment Used:

TN	Description	Model	S/N	Manufacturer	Most Recent Calibration	Calibration Due Date
2409	Signal and Spectrum Analyzer	FSV40	101413	Rohde & Schwarz	21-Mar-2012	21-Mar-2022



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EMC TEST REPORT



# 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:

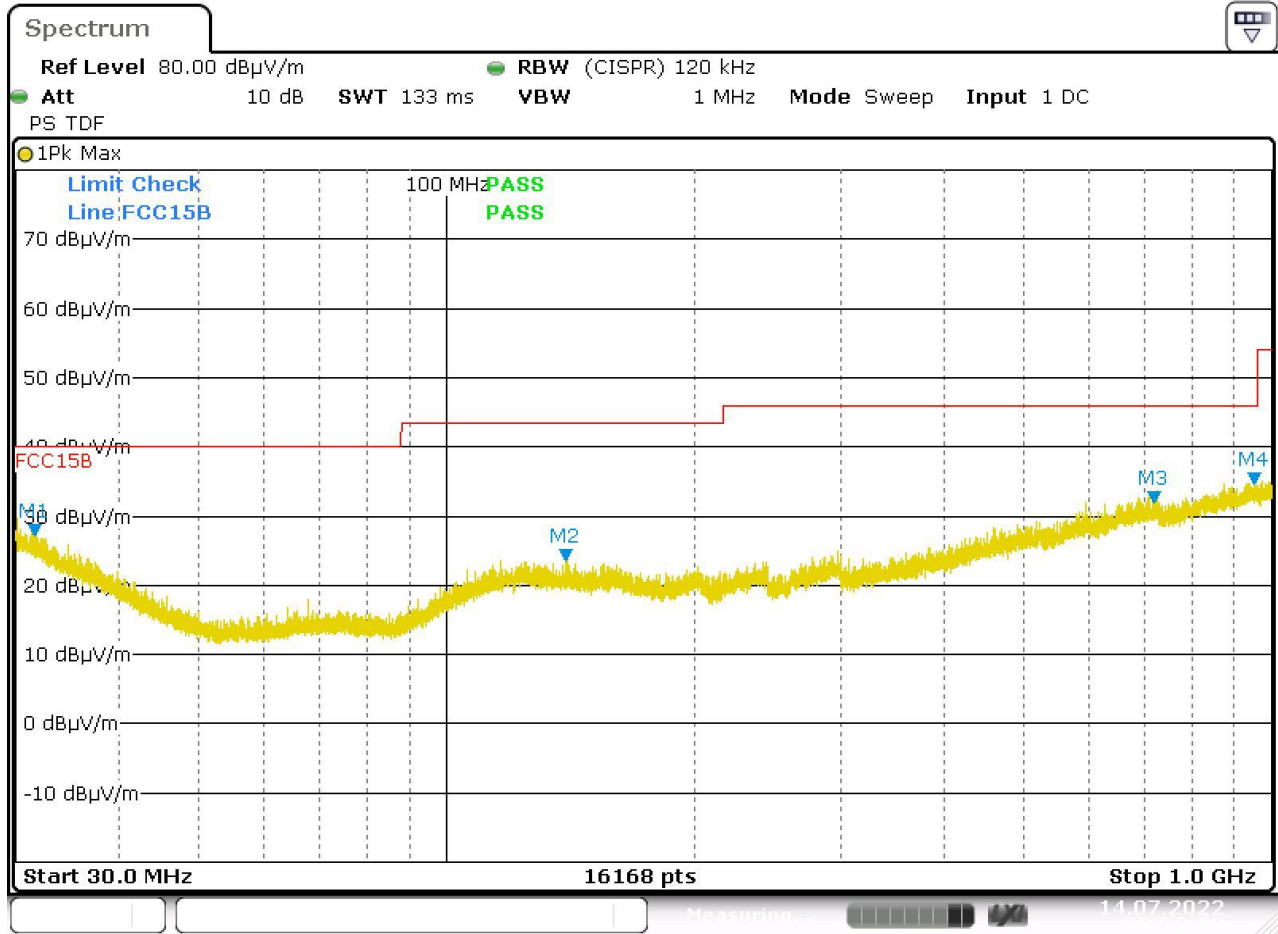
**Radiated Emission Level (dBµV/m)** = EMI Receiver Reading (dBµV) + Antenna Correction Factor (dB/m) – Preamplifier Gain (dB) + Cable Loss (dB)

