Wireless	DESIGN ASSURANCE ENGINEERING s Transceiver Bluetooth I ow Energy Test Report
ACCREDITED	
Certificate # 1514.1	-CC ID: A94424611 IC: 3232A-424611
Test Type:	Emissions [X] Immunity []
Product Type:	Wireless Earbuds
Product Name/Number:	Model Number: 424611
Prepared For:	<i>FCC ID: A94424611 IC: 3232A-424611 Design Assurance Engineering Department, Bose Corporation</i>
Test Results:	Pass [ <b>X</b> ] Fail []
Applicable Standards:	FCC CFR 47 PART 15 SUBPART C Industry Canada RSS-247 Issue 2
Report Number:	Industry Canada RSS-GEN Issue 4 EMC. 424611.17. 299.4

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:	Chad Bell	Chad Bell	December 1, 2017
Electrical Engineer Review* By:	Brent Dewitt	But At	December 1, 2017

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

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FCC ID: A94424611 IC: 3232A-424611

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FCC ID: A94424611 IC: 3232A-424611

### **Test Report Summary**

Product Information:

#### Description

The EUT is a wireless earbud that contains BLE transceivers, manufactured by ST Microelectronics, BLUENRG-MSCSP.

Setup (Cables and Accessories)

Radiated emissions was performed with the EUT playing audio while the earbuds are paired to the companion app and while charging the earbuds and the battery in the charging cradle. Conducted emissions was performed while charging the earbuds and the battery in the charging cradle. EUT is sold with Bose part number 776716-0010 power supply which was used for charging during testing. For radio tests, the BLE radio was configured using LightBlue® Explorer by Punch Through.

#### EUT Antenna Description

The antenna is a Laser Direct Structuring (LDS) antenna with 1.316 dBi antenna gain.

#### SOFTWARE AND FIRMWARE

The firmware installed in the charge case during testing was version T0.08.31 and the earbud firmware was version 1.3.1-43-g7b90185.

#### Scope:

This report covers EMC requirements. FCC CFR 47 PART 15 SUBPART C, Industry Canada RSS-247 Issue 2, and Industry Canada RSS-GEN Issue 4

#### 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 selected in section 2 of this report. **[]** does not meet all test standards selected in section 2 of this report.

#### Affirmation of Test Results:

	Print Name	Signature	Date
Testing Engineer/Technician	Chad Bell	Chad Bell	November 8, 2017

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FCC ID: A94424611 IC: 3232A-424611

### Test Standards

#### Emissions:

	Standard
[X]	FCC Part 15C
[X]	Canada RSS-247
[X]	Canada RSS-GEN
 [X]	FCC KDB 558074 D01 DTS measurement guidance v04

### **Environmental Conditions**

#### Ambient:

Temperature:	22±4°C
Humidity:	30-60%RH
Mains Voltage:	[X] 120VAC

### MEASUREMENT METHODS

Duty Cycle: KDB 558074 D01 Section 6.0

6 dB BW: KDB 558074 D01, Section 8.1.

99% Occupied Bandwidth: ANSI C63.10-2013, Section 6.9.3

Output Power: KDB 558074 D01 Section 9.1.2

Power Spectral Density: KDB 558074 D01 Section 10.2.

Out-of-band emissions in non-restricted bands: KDB 558074 D01 Section 11.0. Out-of-band emissions in restricted bands: KDB 558074 D01 Section 12.2.5.2

General Radiated Emissions: ANSI C63.10:2013 Sections 6.3-6.6

Line Conducted Emissions: ANSI C63 10:2013 Sections 6.2

### FCC Test Site Accreditation.

r Firm Name	Location	Accreditation	MRADesignation Number	Expiration Date	Contact	Contact Title	
Bose Corporation	1 New York Avenue, Framingham, MA	American Association for Laboratory Accreditation	N/A US1088	07/31/2018	Carole Park	Quality Manager	

### Canadian Test Site Registration.

Radiated emissions below 1GHz were performed in Test Site 3232A-1. Radiated emissions above 1GHz were performed in Test Site 3232A-2.

### Scope of Accreditation for: Bose Corporation

Test Site	OATS 3m	OATS 10m	OATS 30m	Chamber 3m	Chamber 10m	Expiry Date
3232A-2	No	No	No	Yes	No	2020-06-27
3232A-1	No	No	No	Yes	No	2020-04-25





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# 6dB Bandwidth

### **Requirement:**

FCC 15.247(a)(2); IC RSS-247 5.2 (1) The minimum 6 dB bandwidth shall be at least 500 kHz.

### **Test Procedure:**

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100kHz. The VBW is set  $\ge 3 \times RBW$ . The sweep time is coupled. Peak detector is used with max hold.

