



Certificate # 1514.1

PRODUCT ASSURANCE ENGINEERING  
COMPLIANCE  
EMC TEST REPORT



Test Type: Emissions

Product Type: *Wireless Earbud*

Product Name/Number: *Model 408R*

FCC ID: *A94408R*

IC: *3232A-408R*

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.441408.23.167.2*

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:	Bryan Cerqua	<i>Bryan H Cerqua</i>	8/15/2023
Electrical Engineer Review* By:	Kenneth Lee	<i>Kenneth Lee</i>	8/16/2023

\* 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 0.58 dBi (Left Earbud) and 0.86 dBi (Right Earbud) 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.*

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.



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# Test Results Summary

TEST NAME	TEST RESULT PASS or N/A	COMMENT(S)
On Time and Duty Cycle	N/A	
99% Occupied Bandwidth	N/A	
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	
RF Radiated Emissions 30MHz -1GHz	Pass	
Radiated RF Emissions 1-25GHz	Pass	
Radiated Band Edge	Pass	

## Environmental Conditions

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

## FCC Test Site Accreditation:

Firm Name	Location	Expiration Date	Accreditation	MRA	Designation Number	Contact	Contact Title	Address	PO Box	Mail Stop	City	State	Zip Code	Country	Email	Phone	Fax
Bose Corporation	1 New York Avenue, Framingham, MA	07/31/2024	American Association for Laboratory Accreditation	N/A	US1088	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

## Canadian Test Site Registration:

<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>	US0210	<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:            2024-07-31</b></p> <p>A2LA            ISO/IEC            17025:2017            Expires:            2024-07-31</p>
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# RF Conducted Measurements

## On Time and Duty Cycle

<b>Project number (Integrity):</b>	408R	<b>Build Phase:</b>	C1.5			
<b>Tested by:</b>	Mike Royer	<b>Date:</b>	May 12, 2023			
<b>Requirements Standard(s):</b>		<b>Referenced Standard(s):</b>	ANSI C62.10:2013-11.6-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>	084808M3051E012A1					
<b>EUT Software installed:</b>	1.4.10+g2edc594					
<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.

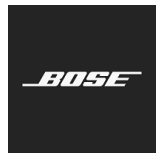
## Equipment Used:

TN	Description	Model	S/N	Manufacturer	Most Recent Calibration	Calibration Due Date
2409	Signal and Spectrum Analyzer	FSV40	101413	Rohde & Schwarz	22-Mar-2023	21-Mar-2024



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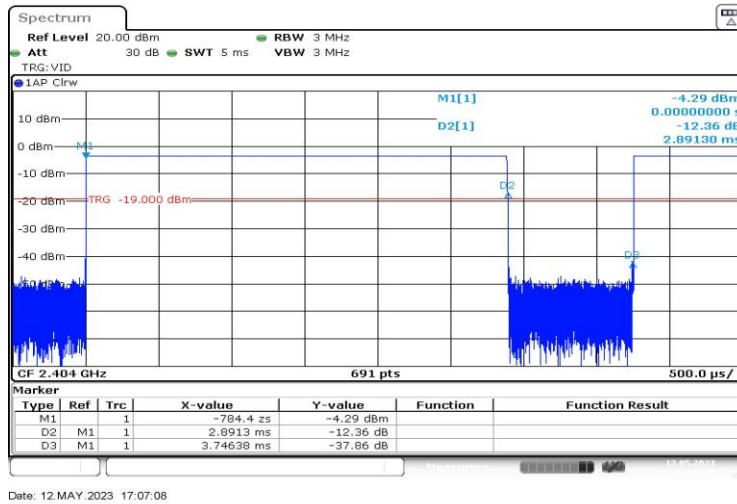
# PRODUCT ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



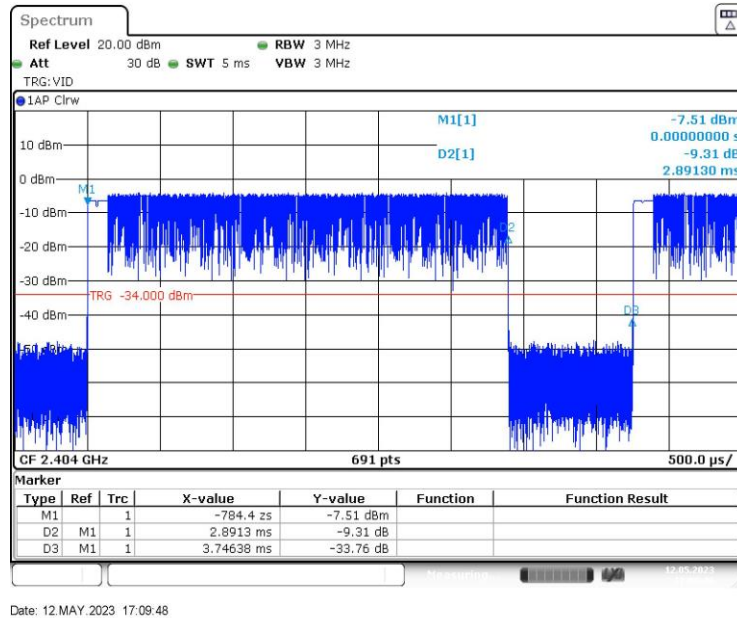
## Data Collection:

Duty cycles shown in the table below represent maximum duty cycle in test mode using maximum packet length.

Mode	ON Time (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	1/Ton (Hz)
Bluetooth DH5	2.891	3.755	.77	77	345.9
Bluetooth 3DH5	2.887	3.755	.77	77	346.4



DH5



3-DH5



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# 99% Occupied Bandwidth

<b>Project number (Integrity):</b>	408R	<b>Build Phase:</b>	C1.5		
<b>Tested by:</b>	Mike Royer	<b>Date:</b>	May 15, 2023		
<b>Requirements Standard(s):</b>		<b>Referenced Standard(s):</b>	ANSI C63.10:2013-6.9.3		
<b>EUT powered with:</b>	5V USB	<b>Temp / Humidity:</b>	n/a	<b>Test location:</b>	Braun Room
<b>Test equipment used TN's:</b>	2409				
<b>EUT Serial number(s):</b>	084808M3051E012A1				
<b>EUT Software installed:</b>	1.4.10+g2edc594				
<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.



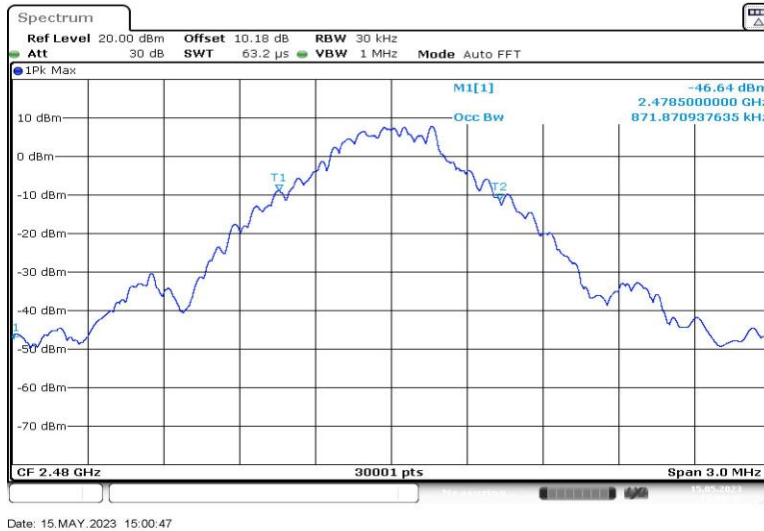
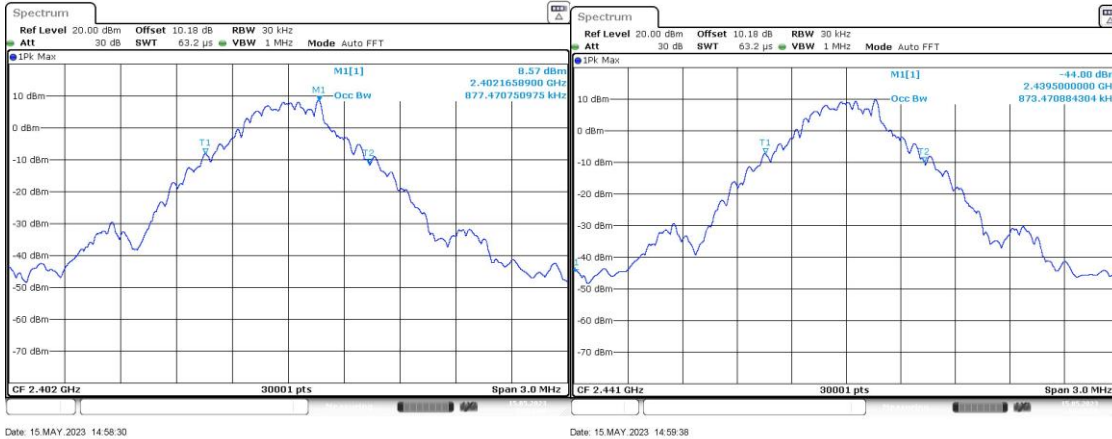
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## Basic Rate (DH5) Data Collection:

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	0.877
Middle	2441	0.873
High	2480	0.872



Date: 15.MAY.2023 15:00:47





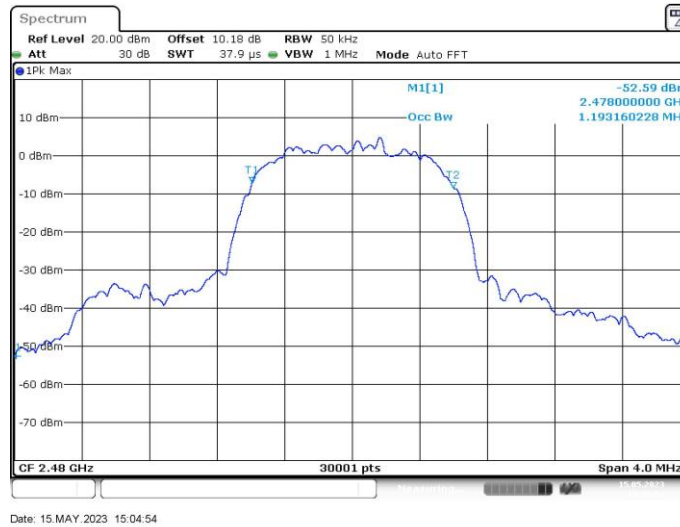
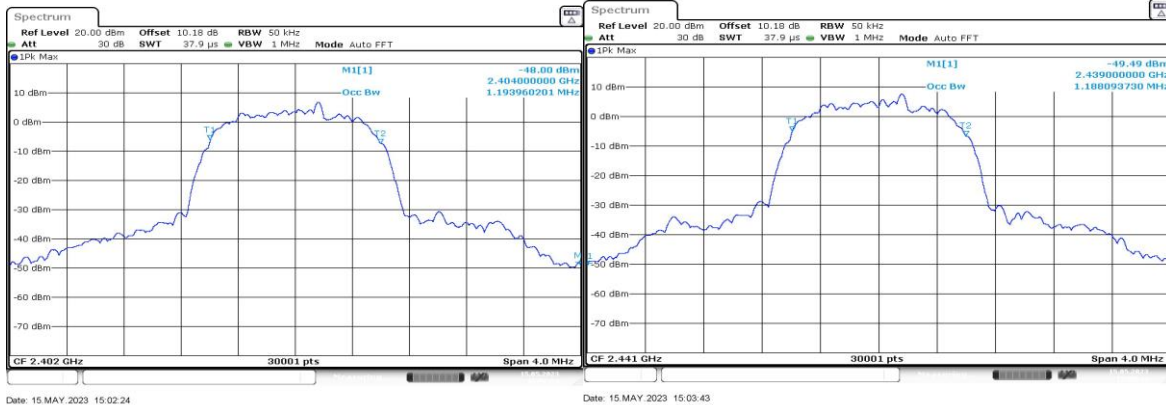
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# Enhanced Data Rate (3DH5) Data Collection:

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.194
Middle	2441	1.188
High	2480	1.193



## Equipment Used:

TN	Description	Model	S/N	Manufacturer	Most Recent Calibration	Calibration Due Date
2409	Signal and Spectrum Analyzer	FSV40	101413	Rohde & Schwarz	22-Mar-2023	21-Mar-2024



# 20dB Occupied Bandwidth

<b>Project number (Integrity):</b>	408R	<b>Build Phase:</b>	C1.5		
<b>Tested by:</b>	Mike Royer	<b>Date:</b>	June 20, 2023		
<b>Requirements Standard(s):</b>	FCC §15.247 (a) (1) RSS-247 5.1 (a)	<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>	084808M3051E012A1				
<b>EUT Software installed:</b>	1.4.10+g2edc594				
<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.