## Data Collection:



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

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

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	

Bose Corporation, 1 New York Ave, Framingham, MA 01701, USA

Tel: (508) 766-6000 Fax: (508) 766-1145

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Report Number: EMC.4353911.22.198.1(4)

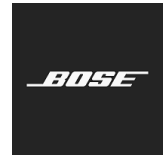
Form FL300959 Rev 06

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		10 m	3 m <sup>2</sup>	3 m	Measurements above 1 GHz are made using average and peak detectors.
FCC §15.247 (d) RSS-247 Section 5.5	30-88	39	49	40	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

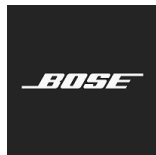
## Uncertainty:

Uncertainty Budget			
Title:	Radiated RF Emissions (30MHz-1GHz)		



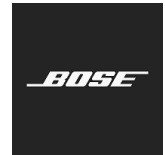
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# DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



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>	C.5		
<b>Tested by:</b>	Mike Royer	<b>Date:</b>	June 8-14, 2022 June 22, 2022		
<b>Requirements Standard(s):</b>	FCC part 15.205m 15.209 RSS-GEN clause 8.9	<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>	1663,2602,2349,1757,1596				
<b>EUT Serial number(s):</b>	084233M2011G016AE				
<b>EUT Software installed:</b>	0.6.18				
<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 by more than 15.5 dB.

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

1-18 GHz the worst case peak signal is 51.7 dBuV/m. The average limit is 54. The margin is 2.3 dB

18-25 GHz the worst peak signal is 58.1. The average limit is 74. The margin is. 15.9 dB.

## Procedure:

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

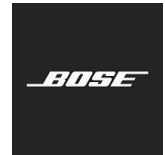
Pretesting showed that the worst orientation was a vertical position. The EUT was taped to a bamboo skewer and stuck into the test support at 150cm above the floor. From there the table was rotated and the antenna scanned up down and horizontal and vertical polarizations.