### Test Results:

DTS Bandwidth Summary Table (BLE)									
Channel	Frequency (MHz)	Mode	DTS BW (kHz)	Limit (kHz)	Margin (kHz)	Result			
Low	2402	BLE	720.6	500	220.6	Pass			
Middle	2442	BLE	747.95	500	247.95	Pass			
High	2480	BLE	764.5	500	264.5	Pass			



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Spectrum	1								[₩
Ref Level 1	.0.00 dBr	n <b>Offset</b> 20.00	dB 👄 F	<b>RBW</b> 100 kHz	2				
Att	10 d	B <b>SWT</b> 32.1	ms 👄 🍾	<b>/BW</b> 300 kHz	: Mode	Sweep			
TDF									
)1PK Max									
					M	1[1]		-4	.98 dBn
) dBm — — — —					- <del>M1</del> -	do		2.442201	6 00 de
			-	time	$\lambda^{2}$	ub w		747 950000	0.00 uc
10 dBm — 🕂				7	<u>~ </u>	factor		747.90000	3265 3
				f	n n n			1	0200.1
20 dBm — 🕇									
						$  \rangle$			
30 aBm									
			<u> </u>			<u> </u>	<u> </u>		
io abiii									
50 dBm —	- and a state						<u>``</u>		
50 dBm — 🕂									
′0 dBm ── ┼─									
30 dBm — 🕂									
F 2.442 GF	łz	- <b>I</b>		32001	pts		l	Span 3	5.0 MHz
arker					•			-	
Type   Ref	Trc	X-value	1	Y-value	Fund	tion	Fun	ction Result	
M1	1	2.44220171 0	iHz	-4.98 dBr	n ndB	down		747	'.95 kHz
Τ1	1	2.44153283 0	ίΗz	-10.99 dBr	n	ndB			6.00 dB
T2	1	2.44228077 0	Hz	–10.99 dBr	n Q	factor			3265.2
Ref Level 1	0.00 dBr. 10 d	n <b>Offset</b> 20.00 B <b>SWT</b> 32-1	dB 👄 F ms 👄 V	<b>RBW</b> 100 kHz <b>/BW</b> 300 kHz	: Mode	Sween			
	10 0	5 <b>5 1</b> 52,1	····> • •	- D-4 300 KHz	moue	oweeh			
1Pk Max									
					M	1[1]		-5	33 dBm
.						-[-]		2.480201	870 GH
I dBm					MI n	dB			6.00 dE
10 40			Т	12	√Т2 в	w		764.510000	0000 kHz
				r		factor			3244.2
					<u> </u>				
						N			
30 dBm——			_/_			$\square$			
40 dBm——									
	the second								
50 dBm 🕂 🔁	Contraction of the local division of the loc						<del>```</del>		
	<b>.</b>								
50 dBm — 🕂									
/U dBm — 🕇									
F 2.48 GHz	z			32001	pts			Span 3	5.0 MHz
arker									
Type   Ref	Trc	X-value		Y-value	Func	tion	Fun	ction Result	
M1	1	2.48020187 0	iHz	-5.33 dBr	n ndB	down		764	1.51 kHz
T1	1	2.47951486 0	iHz	-11.31 dBr	n –	ndB			6.00 dB
12		2,48027937 0	HZ	-11.29 dBr	n   Q	iactor			3244.2
	11				Mone	urina		<b>09/20</b>	5/2017

The minimum 6dB bandwidth is 720.6kHz which is more than the 500kHz minimum required.

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### Test Equipment Used:

TN	Description	Model	S/N	Manufacturer	Most Recent Calibration	Calibration Due Date	Most Recent Verification	Verification Due Date
2409	Signal and Spectrum Analyzer	FSV40	101413	Rohde & Schwarz	05-Apr-2017	05-Apr-2018		
1388	DC Power Supply	E3646A	MY40005729	Agilent			Verify Before Use	Verify Before Use
2877	EMC Cable	GA08- S1S1-39	17024401 002	MegaPhase			Verify Before Use	Verify Before Use

Test performed on November 26, 2017





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# 99% Bandwidth

### **Requirement:**

None; for reporting purposes, only. Test per FCC 15.247(a)(1); IC RSS-247 5.1 (1), RSS-Gen 6.6.

### **Test Procedure:**

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

### Test Results:

99% Bandwidth Summary Table (BLE)								
Channel	Frequency (MHz)	Mode	99% Bandwidth (kHz)					
Low	2402	BLE	1002.0					
Middle	2442	BLE	999.0					
High	2480	BLE	1002.0					





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The maximum 99% occupied bandwidth is 1002.0 kHz.

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#### FCC ID: A94424611 IC: 3232A-424611

### Test Equipment Used:

	ΤN	Description	Model	S/N	Manufacturer	Most Recent Calibration	Calibration Due Date	Most Recent Verification	Verification Due Date
Ē	2409	Signal and Spectrum Analyzer	FSV40	101413	Rohde & Schwarz	05-Apr-2017	05-Apr-2018		
	1388	DC Power Supply	E3646A	MY40005729	Agilent			Verify Before Use	Verify Before Use
	2877	EMC Cable	GA08- S1S1-39	17024401 002	MegaPhase			Verify Before Use	Verify Before Use

Test performed on September 26, 2017





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# Conducted Output Power Requirements:

#### FCC 15.247 (b) (3)

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt, based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

#### RSS-247 5.4 (4)

For EUTs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W. Except as provided in Section 5.4(5), the E.I.R.P. shall not exceed 4 W.