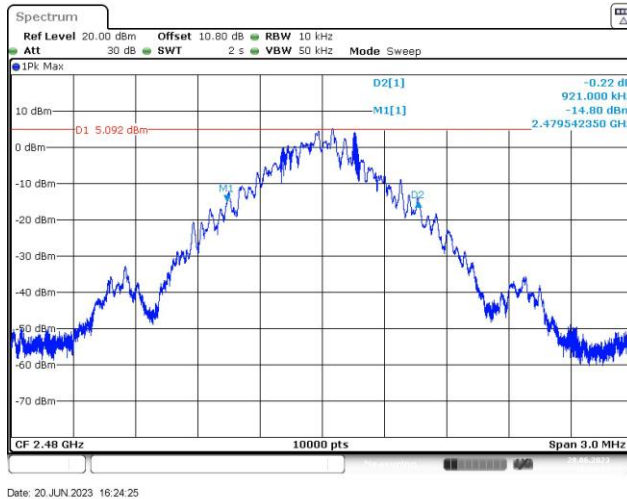
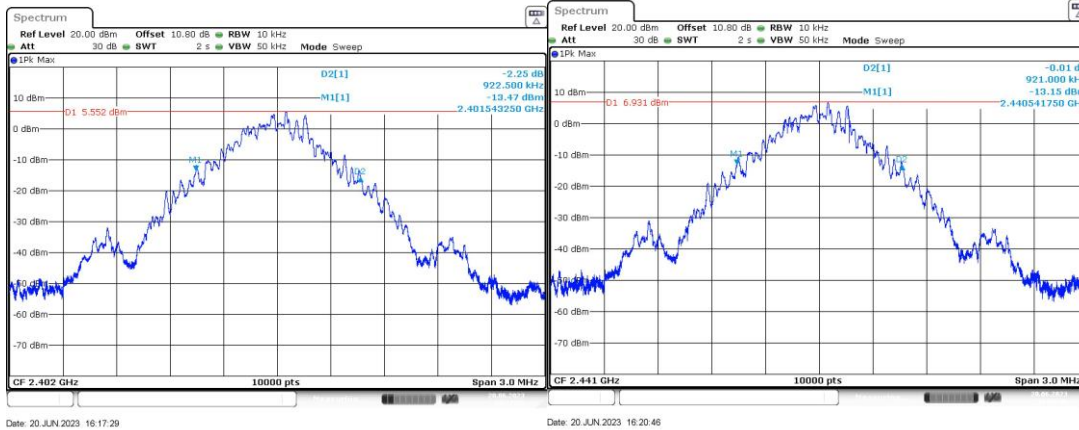
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## Basic Rate (DH5) Data Collection:

Setting	F1	F2	BW kHz
Left DH5 Low	2.401534	2.402469	923
Left DH5 Mid	2.440539	2.441469	921
Left DH5 High	2.479539	2.480469	921





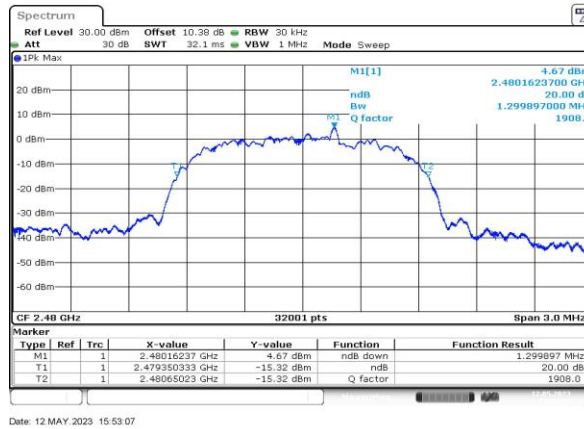
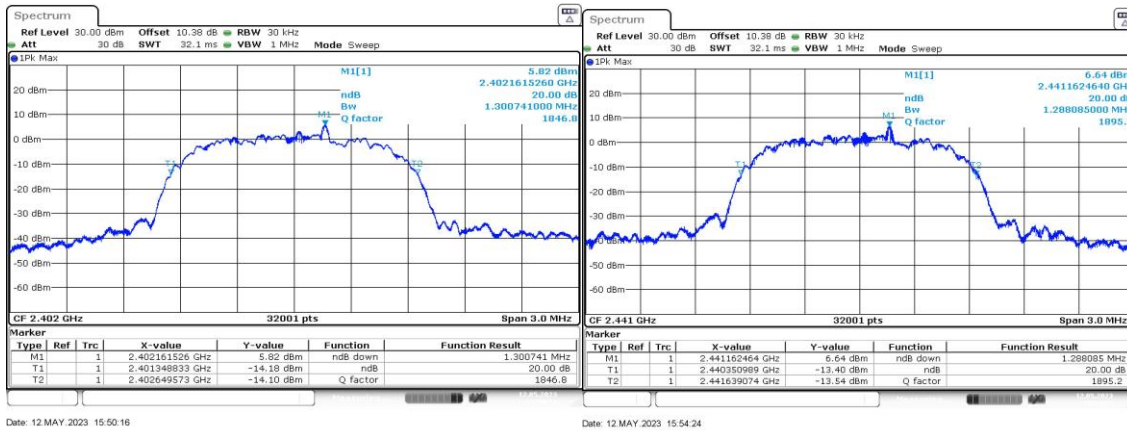
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# Enhanced Data Rate (3DH5) Data Collection:

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
Low	2402	1.301
Middle	2441	1.288
High	2480	1.300



## Equipment Used:

TN	Description	Model	S/N	Manufacturer	Most Recent Calibration	Calibration Due Date
2409	Signal and Spectrum Analyzer	FSV40	101413	Rohde & Schwarz	22-Mar-2023	21-Mar-2024

# Hopping Frequency Separation

<b>Project number (Integrity):</b>	408R	<b>Build Phase:</b>	C1.5		
<b>Tested by:</b>	Mike Royer	<b>Date:</b>	May 15, 2023		
<b>Requirements Standard(s):</b>	FCC 15.247 (a) (1), RSS-247 5.1 (b)	<b>Referenced Standard(s):</b>	ANSI C63.10-2013 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>	084808M3051E012A1				
<b>EUT Software installed:</b>	1.4.10+g2edc594				
<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 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.

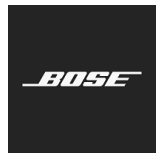
## Equipment Used:

TN	Description	Model	S/N	Manufacturer	Most Recent Calibration	Calibration Due Date
2409	Signal and Spectrum Analyzer	FSV40	101413	Rohde & Schwarz	22-Mar-2023	21-Mar-2024

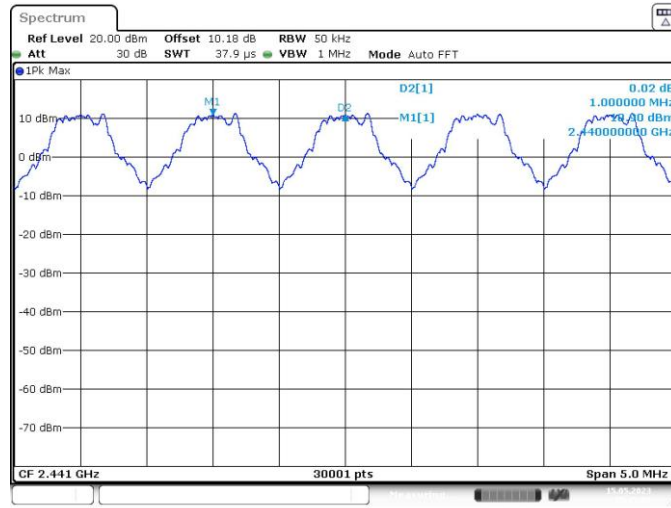


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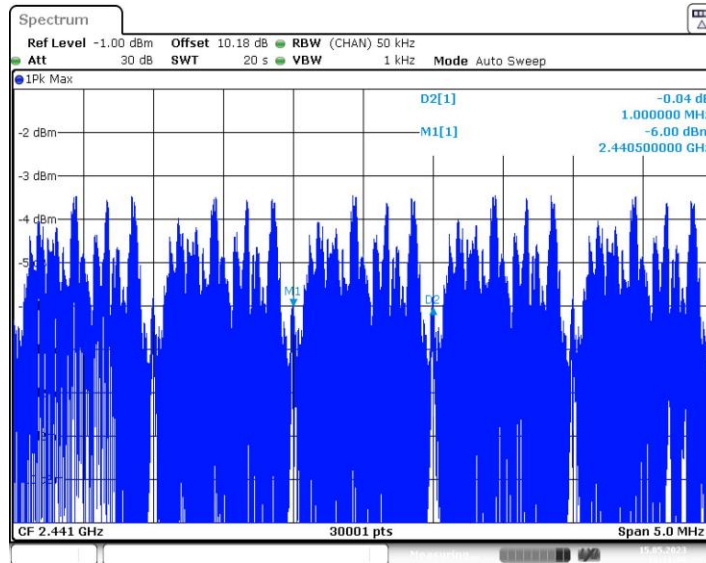


## Data Collection:



Date: 15 MAY 2023 15:45:10

DH5 hopping



Date: 15 MAY 2023 16:11:59

3-DH5 hopping



# Number of Hopping Channels

<b>Project number (Integrity):</b>	408R	<b>Build Phase:</b>	C1.5		
<b>Tested by:</b>	Mike Royer	<b>Date:</b>	March 15 and March 22, 2023		
<b>Requirements Standard(s):</b>	FCC 15.247 (a) (1) (iii) RSS-247 5.1 (d)	<b>Referenced Standard(s):</b>	ANSI C63.10-2013 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>	084808M3051E012A1				
<b>EUT Software installed:</b>	1.4.10+g2edc594				
<b>EUT Modification(s):</b>	Product was tested as built except the antenna was disconnected and a coaxial cable was installed.				

