Certificate # 1514.1

PRODUCT ASSURANCE ENGINEERING
COMPLIANCE
EMC TEST REPORT

Test Type:	Emissions
Product Type:	*Wireless Earbud*
Product Name/Number:	*Model BL3L*
FCC ID: IC:	*A94BL3L* *3232A-BL3L*
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.BL3L.2020.132.1*

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	May 11, 2020
Electrical Engineer Review* By:	Bryan Cerqua	Bryan H Cerqua	May 15, 2020

* 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.

Table of Contents

Tests Performed (Table of Contents):

Test Report Summary

Product Information:

Description

Wireless Earbud. The antenna is an inverted L with a maximum gain of 1.21dBi 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.

Setup (Cables and Accessories)

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
AC Adapter	Bose	S008VU0500160	068170Z50403725AE	N/A

I/O Cable List					
Cable No.	**Port**	**# of Identical Ports**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	AC In	1	N/A	0	Wall-wart adapter
2	USB	1	Shielded	0.3	Output of AC adapter

Scope:

This report covers EMC requirements. *Enter specific EMC requirements covered by this report (i.e. FCC or CE).*

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.

Affirmation of Test Results:

	Print Name	Signature	Date
Testing Engineer/Technician	Chad Bell	Chad Bell	May 1, 2020

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	Accreditation	MRA	Designation Number	Expiration Date	Contact	Contact Title	Address	P.O. Box	Mail Stop	City	State	Zip	Country	E-mail Address	Phone Number
Bose Corporation	1 New York Avenue, Framingham, MA	American Association for Laboratory Accreditation	N/A	US1088	07/31/2020	Carole Park	Quality Manager	Mail Stop 450 The Mountain	N/A	450	Framingham	Massachusetts	01701	United States	Carole_Park@bose.com	508-766-6084

Canadian Test Site Registration:

Organization	CAB identifier	Scope / Recognition Date (yyyy-mm-dd)	Expiration (yyyy-mm-dd)
BOSE CORPORATION 1 New York Avenue Framingham, MA 01701 UNITED STATES Website: https://www.bose.com/en_us/index.html **ISED#: 3232A** Contact: Benjamin Cerretani benjamin_cerretani@bose.com	US0210	RSS-GEN (2019-02-11) RSS-210 (2019-02-11) RSS-247 (2019-02-11)	**RECOGNIZED UNTIL:** **2020-07-31** A2LA ISO/IEC 17025:2005 Expires: 2020-07-31

RF Conducted Measurements

On Time and Duty Cycle

Project code name:		**Marketing name:**		**Model number:**	BL3L
Project number (Integrity):	BL3L	**Build Phase:**	C2.5		
Tested by:	Chad Bell		**Date:**	April 10, 2020	
Requirements Standard(s):			**Referenced Standard(s):**		
EUT powered with:	5V USB	**Temp / Humidity:**	n/a	**Test location:**	
Test equipment used TN's:	2408				
EUT Serial number(s):	Model BL3L conducted #1				
EUT Software installed:	0.3.8				
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:

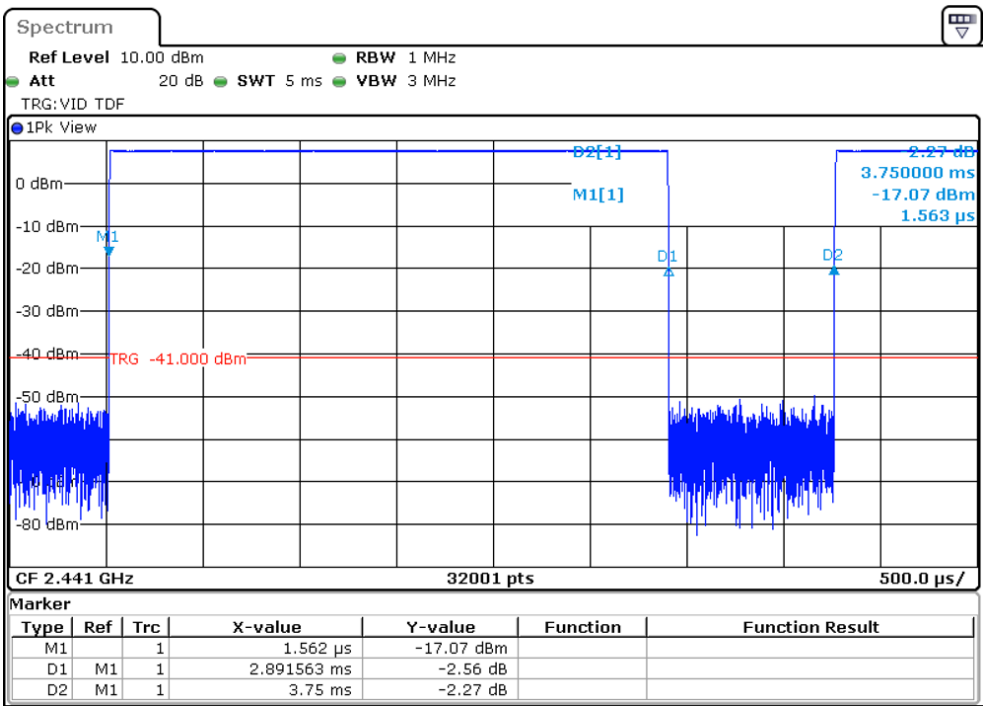
ANSI C63.10, Section 11.6: Zero-Span Spectrum Analyzer Method.

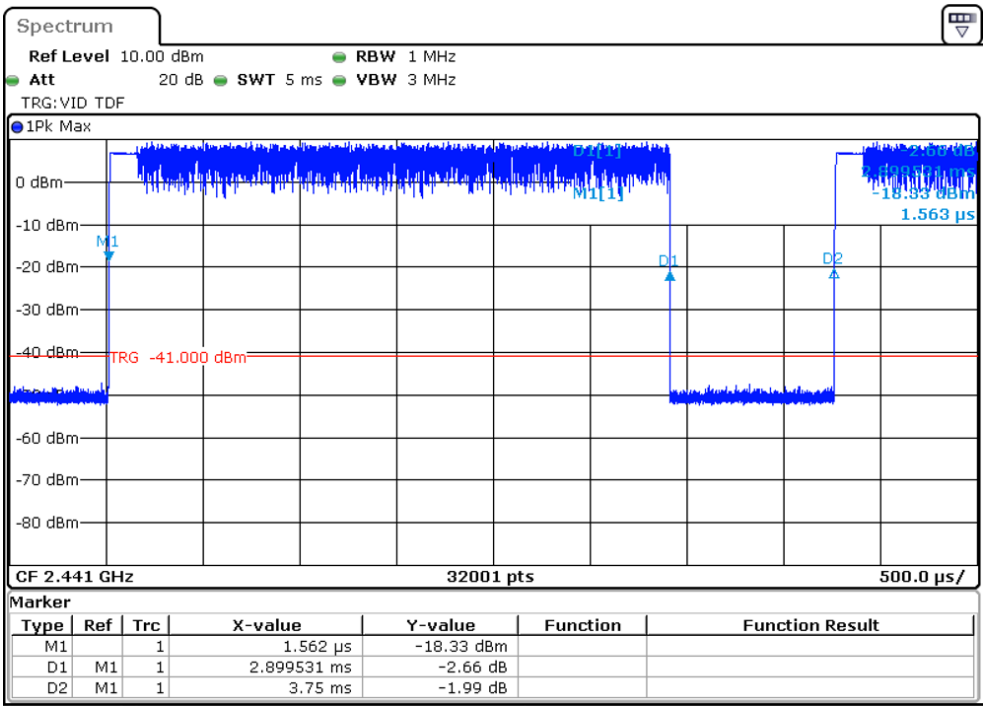
Equipment Used:

TN	Description	Model	S/N	Manufacturer	Most Recent Calibration	Calibration Due Date	Most Recent Verification	Verification Due Date
2408	Signal and Spectrum Analyzer	FSV40	101414	Rohde & Schwarz	25-Mar-2020	25-Mar-2021		

Data Collection:

Mode	ON Time (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
Bluetooth DH5	2.89	3.75	0.771	77.1	2.26
Bluetooth 3DH5	2.9	3.75	0.773	77.3	2.23





99% Occupied Bandwidth

Project code name:		**Marketing name:**		**Model number:**	BL3L
Project number (Integrity):	BL3L	**Build Phase:**	C2.5		
Tested by:	Chad Bell		**Date:**	February 13, 2020	
Requirements Standard(s):			**Referenced Standard(s):**		
EUT powered with:	5V USB	**Temp / Humidity:**	n/a	**Test location:**	Braun Room
Test equipment used TN's:	2408				
EUT Serial number(s):	Model BL3L conducted #1				
EUT Software installed:	0.3.8				
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:

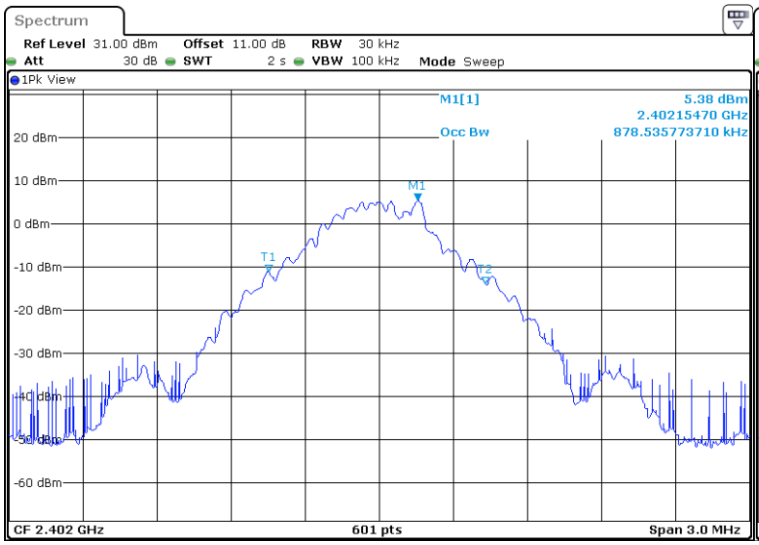
None; for reporting purposes only.

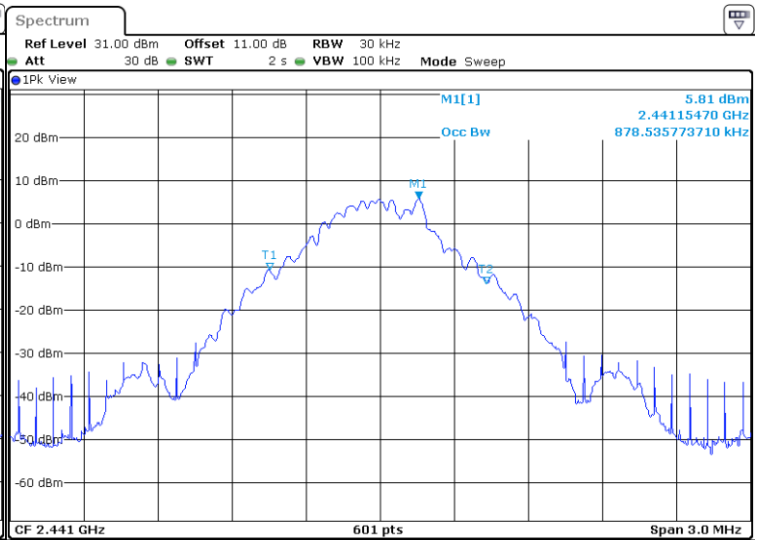
Procedure:

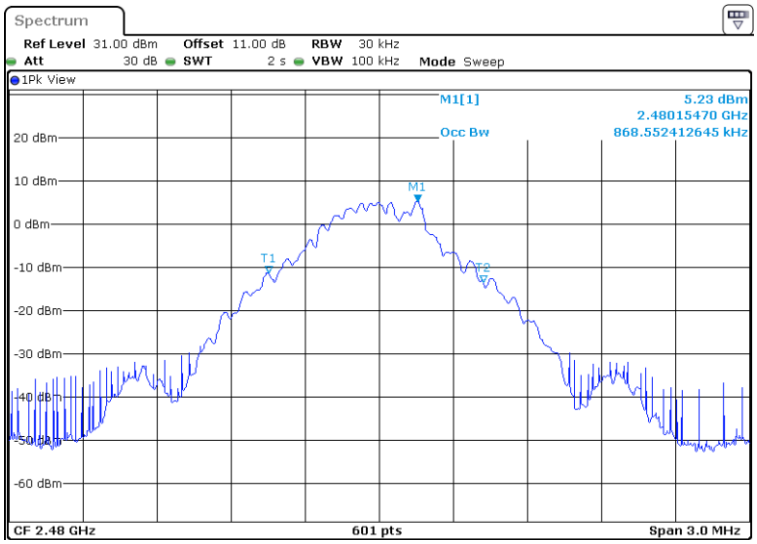
The transmitter output is connected to a spectrum analyzer. The RBW is set to ≥ 1-5% of the 99% Occupied Bandwidth. The VBW is set to ≥ RBW. The sweep time is coupled.

Basic Rate (DH5) Data Collection:

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	0.8785
Middle	2441	0.8785
High	2480	0.8686

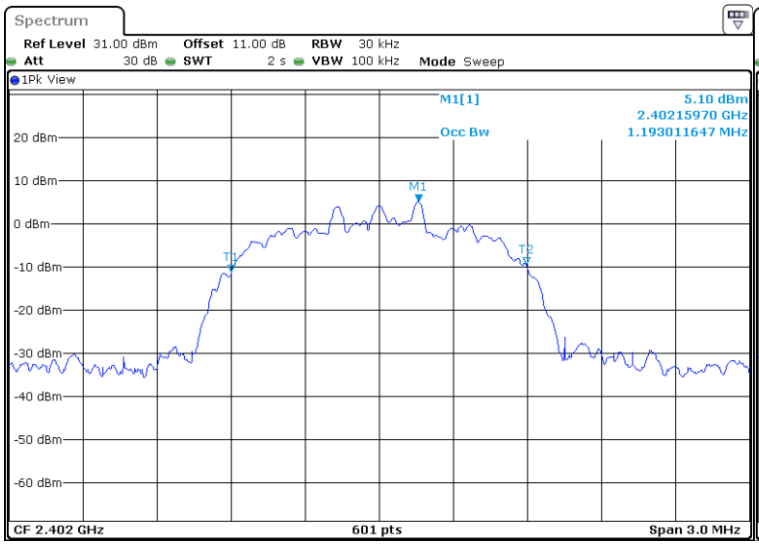


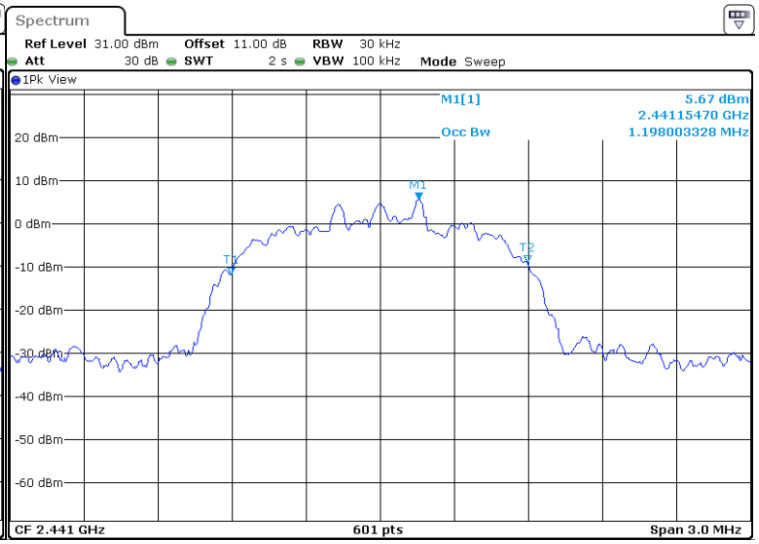


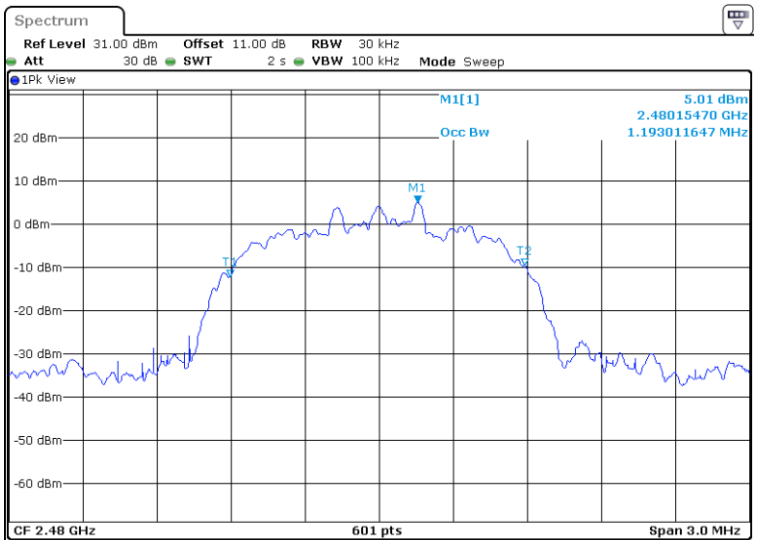


Enhanced Data Rate (3DH5) Data Collection:

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.193
Middle	2441	1.198
High	2480	1.193







Equipment Used:

TN	Description	Model	S/N	Manufacturer	Most Recent Calibration	Calibration Due Date	Most Recent Verification	Verification Due Date
2408	Signal and Spectrum Analyzer	FSV40	101414	Rohde & Schwarz	27-Mar-2019	26-Mar-2020		

20dB Occupied Bandwidth

Project code name:		**Marketing name:**		**Model number:**	BL3L
Project number (Integrity):	BL3L	**Build Phase:**	C2.5		
Tested by:	Chad Bell		**Date:**	February 13, 2020	
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:**	
Test equipment used TN's:	2408				
EUT Serial number(s):	Model BL3L conducted #1				
EUT Software installed:	0.3.8				
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:

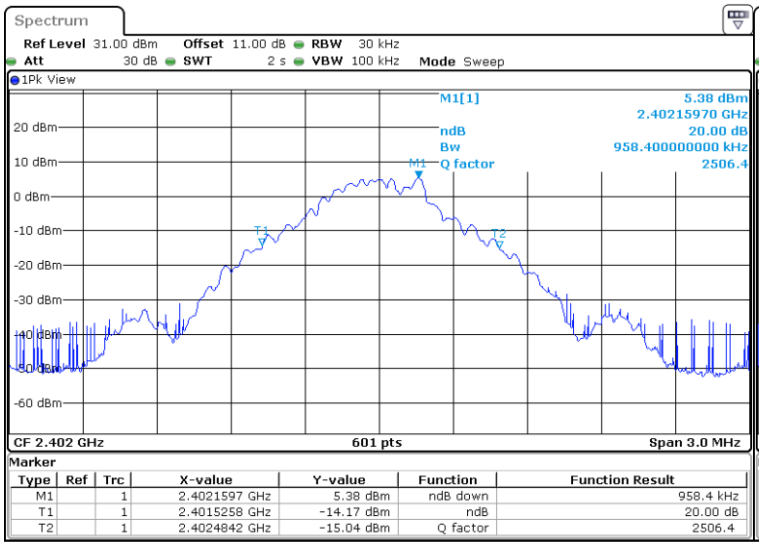
None; for reporting purposes only.

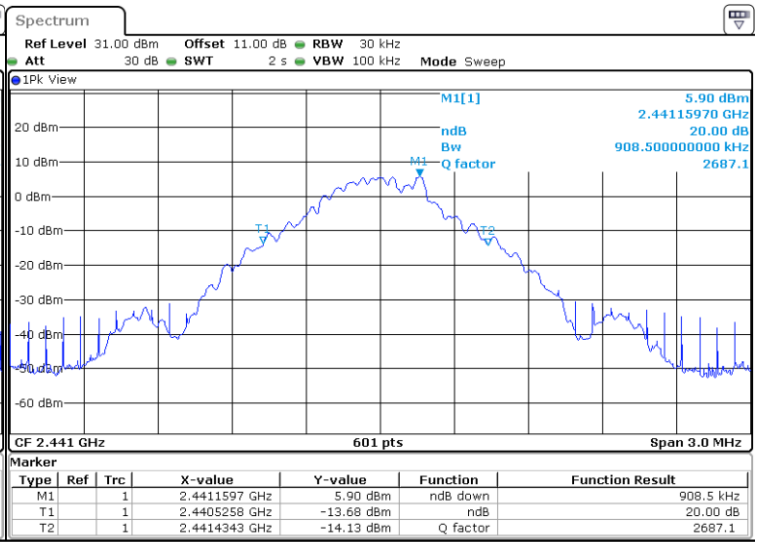
Procedure:

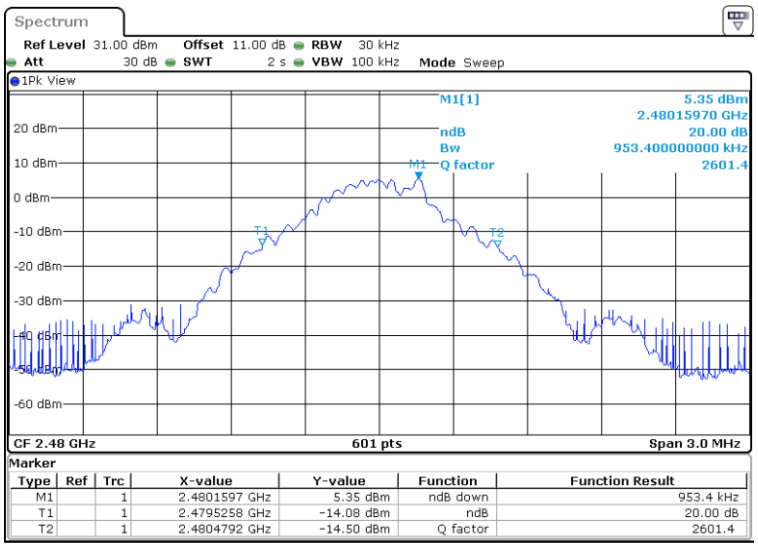
The transmitter output is connected to a spectrum analyzer. The RBW is set to ≥ 1-5% of the 20dB bandwidth. The VBW is set to ≥ RBW. The sweep time is coupled.

Basic Rate (DH5) Data Collection:

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	0.958
Middle	2441	0.909
High	2480	0.953

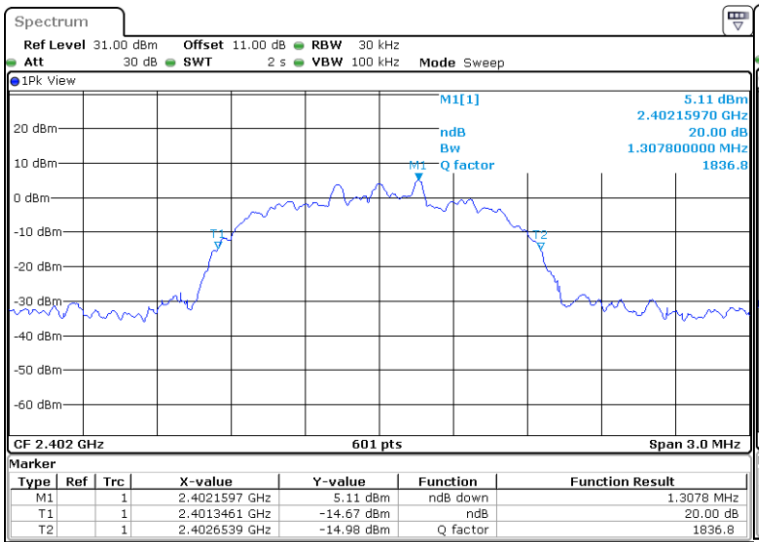


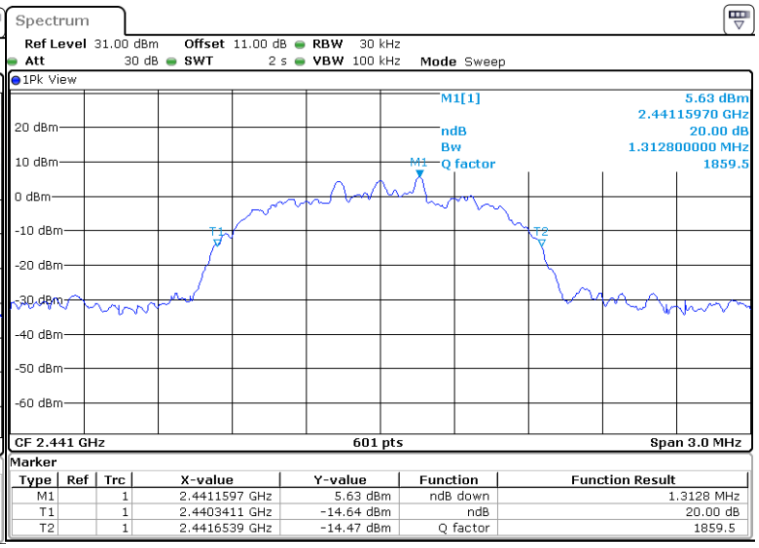


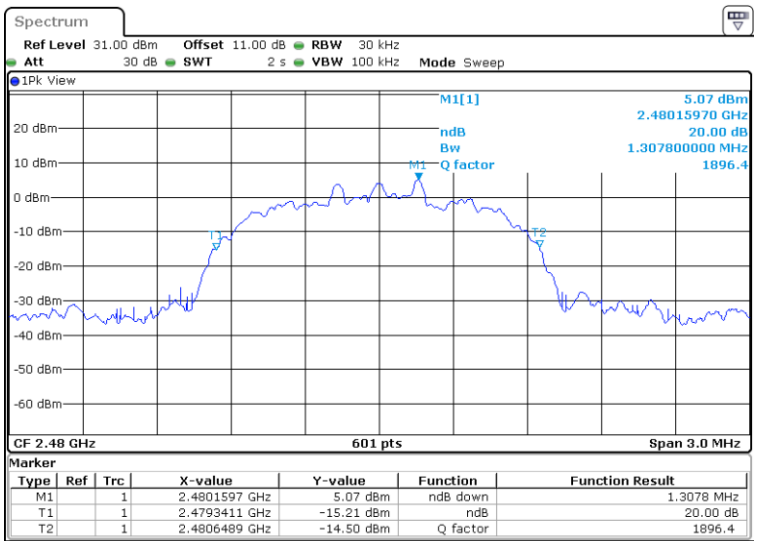


Enhanced Data Rate (3DH5) Data Collection:

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.193
Middle	2441	1.198
High	2480	1.188







Equipment Used:

TN	Description	Model	S/N	Manufacturer	Most Recent Calibration	Calibration Due Date	Most Recent Verification	Verification Due Date
2408	Signal and Spectrum Analyzer	FSV40	101414	Rohde & Schwarz	27-Mar-2019	26-Mar-2020		

Hopping Frequency Separation

Project code name:		**Marketing name:**		**Model number:**	BL3L
Project number (Integrity):	BL3L	**Build Phase:**	C2.5		
Tested by:	Chad Bell		**Date:**	May 11, 2020	
Requirements Standard(s):	FCC 15.247 (a) (1), IC RSS-247 5.1 (2)		**Referenced Standard(s):**		
EUT powered with:	5V USB	**Temp / Humidity:**	n/a	**Test location:**	
Test equipment used TN's:	2408				
EUT Serial number(s):	Model BL3L conducted #1				
EUT Software installed:	0.3.8				
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 795kHz.

Limits:

FCC §15.247 (a) (1)

RSS-247 (5.1) (b)

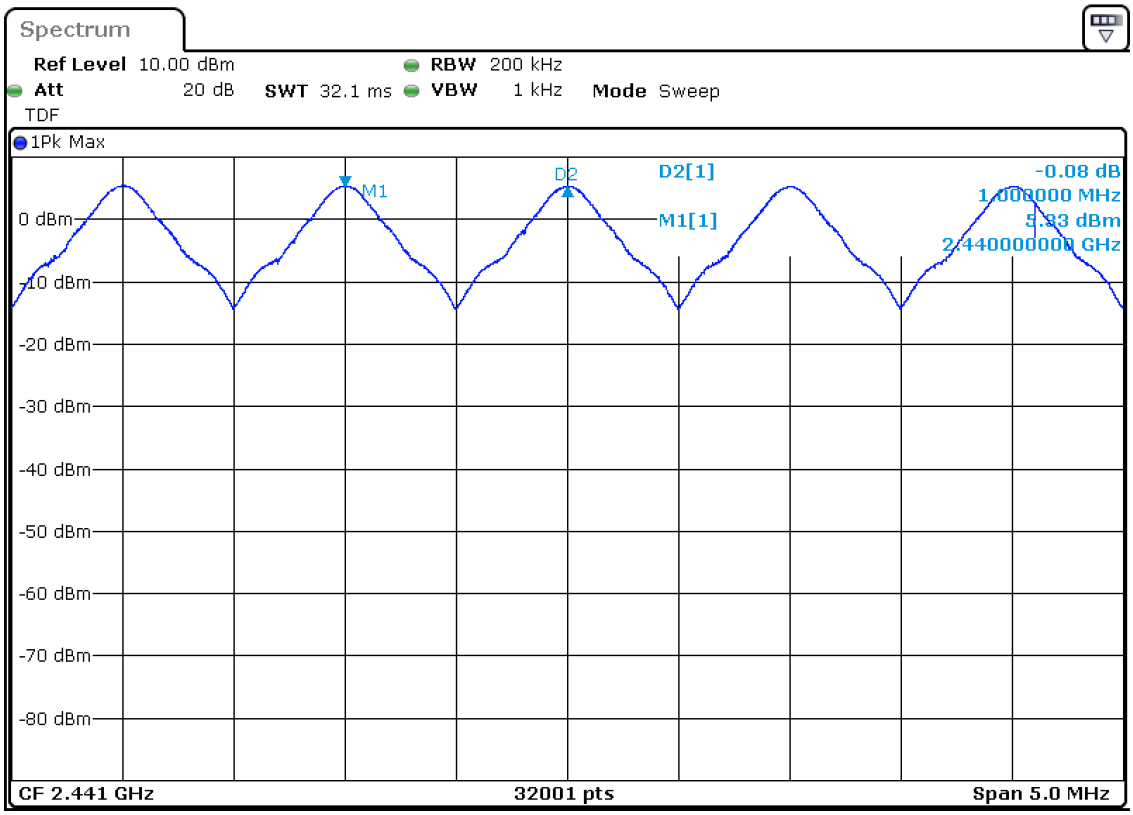
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20dB bandwidth of the hoping channel, whichever is greater.

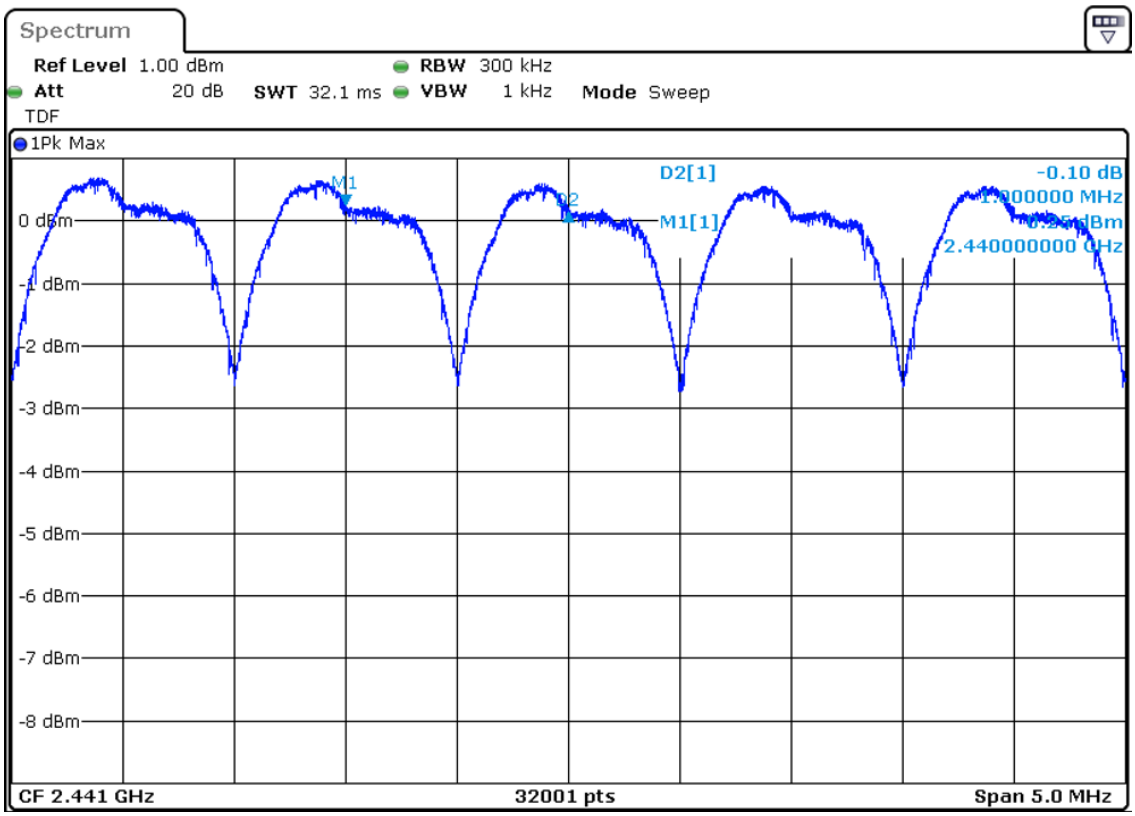
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

Equipment Used:

TN	Description	Model	S/N	Manufacturer	Most Recent Calibration	Calibration Due Date	Most Recent Verification	Verification Due Date
2408	Signal and Spectrum Analyzer	FSV40	101414	Rohde & Schwarz	27-Mar-2019	26-Mar-2020		

Data Collection:





Number of Hopping Channels

Project code name:		**Marketing name:**		**Model number:**	BL3L
Project number (Integrity):	BL3L	**Build Phase:**	C2.5		
Tested by:	Chad Bell		**Date:**	February 13, 2020	
Requirements Standard(s):	FCC 15.247 (a) (1) (iii) IC RSS-247 5.1 (4)		**Referenced Standard(s):**		
EUT powered with:	5V USB	**Temp / Humidity:**	n/a	**Test location:**	
Test equipment used TN's:	2408				
EUT Serial number(s):	Model BL3L conducted #1				
EUT Software installed:	0.3.8				
EUT Modification(s):	Product was tested as built except the antenna was disconnected and a coaxial cable was installed.				