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



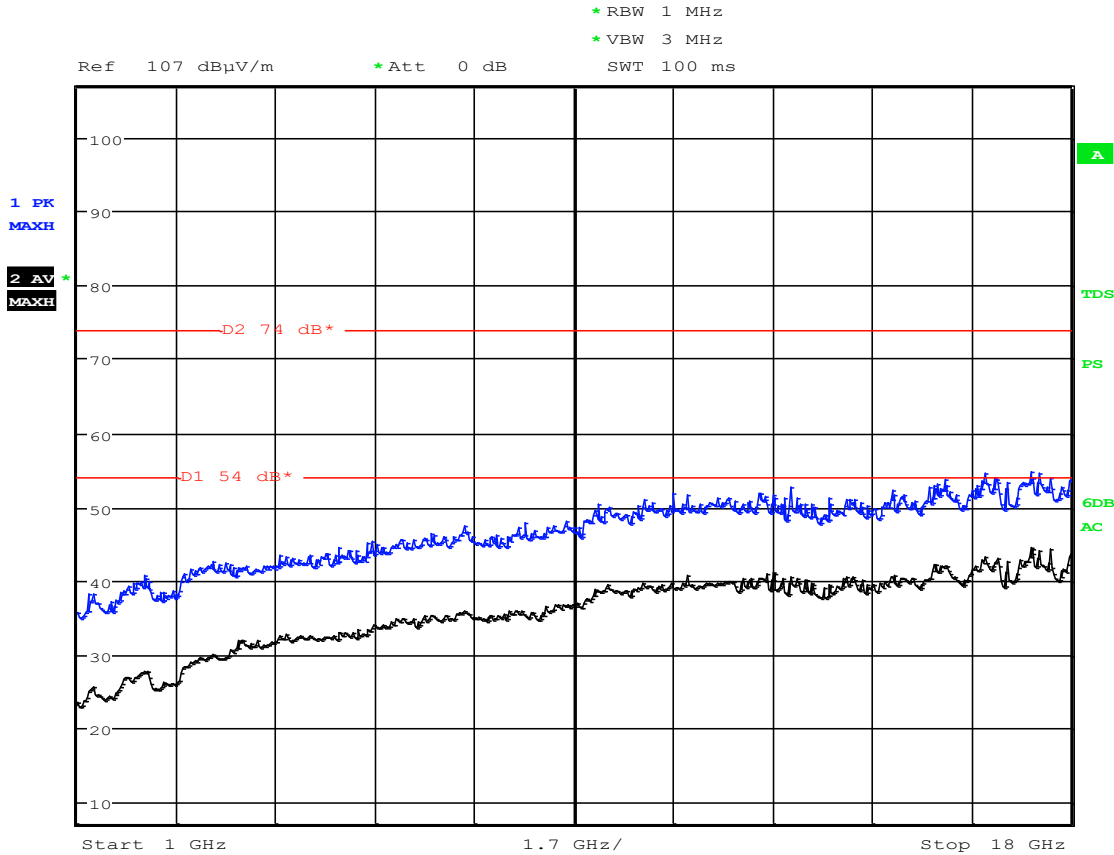
Certificate # 1514.1

# DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



## 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>	QHS 2M Low channel 2404 MHz					
<b>Comments:</b>	1-18 GHz 3m measurement distance, 18-26 GHz 30 cm measurement distance					