### Test setup details:

The EUT is controlled via the LightBlue iOS app. A 4 inch SMA cable with 0.5 dB loss and a 20 dB pad were used for all conducted measurements. To compensate for the cable loss and pad attenuation, the reference level offset feature of the spectrum analyzer was used for the attenuator and a transducer factor was used for the cable. The EUT is programmed to operate on fixed frequencies at the low, middle, and high end of the authorized frequency band. The spectrum analyzer resolution bandwidth is set to 3 MHz (higher than the occupied bandwidth), peak detector and max hold. The maximum output power is recorded for each of the three frequencies.

### Test Results:

	Output Power Summary Table (BLE)											
Channel	Frequency (MHz)	Output Power (dBm)	Directional Gain (dBi)	Limit (dB)	Margin (dB)	Result						
Low	2402	-4.32	1.316	30	33.004	Pass						
Middle	2442	-4.72	1.316	30	33.404	Pass						
High	2480	-5.06	1.316	30	33.744	Pass						



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BASE

	DESIGN / Wireless Transcei	DESIGN ASSURANCE ENGINEERING Vireless Transceiver Bluetooth Low Energy Test Report								
ertificate # 1514.1	FCC ID: A	94424611	IC: 3232A-42461	1						
Spectrum										
RefLevel 10.00 dBm Att 10 dE TDF	n Offset 20.00 dB 👄 3 SWT 32.1 ms 👄	RBW 3 MHz VBW 5 MHz	Mode Sweep							
⊖1Pk Max										
0. d9m			M1[1]	2.47	-5.06 dBn 9691260 GH					
-10 dBm		M1								
-20 dBm										
-30 dBm				and the state of the second						
-50 dBm										
-60 dBm										
-70 dBm										
-80 dBm										
CF 2.48 GHz		32001	pts	Sp	an 20.0 MHz					
Marker										
Type         Ref         Trc           M1         1	X-value 2.47969126 GHz	<b>Y-value</b> -5.06 dBr	n Function	Function Res	ult					
			Measuring 🔳		09/26/2017 03:20:17 AM					

Model 424611 meets the conducted power limit of 1W (30dBm) by 33dB at 2402MHz.

### **Test Equipment Used:**

TN	Description	Model	S/N	Manufacturer	Most Recent Calibration	Calibration Due Date	Most Recent Verification	Verification Due Date
2409	Signal and Spectrum Analyzer	FSV40	101413	Rohde & Schwarz	05-Apr-2017	05-Apr-2018		
1388	DC Power Supply	E3646A	MY40005729	Agilent			Verify Before Use	Verify Before Use
2877	EMC Cable	GA08- S1S1-39	17024401 002	MegaPhase			Verify Before Use	Verify Before Use

Test performed on September 26, 2017





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### Power Spectral Density Requirements:

FCC 15.247 (e) and IC RSS-247 5.2 (2)

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

### Test Results:

	Power Spectral Density Summary Table (BLE)										
Channel	Frequency (MHz)	PSD (dBm)	Limit (dB)	Margin (dB)	Result						
Low	2402	-19.19	8	27.19	Pass						
Middle	2442	-19.66	8	27.66	Pass						
High	2480	-20.02	8	28.02	Pass						





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CF 2.48 GHz 32001 pts Span 2.0 MHz Spurious Emissions Range Low RBW ∆Limit Range Up Frequency Power Abs 2.479 GHz 2.481 GHz 3.000 kHz 2.47971 GHz -20.02 dBm -28.02 dB 09/26/2017 Measuring... 09:41:32 PM

The Model 424611 passes FCC power spectral density by 27.19dB.

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### Test Equipment Used:

ΤN	Description	Model	S/N	Manufacturer	Most Recent Calibration	Calibration Due Date	Most Recent Verification	Verification Due Date
2409	Signal and Spectrum Analyzer	FSV40	101413	Rohde & Schwarz	05-Apr-2017	05-Apr-2018		
1388	DC Power Supply	E3646A	MY40005729	Agilent			Verify Before Use	Verify Before Use
2465	EMC Cable	GA08- S1S1-30	17024401 002	MegaPhase			Verify Before Use	Verify Before Use

Test performed on September 26, 2017



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# Conducted Spurious Emissions Requirements:

#### FCC 15.247 (d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in 15.205(a), must also comply with the radiated emission limits specified in 15.209(a) (see 15.205(c)).

#### IC RSS-247 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section A8.4 (4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

Note: Antenna gain outside of the wanted band was assumed to be zero. The conducted spurious readings are for additional information as the radiated readings take precedence.