## Conclusion:

Bose Model 408R 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), RSS-247 5.1 (d)

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

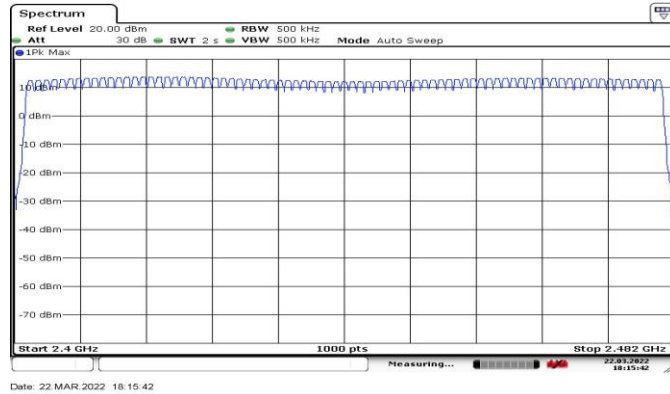


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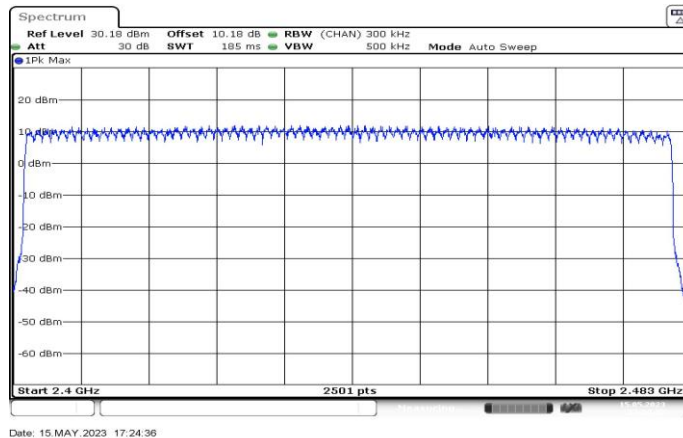
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## Data Collection:



79 hopping channels active DH5



79 Hopping Channels 3-DH5

## Equipment Used:

TN	Description	Model	S/N	Manufacturer	Most Recent Calibration	Calibration Due Date
2409	Signal and Spectrum Analyzer	FSV40	101413	Rohde & Schwarz	22-Mar-2023	21-Mar-2024





# Average Time of Occupancy

<b>Project number (Integrity):</b>	408R	<b>Build Phase:</b>	C1.5		
<b>Tested by:</b>	Mike Royer	<b>Date:</b>	May 22, 2023 and June 20, 2023		
<b>Requirements Standard(s):</b>	FCC 15.247 (a) (1) (iii) RSS-247 5.1 (d)	<b>Referenced Standard(s):</b>	ANSI C63.10-2013 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>	084808M3051E012A1				
<b>EUT Software installed:</b>	1.4.10+g2edc594				
<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 317.4 mS which meets the 400mS limit by 82.5 mS.

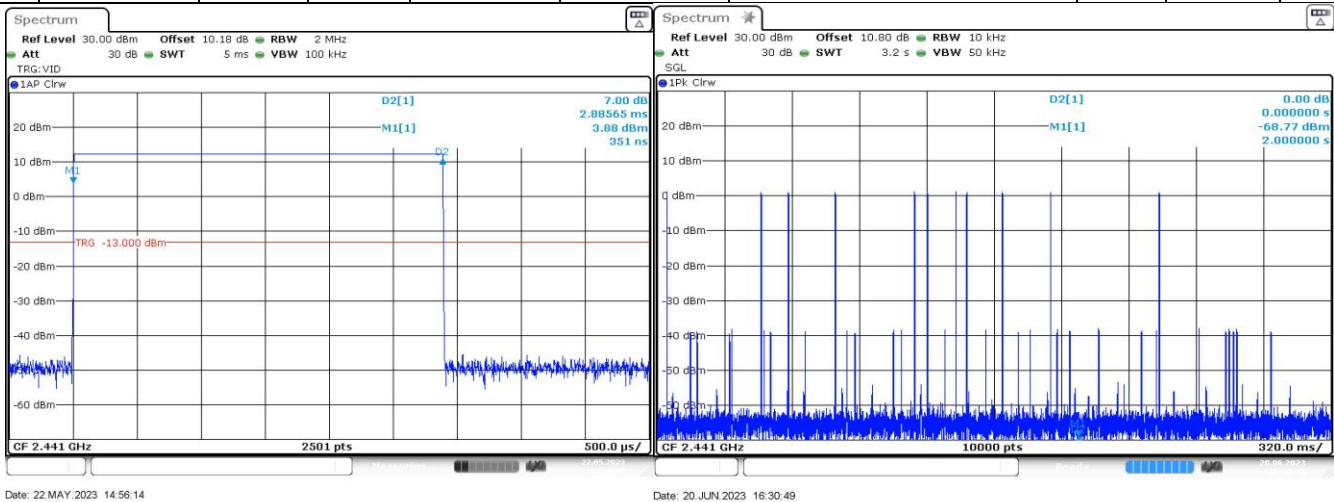
## Limit:

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.

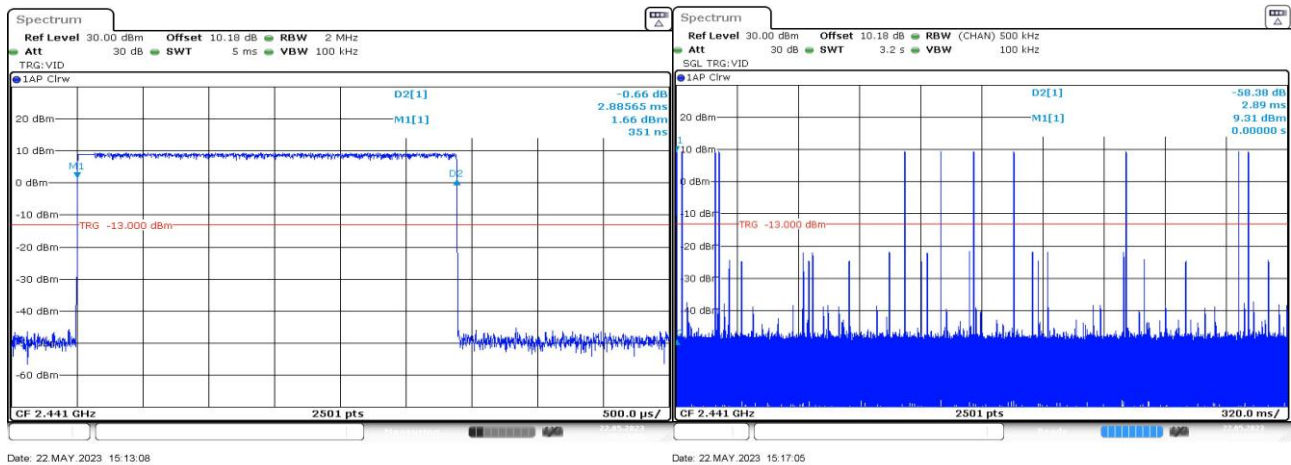
# Data Collection:

Observation time = (79 hopping Channels) \* 400mS = 31.6 Seconds.

Channel	Frequency (MHz)	Mode	Pulse Width (mS)	Number of pulses in 3.16 S	Number of pulses in 31.6 S	Time of occupancy (Pulse Width X Number of pulses) (mS)	Limit (mS)	Margin (mS)	Result
Middle	2441	DH5	2.886	11	110	317.4	400	82.5	Pass
Middle	2441	3-DH5	2.886	11	110	317.4	400	82.5	Pass



DH5



3DH5



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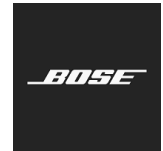
# Equipment Used:

TN	Description	Model	S/N	Manufacturer	Most Recent Calibration	Calibration Due Date
2409	Spectrum Analyzer	FSV40	101413	Rohde & Schwarz	22-Mar-2023	21-Mar-2024



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# Output Power

<b>Project number (Integrity):</b>	408R	<b>Build Phase:</b>	C1.5		
<b>Tested by:</b>	Mike Royer	<b>Date:</b>	May 16, 2023		
<b>Requirements Standard(s):</b>	FCC 15.247 (b) (3) RSS-247 5.4 (b)	<b>Referenced Standard(s):</b>	ANSI 63.10:2013 – 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>	084808M3051E012A1				
<b>EUT Software installed:</b>	1.4.10+g2edc594				
<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 7.77 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.



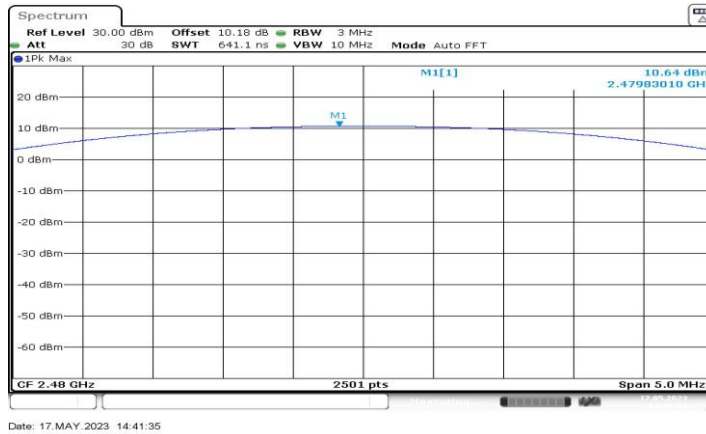
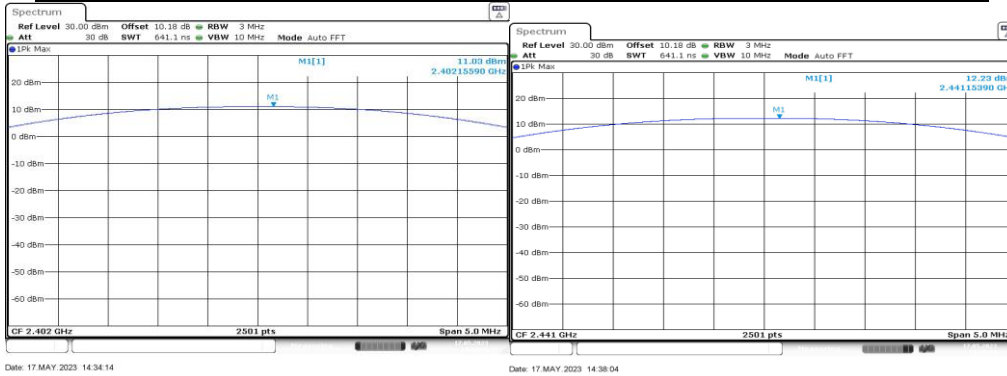
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# PRODUCT ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



## Basic Rate (DH5) Data Collection:

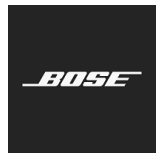
Output Power Summary Table (Basic Rate: 1 Mbps)						
Channel	Frequency (MHz)	Mode	Output Power (dBm)	Limit (dB)	Margin (dB)	Result
Low	2402	DH5	11.03	21	9.97	Pass
Middle	2441	DH5	12.23	21	8.77	Pass
High	2480	DH5	10.64	21	10.36	Pass





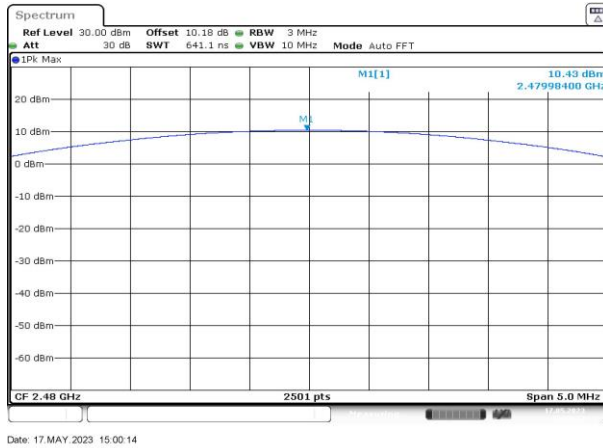
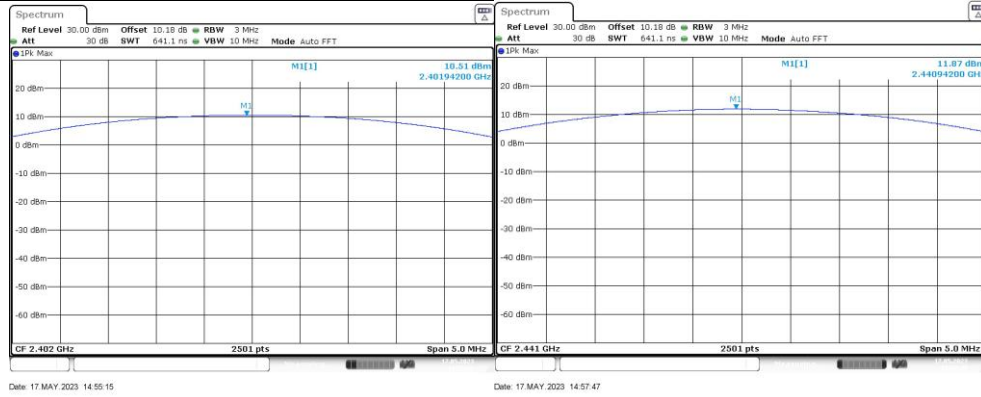
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# Enhanced Data Rate (3DH5) Data Collection:

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	10.51	1	21	9.49	Pass
Middle	2441	3-DH5	11.87	1	21	8.13	Pass
High	2480	3-DH5	10.43	1	21	9.57	Pass



## Equipment Used:

TN	Description	Model	S/N	Manufacturer	Most Recent Calibration	Calibration Due Date
2409	Signal and Spectrum Analyzer	FSV40	101413	Rohde & Schwarz	22-Mar-2023	21-Mar-2024

# Conducted Spurious Emissions

<b>Project number (Integrity):</b>	408R	<b>Build Phase:</b>	C1.5		
<b>Tested by:</b>	Mike Royer	<b>Date:</b>	May 23, 2023		
<b>Requirements Standard(s):</b>	FCC §15.247 (d) RSS-247 5.5	<b>Referenced Standard(s):</b>	ANSI 63.10 7.8.8		
<b>EUT powered with:</b>	5V USB	<b>Temp / Humidity:</b>	n/a	<b>Test location:</b>	Braun Room
<b>Test equipment used TN's:</b>	2409				
<b>EUT Serial number(s):</b>	084808M3051E012A1				
<b>EUT Software installed:</b>	1.4.10+g2edc594				
<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 408R passes Conducted Spurious Emissions by more than 10dB.

## Limits

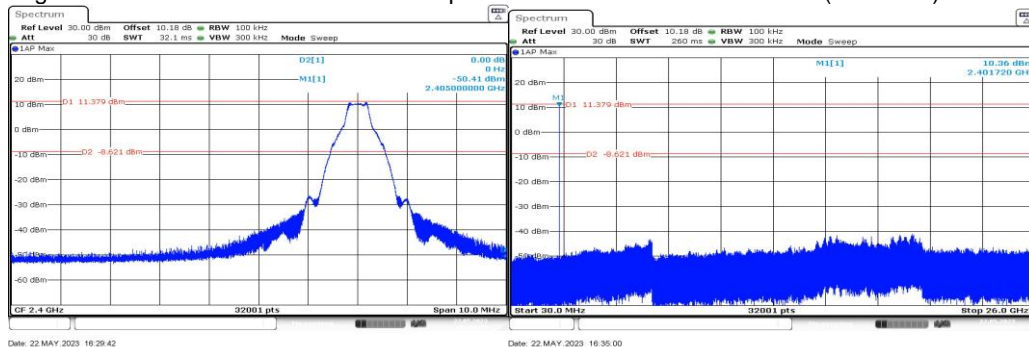
FCC §15.247 (d), RSS-247 5.5

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

## Data Collection:

DH5 low channel band-edge. More than 20 dB down at center freq.

Out of band low channel (2402MHz)





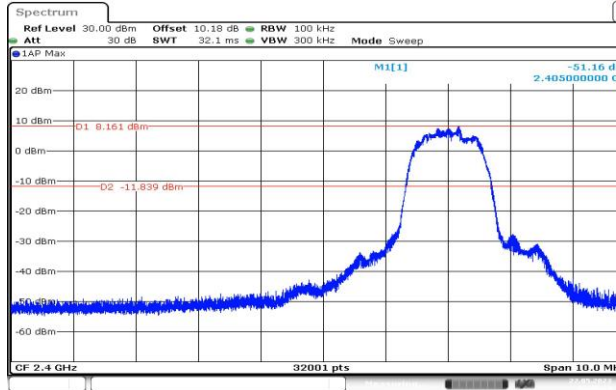
# PRODUCT ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



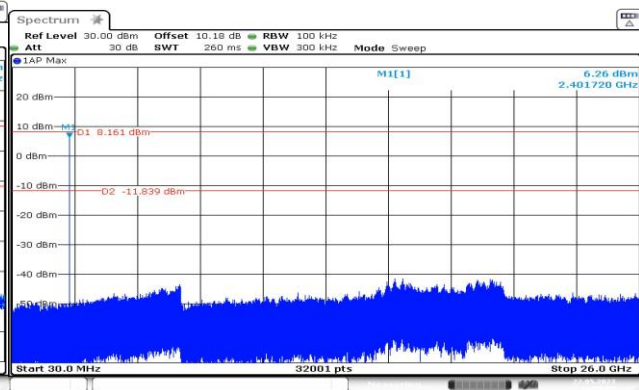
Certificate # 1514.1

3DH5 low channel band-edge

Out of band low channel (2402MHz)



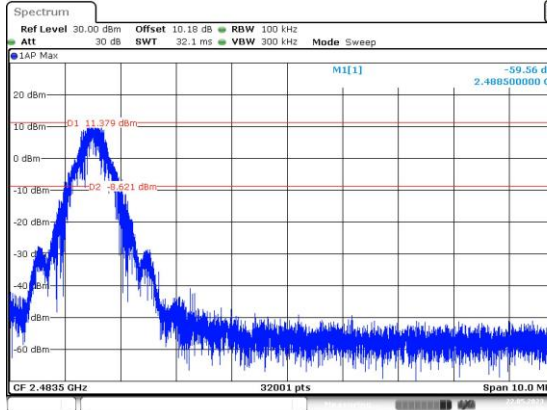
Date: 22 MAY 2023 16:55:30



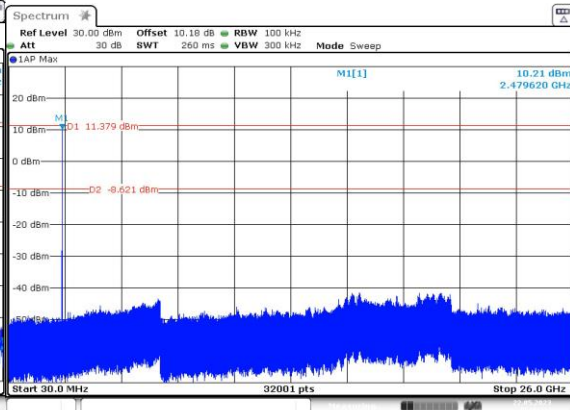
Date: 22 MAY 2023 16:57:06

DH5 high channel band-edge

Out of band high channel (2480MHz)



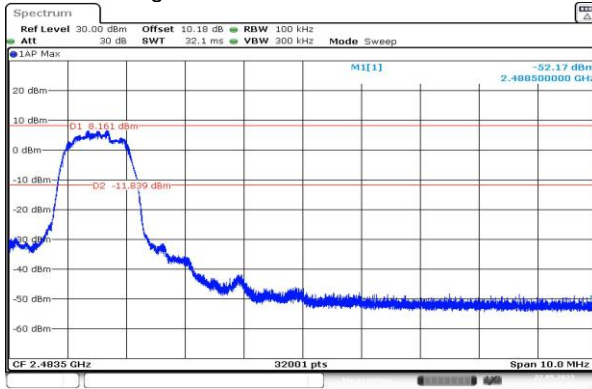
Date: 22 MAY 2023 16:41:36



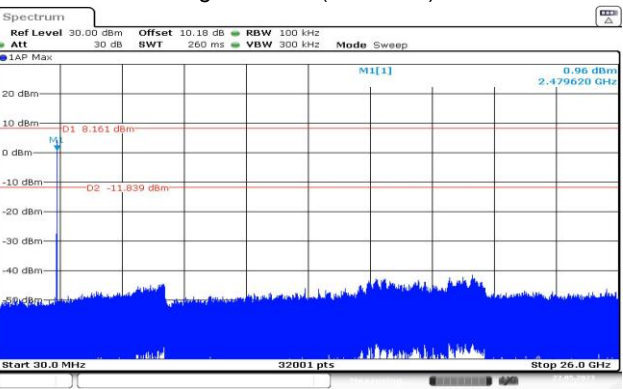
Date: 22 MAY 2023 16:43:06

3DH5 high channel band-edge

Out of band high channel (2480MHz)



Date: 22 MAY 2023 16:59:44



Date: 22 MAY 2023 17:02:22





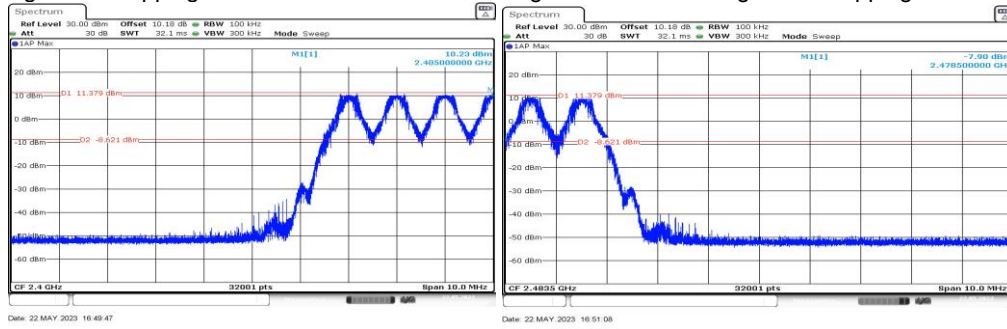
**PRODUCT ASSURANCE ENGINEERING  
COMPLIANCE  
EMC TEST REPORT**



Certificate # 1514.1

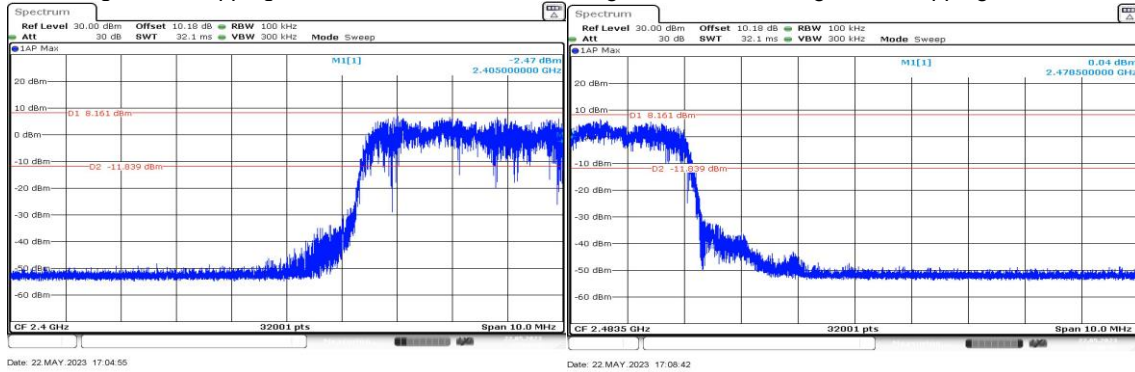
DH5 low channel band-edge while hopping

DH5 high channel band-edge while hopping



3DH5 low channel band-edge while hopping

3DH5 high channel band-edge while hopping



## 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-2023	22-Mar-2024

# RF Radiated Emissions 30MHz -1GHz

## Test Information:

## Objective/Summary/Conclusion:

EUT meets

<b>Project number (Integrity):</b>		<b>Build Phase:</b>	Pre-C1		
<b>Tested by:</b>	M. Mehrmann		<b>Date:</b>	8+9 February 2023	
<b>Requirements Standard(s):</b>	FCC §15.247 (d) and RSS-247 section 5.5		<b>Referenced Standard(s):</b>	ANSI C63.10 6.5 6.3 – 6.6 6.10.5 RBE 4.1.4.2.3 Reduced video BW method for average.	
<b>EUT powered with:</b>		<b>Temp / Humidity:</b>		<b>Test location:</b>	Maxwell House
<b>Test equipment used TN's:</b>	644,2319,1541,2077,1277-22				
<b>EUT Serial number(s):</b>	Left: 084803M3003B005A Right: 084803M3003B004A				
<b>EUT Software installed:</b>	0.0.19 diag code				
<b>EUT Modification(s):</b>	None				

Passes FCC 15.247 and RSS-247 Section 5.5 requirements with a worst-case passing margin of 16.0 dB at 700 MHz.