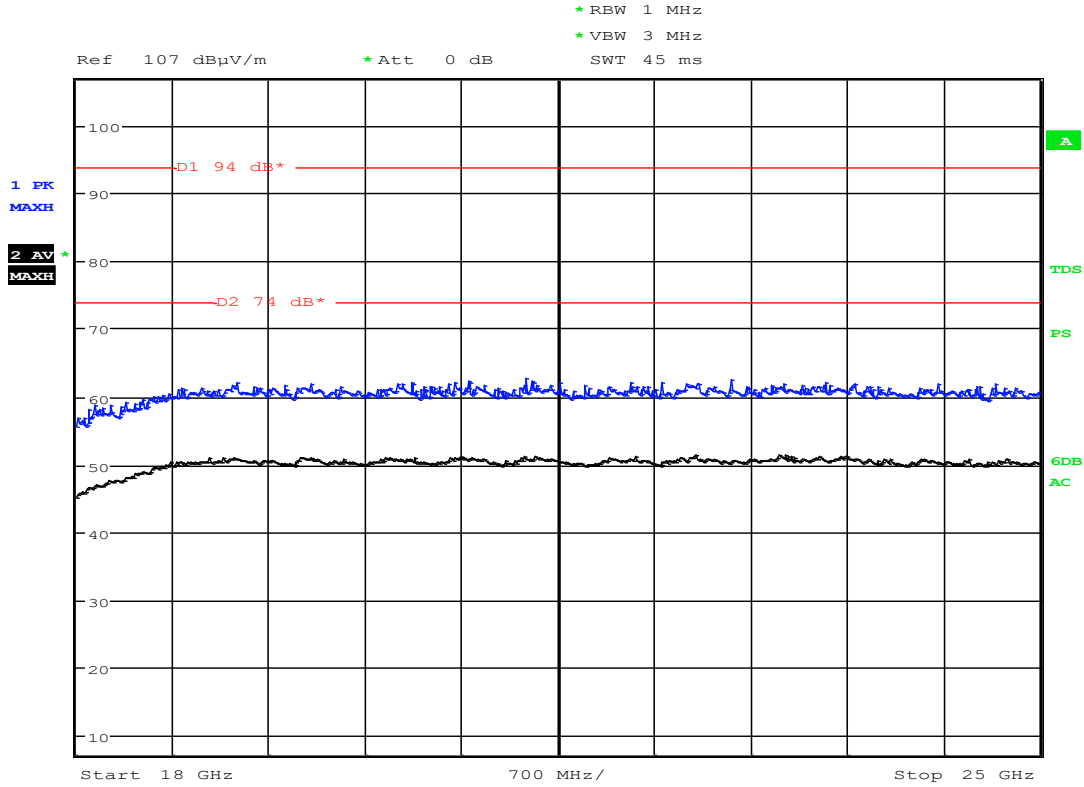
Date: 22.JUN.2022 15:24:34

3m Test Distance



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# DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



Date: 22.JUN.2022 15:27:36

### 30 cm Test Distance

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;

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

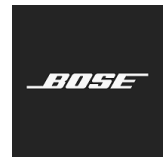
Peak limit of 74 becomes 94 dBuV at 30cm.

Average limit of 54 becomes 74 dBuV at 30cm.



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# DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



<b>EUT S/N:</b>	continued	<b>Power applied:</b>	Battery		<b>Meas#</b>	1
<b>EUT Mods:</b>						
<b>EUT Setup:</b>	QHS 2M Low channel 2404 MHz					
<b>Comments:</b>	1-18 GHz 3m measurement distance, 18-26 GHz 30 cm measurement distance					

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

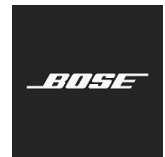
Emission Frequency (MHz)	Measured Amplitude (dBµV/m) AVG	Measured Amplitude (dBµV/m) Peak	FCC 15.247d				Table Azimuth (0° closest to ant)	Receiving Ant		Notes/Mode
			Limit (dBµV/m) AVG	Limit (dBµV/m) Peak	Margin (dB) AVG	Margin (dB) Peak		Pol (H/V)	Height (Meters)	
4808	35.70	47.10	54.0	74.0	18.3	26.9	101	V	1.9	
7212	30.90	44.20	54.0	74.0	23.1	29.8	0	H	1.5	Noise floor
9616	32.40	48.10	54.0	74.0	21.6	25.9	310	H	1.7	Noise floor
12020	35.00	48.90	54.0	74.0	19.0	25.1	0	H	1.5	Noise floor
14424	35.00	48.40	54.0	74.0	19.0	25.6	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 @3 Meters @ 30 cm

Emission Frequency (MHz)	Measured Amplitude (dBµV/m) AVG	Measured Amplitude (dBµV/m) Peak	FCC 15.247d				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	44.20	57.40	74.0	94.0	29.8	36.6				Noise floor
21636	43.20	55.60	74.0	94.0	30.8	38.4				Noise floor
24040	43.20	57.60	74.0	94.0	30.8	36.4				Noise floor



# DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



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

### FCC 15.247d and RSS-247 Section 5.5 @33 Meters

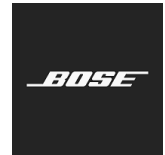
Emission Frequency (MHz)	Measured Amplitude (dBµV/m) AVG	Measured Amplitude (dBµV/m) Peak	Limit (dBµV/m) AVG	Limit (dBµV/m) Peak	Margin (dB) AVG	Margin (dB) Peak	Table Azimuth (0° closest to ant)	Receiving Ant		Notes/Mode
								Pol (H/V)	Height (Meters)	
4880	34.30	45.90	54.0	74.0	19.7	28.1	164	V	1.7	
7320	31.90	45.30	54.0	74.0	22.1	28.7	0	H	1.5	Noise floor
9760	33.40	48.70	54.0	74.0	20.6	25.3	0	V	1.5	Noise floor
12200	35.60	48.70	54.0	74.0	18.4	25.3	0	H	1.5	Noise floor
14640	35.00	48.30	54.0	74.0	19.0	25.7	0	H	1.5	Noise floor
17080	36.50	49.90	54.0	74.0	17.5	24.1	0	H	1.5	Noise floor