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### Spurious Band-edge Emissions

	Lower Band Edge (BLE)										
Channel	Frequency (MHz)	Mode	Worst Case (dBc)	Limit (dBc)	Margin (dB)	Result					
Low	2402	BLE	37.69	20	17.69	Pass					





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ChannelFrequency (MHz)ModeWorst Case (dBc)Limit (dBc)Margin (dB)ResultHigh2480BLE44.032024.03Pass	Upper Band Edge (BLE) (Peak Detector)									
High 2480 BLE 44.03 20 24.03 Pass	Channel	Frequency (MHz)	Mode	Worst Case (dBc)	Limit (dBc)	Margin (dB)	Result			
	High	2480	BLE	44.03	20	24.03	Pass			



BASE



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### **Spurious Emissions**

Spectrun	n									
Ref Level	20.00 d	Bm Offset 20	).00 dB	Mode	Swee	p				
STOP										
●1 Clrw									_	
Limit C	Check		PA	SS						
Line _: 10 dBm—	SPURIO	JS_LINE_ABS_	РА	SS						
0 dBm										
-10 dBm—										
-20 dBm—										
_SPURIOUS_ -30 aBm	LINE_AB	S								
-40 dBm—										
-50 dBm—										
-60,dBm		and a straight of the straight	الالالاستين وأبريا ومترام	ally general points.	han Plaser	alla di materi	Neble entres	ahahaanan na madala Aristo aristo	a cambula an	anlandining <mark>nangandining ba</mark>
-	, <mark>na na hainin a hi</mark> i	nakapat pala Mithi I I. Mithana Ju	dament proves alle	an shirili shekar ti	iligabeljas I	and the second second	an al mir and i	A di Jing miladia di di	d livje <mark>la og sti</mark> .	<mark>a di Kapita Japita Jaata kata kata ka</mark>
Start 30.0 MHz 64002 pts Stop 26.0 GHz										
Spurious E	mission	s								
Range I	Low	Range Up	RE	3W		Freque	ncy	Power A	bs	∆Limit
30.00	0 MHz	2.400 GH	z 100	.000 kHz		1.00	)104 GHz	-58.2	7 dBm	-33.17 dB
2.48	34 GHz	26.000 GH	z 100	.000 kHz		4.80	0311 GHz	-51.3	3 dBm	-26.23 dB
						Meas	uring		474	09/27/2017 12:09:09 AM

BLE Channel 0. In above plot 2.4GHz to 2.4835GHz was not measured. Limit line shown is 20dB below the highest reading using a 100kHz RBW at BLE Channel 0. Passes by 26.23dB when transmitting on channel 0.





Spectrum

#### DESIGN ASSURANCE ENGINEERING Wireless Transceiver Bluetooth Low Energy Test Report

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-											
Ref Level 2	Ref Level 20.00 dBm Offset 20.00 dB Mode Sweep										
STOP											
⊖1 Clrw											
Limit Cl	heck		PA	38							
Line _S	PURIOUS	LINE_ABS_	PA	38							
10 dBm											
0 dBm											
-10 dBm											
-20 dBm											
SPURIOUS I	INE ABS										
-30 aBm					_						
-40 dBm——					-						
-50 dBm					_						
		1 4 5 10			. I.	التعالي متري	المعادية والملاط	E REAL PROPERTY AND A		- <b>k</b> a - d	
±60,dBm	and a state of the	Althe manner franken	Maril Marine Marine	i yana dalahi	art free	and received and a sec	an di se ale sur diffe	, de l'hours de southes diff	COMPANY AND	MULL'	
a ta na la santa la		and the state of the second		La constant of		, tal or all other	العربين أأنطط أعرطها	Later destantistic	december - da	allal an	deataina da cont
	فالفطائين حديه	and the second sec		and the second such	1.11.1	<u></u>	2.0 0.00 <b>0</b>	e a consulta la consulta	Line of the state	1 ' <b>1</b> 1''	lin din di dante
											<u> </u>
Start 30.0 M	VIHZ			640	102	pts				stop	26.0 GHZ
Spurious Err	spurious Emissions										
Range Lo	ow	Range Up	RB	W		Freque	ncy	Power At	25		Limit
30.000	MHz	2.400 GHz	100.	UUO kHz		261.25	293 MHz	-59.89	dBm		-34.79 dB
2.484	4 GHZ	26.000 GHz	:  100.	UUU kHz !		15.87	157 GHz	-53.86	dBm		-28.76 dB

BLE Channel 20. In above plot 2.4GHz to 2.4835GHz was not measured. Limit line shown is 20dB below the highest reading using a 100kHz RBW at BLE Channel 20. Passes by 28.6dB when transmitting on channel 20.

