



PRODUCT ASSURANCE ENGINEERING
COMPLIANCE
EMC TEST REPORT



Test Type: Emissions

Product Type: *Wireless Earbud*

Product Name/Number: *Model 911R*

FCC ID: *A94911R*

IC: *3232A-911R*

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.435911.22.207.1(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>	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.



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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, in Bluetooth Classic 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.):

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



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Test Results Summary

Table with 3 columns: TEST NAME, TEST RESULT PASS or N/A, COMMENT(S). Rows include On Time and Duty Cycle, 99% Occupied Bandwidth, 20dB Occupied Bandwidth, Hopping Frequency Separation, etc.

Environmental Conditions

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

FCC Test Site Accreditation:

Table with columns: 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.



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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>Company Number: 3232A</p> <p>Contact: Mario Espinal mario_espinal@bose.com</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>RECOGNIZED UNTIL: 2022-07-31</p> <p>A2LA ISO/IEC 17025:2017 Expires: 2022-07-31</p>



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RF Conducted Measurements

On Time and Duty Cycle

Project number (Integrity):	911R	Build Phase:	C1.5			
Tested by:	Mike Royer	Date:	March 22, 2022			
Requirements Standard(s):		Referenced Standard(s):	ANSI C62.10:2013-11.6-b			
EUT powered with:	5V USB	Temp / Humidity:	n/a	Test location:	Braun Room	
Test equipment used TN's:	2409					
EUT Serial number(s):	084232M1333A069AE					
EUT Software installed:	0.6.16+g302b20e					
EUT Modification(s):	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.

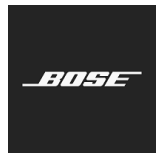
Equipment Used:

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



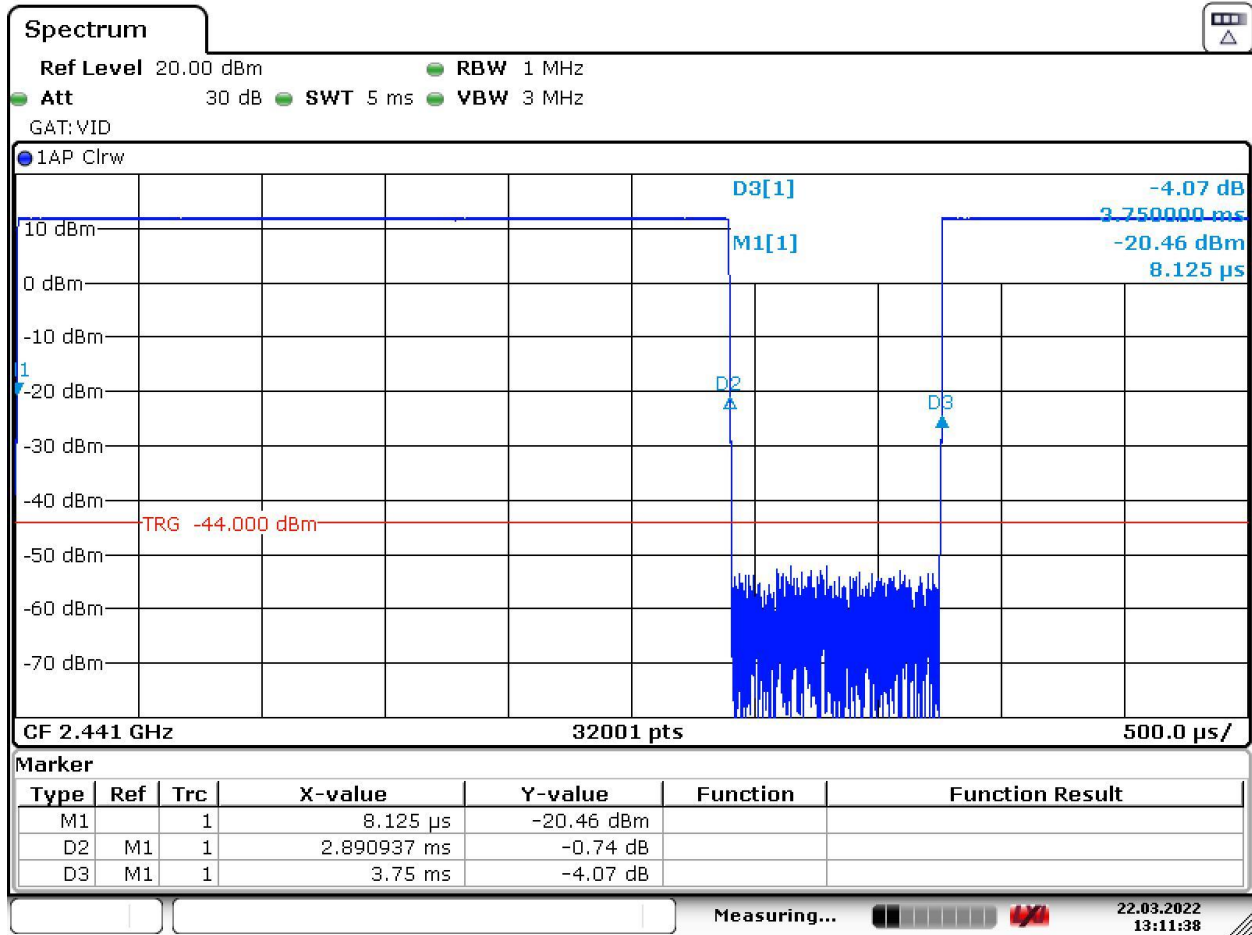
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Data Collection:

Mode	ON Time (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
Bluetooth DH5	2.883	3.742	.77	77	1.13
Bluetooth 3DH5	2.883	3.742	.77	77	1.13



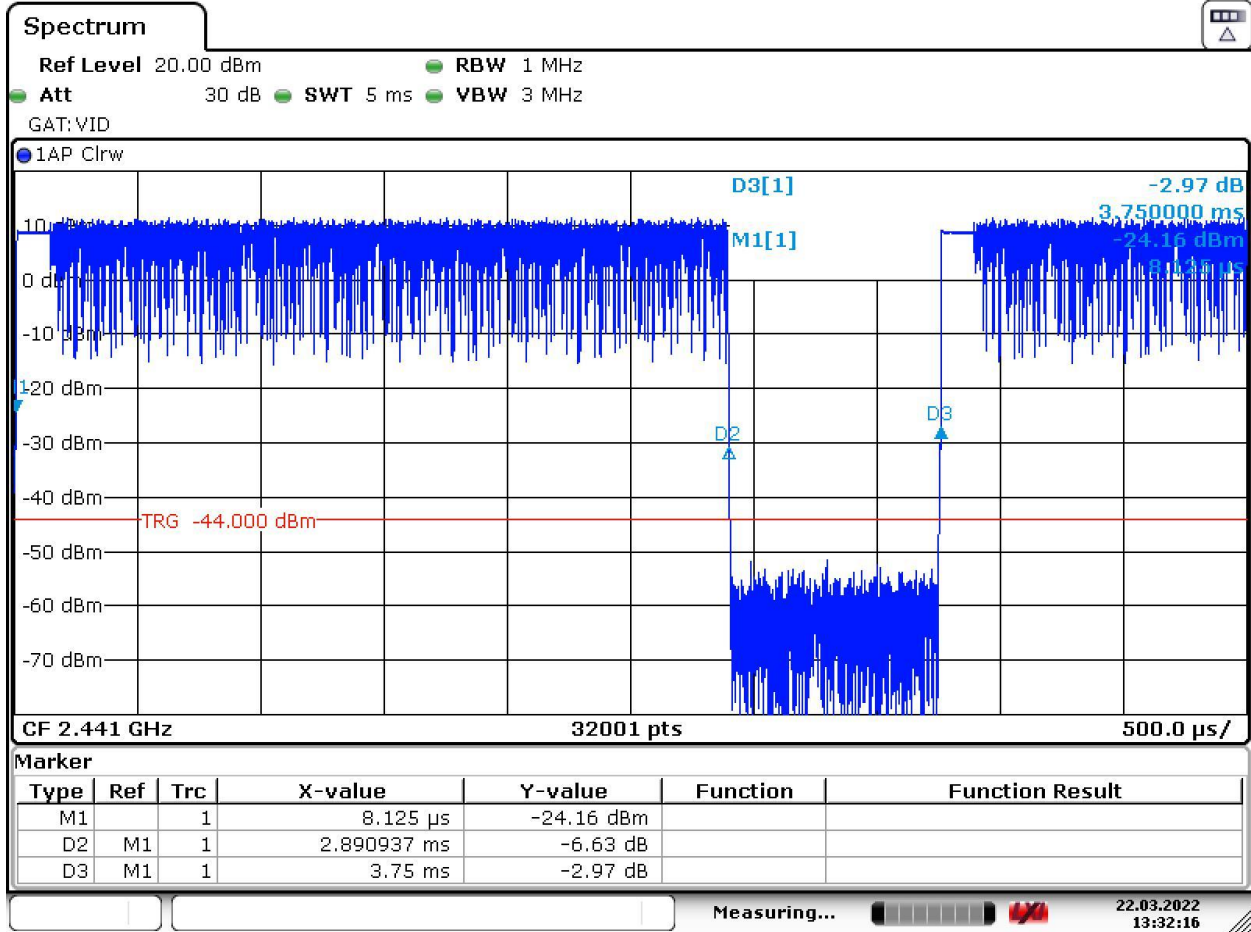
Date: 22.MAR.2022 13:11:38

DH5



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Date: 22.MAR.2022 13:32:16

3-DH5



99% Occupied Bandwidth

Project code name:		Marketing name:		Model number:	911R
Project number (Integrity):	911R	Build Phase:	C1.5		
Tested by:	Mike Royer	Date:	July 18-19, 2022		
Requirements Standard(s):		Referenced Standard(s):	ANSI C63.10:2013-6.9.3		
EUT powered with:	5V USB	Temp / Humidity:	n/a	Test location:	Braun Room
Test equipment used TN's:	2409				
EUT Serial number(s):	084232M1333A069AE				
EUT Software installed:	0.11.2				
EUT Modification(s):	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.