### FCC 15.247d and RSS-247 Section 5.5 @ 30 cm

Frequency (MHz)	Measured Amplitude (dBµV/m) AVG	Measured Amplitude (dBµV/m) Peak	Limit (dBµV/m) AVG	Limit (dBµV/m) Peak	Margin (dB) AVG	Margin (dB) Peak	Table Azimuth (0° closest to ant)	Receiving Ant		Notes/Mode
								Pol (H/V)	Height (Meters)	
19520	43.20	56.30	74.0	94.0	30.8	37.7				Noise floor
21960	43.70	56.60	74.0	94.0	30.3	37.4				Noise floor
24400	43.60	56.90	74.0	94.0	30.4	37.1				Noise floor



# DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



<b>EUT S/N:</b>	Left	<b>Power applied:</b>	Battery		<b>Meas #</b>	3
<b>EUT Mods:</b>						
<b>EUT Setup:</b>	QHS 2M High channel 2478 MHz					
<b>Comments:</b>						

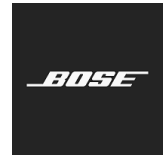
FCC 15.247d and RSS-247 Section 5.5 @ 3 Meters										
Emission Frequency (MHz)	Measured Amplitude (dBµV/m) AVG	Measured Amplitude (dBµV/m) Peak	FCC 15.247d and RSS-247 Section 5.5				Table Azimuth (0° closest to ant)	Receiving Ant		Notes/Mode
			Limit (dBµV/m) AVG	Limit (dBµV/m) Peak	Margin (dB) AVG	Margin (dB) Peak		Pol (H/V)	Height (Meters)	
4956	31.10	44.30	54.0	74.0	22.9	29.7	176	V	1.5	
7434	31.80	45.30	54.0	74.0	22.2	28.7	0	H	1.5	Noise floor
9912	33.90	48.60	54.0	74.0	20.1	25.4	45	V	1.5	Noise floor
12390	35.70	48.80	54.0	74.0	18.3	25.2	0	H	1.5	Noise floor
14868	36.00	49.70	54.0	74.0	18.0	24.3	0	H	1.5	Noise floor
17346	38.50	51.70	54.0	74.0	15.5	22.3	0	H	1.5	Noise floor

FCC 15.247d and RSS-247 Section 5.5 @ 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	44.00	56.70	74.0	94.0	30.0	37.3				Noise floor
22302	44.10	57.10	74.0	94.0	29.9	36.9				Noise floor
24780	43.80	58.10	74.0	94.0	30.2	35.9				Noise floor



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# DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



<b>EUT S/N:</b>	Left	<b>Power applied:</b>	Battery		<b>Meas #</b>	4
<b>EUT Mods:</b>						
<b>EUT Setup:</b>	QHS 6M Low channel 2404 MHz					
<b>Comments:</b>						

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

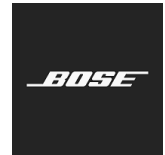
Emission Frequency (MHz)	Measured Amplitude (dBμV/m) AVG	Measured Amplitude (dBμV/m) Peak	FCC 15.247d and RSS-247 Section 5.5				Table Azimuth (0° closest to ant)	Receiving Ant		Notes/Mode
			Limit (dBμV/m) AVG	Limit (dBμV/m) Peak	Margin (dB) AVG	Margin (dB) Peak		Pol (H/V)	Height (Meters)	
4808	34.30	47.80	54.0	74.0	19.7	26.2	71	V	1.7	
7212	30.90	44.70	54.0	74.0	23.1	29.3	0	H	1.5	Noise floor
9616	34.40	49.10	54.0	74.0	19.6	24.9	288	H	1.5	Noise floor
12020	35.00	48.80	54.0	74.0	19.0	25.2	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	48.20	54.0	74.0	18.9	25.8	0	H	1.5	Noise floor