Spectrun	n 🗡								
Ref Level STOP	20.00 dB	m Offset 20	).00 dB	Mode	Sweep				-
⊖1 Clrw									
Limit C	heck		PA	SS					
Line _9 10 dBm——	SPURIOU	S_LINE_ABS_	РА	ss					
0 dBm									
-10 dBm——									
-20 dBm—									
_SPURIOUS_ -30 aBm	LINE_ABS	_							
-40 dBm									
-50 dBm									
60 dBm	ATTO BOAT MARKED	and a deliberted and the	Manual Angelia	anggolitheo ban bible	and the setted of the set	to for Long Long	la haden salasi a	المهالي الماطين	helder and the held that the
	an ann allaitha.	a lana dhuhu dhuh	distances discussed	ally shady his a	na, phone benefit philoso	a an	in the second states of the	all have the	the physical static state bank
				T I					
Start 30.0	MHz			640	02 pts	<u> </u>		S	top 26.0 GHz
Spurious E	missions								
Range I	Low	Range Up	RE	sw	Freque	ncy	Power At	os	∆Limit
30.00	IO MHZ	2.400 GH	z 100	.000 kHz	1.00	)274 GHz	-59.86	dBm	-34.76 dB
2.48	84 GHz	26.000 GH	z 100	.000 kHz	15.94	1370 GHz	-53.86	dBm	-28.76 dB

BLE Channel 39. In above plot 2.4GHz to 2.4835GHz was not measured. Limit line shown is 20dB below the highest reading using a 100kHz RBW at BLE Channel 39. Passes by 28.76dB when transmitting on channel 39.





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### Test Equipment Used:

ΤN	Description	Model	S/N	Manufacturer	Most Recent Calibration	Calibration Due Date	Most Recent Verification	Verification Due Date
2409	Signal and Spectrum Analyzer	FSV40	101413	Rohde & Schwarz	05-Apr-2017	05-Apr-2018		
1388	DC Power Supply	E3646A	MY40005729	Agilent			Verify Before Use	Verify Before Use
2465	EMC Cable	GA08- S1S1-30	17024401 002	MegaPhase			Verify Before Use	Verify Before Use

Test performed on September 26, 2017



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## **Radiated Emissions Test Results**

### **Requirements:**

FCC 15.205, 15.209, 15.247 (d), IC RSS-GEN Clause 8.9 (Transmitter)

### Limits:

	Freq Range	Limits (dBu	V QP <sup>1</sup> )		Comments
Standard	(MHz)	Class A		Class B	Measurements above 1 GHz are made using
		10 m	3 m <sup>2</sup>	3 m	average and peak detectors.
	30-88	39	49	40	Mains cables draped to floor, not bundled.
	88-216	43.5	53.5	43.5	*For measurements above 1 GHz, peak
	216-960	46.5	56.5	46	limits must also be met that are 20 dB
	>960	49.5*	59.5*	54*	higher than average limits.

In any of the restricted bands defined in FCC part 15.209(a), the field strength at 3 meters shall not exceed 54dBµV/m (average) or 74dBµV/m (peak)

### Test Setup

The EUT is placed in a standard ANSI C63.10 test setup. Standard Gain Horn Antennas and Double-Ridged Guide Horn Antennas with suitable pre-amps mounted directly on the horn antennas are used for the measurement of the harmonics. The EUT hopping is stopped and measurements are made in the low, mid and high end of the frequency range at the defined limit distance of 3 meters. The EUT is placed on a non-conducting table 80 cm above the ground plane for below 1GHz measurements and 1.5 m above the ground plane for above 1GHz measurements. The EUT is rotated around the vertical axis, the antenna polarization changed from H to V and the antenna height is varied from 1 to 4 meters in order to find the maximum value of the harmonic emission. Account is taken of the beam width of the horn antennas to make sure the EUT remains in the main lobe of the antenna. EUT was tested in 3 orthogonal axes and the worst-case results are shown below.

For measurements below 1 GHz, the resolution bandwidth is set to 120 kHz and a quasi-peak detector was used. For peak measurements above 1 GHz, a resolution bandwidth of 1 MHz was used and video bandwidth of 3 MHz was used. For average measurements above 1GHz, the resolution bandwidth and video bandwidth are set as described in ANSI C63.10:2013 for the applicable measurement. An average detector was used and a duty cycle correction factor was added to correspond to the average during the transmission to compute the emission level that would have been measured had the test been performed at 100 % duty cycle. The duty cycle correction factor used was 6.7dB to correct for the 46.3% duty cycle.

### **Transmitter Harmonics/Spurious**

Typically, we use a notch filter to protect the preamp from overload however, in this case, the transmit power is sufficiently low that overload was not a concern. The radio was programmed to transmit on a single channel, low mid and high channels were checked, at max power at higher duty cycles than would ever be realized in normal operation. Then a duty cycle correction factor of 6.7dB was added to the average readings. For each frequency tested the earbud was oriented in 3 orthogonal axes and the highest plots and readings are shown below.