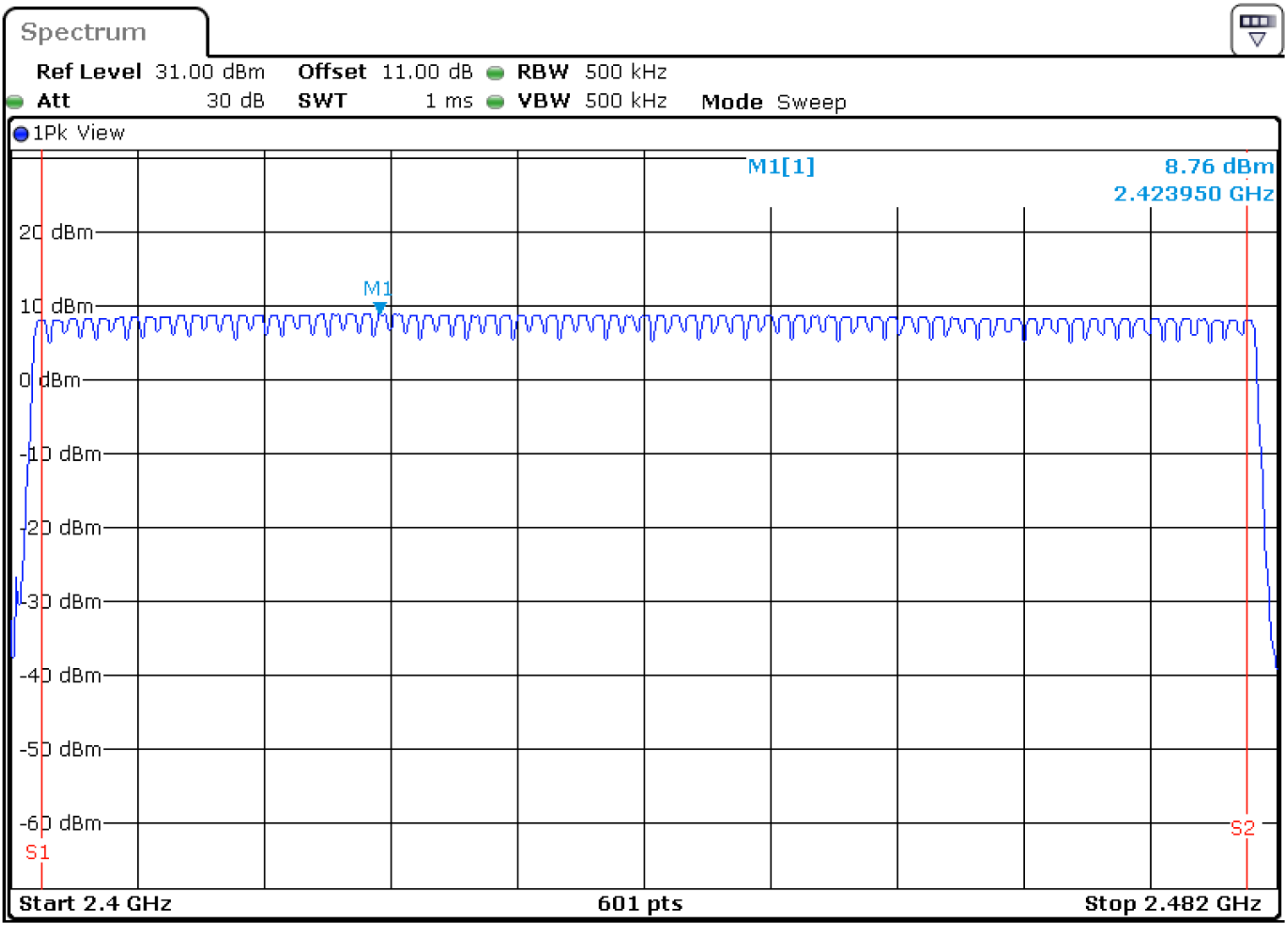
Conclusion:

Bose Model BL3L 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 (4)
Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping channels.

Data Collection:



Equipment Used:

TN	Description	Model	S/N	Manufacturer	Most Recent Calibration	Calibration Due Date	Most Recent Verification	Verification Due Date
2408	Signal and Spectrum Analyzer	FSV40	101414	Rohde & Schwarz	27-Mar-2019	26-Mar-2020		

Average Time of Occupancy

Project code name:		**Marketing name:**		**Model number:**	BL3L
Project number (Integrity):	BL3L	**Build Phase:**	C2.5		
Tested by:	Chad Bell		**Date:**	February 13, 2020	
Requirements Standard(s):	FCC 15.247 (a) (1) (iii) IC RSS-247 5.1 (4)		**Referenced Standard(s):**		
EUT powered with:	5V USB	**Temp / Humidity:**	n/a	**Test location:**	
Test equipment used TN's:	2408				
EUT Serial number(s):	Model BL3L conducted #1				
EUT Software installed:	0.3.8				
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 318.5mS which passes the 400mS limit by 81.53mS.

Limit:

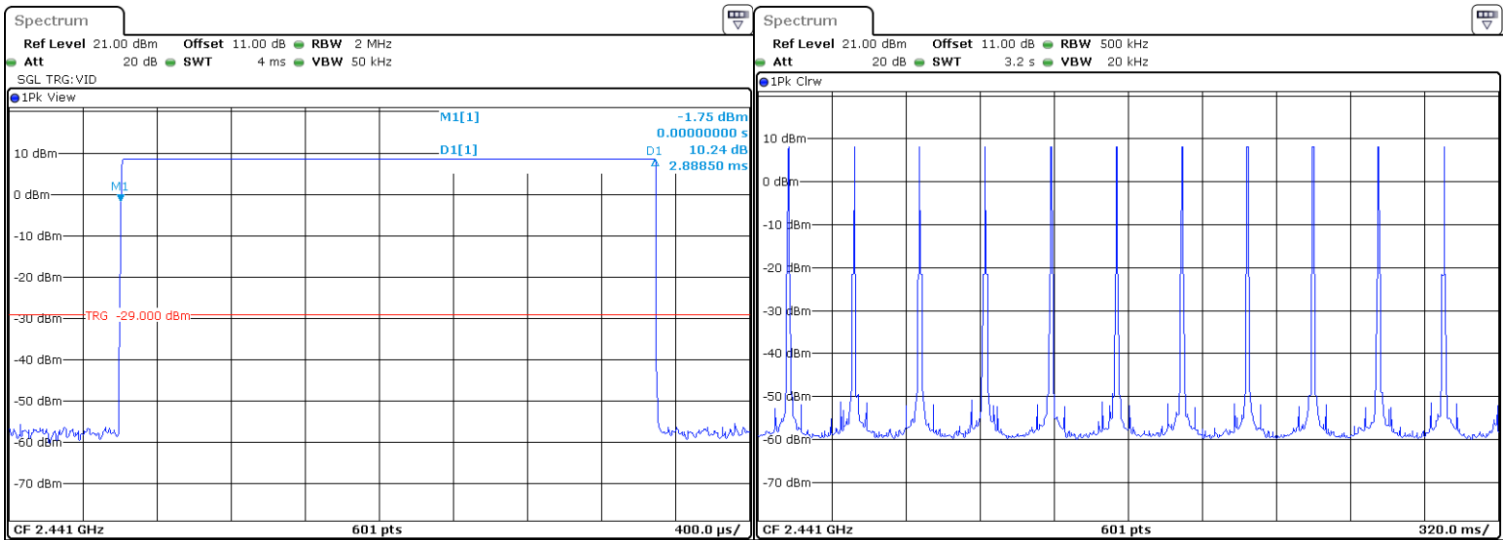
The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

Equipment Used:

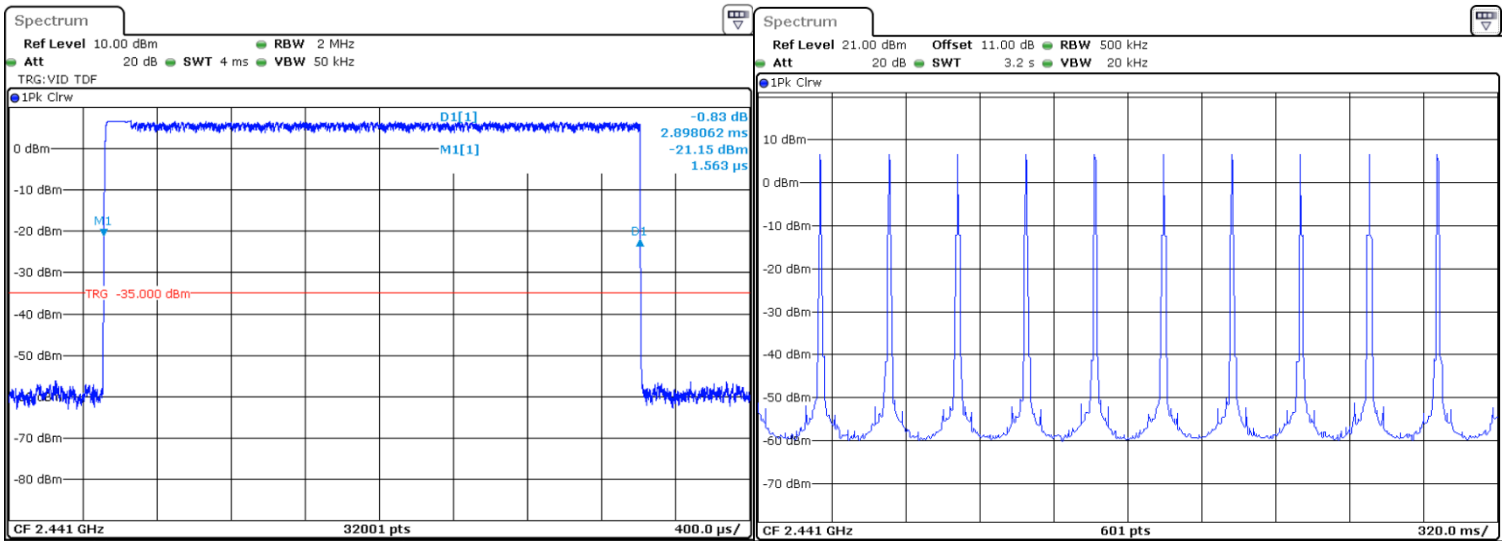
TN	Description	Model	S/N	Manufacturer	Most Recent Calibration	Calibration Due Date	Most Recent Verification	Verification Due Date
2408	Spectrum Analyzer	FSV40	101414	Rohde & Schwarz	27-Mar-2019	26-Mar-2020		

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	2.889	11	110	317.7	400	82.26	Pass
Middle	2441	2-DH5	2.895	11	110	318.5	400	81.53	Pass
Middle	2441	3-DH5	2.895	11	110	318.5	400	81.53	Pass



DH5



3DH5

Output Power

Project code name:		**Marketing name:**		**Model number:**	BL3L
Project number (Integrity):	BL3L	**Build Phase:**	C2.5		
Tested by:	Chad Bell		**Date:**	February 13, 2020	
Requirements Standard(s):	FCC 15.247 (b) (3) RSS-247 5.4 (d)		**Referenced Standard(s):**		
EUT powered with:	5V USB	**Temp / Humidity:**	n/a	**Test location:**	Braun Room
Test equipment used TN's:	2408				
EUT Serial number(s):	Model BL3L conducted #1				
EUT Software installed:	0.3.8				
EUT Modification(s):	Product was tested as built except the antenna was disconnected and a coaxial cable was installed.				

Conclusion:

The Bose Model BL3L passes output power by 18.63dB.

Limits:

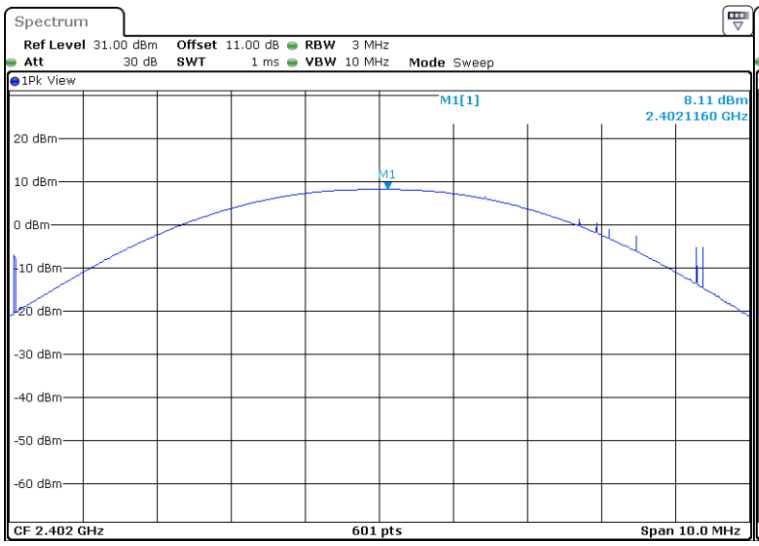
FCC §15.247 (b) (3)

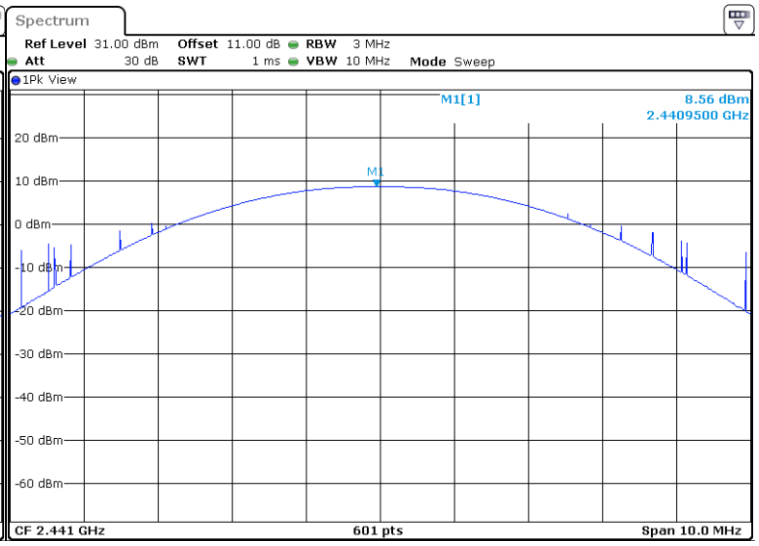
RSS-247 5.4 (d)