## Additional EUT Information:

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

The device was scanned in three orthogonal axis and no signals were detected.

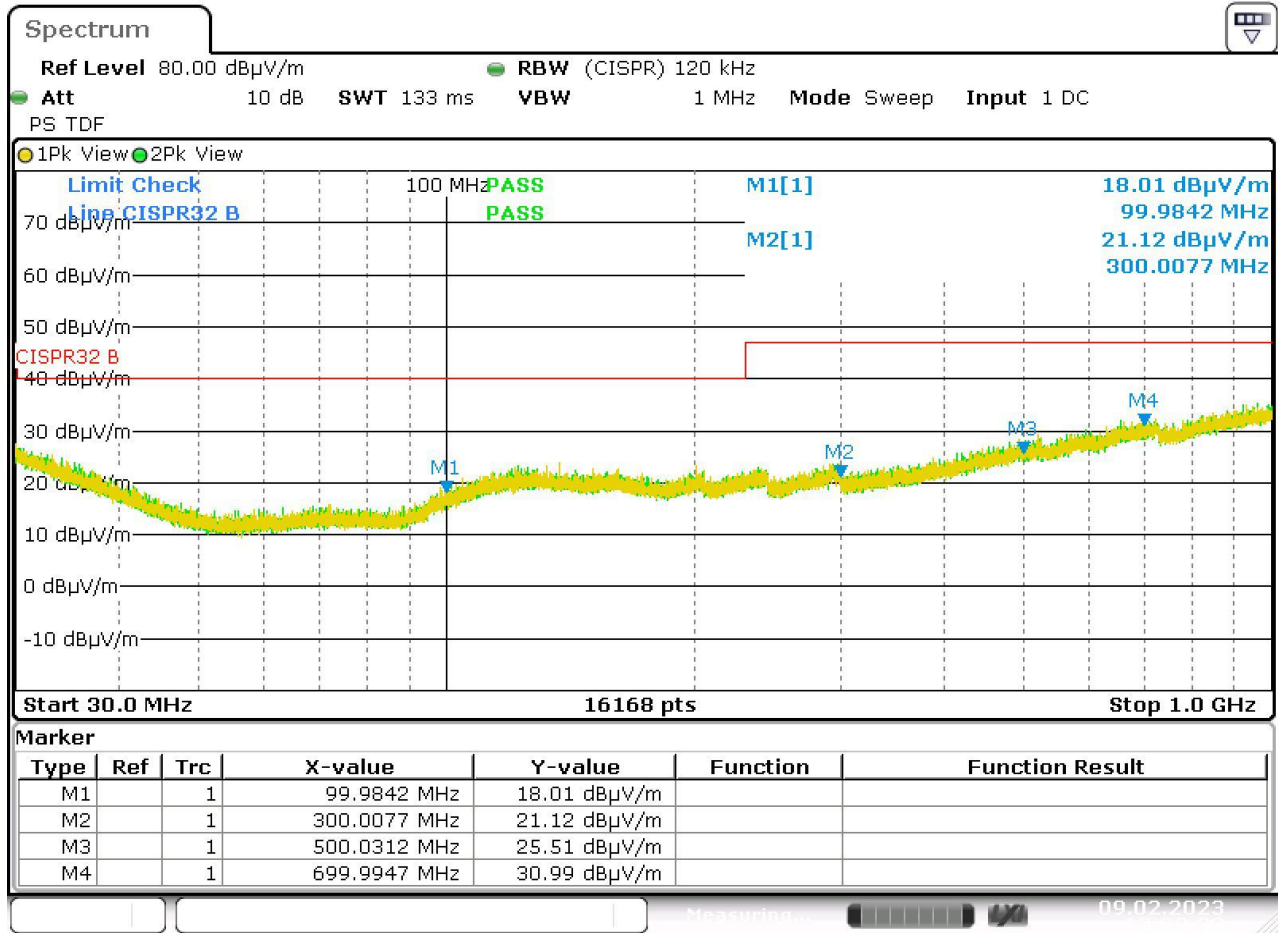
## Test Setup Details:

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

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

# Data Collection:

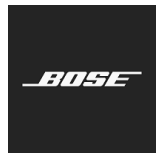
<b>EUT S/N:</b>	Right Bud	<b>Power applied:</b>		<b>Plot#</b>	1
<b>EUT Mods:</b>					
<b>EUT Setup:</b>					
<b>Comments:</b>	Position X				



Date: 9.FEB.2023 13:00:32

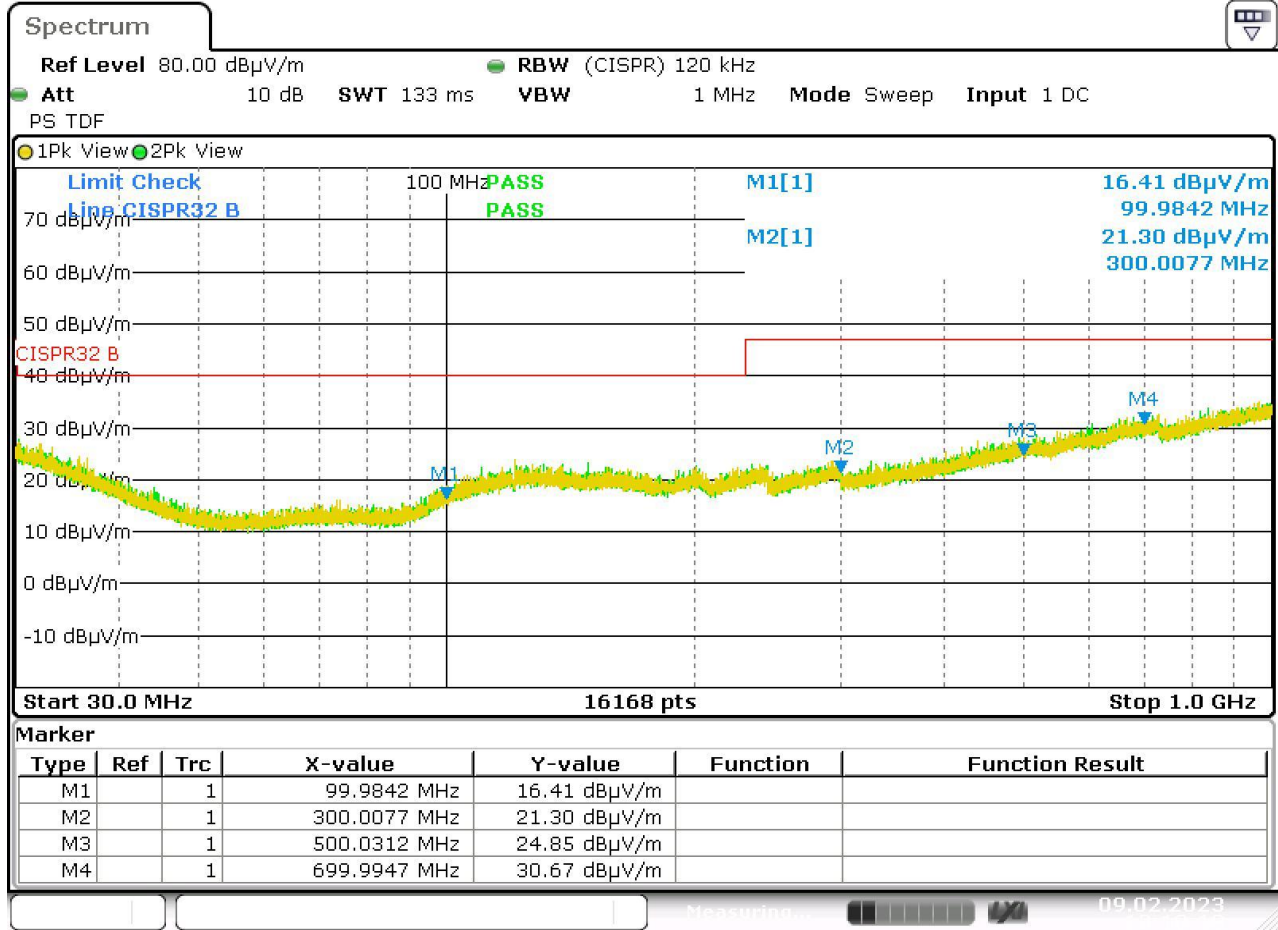


# DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



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<b>EUT S/N:</b>	Right bud	<b>Power applied:</b>		<b>Plot#</b>	2
<b>EUT Mods:</b>					
<b>EUT Setup:</b>					
<b>Comments:</b>	Position Y				



Date: 9.FEB.2023 13:10:18

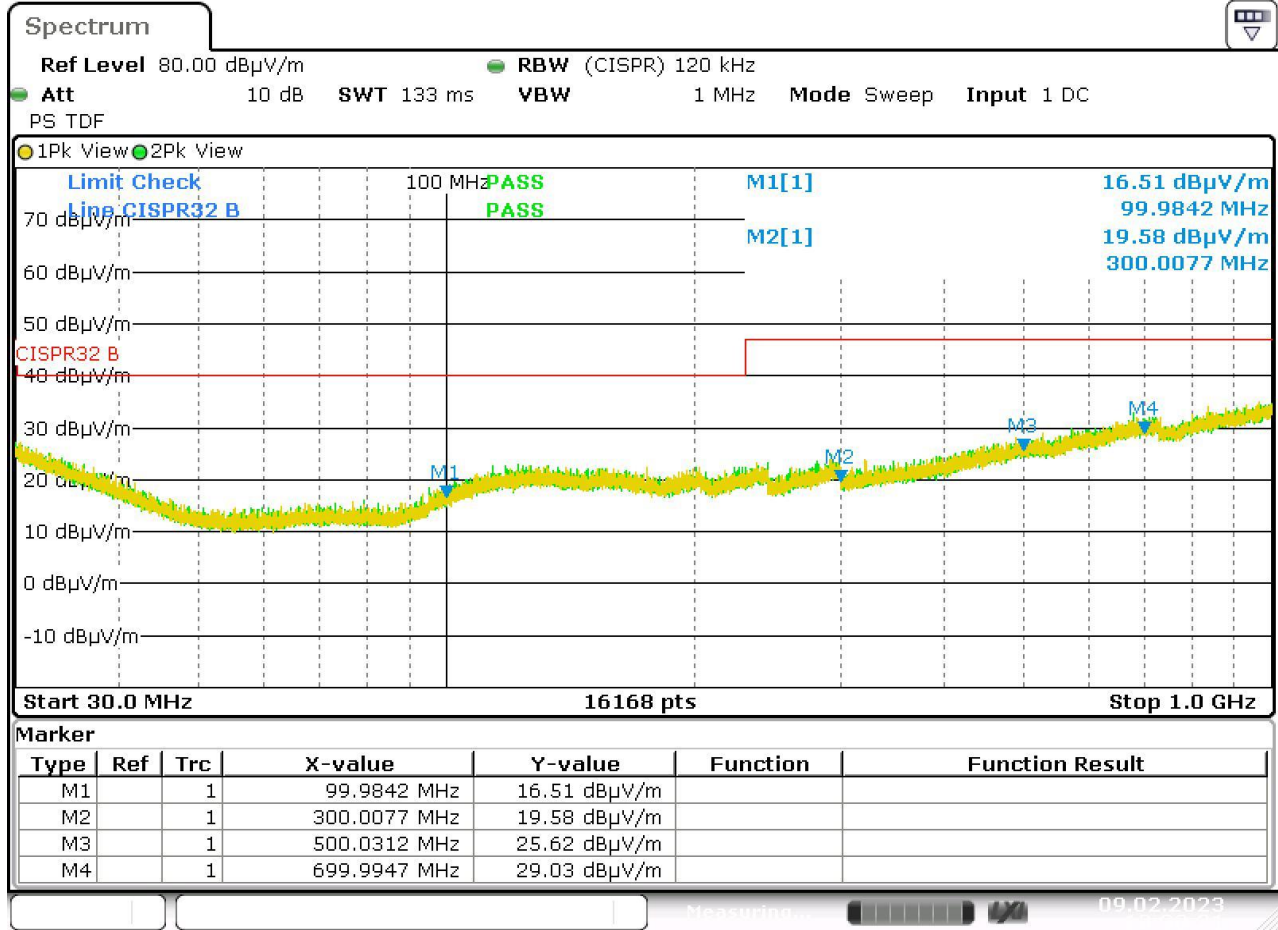


# DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



Certificate # 1514.1

<b>EUT S/N:</b>	Right bud	<b>Power applied:</b>		<b>Plot#</b>	3
<b>EUT Mods:</b>					
<b>EUT Setup:</b>					
<b>Comments:</b>	Position Z				