Bose Corporation 1 New York Ave.., Framingham, MA 01701, USA Tel: (508) 766-6000 Fax: (508) 766-1145 Without written permission of laboratory, this report shall not be reproduced except in full. Report Number: EMC. 424611.17. 299.4 Form FL300959 Rev 04 BOSE CONFIDENTIAL



FCC ID: A94424611 IC: 3232A-424611 MARKER 1 \* RBW 1 MHz Marker 1 [T1 ] 2.4365 GHz \* VBW 3 MHz 77.94 dBµV/m 90 dBuV/m \* Att 0 dB SWT 100 ms 2.436500000 GHz Ref Marker 2 [T1 90 45.97 dBµV/m 884500 000 GHz 80 Marker 3 [T1 FC 1 PK 40.2 dBuV/r VIEW 70550 70 00 2 PK TDS VIEW 60 FCC A P.S 50 water a server a relation water a server and з 608 30 20 -10 Start 1 GHz 1.7 GHz/ Stop 18 GHz Transmitting at 2480MHz

FCC 15B Class B Product (Residential) @ 3 Meters Emission Measured Measured FCC 15B Table **Receiving Antenna** Notes / Mode Amplitude Amplitude Frequency Azimuth Limit Limit Margin Pol Height Margin (MHz) (dBµV/m) (dBµV/m) (0° (dBµV/m) (dBµV/m) (dB) (dB) (H/V) (Meters) AVG Peak ÀVĠ Peak ÀVĠ Peak closest to ant) 2402.000 73.90 81.90 54.0 74.0 -19.9 -7.9 177 Н 1.6 Fundamental 2479.700 66.20 74.50 54.0 74.0 -12.2 -0.5 177 Н 1.6 Fundamental 2441.655 70.10 78.60 54.0 74.0 -16.1 -4.6 178 н 1.6 Fundamental 2402, horizontal single frequency 4803.401 45.00 49.30 54.0 74.0 9.0 24.7 183 V 1.8 6.7dB duty cycle correction added to average reading 7205.184 37.50 44.80 54.0 74.0 16.5 29.2 183 V 6.7dB duty cycle 1.8 correction added to average reading 9608.000 31.20 45.00 54.0 74.0 22.8 29.0 noise floor 46.80 74.0 27.2 12010.000 33.60 54.0 20.4 noise floor 14412.000 33.80 46.70 54.0 74.0 20.2 27.3 noise floor 16814.000 74.0 25.2 35.50 48.80 54.0 18.5 noise floor 19216.000 54.0 74.0 27.9 33.10 46.10 20.9 noise floor 21618.000 36.20 49.20 54.0 74.0 17.8 24.8 noise floor 24020.000 39.30 52.30 54.0 74.0 14.7 21.7 noise floor 2441, horizontal single frequency

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4883.400	42.60	47.50	54.0	74.0	11.4	26.5	359	V	1.3	6.7dB duty cycle correction added to average reading
7325.120	38.20	45.20	54.0	74.0	15.8	28.8	200	V	1.6	6.7dB duty cycle correction added to average reading
9768.000	31.20	45.00	54.0	74.0	22.8	29.0				noise floor
12210.000	33.60	46.80	54.0	74.0	20.4	27.2				noise floor
14652.000	33.80	46.70	54.0	74.0	20.2	27.3				noise floor
17094.000	35.50	48.80	54.0	74.0	18.5	25.2				noise floor
19536.000	33.10	46.10	54.0	74.0	20.9	27.9				noise floor
21978.000	36.20	49.20	54.0	74.0	17.8	24.8				noise floor
24420.000	39.30	52.30	54.0	74.0	14.7	21.7				noise floor
2480, horizo	2480, horizontal single frequency									
4959.360	46.10	50.70	54.0	74.0	7.9	23.3	172	V	1.3	6.7dB duty cycle correction added to average reading
7439.090	38.30	45.50	54.0	74.0	15.7	28.5	138	Η	1.6	6.7dB duty cycle correction added to average reading
9920.000	31.00	44.20	54.0	74.0	23.0	29.8				noise floor
12400.000	31.50	44.50	54.0	74.0	22.5	29.5				noise floor
14880.000	32.00	45.40	54.0	74.0	22.0	28.6				noise floor
17360.000	37.00	51.10	54.0	74.0	17.0	22.9				noise floor
19840.000	33.10	46.10	54.0	74.0	20.9	27.9				noise floor
22320.000	36.20	49.20	54.0	74.0	17.8	24.8				noise floor
24800 000	39 30	52.30	54.0	74.0	14.7	21.7				noise floor

### Band edge radiated emission measurements:

BITSE





X1 MAXH 797 Mark r 3 [T1 1 2 AV 30.35 dBuV/n AVG rain the second states Labert Labor Walter Fairlie Kanlasta -10 Center 2.4835 GHz 1 MHz/ Span 10 MHz

Passes by a minimum of 44.71dB.