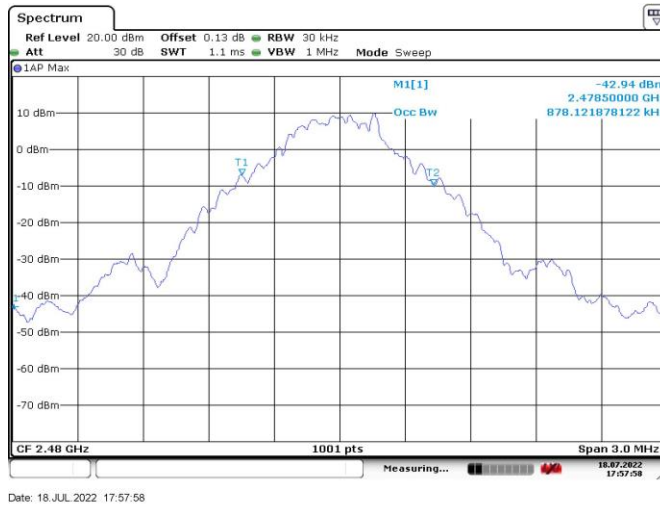
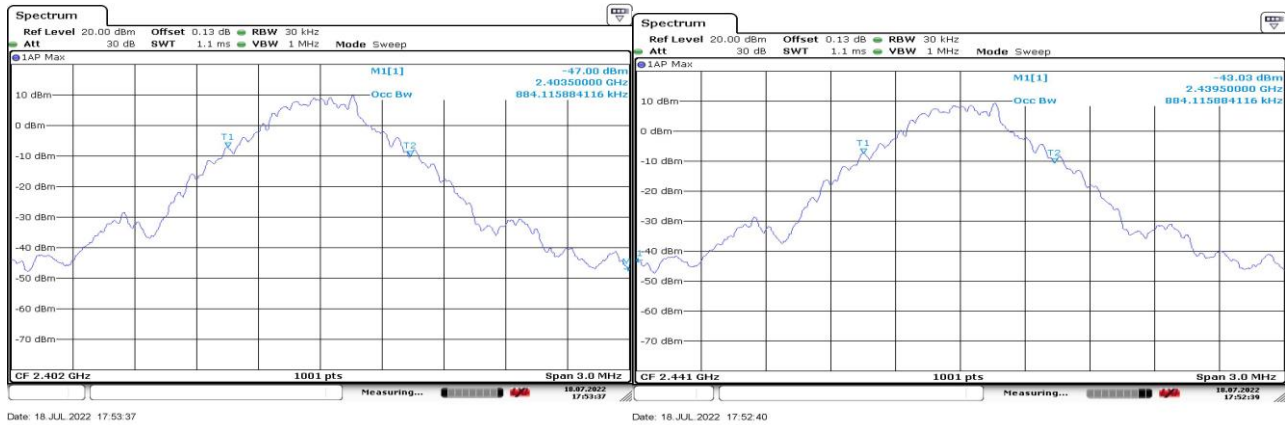
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Basic Rate (DH5) Data Collection:

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	0.884
Middle	2441	0.884
High	2480	0.878





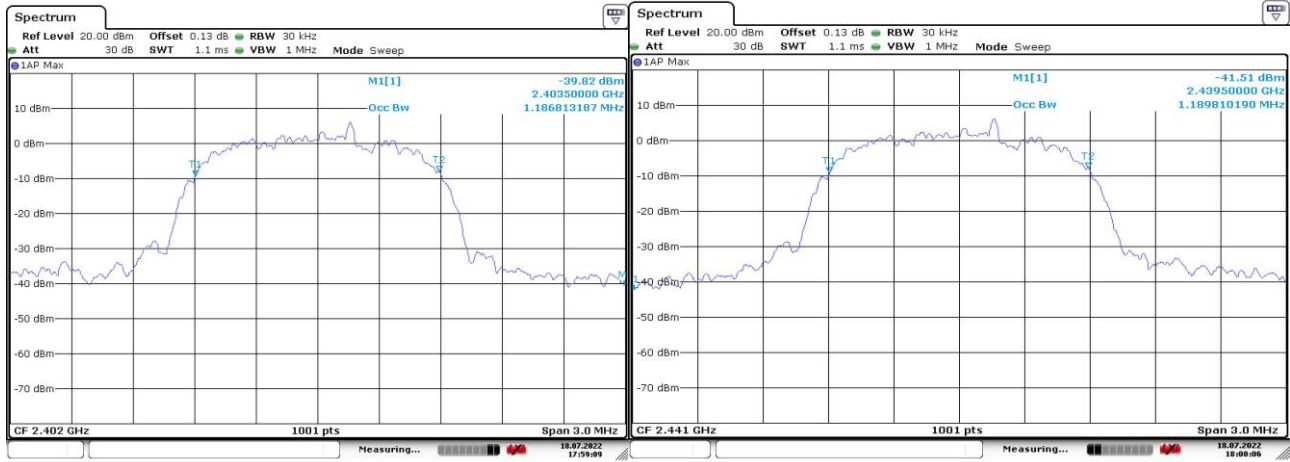
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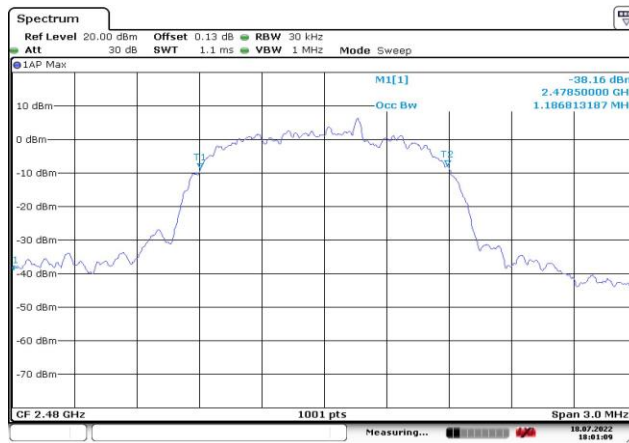
Enhanced Data Rate (3DH5) Data Collection:

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.187
Middle	2441	1.190
High	2480	1.187



Date: 18 JUL 2022 17:59:09

Date: 18 JUL 2022 18:00:07



Date: 18 JUL 2022 18:01:10

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



20dB Occupied Bandwidth

Project number (Integrity):	911R	Build Phase:	C1.5		
Tested by:	Mike Royer	Date:	July 19, 2022		
Requirements Standard(s):	FCC §15.247 (2) RSS-247 5.2 (a)	Referenced Standard(s):	ANSI 63.10:2013 - 6.9.2		
EUT powered with:	5V USB	Temp / Humidity:	n/a	Test location:	Braun Room
Test equipment used TN's:	2409				
EUT Serial number(s):	084232M1333A069AE				
EUT Software installed:	0.11.2				
EUT Modification(s):	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.



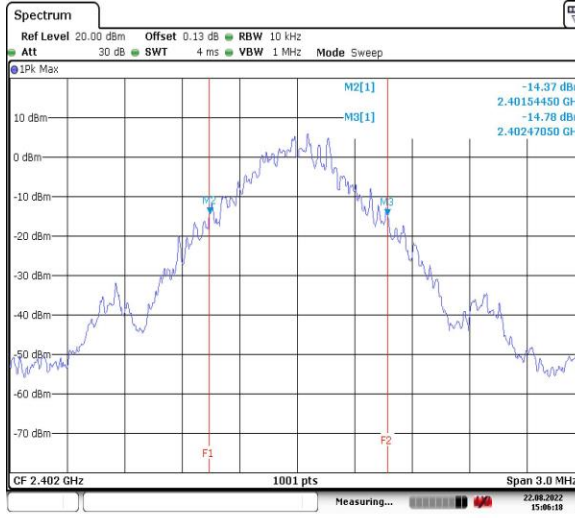
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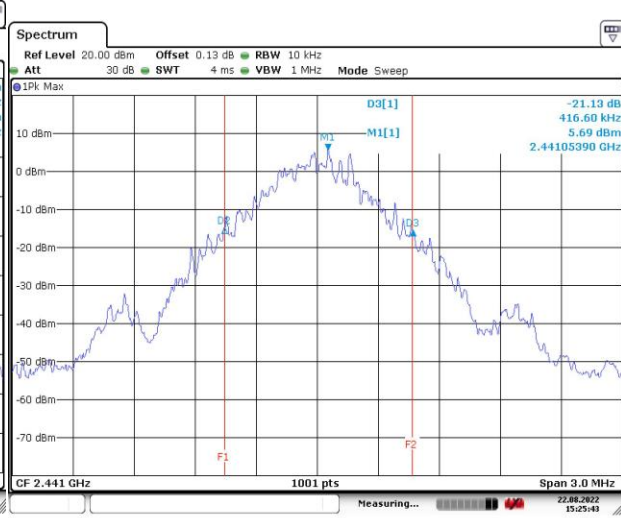


Basic Rate (DH5) Data Collection:

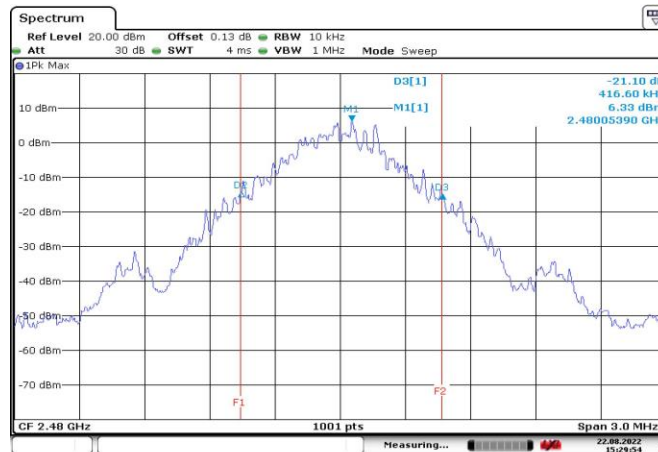
Channel	Frequency (MHz)	20dB Bandwidth (MHz)
Low	2402	0.926
Middle	2441	0.922
High	2480	1.106



Date: 22 AUG 2022 15:06:19



Date: 22 AUG 2022 15:25:43

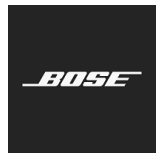


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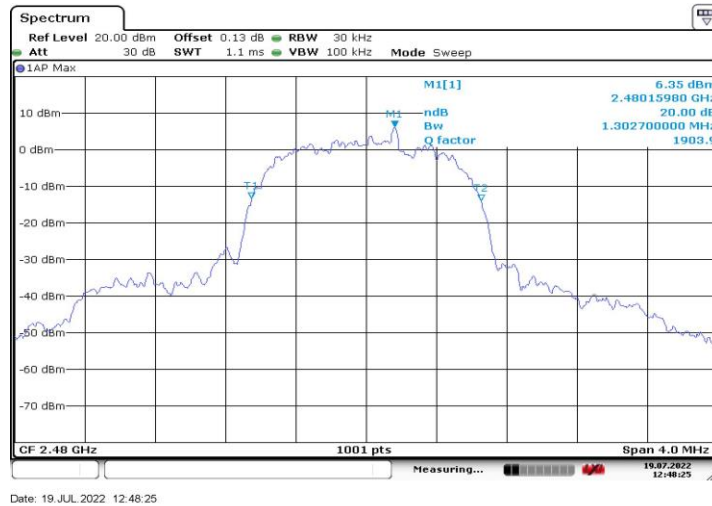
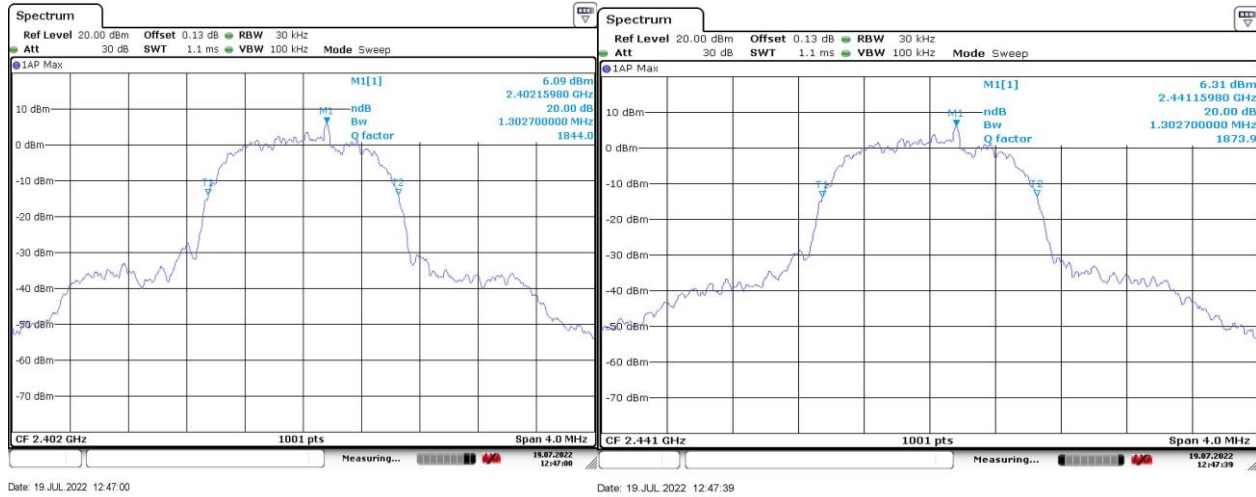
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Enhanced Data Rate (3DH5) Data Collection:

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
Low	2402	1.303
Middle	2441	1.303
High	2480	1.303



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

Project number (Integrity):	911R	Build Phase:	C1.5		
Tested by:	Mike Royer	Date:	March 22, 2022		
Requirements Standard(s):	FCC 15.247 (a) (1), IC RSS-247 5.1 (b)	Referenced Standard(s):	ANSI C63.10-2013		
EUT powered with:	5V USB	Temp / Humidity:	n/a	Test location:	Braun room
Test equipment used TN's:	2409				
EUT Serial number(s):	084232M1333A069AE				
EUT Software installed:	0.6.16+g302b20e				
EUT Modification(s):	Product was tested as built except the antenna was disconnected and a coaxial cable was installed.				