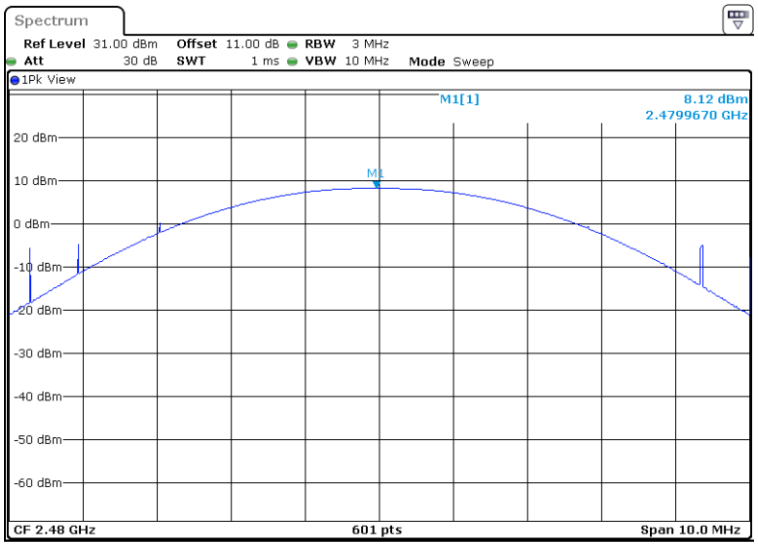
The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

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	8.11	1.21	30	20.68	Pass
Middle	2441	DH5	8.56	1.21	30	20.23	Pass
High	2480	DH5	8.12	1.21	30	20.67	Pass

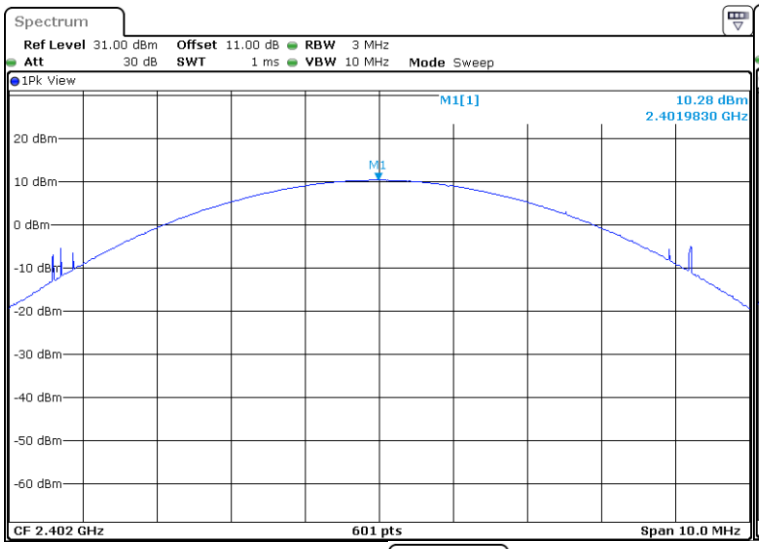


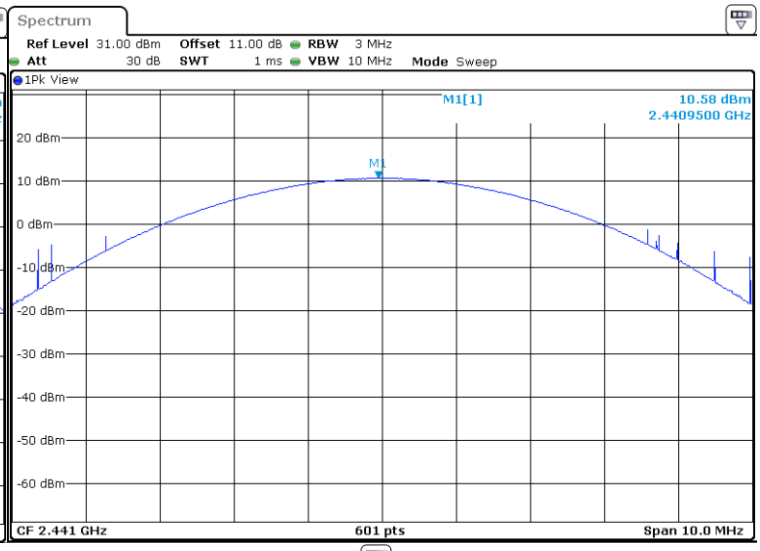


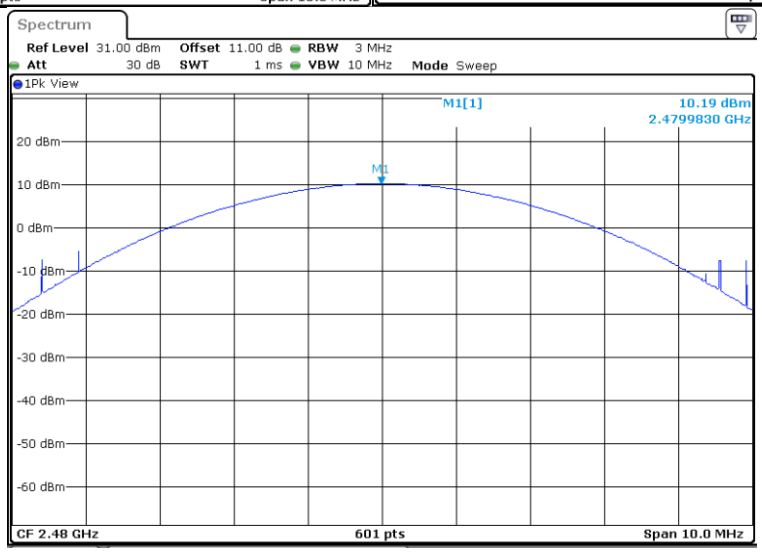


Enhanced Data Rate (3DH5) Data Collection:

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	10.28	1.21	30	18.51	Pass
Middle	2441	3-DH5	10.58	1.21	30	18.21	Pass
High	2480	3-DH5	10.19	1.21	30	18.60	Pass







Equipment Used:

TN	Description	Model	S/N	Manufacturer	Most Recent Calibration	Calibration Due Date	Most Recent Verification	Verification Due Date
2408	Signal and Spectrum Analyzer	FSV40	101414	Rohde & Schwarz	27-Mar-2019	26-Mar-2020		

Conducted Spurious Emissions

Project code name:		**Marketing name:**		**Model number:**	BL3L
Project number (Integrity):	BL3L	**Build Phase:**	C2.5		
Tested by:	Chad Bell		**Date:**	March 19, 2020	
Requirements Standard(s):	FCC §15.247 (d) RSS-247 5.5		**Referenced Standard(s):**	ANSI 63.10 (11.10.2)	
EUT powered with:	5V USB	**Temp / Humidity:**	n/a	**Test location:**	
Test equipment used TN's:	2408				
EUT Serial number(s):	Model BL3L conducted #1				
EUT Software installed:	0.3.8				
EUT Modification(s):	Product was tested as built except the antenna was disconnected and a coaxial cable was installed.				

Conclusion:

The Bose Model BL3L passes Conducted Spurious Emissions by more than 20dB.

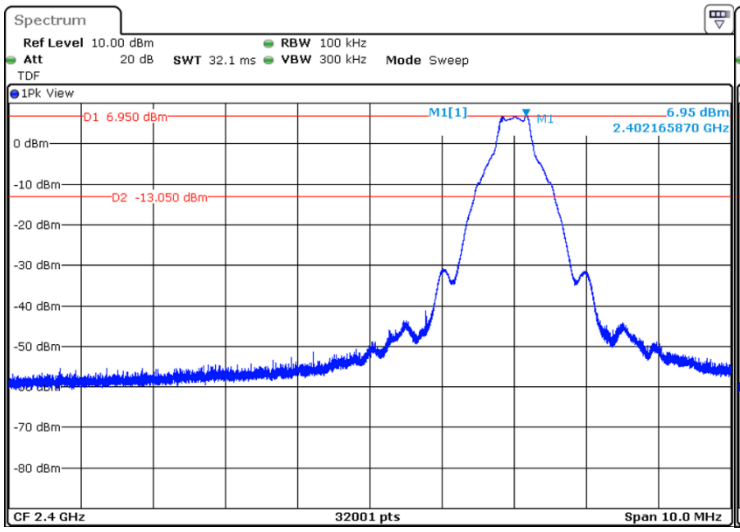
Limits

FCC §15.247 (d)

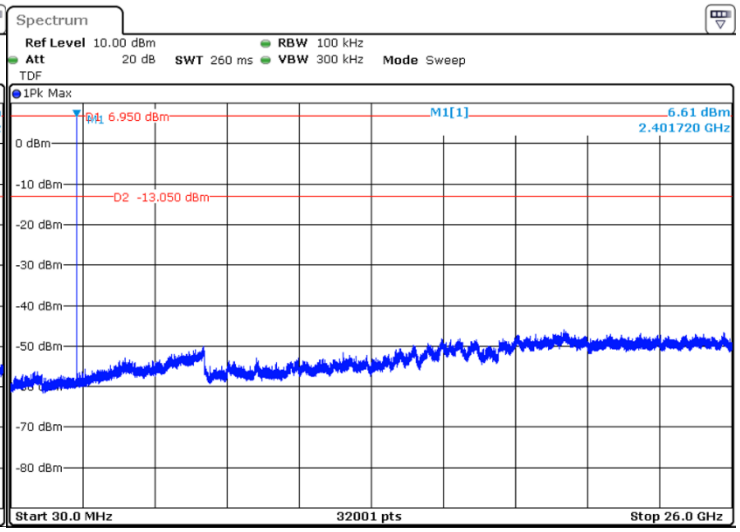
RSS-247 5.5

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

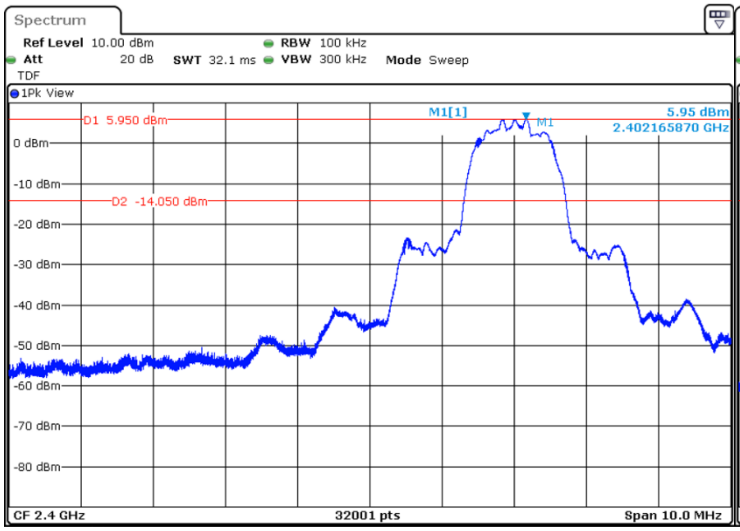
Data Collection:



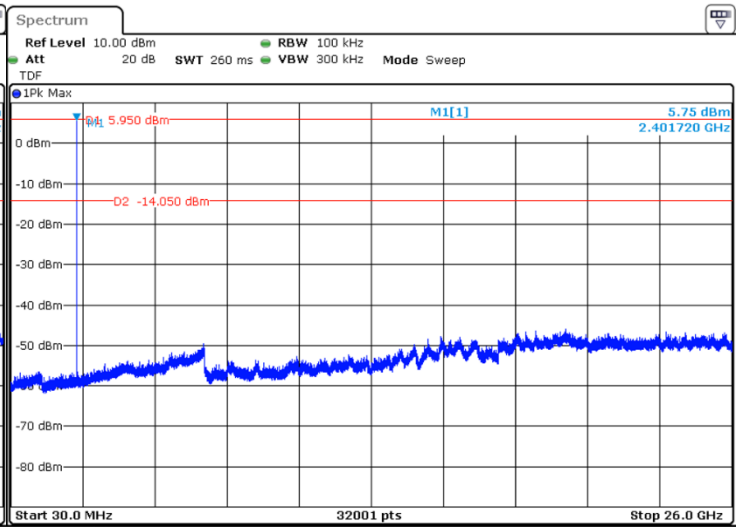
DH5 low channel band-edge



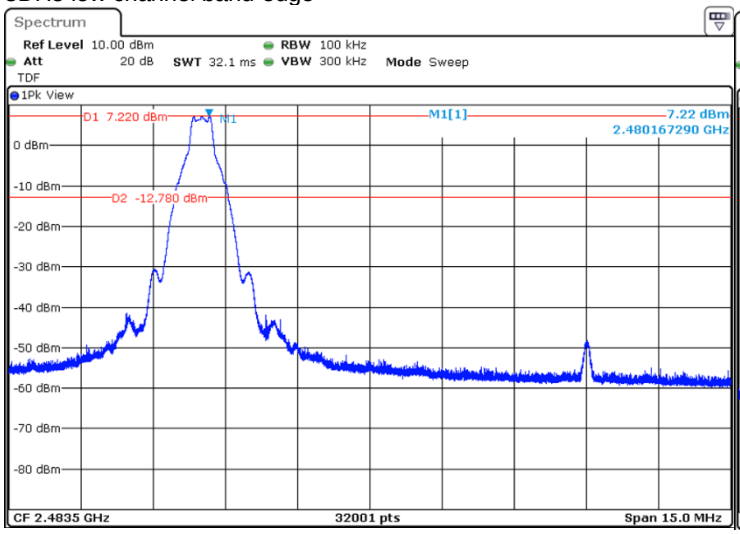
Out of band low channel (2402MHz)



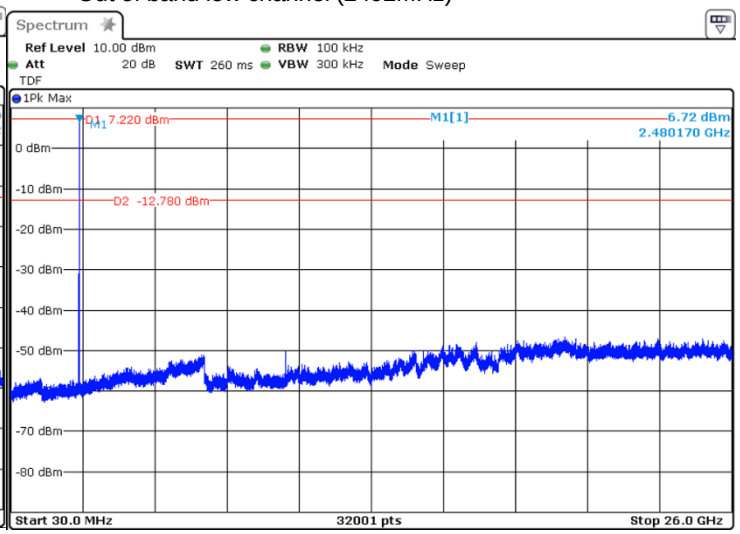
3DH5 low channel band-edge



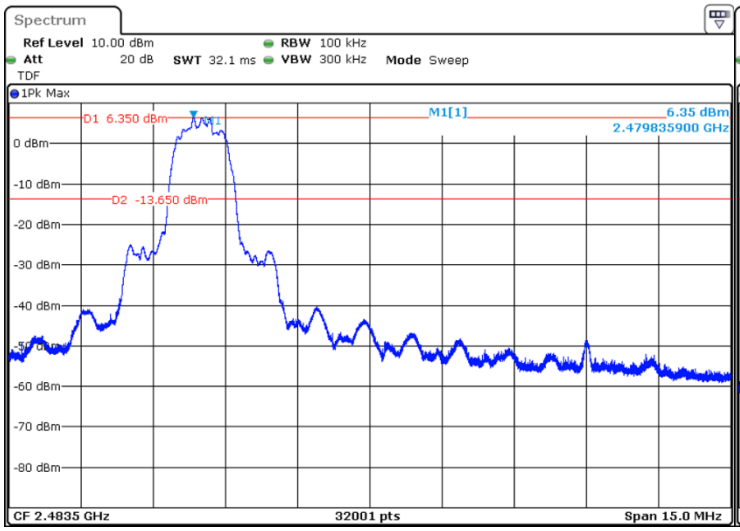
Out of band low channel (2402MHz)