Date: 9.FEB.2023 13:20:21



Certificate # 1514.1

# DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



## Limits:

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

## Equipment Used:

TN	Description	Model	S/N	Manufacturer	Most Recent Calibration	Calibration Due Date	Most Recent Verification	Verification Due Date
1541	Antenna 30MHz - 6GHz	JB6	A050807	Sunol Sciences Corp	14-Dec-2021	14-Dec-2023		
3062	RF Cable 10MHz-18GHz, low loss LL142 coax, 26 feet, "N" connectors	SCE18110505-312	N/A	Fairview Microwave[2]			01-Sep-2022	01-Sep-2023
2077	Maxwell House RE Pre-amp (20MHz-3GHz)	N/A	N/A	Bose Corporation			01-Sep-2022	01-Sep-2023
2319	EMI Test Receiver	ESR26	101276	Rohde & Schwarz	29-Mar-2023	28-Mar-2024		



# 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
Preamplifier 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>	408R	<b>Build Phase:</b>	C1.5		
<b>Tested by:</b>	Mike Royer	<b>Date:</b>	June 5 and June 13, 2023		
<b>Requirements Standard(s):</b>	FCC §15.247 (d) RSS-247 Section 5.5	<b>Referenced Standard(s):</b>	ANSI C63.10-2013 6.6		
<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>	1663,3685,2349,2602,2414				
<b>EUT Serial number(s):</b>	084803M3051D038A1				
<b>EUT Software installed:</b>	0.4.10				
<b>EUT Modification(s):</b>	USB Debug wires were attached to the earbud to allow control of the radio.				

## Conclusion:

The Bose model 408R passes radiated emissions from 1-25GHz.

The peak emissions maximum is below the average limit in all cases.

1-18 GHz, the maximum emission was 53.3 dBuV/m peak, noise floor. The average limit is 54 dBuV/m and the margin is 0.7 dB.  
18-25 GHz. The maximum emission was 60.5 dBuV peak. The average limit is 74 dBuV/m, and the margin is 13.5 dB.

## Procedure:

Per 558074 D01 15.247 Meas Guidance v05r02:

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

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 notch filter was used to block the fundamental emission from overloading the measurement equipment including the pre-amplifier and the spectrum analyzer.

The signal duty cycle was set to 100%





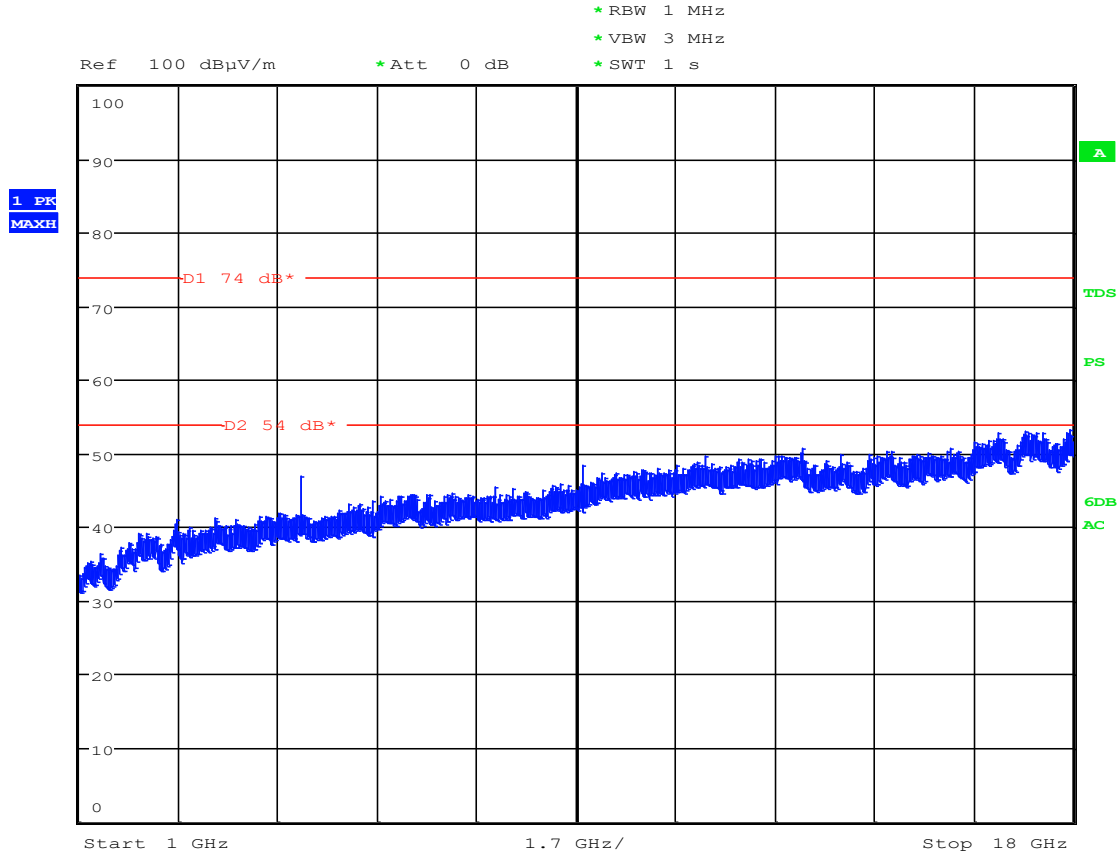
Certificate # 1514.1

# DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



## Data Collection:

<b>EUT S/N:</b>	Right	<b>Power applied:</b>	Battery		<b>Plot#</b>	7
<b>EUT Mods:</b>						
<b>EUT Setup:</b>	DH5 Low channel					
<b>Comments:</b>	1-18 GHz measured at 3m distance. 18-25 GHz measured at 30cm distance.					

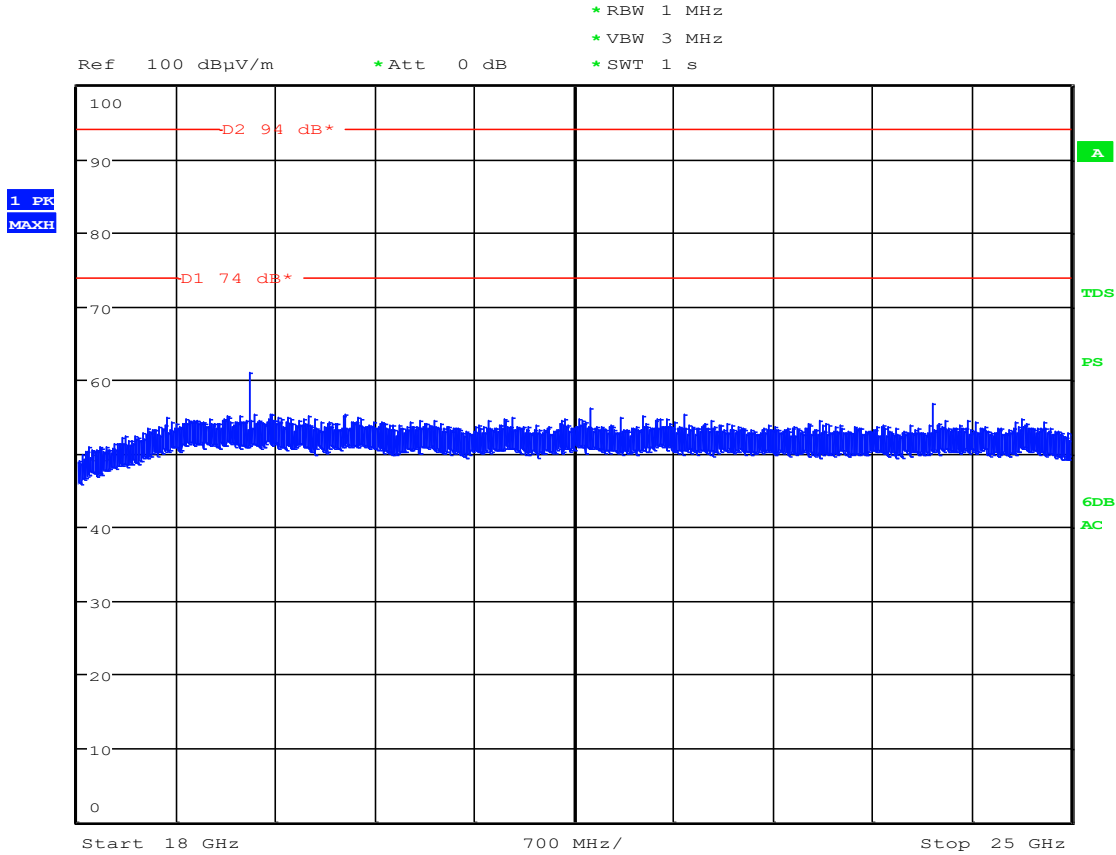


Date: 6.JUN.2023 12:42:07



Certificate # 1514.1

# DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



Date: 14.JUN.2023 16:23:15

**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.



Certificate # 1514.1

# DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



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

MK #	Emission Frequency (MHz)	Measured Amplitude (dBµV/m) QP/AVG*	Measured Amplitude (dBµV/m) Peak	FCC 15.247d and RSS-247 Section 5.5				Table Azimuth (0°closest to ant)	Receiving Antenna		*Average detector used for frequencies above 1 GHz. Notes/Mode
				Limit (dBµV/m) QP/AVG*	Limit (dBµV/m) Peak	Margin (dB) QP/AVG	Margin (dB) Peak		Pol (H/V)	Height (Meters)	
1	4804	40.40	48.30	54.0	74.0	13.6	25.7	0	V	1.60	Signal Maximized
2	7206	31.40	45.40	54.0	74.0	22.6	28.6	0	H	1.50	Noise floor
3	9608	38.80	51.00	54.0	74.0	15.2	23.0	0	H	1.50	Signal Maximized
4	12010	35.00	49.20	54.0	74.0	19.0	24.8	0	V	1.50	Noise floor
5	12010	35.10	49.20	54.0	74.0	18.9	24.8	0	H	1.50	Noise floor
6	16814	38.30	51.30	54.0	74.0	15.7	22.7	0	V	1.50	Noise floor

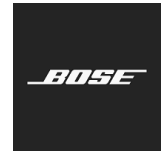
FCC 15.247d and RSS-247 Section 5.5 @ 30 cm