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TDS

PS

6DB DC



FCC ID: A94424611 IC: 3232A-424611







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### **Resources Used**

ΤN	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	06-Apr-2016	06-Apr-2017	n/a	n/a
2357	RF Cable 30MHz-18GHz	TRU-300	TRU- 12707-03	TRU Corporation	n/a	n/a	08-Jan-2016	07-Jan-2018
2373	RF Cable 30MHz-18GHz	TRU-300	N/A	TRU Corporation	n/a	n/a	12-Nov-2014	12-Nov-2017
2385	Marconi Manor	3 Meter Chamber	N/A	AP Americas	n/a	n/a	24-Nov-2015	24-Nov-2018
2478	RF cable 30MHz-18GHz	257-257- 3052640	N/A	SRC Haverhill	n/a	n/a	06-Jan-2016	05-Jan-2018
2342	Band Reject Filter	BRM50702-07	001	Micro-Tronics	n/a	n/a	29-Mar-2016	29-Mar-2018
2602	Miteq pre-amp 1-18GHz 35dB	AFS42- 01001800-28- 10P-42	N/A	Miteq	n/a	n/a	08-Jan-2016	07-Jan-2018
1757	18GHz-40GHz Preamp	JS4018004000- 30-8P-A1	1406279	Miteq	n/a	n/a	08-Jan-2016	07-Jan-2018
1596	Standard Gain Horn Antenna 18GHz - 26.5GHz	AT4640	309234	Amplifier Research	n/a	n/a	n/a	n/a
2368	RF Cable 30MHz- 26.5GHz	TRU-210	TRU- 12767-35	TRU Corporation	n/a	n/a	08-Jan-2016	07-Jan-2018
2349	Double Ridged Guide Horn Antenna 1- 18GHz	3117	00152406	ETS Lindgren	23-Nov-2016	23-Nov- 2017	n/a	n/a

Test performed on October 27, 2017



FCC ID: A94424611 IC: 3232A-424611

### 30-1000MHz radiated emissions:

EUT Mods:	None
EUT Setup:	Charging case battery and earbuds with new firmware that supports earbud charging
Comments:	



Max hold pre-scan. The yellow trace is Vertical, the green trace is Horizontal, and orange trace is a max hold for vertical and horizontal combined.

	FCC 15B Class B Product (Residential) @ 3 Meters												
	MK Frequency (MHz)	Measured Amplitude (dBµV/m) QP/AVG*	Measured Amplitude (dBµV/m) Peak		FCC	15B		Table	Receiving Antenna		*Average detector used for frequencies		
MK #				Limit (dBµV/m) QP/AVG*	Limit (dBµV/m) Peak	Margin (dB) QP/AVG*	Margin (dB) Peak	Azimuth (0° closest to ant)	Pol (H/V)	Height (Meters)	above 1 GHz. Notes / Mode		
1	33.026	16.60	24.90	40.0	N/A	23.4	N/A	0	V	1.00			
2	35.288	15.30	23.30	40.0	N/A	24.7	N/A	0	V	1.00			
3	86.656	11.60	17.90	40.0	N/A	28.4	N/A	0	V	1.01			
4	156.036	11.20	18.90	43.5	N/A	32.3	N/A	0	V	1.01			
5	202.948	10.20	18.50	43.5	N/A	33.3	N/A	0	V	1.01			
6	785.094	21.60	29.70	46.0	N/A	24.4	N/A	0	V	1.01			

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	DESIGN ASSURANCE ENGINEERING Wireless Transceiver Bluetooth Low Energy Test Report
REDITED	FCC ID <sup>-</sup> A94424611 IC <sup>-</sup> 3232A-424611

Certifica EUT S/N: 0288AE Power applied: 120V Plot# 2 EUT Mods: None Playing pink noise at max volume while paired to test app on iPad EUT Setup: Comments:



Max hold pre-scan. Yellow trace is Vertical, green trace is Horizontal.

ACC

	FCC 15B Class B Product (Residential) @ 3 Meters													
Emination		Measured	sured Measured FCC 15B					Table	Receiving	g Antenna	*A verage detector used for frequencies above 1GHz.			
MK	Emission	Amplitude	Amplitude	Limit	Limit	Margin	Margin	Azimuth	Pol	Height	Notes / Mode			
#		(dBµV/m)	(dBµV/m)	(dBµV/m)	(dBµV/m)	(dB)	(dB)	(0° closest						
(IVI⊓ <i>∠)</i>	(1011 12)	QP/AVG*	Peak	QP/AVG*	Peak	QP/AVG*	Peak	to ant)	(H/V)	(Meters)				
1	30.000	19.20	25.90	40.0	N/A	20.8	N/A	0	V	1.00	Noise floor reading. Earbud playing music			
2	32.000	17.30	24.80	40.0	N/A	22.7	N/A	0	V	1.00	Noise floor reading. Earbud playing music			
3	35.000	15.90	23.40	40.0	N/A	24.1	N/A	0	V	1.00	Noise floor reading. Earbud playing music			
4	990.000	24.40	32.40	54.0	N/A	29.6	N/A	0	V	1.00	Noise floor reading. Earbud playing music			
5	995.000	24.60	32.60	54.0	N/A	29.4	N/A	0	V	1.00	Noise floor reading. Earbud playing music			
6	1000.000	24.60	32.40	54.0	N/A	29.4	N/A	0	V	1.00	Noise floor reading. Earbud playing music			