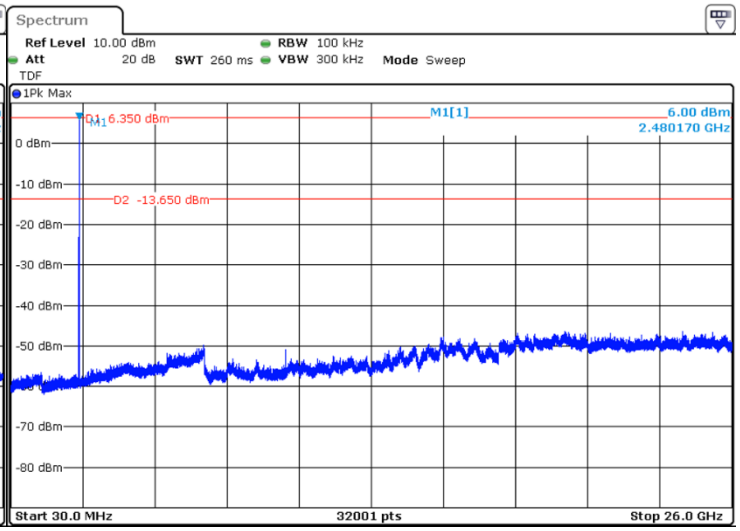
DH5 high channel band-edge



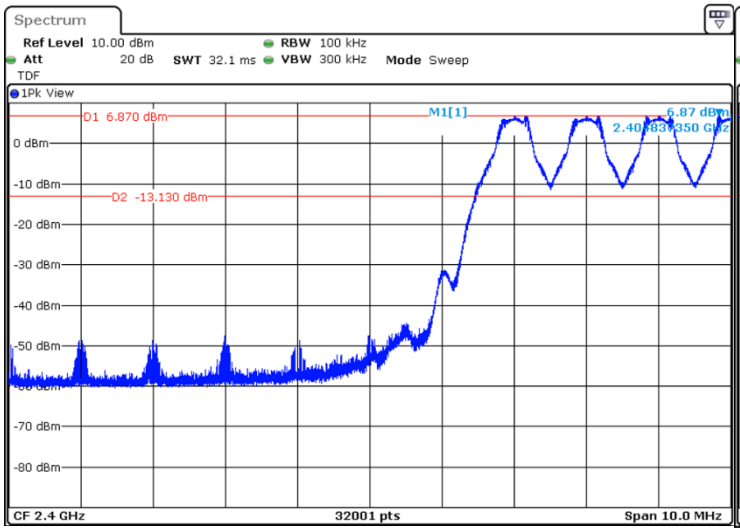
Out of band high channel (2480MHz)



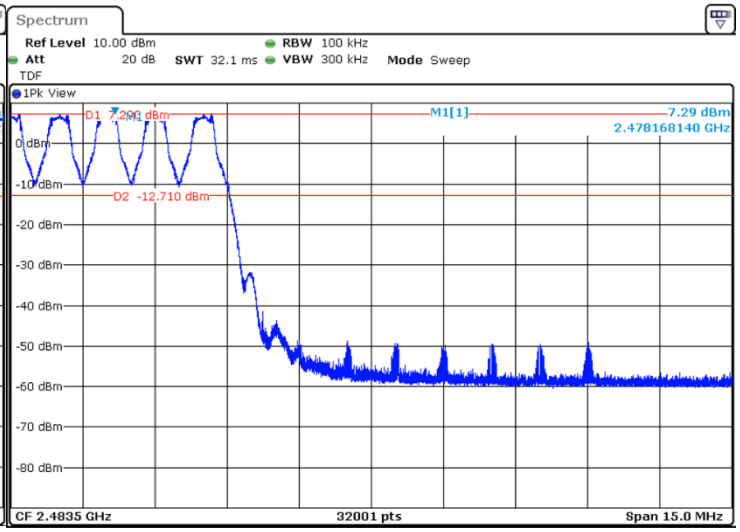
3DH5 high channel band-edge



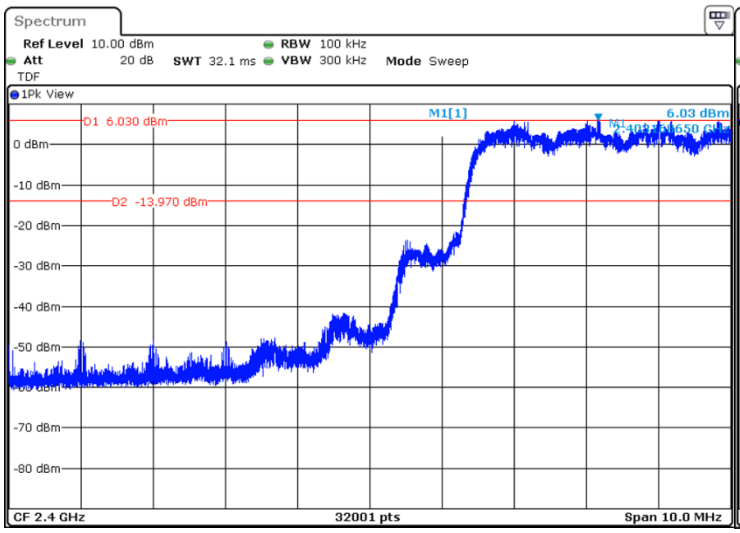
Out of band high channel (2480MHz)



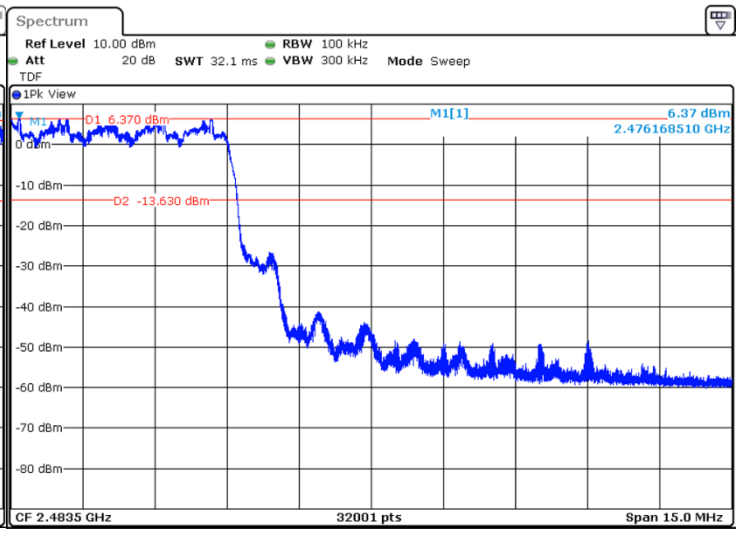
DH5 low channel band-edge while hopping



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	Most Recent Verification	Verification Due Date
2408	Signal and Spectrum Analyzer	FSV40	101414	Rohde & Schwarz	27-Mar-2019	26-Mar-2020		

RF Conducted Emissions – AC Mains

Project code name:		**Marketing name:**		**Model number:**	BL3L
Project number (Integrity):	BL3L	**Build Phase:**	C2.5		
Tested by:	Chad Bell		**Date:**	March 20, 2020	
Requirements Standard(s):	FCC Part15B, EN55032, EN301489		**Referenced Standard(s):**		
EUT powered with:	Bose Power P/T 722809-0010	**Temp / Humidity:**	N/A	**Test location:**	Henry Room
Test equipment used TN's:	2247,1380,2236				
EUT Serial number(s):	C2.5 sample #2				
EUT Software installed:	0.3.8				
EUT Modification(s):	Product was tested as built				

Conclusion:

The Bose Model BL3L passes RF Conducted Emissions on the AC Mains by 18.1dB.

Limits:

AC MAINS PORTS

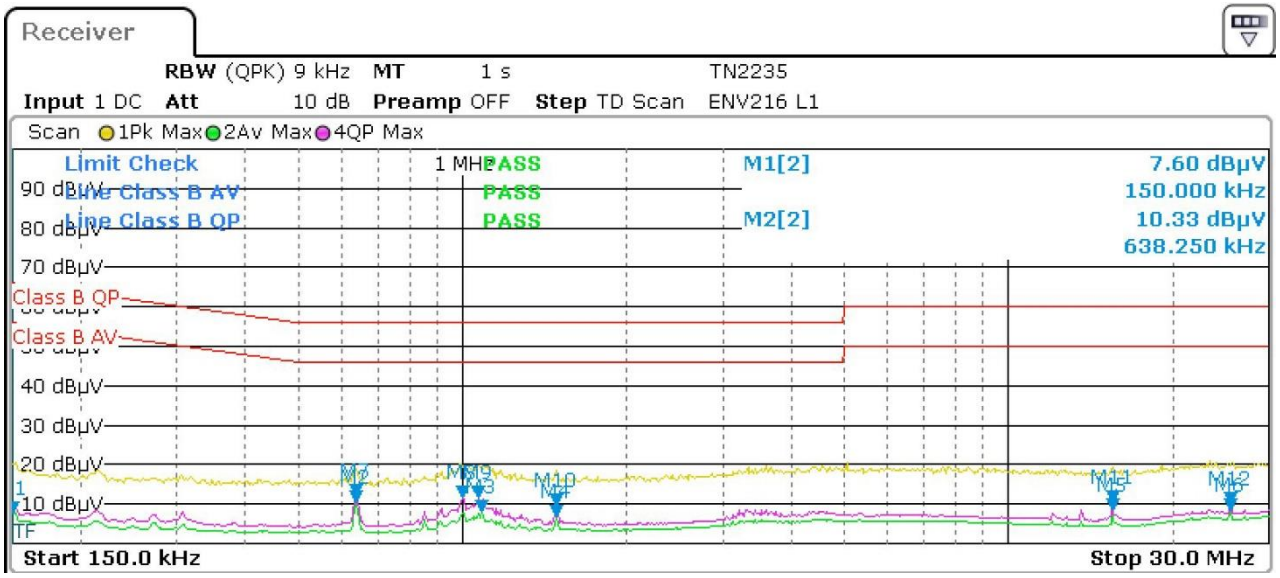
Standard	Class	Freq Range (MHz)	Limits (dBµV)		Comments
			QP	AVG	
FCC 15B/ CISPR32 based Class B only	A	0.15 - 0.5	79	66	-Ensure bandwidth set to 9 kHz. -EUT must pass both QP and AVG Limits. [1] These Limits decrease linearly with the log of the frequency. CISPR32 based standards: EN55032, AS/NZS CISPR32
		0.5 - 30	73	60	
	B	0.15 - 0.5	66-56[1]	56-46[1]	
		0.5 - 5	56	46	
		5 - 30	60	50	

Test Checklist:

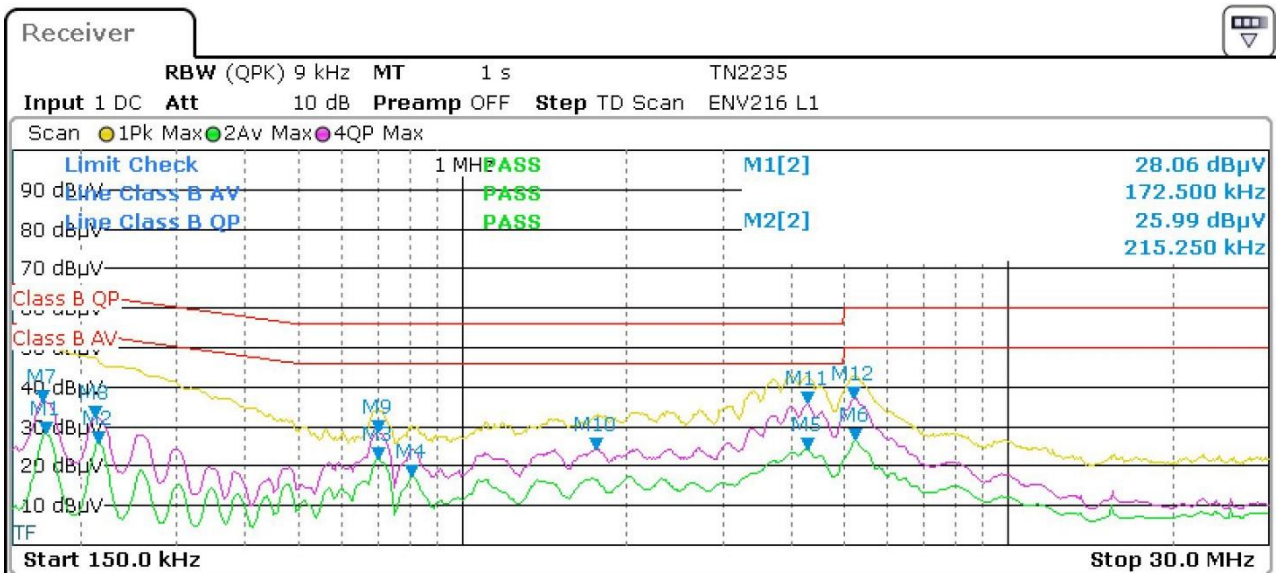
No.	ITEM	(√ or n/a) →	OK
1	This checklist is intended to be a reminder of some highlights from the standards listed above, and not a step by step procedure. You must be familiar with the listed standards prior to using this checklist.		√
2	Check EUT performance prior to any testing.		√
3	Place the EUT on the table, with the rear of the unit aligned with the rear of the table. The EUT is to be 40 cm away from the screen room walls and ≥80 cm from all other metal objects (including other walls). Other system components should have a ~10 cm spacing and should be ≥80 cm from any metal objects.		√
4	Connect cables, accessories, and loads that would be utilized in a nominal configuration. Use judgment to determine minimum number of accessories required to achieve maximum level of emissions. If possible, avoid using peripheral components that would force multiple earth grounds. • For audio amplifier products that incorporate external speaker outputs, and are designed to connect to a variety of loudspeakers, it is recommended to terminate the speaker outputs with resistive loads equal to rated load impedance.		√
5	At least one of each type of EUT I/O port should have a customer intent cable connected to it. **Document cable configuration used for the test (describe cables used and take picture).**		√
6	Bundle EUT mains cord into 30-40 cm bundle. Do not bundle peripheral components' mains cords. I/O cables are draped over rear edge of tabletop, bundled if necessary, to keep them >40 cm above reference ground plane (floor).		√
7	RF filter/bead all non-system component cables (external source) where necessary.		√
8	Verify the proper mains voltage and frequency for the EUT.		√
AC MAINS PORT TESTING…			
9	The EUT line cord under test is connected to the EUT LISN. For multiple component systems with multiple line cords, each line cord shall be tested separately. All other system component line cords are connected to a second ("other system components") LISN. A power strip can be used for multiple components connected to the second LISN (but not for the EUT LISN). Unused LISN ports are terminated with 50 Ω terminators.		√
10	**If the EUT has I/O terminals which can be connected to an earth ground through peripheral equipment, the measurements shall be performed both with and without the EUT I/O ground/shell terminal connected to earth ground, with 150 ohms in series.** • Perform this test for each line cord which comprises the EUT (i.e. for a console/bass box type system, even when measuring the bass box line cord, the console is still considered part of the EUT, so measurements are performed with the console grounded, with 150 ohms in series, and ungrounded). • If the EUT has an unbalanced (coax) antenna input terminal as well as other I/O or mains terminals which connect to earth ground, measurements shall be performed with the antenna shell both ungrounded and grounded, with 150 ohms in series. When measuring with the antenna shell grounded with 150 ohms in series, no other earth grounds shall be connected per CISPR 32 (i.e. float safety grounds if necessary).		√
11	A transient limiter MUST be used to protect receiver input.		√
12	Ensure correct frequency, amplitude, bandwidth, and transducer factors are set on receiver.		√
13	**For average measurements, it is generally recommended to use receiver mode. If using spectrum analyzer mode for average measurements, be careful to provide sufficient sweep time to ensure accurate results.**		√
14	Perform measurements on both sides of mains (line and neutral).		√
15	EUT measured in all typical operational modes. Give special attention to modes where there is a potentially significant difference in spectral emissions. • Amplifiers are exercised up to maximum power (though not a requirement for CISPR 32). **• We deem it acceptable to use pink noise instead of 1 kHz sine wave as the input signal (allowed by CISPR 32).** • Connecting cable positions are varied to obtain worst case emissions, within the range of likely configurations. Cables are not positioned on top of, or under, the system components unless required by design. **• CISPR 32 specifies audio amps to be set to 1/8 power output during measurement, however if worst case emissions are found to be at another output level and are passing, it is sufficient to capture just the worst case emissions** (i.e. passing worst case results can be used for CISPR 32 as for FCC with a statement that emissions at other volume/output levels were less).		√
16	At each frequency where there is a significant emission, maximize each emission by changing the EUT cable orientation. Record the worst-case frequency, amplitude, mains conductor.		√

17	Document test results and test equipment using test template.	√
18	Take picture(s) of worst-case test set up.	√

Data Collection:

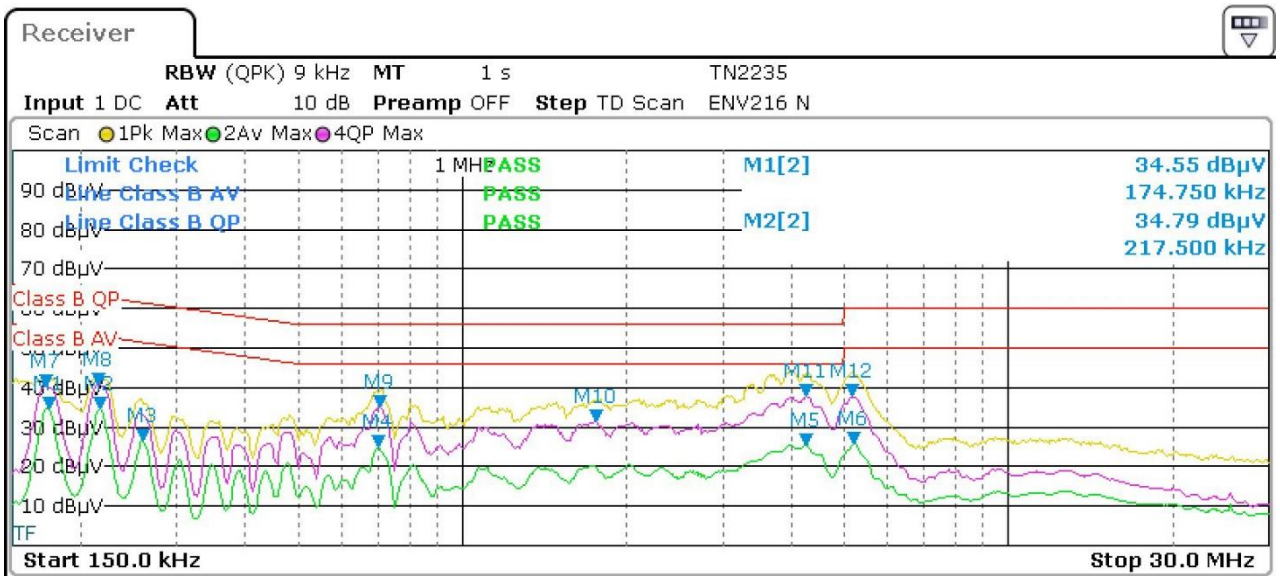


Ambient



Max current draw with fully depleted battery in charging case and both earbuds, 120V 60Hz, Measuring Line

FCC 15B and CISPR 32 Class B Product								
Mk	Frequency	MEASURED		LIMIT		MARGIN		
#	MHz	dBµV QP	dBµV AVG	dBµV QP	dBµV AVG	dB QP	dB AVG	Notes
1	4.2945	35.70	24.30	56.0	46.0	20.3	21.7	
2	4.3013	35.70	24.30	56.0	46.0	20.3	21.7	
3	5.2283	37.10	26.30	60.0	50.0	22.9	23.7	
4	5.2598	37.00	26.50	60.0	50.0	23.0	23.5	
5	0.7035	28.60	22.00	56.0	46.0	27.4	24.0	
6	0.7013	28.60	22.00	56.0	46.0	27.4	24.0	
7	0.1725	36.20	28.10	64.8	54.8	28.6	26.7	
8	0.2153	32.30	26.00	63.0	53.0	30.7	27.0	
9	0.1703	36.30	27.50	64.9	54.9	28.6	27.4	
10	0.2130	32.30	25.20	63.1	53.1	30.8	27.9	
11	0.8093	24.20	17.40	56.0	46.0	31.8	28.6	
12	1.7588	24.40	16.70	56.0	46.0	31.6	29.3	



Max current draw with fully depleted battery, 120V 60Hz, Measuring Neutral

FCC 15B and CISPR 32 Class B Product								
Mk	Frequency	MEASURED		LIMIT		MARGIN		
#	MHz	dBµV QP	dBµV AVG	dBµV QP	dBµV AVG	dB QP	dB AVG	Notes
1	0.2175	40.60	34.80	62.9	52.9	22.3	18.1	
2	4.2540	37.70	25.50	56.0	46.0	18.3	20.5	
3	4.2585	37.70	25.50	56.0	46.0	18.3	20.5	
4	0.2153	40.60	34.50	63.0	53.0	22.4	18.5	
5	0.1748	40.00	34.50	64.7	54.7	24.7	20.2	
6	0.1725	40.20	34.50	64.8	54.8	24.6	20.3	
7	0.7058	35.10	24.70	56.0	46.0	20.9	21.3	
8	0.7035	35.00	24.80	56.0	46.0	21.0	21.2	
9	5.1810	37.80	25.60	60.0	50.0	22.2	24.4	
10	5.2193	37.70	25.90	60.0	50.0	22.3	24.1	
11	0.2603	33.20	26.80	61.4	51.4	28.2	24.6	
12	1.7565	31.40	19.80	56.0	46.0	24.6	26.2	

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	27-Mar-2019	26-Mar-2020		
1380	Conducted Comb Generator	CGC-510	311559	Com-Power Corporation			15-Mar-2019	14-Mar-2020
2236	2-LINE V-NETWORK	ENV216	101193	Rohde & Schwarz	21-Jan-2020	20-Jan-2022		

Uncertainty:

Uncertainty Budget (AC mains measurements)				
Title:	Conducted RF Emissions (Mains)			
Source of Uncertainty	Value units:± dB	Distribution	Divisor	Uncertainty (± dB)
Receiver - absolute level	0.3	Rect.	1.73	0.17
Receiver - frequency response	1.0	Rect	1.73	0.58
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
LISN impedance	2.6	Triang.	2.45	1.06
LISN insertion loss	0.6	Norm.	2.00	0.30
Cable correction factor	0.1	Norm.	2.00	0.05
			Combined uncertainty (RSS):	1.30
			Coverage factor (2 sigma):	2.00
			Extended uncertainty (95% confidence):	**2.60**

Radiated Measurements

RF Radiated Emissions 30MHz -1GHz

Project code name:		**Marketing name:**		**Model number:**	BL3L
Project number (Integrity):	BL3L	**Build Phase:**	C2.5		
Tested by:	Chad Bell		**Date:**	March 10, 2020	
Requirements Standard(s):	FCC Part15B		**Referenced Standard(s):**		
EUT powered with:	Bose Power P/T 722809-0010	**Temp / Humidity:**	N/A	**Test location:**	Maxwell House
Test equipment used TN's:	1375,2319,1541,3062,2077				
EUT Serial number(s):	C2.5 sample #2				
EUT Software installed:	Special software to enable 900mA charging in the charging case.				
EUT Modification(s):	None				

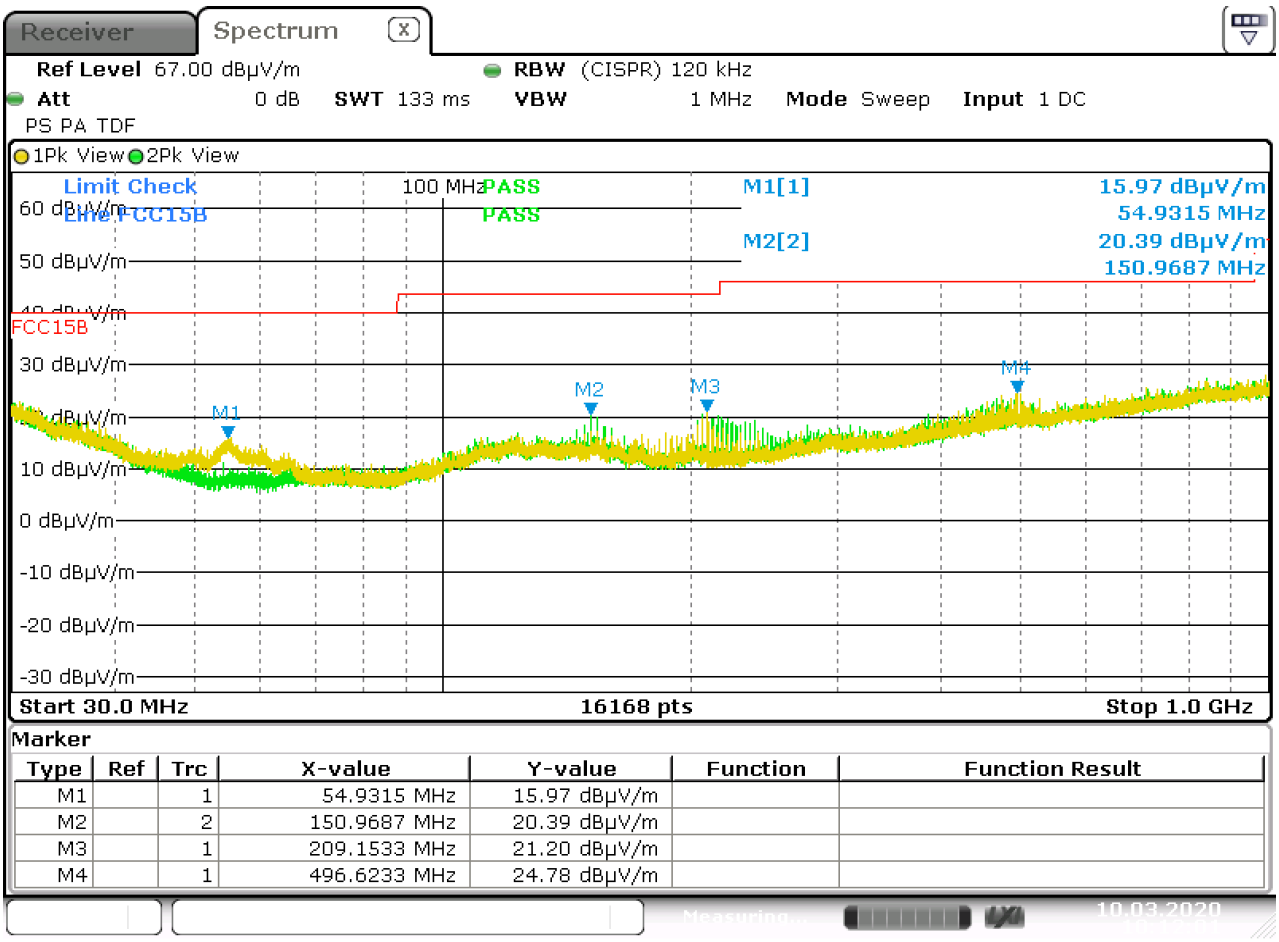
Conclusion:

Tested while playing audio and while charging, charging mode was found to be worst case and therefore what is represented in the report. The Bose Model BL3L passes Radiated Emissions from 30MHz-1GHz by 12.3dB.

Test Checklist:

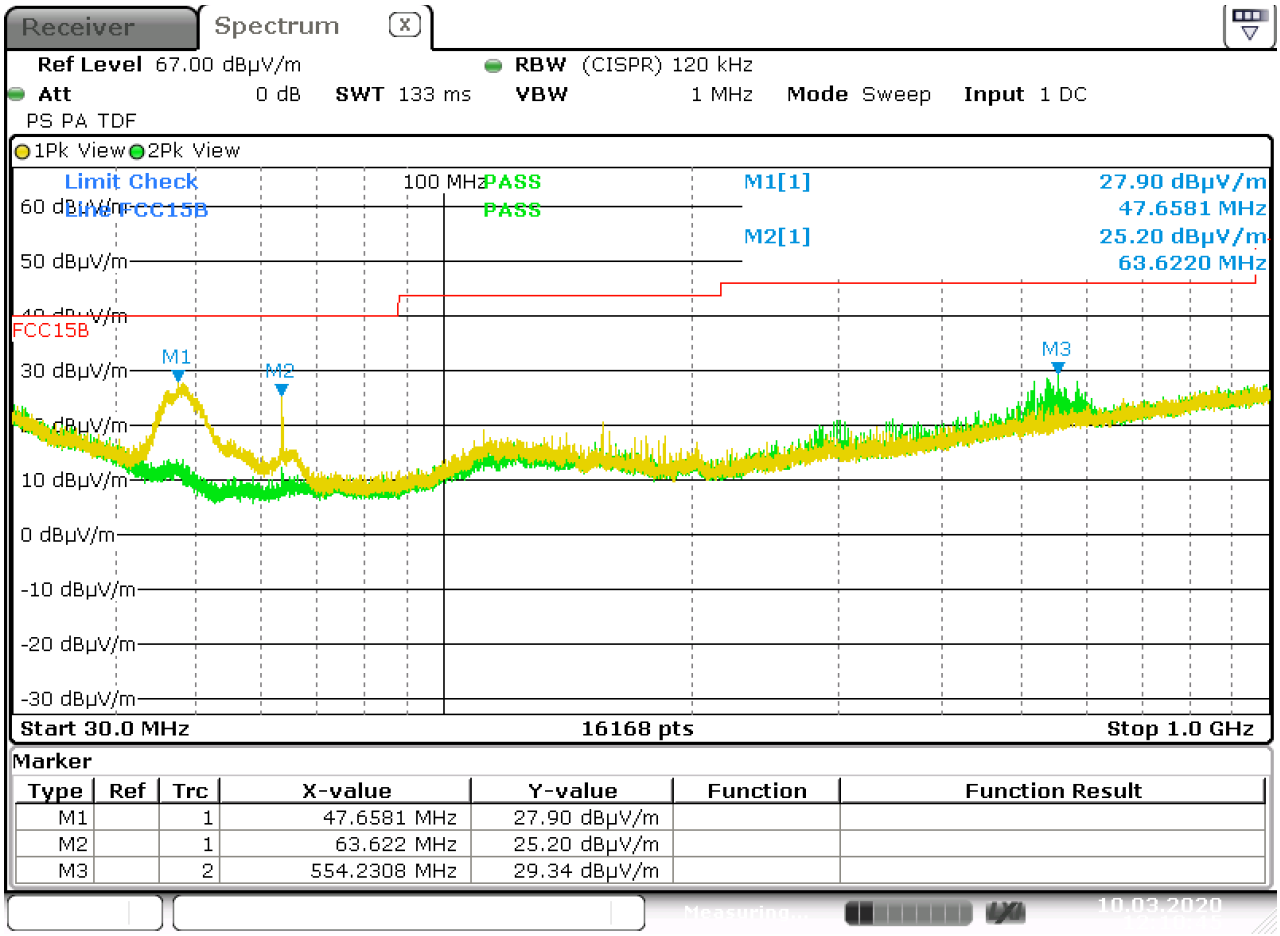
No.	ITEM	(√ or n/a) →	OK
1	This checklist is intended to be a reminder of some highlights from the standards listed above, and not a step by step procedure. You must be familiar with the listed standards prior to using this checklist.		√
2	Check EUT performance, confirm proper mains voltage prior to testing.		√
3	If dimensions of EUT are greater than 1 meter in any direction, measurements performed at 3 meters may not be accurate, especially at lower frequencies.		√
4	Remove all non-essential items from the Maxwell House chamber.		√
5	Place comb generator field site source in reference location on turntable. Sweep source, verify results against established reference plot. Verification plot should be recorded in test setup verification section of this document.		√
6	Place EUT on turntable with the rear of the unit aligned with the table edge closest to the antenna (maintain ~10 cm spacing between components). Connect the cables, accessories, and loads that would be utilized in a nominal configuration (judgment can be used to determine the minimum number of accessories required to achieve the maximum level of emissions). Telescoping antennas should be fully extended and vertical. If this is an initial test of a system, decide what nominal configuration setup should be, bundle cables, and take a picture to ensure future tests are performed using same configuration. For formal reports record type and length of cables used.		√
7	At least one of each type of EUT I/O port shall have a customer intent cable connected to it. If more than one cable of any cable type measurably increases emissions, those cables shall be maintained in the test setup. Investigate all surfaces (top, bottom, sides, and front) for I/O ports not in the main cluster. Examples of ports that may not be in the main cluster of jacks are: • Headphone, HDMI, USB, jacks or other convenience jacks on the front of the EUT. Document cable configuration used for the test (describe cables used and take picture).		√
8	Whenever practical, all cables will be terminated in a representative load both with respect to impedance matching and paths to earth via power connections.		√
9	Dress mains cord according to standard (see below). Drape all other cables over the edge of the table at the rear of the EUT, and bundle the excess in the center to ensure ~40 cm above the ground plane (floor). Bundles should be ~30-40 cm in length.		√
10	Verify appropriate test antenna is being used. The central point of the EUT arrangement shall be positioned at the center of the turntable. The measurement distance is the shortest horizontal distance between an imaginary circular periphery just encompassing this arrangement and the calibration point of the antenna.		√
11	Ensure proper correction factors and limit lines are selected on receiver.		√
12	Ensure highest clock frequency used in EUT is known and taken into account to determine required frequency range. (Less than 108 MHz: 1 GHz, 108-500 MHz: 2 GHz, 500-1000 MHz: 5 GHz, greater than 1 GHz: 5 x fundamental up to 40 GHz for FCC and 6 GHz for CISPR22.) Above 1 GHz, average and peak Limits exist.		√
13	For average measurements, it is recommended to use receiver mode. If using spectrum analyzer mode for average measurements, be careful to provide sufficient sweep time to ensure accurate results.		√
14	For all measurements, it may be necessary to investigate individual emissions for periodic nature and insure adequate dwell time to obtain an accurate reading.		√
15	Since broadband emissions sources can at times look like the noise floor, when making measurements of these types of emission sources, be extra careful in making sure the signals to be measured have sufficient S/N ratio to provide valid measurements.		√
16	EUT is measured in all typical operational modes. Give special attention to modes where there is a potentially significant difference in spectral emissions. • Amplifiers are exercised up to maximum power. • Consider ports that may require active loads or signal sources to properly exercise the port and produce electrical traffic and emissions. • Ports may need to be activated (source selected) to “wake up” electrical signals and produce emissions.		√
17	Vary antenna height, antenna polarization, turn-table position, user controls, and connecting cable positions to obtain the worst case emissions, within the range of anticipated end user configurations. Cables are not positioned on top of, or under, the system components unless required by design.		√
18	Document the six worst case test result peaks using instrument software and or test template. Exclusions include peaks 20 dB or more below the limit and or system noise floor measurements.		√
19	Document all equipment used during the test. If tripod mounted antennas are used in the multi-GHz range, document the antenna positioning method and height scan range in the report.		√
20	Take picture(s) of worst case test set up.		√

Data Collection:



Date: 10.MAR.2020 10:12:01

CISPR 32&11 @ 3 Meters and FCC B Class B @ 3 Meters											
MK #	Emission Frequency (MHz)	Measured Amplitude (dBµV/m) QP	Measured Amplitude (dBµV/m) Peak	CISPR 32&11 Limit (dBµV/m) QP	CISPR 32&11 Margin (dB) QP	FCC B Limit (dBµV/m) QP	FCC B Margin (dB) QP	Table Azimuth (0°closest to ant)	Receiving Antenna Pol (H/V)	Receiving Antenna Height (Meters)	Notes / Mode
1	54.932	9.60	26.50	40.0	30.4	40.0	30.4	251	V	1.00	Fully depleted batteries in earbud and charging case.
2	150.969	10.80	17.80	40.0	29.2	43.5	32.7	0	H	1.49	Fully depleted batteries in earbud and charging case.
3	209.153	15.60	22.30	40.0	24.4	43.5	27.9	67	V	1.00	Fully depleted batteries in earbud and charging case.
4	496.623	15.60	22.40	47.0	31.4	46.0	30.4	359	V	1.00	Fully depleted batteries in earbud and charging case.