### FCC 15.247d and RSS-247 Section 5.5 @ 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	44.30	56.90	74.0	94.0	29.7	37.1				Noise floor
21636	43.20	56.30	74.0	94.0	30.8	37.7				Noise floor
24040	43.20	56.40	74.0	94.0	30.8	37.6				Noise floor



# DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



<b>EUT S/N:</b>	Left	<b>Power applied:</b>	Battery		<b>Meas #</b>	5
<b>EUT Mods:</b>						
<b>EUT Setup:</b>	QHS 6M Mid channel 2440 MHz					
<b>Comments:</b>						

### FCC 15.247d and RSS-247 Section 5.5 @ 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	32.30	45.70	54.0	74.0	21.7	28.3	86	V	1.6	
7320	31.80	45.10	54.0	74.0	22.2	28.9	0	H	1.5	Noise floor
9760	34.40	48.90	54.0	74.0	19.6	25.1	113	H	1.5	Noise floor
12200	35.00	48.70	54.0	74.0	19.0	25.3	0	H	1.5	Noise floor
14640	34.90	47.30	54.0	74.0	19.1	26.7	0	H	1.5	Noise floor
17080	36.50	50.70	54.0	74.0	17.5	23.3	0	H	1.5	Noise floor

### FCC 15.247d and RSS-247 Section 5.5 @ 30 cm

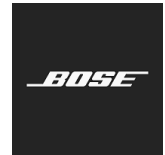
Emission Frequency (MHz)	Measured Amplitude (dBµV/m) AVG	Measured Amplitude (dBµV/m) Peak	FCC 15.247d and RSS-247 Section 5.5				Table Azimuth (0° closest to ant)	Receiving Ant		Notes/Mode
			Limit (dBµV/m) AVG	Limit (dBµV/m) Peak	Margin (dB) AVG	Margin (dB) Peak		Pol (H/V)	Height (Meters)	
19520	43.20	56.30	74.0	94.0	30.8	37.7				Noise floor
21960	43.70	56.40	74.0	94.0	30.3	37.6				Noise floor
24400	43.60	57.00	74.0	94.0	30.4	37.0				Noise floor





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# DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



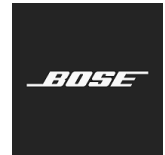
<b>EUT S/N:</b>	Left	<b>Power applied:</b>	Battery		<b>Meas #</b>	6
<b>EUT Mods:</b>						
<b>EUT Setup:</b>	QHS 6M High channel 2478 MHz					
<b>Comments:</b>						

### FCC 15.247d and RSS-247 Section 5.5 @ 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	30.40	43.80	54.0	74.0	23.6	30.2	179	V	1.5	
7434	31.70	44.80	54.0	74.0	22.3	29.2	0	H	1.5	Noise floor
9912	36.60	50.70	54.0	74.0	17.4	23.3	77	H	1.5	Noise floor
12390	35.70	49.10	54.0	74.0	18.3	24.9	0	H	1.5	Noise floor
14868	36.00	49.40	54.0	74.0	18.0	24.6	0	H	1.5	Noise floor
17346	38.50	51.50	54.0	74.0	15.5	22.5	0	H	1.5	Noise floor

### FCC 15.247d and RSS-247 Section 5.5 @ 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	57.00	74.0	94.0	29.9	37.0				Noise floor
22302	44.10	56.50	74.0	94.0	29.9	37.5				Noise floor
24780	43.90	57.10	74.0	94.0	30.1	36.9				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 RDD-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		

## Procedure:

Per 558074 D01 15.247 Meas Guidance v05r02:

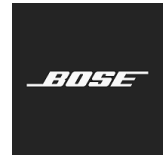
Taking a RMS average measurement while the EUT is transmitting in operational duty cycle – The RMS average detector of a spectrum analyzer can be used for making average measurements with the EUT operating on its operational duty cycle. If the EUT supports more than one operational duty cycle the worst-case value should be used, i.e., the highest operational duty cycle. The measured RMS value using this method is compared against the limits and no other corrections are permitted.