Conclusion:

Hopping frequencies are separated by 1MHz 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 869 kHz.

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.

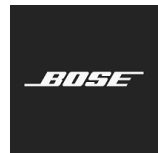
Equipment Used:

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

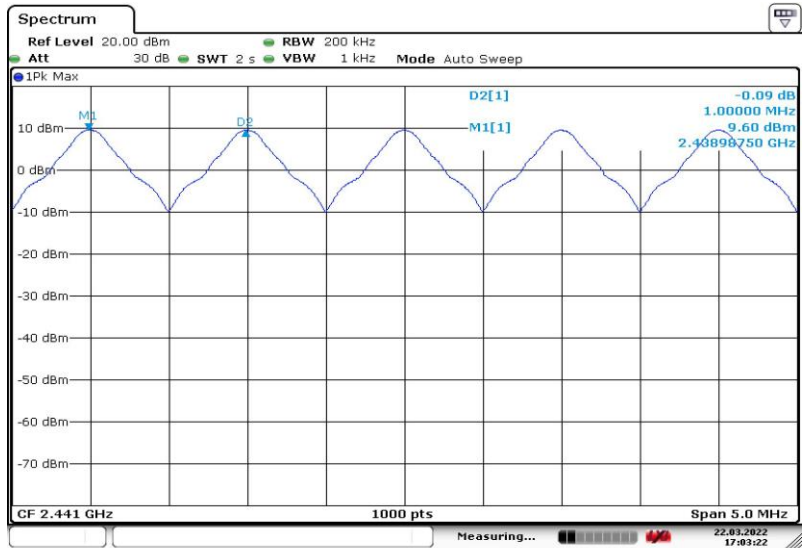


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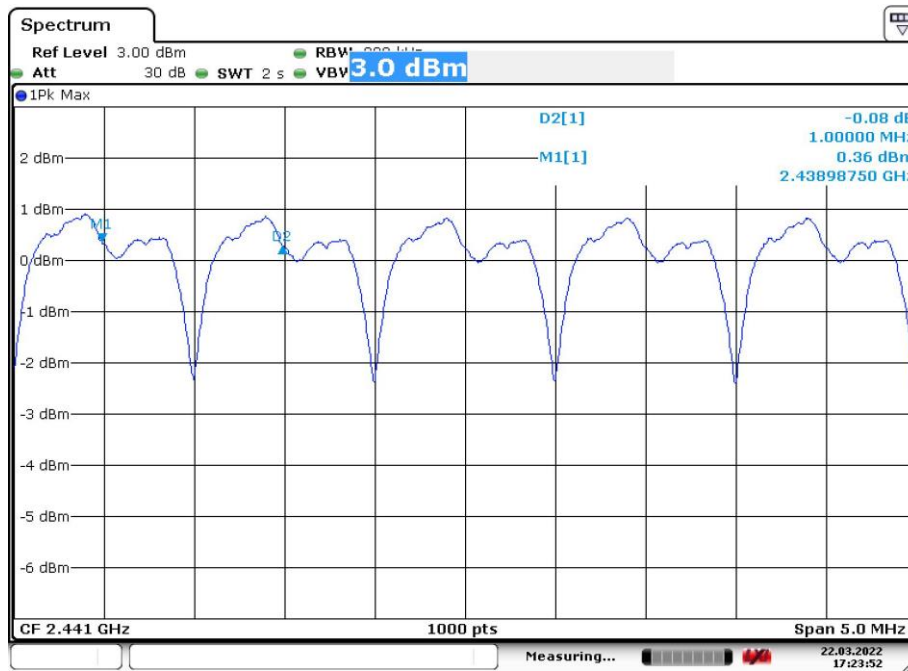


Data Collection:



Date: 22.MAR.2022 17:03:22

DH5 hopping



Date: 22.MAR.2022 17:23:52

3-DH5 hopping



Number of Hopping Channels

Project number (Integrity):	911R	Build Phase:	C1.5		
Tested by:	Mike Royer	Date:	March 22, 2022		
Requirements Standard(s):	FCC 15.247 (a) (1) (iii) IC RSS-247 5.1 (d)	Referenced Standard(s):	ANSI C63.10-2013		
EUT powered with:	5V USB	Temp / Humidity:	n/a	Test location:	Braun Room
Test equipment used TN's:	2409				
EUT Serial number(s):	084232M1333A069AE				
EUT Software installed:	0.6.16+g302b20e				
EUT Modification(s):	Product was tested as built except the antenna was disconnected and a coaxial cable was installed.				

Conclusion:

Bose Model 911R uses 79 hopping channels in normal operation and always uses at least 20, 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.

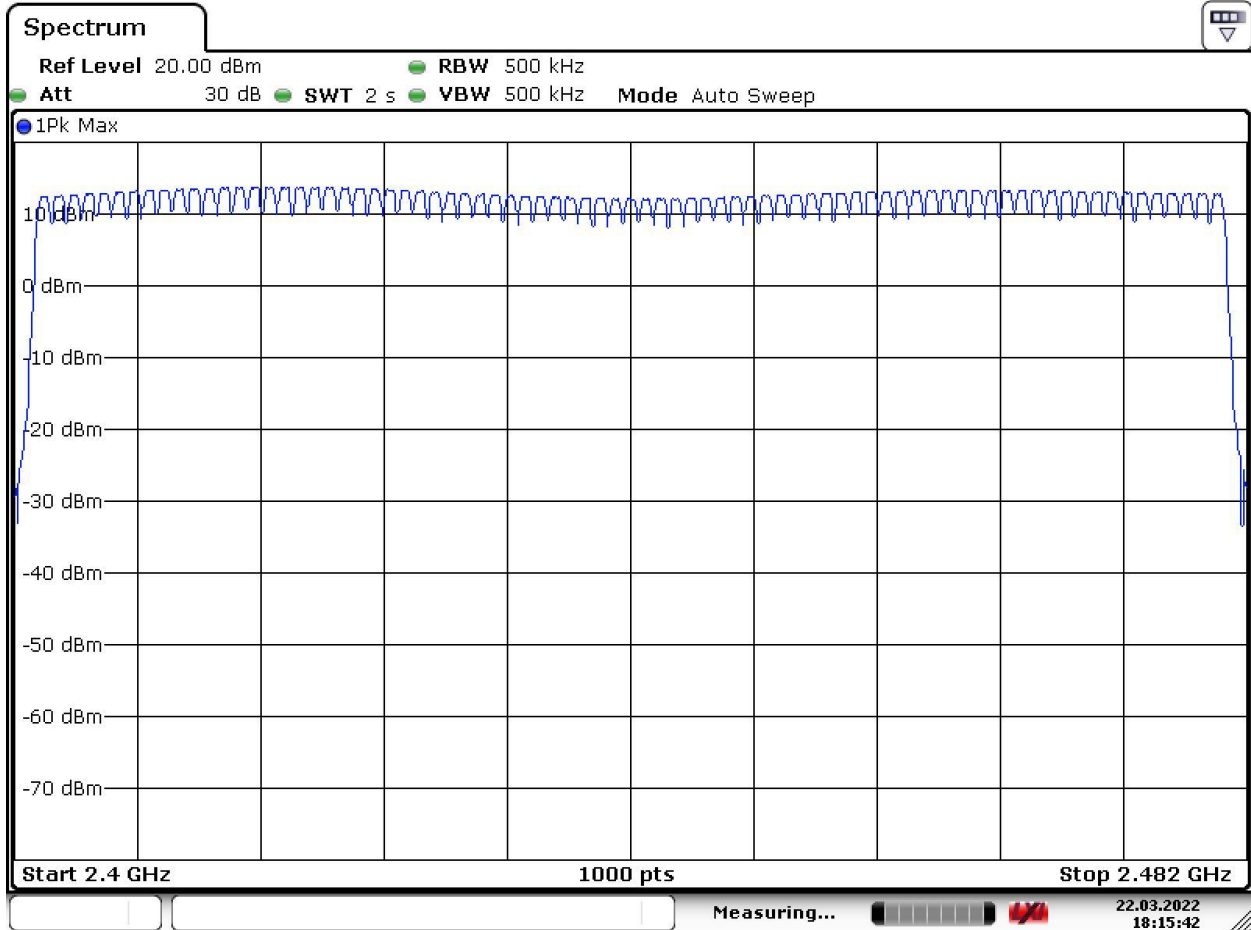


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Data Collection:



Date: 22.MAR.2022 18:15:42

79 hopping channels active DH5

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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Average Time of Occupancy

Project number (Integrity):	911R	Build Phase:	C1.5		
Tested by:	Mike Royer	Date:	March 23, 2022		
Requirements Standard(s):	FCC 15.247 (a) (1) (iii) IC RSS-247 5.1 (d)	Referenced Standard(s):	ANSI C63.10-2013		
EUT powered with:	5V USB	Temp / Humidity:	n/a	Test location:	Braun Room
Test equipment used TN's:	2409				
EUT Serial number(s):	084232M1333A069AE				
EUT Software installed:	0.6.16+g302b20e				
EUT Modification(s):	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 318 mS which meets the 400mS limit by 82mS.