MK #	Emission Frequency (MHz)	Measured Amplitude (dBµV/m) QP/AVG*	Measured Amplitude (dBµV/m) Peak	FCC 15.247d and RSS-247 Section 5.5				Table Azimuth (0°closest to ant)	Receiving Antenna		*Average detector used for frequencies above 1 GHz. Notes/Mode
				Limit (dBµV/m) QP/AVG*	Limit (dBµV/m) Peak	Margin (dB) QP/AVG	Margin (dB) Peak		Pol (H/V)	Height (Meters)	
1	19215	54.40	60.50	74.0	94.0	19.6	33.5				Signal Maximized
2	21617	47.10	56.80	74.0	94.0	26.9	37.2				Noise floor
3	24018	51.70	58.70	74.0	94.0	22.3	35.3				Signal Maximized



Certificate # 1514.1

# DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



<b>EUT S/N:</b>	Right	<b>Power applied:</b>	Battery	<b>Plot#</b>	8
<b>EUT Mods:</b>					
<b>EUT Setup:</b>	DH5 Mid channel				
<b>Comments:</b>					

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

MK #	Emission Frequency (MHz)	Measured Amplitude (dBµV/m) QP/AVG*	Measured Amplitude (dBµV/m) Peak	FCC 15.247d and RSS-247 Section 5.5				Table Azimuth (0°closest to ant)	Receiving Antenna		*Average detector used for frequencies above 1 GHz. Notes/Mode
				Limit (dBµV/m) QP/AVG*	Limit (dBµV/m) Peak	Margin (dB) QP/AVG	Margin (dB) Peak		Pol (H/V)	Height (Meters)	
1	4882	40.60	48.00	54.0	74.0	13.4	26.0	0	V	1.50	Signal Maximized
2	7323	31.80	45.60	54.0	74.0	22.2	28.4	0	H	1.50	Noise floor
3	9764	37.80	51.30	54.0	74.0	16.2	22.7	0	H	1.50	Signal Maximized
4	12205	36.10	49.60	54.0	74.0	17.9	24.4	0	V	1.50	Noise floor
5	14646	36.30	49.70	54.0	74.0	17.7	24.3	0	H	1.50	Noise floor
6	17087	38.70	52.20	54.0	74.0	15.3	21.8	0	V	1.50	Noise floor

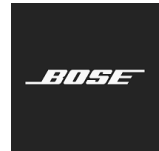
### FCC 15.247d and RSS-247 Section 5.5 @ 30 cm

MK #	Emission Frequency (MHz)	Measured Amplitude (dBµV/m) QP/AVG*	Measured Amplitude (dBµV/m) Peak	FCC 15.247d and RSS-247 Section 5.5				Table Azimuth (0°closest to ant)	Receiving Antenna		*Average detector used for frequencies above 1 GHz. Notes/Mode
				Limit (dBµV/m) QP/AVG*	Limit (dBµV/m) Peak	Margin (dB) QP/AVG	Margin (dB) Peak		Pol (H/V)	Height (Meters)	
1	19527	50.20	57.70	74.0	94.0	23.8	36.3				Signal Maximized
2	21969	40.80	54.20	74.0	94.0	33.2	39.8				Noise floor
3	24408	49.70	57.90	74.0	94.0	24.3	36.1				Signal Maximized



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# DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



<b>EUT S/N:</b>	Right	<b>Power applied:</b>	Battery		<b>Plot#</b>	9
<b>EUT Mods:</b>						
<b>EUT Setup:</b>	DH5 High channel					
<b>Comments:</b>						

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

MK #	Emission Frequency (MHz)	Measured Amplitude (dBµV/m) QP/AVG*	Measured Amplitude (dBµV/m) Peak	FCC 15.247d and RSS-247 Section 5.5				Table Azimuth (0°closest to ant)	Receiving Antenna		*Average detector used for frequencies above 1 GHz. Notes/Mode
				Limit (dBµV/m) QP/AVG*	Limit (dBµV/m) Peak	Margin (dB) QP/AVG	Margin (dB) Peak		Pol (H/V)	Height (Meters)	
1	4960	37.10	45.80	54.0	74.0	16.9	28.2	0	V	1.60	Signal Maximized
2	7440	32.20	45.80	54.0	74.0	21.8	28.2	0	H	1.50	Noise floor
3	9920	40.50	52.30	54.0	74.0	13.5	21.7	0	V	1.50	Signal Maximized
4	12400	34.80	48.50	54.0	74.0	19.2	25.5	0	H	1.50	Noise floor
5	14879	40.10	52.30	54.0	74.0	13.9	21.7	360	H	1.50	Signal Maximized
6	17360	39.20	53.30	54.0	74.0	14.8	20.7	360	V	1.50	Noise floor

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

MK #	Emission Frequency (MHz)	Measured Amplitude (dBµV/m) QP/AVG*	Measured Amplitude (dBµV/m) Peak	FCC 15.247d and RSS-247 Section 5.5				Table Azimuth (0°closest to ant)	Receiving Antenna		*Average detector used for frequencies above 1 GHz. Notes/Mode
				Limit (dBµV/m) QP/AVG*	Limit (dBµV/m) Peak	Margin (dB) QP/AVG	Margin (dB) Peak		Pol (H/V)	Height (Meters)	
1	19839	54.90	60.10	74.0	94.0	19.1	33.9				Signal Maximized
2	22320	40.80	54.00	74.0	94.0	33.2	40.0				Noise floor
3	24798	53.90	59.50	74.0	94.0	20.1	34.5				Signal Maximized



Certificate # 1514.1

# DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



<b>EUT S/N:</b>	Right	<b>Power applied:</b>	Battery		<b>Plot#</b>	10
<b>EUT Mods:</b>						
<b>EUT Setup:</b>	3-DH5 Low channel					
<b>Comments:</b>						

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

MK #	Emission Frequency (MHz)	Measured Amplitude (dBµV/m) QP/AVG*	Measured Amplitude (dBµV/m) Peak	FCC 15.247d and RSS-247 Section 5.5				Table Azimuth (0°closest to ant)	Receiving Antenna		*Average detector used for frequencies above 1 GHz. Notes/Mode
				Limit (dBµV/m) QP/AVG*	Limit (dBµV/m) Peak	Margin (dB) QP/AVG	Margin (dB) Peak		Pol (H/V)	Height (Meters)	
1	4804	39.00	47.10	54.0	74.0	15.0	26.9	360	V	1.50	Signal Maximized
2	7206	32.00	45.80	54.0	74.0	22.0	28.2	360	H	1.50	Noise floor
3	9608	44.70	51.10	54.0	74.0	9.3	22.9	360	H	1.50	Signal Maximized
4	12010	37.40	49.40	54.0	74.0	16.6	24.6	360	V	1.50	Noise floor
5	14412	35.20	48.70	54.0	74.0	18.8	25.3	360	V	1.50	Noise floor
6	16814	38.40	51.90	54.0	74.0	15.6	22.1	360	H	1.50	Noise floor

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

MK #	Emission Frequency (MHz)	Measured Amplitude (dBµV/m) QP/AVG*	Measured Amplitude (dBµV/m) Peak	FCC 15.247d and RSS-247 Section 5.5				Table Azimuth (0°closest to ant)	Receiving Antenna		*Average detector used for frequencies above 1 GHz. Notes/Mode
				Limit (dBµV/m) QP/AVG*	Limit (dBµV/m) Peak	Margin (dB) QP/AVG	Margin (dB) Peak		Pol (H/V)	Height (Meters)	
1	19216	52.50	59.40	74.0	94.0	21.5	34.6				Signal Maximized
2	21618	42.80	54.80	74.0	94.0	31.2	39.2				Noise floor
3	24020	53.50	59.50	74.0	94.0	20.5	34.5				Signal Maximized



Certificate # 1514.1

# DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



<b>EUT S/N:</b>	Right	<b>Power applied:</b>	Battery		<b>Plot#</b>	11
<b>EUT Mods:</b>						
<b>EUT Setup:</b>	3-DH5 Mid channel					
<b>Comments:</b>						

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

MK #	Emission Frequency (MHz)	Measured Amplitude (dBµV/m) QP/AVG*	Measured Amplitude (dBµV/m) Peak	FCC 15.247d and RSS-247 Section 5.5				Table Azimuth (0°closest to ant)	Receiving Antenna		*Average detector used for frequencies above 1 GHz. Notes/Mode
				Limit (dBµV/m) QP/AVG*	Limit (dBµV/m) Peak	Margin (dB) QP/AVG	Margin (dB) Peak		Pol (H/V)	Height (Meters)	
1	4882	39.60	47.20	54.0	74.0	14.4	26.8	360	V	1.50	Signal Maximized
2	7323	31.90	45.50	54.0	74.0	22.1	28.5	360	H	1.50	Noise floor
3	9764	45.00	51.90	54.0	74.0	9.0	22.1	360	H	1.50	Signal Maximized
4	12205	36.00	49.60	54.0	74.0	18.0	24.4	360	H	1.50	Noise floor
5	14646	38.30	50.70	54.0	74.0	15.7	23.3	360	H	1.50	Signal Maximized
6	17087	38.80	53.30	54.0	74.0	15.2	20.7	360	V	1.50	Noise floor

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

MK #	Emission Frequency (MHz)	Measured Amplitude (dBµV/m) QP/AVG*	Measured Amplitude (dBµV/m) Peak	FCC 15.247d and RSS-247 Section 5.5				Table Azimuth (0°closest to ant)	Receiving Antenna		*Average detector used for frequencies above 1 GHz. Notes/Mode
				Limit (dBµV/m) QP/AVG*	Limit (dBµV/m) Peak	Margin (dB) QP/AVG	Margin (dB) Peak		Pol (H/V)	Height (Meters)	
1	19528	50.10	58.30	74.0	94.0	23.9	35.7				Signal Maximized
2	21969	41.90	54.50	74.0	94.0	32.1	39.5				Noise floor
3	24410	53.80	59.80	74.0	94.0	20.2	34.2				Signal Maximized



Certificate # 1514.1

# DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



<b>EUT S/N:</b>	Right	<b>Power applied:</b>	Battery		<b>Plot#</b>	12
<b>EUT Mods:</b>						
<b>EUT Setup:</b>	3-DH5 High channel					
<b>Comments:</b>						

FCC 15.247d and RSS-247 Section 5.5 @ 3 Meters											
MK #	Emission Frequency (MHz)	Measured Amplitude (dBµV/m) QP/AVG*	Measured Amplitude (dBµV/m) Peak	FCC 15.247d and RSS-247 Section 5.5				Table Azimuth (0°closest to ant)	Receiving Antenna		*Average detector used for frequencies above 1 GHz. Notes/Mode
				Limit (dBµV/m) QP/AVG*	Limit (dBµV/m) Peak	Margin (dB) QP/AVG	Margin (dB) Peak		Pol (H/V)	Height (Meters)	
1	4960	38.10	45.70	54.0	74.0	15.9	28.3	0	V	1.50	Signal Maximized
2	7440	32.30	45.60	54.0	74.0	21.7	28.4	0	H	1.50	Noise floor
3	9920	46.70	52.80	54.0	74.0	7.3	21.2	0	V	1.50	Signal Maximized
4	12400	35.60	49.20	54.0	74.0	18.4	24.8	0	V	1.50	Noise floor
5	14880	41.70	52.00	54.0	74.0	12.3	22.0	0	V	1.50	Signal Maximized
6	17360	39.20	52.60	54.0	74.0	14.8	21.4	0	H	1.50	Noise floor

FCC 15.247d and RSS-247 Section 5.5 @ 30 cm											
MK #	Emission Frequency (MHz)	Measured Amplitude (dBµV/m) QP/AVG*	Measured Amplitude (dBµV/m) Peak	FCC 15.247d and RSS-247 Section 5.5				Table Azimuth (0°closest to ant)	Receiving Antenna		*Average detector used for frequencies above 1 GHz. Notes/Mode
				Limit (dBµV/m) QP/AVG*	Limit (dBµV/m) Peak	Margin (dB) QP/AVG	Margin (dB) Peak		Pol (H/V)	Height (Meters)	
1	19840	55.30	60.50	74.0	94.0	18.7	33.5				Signal Maximized
2	22320	40.90	54.10	74.0	94.0	33.1	39.9				Noise floor
3	24800	55.40	60.20	74.0	94.0	18.6	33.8				Signal Maximized