The spectrum analyzer settings shall meet the requirements of ANSI C63.10 for making Average measurements. This measurement refers to spectrum analyzer settings in either 11.12.2.5.2 or 11.12.2.5.3 in ANSI C63.10; except when using 11.12.2.5.2, set Trace mode = Max Hold and the measurement correction factor in 11.12.2.5.2 i) is not added.



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# DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



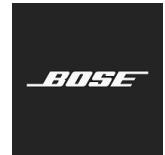
## Equipment Used:

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
2373	RF Cable 30MHz-18GHz - 25 feet "N"	TRU-300	Cable Group	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
2357	RF Cable 30MHz-18GHz	TRU-300	TRU-12707-03	TRU Corporation	20-Mar-2022	20-Mar-2023
2602	Miteq pre-amp 1-18GHz 35dB	AFS42-01001800-28-10P-42	N/A	Miteq	7-Jul-2021	7-Jul-2022
2349	Double Ridge Waveguide Horn Antenna 1-18GHz	3117	00152406	ETS Lindgren	24-Feb-2022	24-Feb-2024
2414	Band Reject Filter (2.4GHz)	BRM50702-07	003	Micro-Tronics	20-Mar-2022	20-Mar-2024
2385	Marconi Manor	3 Meter Semi Anechoic Chamber	N/A	AP Americas	20-Jan-2022	20-Jan-2024
1757	18GHz-40GHz Preamp	JS4018004000-30-8P-A1	1406279	Miteq	7-Jul-2021	7-Jul-2022
1596	Horn Antenna 18GHz - 26.5GHz	AT4640	309234	Amplifier Research		
2368	RF Cable 30MHz-26.5GHz	TRU-210	TRU-12767-35	TRU Corporation	20-Mar-2022	20-Mar-2024



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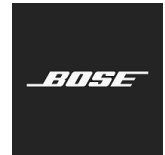
# Uncertainty:

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>



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COMPLIANCE  
EMC TEST REPORT



# Radiated Band Edge

<b>Project number (Integrity):</b>	911L	<b>Build Phase:</b>	C1.5		
<b>Tested by:</b>	Mike Royer	<b>Date:</b>	21 June 2022		
<b>Requirements Standard(s):</b>	FCC part 15.247d	<b>Referenced Standard(s):</b>			
<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,				
<b>EUT Serial number(s):</b>	084233M2011G016AE				
<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, and the black trace is average detection.

## Procedure:

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

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

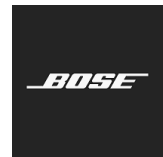
Taking a RMS average measurement while the EUT is transmitting in 100% duty cycle. If the EUT supports more than one operational duty cycle the worst-case value should be used, i.e., the highest operational duty cycle.

The average detector built into the receiver was used for taking average measurements.

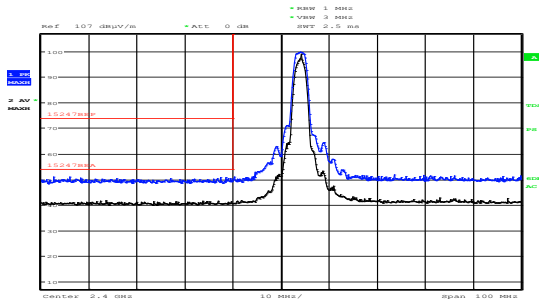


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# DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT

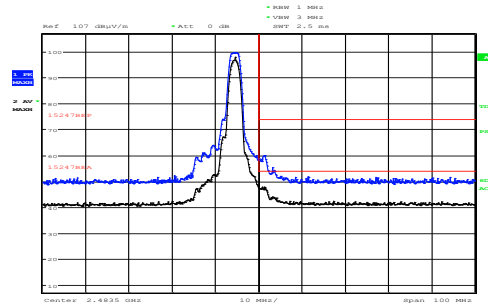


## Data Collection:



Date: 21.JUN.2022 14:42:58

Lower Band edge, QHS P2



Date: 21.JUN.2022 14:45:57

Upper Band edge, QHS P2

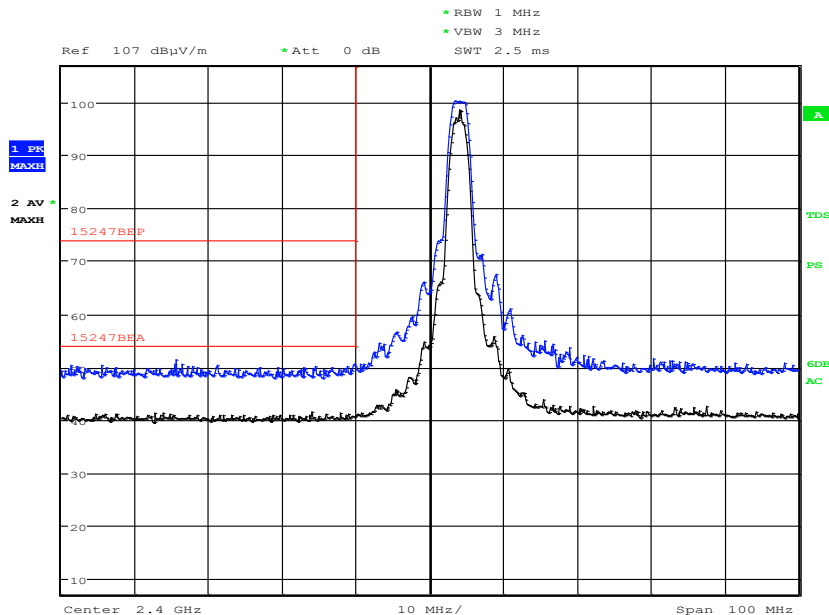
### FCC 15.247d and RSS-247 Section 5.5 @ 3 Meters

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	49.30	64.20	54.0	74.0	4.7	9.8	0	H	150.00	QHS P2, 100% DC
2483.500	49.30	65.40	54.0	74.0	4.7	8.6	0	H	150.00	QHS P6, 100% DC



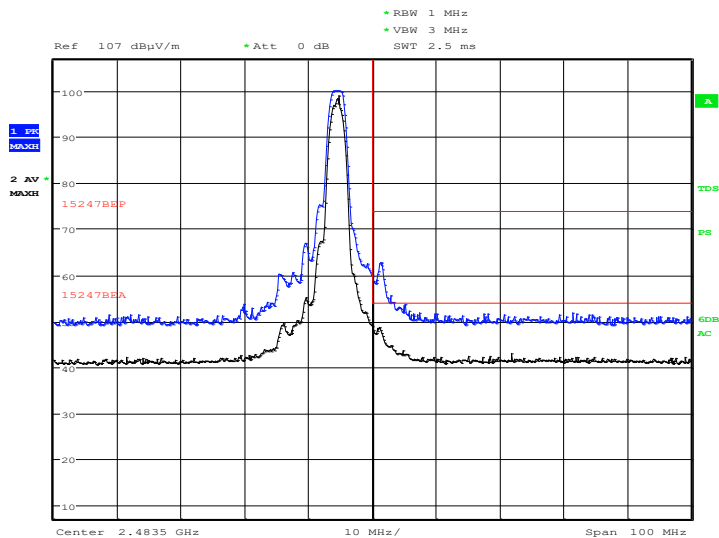
Certificate # 1514.1

# DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



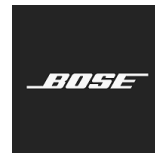
Date: 21.JUN.2022 14:51:21

Lower Band edge, QHS P6



Date: 21.JUN.2022 14:55:49

Upper Band edge, QHS P6



## 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	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 Calibration	Calibration 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



## 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>