Limit:

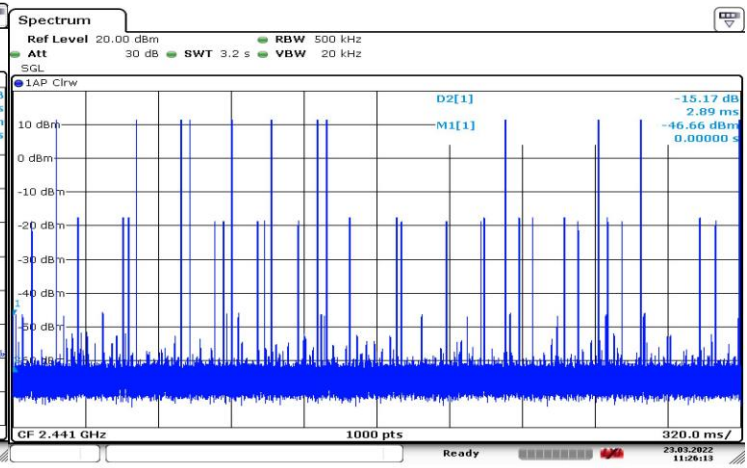
The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

Data Collection:

Channel	Frequency (MHz)	Mode	Pulse Width (mS)	Number of pulses in 3.16 S	Number of pulses in 31.6 S (X 10)	Time of occupancy (Pulse Width X Number of pulses) (mS)	Limit (mS)	Margin (mS)	Result
Middle	2441	DH5	2.890	11	110	318	400	82	Pass
Middle	2441	2-DH5	2.890	10	100	289	400	111	Pass
Middle	2441	3-DH5	2.890	8	80	232	400	168	Pass

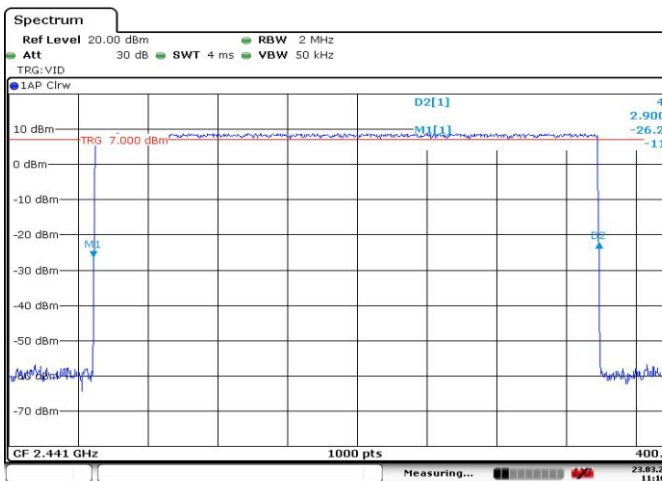


Date: 23.MAR.2022 11:14:02

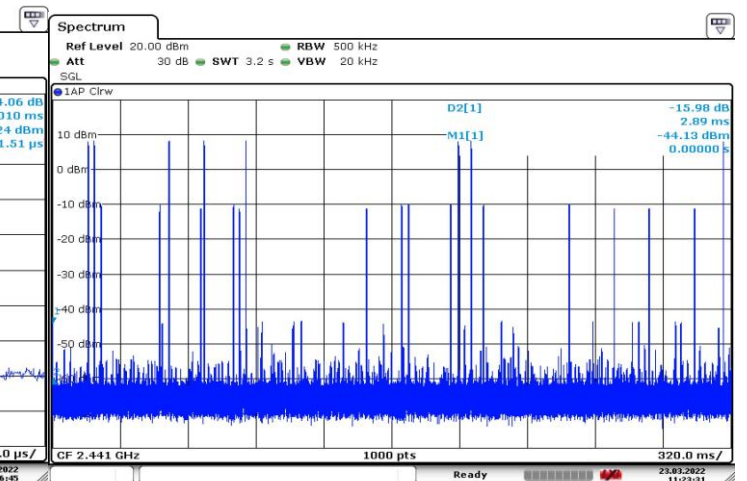


Date: 23.MAR.2022 11:26:14

DH5



Date: 23.MAR.2022 11:16:45

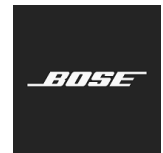


Date: 23.MAR.2022 11:23:31

3DH5



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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



Output Power

Project number (Integrity):	911R	Build Phase:	C1.5		
Tested by:	Mike Royer	Date:	June 7, 2022		
Requirements Standard(s):	FCC 15.247 (b) (3) RSS-247 5.4 (b)	Referenced Standard(s):	ANSI 63.10:2013 – 7.8.5		
EUT powered with:	5V USB	Temp / Humidity:	n/a	Test location:	Braun Room
Test equipment used TN's:	2409				
EUT Serial number(s):	084232M1333A069AE				
EUT Software installed:	0.6.16+g302b20e				
EUT Modification(s):	Product was tested as built except the antenna was disconnected and a coaxial cable was installed.				

Conclusion:

The unit passes output power by 8.2 dB.

Limits:

FCC §15.247 (b) (1)

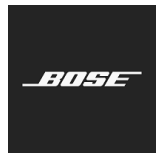
RSS-247 5.4 (b)

The device maintains a minimum of 20 hopping channels. The limit is 21 dBm.



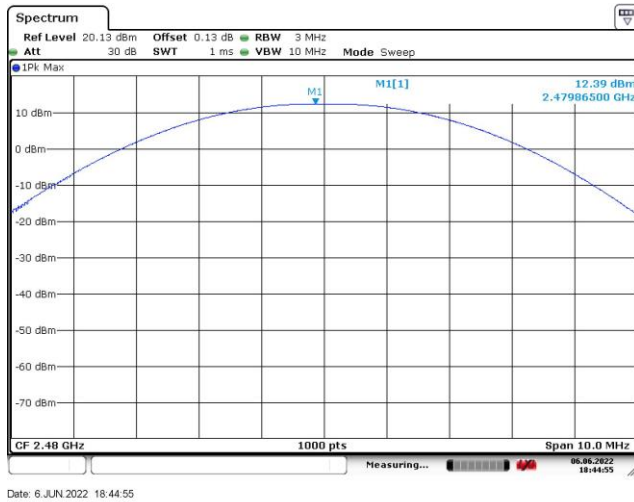
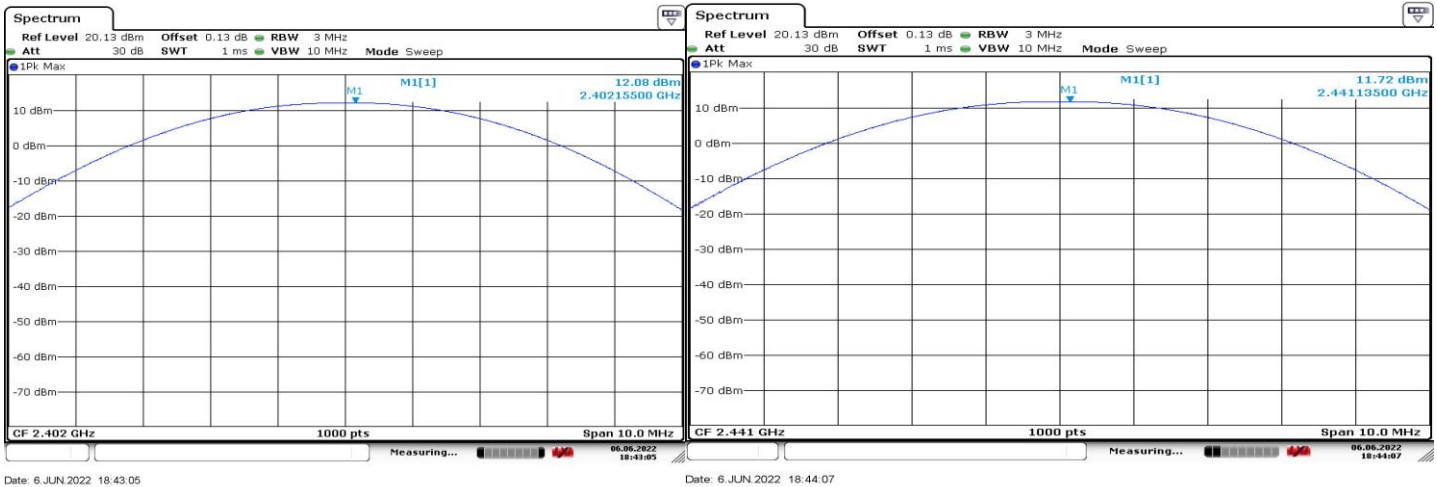
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Basic Rate (DH5) Data Collection:

Output Power Summary Table (Basic Rate: 1 Mbps)							
Channel	Frequency (MHz)	Mode	Output Power (dBm)	Directional Gain (dBi)	Limit (dB)	Margin (dB)	Result
Low	2402	DH5	12.08	1	21	8.92	Pass
Middle	2441	DH5	11.72	1	21	9.28	Pass
High	2480	DH5	12.39	1	21	8.61	Pass





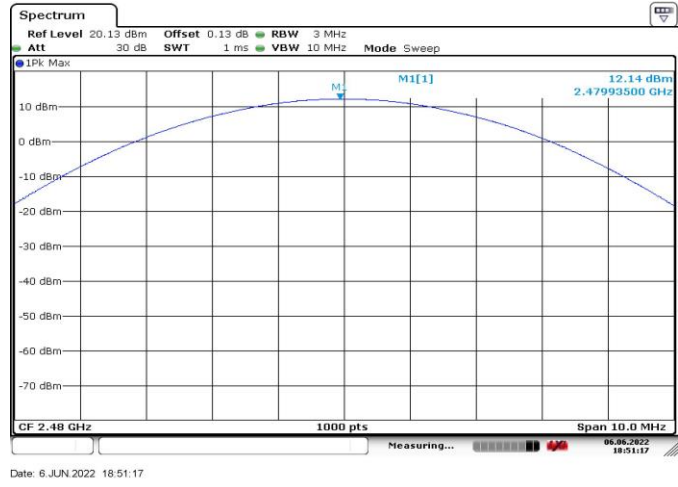
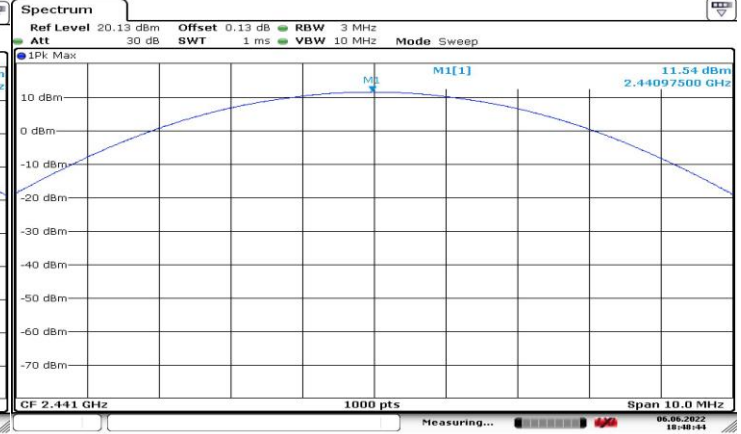
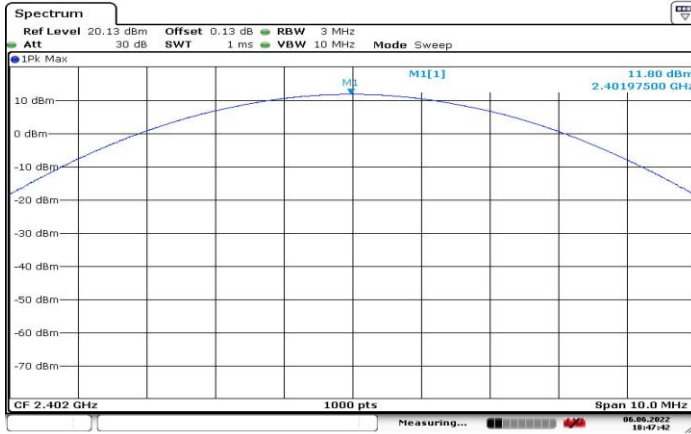
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DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



Enhanced Data Rate (3DH5) 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	2402	3-DH5	11.80	1	21	8.20	Pass
Middle	2441	3-DH5	11.54	1	21	9.46	Pass
High	2480	3-DH5	12.14	1	21	8.86	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

Project number (Integrity):	911R	Build Phase:	C1.5		
Tested by:	Mike Royer	Date:	June 7, 2022 and Aug 26, 2022		
Requirements Standard(s):	FCC §15.247 (d) RSS-247 5.5	Referenced Standard(s):	ANSI 63.10 (7.8.8)		
EUT powered with:	5V USB	Temp / Humidity:	n/a	Test location:	Braun Room
Test equipment used TN's:	2409				
EUT Serial number(s):	084232M1333A069AE				
EUT Software installed:	0.6.16+g302b20e				
EUT Modification(s):	Product was tested as built except the antenna was disconnected and a coaxial cable was installed.				

Conclusion:

The Bose Model 911R 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.