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FCC ID: A94424611 IC: 3232A-424611

### **Resources Used**

ΤN	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			23-Mar-2016	23-Mar-2018
1375	System Controller	SC99V	050905- 1	Sunol Sciences Corp				
1445	Maxwell House Radiated Emissions Cable Set	N/A	N/A	Bose Corporation			28-Jul-2017	28-Jul-2018
1541	Antenna 30MHz - 6GHz	JB6	A050807	Sunol Sciences Corp	24-Oct-2016	24-Oct-2017		
2077	PreAmplifier	N/A	N/A	Bose Corporation			28-Jul-2017	28-Jul-2018
2319	EMI Test Receiver	ESR26	101276	Rohde & Schwarz	06-Apr-2017	06-Apr-2018		

Test performed on October 4, 2017





FCC ID: A94424611 IC: 3232A-424611

# **AC Power Line Conducted Emissions**

Limits:

FCC §15.207 (a)

RSS-Gen 7.2.2 AC MAINS PORTS

		Freq	Limits (dBµV)		Comments
Standard	Class	Range (MHz)	QP	AVG	
	٨	0.15 - 0.5	79	66	-Ensure bandwidth set to 9 kHz. -EUT must pass both QP and AVG limits.
	A	0.5 - 30	73	60	<sup>1</sup> These limits decrease linearly with the log of the frequency.
CISPR32 based	В	0.15 - 0.5	66-56 <sup>1</sup>	56-46 <sup>1</sup>	CISPR32 based standards: EN55032, AS/NZS
buscu		0.5 - 5	56	46	
		5 - 30	60	50	

### TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.10. The receiver is set to a resolution bandwidth of 9 kHz. Quasipeak and average detectors were used. Line conducted data is recorded for both line and neutral.



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MHZ	αβήλ αδ	dBµV AVG	αβήλ αδ	dBµV AVG	dB QP	dB AVG	Notes
0.6338	34.00	24.00	56.0	46.0	22.0	22.0	Line - 120V charging
0.6360	34.00	24.00	56.0	46.0	22.0	22.0	Line - 120V charging
0.1613	39.60	25.10	65.4	55.4	25.8	30.3	Line - 120V charging
0.1658	39.30	26.80	65.2	55.2	25.9	28.4	Line - 120V charging
0.1905	38.10	26.40	64.0	54.0	25.9	27.6	Line - 120V charging
0.1883	38.10	26.70	64.1	54.1	26.0	27.4	Line - 120V charging
0.2108	36.90	24.70	63.2	53.2	26.3	28.5	Line - 120V charging
0.2063	37.00	22.80	63.3	53.3	26.3	30.5	Line - 120V charging
4.5443	29.50	17.10	56.0	46.0	26.5	28.9	Line - 120V charging
4.5690	29.30	17.20	56.0	46.0	26.7	28.8	Line - 120V charging
4.0470	28.10	16.80	56.0	46.0	27.9	29.2	Line - 120V charging
0.2288	34.40	19.80	62.5	52.5	28.1	32.7	Line - 120V charging
0.6360	32.50	23.10	56.0	46.0	23.5	22.9	Neutral - 120V charging
0.6360	32.50	23.10	56.0	46.0	23.5	22.9	Neutral - 120V charging
0.1613	39.10	22.30	65.4	55.4	26.3	33.1	Neutral - 120V charging
0.1658	38.80	23.70	65.2	55.2	26.4	31.5	Neutral - 120V charging
0.1883	37.30	22.50	64.1	54.1	26.8	31.6	Neutral - 120V charging
0.1838	37.40	20.60	64.3	54.3	26.9	33.7	Neutral - 120V charging
0.2063	36.10	18.60	63.3	53.3	27.2	34.7	Neutral - 120V charging
4.6140	27.30	17.60	56.0	46.0	28.7	28.4	Neutral - 120V charging
4.5420	27.40	17.10	56.0	46.0	28.6	28.9	Neutral - 120V charging
0.2288	33.30	16.30	62.5	52.5	29.2	36.2	Neutral - 120V charging
4.0448	24.70	16.20	56.0	46.0	31.3	29.8	Neutral - 120V charging
3.5858	21.50	13.80	56.0	46.0	34.5	32.2	Neutral - 120V charging

Drowsy DP1 powered at 120V passes conducted emissions by 22dB

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BASE





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### Equipment Used:

TN	Description	Model	S/N	Manufacturer	Most Recent Calibration	Calibration Due Date	Most Recent Verification	Verification Due Date
2247	EMI Test Receiver, 7GHZ	ESR7	101263	Rohde & Schwarz	04-Apr-2017	04-Apr-2018		
2235	2-LINE V- NETWORK	ENV216	101192	Rohde & Schwarz	03-Dec-2015	02-Dec-2017		
1380	Conducted Comb Generator	CGC- 510	311559	Com-Power Corporation			25-Apr-2017	25-Apr-2018

Test performed on October 6, 2017



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# End of Report

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