Date: 10.MAR.2020 12:10:44

CISPR 32&11 @ 3 Meters and FCC B Class B @ 3 Meters											
MK #	Emission Frequency (MHz)	Measured Amplitude (dBµV/m) QP	Measured Amplitude (dBµV/m) Peak	CISPR 32&11		FCC B		Table Azimuth (0°closest to ant)	Receiving Antenna		Notes / Mode
				Limit (dBµV/m) QP	Margin (dB) QP	Limit (dBµV/m) QP	Margin (dB) QP		Pol (H/V)	Height (Meters)	
1	47.920	24.50	27.90	40.0	15.5	40.0	15.5	360	V	1.00	Long amazon cable resistive loads installed in earbuds to ensure max charging rate
2	63.587	27.70	29.80	40.0	12.3	40.0	12.3	0	V	1.00	Long amazon cable resistive loads installed in earbuds to ensure max charging rate
3	554.231	19.60	26.50	47.0	27.4	46.0	26.4	256	H	1.00	Long amazon cable resistive loads installed in earbuds to ensure max charging rate

Limits:

Standard	Freq Range (MHz)	Limits (dBuV QP[1])			**Comments**
		Class A		Class B	Measurements above 1 GHz are made using average and peak detectors.
		10 m	3 m [2]	3 m	
FCC 15B	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*	
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.** ***Not included in CISPR 11**
			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	Most Recent Verification	Verification Due Date
1375	System Controller	SC99V	050905-1	Sunol Sciences Corp				
2319	EMI Test Receiver	ESR26	101276	Rohde & Schwarz	26-Mar-2019	25-Mar-2020		
1541	Antenna 30MHz - 6GHz	JB6	A050807	Sunol Sciences Corp	10-Dec-2019	09-Dec-2020		
3062	RF Cable DC-18GHz, low loss LL142 coax, 26 feet, "N" connectors	SCE18110505-312	N/A	Fairview Microwave[2]	26-Jul-2018		13-Aug-2019	12-Aug-2020
2077	PreAmplifier	N/A	N/A	Bose Corporation			13-Aug-2019	12-Aug-2020

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 code name:		**Marketing name:**		**Model#:**	BL3L
Project number (Integrity):	BL3L	**Build Phase:**	C2.5		
Tested by:	N. Sanford		**Date:**	12Mar2020	
Requirements Standard(s):	CISPR32, FCC part 15B		**Referenced Standard(s):**		
EUT powered with:	Battery	**Temp / Humidity:**	N/A	**Test location:**	Marconi Manor
Test equipment used TN's:	1663,2373,2479,2357,2602,2349,2414,2385,1757,1596,2368				
EUT Serial number(s):	Left Earbud: L1520				
EUT Software installed:	0.3.8				
EUT Modification(s):	USB Debug wires were attached to the earbud to allow control of the radio.				

Conclusion:

The Bose model BL3L passes radiated emissions from 1-25GHz by 5.5dB.

Transmit Settings

CFG TX POWER = 10
Basic Rate = CFG PKT 15/339
EDR = CFG PKT 31/1020
TX DATA1 set frequency

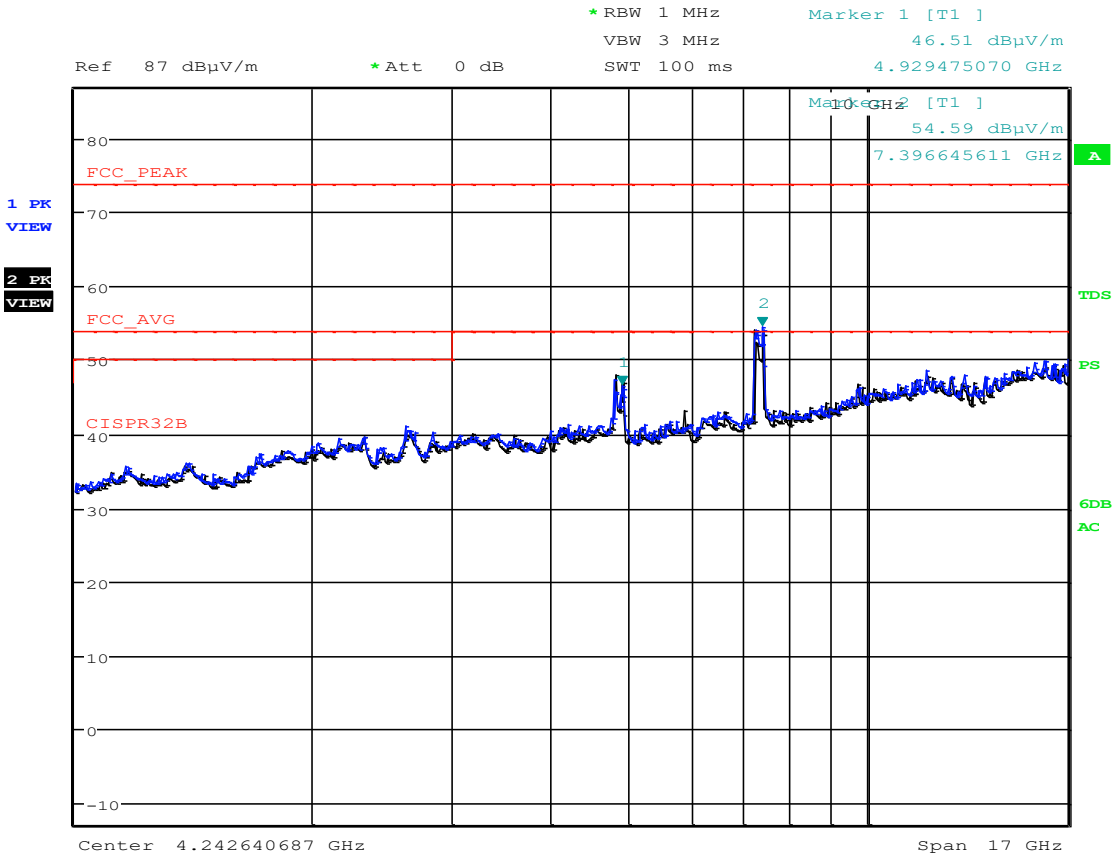
Test Checklist:

No.	ITEM	(√ or n/a) →	OK
1	This checklist is intended to be a reminder of some highlights from the standards listed above, and not a step by step procedure. You must be familiar with the listed standards prior to using this checklist.		√
2	Check EUT performance, confirm proper mains voltage prior to testing.		√
3	Using the Test Setup Verification section on this document perform verification check. Note: Six ferite panels placed under the six middle cones, check 3-meter distance horn to front edge of turntable. Remove all non-essential items from the 3m chamber. Check bore-site (tilt) option set to on in the mast controller.		√
4	If EUT has an intentional radiator at 2.4GHz or 5GHz notch filters should be placed before the pre-amp to prevent its overload. Modify correction factor set in the receiver to include notch filter used.		√
5	Place EUT on turntable with the rear of the unit aligned with the table edge closest to the antenna (maintain ~10 cm spacing between components). Connect the cables, accessories, and loads that would be utilized in a nominal configuration (judgment can be used to determine the minimum number of accessories required to achieve the maximum level of emissions). Telescoping antennas should be fully extended and vertical. **If this is an initial test of a system, decide what nominal configuration setup should be, bundle cables, and take a picture to ensure future tests are performed using same configuration.** For formal reports record type and length of cables used.		√
6	At least one of each type of EUT I/O port shall have a customer intent cable connected to it. Investigate all surfaces (top, bottom, sides, and front) for I/O ports not in the main cluster. Examples of ports that may not be in the main cluster of jacks are headphone jacks or convenience jacks on the front of the EUT. **Document cable configuration used for the test (describe cables used and take picture(s)).**		√
7	Dress mains cord according to standard (see below). Drape all other cables over the edge of the table at the rear of the EUT, and bundle the excess in the center to ensure ~40 cm above the ground plane (floor). Bundles should be ~30-40 cm in length.		√
8	**Ensure highest clock frequency used in EUT is known and taken into account to determine required frequency range.** (Less than 108 MHz: 1 GHz, 108-500 MHz: 2 GHz, 500-1000 MHz: 5 GHz, greater than 1 GHz: 5 x fundamental up to 40 GHz for FCC and 6 GHz for CISPR22 and CISPR32.) For measurements above 1 GHz, both average and peak limits exist.		√
9	**For average measurements, it is generally recommended to use receiver mode. If using spectrum analyzer mode for average measurements, be careful to provide sufficient sweep time to ensure accurate results.**		√
10	EUT is measured in all typical operational modes. Give special attention to modes where there is a potentially significant difference in spectral emissions. Amplifiers are exercised up to maximum power. Vary, antenna polarization, turn-table position, user controls, and cable positions, to obtain the worst case emissions, within the range of likely configurations. Cables are not positioned on top of, or under, the system components unless required by design.		√
11	Document the six worst case test result peaks using instrument software and or test template. Exclusions include peaks 20 dB or more below the limit and or system noise floor measurements.		√
12	Document all equipment used during the test.		√
13	Take picture(s) of worst case test set up.		√

Data Collection:

FCC 15B Class B Product (Residential) @ 3 Meters										
Emission Frequency (MHz)	Measured Amplitude (dBµV/m) AVG	Measured Amplitude (dBµV/m) Peak	FCC 15B Limit (dBµV/m) AVG	FCC 15B Limit (dBµV/m) Peak	FCC 15B Margin (dB) AVG	FCC 15B Margin (dB) Peak	Table Azimuth (0° closest to ant)	Receiving Ant Pol (H/V)	Receiving Ant Height (Meters)	Notes/Mode
4804.000	45.60	52.00	54.0	74.0	8.4	22.0	219	V	1.1	BL3L, Basic Rate
7206.000	47.50	54.70	54.0	74.0	6.5	19.3	235	V	1.4	BL3L, Basic Rate
4882.000	40.90	48.50	54.0	74.0	13.1	25.5	226	V	1.3	BL3L, Basic Rate
7323.000	48.50	55.70	54.0	74.0	5.5	18.3	234	V	1.5	BL3L, Basic Rate
4960.000	43.80	50.50	54.0	74.0	10.2	23.5	213	V	1.2	BL3L, Basic Rate
7440.000	47.80	55.10	54.0	74.0	6.2	18.9	229	V	1.4	BL3L, Basic Rate
4804.000	45.20	51.20	54.0	74.0	8.8	22.8	219	V	1.1	BL3L, EDR
7206.000	44.80	54.70	54.0	74.0	9.2	19.3	235	V	1.4	BL3L, EDR
4882.000	38.60	48.80	54.0	74.0	15.4	25.2	226	V	1.3	BL3L, EDR
7323.000	46.60	56.30	54.0	74.0	7.4	17.7	234	V	1.5	BL3L, EDR
4960.000	41.20	50.40	54.0	74.0	12.8	23.6	213	V	1.2	BL3L, EDR
7440.000	45.90	55.70	54.0	74.0	8.1	18.3	229	V	1.4	BL3L, EDR
19216.000	34.80	47.00	54.0	74.0	19.2	27.0				Noise Floor
21618.000	37.00	49.60	54.0	74.0	17.0	24.4				Noise Floor
24020.000	39.40	52.50	54.0	74.0	14.6	21.5				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
19840.000	34.30	46.50	54.0	74.0	19.7	27.5				Noise Floor
22320.000	36.50	49.20	54.0	74.0	17.5	24.8				Noise Floor
24800.000	39.00	52.80	54.0	74.0	15.0	21.2				Noise Floor

Readings taken in test mode which enable much higher duty cycle than is possible in real world usage. Average readings were taken in this mode.



Left Earbud, hopping on all channels, Basic Rate

Limits:

Standard	Freq Range (MHz)	Limits (dBuV QP[1])			**Comments**
		Class A		Class B	Measurements above 1 GHz are made using average and peak detectors.
		10 m	3 m	3 m	
FCC 15B	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

Procedure:

Per 558074 D01 15.247 Meas Guidance v05r02:

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

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

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	24-Mar-2020	24-Mar-2021		
2373	RF Cable 30MHz-18GHz - 25 feet "N"	TRU-300	N/A	TRU Corporation			12-Nov-2014	
2479	RF cable 30MHz-18GHz	257-257-3052640	N/A	SRC Haverhill			12-Mar-2020	12-Mar-2021
2357	RF Cable 30MHz-18GHz	TRU-300	TRU-12707-03	TRU Corporation			12-Mar-2020	12-Mar-2021
2602	Miteq pre-amp 1-18GHz 35dB	AFS42-01001800-28-10P-42	N/A	Miteq			19-Jun-2019	18-Jun-2020
2349	Double Ridge Waveguide Horn Antenna 1-18GHz	3117	00152406	ETS Lindgren	30-Jan-2020	29-Jan-2021		
2414	Band Reject Filter (2.4GHz)	BRM50702-07	003	Micro-Tronics	13-Jan-2015		05-Mar-2019	04-Mar-2020
2385	Marconi Manor	3 Meter Semi Anechoic Chamber	N/A	AP Americas			29-Oct-2019	28-Oct-2020
2929	Mini-circuits band-edge pre-amp 300 MHz - 8 GHz 20 dB	ZX60HV-83LN+	N/A	Mini-Circuits			17-Dec-2018	17-Dec-2019
1757	18GHz-40GHz Preamp	JS4018004000-30-8P-A1	1406279	Miteq			18-Jun-2019	17-Jun-2020
1596	Horn Antenna 18GHz - 26.5GHz	AT4640	309234	Amplifier Research				
2368	RF Cable 30MHz-26.5GHz	TRU-210	TRU-12767-35	TRU Corporation			12-Mar-2020	12-Mar-2021

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**

Radiated Band Edge

Project code name:		**Marketing name:**		**Model#:**	BL3L
Project number (Integrity):	BL3L	**Build Phase:**	C2.5		
Tested by:	N. Sanford		**Date:**	20Mar2020	
Requirements Standard(s):	CISPR32, FCC part 15B		**Referenced Standard(s):**		
EUT powered with:	Battery	**Temp / Humidity:**	N/A	**Test location:**	Marconi Manor
Test equipment used TN's:	1663,2373,2479,2357,2349,2385, 2929				
EUT Serial number(s):	Right Earbud: R3393				
EUT Software installed:	0.3.8				
EUT Modification(s):	USB Debug wires were attached to the earbud to allow control of the radio.				