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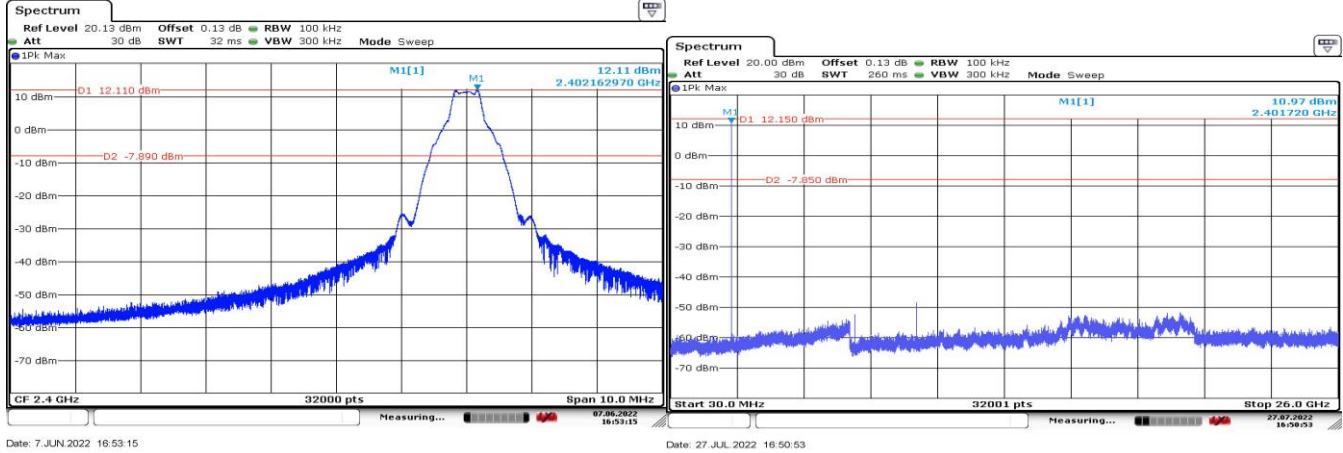
DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



Data Collection:

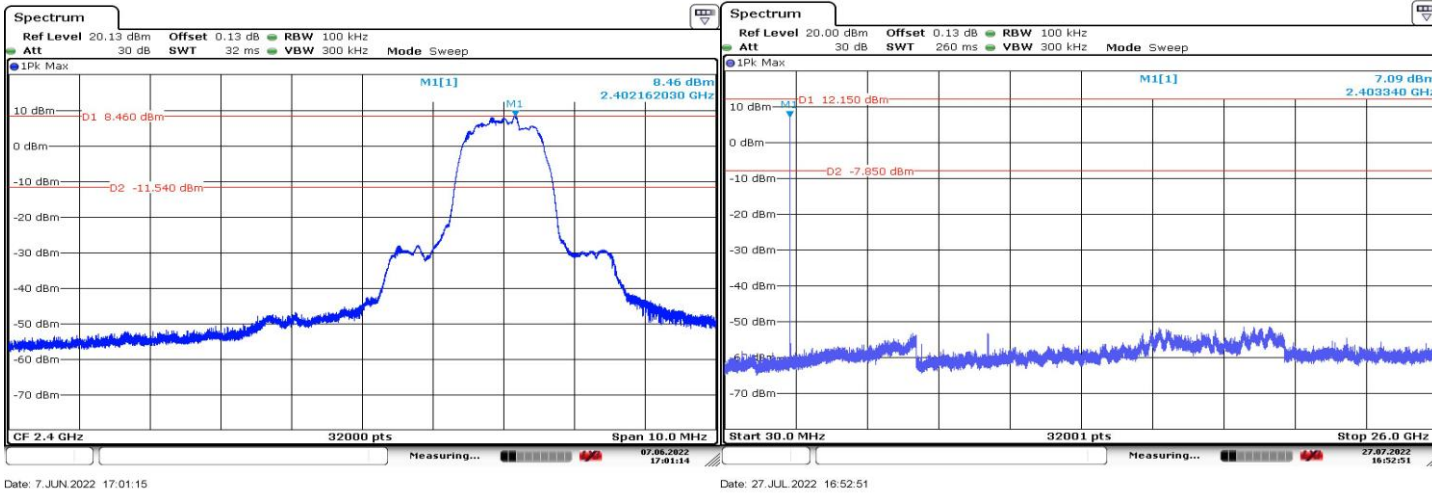
DH5 low channel band-edge.

Out of band low channel (2402MHz)



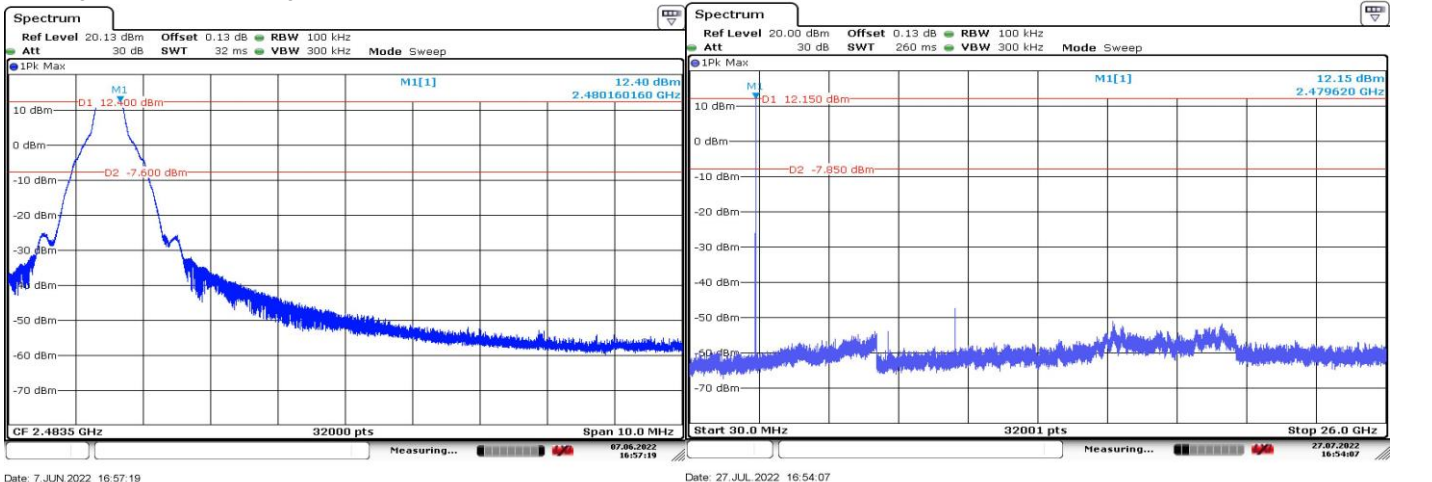
3DH5 low channel band-edge

Out of band low channel (2402MHz)



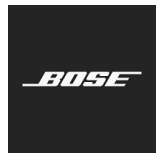
DH5 high channel band-edge

Out of band high channel (2480MHz)



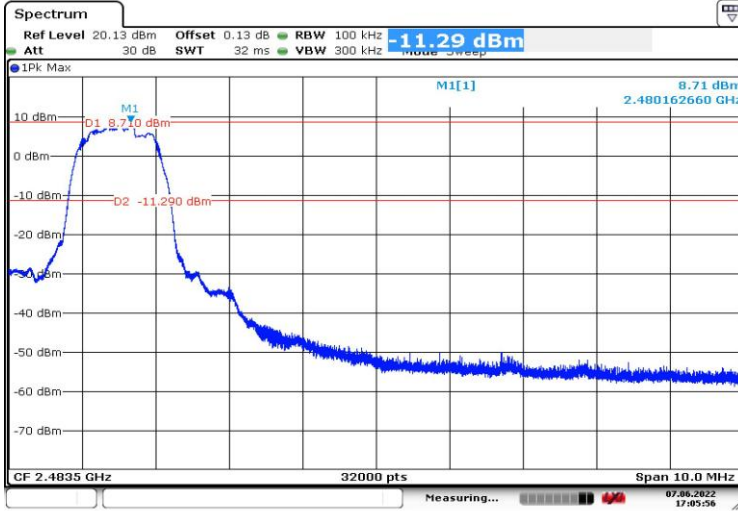


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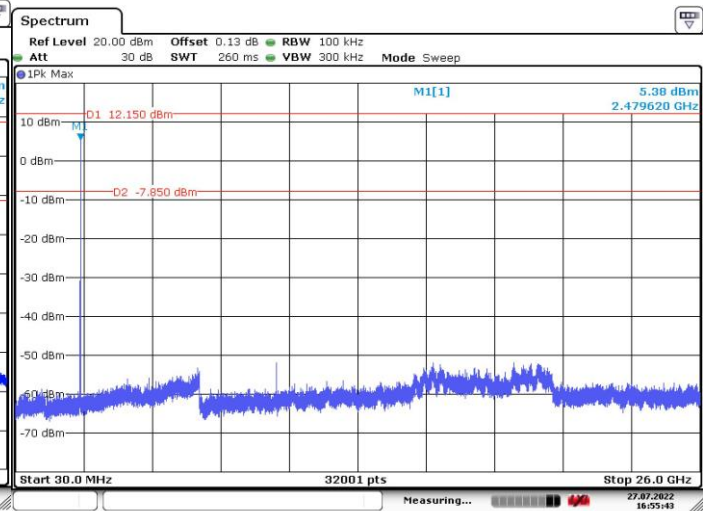
Certificate # 1514.1

3DH5 high channel band-edge



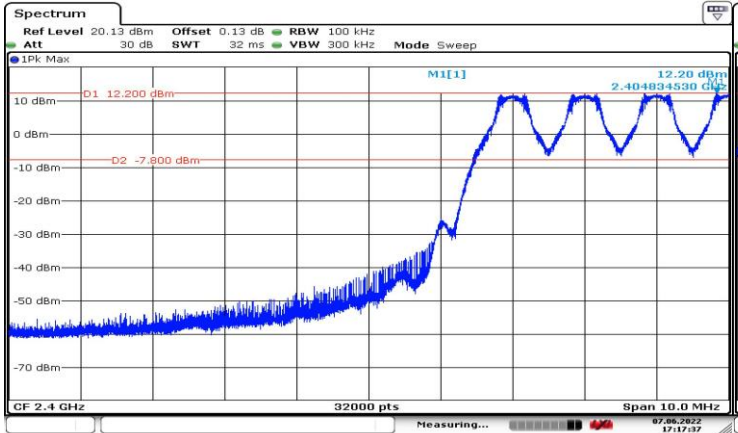
Date: 7 JUN 2022 17:05:56

Out of band high channel (2480MHz)