Certificate # 1514.1

# DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



<b>EUT S/N:</b>	Left	<b>Power applied:</b>	Battery	<b>Plot#</b>	6
<b>EUT Mods:</b>					
<b>EUT Setup:</b>	3-DH5 High channel				
<b>Comments:</b>					

FCC 15.247d and RSS-247 Section 5.5 @ 3 Meters											
MK #	Emission Frequency (MHz)	Measured Amplitude (dBµV/m) QP/AVG*	Measured Amplitude (dBµV/m) Peak	FCC 15.247d and RSS-247 Section 5.5				Table Azimuth (0°closest to ant)	Receiving Antenna		*Average detector used for frequencies above 1 GHz. Notes/Mode
				Limit (dBµV/m) QP/AVG*	Limit (dBµV/m) Peak	Margin (dB) QP/AVG	Margin (dB) Peak		Pol (H/V)	Height (Meters)	
1	4960	39.10	46.30	54.0	74.0	14.9	27.7	0	V	1.60	Signal Maximized
2	7440	34.20	46.20	54.0	74.0	19.8	27.8	0	H	1.50	Noise floor
3	9920	44.20	51.80	54.0	74.0	9.8	22.2	0	H	1.50	Signal Maximized
4	12400	36.50	48.80	54.0	74.0	17.5	25.2	0	V	1.50	Noise floor
5	14880	36.90	50.30	54.0	74.0	17.1	23.7	0	H	1.50	Noise floor
6	17360	39.00	52.70	54.0	74.0	15.0	21.3	0	V	1.50	Noise floor

FCC 15.247d and RSS-247 Section 5.5 @ 30 cm											
MK #	Emission Frequency (MHz)	Measured Amplitude (dBµV/m) QP/AVG*	Measured Amplitude (dBµV/m) Peak	FCC 15.247d and RSS-247 Section 5.5				Table Azimuth (0°closest to ant)	Receiving Antenna		*Average detector used for frequencies above 1 GHz. Notes/Mode
				Limit (dBµV/m) QP/AVG*	Limit (dBµV/m) Peak	Margin (dB) QP/AVG	Margin (dB) Peak		Pol (H/V)	Height (Meters)	
1	19840	50.20	58.00	74.0	94.0	23.8	36.0				Signal Maximized
2	22320	41.10	54.00	74.0	94.0	32.9	40.0				Noise floor
3	24800	46.00	56.90	74.0	94.0	28.0	37.1				Signal Maximized

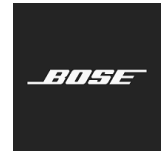
## Limits:

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



Certificate # 1514.1

**DESIGN ASSURANCE ENGINEERING  
COMPLIANCE  
EMC TEST REPORT**



## Equipment Used:

TN	Description	Model	S/N	Manufacturer	Most Recent Calibration	Calibration Due Date	Most Recent Verification	Verification Due Date
1663	EMI Test Receiver	ESU40	100098	Rohde & Schwarz	20-Mar-2023	19-Mar-2024		
3685	Marconi Manor 3M mast position RE cable set	3 cables (TN's 2373, 2479, 2357)					28-Mar-2023	27-Mar-2024
2349	Double Ridge Waveguide Horn Antenna 1-18GHz	3117	00152406	ETS Lindgren	24-Feb-2023	23-Feb-2025		
2602	Miteq pre-amp 1-18GHz 35dB	AFS42-01001800-28-10P-42	N/A	Miteq			07-Jul-2022	07-Jul-2023
2414	Band Reject Filter (2.4GHz)	BRM50702-07	003	Micro-Tronics	13-Jan-2015		28-Mar-2023	27-Mar-2024
1757	18GHz-40GHz Preamp	JS4018004000-30-8P-A1	1406279	Miteq			07-Jul-2022	07-Jul-2023
1596	Horn Antenna 18GHz - 26.5GHz	AT4640	309234	Amplifier Research				
2368	RF Cable 30MHz-26.5GHz	TRU-210	TRU-12767-35	TRU Corporation			28-Mar-2023	27-Mar-2024

## Uncertainty:

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



# Radiated Band Edge

<b>Project number (Integrity):</b>	408R	<b>Build Phase:</b>	C1.5		
<b>Tested by:</b>	Mike Royer	<b>Date:</b>	24 May 2023		
<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>	Battery	<b>Temp / Humidity:</b>	N/A	<b>Test location:</b>	Marconi Manor
<b>Test equipment used TN's:</b>	1663,2929,2349,3685				
<b>EUT Serial number(s):</b>	084803M3051D038A1				
<b>EUT Software installed:</b>	1.4.10+g2edc594				
<b>EUT Modification(s):</b>	USB Debug wires were attached to the earbud to allow control of the radio.				

## Conclusion:

The Bose model 408R passes Radiated Band Edge.

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

## Procedure:

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.

All measurements were taken in peak mode and were below the average limits. Pass.

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.

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

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



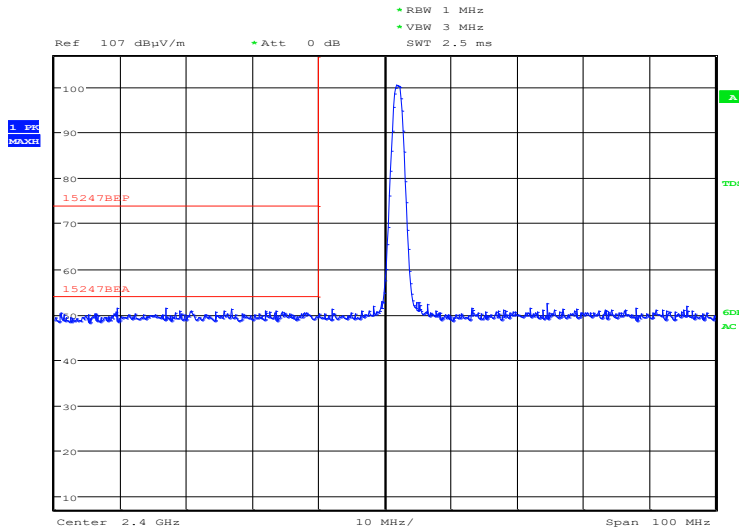
Certificate # 1514.1

# DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT



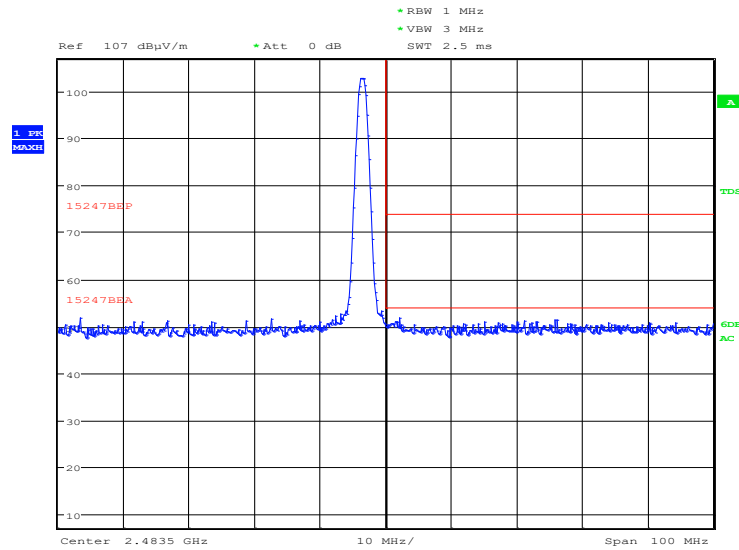
## Data Collection:

### DH5 low channel band edge



Date: 24.MAY.2023 18:00:28

### DH5 high channel band edge



Date: 24.MAY.2023 18:14:41

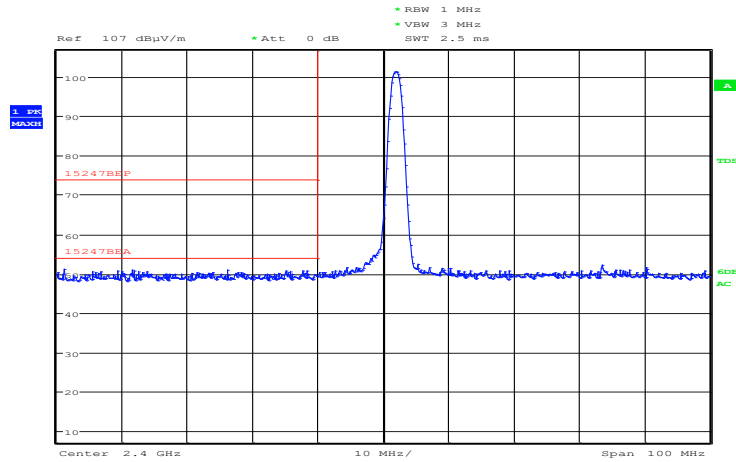


Certificate # 1514.1

# DESIGN ASSURANCE ENGINEERING COMPLIANCE EMC TEST REPORT

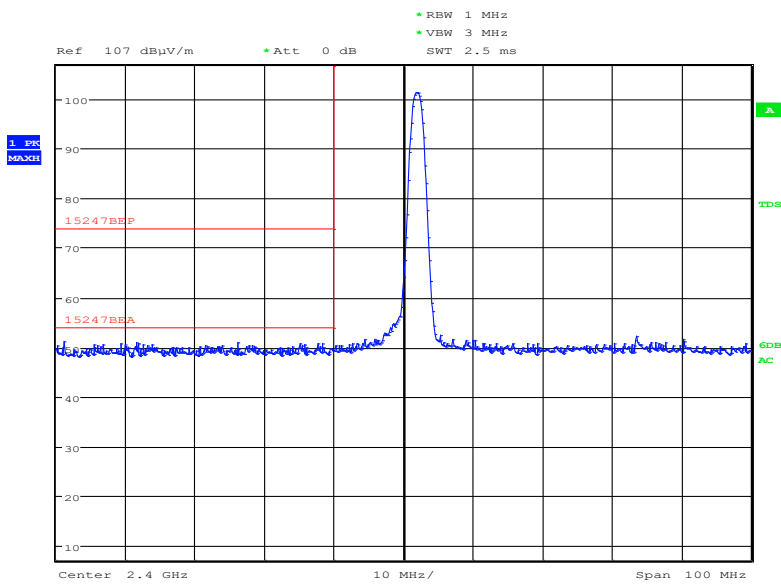


## 3-DH5 low channel band edge



Date: 24.MAY.2023 18:06:27

## 3 DH5 high channel band edge



Date: 24.MAY.2023 18:06:27

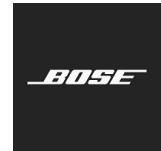


## Limits:

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

## Equipment Used:

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1663	EMI Test Receiver	ESU40	100098	Rohde & Schwarz	20-Mar-2023	19-Mar-2024		
2929	Mini-circuits band-edge pre-amp 300 MHz - 8 GHz 20 dB	ZX60HV-83LN+	N/A	Mini-Circuits			28-Mar-2023	27-Mar-2024
2349	Double Ridge Waveguide Horn Antenna 1-18GHz	3117	00152406	ETS Lindgren	24-Feb-2023	23-Feb-2025		
3685	Marconi Manor 3M mast position RE cable set	3 cables (TN's 2373, 2479, 2357)					28-Mar-2023	27-Mar-2024



## Uncertainty:

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Title:	Radiated Emissions (>1GHz)			
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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>

## End of report