Conclusion:

The Bose model BL3L passes Radiated Band Edge by 16.1dB.

Transmit Settings

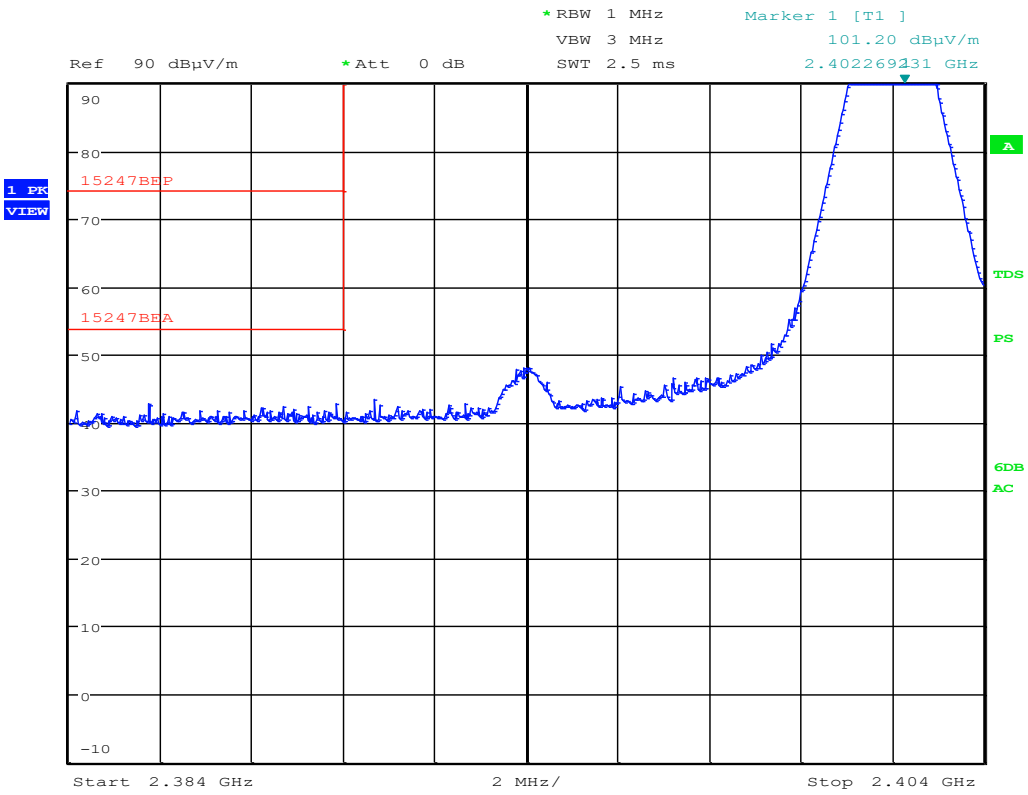
CFG TX POWER = 10
Basic Rate = CFG PKT 15/339
EDR = CFG PKT 31/1020
TX DATA1 set frequency

Test Checklist:

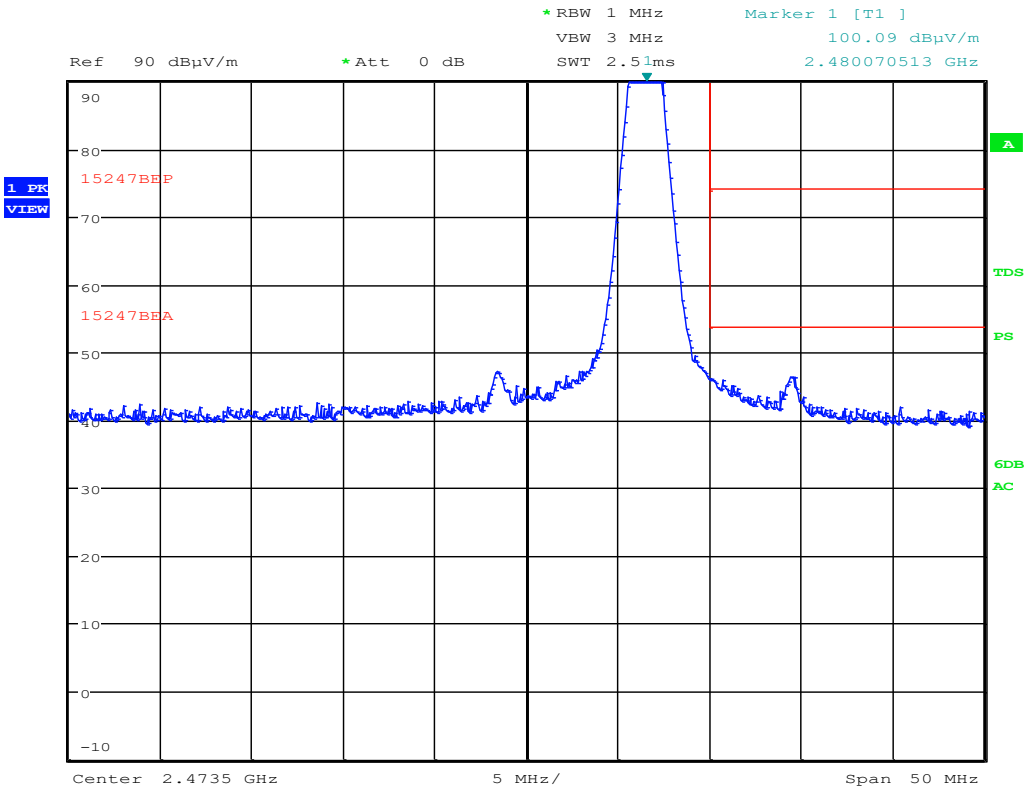
No.	ITEM	(√ or n/a) →	OK
1	This checklist is intended to be a reminder of some highlights from the standards listed above, and not a step by step procedure. You must be familiar with the listed standards prior to using this checklist.		√
2	Check EUT performance, confirm proper mains voltage prior to testing.		√
3	Using the Test Setup Verification section on this document perform verification check. Note: Six ferite panels placed under the six middle cones, check 3-meter distance horn to front edge of turntable. Remove all non-essential items from the 3m chamber. Check bore-site (tilt) option set to on in the mast controller.		√
4	If EUT has an intentional radiator at 2.4GHz or 5GHz notch filters should be placed before the pre-amp to prevent its overload. Modify correction factor set in the receiver to include notch filter used.		√
5	Place EUT on turntable with the rear of the unit aligned with the table edge closest to the antenna (maintain ~10 cm spacing between components). Connect the cables, accessories, and loads that would be utilized in a nominal configuration (judgment can be used to determine the minimum number of accessories required to achieve the maximum level of emissions). Telescoping antennas should be fully extended and vertical. **If this is an initial test of a system, decide what nominal configuration setup should be, bundle cables, and take a picture to ensure future tests are performed using same configuration.** For formal reports record type and length of cables used.		√
6	At least one of each type of EUT I/O port shall have a customer intent cable connected to it. Investigate all surfaces (top, bottom, sides, and front) for I/O ports not in the main cluster. Examples of ports that may not be in the main cluster of jacks are headphone jacks or convenience jacks on the front of the EUT. **Document cable configuration used for the test (describe cables used and take picture(s)).**		√
7	Dress mains cord according to standard (see below). Drape all other cables over the edge of the table at the rear of the EUT, and bundle the excess in the center to ensure ~40 cm above the ground plane (floor). Bundles should be ~30-40 cm in length.		√
8	**Ensure highest clock frequency used in EUT is known and taken into account to determine required frequency range.** (Less than 108 MHz: 1 GHz, 108-500 MHz: 2 GHz, 500-1000 MHz: 5 GHz, greater than 1 GHz: 5 x fundamental up to 40 GHz for FCC and 6 GHz for CISPR22 and CISPR32.) For measurements above 1 GHz, both average and peak limits exist.		√
9	**For average measurements, it is generally recommended to use receiver mode. If using spectrum analyzer mode for average measurements, be careful to provide sufficient sweep time to ensure accurate results.**		√
10	EUT is measured in all typical operational modes. Give special attention to modes where there is a potentially significant difference in spectral emissions. Amplifiers are exercised up to maximum power. Vary, antenna polarization, turn-table position, user controls, and cable positions, to obtain the worst case emissions, within the range of likely configurations. Cables are not positioned on top of, or under, the system components unless required by design.		√
11	Document the six worst case test result peaks using instrument software and or test template. Exclusions include peaks 20 dB or more below the limit and or system noise floor measurements.		√
12	Document all equipment used during the test.		√
13	Take picture(s) of worst case test set up.		√

Data Collection:

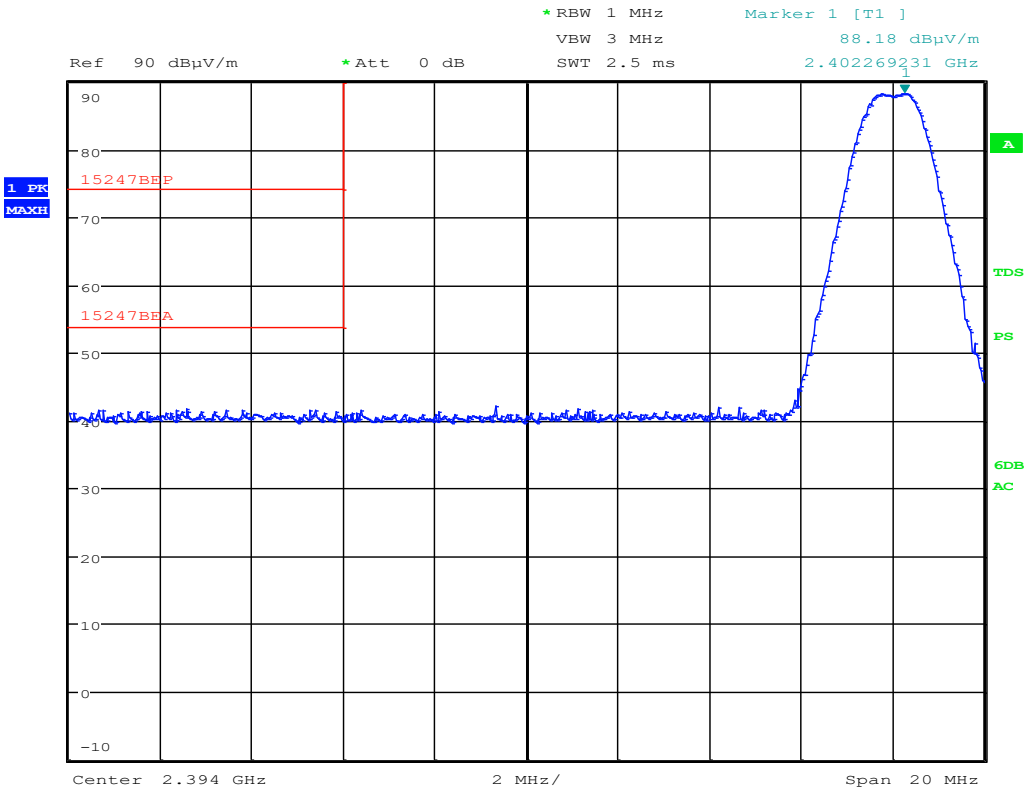
FCC 15B Class B Product (Residential) @ 3 Meters										
Emission Frequency (MHz)	Measured Amplitude (dBµV/m) AVG	Measured Amplitude (dBµV/m) Peak	FCC 15B				Table Azimuth (0° closest to ant)	Receiving Ant		Notes/Mode
			Limit (dBµV/m) AVG	Limit (dBµV/m) Peak	Margin (dB) AVG	Margin (dB) Peak		Pol (H/V)	Height (Meters)	
2390.000	28.80	42.10	54.0	74.0	25.2	31.9	0	H	1.5	BL3L, Basic Rate, transmitting only on lowest channel
2483.500	33.80	54.70	54.0	74.0	20.2	19.3	0	H	1.5	BL3L, Basic Rate, transmitting only on lowest channel
2390.000	29.00	42.20	54.0	74.0	25.0	31.8	0	H	1.5	BL3L, Basic Rate, while hopping on all channels
2483.500	34.00	54.70	54.0	74.0	20.0	19.3	0	H	1.5	BL3L, Basic Rate, while hopping on all channels
2390.000	28.80	42.30	54.0	74.0	25.2	31.7	0	H	1.5	BL3L, EDR, transmitting only on lowest channel
2483.500	35.10	56.70	54.0	74.0	18.9	17.3	0	H	1.5	BL3L, EDR, transmitting only on lowest channel
2390.000	29.90	42.40	54.0	74.0	24.1	31.6	0	H	1.5	BL3L, Basic Rate, while hopping on all channels
2483.500	35.20	57.90	54.0	74.0	18.8	16.1	0	H	1.5	BL3L, Basic Rate, while hopping on all channels



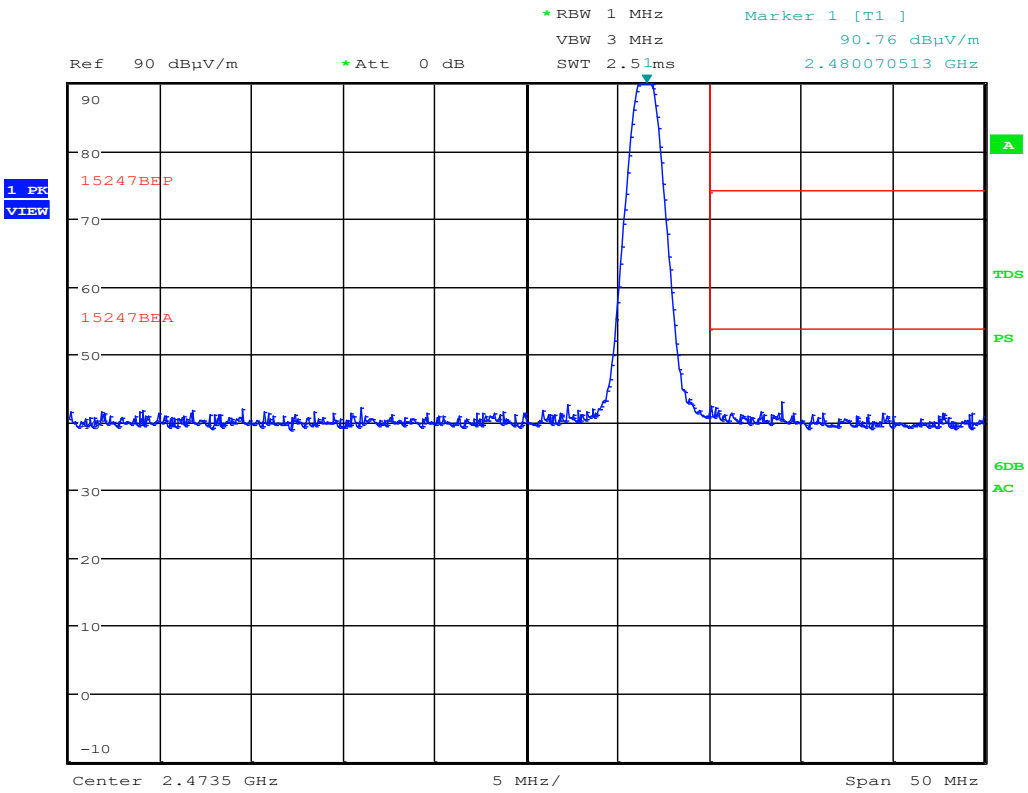
Lower Band edge, Basic Rate



Upper Band edge, Basic Rate



Lower Band edge, EDR



Upper Band edge, EDR

Limits:

Standard	Freq Range (MHz)	Limits (dBuV QP[1])			Comments
		Class A		Class B	Measurements above 1 GHz are made using average and peak detectors.
		10 m	3 m	3 m	
FCC 15B	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*	
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	Most Recent Verification	Verification Due Date
1663	EMI Test Receiver	ESU40	100098	Rohde & Schwarz	24-Mar-2020	24-Mar-2021		
2479	RF cable 30MHz-18GHz	257-257-3052640	N/A	SRC Haverhill			12-Mar-2020	12-Mar-2021
2357	RF Cable 30MHz-18GHz	TRU-300	TRU-12707-03	TRU Corporation			12-Mar-2020	12-Mar-2021
2349	Double Ridge Waveguide Horn Antenna 1-18GHz	3117	00152406	ETS Lindgren	30-Jan-2020	29-Jan-2021		
2385	Marconi Manor	3 Meter Semi Anechoic Chamber	N/A	AP Americas			29-Oct-2019	28-Oct-2020
2929	Mini-circuits band-edge pre-amp 300 MHz - 8 GHz 20 dB	ZX60HV-83LN+	N/A	Mini-Circuits			17-Dec-2019	17-Dec-2020

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**