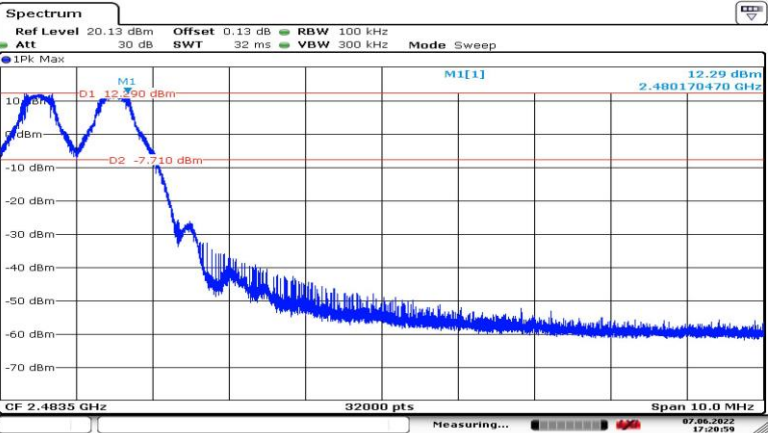
Date: 27 JUL 2022 16:55:44

DH5 low channel band-edge while hopping



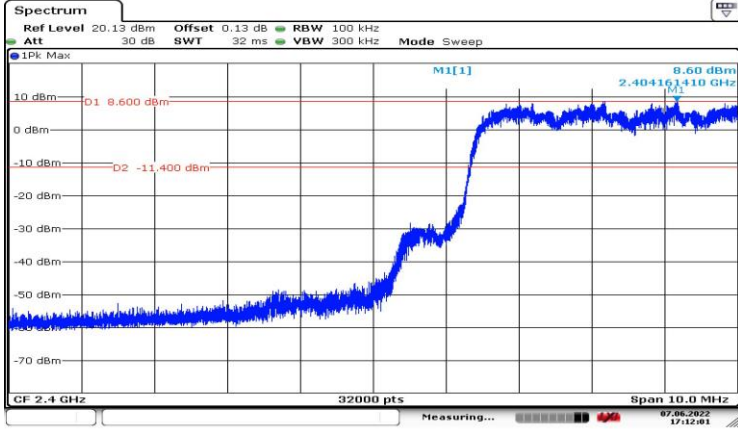
Date: 7 JUN 2022 17:17:37

DH5 high channel band-edge while hopping



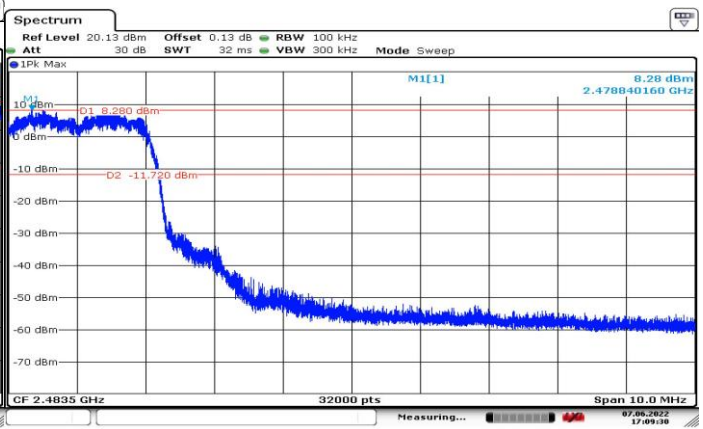
Date: 7 JUN 2022 17:21:00

3DH5 low channel band-edge while hopping



Date: 7 JUN 2022 17:12:01

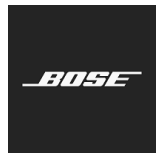
3DH5 high channel band-edge while hopping



Date: 7 JUN 2022 17:09:30



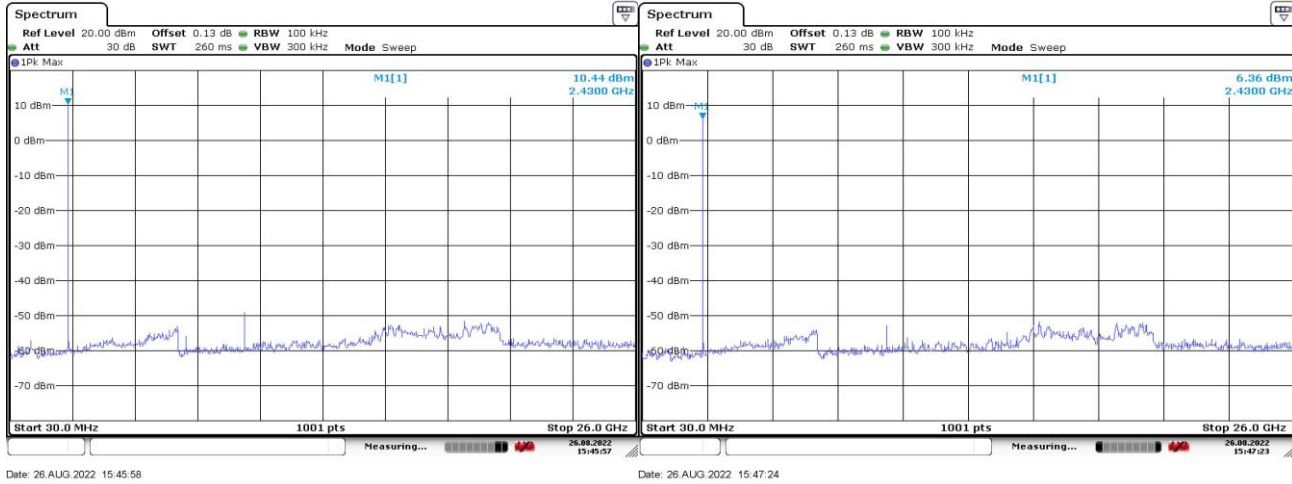
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Certificate # 1514.1

DH5 mid channel out of band

3-DH5 mid channel out of band



Date: 26 AUG 2022 15:45:58

Date: 26 AUG 2022 15:47:24

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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DESIGN ASSURANCE ENGINEERING
COMPLIANCE
EMC TEST REPORT



RF Radiated Emissions 30MHz -1GHz

Test Information:

Project number (Integrity):	435911	Build Phase:	DV		
Tested by:	K Thibodeau		Date:	7/14/2022	
Requirements Standard(s):	FCC §15.247 (d) RSS-247 Section 5.5		Referenced Standard(s):	ANSI C63.10-2013	
EUT powered with:	EUT battery	Temp / Humidity:	N/A	Test location:	Maxwell House
Test equipment used TN's:	644,1541,2319,2077,1445,1569				
EUT Serial number(s):	Right: Etched on bud:O4-2R SN: 084232M21440096AE Left: Etched on bud:O4-2L SN: 084233M21650042AE Case: 084231M21500145AE				
EUT Software installed:	Right: 0.11.6 Left: 0.11.6 Case: 0.11.2				
EUT Modification(s):	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:

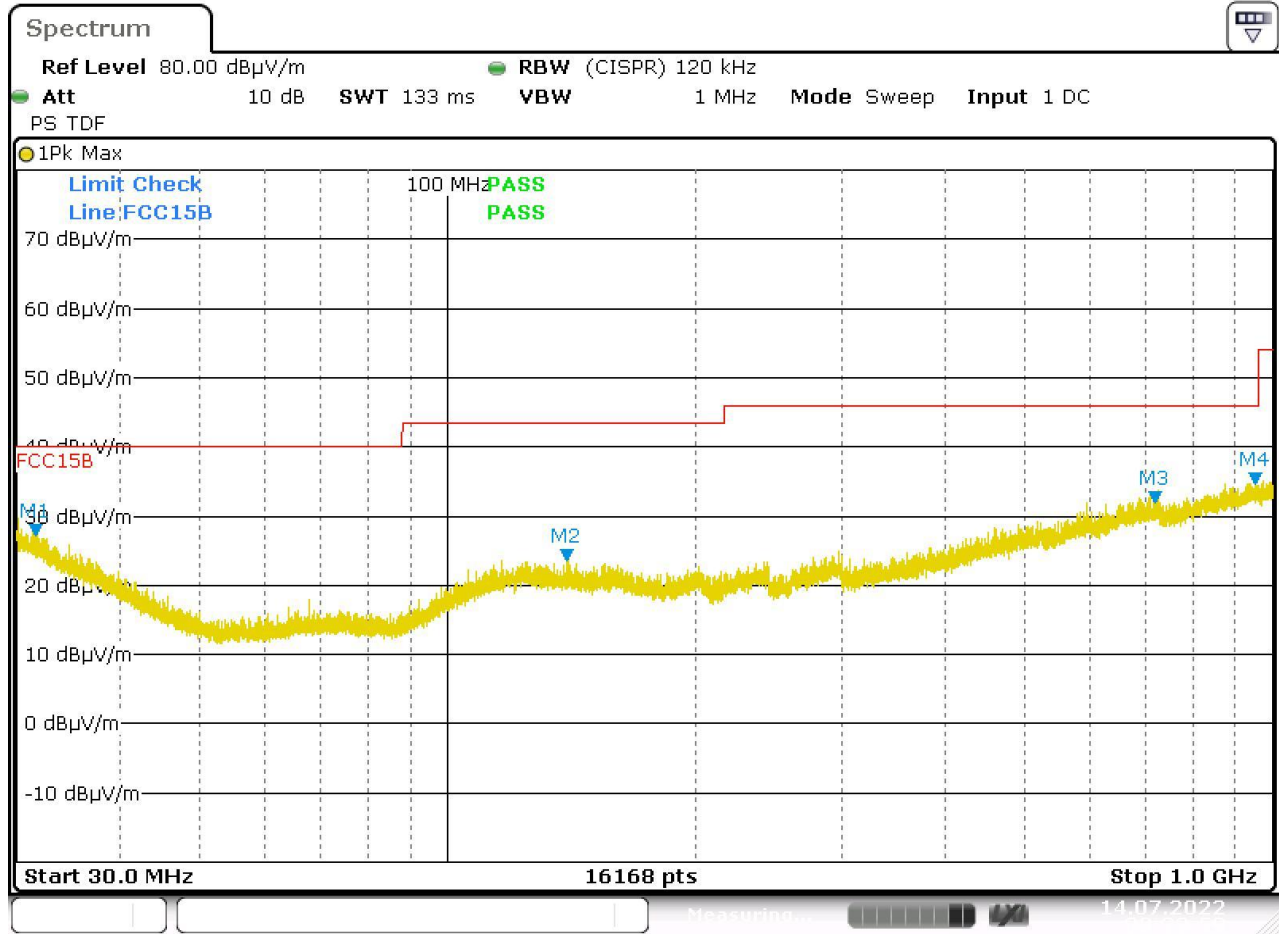
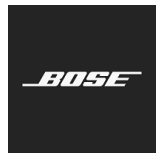
Radiated Emission Level (dBµV/m) = EMI Receiver Reading (dBµV) + Antenna Correction Factor (dB/m) – Preamplifier Gain (dB) + Cable Loss (dB)

Data Collection:



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DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



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

Plots are pre-compliance investigative information. Tables contain the compliance data.			
EUT S/N:	See page 1	Power applied:	EUT battery
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 ¹)		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.435911.20.207.1(4)

Form FL300959 Rev 06

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		10 m	3 m ²	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. *For measurements above 1 GHz, peak limits must also be met that are 20 dB higher than average limits.
	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)		
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):				3.97



Radiated Spurious Emissions 1-25GHz

Project number (Integrity):	911R	Build Phase:	C.5		
Tested by:	Mike Royer	Date:	June 8-14, 2022 June 21, 2022		
Requirements Standard(s):	FCC §15.247 (d) RSS-247 Section 5.5	Referenced Standard(s):	ANSI C63.10-2013		
EUT powered with:	Battery	Temp / Humidity:	N/A	Test location:	Marconi Manor
Test equipment used TN's:	1663,2602,2349,1757,1596				
EUT Serial number(s):	084232M2011G099AE				
EUT Software installed:	0.6.18				
EUT Modification(s):	USB Debug wires were attached to the earbud to allow control of the radio.				

Conclusion:

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

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

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

1-18 GHz, the worst case peak is 51.6 dBuV/m. The average limit is 54. The margin is 2.4 dB
 18-25 GHz the worst case peak is 57.6 dBuV/m. The average limit is 74. The margin is 16.4 dB.

Procedure:

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

Pretesting in 3 axis 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.



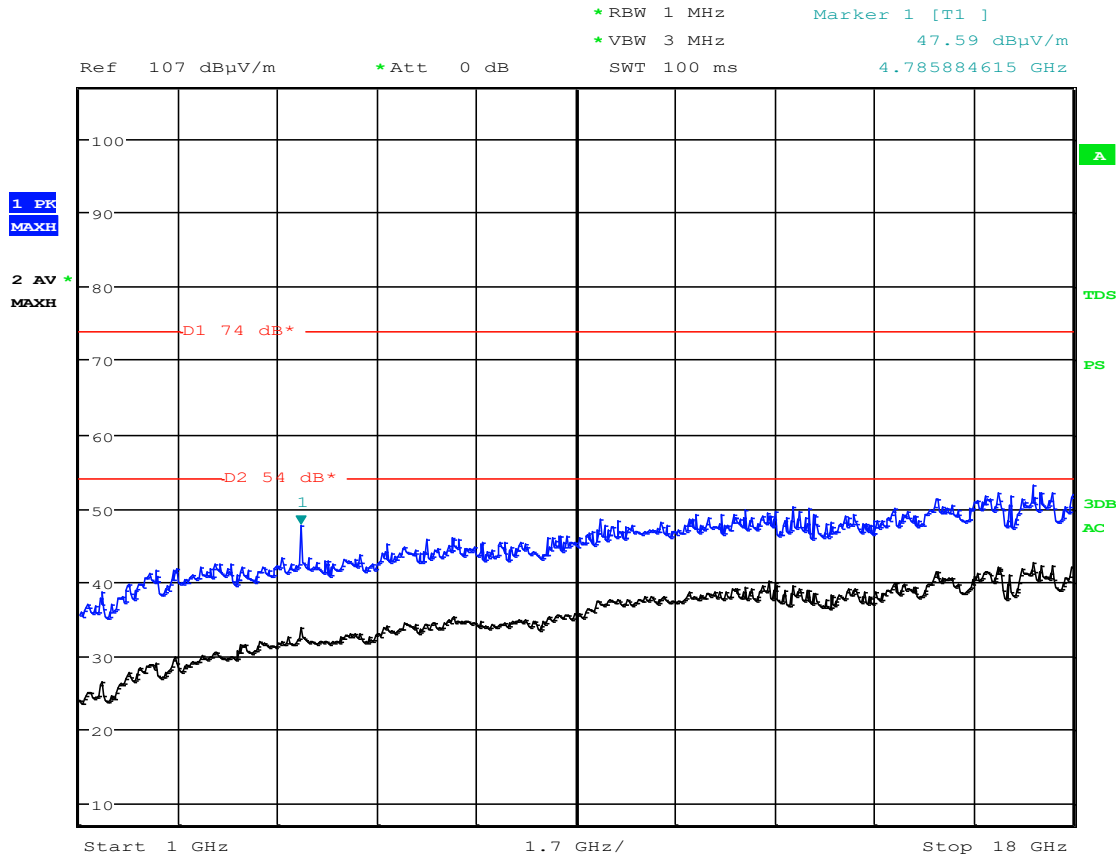
Certificate # 1514.1

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Data Collection:

EUT S/N:	Right	Power applied:	Battery		Meas#	1
EUT Mods:						
EUT Setup:	DH5 Low channel 2402 MHz					
Comments:	1-18 GHz measured at 3m distance. 18-25 GHz measured at 30cm distance.					



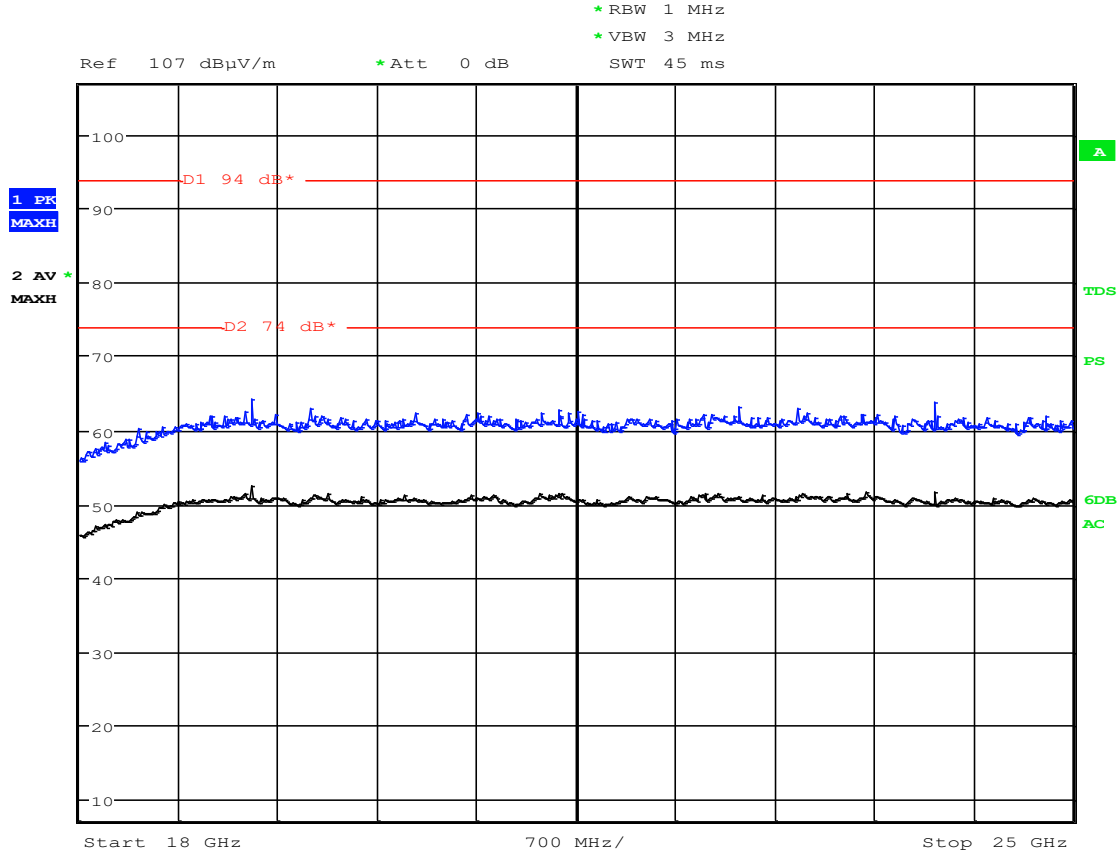
Date: 13.JUN.2022 18:02:44

3m Measurement Distance



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Date: 21.JUN.2022 16:55:06

30cm Measurement 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



EUT S/N:	continued	Power applied:	Battery		Meas#	1
EUT Mods:						
EUT Setup:	DH5 Low channel 2402 MHz					
Comments:	1-18 GHz measured at 3m distance. 18-25 GHz measured at 30cm distance.					

FCC §15.247 (d), RSS-247 Section 5.5 @ 3 Meters

Emission Frequency (MHz)	Measured Amplitude (dBµV/m) AVG	Measured Amplitude (dBµV/m) Peak					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	41.20	49.50	54.0	74.0	12.8	24.5	151	V	1.7	
7206	30.60	44.00	54.0	74.0	23.4	30.0	0	H	1.5	noise floor
9608	37.70	48.70	54.0	74.0	16.3	25.3	313	H	1.7	
12010	34.40	47.10	54.0	74.0	19.6	26.9	0	H	1.5	noise floor
14412	34.70	47.80	54.0	74.0	19.3	26.2	0	H	1.5	noise floor
16814	36.10	48.90	54.0	74.0	17.9	25.1	0	H	1.5	noise floor

FCC §15.247 (d), RSS-247 Section 5.5 @ 30 cm

Emission Frequency (MHz)	Measured Amplitude (dBµV/m) AVG	Measured Amplitude (dBµV/m) Peak					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	57.30	74.0	94.0	29.6	36.7				noise floor
21618	43.20	56.60	74.0	94.0	30.8	37.4				noise floor
24020	42.90	55.90	74.0	94.0	31.1	38.1				noise floor



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DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



EUT S/N:	Right	Power applied:	Battery		Meas#	2
EUT Mods:						
EUT Setup:	DH5 Mid channel 2441 MHz					
Comments:						

FCC §15.247 (d), RSS-247 Section 5.5 @ 3 Meters

Emission Frequency (MHz)	Measured Amplitude (dBµV/m) AVG	Measured Amplitude (dBµV/m) Peak	Limit				Table Azimuth (0° closest to ant)	Receiving Ant		Notes/Mode
			(dBµV/m) AVG	(dBµV/m) Peak	Margin (dB) AVG	Margin (dB) Peak		Pol (H/V)	Height (Meters)	
4882	39.40	47.70	54.0	74.0	14.6	26.3	160	V	1.7	
7323	31.60	44.50	54.0	74.0	22.4	29.5	0	H	1.5	noise floor
9764	40.40	51.60	54.0	74.0	13.6	22.4	-4	H	1.7	
12205	35.20	48.50	54.0	74.0	18.8	25.5	0	H	1.5	noise floor
14646	35.00	47.70	54.0	74.0	19.0	26.3	0	H	1.5	noise floor
17087	36.80	49.80	54.0	74.0	17.2	24.2	0	H	1.5	noise floor

FCC §15.247 (d), RSS-247 Section 5.5 @ 30 cm

Emission Frequency (MHz)	Measured Amplitude (dBµV/m) AVG	Measured Amplitude (dBµV/m) Peak	Limit				Table Azimuth (0° closest to ant)	Receiving Ant		Notes/Mode
			(dBµV/m) AVG	(dBµV/m) Peak	Margin (dB) AVG	Margin (dB) Peak		Pol (H/V)	Height (Meters)	
19528	43.30	56.20	74.0	94.0	30.7	37.8				noise floor
21969	43.70	56.70	74.0	94.0	30.3	37.3				noise floor
24410	43.60	56.80	74.0	94.0	30.4	37.2				noise floor



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DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



EUT S/N:	Right	Power applied:	Battery		Meas#	3
EUT Mods:						
EUT Setup:	DH5 High channel 2480 MHz					
Comments:						

FCC §15.247 (d), RSS-247 Section 5.5 @ 3 Meters

Emission Frequency (MHz)	Measured Amplitude (dBµV/m) AVG	Measured Amplitude (dBµV/m) Peak	Limit				Table Azimuth (0° closest to ant)	Receiving Ant		Notes/Mode
			(dBµV/m) AVG	(dBµV/m) Peak	Margin (dB) AVG	Margin (dB) Peak		Pol (H/V)	Height (Meters)	
4960	37.00	46.40	54.0	74.0	17.0	27.6	165	V	1.7	
7440	32.00	44.80	54.0	74.0	22.0	29.2	0	H	1.5	noise floor
9920	39.70	50.60	54.0	74.0	14.3	23.4	240	H	1.7	
12400	35.30	48.50	54.0	74.0	18.7	25.5	0	H	1.5	noise floor
14880	36.30	49.80	54.0	74.0	17.7	24.2	0	H	1.5	noise floor
17360	38.10	50.60	54.0	74.0	15.9	23.4	0	H	1.5	noise floor

FCC §15.247 (d), RSS-247 Section 5.5 @ 30 cm

Emission Frequency (MHz)	Measured Amplitude (dBµV/m) AVG	Measured Amplitude (dBµV/m) Peak	Limit				Table Azimuth (0° closest to ant)	Receiving Ant		Notes/Mode
			(dBµV/m) AVG	(dBµV/m) Peak	Margin (dB) AVG	Margin (dB) Peak		Pol (H/V)	Height (Meters)	
19840	44.10	57.60	74.0	94.0	29.9	36.4				noise floor
22320	44.00	57.20	74.0	94.0	30.0	36.8				noise floor
24800	43.60	56.30	74.0	94.0	30.4	37.7				noise floor



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DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



EUT S/N:	Right	Power applied:	Battery	Meas#	4
EUT Mods:					
EUT Setup:	3-DH5 Low channel 2402 MHz				
Comments:					

FCC §15.247 (d), RSS-247 Section 5.5 @ 3 Meters

Emission Frequency (MHz)	Measured Amplitude (dBµV/m) AVG	Measured Amplitude (dBµV/m) Peak	Limit				Table Azimuth (0° closest to ant)	Receiving Ant		Notes/Mode
			(dBµV/m) AVG	(dBµV/m) Peak	Margin (dB) AVG	Margin (dB) Peak		Pol (H/V)	Height (Meters)	
4804	36.80	47.90	54.0	74.0	17.2	26.1	152	V	1.7	
7206	30.80	45.00	54.0	74.0	23.2	29.0	0	H	1.5	noise floor
9608	36.50	48.80	54.0	74.0	17.5	25.2	226	H	1.7	
12010	34.50	47.30	54.0	74.0	19.5	26.7	0	H	1.5	noise floor
14412	34.70	47.40	54.0	74.0	19.3	26.6	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 §15.247 (d), RSS-247 Section 5.5 @ 30 cm

Emission Frequency (MHz)	Measured Amplitude (dBµV/m) AVG	Measured Amplitude (dBµV/m) Peak	Limit				Table Azimuth (0° closest to ant)	Receiving Ant		Notes/Mode
			(dBµV/m) AVG	(dBµV/m) Peak	Margin (dB) AVG	Margin (dB) Peak		Pol (H/V)	Height (Meters)	
19216	44.30	57.30	74.0	94.0	29.7	36.7				noise floor
21618	43.20	56.10	74.0	94.0	30.8	37.9				noise floor
24020	43.00	56.40	74.0	94.0	31.0	37.6				noise floor



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DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



EUT S/N:	Right	Power applied:	Battery	Meas#	5
EUT Mods:					
EUT Setup:	3-DH5 Mid channel 2441 MHz				
Comments:					

FCC §15.247 (d), RSS-247 Section 5.5 @ 3 Meters

Emission Frequency (MHz)	Measured Amplitude (dBµV/m) AVG	Measured Amplitude (dBµV/m) Peak	Limit				Table Azimuth (0° closest to ant)	Receiving Ant		Notes/Mode
			(dBµV/m) AVG	(dBµV/m) Peak	Margin (dB) AVG	Margin (dB) Peak		Pol (H/V)	Height (Meters)	
4882	29.30	43.50	54.0	74.0	24.7	30.5	229	V	1.7	
7323	31.70	45.70	54.0	74.0	22.3	28.3	0	H	1.5	noise floor
9764	32.50	47.20	54.0	74.0	21.5	26.8	179	H	1.7	
12205	34.00	47.10	54.0	74.0	20.0	26.9	0	H	1.5	noise floor
14646	34.80	48.20	54.0	74.0	19.2	25.8	0	H	1.5	noise floor
17087	36.80	49.70	54.0	74.0	17.2	24.3	0	H	1.5	noise floor

FCC §15.247 (d), RSS-247 Section 5.5 @ 30 cm

Emission Frequency (MHz)	Measured Amplitude (dBµV/m) AVG	Measured Amplitude (dBµV/m) Peak	Limit				Table Azimuth (0° closest to ant)	Receiving Ant		Notes/Mode
			(dBµV/m) AVG	(dBµV/m) Peak	Margin (dB) AVG	Margin (dB) Peak		Pol (H/V)	Height (Meters)	
19528	43.30	56.10	74.0	94.0	30.7	37.9				noise floor
21969	43.70	56.80	74.0	94.0	30.3	37.2				noise floor
24410	43.70	56.10	74.0	94.0	30.3	37.9				noise floor



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DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



EUT S/N:	Right	Power applied:	Battery		Meas#	6
EUT Mods:						
EUT Setup:	3-DH5 High channel 2480 MHz					
Comments:						

@ 3 Meters										
Emission Frequency (MHz)	Measured Amplitude (dBµV/m) AVG	Measured Amplitude (dBµV/m) Peak					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	31.80	44.80	54.0	74.0	22.2	29.2	180	V	1.6	
7440	31.70	45.70	54.0	74.0	22.3	28.3	0	H	1.5	noise floor
9920	37.50	50.50	54.0	74.0	16.5	23.5	243	H	1.6	
12400	35.20	47.90	54.0	74.0	18.8	26.1	0	H	1.5	noise floor
14880	37.10	50.20	54.0	74.0	16.9	23.8	0	H	1.5	noise floor
17360	38.00	50.80	54.0	74.0	16.0	23.2	0	H	1.5	noise floor

FCC §15.247 (d), RSS-247 Section 5.5 @ 30 cm										
Emission Frequency (MHz)	Measured Amplitude (dBµV/m) AVG	Measured Amplitude (dBµV/m) Peak					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	56.90	74.0	94.0	29.9	37.1	360	H	1.5	noise floor
22320	44.00	57.20	74.0	94.0	30.0	36.8	360	H	1.5	noise floor
24800	43.60	56.10	74.0	94.0	30.4	37.9	360	H	1.5	noise floor

Limits:

Standard	Freq Range (MHz)	Limits (dBuV QP ¹)			Comments
		Class A		Class B	
		10 m	3 m	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. *For measurements above 1 GHz, peak limits must also be met that are 20 dB higher than average limits.
	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 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	N/A	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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DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



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):				4.17



Certificate # 1514.1

DESIGN ASSURANCE ENGINEERING
COMPLIANCE
EMC TEST REPORT



Radiated Band Edge

Project number (Integrity):	911R	Build Phase:	C1.5		
Tested by:	Mike Royer	Date:	June 20, 2022		
Requirements Standard(s):	FCC §15.247 (d) RSS -247 Section 5.5	Referenced Standard(s):	ANSI C63.10-2013		
EUT powered with:	Battery	Temp / Humidity:	N/A	Test location:	Marconi Manor
Test equipment used TN's:	1663,				
EUT Serial number(s):	084232M2011G099AE				
EUT Software installed:	0.6.18+g5d320d0				
EUT Modification(s):	USB Debug wires were attached to the earbud to allow control of the radio.				

Conclusion:

The Bose model 911R passes Radiated Band Edge.

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

Procedure:

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.

A low gain pre-amp was used to ensure that overloading was avoided. Care was taken in selecting input attenuation and reference level to avoid compression.

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.

The spectrum analyzer settings shall meet the requirements of ANSI C63.10 for making Average measurements.

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

For upper band edge measurements the transmit frequency was 2480 MHz.

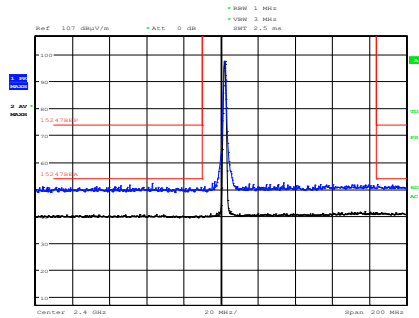


Certificate # 1514.1

DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT

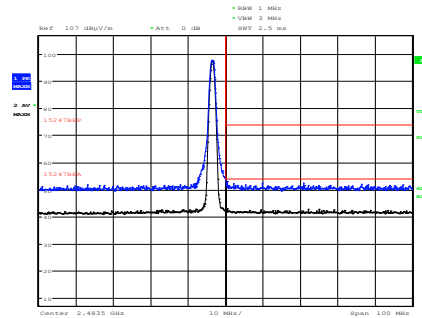


Data Collection:



Date: 20 JUN 2022 14:58:22

Lower Band edge, Basic Rate



Date: 20 JUN 2022 15:07:59

Upper Band edge, Basic Rate

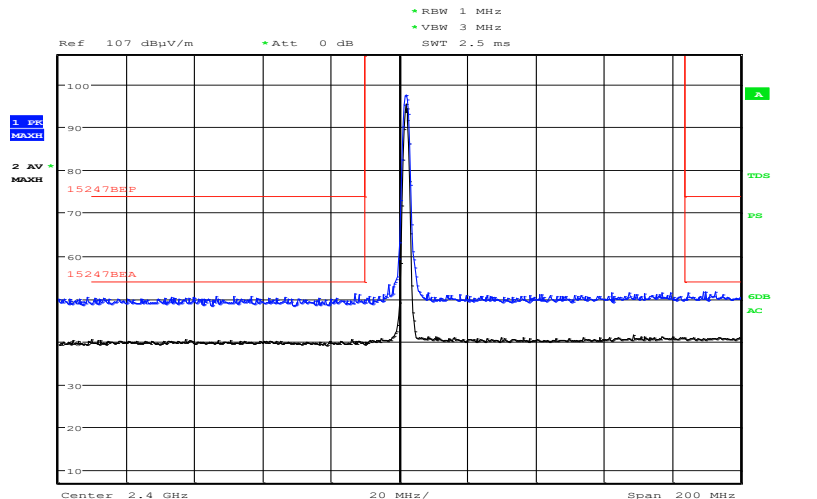
FCC 15.247d and RSS-247 Section 5.5 @ 3 Meters

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	37.60	51.00	54.0	74.0	16.4	23.0	0	H	150.00	DH5, 100% DC
2483.500	37.60	50.70	54.0	74.0	16.4	23.3	0	H	150.00	3-DH5, 100% DC



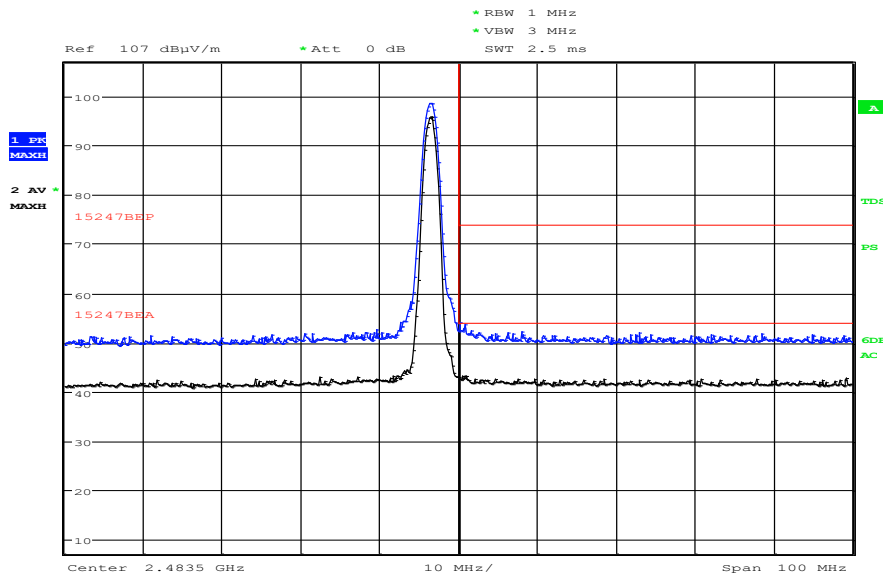
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DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



Date: 20.JUN.2022 15:03:21

Lower Band edge, EDR



Date: 20.JUN.2022 15:14:49

Upper Band edge, EDR



Limits:

Standard	Freq Range (MHz)	Limits (dBuV QP ¹)			Comments
		Class A		Class B	
		10 m	3 m	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. *For measurements above 1 GHz, peak limits must also be met that are 20 dB higher than average limits.
	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. *For measurements above 1 GHz, peak limits must also be met that are 20 dB higher than average limits.
			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
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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)			
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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
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Site imperfection - NSA	3.0	Triang.	2.45	1.22
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Coverage factor (2 sigma):				2.00
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